WORLD TRADE ORGANIZATION

World Trade Report

2013 | Factors shaping the future of world trade

Contents

Acknowledgements

Disclaimer

Foreword by the WTO Director-General

This year's *World Trade Report* looks at how trade and other forces of change are affecting our world. It combines contemporary analysis with conjecture about the future. The approach is eclectic, reflecting many different forces at work. The intermingling of these drivers of change is multidirectional and complex, and the pace of change is rapid.

The transformation of trade has been underway for some time. It is manifested most clearly in wider geographical participation in trade and the rise of international supply chain production. The first of these developments reflects the dynamism of emerging economies. The second is a vivid part of the recent story of globalization. Technology has been the great enabler of globalization, but globalization is a human construct and is therefore neither inevitable nor irreversible. The forecasts and reflections contained in this report do not foresee a reverse of globalization. But we should remember that the gains it brings could be nullified or at least mitigated if short-term pressures are allowed to override long-term interests, and if its social consequences in terms of the unevenness of its benefits are neglected.

In addition to trade itself – both as a consequence and cause of change – the report identifies a range of economic, political and social factors that together will be fundamental in shaping the future. These include technology, investment, energy and other natural resources, transport, demographics, institutions, socio-economic factors and the environment. The numerical projections presented in the report take a number of these factors into account, but it must be stressed that estimates carrying us decades into the future are very sensitive to changes in assumptions. They are therefore better thought of as comparative scenarios upon which to reflect rather than numerical predictions. One element clearly stands out in the report, and that is the importance of trade for development.

Technology has not just provided the wherewithal to make globalization possible in a physical and virtual sense, but it is also the key source of increased productivity associated with innovation and growth. Likely developments in respect of many of the sectors and issues mentioned above depend crucially on what happens on the technology front. The sources of new technology will shift increasingly towards emerging economies. New technologies and innovation will emerge with greater vigour from the services sector. Technology could also change much of what we take for granted today in terms of production and consumption patterns. New technologies in the field of information and developments in 3D printing and robotics will have a far-reaching impact.

Investment is a major component of international economic linkages. The rise of supply chains has made this even more apparent, since we can no longer treat foreign direct investment (FDI) as an alternative to trade for accessing domestic markets. Much FDI today is related to trade flows that link imports and exports in production along supply chains. Investment is also an important transmission mechanism for spreading technology, knowledge and innovation.

What happens in energy and primary product markets is also central to our future. Technology, again, will be important here. Even with new energy sources coming on stream, demand for energy, like for many other primary commodities, is likely to lead to higher prices. Water scarcity is going to be a significant challenge in some parts of the world. A failure to manage the uneven distribution of natural resources across the globe, the intrinsic scarcity of some of those resources, and the sustainable use of others will exact a heavy price on society.

Demography is another major shaping factor for the future, with some countries being well placed in terms of the demographic transition, while others will have to contend with ageing populations and a shrinking workforce. Migration, urbanization and a growing number of women in the workforce will all play an influential role.

Developments in the transport sector will affect the prospects for merchandise trade. Many factors will influence directions here, not least the policy stance of governments in relation to such matters as trade facilitation, competition and the environment. The extent of new infrastructural investment and innovation and trends in fuel costs will also play a part.

Institutions have always been a fundamental determinant of the human condition. This applies to political institutions that underpin systems of government, economic institutions that determine the functioning and regulation of national and international markets, and cultural values that forge social norms. Links between systems of government and trade are not straightforward. Political borders inhibit exchange but also define the parameters under which globalization can flourish. Strong economic institutions support international integration. At the same time, contrasting social norms may limit integration, but long-term commercial relationships and international cooperation can create mutual benefits that mitigate these constraints.

Strong economic and socio-political pressures have arisen in recent years as a result of widening income gaps at the national level and growing joblessness in many economies. These pressures are likely to grow

and will require focused policy attention if they are not to become disruptive on a wider scale. Policies that can be defended as promoting aggregate welfare will need to be seen as supporting jobs and new opportunities in order to secure political legitimacy.

Technology and trade are both recognized as disruptive forces in terms of income distribution. It is trade that faces the strongest political opposition even if in reality it is a lesser force for change than technology. In either case, long-term policies for education and training, and short-term policies to manage these transitions are indispensable to future growth, stability and social harmony.

A further public policy challenge that will surely grow in magnitude is how to manage the environment. Population growth and rising incomes in large parts of the world will place further stress on the environment, especially in relation to the global commons. A major effort in international cooperation will be required to build a path to sustainable development. Trade is not the sole key to address this complex issue, but it can certainly play its part. Technology will once again play a crucial role, but a formidable socio-political challenge faces the international community in striking agreement on respective national responsibilities for remedial action on such matters as controlling climate change. Whether what we do is sufficient to secure the future of coming generations will be a great test of our ability to bring about coherent collective action.

Painting the prospects for our future on such a broad canvas is useful in providing perspective on trade and where it fits in the broader world. It is a reminder that we do not espouse trade for its own sake, but for its potential contribution to our future. As I have already noted, trade bears a complex two-way relationship with many of the other determinants of that future. It is our responsibility to nurture trade and create the conditions under which it can make its rightful contribution. With a stalled Doha Round and the uncertainty this creates, we have arguably not been doing as much as we might in this regard.

There is much to fight for. Trade has played a remarkable role on different fronts over the last decades as part of a virtuous circle of growth and development, a harbinger of opportunities unimaginable not so many decades ago, and as an agent of greater social harmony. The rise of international supply chains has deepened and broadened opportunities arising from international exchange. When we think about trade in an economically more rational way – that is, in terms not just of flows of goods and services but rather in terms of the contribution of different nations in joined up production relationships – we begin to appreciate the true nature of the common interests that join us together.

Policy-dependent constructs such as the WTO are not self-sustaining. This is why renewed efforts are needed to revive the vibrancy of the global trading system. To do this, the WTO must address traditional issues of long-standing vintage such as tariffs, non-tariff measures, services and agriculture. At the same time, in our increasingly integrated world, other policy issues require attention, including investment, competition, subsidies and the management of public policy in trade-friendly ways. The premium on avoiding incoherence and fragmentation in policy design and management will grow.

The WTO must search for constructive compromise on fundamental issues relating to the balance of rights and obligations among its diverse membership, especially in a world of shifting influence and power among nations. Better accommodation is needed between preferential trade agreements and the multilateral trading system. Convergence in non-tariff measures, such as standards and norms, which will be crucial in levelling the playing field in the future, is not the primary responsibility of the WTO. But the WTO should be in a position to promote more convergence. Questions internal to the design and governance of the WTO also matter. One of these is how to preserve the advantages of non-discriminatory trade arrangements within the system. Another is how to define a role for the Secretariat that can be more supportive of forward movement without challenging the primacy of the membership in deciding outcomes.

This is not an exhaustive menu of challenges facing those responsible for sustaining the contribution of trade and economic cooperation more generally to our future. Some of the challenges identified in this report have also been addressed in the report by the Stakeholder Panel which I convened in 2012 to examine the future of world trade. On a more personal note, this is the eighth and final *World Trade Report* produced under my tenure. I would like to thank the Secretariat staff whose strong intellectual leadership has allowed these publications to become world references on research on trade matters. I should also like to take this opportunity to extend my best wishes to those who will now assume responsibility for leading and guiding this institution, and particularly to my successor, Ambassador Roberto Carvalho de Azevêdo.

Pascal Lamy
Director-General

Executive summary

A. Introduction

The *World Trade Report* 2013 examines likely trends in world trade and how current and future economic, social and political factors might weigh on these trends. Relationships are not uni-directional, with trade being both the cause and effect of certain developments.

The Report starts with an overview of past, present and future economic activity and trade, highlighting chronological milestones, trends and possible scenarios. It stresses in particular the importance of technology and politics in this narrative. Trade has been transformed in recent years through wider and more disperse geographical participation, changes in the composition of trade, and the rise of international supply chains. Simulations of possible future scenarios see a reinforcement of some of these trends but emphasize the sensitivity of outcomes to assumptions about key economic factors and policy developments (see Section B).

Fundamental forces shaping the future of international trade include demography, investment, technology, the disposition and availability of energy and other natural resources, transportation costs and institutions (see Section C). While much economic literature focuses on these factors, broader socio-economic factors are also key. These include social, environmental and macroeconomic concerns that are high on the political agenda (see Section D). All these economic, social and political factors will shape policy and in turn will be affected by policy. A particular concern of this report is the effect that likely trends will have on the multilateral trading system and the challenges it faces as well as ways that the multilateral trading system could influence outcomes (see Section E). Section F concludes by summarizing key factors to watch.

B. Trends in international trade

The evolution of international trade: insights from economic history

Globalization is neither inevitable nor irreversible. Technology – especially transport and communications – has been the main driver of global economic integration over the past 200 years. But political forces have also played a powerful role, sometimes helping to manage and cushion integrationist pressures, and at other times resisting or even reversing them.

Most of the 19th century and the early years of the 20th century produced the first great globalization. The years between 1914 and 1945, however, stand out as a period of dramatic "de-globalization". The combined shocks of the First World War, the Great Depression and the Second World War saw countries pull back from global integration and turn to more nationally focused and state-directed economic models. The world economy became more fragmented and international trade declined over this period.

These trends were reversed after 1945 as the world economy progressively "re-globalized" following the devastation of war and depression. A novel difference in the second age of globalization was the creation of international institutions – the United Nations, the International Monetary Fund (IMF), the World Bank, the General Agreement on Tariffs and Trade (GATT – later the WTO). These institutions were to keep the peace and curtail the economic nationalism and beggar-thy-neighbour policies that had done so much to destroy international stability in the first half of the 20th century. Globalization is unlikely to thrive in the absence of effective international political cooperation.

Trends in international trade: what has changed in the last 20-30 years?

International trade has grown tremendously in the last 30 years, much faster than global output.

Measured in gross terms, the dollar value of world merchandise trade increased by more than 7 per cent per year on average between 1980 and 2011, reaching a peak of US$ 18 trillion at the end of that period. Trade in commercial services grew even faster, at roughly 8 per cent per year on average, amounting to some US$ 4 trillion in 2011. Real merchandise trade growth (i.e. trade growth accounting for changes in prices and exchange rates) was equally impressive, recording a four-fold increase in volume between 1980 and 2011. Since 1980, world trade has grown on average nearly twice as fast as world production. Reductions in tariffs and other barriers to trade during this period contributed to the expansion.

New players have risen to prominence in world trade, most notably large developing countries and rapidly industrializing Asian economies.

Developing economies only accounted for 34 per cent of world exports in 1980 but by 2011 their share had risen to 47 per cent, or nearly half of the total. At the same time, the share of developed economies dropped from 66 per cent to 53 per cent. Surging exports from China boosted its share in world exports from 1 per cent in 1980 to 11 per cent in 2011, making China the world's largest exporter when members of the European Union are counted separately. Meanwhile,

the United States, Japan and the European Union as a whole all recorded declining shares in world exports. A similar picture emerges on the import side.

As developing economies have raised their collective share in world trade, they have increasingly done so by trading with each other. As evidence of this, we note that the share of "South-South" trade in world trade rose from 8 per cent in 1990 to 24 per cent in 2011. The share of North-South trade also increased slightly, from 33 per cent to 38 per cent over this interval, but trade among developed economies (i.e. North-North trade) saw its share slide from 56 per cent to just 36 per cent.

Countries have become less specialized over time in terms of their exports.

Improvements in transport, telecommunications and information technology, together with increased economic integration and greater trade openness, have resulted in higher levels of technological diffusion and increased mobility and accumulation of productive factors over time. As a result, countries have become less specialized in the export of particular products, and therefore more similar in terms of their export composition. Comparative advantage, or international differences in relative efficiencies among products, has become weaker over time in many countries, just as comparative advantage has shifted geographically.

Trade has tended to become more regionalized since 1990, particularly in Asia, but intra-regional trade shares in Europe and North America have remained steady or declined.

The share of intra-regional trade in Asian exports rose from 42 per cent in 1990 to 52 per cent in 2011, giving Asia the largest share of intra-regional trade in exports of any geographic region when the European Union is counted as a single entity. If individual EU member states are counted separately, Europe had the largest intra-regional share of any region in 2011, at 75 per cent. The share of intra-regional trade in North America's exports increased from 41 per cent to 56 per cent between 1990 and 2000, before falling back to 48 per cent in 2011. Excluding intra-EU trade, Europe saw its within-region share of exports drop from 35 per cent in 1980 to 29 per cent in 2011. Other WTO geographic regions (South America, Africa, the Middle East and the Commonwealth of Independent States) mostly export primary products to other regions. While their shares of intra-regional trade have increased, they remain small in comparison to other regions.

The real nature of interdependence among economies, resulting largely from international supply chains, can only be understood if trade is measured in terms of the value added by each location in internationally configured production processes. These new statistics may help to design better trade policies.

International supply chains play a major role in today's world economy: traded goods and services contain inputs that may come from many different countries, and traditional trade statistics misleadingly attribute the full transaction value of traded products to the last economy in the production process. This is why trade must be measured in value-added as well as gross terms. Global input-output tables, combining national input-output tables with gross bilateral trade flows, have been used to describe these production relationships among economies. Preliminary estimates of trade measured in value-added terms show that almost 30 per cent of total trade consists of re-exports of intermediate inputs, thus indicating increased international interdependence through international production chains. Since the mid-1990s, this measure has risen by almost 10 percentage points.

If measured in value-added terms, the contribution of services to international trade is much higher.

The contribution of services to total trade, when measured in value-added terms, was almost twice as high as the corresponding share measured in gross terms, rising from 23 per cent to 45 per cent in 2008. Services are key contributors to trade in goods, either in their role of facilitating international transactions or through their incorporation in the total production cost of merchandise. This has important implications for industrial and trade policies, especially those regulating services markets, and in relation to the integration of small and medium-sized enterprises in international supply chains.

The efficient sourcing of intermediate inputs is crucial for a country's export competitiveness.

Economies import more and more intermediate goods and services to produce both for the domestic market and for exports. A positive correlation has been found between access to imported inputs and export performance – the more an economy integrates into international supply chains, the more its exports grow. Efficient access to imports of intermediate inputs improves the capacity of firms to increase their productivity and remain competitive in an interconnected world.

Future scenarios

Projections of economic activity and trade are sensitive to assumptions, notably concerning technological progress, demographics, investment, energy/natural resources, transportation, institutions and policy.

In looking at future scenarios, technology is a key factor in the transformation towards productivity-driven growth. Productivity improvements in relation to energy and other primary commodities will be

important in light of expected price increases associated with further industrialization. Developments in the transport sector – infrastructure, fuel prices, innovation and regulation – will also impact the costs of trade and the global organization of production.

Several countries, mostly in the developing world, will experience favourable demographics but much will depend on the education and integration of new entrants in the labour force. Others will need to cope with an ageing population and a shrinking working population. With declining savings rates around the globe, capital mobility can play an important role in stimulating economic performance. Economic activity and trade also depend on the wider institutional and policy environment, which is difficult to predict. Specifically in regard to trade policy, current trends, such as the spread of international supply chains, may encourage further trade opening. At the same time, global imbalances, unemployment and environmental concerns may lead to pressure for trade policy reversals. The analysis is complicated by the existence of multiple interlinkages among the various forces driving change, and trade both affects and is shaped by these factors.

Changing assumptions about each shaping factor produces a wide range of potential future economic and trade scenarios. More is at stake for some countries than others, and not all current trends in trade will necessarily continue.

Developing and emerging economies have the most to gain from a vibrant economic scenario with further trade opening and the most to lose from a subdued economic outlook and faltering trade cooperation. Under the high case scenario, they could grow at an average annual rate of 7 per cent, compared with a mere 2.8 per cent in the second scenario. The latter would be barely above the estimated developed country rate of around 2 per cent under both scenarios. For exports, the divergence of the two scenarios is even more dramatic. Developing country export growth is estimated at 8.5 per cent per annum in the high case scenario and at less than 1 per cent in the low case. The latter rate would be below that of developed countries, which would grow at a rate of 1.5 per cent under the low case scenario and about 4.5 per cent in the high case scenario. The direction of trade would hardly change under the low case scenario, with trade among developed countries remaining dominant at over 40 per cent and trade among developing countries retreating slightly to just 18 per cent of total trade. By contrast, under the more optimistic scenario, these positions are reversed. Trade among developing countries would represent the largest share of global trade (at 43 per cent), while trade among developed countries would constitute some 17 per cent.

The rise of services trade is likely to continue although trade in manufactured goods remains important.

Trends of increased trade within certain regional agreements are less likely to persist, with multilateral trade relationships across many regions having the potential to gain significantly in importance. Broad-brushed as they are, these results may raise as many questions as they answer, particularly in relation to the specific challenges faced by individual countries. Further detailed analysis is required for a more certain and detailed picture.

C. Fundamental economic factors affecting international trade

Demography, investment, technology, energy and other natural resources, transportation costs and institutions are fundamental economic factors that shape the overall nature of trade and explain why countries trade.

Demography

The world is experiencing dramatic changes in the size and composition of populations, with sharp differences among countries.

A country's demographic transition typically involves four stages. In the first stage, high fertility and mortality result in a young population and a low old-age dependency ratio. At the start of the demographic transition in the second stage, mortality declines while fertility initially remains high. Then fertility starts to decline and the working-age population increases. The second stage of the transition is associated with a demographic dividend – a condition enjoyed by the world as a whole for the last 40 years. But the third stage has now set in, characterized by ageing. The demographic transition then ends in the fourth stage with an older population and high old-age dependency ratios. The timing of the demographic transition differs widely among countries.

Demographic developments affect trade patterns and the level of import demand.

International differences in population dynamics are a factor determining comparative advantage. Most of the trade effects of the demographic transition, however, are likely to be due to changes in the composition of demand. Older groups in ageing countries will spend more on communication, transport and health services. In countries where the demographic transition is still in its early stages, per capita income will increase, and with it the size of the middle class. The demand for goods and services that are typically consumed by the middle class, such as recreation equipment, cars and mobile phones, as well as recreation and culture services, will disproportionately come from emerging markets.

Two other notable developments in the composition of the labour force linked to the demographic transition are a rising share of educated workers and an increase in female labour force participation. These trends will affect trade in ways not easy to predict.

The educational attainment profile of the working population will continue to increase in a large number of countries, predominantly developing ones, driving a global convergence in education. The demographic transition is also associated with changes in labour force participation rates. Female labour force participation is closely connected with falling fertility but it is also affected by cultural norms and institutions that differ widely among regions and countries. Female labour force participation rates are predicted to rise in the European Union, South and Central America, Sub-Saharan Africa and, to a lesser extent, the Middle East. These developments are likely to affect patterns of comparative advantage because they change the relative abundance of productive factors at a country level.

International migration is a component of demographic change.

Migration can directly influence population growth by changing population levels in different countries. It can also have indirect effects on population growth, mainly through its impact on fertility in affected countries. The global stock of international migrants grew by 38 per cent from 1990 to 2010. International migrants still constitute a very small fraction of the world population, amounting to 3.1 per cent in 2010. However, in several developed countries where fertility is low, immigration is the driving force behind population growth. Migrants are generally working-age adults and can reduce dependency rates in receiving countries. These trends will continue in the future.

Emigration rates of highly educated individuals differ widely across sending countries, exceeding 40 per cent in the Caribbean and in several Sub-Saharan African countries. In general, emigrants from Africa and South and Central America tend to be relatively highly educated. Various studies have argued that this "brain drain" need not be detrimental for sending countries on account of several mechanisms, including incentives for capital formation, remittances from migrants and the positive effects of migrant networks.

Migrant networks promote trade between source and host countries in two ways. First, they reduce trade costs relating to informational, language and institutional barriers while facilitating the creation of business relationships. Secondly, migrants boost trade because they demand disproportionately more goods and services from their origin country.

Urbanization and agglomeration effects are among the most salient global demographic trends.

Urbanization is likely to affect trade through changing relative efficiencies (comparative advantage). Between 1950 and 2011, the rate of urbanization (share of the population living in urban areas) increased by 77 per cent. Urbanization is expected to reach 67.1 per cent of the total population in 2050. Agglomeration economies, closely linked to urbanization, can also influence trade patterns indirectly via their impact on productivity. Innovation in knowledge-intensive sectors is particularly affected by the spatial concentration of economic activity. Comparative advantage in these sectors, therefore, will also depend on agglomeration.

The relationship between demography and trade is complicated by numerous factors.

Causality is likely to run in both directions. The possibility of reverse causality affects the link between migration and trade (trade links can affect migration decisions). The same applies to the link between urbanization and trade (trade opening can foster agglomeration). Institutions also have a significant effect on both demography and trade. Moreover, history shows that the timing of demographic transitions has been crucially affected by international trade. Overall, caution is called for in making predictions on the trade effects of demographic trends.

Investment

Investment in physical capital can lead to the emergence of new players in international trade, especially in the context of international supply chains, and change the comparative advantage of countries already widely engaged in international trade.

Public investment in roads, ports and other transport infrastructure reduces trade costs and hence could, for example, enhance the participation of Africa in world merchandise trade. For instance, the empirical literature suggests that doubling the kilometres of paved roads or the number of the paved airports per square kilometre of a country's territory can boost trade by 13 per cent and 14 per cent, respectively. Similarly, investment in information and communication technology (ICT) infrastructure could enable African countries to participate more fully in world markets for services. Investment in physical capital (such as plant, machinery and equipment) may transform a relatively labour-intensive economy into a relatively capital-intensive one over time, as it did in the case of Japan, which saw its capital-labour ratio increase from less than 10 in the early 1960s to almost 180 in 1990.

Domestic savings are crucial for enhancing investment in physical capital.

For high and middle-income countries, the correlation between savings and investment has been high during the last two decades. Countries with the highest average savings rates between 2000 and 2010 are mostly Asian nations and resource-rich economies in the Middle East and North Africa. Middle-income countries as a group had a savings rate of 30 per cent in 2010, almost double the level of high-income countries. High savings rates should continue to provide funds for investment in physical capital in middle-income countries. In low-income countries, growth will be central to higher savings rates. Effective tax regimes, sound macroeconomic policies and more efficient capital markets are also important for translating savings into investment.

Foreign capital flows can complement domestic savings in promoting domestic investment by lowering the cost of capital.

Overseas development assistance and migrant remittances have played a part in financing the savings-investment gap in low-income countries. The WTO's Aid for Trade initiative is also important in this regard as it can increase a country's supply capacity.

The importance of foreign direct investment (FDI) in increasing capital formation in low-income countries in the future should not be underestimated. In order to attract foreign capital inflows, low-income countries will need to adopt stable macroeconomic policies and develop strong institutions, such as a sound legal framework, effective transparency arrangements and independent regulation.

Private capital flows are also likely to be important for further enhancing investment rates in middle-income countries. The top ten recipients of FDI, portfolio investment and bank lending from abroad among developing economies during the last decade were almost entirely middle-income countries in Asia or Latin America. While deregulation and market opening measures led the way, continuous improvements in supporting infrastructure and the quality of institutions will be crucial for sustaining these private capital inflows. Some developing countries have become capital exporters in recent years, with outflows of FDI increasing from close to zero in the early 1990s to more than US$ 400 billion in 2010. In the longer run, high expected growth, familiarity with similar policy environments, and the strengthening of South-South trade links are likely to enhance South-South FDI.

Foreign capital flows also facilitate the development of international supply chains.

Foreign direct investment increases export possibilities for intermediate products and services, such as design and research and development (R&D). The transfer of technology and knowledge associated with FDI is likely to influence a country's comparative advantage over time. International financial relationships can increase trade flows by reducing information asymmetries between exporters and importers.

To the extent that investment and trade are complementary, global investment rules could ensure a more efficient allocation of resources across borders, which in turn should help trade.

Bilateral or regional agreements, which are being increasingly used to govern international investment, run the risk of creating regulatory divergence. A set of multilateral investment rules could address this and also open up more investment opportunities for smaller countries for whom bilateral networks may be disadvantageous.

Technology

The geography of technological progress is changing. New players are emerging among the countries driving technological progress, and technology transfer is becoming more regional.

In recent years, the world has experienced significant changes in the geography of innovation. Although the technological gap between high and low-income countries persists, R&D expenditure has become less concentrated. In general, empirical evidence supports the view that international spillovers tend to be localized although the degree of localization has decreased over time. One possible explanation for this is the growing importance of international production networks in trade. However, since production networks tend to be regional, intra-regional technology spillovers are greater than inter-regional spillovers. An implication of stronger regional spillovers is the possible development of groups of countries that become increasingly similar in terms of technology levels ("convergence clubs"). This may lead to more intra-regional trade, the emergence of shared economic interests and the evolution of stronger regional institutions.

Although most innovation still occurs in manufacturing, R&D in services has increased faster since the early 1990s.

R&D spending is highly concentrated. Nearly 90 per cent of R&D investment takes place in the manufacturing sector, in a few industries, including chemical products, electrical and non-electrical machinery (covering ICT) and transportation equipment. Nevertheless, R&D in services has grown in knowledge-intensive business services (KIBS) and may in the long run replace manufacturing as the engine of global innovation.

Technological progress is a major factor in explaining trade. Technology affects trade by shaping comparative advantage and reducing trade costs.

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Countries trade on the basis of relative efficiencies, and knowledge spillovers create agglomeration forces that shape trade. Countries will tend to export products for which they have a home market advantage – that is, products with the greatest domestic demand. Technological innovation has also had a significant impact on trade costs through the introduction of jet engines, containerization, advances in information-based logistics, and ICT.

A two-way relationship exists between technology and trade. Technology drives trade and trade is one of the factors shaping technological progress.

Trade affects technological progress through incentives to innovate and through technology transfers. Incentives for firms to innovate that are affected by trade include market size (positive scale effect), competition (ambiguous competition effects) and technological spillovers (ambiguous effects of imitation). Trade also affects institutions that shape the economic incentives facing firms. Imports of technologically advanced goods provide access to the technologies they embody. In addition, international trade provides a channel of communication that favours cross-border learning of production methods, product design and market conditions. Exporting is also a channel of technology transmission.

Other factors affecting technological progress include intellectual property rights, the movement of factors of production, and a country's absorptive capacity.

Technological progress will be influenced by the strength of intellectual property (IP) rights. Theoretical arguments and empirical evidence on the relationship between IP protection and technological progress are mixed. Other important determinants of technology transfers are FDI flows, the movement of people, and direct trade in knowledge through technology purchases or licensing. The international diffusion of technology is not automatic. Differences in observed absorptive capacity among countries point to explanatory factors such as the ease of doing business and the quality of tertiary education systems.

In the future, we may see mounting pressure for specific domestic policies.

If the production fragmentation process continues or intensifies, governments will be increasingly pressured to adopt policies that foster the integration of domestic industries into international production chains. The policies involved may include R&D subsidies, investment in infrastructure, and reinforced IP protection. The perception of a misfit between the operating environment and the regulatory regime may also increase the demand by industry for international rules covering such matters as competition.

Technological innovations may also relocate business activities across countries and among large and small firms.

By individualizing production, 3D printing may provide small and medium-sized enterprises (SMEs) easier access to export markets. By reducing the importance of labour costs for comparative advantage, robotics may induce some manufacturing to relocate in developed countries. The internet will also influence buying and selling modalities in the retail sector.

Energy and other natural resources

The disposition of energy, land and water resources has a crucial bearing on the volume, pattern and growth of international trade, particularly in a world where these resources are distributed unevenly.

The link between national endowments of natural resources and exports is readily apparent in the case of energy and land but less so in the case of water. Typically, countries with energy reserves and land will tend to export products that use these factors intensively. The uneven international distribution of resources may create a temptation to exploit market power through the use of export restrictions. By reducing supply of the natural resource in international markets through export restrictions, for example, the world price of the resource can increase and impart a terms-of-trade gain for the exporting country. While just 5 per cent of world trade is covered by export taxes, the share is more than twice as high, at 11 per cent, for natural resource products. Of all export restrictions notified to the WTO, more than a third have been applied to such products. Countries with abundant supplies can also use control over their resources to support strategic and geopolitical objectives. To the extent that these motivations contribute to international tension, they can add a risk premium to the price of natural resources and also increase price volatility.

Increases in prices and the price volatility of natural resources, such as oil, can have large adverse effects on economic activity and international trade.

Since oil is a major factor of production and little scope exists for substitution in the short run, an increase in the oil price will reduce production and growth in net energy-importing countries. At the same time, higher oil prices should expand output and growth in net energy-exporting countries but this will not offset the negative consequences of a price increase on economies that are net importers of oil. In general, an increase in energy prices will raise the prices of these energy-intensive products and reduce demand for them, thus altering the commodity composition of trade for many countries. Volatility in oil prices tends to

reduce trade flows because it increases the risks faced by importers. Uncertainty about the future path of oil prices will lead households to postpone purchases of consumer durables and firms to postpone investment decisions. This reduces aggregate demand and total imports.

Substitution possibilities and technological change will largely determine the degree to which the finite availability of some natural resources influences economic growth and trade.

The exhaustibility of some natural resources has frequently caused a degree of alarm that may not be entirely warranted. The total supply of practically all exhaustible resources is not known for certain. Given appropriate economic incentives, reserves can be maintained or increased through the exploitation of deposits initially considered economically inaccessible. For example, over the last three decades, the stock of proven oil reserves rose by more than 140 per cent and the ratio of reserves to global consumption increased from 11 to 19. Innovation can also increase efficiency in the use of an exhaustible resource and lower its marginal extraction cost. New methods of exploration can increase the likelihood of making geological discoveries. Technology can lead to the substitution of non-renewable resources for renewables. Nevertheless, as exhaustible natural resources are run down, countries with large reserves will experience an erosion of comparative advantage in the relevant product lines.

The extraction and consumption of natural resources can have harmful environmental effects.

The most serious current example of negative externalities associated with natural resource use is the burning of fossil fuels. Many countries have taken steps, sometimes unilaterally and sometimes in concert with others, to mitigate the adverse consequences of carbon emissions. Climate change policy will prove crucial to the future evolution of energy prices and to the extent the world economy continues to rely on fossil fuels. Moreover, differences in the stringency of climate change policies adopted by governments can create competitiveness concerns, especially in energy-intensive sectors.

Energy needs are projected to rise by nearly one-third by the year 2035, with most of the growth in demand coming from emerging economies. The rapid development of shale gas in the United States will create a sea change in global energy flows and the pattern of international trade in oil. Nevertheless, higher energy prices are likely in the future. There is also likely to be increasing water scarcity in some areas of the world.

Fossil fuels will continue to meet the bulk of the world's energy needs, with the share of natural gas expected to rise. Almost all of the increase in natural gas supply will be due to shale gas production. The United States will become a net exporter of natural gas, while demand for Middle East oil is likely to come increasingly from Asia. These developments will give rise to shifts in the composition of trade.

The populations of South Asia and the Middle East as well as large shares of China's and North Africa's population will face increasing water scarcity. They will be required to import more food and agricultural products, raising the possibility that the long-term decline in the share of food and agricultural products in international trade might be arrested or even reversed.

Transportation costs

Transportation costs affect the volume, direction and composition of international trade.

Transportation costs drive a wedge between origin and destination prices, so higher transportation costs will reduce the volume of trade. Furthermore, if transportation costs are charged on a per unit basis rather than simply proportionately to the price of the traded good, higher transportation costs will tend to decrease the share of low-quality goods and goods with low value-to-weight ratios in international trade. Declining transportation costs can increase the range of goods available for international commerce. For example, estimates from Latin American countries suggest that a 10 per cent decline in average transport costs would be associated with an expansion of more than 10 per cent in the number of products exported, and a 9 per cent increase in the number of products imported. Transport costs are also time-sensitive, and this has become more important with the rise of international supply chains, just-in-time inventory management and lean retailing.

Empirical estimates show that a delay of one week in shipments can reduce the volume of exports by as much as 7 per cent or raise the delivered price of goods by 16 per cent and for extra time-sensitive goods, such as parts and components, by as much as 26 per cent. Being landlocked and distant from markets adds significantly to transportation costs. Evidence suggests that, on average, being landlocked reduces trade volume by about 40 per cent, while an increase in distance between trading partners lowers bilateral trade by about 9 per cent. The extent and quality of transportation infrastructure in source, destination and transit countries also have a major impact on transportation costs. The disadvantage of having poor transportation infrastructure is substantial. For example, a country whose road infrastructure quality placed it on the 75th percentile globally, i.e. three-quarters down to the bottom, would have transportation costs that are 12 percentage points higher than the median country. As a consequence, its trade will on average be 28 per cent lower than that of the median country.

The transportation sector is a service industry whose efficiency will depend in part on how much competition is allowed in the sector.

Lack of competition may arise from the existence of a natural monopoly but government policies may also play a big role. In the case of maritime transport, for example, the liner market has been exempt from national anti-trust laws since the turn of the 20th century partly because of the desire to reduce price volatility in the market. However, this reduction in price volatility has come at the cost of higher freight charges and lower trade volumes. For instance, limited competition in maritime transport means developing countries pay as much as 30 per cent more in freight charges and consequently have some 15 per cent less trade. Significant efficiency gains are likely to result from increased competition. In the case of air transport, studies of open skies agreements tend to find that they lead to reduced transport prices and increase cargo quantities.

Innovation makes an important contribution to the reduction of transportation costs.

The development of the jet engine reduced the cost of air transport more than ten-fold. Containerization in maritime transport ushered in a system of automated handling of cargo and multi-modal transport that both accelerated delivery times and reduced uncertainty about them.

Customs and other border procedures and controls governing the movement of goods across national borders can create delays and increase trade costs.

The growing prominence of time-sensitive trade and international supply chains increases the cost burden of border and customs-related delays. The potential reduction in costs through trade facilitation is significant and explains why this is a major part of the WTO's Doha Round negotiations. The trade facilitation measures being negotiated in Geneva have the potential of reducing total trade costs by almost 10 per cent for OECD countries alone. Many developing and least-developed economies suffer disproportionately from costly border procedures. The cost of importing into low-income countries has been estimated at some 20 per cent higher than in middle-income countries, plus a further 20 per cent in comparison to high-income economies.

The real price of energy, including fuel, is likely to rise in the long-term. However, there is scope for taking policy initiatives at the national and multilateral level to offset rising fuel costs.

Rising energy prices will adversely affect some transport modes more than others. On the basis of various estimates of the share of fuel in the cost of transportation, a double-digit rise in transportation cost is likely. Energy costs also influence the composition of traded goods, as they are likely to more adversely impact goods with low value-to-weight ratios. Although the evidence is far from conclusive, high oil prices can also induce trade diversion from trading partners located further away towards neighbouring regions.

Policy initiatives to address rising fuel costs include improving the quantity and quality of transportation infrastructure, successfully concluding the Doha Round negotiations on trade facilitation, introducing more competition, and supporting innovation. Ample scope exists for improvements in these areas to compensate for higher energy prices in the future. If no significant progress is made on these fronts, the expected rise in fuel prices is likely to translate into a long-run rise in transportation costs. The consequences will be slower trade growth, more regionalization of trade, a shift in the composition of trade which will favour high-quality goods and goods with higher value-to-weight ratios, a reduction in the share of time-sensitive goods in trade, a reduction in product variety, a move away from merchandise goods to services, and greater reliance on the sale of technology, ideas and blueprints, since these do not require a lot of transportation services.

Institutions

Institutions include social norms, ordinary laws, regulations, political constitutions and international treaties within which policies are determined and economic exchanges are structured.

This report looks at three sets of institutions: political institutions, such as the form of government and political borders; economic institutions, such as the quality of the regulatory system and the rule of law; and cultural norms, such as those embedded in social values.

In the long run, a two-way relationship exists between international trade and institutions.

On the one hand, institutions are a shaping factor of trade. Institutional differences create transaction costs. They may also form the basis of comparative advantage in certain sectors or production tasks. Domestic and international institutions determine how trade and trade-related policies are set and negotiated. On the other hand, international trade is an important determinant of institutional development in the political, economic and cultural spheres.

International trade may be linked to systems of government.

Some studies have concluded that open trade policies tend to be associated with more democratic regimes but this relationship is not confirmed for a considerable

number of individual countries. Indeed, some have argued the contrary. Moreover, the relationship may flow in the opposite direction – the form of government could be affected by trade openness. Globalization alters factor prices and may shuffle wealth and economic power among social groups, possibly leading to pressure for political change.

Political borders hinder international trade but they also respond to changes in the trading environment.

Political borders create different forms of transactions costs that negatively affect international trade. The empirical literature finds that this "border effect" is sizeable – only among industrialized countries, borders are estimated to reduce international trade by 30 per cent. On the other hand, globalization reshapes national borders. Economic integration changes the calculus regarding national sovereignty, releasing both centrifugal and centripetal forces. The coexistence of these forces contributes to an explanation of the growing number of sovereign countries over the past 60 years and the parallel growth of supranational institutions. The rising importance of international supply chains, in association with deeper trade agreements, is evidence of the complex relationship between changing borders/sovereignty and international trade.

Strong economic institutions promote international integration and are an important source of comparative advantage.

Institutions that guarantee the value of contracts, protect property rights, defend efficient regulations and underwrite respect for the law create incentives for exchange by reducing transactions costs and costs associated with uncertainty. Countries with better institutions specialize in the production of more complex products for which a resilient contractual environment is essential. Available empirical evidence confirms the importance of the relationship between the costs of trade and institutional quality. The quality of economic institutions is also associated with the ability to integrate into international supply chains and to attract foreign direct investment.

Differences in informal institutions can create various costs that may limit international trade. But long-run commercial relationships and the presence of deep agreements may smooth these costs.

In addition to formal institutions, informal institutions such as social norms and conventions (in a word, culture) structure human interactions and, therefore, affect international trade. Cultural differences may be negatively correlated with trade flows. Different informal institutions can form an implicit barrier to trade as they create transactions and information costs and may reduce trust between agents. On the other hand, over

the long run international trade is a vector of cultural transmission and contributes to creating trust between heterogeneous communities. Formal institutional structures may also be constructed to bridge informal institutional differences among countries.

D. Trade openness and the broader socio-economic context

Trade takes place in a broad economic, societal and political context. This context matters for trade policy decisions. Historically, social and macroeconomic concerns have repeatedly influenced decisions in trade policy matters. Both themes are currently again high on the political agenda. Another issue that has rapidly been gaining prominence in national, regional and global policy debates is environmental sustainability.

Social concerns: inequality and unemployment

Increasingly, policies need to be perceived as supporting jobs in order to receive public support.

Jobs have been high on policy-makers' agendas in recent years. The concern is widespread although the reasons for it differ among countries. Some are struggling to bring unemployment down from record levels achieved during the Great Recession. Others are looking for ways to absorb large cohorts of young workers into the formal labour market or to facilitate the transition of rural workers into urban labour markets.

Trade is good for jobs but can put labour markets under pressure to adjust.

Trade opening contributes to the creation of new and high-quality jobs, in particular in firms that successfully integrate into global markets. But it also puts jobs in non-competitive firms under pressure and some of those jobs may be destroyed. The adjustment process following trade reform may therefore lead to surges in unemployment. Empirical evidence, however, indicates that the long-run employment effects of trade opening are likely to be positive.

Trade – and globalization more generally – facilitates the spread of ideas and innovation. This contributes to economic growth, in particular in countries that are in the process of catching up with the technology frontier. But the spread of ideas and innovation also implies technological change. Successful integration in global markets therefore implies the constant need for individuals and societies to adjust to changes in the competitive environment.

Adjustment challenges differ across countries and notably depend on countries' level of development.

The nature and the extent of labour market challenges will differ among countries. For those not yet well integrated into global markets, successful integration may imply significant economic restructuring, most likely from agricultural to industrial and services employment. This is the case for many low-income countries, in particular least-developed countries (LDCs). A number of emerging economies may face the double challenge of having to employ large numbers of rural workers while simultaneously moving into higher value-added activities. Taking into account the continuing evolution of comparative advantage and technological change, pressure for adjustment in labour markets may also persist in industrialized countries.

The adjustment path is also influenced by within-country income distribution, as inequality may hamper process.

Evidence suggests that within-country inequality has increased in many countries in the past two decades. Income distribution matters for trade flows, as it affects comparative advantage and consumption patterns. Inequality may hamper economic adjustment to changes in trade policy or the competitive environment, in particular in economies where financial markets do not function well.

Policies strengthening the capacity of economies to adjust to changes in the competitive environment can have high pay-offs in terms of economic benefits and public support for trade reform.

Well-designed education and training policies can play an important role in facilitating adjustment to change and in easing the burden falling on individuals. Social protection systems and active labour market policies can also play an important role. Policies that strengthen the enabling environment for enterprises can have particularly high pay-offs, as they positively contribute to job creation. More generally, initiatives – like Aid for Trade – that aim at strengthening supply responses can contribute to fortifying the multilateral system's capacity to handle challenges in labour markets.

Environmental concerns

The transition to a sustainable development path involves careful management of the multifaceted relationship between trade and the environment.

Trade openness and environmental protection are key components of sustainable development, and policies in both fields should work to utilize existing resources better. Beyond this broad level of commonality, trade and the environment interact in complex ways, with multiple links and feedback effects between the two systems. If not managed carefully, this relationship may give rise to tensions which can undermine the positive contribution of trade to economic growth and sustainable development.

The impact of trade on the environment may be positive or negative. Trade protectionism is ineffective in addressing negative environmental effects because it deprives the international community not only of an engine of economic growth but also of the environmental gains associated with improved efficiency.

Trade involves a complicated set of changes and the net effect of trade on the environment has not been measured robustly. The dramatic increase in world trade during the past three decades has drawn attention to the scale effects of trade on environmental quality.

Many unexploited opportunities exist to bolster environmental gains from trade. Trade has the potential to induce changes in the methods by which goods and services are produced, thereby lowering the energy and pollution intensity of production, and lessening the scale effects of trade. These beneficial effects will not happen automatically. They will be contingent on many conditions, including an open trade regime, sound environmental policies and other institutional factors. This highlights the importance and urgency of the first ever multilateral negotiations on trade and the environment, where WTO members are seeking to reduce or eliminate the barriers affecting trade in green goods and services.

Transport has also come under increased scrutiny because of its contribution to carbon emissions. Although the bulk of trade relies on maritime transport, which is the most efficient mode of transportation in terms of carbon emissions, trade-related transport is projected to increase sharply during the next few decades, as are transport-related emissions costs.

Environmental policies may affect the competitiveness of particular firms and sectors, creating pressures on open economies to resort to green protectionism.

Besides the scale effects of trade, academic and policy discussions on the interface between trade and the environment have devoted significant attention to the competitiveness effects of environmental policy, which are difficult to analyse but are sometimes perceived as holding back environmental policy reform. Environmental policies inevitably affect production and consumption patterns, and may therefore have adverse effects on the competitiveness of particular firms or sectors. Governments may respond to resulting pressure from industry by incorporating trade-restrictive elements into environmental policies as a means of compensating affected firms and sectors.

A growing number of governments have put in place ambitious green incentive packages. The emphasis on a variety of environmental and industrial policy goals as a justification for these measures may undermine their environmental effectiveness and exacerbate their potentially adverse trade effects.

One response adopted by a growing number of governments to concerns about the compliance costs associated with environmental policy has been to promote "green competitiveness". As part of these efforts, several governments have established incentive packages for green technologies, with a focus on renewable energy. These measures have been variously justified on the basis not only of particular hurdles facing renewable energy but also of broader policy goals such as stimulating economic growth, spurring job creation and promoting export diversification. The risk is that the intertwining of environmental and green competitiveness objectives may increase the vulnerability of renewable energy incentives to powerful lobbies and rent-seeking behaviour or result in flawed design due to the lack of sufficient information to achieve multiple (and often vaguely defined) policy objectives. This could exacerbate the adverse trade effects associated with some types of incentive measures and undermine their environmental effectiveness.

The emerging patchwork of regional, national and sub-national environmental policies to tackle global environmental problems such as climate change will add complexity to the future management of the interface between trade and the environment.

This patchwork of regimes may lead to concerns about the loss of competitiveness of energy-intensive and trade-exposed firms and sectors, and the related possibility of "carbon leakage", which countries may try to manage by extending carbon pricing to imports. This kind of second-best policy is likely to raise international tension and carries the risk of mixing environmental and protectionist objectives. It is a poor substitute for international cooperation on climate change policy.

The individual and collective decisions by open economies in managing the relationship between trade and the environment carry significant implications for the future of international trade and the WTO.

Collective efforts that result in agreed policy approaches towards global environmental problems would limit the likelihood of a clash of regimes. This suggests, however, that the future evolution of the interface between trade and the environment may depend on improved multilateral cooperation at the WTO as much as within the international environmental governance regime.

Macroeconomic and financial concerns: trade finance and currency movements

Macroeconomic and financial shocks can only affect trade beyond the short term if they alter fundamentals.

The 2008-09 financial crisis could generate long-term effects if it results in a lasting contraction of the financial sector or triggers less than temporary exchange rate movements.

Finance is the lubricant of commerce. While normally a low-risk proposition, the financial crisis affected the supply of trade finance.

Financial crises affect the supply of trade credit through heightened perceptions of risk and re-financing difficulties in money markets. To prevent trade finance markets from collapsing in 2008-09, the G-20 intervened by offering up to US$ 250 billion in additional liquidity and risk mitigation capacity, two-thirds of which has been used by traders.

While the trade finance markets recovered quickly after the crisis in the major markets, problems with accessing affordable trade finance have worsened for traders in low-income countries. Multilateral development banks have developed a network of trade finance facilitation programmes aimed at supporting trade transactions at this lower end of trade finance markets. Demand for these facilities keeps growing, as an indicator of the market gap in these countries.

A risk of the current downsizing of the financial sector is that it could potentially lead to a reduction in the supply of trade finance. Deleveraging may affect trade negatively if new credit is rationed to meet prudential ratios.

The new prudential system should restore incentives to engage in low-risk, safe banking activities such as trade finance. In this case, lending would be reoriented towards real economy financing, including trade finance. Multilateral agencies will need to remain engaged in trade finance, at least to help fill the structural gap at the lower end of the market. Dialogue with regulatory agencies will need to be pursued to ensure that trade finance is recognized as a development-friendly and low-risk form of finance.

The trade impact of exchange rates can be analysed in terms of currency fluctuations as well as relative currency levels – so-called misalignments.

On average, exchange rate volatility has a negative, even if not very large, impact on trade flows. Exchange rate volatility increases commercial risk, introduces uncertainty, and can influence the decision of whether or not to enter foreign markets. The extent of these

effects depends on a number of factors, including the existence of hedging instruments, the structure of production (e.g. the prevalence of small firms) and the degree of economic integration across countries.

In the longer run, the situation is less clear. Economic theory suggests that when markets are free of distortions, an exchange rate misalignment has no long-run effect on trade flows, as it does not change relative prices. But long-run effects are predicted in models that assume market distortions. In the short run, when some prices in the economy are "sticky" (i.e. take time to adjust), movements in nominal exchange rates can alter relative prices and affect international trade flows, although this depends on several factors. Persistent misalignments in exchange rates are a systemic irritant in international trade because they fuel perceptions of unfair competition, creating pressure on WTO members to use trade policy measures to redress perceived monetary imbalances. Exchange rate issues can be expected to remain with the world trading system for some time, suggesting the need for improved monetary cooperation.

E. Prospects for multilateral trade cooperation

This report has identified a number of trends in the nature, composition and geography of trade as well as in the trading environment, which raise challenges for the multilateral trading system.

Among the main trends discussed are the emergence of international supply chains, the rise of new forms of regionalism, the growth of trade in services and increased linkages between trade in goods and trade in services. Other factors are higher and more volatile commodity prices, the rise of several emerging economies, growing concern regarding the social and environmental effects of trade, and the increasing potential for tensions between WTO rules and those in other international bodies.

As it has in the past, the WTO will need to respond to these challenges and adjust to the realities of the 21st century.

Traditional market access issues will remain on the agenda.

With regard to tariffs, priorities involve the breaking of the market access impasse and the multilateralization of preferential tariffs. The reasons behind the stalemate in the market access negotiations are several. One step towards a solution, however, may involve a redefinition of special and differential treatment to better reflect differences among

developing countries. This could be part of an attempt to re-examine the role that reciprocity should play in the negotiations.

Another contribution to breaking the deadlock in this area would be to acquire a better understanding of the value of tariff bindings and the corresponding reduction in trade policy uncertainty. At the same time, proposals to reduce the trade-distorting effects of preferential rules of origin would need to be examined. While some of the action in this area would have to take place at the level of preferential trade agreements (PTAs), the WTO could play a central role in a complementary top-down approach.

With regard to non-tariff measures (NTMs), the WTO will need to pursue its effort to increase transparency and improve existing mechanisms. This may involve changing incentives for WTO members to abide by their notification obligations as well as reinforcing review and monitoring mechanisms. Beyond transparency, a greater focus on regulatory convergence will be required. WTO members will need to re-examine existing provisions and the case for adopting multilateral disciplines to ensure the right mix of regional and multilateral convergence.

The WTO also needs to find ways of refining the "tests" used today to distinguish between legitimate measures and those that are protectionist. Finally, a specific NTM-related issue that has been identified as a matter that should form part of the WTO's agenda is re-balancing in terms of the relative attention devoted to import barriers and to export restrictions.

Proposals aimed at addressing challenges related to the "servicification" of manufacturing involve establishing mechanisms to ensure that the position of manufacturers is taken into account in services negotiations, and that services and goods market opening are not negotiated separately, with commitments in one area traded against commitments in the other. As regards proposals to address the challenges that arise in the services area as a result of the internationalization of supply chains and the proliferation of public policies, these are largely similar to those discussed above in relation to the proliferation of NTMs.

New issues are also emerging.

The inclusion of investment and competition policy on the WTO agenda remains contentious but there may be new impetus from some quarters for addressing these issues in the WTO. Environmental measures will continue to gain prominence, particularly given the urgency of tackling climate change. Establishing disciplines on fishing subsidies and the opening of markets for environmental goods are two areas in which the WTO can contribute to sustainable development.

Fragmentation of environmental policy-making and the experimentation that this allows can have advantages. But this carries the risk that measures taken domestically will be challenged at the WTO when they have trade effects. Indeed, several recent WTO disputes involve industrial policies aimed at promoting a green economy. It has been argued that the challenges raised by exchange rate misalignments and global imbalances relate to a "coherence gap" in global governance. WTO-triggered trade actions alone would not provide an efficient instrument to compensate for the weaknesses in international cooperation in macroeconomic, exchange rate and structural policies but they could form part of a broader solution.

The WTO could also address internal governance matters.

A number of the challenges arising from trends in trade and the trade environment relate to WTO governance. Among the institutional reforms that have been raised is the notion of a variable geometry model that would allow subgroups of members to move forward on an issue while others abstain. Variable geometry with most-favoured nation (MFN) typically takes the form of the so-called "critical-mass" approach, where a sufficiently large subset of the entire membership agrees to cooperate under the auspices of the WTO without excluding non-participants. A critical-mass approach could be used to address the challenges raised by the proliferation of regional trade agreements. Where the non-discrimination constraint can be relaxed, a plurilateral agreement could provide an alternative.

Other proposals have focused on the role of the WTO Secretariat in supporting the decision-making process. The idea would be to give greater power of initiative to the WTO Secretariat and Director-General without diluting the authority of the membership. A source of concern is that an increase in efficiency may come at a cost in terms of legitimacy. To address the challenge of small and poor country participation, one option could be to improve the representation of developing country coalitions.

The role of the WTO in global governance is becoming a pressing question.

The growing number of PTAs has been identified as the greatest challenge to the WTO's role in multilateral trade governance. The challenge is all the greater as more recent PTAs go beyond WTO disciplines and promote deeper cooperation on domestic regulatory issues. A related issue is current efforts to negotiate so-called mega-PTAs. Thus, a key question for the WTO turns on the prospects for "multilateralizing" the gains made in these PTAs, not just on tariffs but also in order to secure regulatory convergence. In addition, the growing relevance of NTMs that pursue legitimate policy objectives, such as health and the protection of the environment, make it necessary for the WTO to reinforce its links with other multilateral institutions that deal with such issues.

I. Trade developments in 2012 and early 2013

World trade growth fell to 2.0 per cent in 2012 from 5.2 per cent in 2011, and remained sluggish in the opening months of 2013 as the economic slowdown in Europe suppressed global import demand. The abrupt deceleration of trade in 2012 was mainly attributable to slow growth in developed economies and recurring bouts of uncertainty over the future of the euro. Flagging output and high unemployment in developed countries reduced imports and fed through to a lower pace of export growth in both developed and developing economies. More positive economic developments in the United States in the early months of 2013 were offset by lingering weakness in the European Union, as peripheral euro area economies continued to struggle and even core euro area economies increasingly felt the impact of the downturn in the region.

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China's growth outpaced that of other leading economies in 2012, partly cushioning the shortfall in demand from developed economies. However, the country's economic performance in the first quarter was weaker than expected as exports were still constrained by weak demand in Europe. Other developing economies saw their trade and output slow more sharply than China's in the middle of 2012 before staging a partial recovery.

Overall, world trade and output grew more slowly than their long-term average rates in 2012 and this weakness appears to have extended into the first quarter of 2013 based on available monthly data (see Figure 1.1 and Appendix Figure 1.1).

The preliminary estimate of 2.0 per cent growth for world trade in 2012 is 0.5 points below the WTO's forecast of 2.5 per cent from September 2012. The deviation is mostly explained by a worse than expected second-half performance of developed economies, which only managed a 1 per cent increase in exports and a 0.1 per cent decline in imports for the year. The growth of exports from developing economies (which for the purposes of this analysis includes the Commonwealth of Independent States) was in line with expectations, but the rate for imports was lower than expected.

These figures refer to merchandise trade in volume terms, i.e. they are adjusted to account for inflation and exchange rate movements. However, nominal trade flows (i.e. trade values in current US$ terms) for both merchandise and commercial services displayed similar trends.

In 2012, the dollar value of world merchandise exports only increased two-tenths of 1 per cent (i.e. 0.2 per cent) to US$ 18.3 trillion, leaving it essentially unchanged. The slower growth in the dollar value of world trade compared with trade in volume terms is explained by falling prices for traded goods. Some of the biggest price declines were recorded for commodities such as coffee (-22 per cent), cotton (-42 per cent), iron ore (-23 per cent) and coal (-21 per cent), according to IMF commodity price statistics.

The value of world commercial services exports rose just 2 per cent in 2012 to US$ 4.3 trillion, with strong differences in growth rates across countries and regions. For example, the United States saw its exports of commercial services climb 4 per cent, while those of Germany dropped 2 per cent and France's tumbled 7 per cent. On the import side, several European countries recorded sharp declines, including Italy (-8 per cent), France (-10 per cent), Portugal (-16 per cent) and Greece (-18 per cent).

Trade growth in 2012 was accompanied by slow global output growth of 2.1 per cent at market exchange rates, down from 2.4 per cent in 2011 and 3.8 per cent in 2010.

Fiscal consolidation was a hallmark of 2012 as European governments tried to reduce their large debts and deficits, while budget negotiations in the United States threatened to undermine confidence. After seeing its economy stall in 2012, Japan opted for a more expansionary fiscal policy stance in the early months of 2013 despite the country's elevated debt/GDP ratio.

Figure 1.1: **Growth in volume of world merchandise trade and GDP, 2005-12** (annual percentage change)
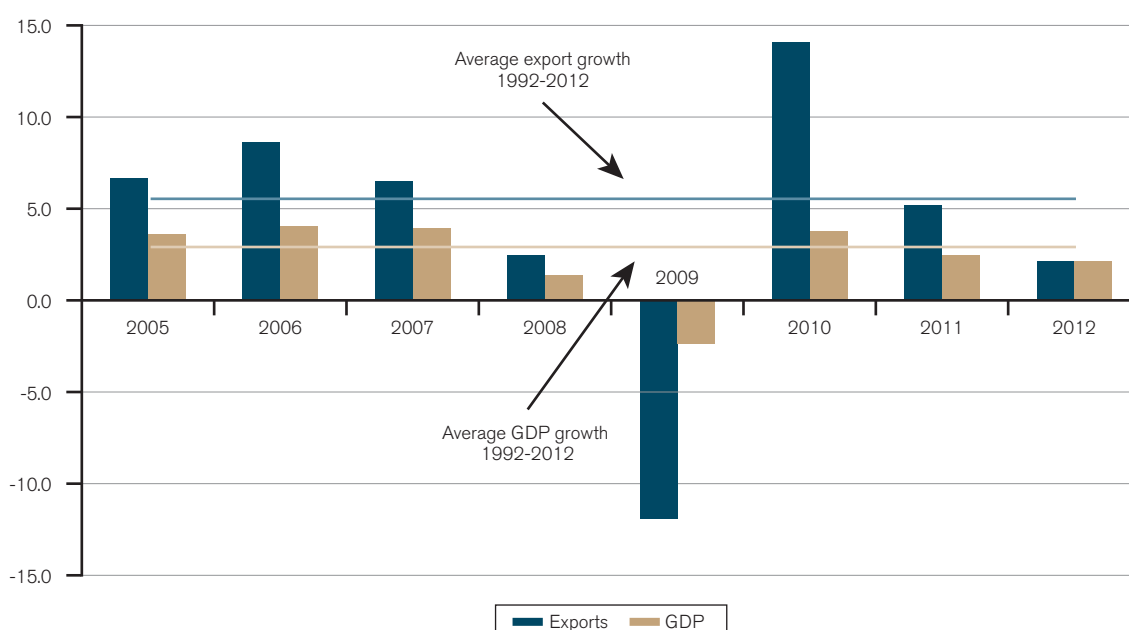
Source: WTO Secretariat.

Finding an appropriate mix of policies has been challenging for developed countries, since they have had to balance long-term fiscal objectives against the need to sustain fragile economic recoveries in the short term.

Indicators of production, business sentiment and employment painted a mixed picture of economic conditions in the first quarter of 2013. Purchasing managers' indices suggested that the euro area downturn had accelerated despite continued resilience in Germany. At the same time, the leading indicators for the United States, Japan, China and the Republic of Korea pointed to a firming of growth in these countries.

Unemployment in the United States fell to its lowest level since before the economic crisis at 7.6 per cent in April 2013, whereas the rate for the euro area stood at close to 12 per cent in February. Together, these figures point to ongoing weakness in European import demand even as conditions gradually improve elsewhere. The fall in EU import demand in 2012 had a particularly strong impact on global trade flows due to the large weight of the European Union in world imports (32 per cent in 2012 including trade within the EU, 15 per cent excluding it).

1. The world economy and trade in 2012

(a) Additional perspectives on trade developments

WTO statistics on short-term trade developments illustrate the divergent trade performances of major economies over the course of 2012. Figure 1.2 shows seasonally adjusted quarterly merchandise trade volume indices for the United States, the European Union, Japan and developing Asia (including China). Exports from the United States and from the European Union to the rest of the world (i.e. EU-extra exports) remained relatively strong for most of the year before dipping slightly in the fourth quarter (Q4). Asian exports also held up relatively well, finishing the year on a positive note after pausing in the third quarter (Q3).

Meanwhile, Japan's shipments of goods dropped 11 per cent in the last two quarters of the year. A significant part of this downturn appears to have been caused by a deterioration of Japan's trade with China following a territorial dispute that soured relations between the two countries. Annual figures on merchandise trade in dollar terms show that the value of Japan's exports declined by 3 per cent in 2012. However, shipments to China, which represent around 20 per cent of the country's exports, were down 11 per cent year-on-year, while exports to other destinations only declined by 1 per cent.

On the import side, the European Union maintained its recent downward trajectory, with Q4 imports in volume terms from the rest of the world falling to 5 per cent

below their level in the middle of 2011, and imports from other EU member states (i.e. intra-EU trade) slipping by the same amount.

Japanese imports recorded strong growth for most of the year before dropping 6 per cent in Q4. The rise in imports in the earlier quarters was partly due to increased purchases of fuels from abroad for use in conventional thermal electricity generation following the loss of output from nuclear power stations after the Fukushima disaster. The dollar value of Japanese imports rose 3.5 per cent in 2012, but imports from the Kingdom of Saudi Arabia were up 8 per cent and purchases from Qatar (mostly natural gas) rose 19 per cent. Japan's merchandise trade deficit of US$ 87 billion for 2012 was the largest ever recorded for the country in a dataset stretching back to 1948.

Quarterly developments for trade in commercial services show a similar pattern to trade in goods, with year-on-year growth in dollar values flat or declining in Europe and growing in other regions.[1]

The growth of world merchandise trade in 2012 was much lower than one would expect given the rate of world gross domestic product (GDP) growth for the year. Under normal conditions, the growth rate for trade is usually around twice that of GDP, but in 2012 the ratio of trade growth to GDP growth fell to around 1:1. Possible reasons for the decline in this ratio include reduced access to credit in distressed euro area economies and the perception in 2011 and the first half of 2012 that one or more countries might be forced to leave the euro. The threat of the latter has receded following the European Central Bank's promise to support the euro with bond purchases, and as a result the WTO expects the usual ratio of trade growth to GDP growth to re-establish itself going forward.

Despite the unusually slow rate of trade volume growth in 2012, the ratio of world exports of merchandise and commercial services to world GDP in current dollar terms only dipped slightly, from around 32 per cent, and remained close to its peak value of 33 per cent in 2008 (see Figure 1.3).

It should be noted that slowing economic growth in Europe has a disproportionate impact on world trade due to the fact that by convention we include trade between EU member states in world trade totals. However, if we were to treat the European Union as a single entity, which it is for purposes of trade policy, the slowdown in world trade in 2012 would not appear as extreme. In this case, world trade growth would be 3.2 per cent in 2012 rather than 2.0 per cent.

The 2.0 per cent growth in world merchandise trade in 2012 was below the average rate of 5.3 per cent for the last 20 years (1992-2012) and well below the pre-crisis average rate of 6.0 per cent (1990-2008) (see Figure 1.4). The difference between the earlier

Figure 1.2: **Quarterly merchandise trade flows of selected economies, 2010Q1-2012Q4**
(seasonally adjusted volume indices, 2010Q1=100)

Source: WTO short-term trade statistics.

trend and actual trade outcomes in recent years appears to be widening, albeit slowly. This gap in percentage terms was equal to 11 per cent in 2010, 12 per cent in 2011 and 15 per cent in 2012.

At some point in the future, trade growth will again surpass its 20 year average, if only because this average keeps falling with every passing year of sub-par growth. When or if it will manage to bridge the gap with its pre-crisis trend remains to be seen. In addition to a durable level shift in the series, it appears that the fundamental growth rate of world trade may have also been reduced. To return to the previous trend would require a period of very rapid trade expansion at some point in the future.

(b) Economic growth

Economies in the euro area stalled in 2012 and the sovereign debt crisis flared again in the summer, pushing long-term borrowing costs for Italy and Spain above 6 per cent and stoking uncertainty about the future of the common currency (see Figure 1.5). Growth also slowed worryingly in the United States in Q4, and Japan slipped in and out of recession during the year. As a result, world GDP growth at market exchange rates dropped to 2.1 per cent in 2012 from 2.4 per cent in 2011. This pace of expansion was below the average of 3.2 per cent for the two decades preceding the financial crisis and also below the

2.8 per cent average of the last 20 years including the crisis period (see Table 1.1).

Policy responses from the European Central Bank and the Federal Reserve in the middle of 2012 appeared to have succeeded in easing the sovereign debt crisis and putting US growth on a firmer footing. Borrowing costs in the euro area returned to more manageable

levels in the second half of the year and employment picked up in the United States, but this progress remained fragile.

The 2.3 per cent growth in the United States was nearly double the 1.2 per cent rate for developed economies as a whole in 2012. Japan's increase for the year was also above average at 1.9 per cent, but the European Union's growth was close to zero at -0.3 per cent.

Developing countries and the Commonwealth of Independent States (CIS) collectively raised their output by 4.7 per cent in 2012, with Africa recording the fastest growth of any country or region at 9.3 per cent. The outsized growth rate for the African continent was mostly due to the resurgence of Libyan output after oil supplies were disrupted by civil conflict in 2011, but growth in Sub-Saharan Africa was still above the world average at 4.0 per cent. China's GDP advanced 7.8 per cent, while India recorded a 5.2 per cent increase. However, the newly industrialized Asian economies of Hong Kong (China), the Republic of Korea, Singapore and Chinese Taipei registered a disappointing 1.8 per cent increase as slumping European demand penalized their exports.

The next fastest growing region after Africa was Asia (3.8 per cent) followed by the CIS (3.7), the Middle East (3.3 per cent), South and Central America (2.6 per cent), North America (2.3 per cent) and Europe (-0.1 per cent). Aggregate quarterly figures for world GDP growth are not readily available, but such growth likely slowed towards the end of the year as output in the European Union contracted in Q4 and US and Japanese growth slowed.

Figure 1.3: **Ratio of world exports of merchandise and commercial services to world GDP, 1980-2012** (ratio of current US$ values)
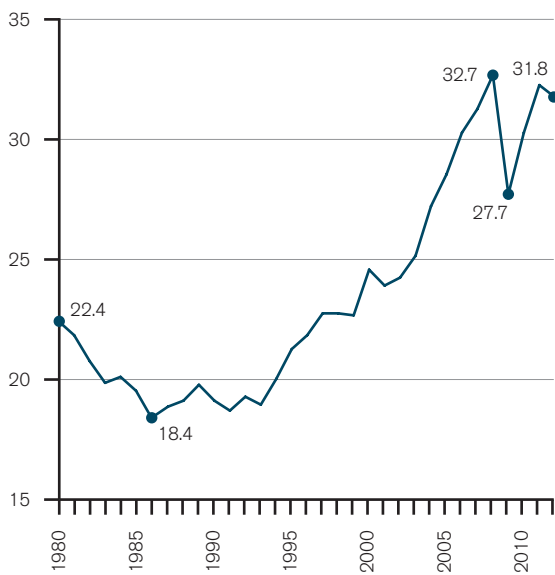
Sources: IMF for world GDP, WTO Secretariat for merchandise trade, WTO Secretariat and UNCTAD for commercial services.

Figure 1.4: **Volume of world merchandise exports, 1990-2012** (index, 1990=100)

Source: WTO Secretariat.

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Table 1.1: **Real GDP and merchandise trade volume growth by region, 2010-12**
(annual percentage change)

	GDP			Exports			Imports		
	2010	2011	2012	2010	2011	2012	2010	2011	2012
World	3.8	2.4	2.1	14.1	5.2	2.1	13.6	5.1	1.9
North America	2.6	2.0	2.3	15.0	6.6	4.5	15.7	4.4	3.1
United States	2.4	1.8	2.2	15.4	7.1	4.1	14.8	3.8	2.8
South and Central America[a]	6.2	4.3	2.6	5.2	6.1	1.4	22.7	12.0	1.8
Europe	2.3	1.7	-0.1	11.0	5.5	0.6	9.4	2.8	-1.9
European Union (27)	2.1	1.5	-0.3	11.7	5.7	0.3	9.1	2.4	-2.0
Commonwealth of Independent States (CIS)	4.7	4.8	3.7	6.1	1.8	1.6	18.8	17.1	6.8
Africa[b]	4.5	0.7	9.3	5.4	-8.5	6.1	8.1	4.5	11.3
Middle East	4.9	5.2	3.3	7.5	5.5	1.2	8.2	5.1	7.9
Asia	6.7	3.3	3.8	22.7	6.4	2.8	18.2	6.7	3.7
China	10.4	9.2	7.8	28.1	8.8	6.2	22.0	8.8	3.6
Japan	4.5	-0.6	1.9	27.5	-0.6	-1.0	10.1	4.3	3.7
India	10.1	7.9	5.2	25.7	15.0	-0.5	22.7	9.7	7.2
Newly industrialized economies (4)[c]	8.2	4.0	1.8	20.9	7.8	1.6	17.9	2.7	1.5
Memo: Developed economies	2.7	1.5	1.2	13.1	5.1	1.0	10.7	3.1	-0.1
Memo: Developing and CIS	7.3	5.3	4.7	15.3	5.4	3.3	18.2	8.0	4.6

[a] Includes the Caribbean.

[b] Includes Northern Africa. GDP growth was lower for Sub-Saharan Africa than for Africa as a whole in 2012 at 4.0 per cent and higher in 2011 at 4.4 per cent. This discrepancy is mostly due to strong fluctuations in Libyan output.

[c] Hong Kong, China; Republic of Korea; Singapore; and Chinese Taipei.

Source: WTO Secretariat.

(c) Merchandise trade in volume (i.e. real) terms

The volume of world merchandise trade (as measured by the average of exports and imports) registered an increase of just 2 per cent in 2012. If we exclude years in which trade volume declined, this was the smallest annual increase in a dataset extending back to 1981. Shipments from developed countries grew more slowly than the world average at 1.0 per cent, while exports of developing economies grew faster at 3.3 per cent. On the import side, developed economies dropped 0.1 per cent, while developing economies grew at a 4.6 per cent pace (see Table 1.1).

After seeing its exports shrink by 8.5 per cent in 2011 following the Libyan civil war, Africa rebounded in 2012 to record the fastest export growth of any region at 6.1 per cent. This was followed by North America, where exports rose 4.5 per cent on the strength of a 4.1 per cent increase in the United States. Asia only managed to increase its exports by 2.8 per cent i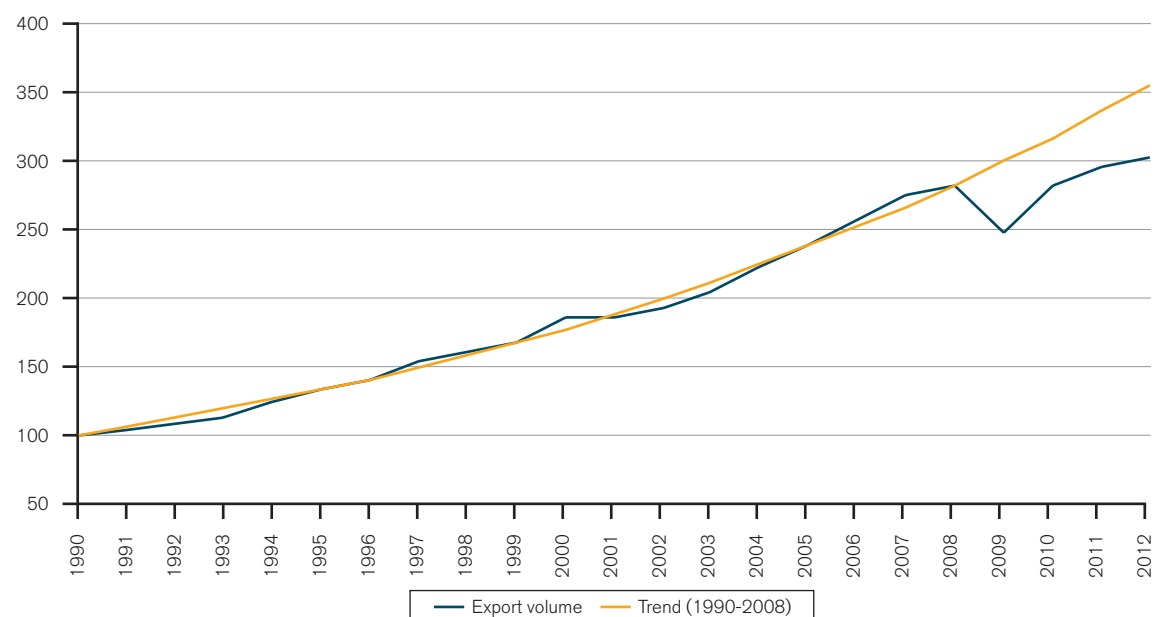n 2012 despite 6.2 per cent growth in China's exports. Contributing to the slow growth in Asia were India and Japan, where exports declined by 0.5 per cent and 1.0 per cent, respectively. Other regions that export large quantities of natural resources saw small increases in export volumes, including the Commonwealth of Independent States (1.6 per cent), South and Central America (1.4 per cent), and the Middle East (1.2 per cent). This is to be expected since quantities of primary products tend not to change very much from year to year. The region with the slowest export growth was again Europe at 0.6 per cent, but the European Union grew even more slowly at 0.3 per cent.

Africa's imports also grew faster than those of any other region at 11.3 per cent, making it the only region with double digit growth in either exports or imports. This was followed by the Middle East (7.9 per cent) and the Commonwealth of Independent States (6.8 per cent), which took advantage of the high average oil prices in 2012 to boost their export earnings to purchase more imports (see Table 1.2). Asia's import growth of 3.7 per cent was driven by a 3.6 per cent increase in China. North America's 3.1 per cent rise was slightly stronger than that of the United States (2.8 per cent). South and Central America, with import growth of 1.8 per cent, lagged behind all regions other than Europe, which recorded a 1.9 per cent decline in imports.

(d) Merchandise and commercial services trade in value (i.e. dollar) terms

The dollar value of world merchandise exports in 2012 was US$ 18.3 trillion, nearly unchanged from 2011. The stagnation in values reduced the average growth

Figure 1.5: **Long-term interest rates on euro area sovereign debt, July 2008 – February 2013**[a] (period average percentage per annum)

[a] Secondary market yields on ten-year government bonds issued by all euro area governments except Estonia, Greece and Cyprus, sorted in descending order by rates in February 2013.

Source: European Central Bank.
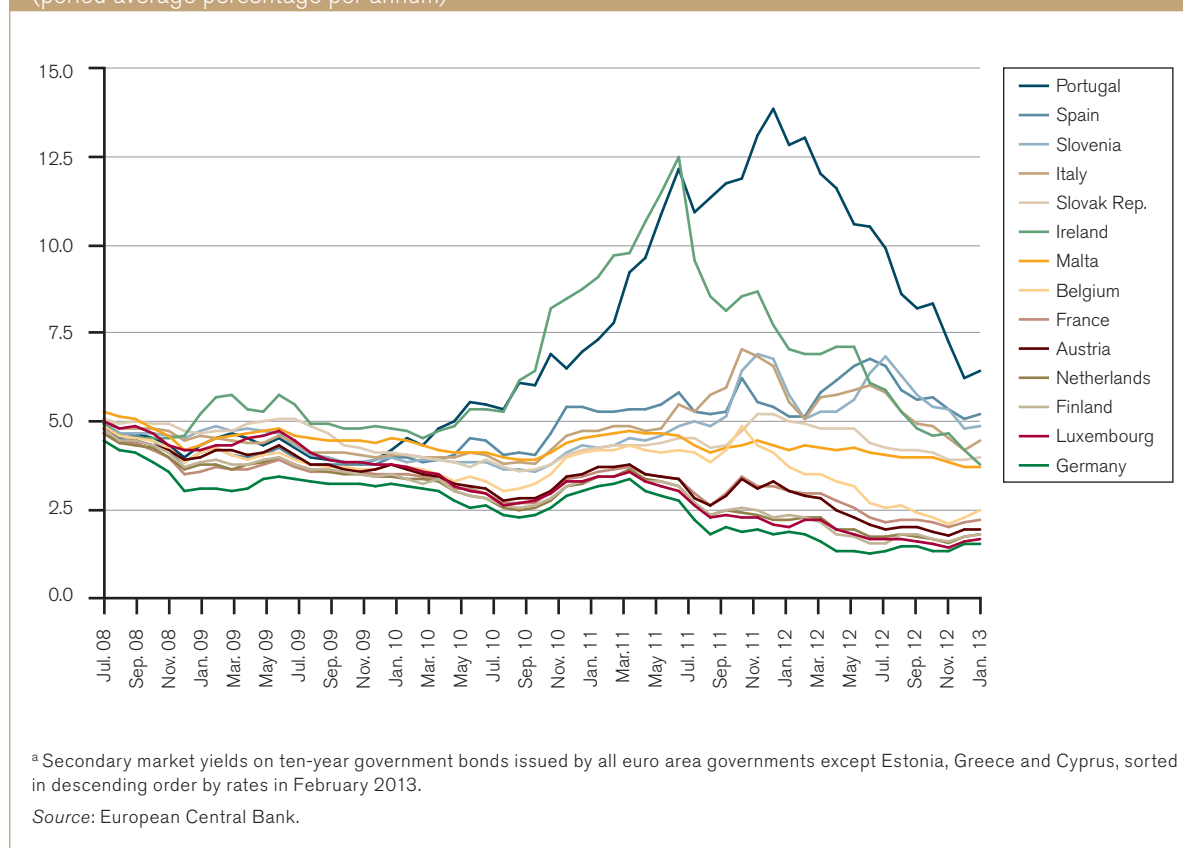
Table 1.2: **World prices of selected primary products, 2000-12** (annual percentage change and US$ per barrel)

	2010	2011	2012	2000-12	2005-12
All commodities	26	29	-3	10	10
Metals	48	14	-17	10	10
Food	11	20	-2	7	8
Beverages[a]	14	17	-19	7	8
Agricultural raw materials	32	23	-13	3	4
Energy	26	36	1	12	11
Memo: Crude oil price in US$/barrel[b]	79	104	105	60	79

[a] Comprising coffee, cocoa beans and tea.

[b] Average of Brent, Dubai, and West Texas Intermediate.

Source: IMF International Financial Statistics.

rate for the post-2005 period to 8 per cent from 10 per cent last year. This contrasts with the stronger growth rates of 22 per cent in 2010 and 20 per cent in 2011. Meanwhile, world commercial services exports in 2012 were only 2 per cent higher than in 2011 at US$ 4.3 trillion. The 2012 growth rate for transport services was in line with total world commercial services exports at 2 per cent, while travel services grew faster (4 per cent) and other commercial services grew more slowly (1 per cent) (see Table 1.3).

Commercial services accounted for roughly 19 per cent of total world trade in world goods and commercial services in 2012. However, it should be noted that traditional trade statistics, which measure gross trade

flows rather than value-added at various stages of production, strongly under-estimate the contribution of services to international trade. A joint initiative between the WTO and the Organisation for Economic Co-operation and Development (OECD) has developed new indicators of trade in value-added that provide additional perspectives on the role of services in world trade.[2]

Some sub-categories of other commercial services grew faster than others. Communications (including postal, courier and telecommunications services) declined by 3 per cent, while construction rose 3 per cent and insurance services increased by 2 per cent in 2012. The biggest decline was observed in financial services (i.e. services provided by banks and other financial

Table 1.3: **World exports of merchandise and commercial services, 2005-12**
(US$ billion and annual percentage change)

	Value	Annual percentage change			
	2010	2010	2011	2012	2005-12
Merchandise	18,323	22	20	0	8
Commercial services	4,345	10	11	2	8
Transport	885	16	9	2	7
Travel	1,105	9	12	4	7
Other commercial services	2,350	8	12	1	10
of which:					
Communications services	100	3	10	-3	8
Construction	110	-4	8	3	10
Insurance services	100	1	0	2	11
Financial services	300	7	12	-4	8
Computer and information services	265	12	14	6	14
Royalties and licence fees	285	8	14	-2	9
Other business services	1,145	9	13	2	9
Personal, cultural and recreational services	35	14	13	3	7
Memo: Goods and commercial services (BOP)	22,520	19	18	1	8

Sources: WTO Secretariat estimates for merchandise and WTO and UNCTAD Secretariat estimates for commercial services.

intermediaries), which fell 4 per cent. The fastest growing sub-sector of other commercial services was computer and information services, which jumped 6 per cent in 2012. Royalties and licence fees fell 2 per cent, and other business services (including engineering services, legal/accounting services, management consulting, advertising and trade related services, among others) increased by 2 per cent.

In dollar terms, US exports of financial services declined by 4 per cent in 2012, the United Kingdom dropped 13 per cent, Germany slipped 2 per cent and France plunged 20 per cent. Several other EU member states also recorded double digit declines in financial services, including Austria (-11 per cent), Cyprus (-21 per cent), Greece (-29 per cent) and Spain (-11 per cent). Total exports of financial services from Switzerland declined by 8 per cent. Meanwhile, Japan's exports of financial services gained 13 per cent and China's advanced 58 per cent. Finally, the Asian financial centres of Singapore and Hong Kong, China treaded water in 2012 with 0 per cent and 4 per cent growth, respectively.

Overall, developed economies' exports of financial services fell 6 per cent while those of developing economies and the Commonwealth of Independent States together rose 3 per cent.

The US dollar appreciated against most major currencies between 2011 and 2012, rising 3.7 per cent on average according to data from the Federal Reserve Bank of St. Louis (see Figure 1.6). Exceptions include the Chinese yuan, which rose 2.4 per cent against the dollar, and the Japanese yen, which was more or less unchanged against the dollar (-0.2 per cent). The

appreciation of the dollar against other currencies would tend to understate the value of some trade flows in 2012 and overstate the magnitude of any declines from 2011, particularly for trade not denominated in dollars (e.g. trade within the EU). The euro dropped 7.7 per cent in value against the dollar in 2012.

(i) Merchandise trade

North America's merchandise exports rose 4 per cent in 2012 to US$ 2.37 trillion (13.3 per cent of the world total) while imports increased by 3 per cent to US$ 3.19 trillion (17.6 per cent) (see Appendix Table 1.1). South and Central America's exports were essentially unchanged at US$ 749 billion (4.2 per cent), but the region's imports recorded a small 3 per cent increase to reach US$ 753 billion (4.1 per cent). European exports fell 4 per cent to US$ 6.37 trillion (34.7 per cent of total world trade). Meanwhile, Europe's imports dropped 6 per cent to US$ 6.52 trillion (35.9 per cent of the total).

Exports of the Commonwealth of Independent States rose 2 per cent in 2012 to US$ 904 billion as oil prices remained high. CIS imports also increased 5 per cent to US$ 568 billion. Respectively, the region's exports and imports represented 4.5 per cent and 3.1 per cent of world trade in 2012.

Africa's exports were up 5 per cent to US$ 626 billion (3.5 per cent of the world total) while its imports advanced 8 per cent to US$ 604 billion (3.3 per cent).

Middle East exports grew 3 per cent to US$ 1.29 trillion (or 7.2 per cent of the world total) and the region's imports rose 6 per cent to US$ 7.21 billion (4 per cent).

Figure 1.6: **Trade-weighted US dollar exchange rate against major currencies, Jan. 2010 – Feb. 2013**
(index, Jan. 2010=100)
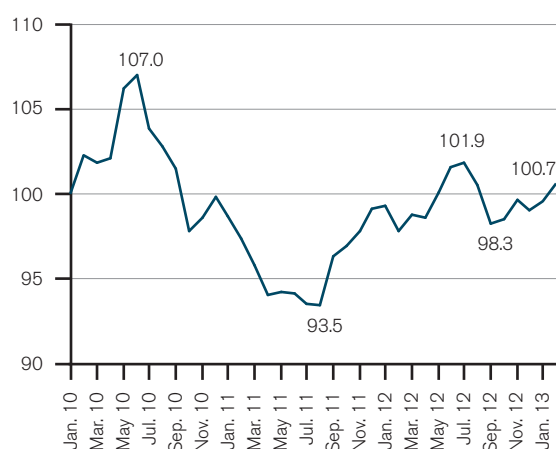
Source: Federal Reserve Bank of St. Louis.

Finally, Asia's exports only managed to grow 2 per cent to US$ 5.64 trillion (31.6 per cent of the global total) in 2012. Meanwhile, imports of the region increased by 4 per cent to US$ 5.79 trillion (31.9 per cent).

The top five merchandise exporters in 2012 were China (US$ 2.05 trillion, 11.2 per cent of world trade), the United States (US$ 1.55 trillion, 8.4 per cent), Germany (US$ 1.41 trillion, 7.7 per cent), Japan (US$ 799 billion, 4.4 per cent) and the Netherlands (US$ 656 billion, 3.6 per cent). The leading importers were the United States (US$ 2.34 trillion, 12.6 per cent of world imports), China (US$ 1.82 trillion, 9.8 per cent), Germany (US$ 1.17 trillion, 6.3 per cent), Japan (US$ 886 billion, 4.8 per cent) and the United Kingdom (displacing France at US$ 680 billion, 3.7 per cent) (see Appendix Table 1.2).

If we count all 27 European Union members as a single entity and exclude intra-EU trade, the leading exporters were the European Union (US$ 2.16 trillion, or 14.7 per cent of the world total), China (13.9 per cent), the United States (10.5 per cent), Japan (5.4 per cent) and the Republic of Korea (US$ 548 billion, or 3.7 per cent). The leading importers when intra-EU trade is excluded were the United States (displacing the EU at 15.6 per cent), the European Union (US$ 2.30 trillion or 15.4 per cent), China (12.2 per cent), Japan (5.9 per cent) and Hong Kong, China (US$ 554 billion, or 3.7 per cent) (see Appendix Table 1.3).

(ii) Commercial services trade

The region that recorded the fastest growth in commercial services exports in 2012 was the CIS with a 10 per cent increase to US$ 105 billion. This was followed by the Middle East at 9 per cent (US$ 125 billion), Asia at 6 per cent (US$ 1.16 trillion), South and Central America also at 6 per cent

(US$ 136 billion), Africa at 5 per cent (US$ 90 billion), North America at 4 per cent (US$ 709 billion), and Europe, which fell 3 per cent to US$ 2.02 trillion. On the import side, the fastest growing region was the CIS at 17 per cent (US$ 151 billion), followed by South and Central America at 9 per cent (US$ 178 billion), Asia at 8 per cent (US$ 1.18 trillion), Africa at 3 per cent (US$ 162 billion), North America at 2 per cent (US$ 537 billion), Middle East also at 2 per cent (US$ 222 billion), and finally Europe with a decline of 3 per cent (US$ 1.68 trillion) (see Appendix Table 1.4).

The top five exporters of commercial services in 2012 were the United States (US$ 614 billion, or 14.1 per cent of the world total), the United Kingdom (US$ 278 billion, 6.4 per cent), Germany (US$ 255 billion, 5.9 per cent), France (US$ 208 billion, 4.8 per cent) and China (US$ 190 billion, 4.4 per cent). Although France appears above China as an exporter of commercial services compared to last year's tables, this is due to changes in data coverage rather than an improved trade performance on the part of France, whose exports actually dropped 7 per cent in 2012 (see Appendix Table 1.5).

The five leading importers of commercial services were the United States (US$ 406 billion, or 9.9 per cent of the world total), Germany (US$ 285 billion, 6.9 per cent), China (US$ 281 billion, 6.8 per cent), the United Kingdom (US$ 176 billion, 4.3 per cent) and Japan (US$ 174 billion, 4.2 per cent). There were no changes in rank among the top importers.

If we exclude trade between EU member states and treat the European Union as a single entity, the EU was the top exporter of commercial services in 2012 with exports valued at US$ 823 billion (24.6 per cent of the world total). It was followed by the United States (18.3 per cent), China (5.7 per cent), India (US$ 148 billion, 4.4 per cent) and Japan (US$ 140 billion, 4.2 per cent). The European Union was also the leading importer of services at US$ 639 billion (20.0 per cent of the world total), followed by the United States (12.7 per cent), China (8.8 per cent), Japan (5.4 per cent) and India (US$ 125 billion, 3.9 per cent) (see Appendix Table 1.6).

(iii) Sectoral merchandise trade developments

Figure 1.7 shows estimated year-on-year growth in the dollar value of world trade for major categories of manufactured goods. It illustrates the fact that some products declined earlier and recovered sooner than others during the trade collapse of 2009. In the case of the current trade slowdown, it may provide an indication of whether trade is still slowing or has already bottomed out and started to recover.

Iron and steel trade appears to be a highly pro-cyclical and somewhat lagging indicator of global trade growth. It registered the biggest decline of any sector during

Figure 1.7: **World exports of manufactured goods by product, 2008Q1-2012Q4** (year-on-year percentage change in current US$ values)

Source: WTO Secretariat estimates based on mirror data for available reporters in the Global Trade Atlas database, Global trade Information Systems.
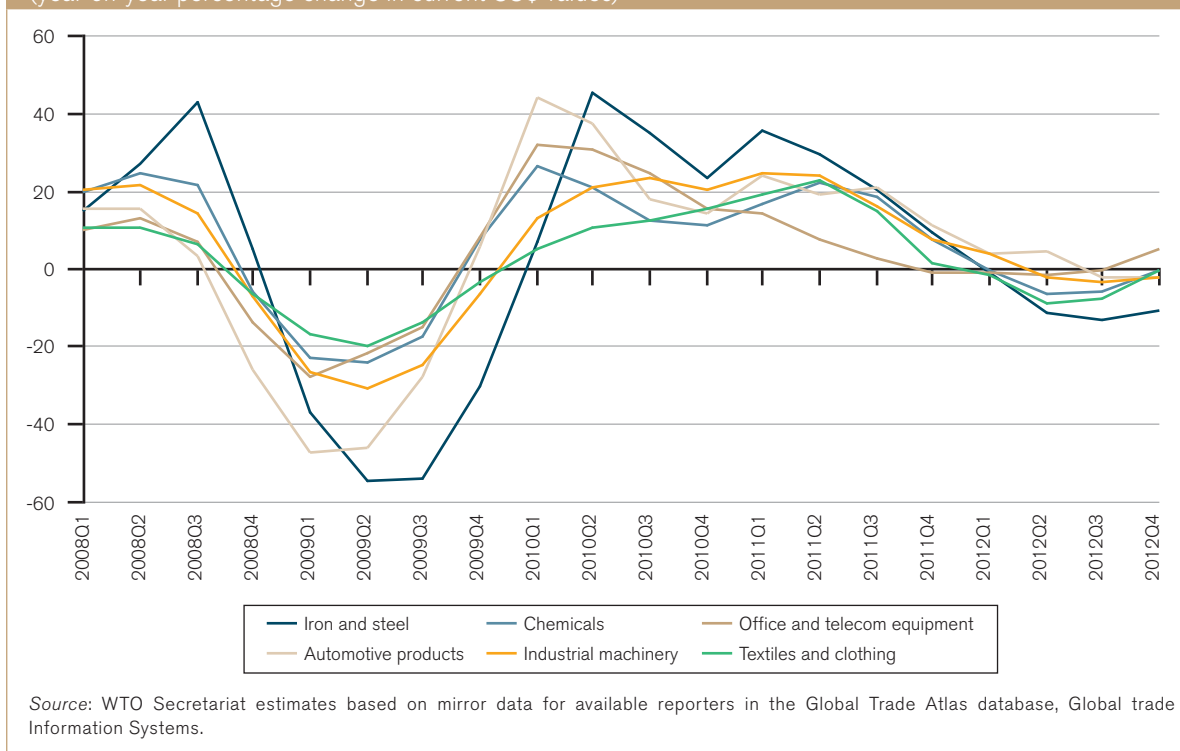
both the 2009 trade collapse and the recent slump. Although it was down 11 per cent year-on-year in the fourth quarter of 2012, this was less negative than the previous quarter, when it was down 13 per cent.

Year-on-year growth in office and telecom equipment was -1 per cent in the second quarter and 0 per cent in the third, but in the fourth it returned to positive territory with an increase of 6 per cent. This sector led the recovery following the 2009 trade collapse, so its return to growth is a positive sign for a revival of trade in the coming months.

Most other sectors saw improvements in year-on-year growth between the third and fourth quarters, which suggest that a recovery in trade may be under way. Chemicals increased from -6 per cent to 0 per cent, industrial machinery rose from -3 per cent to -2 per cent and clothing and textiles went from -8 per cent to -1 per cent. An important exception is automotive products, which tend to be a coincident indicator of trade cycles. This category was down 2 per cent in both the third and fourth quarters, showing no improvement.

Endnotes

1   WTO short-term trade statistics can be downloaded at www.wto.org/statistics.

2   More information can be found on the WTO's website at www.wto.org/miwi.

Appendix figure

Appendix Figure 1.1: **Merchandise exports and imports of selected economies, July 2011 – February/March 2013**
(year-on-year percentage change in current US$ values)

Sources: IMF International Financial Statistics, Global Trade Information Services GTA database, national statistics.

Appendix Figure 1.1: **Merchandise exports and imports of selected economies, July 2011 –
February/March 2013** (continued)
(year-on-year percentage change in current US$ values)

Sources: IMF International Financial Statistics, Global Trade Information Services GTA database, national statistics.

Appendix Figure 1.1: **Merchandise exports and imports of selected economies, July 2011 –
February/March 2013** (continued)
(year-on-year percentage change in current US$ values)

Sources: IMF International Financial Statistics, Global Trade Information Services GTA database, national statistics.

Appendix tables

Appendix Table 1.1: **World merchandise trade by region and selected economies, 2005-12** (US$ billion and annual percentage change)									
	Exports					Imports			
	Value	Annual percentage change				Value	Annual percentage change			
	2012	2005-12	2010	2011	2012	2012	2005-12	2010	2011	2012
World	17,850	8	22	20	0	18,155	8	21	19	0
North America	2,373	7	23	16	4	3,192	5	23	15	3
United States	1,547	8	21	16	5	2,335	4	23	15	3
Canada[a]	455	3	23	17	1	475	6	22	15	2
Mexico	371	8	30	17	6	380	8	28	16	5
South and Central America[b]	749	11	25	27	0	753	14	30	25	3
Brazil	243	11	32	27	-5	233	17	43	24	-2
Other South and Central America[b]	506	11	22	28	2	520	13	24	25	5
Europe	6,373	5	12	18	-4	6,519	5	13	17	-6
European Union (27)	5,792	5	12	18	-5	5,927	5	13	17	-6
Germany	1,407	5	12	17	-5	1,167	6	14	19	-7
Netherlands	656	7	15	16	-2	591	7	17	16	-1
France	569	3	8	14	-5	674	4	9	18	-6
United Kingdom	468	3	17	21	-7	680	4	14	14	1
Italy	500	4	10	17	-4	486	3	17	15	-13
Commonwealth of Independent States (CIS)	804	13	31	34	2	568	15	25	30	5
Russian Federation[a]	529	12	32	30	1	335	15	30	30	4
Africa	626	11	30	17	5	604	13	16	18	8
South Africa	87	8	31	21	-11	123	10	27	29	1
Africa less South Africa	539	11	30	16	8	481	14	13	15	9
Oil exporters[c]	370	11	34	15	12	179	14	10	10	8
Non oil exporters	169	11	22	20	-1	303	14	15	18	10
Middle East	1,287	13	28	37	3	721	12	13	17	6
Asia	5,640	11	31	18	2	5,795	12	33	23	4
China	2,049	15	31	20	8	1,818	16	39	25	4
Japan	799	4	33	7	-3	886	8	26	23	4
India	293	17	37	34	-3	489	19	36	33	5
Newly industrialized economies (4)[d]	1,280	8	30	16	-1	1,310	9	32	19	0
Memorandum										
MERCOSUR[e]	340	11	29	26	-4	325	16	43	25	-3
ASEAN[f]	1,254	10	29	18	1	1,221	11	31	21	6
EU (27) extra-trade	2,166	7	17	21	0	2,301	7	18	18	-4
Least-developed countries (LDCs)	204	14	27	25	1	223	14	11	22	8

[a] Imports are valued f.o.b.

[b] Includes the Caribbean. For composition of groups see the Technical Notes of WTO *International Trade Statistics 2012*.

[c] Algeria, Angola, Cameroon, Chad, Congo, Equatorial Guinea, Gabon, Libya, Nigeria, Sudan.

[d] Hong Kong, China; Republic of Korea; Singapore; and Chinese Taipei.

[e] Common Market of the Southern Cone: Argentina, Brazil, Paraguay, Uruguay.

[f] Association of Southeast Asian Nations: Brunei Darussalam, Cambodia, Indonesia, Lao People's Democratic Republic, Malaysia, Myanmar, Philippines, Singapore, Thailand, Viet Nam.

Source: WTO Secretariat.

Appendix Table 1.2: **Merchandise trade: leading exporters and importers, 2012**
(US$ billion and percentage)

Rank	Exporter	Value	Share	Annual percentage change	Rank	Importer	Value	Share	Annual percentage change
1	China	2,049	11.2	8	1	United States	2,335	12.6	3
2	United States	1,547	8.4	5	2	China	1,818	9.8	4
3	Germany	1,407	7.7	-5	3	Germany	1,167	6.3	-7
4	Japan	799	4.4	-3	4	Japan	886	4.8	4
5	Netherlands	656	3.6	-2	5	United Kingdom	680	3.7	1
6	France	569	3.1	-5	6	France	674	3.6	-6
7	Korea, Republic of	548	3.0	-1	7	Netherlands	591	3.2	-1
8	Russian Federation	529	2.9	1	8	Hong Kong, China	554	3.0	8
9	Italy	500	2.7	-4		– retained imports	140	0.8	6
10	Hong Kong, China	493	2.7	8	9	Korea, Republic of	520	2.8	-1
	– domestic exports	22	0.1	33	10	India	489	2.6	5
	– re-exports	471	2.6	7	11	Italy	486	2.6	-13
11	United Kingdom	468	2.6	-7	12	Canada[a]	475	2.6	2
12	Canada	455	2.5	1	13	Belgium	435	2.3	-7
13	Belgium	446	2.4	-6	14	Mexico	380	2.0	5
14	Singapore	408	2.2	0	15	Singapore	380	2.0	4
	– domestic exports	228	1.2	2		– retained imports[b]	199	1.1	11
	– re-exports	180	1.0	-3	16	Russian Federation[a]	335	1.8	4
15	Saudi Arabia, Kingdom of[c]	386	2.1	6	17	Spain	332	1.8	-12
16	Mexico	371	2.0	6	18	Taipei, Chinese	270	1.5	-4
17	Taipei, Chinese	301	1.6	-2	19	Australia	261	1.4	7
18	United Arab Emirates[c]	300	1.6	5	20	Thailand	248	1.3	8
19	India	293	1.6	-3	21	Turkey	237	1.3	-2
20	Spain	292	1.6	-5	22	Brazil	233	1.3	-2
21	Australia	257	1.4	-5	23	United Arab Emirates[c]	220	1.2	7
22	Brazil	243	1.3	-5	24	Switzerland	198	1.1	-5
23	Thailand	230	1.3	3	25	Malaysia	197	1.1	5
24	Malaysia	227	1.2	0	26	Poland	196	1.1	-7
25	Switzerland	226	1.2	-4	27	Indonesia	190	1.0	8
26	Indonesia	188	1.0	-6	28	Austria	178	1.0	-7
27	Poland	183	1.0	-3	29	Sweden	162	0.9	-8
28	Sweden	172	0.9	-8	30	Saudi Arabia, Kingdom of	144	0.8	9
29	Austria	166	0.9	-6					
30	Norway	160	0.9	0					
	Total of above[d]	14,870	81.2	-		Total of above[d]	15,270	82.3	-
	World[d]	18,325	100.0	0		World[d]	18,565	100.0	0

[a] Imports are valued f.o.b.

[b] Singapore's retained imports are defined as imports less re-exports.

[c] WTO Secretariat estimates.

[d] Includes significant re-exports or imports for re-export.

Source: WTO Secretariat.

Appendix Table 1.3: Merchandise trade: leading exporters and importers (excluding intra-EU(27) trade), 2012
(US$ billion and percentage)

Rank	Exporter	Value	Share	Annual percentage change	Rank	Importer	Value	Share	Annual percentage change
1	Extra-EU(27) exports	2,166	14.7	0	1	United States	2,335	15.6	3
2	China	2,049	13.9	8	2	Extra-EU(27) imports	2,301	15.4	-4
3	United States	1,547	10.5	5	3	China	1,818	12.2	4
4	Japan	799	5.4	-3	4	Japan	886	5.9	4
5	Korea, Republic of	548	3.7	-1	5	Hong Kong, China	554	3.7	8
6	Russian Federation	529	3.6	1		– retained imports	140	0.9	6
7	Hong Kong, China	493	3.4	8					
	– domestic exports	22	0.2	33	6	Korea, Republic of	520	3.5	-1
	– re-exports	471	3.2	7	7	India	489	3.3	5
8	Canada	455	3.1	1	8	Canada[a]	475	3.2	2
9	Singapore	408	2.8	0	9	Mexico	380	2.5	5
	– domestic exports	228	1.6	2	10	Singapore	380	2.5	4
	– re-exports	180	1.2	-3		– retained imports[b]	199	1.3	11
10	Saudi Arabia, Kingdom of[c]	386	2.6	6	11	Russian Federation[a]	335	2.2	4
11	Mexico	371	2.5	6	12	Taipei, Chinese	270	1.8	-4
12	Taipei, Chinese	301	2.0	-2	13	Australia	261	1.7	7
13	United Arab Emirates[c]	300	2.0	5	14	Thailand	248	1.7	8
14	India	293	2.0	-3	15	Turkey	237	1.6	-2
15	Australia	257	1.7	-5	16	Brazil	233	1.6	-2
16	Brazil	243	1.7	-5	17	United Arab Emirates[c]	220	1.5	7
17	Thailand	230	1.6	3	18	Switzerland	198	1.3	-5
18	Malaysia	227	1.5	0	19	Malaysia	197	1.3	5
19	Switzerland	226	1.5	-4	20	Indonesia	190	1.3	8
20	Indonesia	188	1.3	-6	21	Saudi Arabia, Kingdom of	144	1.0	9
21	Norway	160	1.1	0	22	South Africa[c]	123	0.8	1
22	Turkey	153	1.0	13	23	Viet Nam	114	0.8	7
23	Qatar[c]	129	0.9	12	24	Norway	87	0.6	-4
24	Kuwait, the State of[c]	121	0.8	17	25	Ukraine	85	0.6	2
25	Viet Nam	115	0.8	18	26	Chile	79	0.5	6
26	Nigeria[c]	114	0.8	0	27	Israel[c]	76	0.5	0
27	Venezuela, Bolivarian Rep. of	97	0.7	5	28	Egypt	70	0.5	19
28	Iran[c]	96	0.6	-27	29	Argentina	69	0.5	-7
29	Iraq[c]	94	0.6	13	30	Philippines	65	0.4	3
30	Kazakhstan	92	0.6	5					
	Total of above[d]	13,185	89.7	-		Total of above[d]	13,440	89.9	-
	World (excl. intra-EU(27))[d]	14,700	100.0	2		World (excl. intra-EU(27))[d]	14,940	100.0	2

[a] Imports are valued f.o.b.

[b] Singapore's retained imports are defined as imports less re-exports.

[c] WTO Secretariat estimates.

[d] Includes significant re-exports or imports for re-export.

Source: WTO Secretariat.

Appendix Table 1.4: **World trade of commercial services by region and selected country, 2005-12**
(US$ billion and annual percentage change)

	Exports					Imports				
	Value	Annual percentage change				Value	Annual percentage change			
	2012	2005-12	2010	2011	2012	2012	2005-12	2010	2011	2012
World	4,345	8	10	11	2	4,105	8	10	11	2
North America	709	7	9	9	4	537	6	8	8	2
United States	614	8	9	9	4	406	6	5	7	3
South and Central America[a]	136	10	13	13	6	178	14	23	18	9
Brazil	38	14	15	20	5	78	19	36	22	7
Europe	2,024	7	4	12	-3	1,680	6	3	10	-3
European Union (27)	1,819	6	4	12	-3	1,553	5	2	10	-4
Germany	255	7	3	9	-2	285	4	3	11	-3
United Kingdom	278	5	4	10	-4	176	1	1	6	1
France	208	8	1	17	-7	171	7	4	12	-10
Netherlands	126	5	4	17	-7	115	5	-2	15	-5
Spain	140	6	1	14	-1	90	4	-1	8	-5
Commonwealth of Independent States (CIS)	105	14	13	19	10	151	14	19	18	17
Russian Federation[a]	58	13	8	20	10	102	15	21	23	16
Ukraine	19	11	24	14	1	13	9	10	5	2
Africa	90	7	12	0	5	162	12	11	12	3
Egypt	21	6	11	-19	11	16	7	2	1	19
South Africa	15	4	17	6	3	17	5	25	7	-11
Nigeria	2	6	49	-12	-4	27	23	21	13	18
Middle East	125	…	11	10	9	222	…	12	11	2
United Arab Emirates[b]	12	…	16	9	…	50	…	12	18	…
Saudi Arabia, Kingdom of	10	…	10	7	-9	49	…	8	8	-10
Asia	1,159	11	22	12	6	1,175	11	21	14	8
China[c]	190	14	25	13	4	281	19	22	23	19
Japan	140	4	10	3	-2	174	4	6	6	5
India	148	16	34	11	8	125	15	46	6	1
Singapore	133	13	20	15	3	117	11	22	18	3
Korea, Republic of	109	12	19	9	16	105	9	19	3	7
Hong Kong, China	126	10	23	14	7	57	8	17	10	2
Australia	53	8	15	10	4	65	12	22	18	10
Memorandum										
EU (27) extra-trade	823	8	6	12	-1	639	6	3	10	-4

[a] Includes the Caribbean. For composition of groups see Chapter IV Metadata of WTO *International Trade Statistics 2012*.

[b] WTO Secretariat estimates.

[c] Preliminary estimates.

… indicates unavailable or non-comparable figures.

Note: While provisional full year data were available in mid-March for some 50 countries accounting for more than two-thirds of world commercial services trade, estimates for most other countries are based on data for the first three quarters.

Sources: WTO and UNCTAD Secretariats.

Appendix Table 1.5: **Leading exporters and importers in world trade in commercial services, 2012** (US$ billion and percentage)

Rank	Exporters	Value	Share	Annual percentage change	Rank	Importers	Value	Share	Annual percentage change
1	United States	614	14.1	4	1	United States	406	9.9	3
2	United Kingdom	278	6.4	-4	2	Germany	285	6.9	-3
3	Germany	255	5.9	-2	3	China[a]	281	6.8	19
4	France	208	4.8	-7	4	United Kingdom	176	4.3	1
5	China[a]	190	4.4	4	5	Japan	174	4.2	5
6	India	148	3.4	8	6	France	171	4.2	-10
7	Japan	140	3.2	-2	7	India	125	3.0	1
8	Spain	140	3.2	-1	8	Singapore	117	2.8	3
9	Singapore	133	3.1	3	9	Netherlands	115	2.8	-5
10	Netherlands	126	2.9	-7	10	Ireland	110	2.7	-5
11	Hong Kong, China	126	2.9	7	11	Canada	105	2.6	1
12	Ireland	115	2.6	2	12	Korea, Republic of	105	2.6	7
13	Korea, Republic of	109	2.5	16	13	Italy	105	2.6	-8
14	Italy	104	2.4	-1	14	Russian Federation	102	2.5	16
15	Belgium	94	2.2	0	15	Belgium	90	2.2	-1
16	Switzerland	88	2.0	-7	16	Spain	90	2.2	-5
17	Canada	78	1.8	-1	17	Brazil	78	1.9	7
18	Sweden	76	1.7	2	18	Australia	65	1.6	10
19	Luxembourg	70	1.6	0	19	Denmark	57	1.4	-2
20	Denmark	65	1.5	-2	20	Hong Kong, China	57	1.4	2
21	Austria	61	1.4	1	21	Sweden	55	1.3	0
22	Russian Federation	58	1.3	10	22	Thailand	53	1.3	1
23	Australia	53	1.2	4	23	United Arab Emirates[b]	50	1.2	…
24	Norway	50	1.2	3	24	Saudi Arabia, Kingdom of	49	1.2	-10
25	Thailand	49	1.1	18	25	Norway	49	1.2	6
26	Taipei, Chinese	49	1.1	7	26	Switzerland	44	1.1	-2
27	Macao, China	45	1.0	14	27	Austria	43	1.1	3
28	Turkey	42	1.0	9	28	Taipei, Chinese	42	1.0	2
29	Brazil	38	0.9	5	29	Malaysia	42	1.0	10
30	Poland	38	0.9	1	30	Luxembourg	41	1.0	0
	Total of above	3,640	83.7	-		Total of above	3,285	80.0	-
	World	4,345	100.0	2		World	4,105	100.0	2

[a] Preliminary estimates.

[b] WTO Scretariat estimate.

… indicates unavailable or non-comparable figures.

- indicates non-applicable.

Note: Figures for a number of countries and territories have been estimated by the WTO Secretariat. Annual percentage changes and rankings are affected by continuity breaks in the series for a large number of economies, and by limitations in cross-country comparability.

Sources: WTO and UNCTAD Secretariats.

Appendix Table 1.6: **Leading exporters and importers in world trade in commercial services excluding intra-EU(27) trade, 2012**
(US$ billion and annual percentage change)

Rank	Exporters	Value	Share	Annual percentage change	Rank	Importers	Value	Share	Annual percentage change
1	Extra-EU(27) exports	823	24.6	-1	1	Extra-EU(27) imports	639	20.0	-4
2	United States	614	18.3	4	2	United States	406	12.7	3
3	China[a]	190	5.7	4	3	China[a]	281	8.8	19
4	India	148	4.4	8	4	Japan	174	5.4	5
5	Japan	140	4.2	-2	5	India	125	3.9	1
6	Singapore	133	4.0	3	6	Singapore	117	3.7	3
7	Hong Kong, China	126	3.8	7	7	Canada	105	3.3	1
8	Korea, Republic of	109	3.3	16	8	Korea, Republic of	105	3.3	7
9	Switzerland	88	2.6	-7	9	Russian Federation	102	3.2	16
10	Canada	78	2.3	-1	10	Brazil	78	2.4	7
11	Russian Federation	58	1.7	10	11	Australia	65	2.0	10
12	Australia	53	1.6	4	12	Hong Kong, China	57	1.8	2
13	Norway	50	1.5	3	13	Thailand	53	1.7	1
14	Thailand	49	1.5	18	14	United Arab Emirates[b]	50	1.6	…
15	Taipei, Chinese	49	1.5	7	15	Saudi Arabia, Kingdom of	49	1.5	-10
16	Macao, China	45	1.3	14	16	Norway	49	1.5	6
17	Turkey	42	1.3	9	17	Switzerland	44	1.4	-2
18	Brazil	38	1.1	5	18	Taipei, Chinese	42	1.3	2
19	Malaysia	38	1.1	5	19	Malaysia	42	1.3	10
20	Israel	30	0.9	11	20	Indonesia	34	1.1	8
21	Lebanese Republic[b]	23	0.7	…	21	Nigeria	27	0.8	18
22	Indonesia	22	0.7	12	22	Mexico	25	0.8	0
23	Egypt	21	0.6	11	23	Angola[b]	23	0.7	…
24	Ukraine	19	0.6	1	24	Qatar	22	0.7	41
25	Philippines	18	0.5	15	25	Israel	21	0.7	6
26	Mexico	16	0.5	5	26	Iran[b]	19	0.6	…
27	South Africa	15	0.4	3	27	Turkey	19	0.6	-3
28	Argentina	14	0.4	2	28	Argentina	18	0.6	9
29	Morocco	13	0.4	-4	29	Venezuela, Bolivarian Rep. of	17	0.5	42
30	Chile	13	0.4	2	30	South Africa	17	0.5	-11
	Total of above	3,075	91.7	-		Total of above	2,825	88.4	-
	World (excl. intra-EU(27))	3,350	100.0	4		World (excl. intra-EU(27))	3,190	100.0	4

[a] Preliminary estimates.

[b] WTO Secretariat estimate.

… indicates unavailable or non-comparable figures.

- indicates non-applicable.

Note: Figures for a number of countries and territories have been estimated by the WTO Secretariat. Annual percentage changes and rankings are affected by continuity breaks in the series for a large number of economies, and by limitations in cross-country comparability.

Sources: WTO and UNCTAD Secretariats.

II. Factors shaping the future of world trade

The world is changing with extraordinary rapidity, driven by many influences, including shifts in production and consumption patterns, continuing technological innovation, new ways of doing business and, of course, policy. The *World Trade Report 2013* focuses on how trade is both a cause and an effect of change and looks into the factors shaping the future of world trade.

Contents

A. Introduction

Long-term forecasts are chronically difficult. It is unlikely that "revolutionary" events, such as the explosion of communication and interactive facilities that shape our current way of life, from social networking to international offshoring, could have been predicted 20 years ago with any degree of precision. Nevertheless, even though attempts to predict the future may, to a large extent, rely on extrapolations of current trends, these efforts may help to take stock of important developments and identify challenges arising from changes that we are likely to face.

The focus of this report is on the future of trade. This does not imply that more trade is always better. After all, trade is but one means to achieve higher living standards. It is important to understand the channels through which trade can improve economic welfare along with other growth determinants, and a large literature exists in this regard. However, trade depends on a range of factors that may change in the future and influence not only the extent but also the nature and impact of trade as we know it today. What are these factors that will shape world trade in the decades ahead? What does this imply for policy both at the national and international levels, including in the World Trade Organization?

A report that seeks to analyse the factors that will shape world trade over the next decades needs to focus on trends in fundamental factors rather than cyclical developments. Trade is principally driven by countries' production possibilities, which can be described, for instance, by technology and endowments of labour, capital and natural resources, the demand for traded goods and services (which depends on people's preferences and incomes), as well as trade costs, both geography- and policy-related. Depending on how these fundamental driving forces of world trade develop in the future, the nature, volume, composition and geography of trade, as well its effect on countries' social and economic fabric, will change. This may reinforce, moderate or reverse currently observed trends, such as the increased fragmentation of production and trade in intermediate goods, the rising importance of trade in services or the continued growth in trade relationships between developing countries.

Trade does not take place in a vacuum, and evolving societal concerns may have an impact on trade and trade policy as well. Changing patterns of economic activity, new trade frictions and the broader context in which trade is embedded may call for enhanced and new areas of cooperation in order for trade to continue to function as the "transmission belt" balancing supply and demand disequilibria across the globe.

The first substantive section of this report (Section B) begins by looking at factors that have shaped global trade in economic history, focusing on pivotal events that have influenced the path of commercial exchanges, often in an unpredictable manner (B.1). These may range from the use of steam power in ocean shipping and the opening of the Suez and Panama Canals to events in recent history, such as market reforms in China and the arrival of the internet. Following the historical perspective, we turn to current developments, highlighting a number of principal trends that continue to transform international trade (B.2). We analyse the changing geographical distribution (new players in global trade and regionalization), composition (increased importance of services, technological content of exports) and nature

of trade (role of big firms, trade within firms and global supply chains). The latter discussion also emphasizes how the perspective may change when trade is considered in value-added terms rather than gross flows. Finally, we consider possible future scenarios (B.3). We review the literature in this regard and provide suitable simulations in order to gain a comprehensive and consistent overview of possible global scenarios and in order to illustrate the sensitivity of economic and trade outcomes to the underlying assumptions about key inputs to the model.

In light of the extensive data requirements and technical sophistication of such simulation models, the assumptions about fundamental economic factors shaping international trade are kept reasonably simple. In reality, each of these factors, notably demographic change, investment, technological progress, developments in the transportation and energy/natural resource sectors, as well as institutions, are capable of affecting international trade in multiple, complex ways that merit a more detailed discussion. This is undertaken in Section C. Besides these fundamental economic factors, trade policy has shaped and will continue to influence economic and trade outcomes.

Trade policy is affected by a multitude of factors, including the underlying conditions for trade described in Section C. For example, changes in the age structure of the population, a growing middle class and institutional development may lead to changes in trade policy preferences and the sphere for political influence. While it is difficult to predict specific trade policies on this basis, it is nevertheless useful to analyse current and prospective developments in society that could motivate policy-makers to enact certain measures in the future or alter existing trade policy. The forces driving such policy action are usually less well represented in global trade models and relate to wider societal concerns, such as justice and livelihoods, environmental quality and macroeconomic stability. The broader social, environmental and economic context may thus influence people's perceptions about the causes and consequences of trade and lead to policy responses affecting the prospects for trade openness. These issues are covered in Section D.

To varying degrees, all of the relationships discussed in Sections C and D are endogenous, with "everything affecting everything else", particularly in the long run. For example, the quality of institutions both encourages international trade and is further enhanced by these exchanges. Similarly, income inequalities may be affected by international trade and contribute to people's attitudes towards trade openness. We note this potential for two-way relationships as we go along.

The principal objective of Sections C and D is to gain a better understanding of the channels through which

developments in each of these areas can affect the overall nature of international trade. Another objective in each section is to illustrate trends and patterns, determinants and possible future scenarios for each factor and policy concern discussed. This allows us to assess the extent to which possible developments in these areas are likely to affect currently observed trends in international trade in the future.

The discussion in Section C on fundamental economic factors combines supply factors, such as endowments of labour, capital and natural resources as well as technology, the demand side (changes in preferences, incomes) and trade costs. Individual factors may affect global trade predominantly in one area (e.g. the effect of transport on trade costs), two areas (e.g. the quality of institutions can shape comparative advantage and reduce trade costs) or all areas (with technology, for example, affecting supply, demand and trade costs). Specifically, the discussion is organized as follows:

- Demographic change (C.1) is likely to affect trade patterns through both the supply and demand channels, via changes in the size and composition of the labour force (ageing, migration, education, new entrants), for example, and changes in saving and consumption behaviour (e.g. global middle class, spending of savings in old age and increased demand for health, leisure and travel services).

- Investment in physical capital (C.2) leads to capital accumulation and technological progress, and hence economic growth. It may shift comparative advantage towards relatively capital-intensive activities and may also reduce trade costs through investments in public infrastructure. Both domestic savings and capital flows from abroad matter and are related, in turn, to demographic and institutional factors, among other things.

- Technology (C.3) is a crucial determinant of trade (and vice versa). Besides differences in resource endowments, trade occurs because technological knowledge differs across countries and firms. Incentives to innovate, technology transfer and the geographical reach of "knowledge spillovers" can change trade patterns. Technological progress also affects consumption possibilities and trade costs. Advances in transport and in information and communication technologies (ICT) reduce trade costs and hence facilitate participation in complex production networks. ICT also enables new forms of consumption, e.g. via cross-border trade. Remote education or distance learning may also improve the accumulation of know-how. Technology also plays a role in alleviating scarcity in natural resources and addressing environmental challenges, such as climate change, which have the potential to put pressure on the expansion of trade and economic activity.

- Endowments in energy and other natural resources, such as land and water (C.4), are unevenly distributed around the globe. Volatility in prices and uncertainty in supply can have consequences for global production and international trade. So too can the negative environmental externalities associated with resource extraction. The appropriate pricing of these externalities may therefore become important. It must also be asked whether natural resource scarcity, notably with regard to non-renewables, may limit economic growth and commercial exchange, and to what extent technological progress can offer relief.

- Transport (C.5) is a major component of trade costs. As such, transport costs affect the volume, direction and composition of trade as well as the tradability of goods themselves. Transport costs depend on a range of factors, such as geography, fuel costs, infrastructure and regulatory issues. Fuel cost increases could exert pressure on the geographical fragmentation of production and result in reductions of the length of global supply chains. At the same time, progress in transport technology, new routes and improvements in trade infrastructure could further reduce the costs of shipping.

- Institutions (C.6) are a determinant of comparative advantage, allowing for specialization in certain kinds of activities. They also affect trade costs, for instance in relation to contract enforcement. The discussion therefore spans political, economic and cultural institutions and highlights the two-way nature of the relationship for several aspects of institutional quality and trade openness.

In Section D, we elaborate on the wider societal context in which trade takes place. Although some of the issues raised, such as income inequality, can have a "direct" impact on growth perspectives and ultimately trade patterns, the focus in this section is on public perceptions and policies and their potential impact on trade. In many instances, it is the actual or perceived impact of trade on societal concerns, such as the uneven distribution of benefits, which shapes attitudes towards trade openness and related policy responses. The section comprises three parts:

- Social concerns (D.1) related to income inequality and jobs, such as the loss of manufacturing employment and the social costs related to it, affect politics and attitudes towards further economic integration. This begs the question to what extent trade openness affects unemployment and the distribution of incomes both within and across countries. Future developments will depend on whether such perceptions lead to protectionist pressures on the one hand, or to the implementation of policy measures that strengthen balanced outcomes and positive employment effects on the other.

- Environmental problems place a burden on economic well-being, and many countries seek to pursue green growth strategies and policies (D.2). Such measures may increase production costs in affected sectors. By the same token, competitive pressures are sometimes seen as preventing environmental costs from being incorporated into market prices, and this can create resistance to trade openness. Lack of information as to the true objective and impact of environmental measures can create additional tensions. The situation is further complicated by the global scope of certain environmental problems, which require global cooperation and may invite free-riding, with certain parties relying on others to tackle the issue.

- Macroeconomic and financial shocks (D.3), despite their "short-term" nature, can cast a shadow on long-term developments. A lack of finance as the "greasing oil" of trade as well as turmoil in currency markets can cripple and distort international transactions. While eventually exchange rates may adjust and credit crunches may be alleviated through restructuring in the financial sector, long periods of instability can lead to changes in the macro-financial environment, including via regulation and other forms of policy intervention. These may hurt certain traders disproportionately. Also, perceptions of unfair monetary competition can lead to pressures for trade policy responses.

From the discussions in Sections B, C and D, it emerges that a continuing closer integration of the world economy, although the most likely scenario, cannot be taken for granted. Nor is the nature of economic integration necessarily going to stay the same. The final part of the report (Section E) therefore recaps main trends in global trade that are likely to raise challenges for the multilateral trading system (E.1), analyses these challenges in more detail (E.2) and explores what the WTO could do about them (E.3). The discussion is structured according to the implications for the WTO's agenda, its own governance structure and its wider role in the global institutional environment.

In terms of its agenda, the WTO may need to adjust in order to reflect 21st-century policy concerns, many of which are currently addressed at the regional level, where the spread of integrated supply chains is particularly intense. These include further opening of trade in services, trade facilitation and regulatory cooperation. In order to retain legitimacy in a possible expansion of its agenda, the WTO needs to take account of the emergence of new trading powers and the diversity of interests of countries at different levels of development. This may give rise to institutional reform at several levels in the WTO's own governance structure.

In the context of the WTO's contribution to the global institutional framework, the WTO's traditional role may stay relevant and even need further strengthening in order to effectively combat protectionist tendencies that may arise from short-sighted pressures (and that eventually may backfire given the increasing import content of countries' exports). At the same time, such activities may call for an improved coordination between different international regimes, as some policies may be enacted in response to measures taken in other policy areas, such as climate change. Some domestic policy areas may also call for intensified international coordination, including WTO involvement, e.g. in the areas of Aid for Trade or trade finance.

B. Trends in international trade

A comprehensive and fruitful analysis of the shaping factors of international trade and their implications for trade policy cannot be performed without having a clear idea of the evolution of trade patterns over time. This part of the Report analyses past, present and future trends in international trade and economic activity. It begins with a historical analysis of trade developments from pre-industrial times to the present, focusing on the key role that technology and institutions have played in the past. It then identifies and explains important trends in international trade that have emerged over the last 30 years. In doing so, the section describes who the main players are in international trade (in terms of countries or companies), what countries trade and with whom, and how the nature of trade has changed over time. Finally, it provides some illustrative simulations of possible future trade scenarios.

Contents

Some key facts and findings

- Dramatic decreases in transport and communication costs have been the driving forces behind today's global trading system. Geopolitics has also played a decisive role in advancing and reinforcing these structural trends.

- In the last 30 years, world merchandise and commercial services trade have increased by about 7 per cent per year on average, reaching a peak of US$ 18 trillion and US$ 4 trillion respectively in 2011. When trade is measured in value-added terms, services play a larger role.

- Between 1980 and 2011, developing economies raised their share in world exports from 34 per cent to 47 per cent and their share in world imports from 29 per cent to 42 per cent. Asia is playing an increasing role in world trade.

- For a number of decades, world trade has grown on average nearly twice as fast as world production. This reflects the increasing prominence of international supply chains and hence the importance of measuring trade in value-added terms.

- Simulations show that in a dynamic economic and open trade environment, developing countries are likely to outpace developed countries in terms of both export and GDP growth by a factor of two to three in future decades. By contrast, their GDP would grow by less than half this rate in a pessimistic economic and protectionist scenario, and export growth would be lower than in developed countries.

1. The evolution of international trade: insights from economic history

Understanding the future shaping factors of world trade begins with an understanding of the historical forces that created the global trading system we have today. The rise of a world trading system, like so many other features of the modern world economy, began largely with the industrial revolution. The immense technological advances in transportation and communications that it unleashed – from steamships, railroads and telegraphs to automobiles, aeroplanes and the internet – steadily reduced the cost of moving goods, capital, technology, and people around the globe. This "death of distance", to use the modern metaphor, has been one of the most important forces shaping global economic development since the early 1800s (Cairncross, 1997).

The rise of a world economy, the spread of investment and technology, the growth of international specialization, the ascent of new economic powers, the dramatic surge in growth and population – none of this in turn would have been possible without a massive expansion of global trade over the past 200 years. At the same time, the spread of industrialization – first to Europe, next to the Americas, and then to Asia, Africa and elsewhere – fuelled a further expansion of international trade and economic integration. Since the mid-1800s, the world's population has grown roughly six-fold, world output has grown 60-fold, and world trade has grown over 140-fold (Maddison, 2008). This virtuous circle of deepening integration and expanding growth is what we now refer to as globalization.

While underlying technological and structural forces are the main drivers behind globalization, political forces play an equally central role – sometimes facilitating and cushioning the rise of a globally integrated market, other times resisting or reversing it. Karl Polanyi's insight that a global free market is not only impossible, but doomed to self-destruction in the absence of effective international cooperation looks as valid today as it did when he first advanced it in 1944 (Polanyi, 1944).

It is difficult to imagine the rise of globalization during the 19th century without the gold standard, the dense web of bilateral trade agreements, and Great Britain's economic dominance, just as it is difficult to imagine the post-1945 resumption of globalization without the advent of the new multilateral economic institutions, more activist economic and social policies at the domestic level, and America's assumption of the global leadership mantle. Indeed, the evolution of globalization over the past 200 years has generally been accompanied not by a contraction of government but by its steady expansion at both the national and international level (see Section C.6).

Yet at other times, politics has intervened – sometimes consciously, sometimes accidentally – to slow down or even roll back the integrationist pressures of technology and markets. It is this complex interplay of structural and political forces that explains the successive waves of economic integration and disintegration over the past 200 years; and in particular how the seemingly inexorable rise of the "first age of globalization" in the 19th century was abruptly cut short between 1914 and 1945 – by the related catastrophes of the First World War, the Great Depression and the Second World War – only to be followed by the rise of a "second age of globalization" during the latter half of the 20th century. While the long-term trend has been in the direction of expanding trade and deeper integration, unpredicted (and perhaps unpredictable) geopolitical shocks have periodically interrupted or reversed this trend, suggesting the need for caution in extrapolating from the economic past into the economic future.

(a) The first age of globalization

The early 19th century marked a major turning point for world trade. Although the outlines of a world economy were already evident in the 17th and 18th centuries – as advances in ship design and navigation led to Europe's discovery of the Americas, the opening up of new routes to Asia around Africa, and Magellan's circumnavigation of the globe (Maddison, 2008) – it was the arrival of the industrial revolution in the early 1800s which triggered the massive expansion of trade, capital and technology flows, the explosion of migration and communications, and the "shrinking" of the world economy, that is now referred to as "the first age of globalization" (Ikenberry, 2000). In particular, breakthroughs in transport technologies opened up national economies to trade and investment in ways that differed radically from what had gone before, relentlessly eroding what economic historian Geoffrey Blainey has termed "the tyranny of distance" (Blainey, 1968).

Steam power was the first revolutionary technology to transform transportation, starting with steamships. Although early vessels were initially limited to inland rivers and canals, by the late 1830s steamships were regularly crossing the Atlantic and by the 1850s a service to South and West Africa had begun. At first, steamships carried only high-value commodities, such as mail, but a series of incremental technological improvements over subsequent decades – screw propellers, the compound and turbine engine, improved hull design, more efficient ports – resulted in faster, bigger, and more fuel-efficient steamships, further driving down transport costs, and opening up trans-oceanic steamship trade to bulk commodities, as well as luxury goods (Landes, 1969).

The opening of the Suez Canal in 1869 marked a further breakthrough in trans-oceanic steam shipping. Until then, steamships could not carry enough coal to

circumnavigate Africa leaving sailing ships still dominant on Far Eastern trade routes. By creating a major short-cut to Asia from Europe, the Suez Canal suddenly made steamships viable, and most cost efficient on these routes as well, completing their conquest of trans-oceanic shipping by the end of the 1800s.

Railways were the other major steam-related transport innovation of the industrial revolution. Inland transportation costs had already started to fall in the late 18th century as a result of road and especially canal construction. The length of navigable waterways in Britain quadrupled between 1750 and 1820; canal construction in France also soared while in the United States the massive Erie Canal, constructed between 1817 and 1825, reduced the transportation costs between Buffalo and New York by 85 per cent and cut the journey time from 21 to eight days (O'Rourke and Williamson, 1999).

The importance of inland waterways was soon eclipsed by the railway boom. The world's first rail line, the Stockton and Darlington Railway, opened in 1825, and was soon copied, not just throughout Britain, but in Belgium, France, Germany and the rest of Western Europe. The explosion of railways was particularly notable in the United States during the second half of the 19th century, where new trans-continental networks would play a major role, not just in the settlement of the West and in forging a national economy but in linking the vast American hinterland to global markets (O'Rourke and Findlay, 2007). A transcontinental line linked the East and West coasts of the United States by 1869; the Canadian-Pacific railroad was completed by 1885 and the trans-Siberian railway by 1903. The decade prior to the First World War also saw an explosion of railway building in Argentina, India, Australia, China and elsewhere, largely financed by British capital. From virtually nothing in 1826, almost a million kilometres of rail had been built by 1913 (Maddison, 2008).

If steam power revolutionized trade in the first half of the 19th century, a wave of even newer technologies – such as refrigerated ships and submarine telegraph cables – contributed to a further lowering of trade and communications costs and a deepening of global integration in the second half of the 19th century. Refrigeration had major trade implications. Developed in the 1830s and refined over the following two decades, mechanical refrigeration meant that chilled beef could be exported from the United States to Europe as early as 1870; by the 1880s, South American meat, Australian meat and New Zealand butter were all being exported in large quantities to Europe (Mokyr, 1990).

The arrival of the electronic telegraph in the 1840s was another transformative event, ushering in the modern era of near instantaneous global communications. The first successful transatlantic telegraph message was

Table B.1: **Share of world exports in world GDP, 1870-1998** (percentage)	
1870	4.6
1913	7.9
1950	5.5
1973	10.5
1998	17.2

Source: OECD (2001).

sent in August 1858, reducing the communication time between Europe and North America from ten days – the time it took to deliver a message by ship – to a matter of minutes. By the end of the 19th century, British-, French-, German- and US-owned cables linked Europe and North America in a sophisticated web of telegraphic communications.

International trade increased rapidly after 1820, underpinned by falling transport and communications costs. Inland transport costs fell by over 90 per cent between 1800 and 1910; transatlantic transport costs fell roughly 60 per cent in just three decades between 1870 and 1900 (Lundgren, 1996). Meanwhile, world exports expanded by an average of 3.4 per cent annually, substantially above the 2.1 per cent annual increase in world GDP (Maddison, 2001). As a result, the share of trade in output (or openness) rose steadily, reaching a high point in 1913 (see Table B.1), just before the First World War, which was not surpassed until the 1960s (Maddison, 2001).

(b) A growing division of labour and a widening wealth gap

The vast expansion of international trade in the 19th century enabled countries to specialize in the products at which they were most efficient, thus reinforcing and accelerating the international division of labour. Although trade also helped to diffuse new technologies and products – and to reduce the handicap that countries with limited natural resources had hitherto faced – industrialization and development spread unevenly, with Britain taking an early lead, followed by Western Europe, North America, and much later Japan. Thus, even as global economic integration deepened in the 19th century, the income gap between a fast-industrializing North and a raw-material supplying South widened – a process economic historian Kenneth Pomeranz has called "the great divergence" (Pomeranz, 2000).

Dramatically falling transport costs resulted not just in increasing volumes of trade but also in trade diversification. Before the industrial revolution, the vast majority of goods and raw materials were too difficult or expensive to transport over great distances, with the result that only goods with the highest price-to-weight ratio – spices, precious metals, tea and coffee – were traded. However, as steamships replaced wooden

sailing vessels, and as railways replaced transportation by horses, a greater variety of commodities were suddenly accessible to the world's industrial centres, and a much wider range of manufactured goods were available to the rest of the world.

Over the course of the 19th century, trans-oceanic trade in grains, metals, textiles and other bulk commodities became increasingly common.[1] After the mid-19th century, European farmers increasingly found themselves in direct competition with the vast and highly productive farms of the Americas and Russia.[2] Despite a fast-growing population and limited arable land, food prices in Britain stopped rising in the 1840s and started falling thereafter (O'Rourke and Findlay, 2007; O'Rourke and Williamson, 1999).

Declining food prices benefited industrial workers and urban consumers – helping to fuel further industrialization and urbanization – but disadvantaged landowners and farm labourers. According to Pomeranz, one of the key factors that facilitated Europe's rapid industrialization throughout the 1800s was the vast amount of fertile, uncultivated land in the Americas which could be used to grow the large quantities of agricultural products needed to feed a fast-expanding European population, thereby allowing Europe's labour and land to be freed up for further industrialization (Pomeranz, 2000).

At the same time, the Americas, Asia and Africa served as an expanding market for European manufactured goods. Just as farmers in industrialized countries faced powerful new competition from highly competitive agricultural producers in the New World, developing-country artisanal and craft producers also found themselves out-competed and overwhelmed by more capital- and technology-intensive producers in the fast-industrializing North (Bairoch and Kozul-Wright, 1996).

Massive inflows of European manufactured goods, particularly of textiles and clothing, throughout the 19th century resulted in what economic historian Paul Bairoch describes as the "de-industrialization" of the developing world, both in absolute and relative terms. The destruction of India's textile industry was a striking example, but a similar de-industrialization process was taking place in China, Latin America and the Middle East (Bairoch and Kozul-Wright, 1996). The developing world saw its share of global manufacturing fall from over a third to less than a tenth between 1860 and 1913 (Bairoch, 1982). Only after the turn-of-the-century did the downturn in the developing world's industrial capacity begin to reverse.

Improved transport and communications allowed people and capital as well as goods to move more freely across the globe, further fuelling the growth of overseas markets, providing new investments in transport and communications infrastructure, and driving up the pace of global integration. From 1820 to 1913, 26 million people migrated from Europe to the United States, Canada, Australia, New Zealand, Argentina and Brazil. Five million Indians migrated within the British Empire to destinations such as Burma, Malaysia, Sri Lanka and Africa. An even larger number of Chinese migrated to countries around the Pacific Rim and beyond (Ravenhill, 2011).

The opening up of the Americas, Australasia and Northern Asia to new settlement required massive capital investments, especially in railways. After 1870, there was a massive outflow of European capital for overseas investments. By 1913, Britain, France and Germany had investments abroad totalling over US$ 33 billion; after 1870, Britain invested more than half its savings abroad, and the income from its foreign investments in 1913 was equivalent to almost 10 per cent of all the goods and services produced domestically (Maddison, 2001). Moreover, this capital flowed increasingly towards the developing world. Between 1870 and 1914, the share of British investment going to Europe and the United States halved, from 52 per cent to 26 per cent of the total, while the share of investment absorbed by Latin America and British colonies and dominions rose from 23 per cent to 55 per cent (Kenwood and Lougheed, 1994).

A new global economic landscape – defined by an advanced industrial "core" and a raw-material-supplying "periphery" – gradually took shape over the course of the 19th century, reflecting the increasing international division of labour (O'Rourke and Findlay, 2007). For Britain in particular, trade with its Empire and dominions was more important than trade with other industrialized countries. For example, in 1913, Britain imported more from Australia, Canada and India (and some others) combined than the United States – despite the latter's importance as a supplier of cotton for Britain's textile industry – and it exported five times as much to these countries as to the United States. Similarly, France exported more to Algeria than to the United States in 1913 (Ravenhill, 2011).

Even among industrialized countries, trade was largely dominated by primary products until after the First World War. According to Kenwood and Lougheed (1994), at its peak in 1890, agriculture and other primary products accounted for 68 per cent of world trade, declining slightly to 62.5 per cent by 1913 (Kenwood and Lougheed, 1994). At the outbreak of the First World War, primary products still constituted two-thirds of total British imports (Ravenhill, 2011).

If incomes within the industrialized core generally converged during the 19th century, incomes between the core and the periphery of the world economy dramatically diverged. Many economists, beginning most notably with Raul Prebisch in the 1950s, have argued that this divergence was a result of the growing

international division of labour, especially the way their growing dependence on raw material exports prevented poorer countries from industrializing.[3] Although commodity specialization brought some periphery countries significant economic benefits – Argentina, for example, had among the world's highest per capita income in 1913[4] – for many others, economic progress was modest or non-existent.

Meanwhile, the industrialized countries' access to cheaper raw materials and vast markets for their manufactured goods allowed them to advance at a much greater pace, both economically and technologically, than the rest of the world. In 1860, the three leading industrial countries produced over a third of total global output; by 1913 their share was a little under two-thirds (of a much larger total). In 1820, the richest countries of the world had a GDP per capita about three times the poorest (see Figure B.1); by 1910, the ratio was nine to one and by 1925, fifteen to one (Maddison, 2001).

The industrialized core also gradually expanded during this period. Britain was the undisputed economic power in the mid-1800s, but by 1913 both the United States and Germany were contributing a larger share of world output, as is shown in Table B.2. While in 1870, no country had achieved a level of per capita industrialization half that of Britain's, by 1913 Germany, Belgium, Switzerland and Sweden had caught up.[5] However, as Bairoch notes, even by the end of the 19th century, "the core of world industry comprised a very small group of countries" (Bairoch and Kozul-Wright, 1996).

(c) Global economic cooperation and integration

The spectacular growth in international economic integration in the 19th century rested on relatively simple – but in many ways fragile – international political foundations.

The central pillar of the 19th-century global economy was the international gold standard. Following Britain's example since the early 1820s,[6] Germany guaranteed gold parity for its exchange rate in 1872 as part of its efforts to consolidate its newly unified empire around a single currency and a common monetary policy. Denmark, Norway and Sweden followed Germany in 1873, the Netherlands in 1875, Belgium, France and Switzerland in 1876 and the United States in 1879. By the end of the 1880s, virtually the whole world had joined Britain on the gold standard, effectively creating a single world financial system (Frieden, 2006). Since every country fixed the value of its national currency in terms of gold, each currency had a fixed exchange rate against every other – thus virtually eliminating foreign exchange risk and barriers to international payments. The period between the 1870s and 1914 was one of remarkable stability and predictability in international trade and capital flows.

European countries also negotiated a dense network of bilateral trade agreements with one another during this period, triggered by the conclusion of the Cobden-Chevalier Treaty between Britain and France in 1860. The treaty not only reduced tariff barriers between Europe's two largest economies,[7] but included an
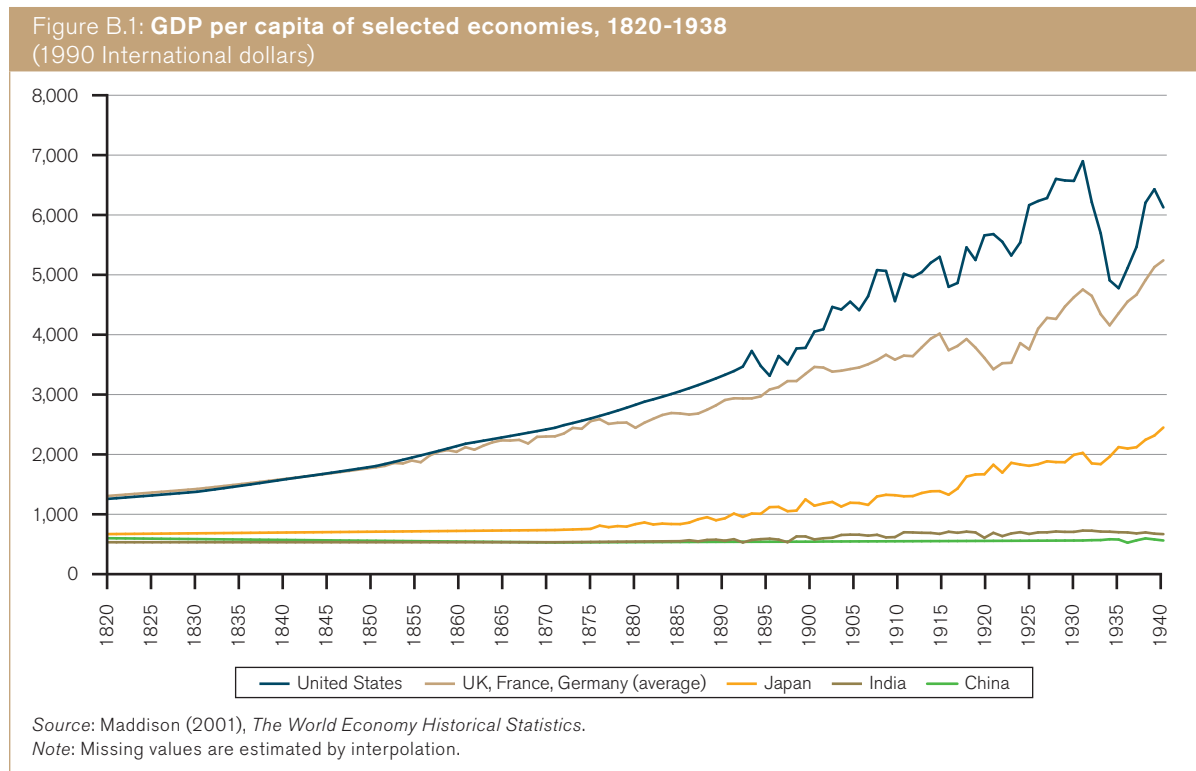

Figure B.1: **GDP per capita of selected economies, 1820-1938**
(1990 International dollars)

Source: Maddison (2001), *The World Economy Historical Statistics*.
Note: Missing values are estimated by interpolation.

Year	United States	Britain	Germany	France	Russia	Other developed countries	Other
1830	2.4	9.5	3.5	5.2	5.6	13.3	60.5
1860	7.2	19.9	4.9	7.9	7.8	15.7	36.6
1913	32.0	13.6	14.8	6.1	8.2	17.8	7.5

Table B.2: **Percentage distribution of the world's manufacturing production**

Source: Bairoch (1982).

unconditional most-favoured-nation (MFN) clause which guaranteed equal, non-discriminatory access if either France or Britain lowered tariffs with third countries. This MFN clause provided the "cornerstone" of the 19th-century commercial treaty network (Bairoch, 1982).

While Britain made its tariff reductions under the treaty applicable to all countries, France adopted a two-tiered tariff system, with lower MFN tariff rates for Britain and higher rates for others – creating a powerful incentive for other European states to negotiate MFN agreements with France as well, thus securing equal treatment for their own exports. France concluded a treaty with Belgium in 1861, followed in quick succession by agreements with the German Zollverein in 1862, Italy in 1863, Switzerland in 1864, Sweden, Norway and the Netherlands in 1865, and Austria in 1866.[8] As economic historian Douglas Irwin puts it, "through a variety of fortuitous circumstances, a single bilateral agreement to reduce tariffs blossomed into dozens of bilateral accords, resulting in an effectively multilateral arrangement under which international trade entered an unprecedentedly liberal era" (Irwin, 1995).

Europe's vast overseas empires and spheres of influence, already deeply integrated by trade, investment, and migration flows, also played a key role in shaping global economic integration. Much of the developing world had been – or was in the process of being – opened up to trade and investment as a result of colonial rule and the expectation that imperial powers should enjoy free access to the resources and markets of their colonial possessions.[9] These extensive imperial and colonial ties meant that large parts of the world economy were automatically drawn into the liberal trading order being constructed among European countries after 1860.

French, German, Belgian and Dutch colonies essentially adopted the same tariff codes as their home countries, while most of Britain's dependencies, such as India, applied the same low, non-discriminatory tariff on foreign as well as British imports. If trade relations among industrialized countries, according to Bairoch, still resembled "islands of liberalism surrounded by a sea of protectionism" in the 19th century, in the developing world they resembled "an ocean of liberalism with islands of protectionism" (Bairoch and Kozul-Wright, 1996).

There were also various attempts at the international level to meet the policy coordination and cooperation challenges thrown up by new transport and communications technologies. For example, the International Telegraph Union (ITU), the world's oldest international body, was formed in 1873 to harmonize telegraph regulations and tariffs.[10] An International Conference for Promoting Technical Uniformity in Railways was held in 1883 to help link up national railway networks; the United International Bureau for the Protection of Intellectual Property was established in 1893 to administer the newly negotiated Berne Convention for the protection of literary and artistic works and the Paris Convention for the protection of industrial property. Many of these 19th-century international innovations provided building blocks for the League of Nations (1919) and the United Nations (1945).

All of these developments can only be understood in relation to Britain's central role in the global economy. As the world's dominant industrial, financial and naval power throughout much of the century, Britain generally used its influence and example to shape an international economy that maximized liberal trade and investment flows. The mid-century push for freer global trade was almost entirely a British preoccupation and initiative, led by Britain's 1846 repeal of the Corn Laws (high agricultural tariffs), its 1849 repeal of the Navigation Acts (laws restricting foreign trade between Britain and its colonies), and finally its invitation to France to negotiate the 1860 Cobden-Chevalier Treaty.

Similarly, the use of sterling as the main international currency and the pivotal role of British banks in the international financial system signified Britain's economic strength and the extent to which it benefited from global economic openness. Just as important, Britain's naval supremacy ensured that the world sea lanes, the arteries of the 19th-century global economy, remained open – and not just to British trade but to the commerce of the world.

One of the striking features of the 19th-century economic system – if it can be termed a "system" – is that it evolved piecemeal and autonomously, not by international design and agreement. Trade relations were underpinned by a patchwork quilt of separate bilateral undertakings, while the international gold standard entailed only countries' individual commitments to fix the price of their domestic

currencies in terms of a specific amount of gold. In this lack of overarching structures and institutions lay the system's fundamental and inherent weakness. In the absence of formal international constraints or scrutiny, most European countries gradually raised the level of their tariffs in the last three decades of the 19th century to protect domestic producers against the increasing global competition that had flowed from falling transport costs.

The unification of Germany and Italy in the early 1870s also placed pressure on Europe's non-discriminatory system of trade relations, as both countries sought to consolidate internal unity by raising external tariff barriers. The worldwide depression from 1873 to 1877 – whose impact approached the severity of the Great Depression 60 years later – added further pressure for more domestic protection and weakened the drive for access to foreign markets. The fact that the United States, already a major agricultural exporter and a fast-rising manufacturing power, refused to lower its own tariffs or to grant unconditional MFN treatment in its trade agreements, also placed a growing strain on the system.

By the turn of the century, the average tariff level in Germany and Japan was 12 per cent, in France 16 per cent, and in the United States 32.5 per cent. The rush by European powers to consolidate and expand their colonial empires in Africa and Asia was a clear sign that Britain's "imperialism of free trade" was already waning (Gallagher and Robinson, 1953). Even in Britain, the free trade orthodoxy was being challenged by growing political calls for Britain to strengthen and protect its Empire through exclusive trade preferences.

(d) De-globalization

The first age of globalization was already under strain when the First World War delivered a fatal blow – destroying not just the liberal economic order but the assumption, remarkably widespread in the 1800s, that technology-driven integration, interdependence and prosperity alone were sufficient to underpin international cooperation and peace (Ravenhill, 2011). Trade was massively disrupted, the gold standard collapsed, economic controls and restrictions were widespread, and Europe, the former core of the world economy, was left devastated or exhausted.

The economic instability and disorder of the inter-war years was rooted in the failed attempt to rebuild the globalized economy of the 19th century. Partly this failure arose from an inability to recognize that the post-war world was fundamentally altered, and that there could be no quick or easy return to the pre-war "golden age" of open trade and financial stability. Countries underestimated the immense challenge of restructuring wartime industries, finding work for millions of unemployed soldiers, or coping with raw material and food shortages. One of the war's most significant impacts was on the changing perceptions of a government's economic role. Mobilizing countries behind total war had demanded unprecedented state involvement in economies. After the war, there were strong political demands for national governments to continue to manage economies in order to promote full employment, reconstruction and greater social justice – but these pressures for economic nationalism often clashed with pressures for international economic cooperation.
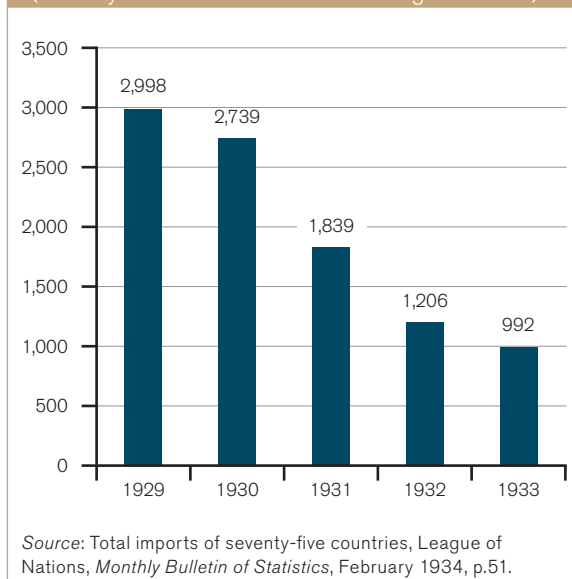
Economic challenges were compounded by financial challenges. In the face of widespread financial volatility and competitive devaluations, countries kept or re-imposed trade and exchange restrictions to slow imports and strengthen their balance of payments. When leading countries finally agreed to reinstate a modified version of the gold standard in 1925, they were uncertain as to what the post-war parities should be: the result was currency misalignments, leaving the pound sterling and the French franc wildly over-valued.

The lack of global economic leadership and cooperation was perhaps the biggest obstacle to inter-war recovery. Pressure for war reparations and loan repayments not only undermined Europe's recovery efforts but poisoned relations, further handicapping international cooperation. The United States failed to lower its trade barriers to European exports – so critical to Europe's economic recovery – even as it accumulated ever-greater surpluses. United States' loans to Europe after 1924 served to mask underlying economic fragilities and accumulating global imbalances. When the Wall Street stock market crashed in October 1929, these weaknesses were exposed and the world economy plunged into the Great Depression.

To the problems of collapsing demand, banking crises and growing unemployment were added rising protectionism and economic nationalism. In response to pressure to protect domestic farmers from falling prices and foreign competition, the US Congress passed the infamous Smoot-Hawley Tariff Act in 1930, raising US tariffs to historically high levels and prompting other countries to retreat behind new tariff walls and trade blocs. Trade wars pushed the world average tariff rate up to 25 per cent at its 1930s peak (Clemens and Williamson, 2001). As a result of these new trade barriers and collapsing demand, international trade collapsed, its value declining by two-thirds between 1929 and 1934 (see Figure B.2).

As Charles Kindleberger famously argued, "the 1929 depression was so wide, so deep, and so long because the international economic system was rendered unstable by British inability and United States unwillingness to assume responsibility for stabilizing it" (Kindleberger, 1973). Inter-war economic "mistakes", most notably the Smoot-Hawley Tariff Act, feature prominently in narratives of this era but the root problem was the absence of a state powerful enough

Figure B.2: **Plummeting world trade during the Great Depression, 1929-33** (monthly values in millions of old US gold dollars)

Source: Total imports of seventy-five countries, League of Nations, *Monthly Bulletin of Statistics*, February 1934, p.51.

to provide leadership to the system, to underwrite a viable recovery plan and to restore international stability and confidence.

Largely as a result of their wartime experience – and its toxic and turbulent aftermath – countries were already wary of working together to find cooperative solutions. Faced with an unprecedented global economic crisis and no sign of an early solution, countries took a series of fateful steps to protect their own national interests at the expense of their collective interests – with the result that their individual interests were also ultimately undermined. Although the 1920s saw some modest progress in efforts to restore the pre-1914 economic order, the Great Depression delivered a devastating blow from which the 1930s never recovered. Economic insecurity fed political insecurity, resulting in the rise of political extremism, the breakdown of collective security, a race to re-arm, and ultimately the outbreak of the Second World War.

(e)   Re-globalization

In many ways, the world economy has undergone a process of "re-globalization" since the Second World War – to use the term coined by Ronald Findlay and Kevin O'Rourke – resuming and dramatically accelerating the integration path that was abruptly de-railed by the First World War and the economic and political chaos that followed (O'Rourke and Findlay, 2007). Indeed, the world economy grew far faster between 1950 and 1973 than it had done before 1914, and its geographical scope was far wider – ushering in a "golden age" of unprecedented prosperity (Maddison, 2001). World per capita GDP rose by nearly 3 per cent a year, and world trade by nearly 8 per cent a year. However, there is one important difference between the first and the second age of globalization. Whereas the

19th-century version was accompanied by only rudimentary efforts at international economic cooperation, the 20th-century version, by explicit design, was built on a foundation of new multilateral economic institutions known collectively as the Bretton Woods system: the International Monetary Fund (IMF), the World Bank and the General Agreement on Tariffs and Trade (GATT).

The key lesson drawn from the inter-war experience was that international political cooperation – and an enduring peace – depended fundamentally on international economic cooperation. No country absorbed this lesson more than the United States. Conscious of how its failure to assume leadership after 1918 – and drift towards economic protectionism and nationalism after 1930 – had contributed to the inter-war economic disasters, it resolved to use its post-war global dominance to construct a new liberal economic order based on open trade, financial stability and economic integration.

This new system was both similar to the 19th-century order and very different. The aim of the IMF was to re-establish the exchange-rate stability of the gold standard era while at the same time preserving countries' freedom to promote full employment and economic growth. Under the new Bretton Woods system, exchange rates were fixed, but adjustable, and international stabilization funds were made available to countries facing balance-of-payments difficulties. Meanwhile, the World Bank was established to provide soft loans for both economic reconstruction and industrial development.

There were also intensive negotiations for a new International Trade Organization (ITO), intended as the third pillar of the new multilateral economic system. However, when the US Congress failed to ratify the ITO charter in the late 1940s, countries were forced to rely on the GATT, designed as a temporary tariff cutting agreement until the ITO was formally established, but embodying most of the ITO's key commercial policy rules. Although the GATT was never intended as an international organization, it gradually came to play that role – both lowering tariffs and strengthening trade rules through eight successive "rounds" of negotiations – until its replacement by the World Trade Organization on 1 January 1995.

This new post-war commitment to international economic cooperation – and the multilateral institutions needed to sustain it – also found expression in a series of bold steps to integrate European economies. The 1948 Marshall Plan, for example, stipulated that European countries should decide among themselves not only how to distribute the US$ 12 billion in Marshall Aid provided by the United States but how to begin dismantling internal barriers to intra-European trade and investment.[11] In the 1950s, the United States also supported European plans to pool production in areas

of heavy industry, to establish international authorities with the power to oversee this common production and to establish huge free trade areas – which later came to fruition in the formation of the European Economic Community (EEC) and ultimately the present-day European Union (EU).

Although the overall trend since 1945 has been towards growing international economic cooperation and deepening integration, progress has been bumpy and uneven, with major obstacles along the ways. The emerging Cold War in the late 1940s put wartime visions of a new global economic order on hold for almost fifty years (but also reinforced the shared interests of free-market economies) until the fall of the Berlin Wall in 1989. The rapid unravelling of Europe's colonial empires after the Second World War – together with the collapse of the Soviet Union after 1991 – led to the creation of dozens of newly independent states, with their own economic, trade and monetary systems, further complicating the task of international coordination. Even the extraordinary success of the post-war international economic order in underpinning global growth and development has created its own political challenges. On-going economic integration is rendering shallower models of cooperation obsolete – first signalled by the abrupt end of the Bretton Woods system of fixed exchange rates in 1971 – without necessarily creating support for alternative, deeper models. Similarly, the rise of new economic powers has entailed the relative decline of the United States, forcing the world to look beyond the old hegemon for wider global economic leadership.

(f) The continuing transport and communications revolution

Even as world politics went through a process of de-globalization between the wars followed by re-globalization after 1945, underlying technological advances in transport and communications continued and, in some instances, even accelerated.

War actually served to fuel innovations in trans-oceanic shipping, including the introduction of better boilers to convert steam, the development of turboelectric transmission mechanisms and the replacement of coal-fired plants with oil and diesel engines. In 1914, almost the entire world merchant fleet, 96.9 per cent, were coal burning steamships; this declined to about 70 per cent in the 1920s and less than 50 per cent from the latter half of the 1930s. By 1961, only 4 per cent of the world fleet, measured in tonnage, were coal-burning ships (Lundgren, 1996).

The mid-1950s witnessed another major breakthrough in shipping technology, prompted largely by the closure of the Suez Canal in 1956-57 (and again in 1965). Suddenly faced with the expense of transporting oil, coal, iron ore and other bulk commodities over much greater distances, the shipping industry decided

to invest in huge, specialized bulk carriers as well as in the harbour facilities needed to handle these new vessels. Whereas oil tankers averaged 16,000 deadweight tonnes (dwts) in the early 1950s (their design partly constrained by the need to navigate the Suez Canal), they averaged over 100,000 dwts by the 1990s – with modern "super-tankers" exceeding 500,000 dwts and capable of carrying over 3 million barrels of oil. The same technological advances transformed bulk freighters as well, with ships growing from an average of less than 20,000 dwts in 1960 to about 45,000 dwts in the early 1990s. World maritime trade has grown from 500 million tonnes in 1950 to 4,200 million tonnes in 1992 (Lundgren, 1996).

Railway networks also expanded rapidly between the two world wars, especially in developing countries. By 1937, 5.7 per cent of the world's railway mileage was located in Africa, 10.2 per cent in Latin America and 10.9 per cent in Asia (O'Rourke and Findlay, 2007). By the late 1920s, diesel and electric locomotives were increasingly replacing steam engines. The inter-war period also witnessed the mass adoption of the motor vehicle. Initially limited to transporting passengers in urban areas, large motorized trucks were soon serving on feeder routes to the main railways lines, and eventually they were competing with those lines. Adoption was particularly rapid in the United States: in 1921 there was one commercial motor vehicle for every 85 Americans, whereas in 1938 there was one for every 29. In 1913, the fleet of passenger cars was about 1.5 million; by 2002, it was 530 million (Maddison, 2008). The growing importance of motor vehicles was in turn one of the main factors underlying the rise of petroleum as an increasingly vital energy source for the world economy.

The rapid expansion of airfreight represented yet another major transportation breakthrough. Aircraft were put to use carrying cargo in the form of "air mail" as early as 1911. During the First World War, airborne military cargo dramatically increased and by the mid-1920s aircraft manufacturers were designing and building dedicated cargo aircraft. After the arrival of Federal Express in the late 1970s, promising next-day delivery of freight through a dedicated fleet of cargo carriers, the industry grew exponentially. By 1980, the real costs of airfreight had fallen to about a quarter of its level at the beginning of the Second World War (Dollar, 2001). This, in turn, has massively expanded the volumes traded, the distances covered, and the products involved. Used in conjunction with other forms of shipping, such as sea, rail and ground transport, airfreight has become a key component of international trade. Overall, air passenger miles rose from 28 billion in 1950 to 2.6 trillion in 1998 (Maddison, 2008).

As the remainder of this Report makes clear, the world economy is being reshaped by an even newer wave of integrationist technologies, driven by innovations in

telecommunications, computing and the global information networks they have spawned. Thanks to fibre optic cables, satellites and digital technology, the cost of overseas telecommunications is approaching zero. As the power of computer chips has multiplied – following Moore's Law (that the power of integrated circuits roughly doubles every two years) – the price of computing power has also fallen dramatically. Meanwhile, the internet has emerged, almost by accident, as the embodiment of the "global information superhighway" first predicted in the early 1990s, serving not just as a new means of global communications but also as a vast source of global information.

One striking change is the globalization of production. Just as rapidly falling transport costs in the 19th century led to globalization's "first unbundling" – separating factories from consumers – the newest wave of integrationist technologies, according to Richard Baldwin, is leading to globalization's "second unbundling" – the end of the need to perform most manufacturing stages near one another (Baldwin, 2011a). Manufacturing is increasingly managed through complex global supply chains – effectively world factories – which locate various stages of the production process in the world's most cost-efficient locations.

Whereas in the inter-war years, the composition of trade differed little from that of the previous century – that is, it was largely dominated by the exchange of raw materials and agricultural products for manufactured goods – since 1945, the main component of trade has been the international exchange of manufactured goods or the components of manufactured goods (from 40 per cent of world trade in 1900 to 75 per cent in 2000), while agriculture's relative share of world trade has steadily declined (see Figure B.3).

As a result of radical reductions in communications costs, services trade is also expanding dramatically. Whole sectors that were once non-traded (and thus impervious to foreign competition) – such as banking, retail, medicine or education – are rapidly transforming through e-banking, e-commerce, e-medicine or e-learning into some of the most globally tradable sectors. Meanwhile, world trade has been growing even more rapidly than world production – by 7.2 per cent per annum between 1950 and 1980 (with manufacture goods growing even more rapidly than primary commodities), whereas world gross domestic product (GDP) grew by 4.7 per cent over the same period (WTO *International Trade Statistics*, 2012) – underscoring the powerful forces continuing to drive global economic integration.

A central feature of this second age of globalization is the rise of multinational corporations and the explosion of foreign direct investment (FDI). With some notable exceptions, such as the major oil companies, firms that engaged in FDI – that is, the ownership and management of assets in more than one country for the purposes of production of goods and services – were relative rarities before 1945. In the post-1945 period, however, FDI has surged, growing more rapidly than either production or international trade – even though this growth has been volatile, with dramatic falls as well as rises over this period.[12] By 2009, it was estimated that there were 82,000 multinationals in operation, controlling more than 810,000 subsidiaries worldwide. Upwards of two-thirds of world trade now takes place within multinational companies or their suppliers – underlining the growing importance of global supply chains (UNCTAD, 2010).

A far more significant change is the rise of new economic powers – both reflecting and driving the on-going expansion of world trade. If the first age of

Figure B.3: **Product shares in world merchandise exports since 1900** (percentage)
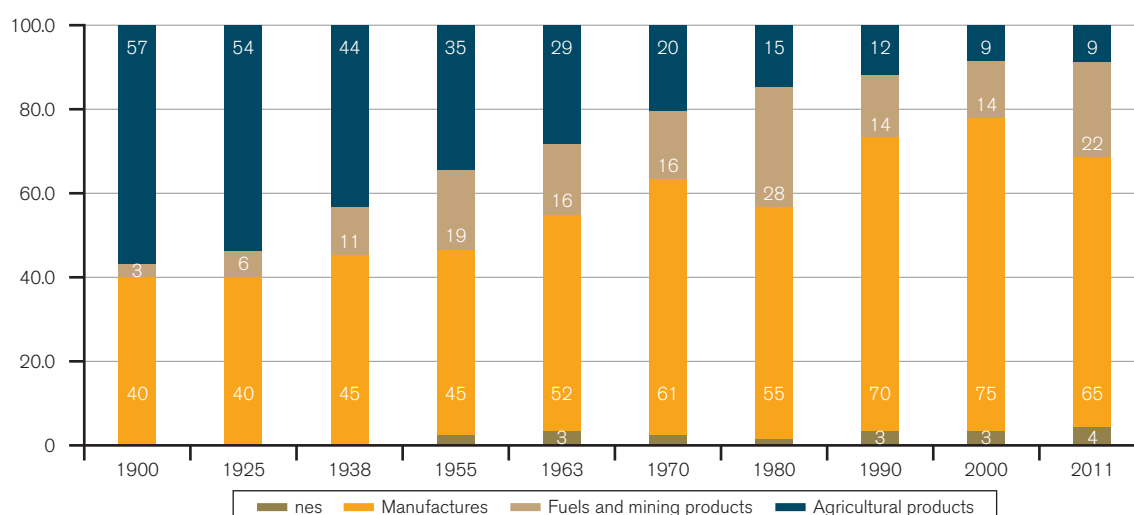
Sources: UN Statistical Yearbook (1969), GATT Special Studies No.5 and No.7, and WTO Secretariat estimates.

globalization involved de-industrialization in the periphery and industrialization in the core, the second age has, in some respects, reversed this pattern. The 1980s and especially the 1990s saw the rapid industrialization of many developing countries – and a huge increase in their share of manufactured exports and foreign investment – while advanced countries have become increasingly concerned about de-industrialization as a result of the "off-shoring" and "outsourcing" of manufacturing capacity and jobs.

Likewise, if the 19th century was marked by the "great divergence", we are now experiencing the "great convergence" – as billions in the developing world rapidly "catch up" with the advanced West. China, with its 1.3 billion people, has grown at an average of 9 per cent a year for the past three decades – largely without interruption – overtaking Japan as the world's second biggest economy and Germany as the world's biggest exporter. India is travelling a similar economic path, as is much of the rest of Asia, South America and Africa.

(g)   Summary

The industrial revolution marked a major turning point for the world economy – from the pre-globalization age to the age of globalization. Indeed, the current rise of the developing world is in many ways merely a reflection of the on-going spread of the industrial revolution – two centuries after it first swept through Britain – but on a scale and at a pace that easily dwarfs the "great transformation" of Europe and North America.[13] It is also a process that, in many ways, is still unfolding. Real per capita income in the West increased 20-fold between 1820 and 2003, but only seven-fold in the rest of the world – economic catch up has a long way to go (Maddison, 2008). Central to this development – and its continuation – is the unfolding "death of distance" and the on-going transport and communications revolution that lies behind it.

China could not have become the new "workshop of the world" without the transpacific "conveyer belt" provided by breakthroughs in containerization after the 1970s. India could not be a new global services hub without the invention of fibre optics and broadband. It is because of these technological forces that the nature of the global economy is profoundly changing, and with it the political, social and institutional structures needed to sustain and legitimize it. The unprecedented integration and expansion of the world economy in the decades after 1945 is a testament not just to the enduring power of underlying technological and market forces but to the success of the post-war political order that has been so critical to harnessing and managing these forces.

Two broad questions emerge from this discussion. First, will the same shaping factors that have given rise to today's global trade system likely continue in the immediate and longer-term future? In particular, will transport and communication costs continue their dramatic, linear decline as a result of continued incremental technological improvement or even the introduction of entirely new technologies? Or will marginal improvements begin to diminish in the future, making declining transport and communications costs a less salient shaping factor for world trade – even leading to a slowing of trade growth?

Secondly, to what extent can we expect future political shocks to the trading system? And can these shocks be anticipated and hopefully avoided? One of the lessons from the last two centuries is that geopolitics has a decisive impact – for good or ill – on underlying technological and structural trends. The current globalization phase began in 1945 with the rise of US hegemony and the advent of the Bretton Woods system, and then accelerated with China opening up to the world in 1979 and with the end of the Cold War in 1989. What kind of international political accommodation or system is needed for the future?

2.   How has trade changed in the last 20-30 years?

International trade flows have increased dramatically over the last three decades. According to WTO trade statistics, the value of world merchandise exports rose from US$ 2.03 trillion in 1980 to US$ 18.26 trillion in 2011, which is equivalent to 7.3 per cent growth per year on average in current dollar terms. Commercial services trade recorded even faster growth over the same period, advancing from US$ 367 billion in 1980 to US$ 4.17 trillion in 2011, or 8.2 per cent per year. When considered in volume terms (i.e. accounting for changes in prices and exchange rates), world merchandise trade recorded a more than four-fold increase between 1980 and 2011.

Many factors may have contributed to this remarkable expansion of trade but the fact that it coincided with a significant reduction in trade barriers is inescapable. Trade barriers include all costs of getting a good to the final consumer other than the cost of producing the good itself: transportation costs (both freight costs and time costs), policy barriers (tariffs and non-tariff barriers) and internal trade and transaction costs (including domestic information costs, contract enforcement costs, legal and regulatory costs, local distribution, customs clearance procedures, administrative red tape, etc.).

Policy barriers can be broadly divided into tariffs (ad-valorem and specific) and non-tariff measures (NTMs). Although tariffs are still the most widely used policy instrument to restrict trade, their relative importance has been declining. Trade opening, whether unilateral, the result of agreements negotiated under the auspices of the World Trade Organization, or the

consequence of preferential trade agreements (PTAs), has greatly reduced the average level of applied tariffs (WTR, 2011). As an example, consider the fact that the average tariff imposed by developed economies in 2010-11 on all imports was around 5.0 per cent, while the average rate on non-agricultural products was just 2.5 per cent, based on data from the WTO's Integrated Database.

Conversely, the use of NTMs has increased both in terms of the number of products covered and the number of countries utilizing them (WTR, 2012). Non-tariff measures, such as technical barriers to trade (TBT) and sanitary and phytosanitary (SPS) measures, taxes and subsidies, are often used by governments to achieve legitimate public policy objectives such as the protection of domestic consumers from injury or disease. On the other hand, NTMs may also be used by countries to manipulate the terms of trade or to protect domestic producers from foreign competition. The fact remains that NTMs used to pursue public policy objectives can also be misused for protectionist purposes.

The theoretical and empirical literature documenting the positive impact of traditional forms of trade liberalization is extensive. Nevertheless, other types of trade costs, such as domestic trade costs, still present significant barriers to trade. Anderson and Van Wincoop (2004), for instance, show that for developed countries, the overall impact of trade costs can be decomposed as follows: 21 per cent transportation costs (including both directly measured freight costs and a 9 per cent tax equivalent of the time value of goods in transit), 44 per cent border-related trade barriers and 55 per cent retail and wholesale distribution costs.[14] Hoekman and Nicita (2011) find that while traditional trade policies continue to be important in developing countries as well as for some

sectors in high-income countries (agriculture in particular), non-tariff measures and domestic trade costs are also of great importance. Finally, Rubin and Tal (2008) suggest transportation costs represent a greater barrier to trade than policy-induced obstacles, such as tariffs. At a price of US$ 100 per barrel of oil, they estimate transportation costs to be equivalent to an average tariff of 9 per cent, nearly double the WTO's estimate of the average applied tariff.

Perhaps the most significant fact about world trade since 1980 is that it has grown much faster than world output for most of this period. This is illustrated by Figure B.4, which shows five-year average annual growth rates for the volume of world merchandise trade (i.e. the average of exports and imports) and world real GDP growth, together with implied elasticities of trade with respect to global GDP.[15]

Trade and GDP growth are represented by vertical bars in Figure B.4 and are measured against the left axis. Elasticity is shown as a solid line and is measured against the right axis. During the early 1980s, global output and trade grew at nearly the same rate, around 3 per cent per year. Output as measured by GDP increased at a slightly faster pace of 3.2 per cent between 1980 and 1985, while the growth of merchandise exports in volume terms averaged 2.9 per cent per year, implying an elasticity of close to 1 (0.92 to be precise). However, since 1985 world trade has grown nearly twice as fast as output. Trade growth averaged 5.6 per cent per year between 1985 and 2011. Compared to the 3.1 per cent average rate for global GDP for the same period, we see that world trade grew about 1.8 times as fast as output.

Many factors may have contributed to the faster growth of trade relative to GDP over the past three

Figure B.4: **World merchandise trade volume and real GDP, 1980-2011** (annual percentage change)

Source: WTO Secretariat.
Note: Merchandise trade refers to the average of exports and imports.
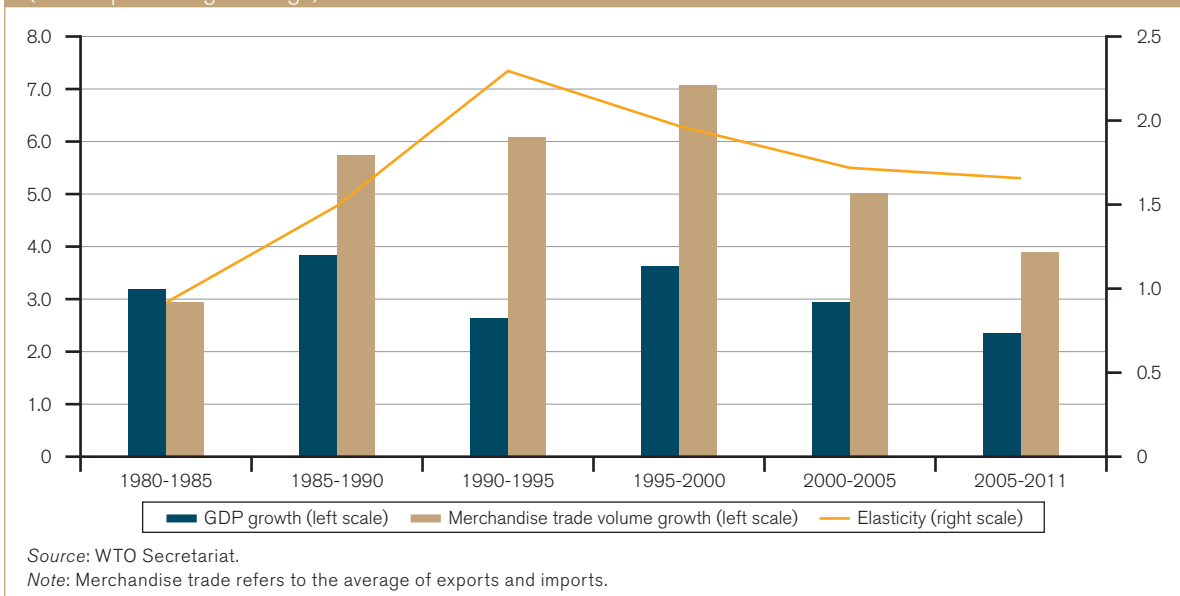
decades. The end of the Cold War provided a "peace dividend" in developed economies, which allowed them to reduce military expenditures and boost investment in other areas. The development of the internet and the digital economy also appears to have boosted trade, possibly to unsustainable levels as witnessed by the subsequent bursting of asset bubbles around the world. Finally, large developing economies such as China and India embraced economic reform and initiated a process of catch-up growth in which trade has played an important role.

The fact that trade grew faster than GDP may also be partly explained by the spread of supply chains, which are characterized by the unbundling of production processes across countries,[16] and partly by measurement issues. Goods are increasingly made in two or more sequential stages, with firms relying more and more on imported material inputs and offshored administrative tasks. However, since world trade is measured in gross terms, the value of intermediate goods may be counted more than once when goods cross borders at different stages of production, whereas intermediate goods are only counted once in GDP statistics.

As a result, the growth of world trade in recent decades may be somewhat inflated compared to output. For example, a television produced entirely in Japan and exported to the United States in 1980 might have contributed US$ 500 to both world GDP and world trade, whereas today components from Japan worth US$ 400 are more likely to be combined with US$ 100 of value added in assembly in China, which would (all other things being equal) raise world GDP by the same US$ 500 while increasing world trade by US$ 900 (i.e. US$ 400 of components exported from Japan to China, plus US$ 500 for the finished television exported from China to the United States).

The measure of trade elasticity shown in Figure B.4 rose to 1.50 in the late 1980s and peaked at 2.32 in the first half of the 1990s, but it has declined in every half decade since then. It fell to 1.96 in the late 1990s, to 1.71 in the early 2000s and finally to 1.66 between 2005 and 2011 (which is admittedly slightly longer than a half-decade).[17] Average trade and GDP growth rates in the latest six-year period have undoubtedly been influenced by the financial crisis and its aftermath but it is difficult to gauge the extent to which these events altered the elasticity of trade. World export volumes contracted much more than world GDP in 2009 (-12.5 per cent for trade and -2.4 per cent for GDP, which implies an elasticity of 5.2).[18] Trade also rebounded much more than GDP during the recovery of 2010 (13.8 per cent for trade, 3.8 per cent for GDP, which implies a 3.7 multiple of trade over output).

It is possible that the ratio of trade growth to GDP growth could move closer to 2 again as the impact of the financial crisis recedes. However, this seems

unlikely since many of the factors that drove trade growth over recent decades (the end of the Cold War, the rise of China, the World Wide Web, etc.) have already been exploited.

Sections B.2(a) through B.2(f) present numerous charts and tables showing the evolution of global trade patterns. The time periods covered by these charts and tables are dictated by data availability, so although every effort has been made to present developments over a 20 to 30 year period, it has sometimes been necessary to use a shorter interval. It is important to note that some of the tendencies identified below may have reached their high-water marks before the financial crisis and trade collapse of 2008-09. As a result, direct extrapolations of current trends are unlikely to be very informative. Although the focus of the Report is on long-run developments, the magnitude of the trade collapse was so great that it casts a shadow over many of the statistics, especially period averages and levels in the latest periods. As a result, the influence of this pivotal event should always be kept in mind when consulting these tables and charts.

(a) Who are the main players in international trade?

Next to the faster rate of trade growth relative to GDP growth, perhaps the most important change in trade patterns in recent years has been the increased share of developing economies in world trade and the corresponding decline in the share of developed economies. Section B.2(a) examines this issue in some detail, identifying countries that have advanced and receded in world trade rankings over the last 30 years or so. It also examines the evolution of trade within and between developed and developing economies (see definitions in Box B.1) over time, and considers whether a small number of large countries are responsible for a disproportionate amount of trade.

(i) Leading exporters and importers by level of development

Figure B.5 illustrates the increased share of developing economies in world merchandise exports between 1980 and 2011, as well as the corresponding reduction in the share of developed countries. Developing economies, whose exports represented just 34 per cent of world trade in 1980, saw their share rise to 47 per cent, or nearly half of the total, by 2011. At the same time, the share of developed economies dropped sharply from 66 per cent to 53 per cent. A striking difference between the two periods is the predominance of oil exporters among developing economies in 1980, in contrast to the more important role played by Asian developing economies in 2011.

China's 1 per cent share in world exports in 1980 made it only the tenth-largest exporter among

Box B.1: **Definitions of developed and developing economies**

The terms "developed" and "developing and emerging" countries are loosely based on the United Nations Millennium Development Goals (MDG) classification. Our developed countries group includes the following: all 27 members of the European Union (including newly acceded members that are regarded as "transition economies" under the MDG classification), other non-EU western European countries and territories (including Switzerland, Norway, Iceland, etc.), the United States, Canada, Japan, Australia and New Zealand. All other countries are termed "developing and emerging economies" although the word emerging is sometimes dropped in the interest of brevity. The developing group basically corresponds to the MDG developing economies group plus the Commonwealth of Independent States (CIS).

Our choice of country groups has certain advantages and disadvantages. Since both the "developed" and "developing and emerging" country groups are fixed, they can be used to analyse trends in trade and output over time. This sort of investigation would be problematic if per capita income were used as the main criterion for determining level of development, since group membership would be constantly changing. On the other hand, under our definitions some countries are presumed to be developed (Greece, Malta, Poland) despite the fact that they may be considerably poorer than some high-income developing economies (Singapore, the United Arab Emirates). An income-based grouping may be preferable for certain analyses (e.g. for examining a cross-section of countries at a point in time) but for the moment we will continue to use our classification while bearing in mind its inherent limitations.

Grouping countries according to level of development poses specific challenges for trade policy-makers. For instance, WTO agreements allow preferential treatment for developing and least-developed economies in certain contexts. The definitions of "developed" and "developing" used in this publication should not be interpreted as implying anything about any country's rights and obligations under WTO agreements, and should only be seen as indicative of a country's status. For further discussion, see Section E.
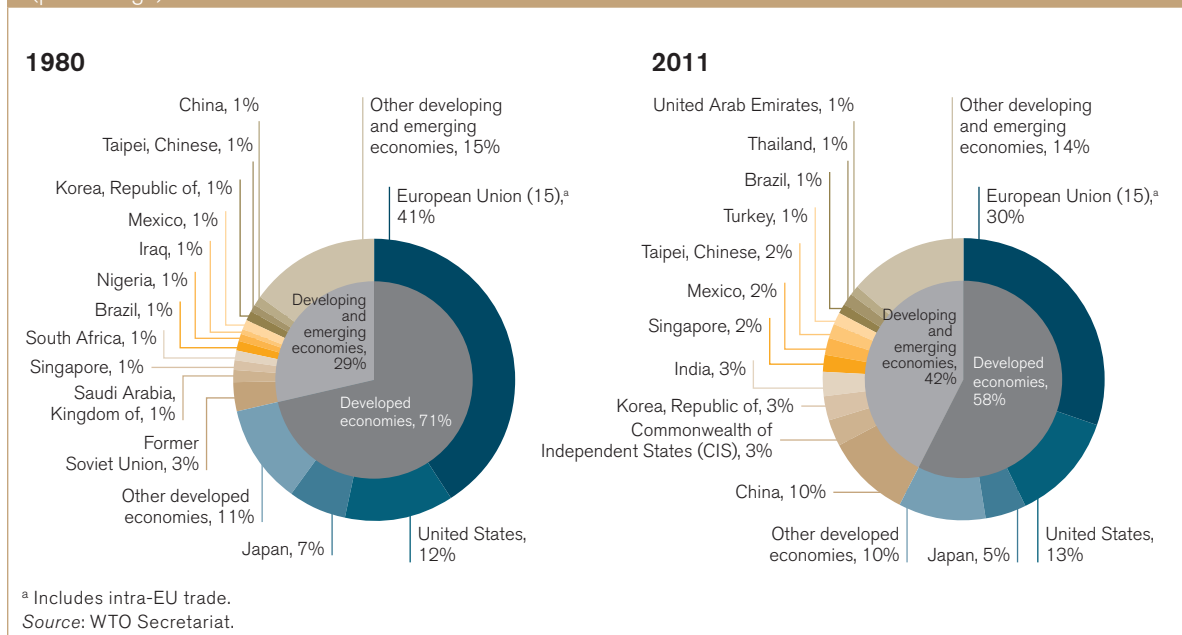
Figure B.5: **Shares of selected economies in world merchandise exports by level of development, 1980-2011**
(percentage)

[a] Includes intra-EU trade.
Source: WTO Secretariat.
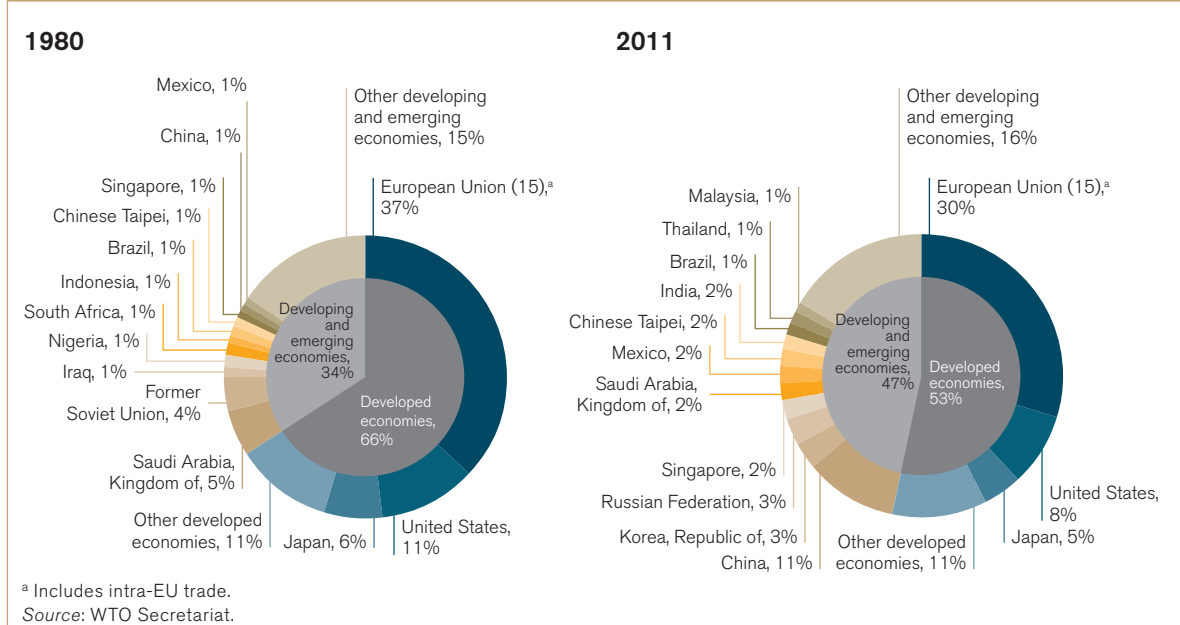
developing economies, but by 2011 its share had risen to 11 per cent, making it the largest developing exporter, and indeed the largest exporter in the world when individual EU member states are counted separately (see Table B.3). The Republic of Korea, India and Thailand were not even represented in the top ten developing exporters in 1980, but by 2011 their shares had risen to 3 per cent, 2 per cent and 1 per cent, respectively.

The European Union, the United States and Japan all recorded declines in their shares in world exports between 1980 and 2011. The European Union saw its share fall from 37 per cent to 30 per cent, while the share of the United States slipped from 11 per cent to 8 per cent and Japan's share dropped from 6 per cent to 5 per cent. It should be noted that the European Union here refers to the 15-country membership prior to the 2004 enlargement, including intra-EU15 trade. It is

Figure B.6: **Shares of selected economies in world merchandise imports by level of development, 1980-2011** (percentage)

1980

China, 1%
Taipei, Chinese, 1%
Korea, Republic of, 1%
Mexico, 1%
Iraq, 1%
Nigeria, 1%
Brazil, 1%
South Africa, 1%
Singapore, 1%
Saudi Arabia, Kingdom of, 1%
Former Soviet Union, 3%
Other developed economies, 11%
Japan, 7%

Other developing and emerging economies, 15%
European Union (15),ᵃ 41%
Developing and emerging economies, 29%
Developed economies, 71%
United States, 12%

2011

United Arab Emirates, 1%
Thailand, 1%
Brazil, 1%
Turkey, 1%
Taipei, Chinese, 2%
Mexico, 2%
Singapore, 2%
India, 3%
Korea, Republic of, 3%
Commonwealth of Independent States (CIS), 3%
China, 10%
Other developed economies, 10%
Japan, 5%

Other developing and emerging economies, 14%
European Union (15),ᵃ 30%
Developing and emerging economies, 42%
Developed economies, 58%
United States, 13%

ᵃ Includes intra-EU trade.
Source: WTO Secretariat.

impossible to calculate the share of the current 27 country membership in 1980 since some members did not exist at that time (Czech Republic, Slovak Republic, Slovenia and the Baltic states) but the enlarged trade bloc's share in 2011 was 34 per cent, which is still less than the 1980 share of the 15 country membership.

Similar trends can be observed on the import side, which is illustrated by Figure B.6. The rise in the share of developing and emerging economies in world imports was nearly as dramatic as the rise on the export side (from 29 per cent in 1980 to 42 per cent in 2011) although the final share was smaller. China's share in world imports was slightly less than its share in world exports in 2011 (10 per cent rather than 11 per cent) but India's share in imports was larger (3 per cent compared with 2 per cent).

The United States' contribution to world imports actually increased slightly, from 12 per cent in 1980 to 13 per cent in 2011 despite an overall reduction in the share of developed economies from 71 per cent to 58 per cent. Japan saw some slippage in its import share from 7 per cent to 5 per cent, while the European Union's share dropped from 41 per cent to 30 per cent during the same period. As with exports, the share in 2011 only refers to the 15 pre-enlargement countries.

Increased exports contributed to higher GDP growth in developing economies between 1980 and 2011, while rising incomes supported expanded imports. To illustrate the parallel development of trade and output in developing countries, shares of developed and developing economies in world GDP are shown in Figure B.7, both at purchasing power parity (PPP) and at current prices. The share of developing economies

in GDP at PPP rose from 31 per cent in 1980 to 52 per cent in 2011. Equivalent shares at current exchange rates were smaller, 24 per cent in 1980 and 39 per cent in 2011. The fact that the share of developing economies in world imports in 2011 remained well below the 50 per cent share of these economies in world GDP at PPP may be explained by the fact that the ability to purchase goods and services from other countries depends more on the dollar value

Figure B.7: **Shares of developed and developing economies in world GDP, 1980-2011** (percentage)
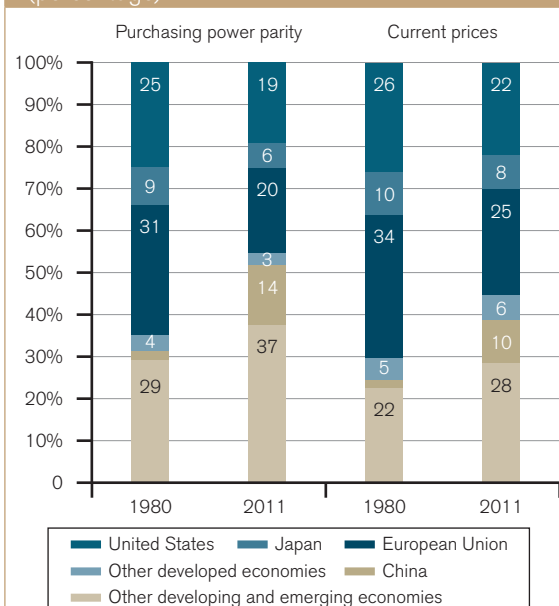
Source: IMF World Economic Outlook database, October 2012.

II B. TRENDS IN INTERNATIONAL TRADE

Table B.3: **Leading merchandise exporters, 1980-2011**
(US$ billion and percentage)

	2011			1980	
	Value	Rank	Share in world	Rank	Share in world
World	18,255.2	-	100.00	-	100.00
China	1,898.4	1	10.40	30	0.89
United States	1,480.4	2	8.11	1	11.09
Germany[a]	1,472.3	3	8.06	2	9.48
Japan	822.6	4	4.51	3	6.41
Netherlands	661.0	5	3.62	9	3.64
France	596.1	6	3.27	4	5.70
Korea, Republic of	555.2	7	3.04	32	0.86
Italy	523.2	8	2.87	7	3.84
Russian Federation	522.0	9	2.86	-	-
Belgium[b]	476.7	10	2.61	11	3.17
United Kingdom	473.2	11	2.59	5	5.41
Hong Kong, China	455.6	12	2.50	22	1.00
Domestic exports	16.8	-	0.09	-	0.67
Re-exports	438.8	-	2.40	-	0.33
Canada	452.4	13	2.48	10	3.33
Singapore	409.5	14	2.24	26	0.95
Domestic exports	223.9	-	1.23	-	
Re-exports	185.6	-	1.02	-	0.33
Saudi Arabia, Kingdom of	364.7	15	2.00	6	5.36
Mexico	349.6	16	1.91	31	0.89
Spain	308.7	17	1.69	21	1.02
Taipei, Chinese	308.3	18	1.69	24	0.98
India	304.6	19	1.67	45	0.42
United Arab Emirates	285.0	20	1.56	17	1.08
Australia	270.4	21	1.48	18	1.08
Brazil	256.0	22	1.40	23	0.99
Switzerland	234.4	23	1.28	13	1.46
Thailand	228.8	24	1.25	48	0.32
Malaysia	227.0	25	1.24	39	0.64
Indonesia	200.6	26	1.10	20	1.08
Poland	187.4	27	1.03	34	0.84
Sweden	187.2	28	1.03	12	1.52
Austria	178.0	29	0.97	33	0.86
Czech Republic	162.3	30	0.89	-	-
Norway	159.3	31	0.87	29	0.91
Turkey	134.9	32	0.74	67	0.14
Iran	131.5	33	0.72	40	0.61
Ireland	126.9	34	0.70	46	0.41
Nigeria	116.0	35	0.64	15	1.28
Qatar	114.3	36	0.63	50	0.28
Denmark	113.3	37	0.62	35	0.82
Hungary	112.2	38	0.61	44	0.42
Kuwait, the State of	103.5	39	0.57	25	0.97
Viet Nam	96.9	40	0.53	124	0.02
Memo					
European Union[c]	6,038.60	-	33.08	-	37.06
intra-trade	3,905.71	-	21.40	-	22.55
extra-trade	2,132.89	-	11.68	-	14.51

Source: WTO Secretariat.

[a] Germany refers to West Germany in 1980.
[b] Belgium refers to Belgium-Luxembourg in 1980.
[c] European Union refers to EU27 in 2011 and EU15 in 1980.

Table B.4: **Leading merchandise importers, 1980-2011**
(US$ billion and percentage)

	2011			1980	
	Value	Rank	Share in world	Rank	Share in world
World	18,437.7	-	100.00	-	100.00
United States	2,265.9	1	12.29	1	12.38
China	1,743.5	2	9.46	22	0.96
Germany[a]	1,253.9	3	6.80	2	9.06
Japan	855.0	4	4.64	3	6.81
France	713.9	5	3.87	4	6.50
United Kingdom	637.8	6	3.46	5	5.57
Netherlands	598.7	7	3.25	7	3.76
Italy	557.5	8	3.02	6	4.85
Korea, Republic of	524.4	9	2.84	20	1.07
Hong Kong, China	510.9	10	2.77	18	1.11
Retained imports	130.2	-	0.71	-	0.79
Canada	462.6	11	2.51	10	3.01
India	462.6	12	2.51	33	0.72
Belgium[b]	461.4	13	2.50	8	3.46
Spain	374.2	14	2.03	12	1.64
Singapore	365.8	15	1.98	17	1.16
Retained imports	180.2	-	0.98	-	0.83
Mexico	361.1	16	1.96	21	1.07
Russian Federation	323.8	17	1.76	-	-
Taipei, Chinese	281.4	18	1.53	23	0.95
Australia	243.7	19	1.32	19	1.08
Turkey	240.8	20	1.31	51	0.38
Brazil	236.9	21	1.28	15	1.20
Thailand	228.5	22	1.24	47	0.44
Switzerland	208.3	23	1.13	11	1.75
Poland	207.7	24	1.13	26	0.92
United Arab Emirates	205.0	25	1.11	49	0.42
Austria	191.0	26	1.04	16	1.18
Malaysia	187.7	27	1.02	40	0.52
Indonesia	176.9	28	0.96	39	0.52
Sweden	176.0	29	0.95	13	1.61
Czech Republic	151.6	30	0.82	-	-
Saudi Arabia, Kingdom of	131.7	31	0.71	14	1.45
South Africa	121.6	32	0.66	24	0.94
Viet Nam	106.7	33	0.58	89	0.06
Hungary	102.6	34	0.56	48	0.44
Denmark	97.8	35	0.53	25	0.93
Norway	90.9	36	0.49	28	0.82
Finland	84.1	37	0.46	30	0.75
Ukraine	82.6	38	0.45	-	-
Portugal	80.3	39	0.44	46	0.45
Slovak Republic	77.3	40	0.42	-	-
Memo					
European Union[c]	6,255.6	-	33.93	-	40.82
intra-trade	3,905.7	-	21.18	-	21.99
extra-trade	2,349.9	-	12.74	-	18.82

Source: WTO Secretariat.

[a] Germany refers to West Germany in 1980.
[b] Belgium refers to Belgium-Luxembourg in 1980.
[c] European Union refers to EU27 in 2011 and EU15 in 1980.

of national income than on relative standard of living. China's share in world imports is also more comparable to its share in world output at market exchange rates than to its share at PPP.

The greater prominence of Asian developing economies, such as China, India and the Republic of Korea, in world trade has already been noted in the discussion of Figures B.5 and B.6. Equally noteworthy are the strong declines in shares and ranks recorded by other economies, particularly certain European countries and natural resource exporters, on both the export and import sides.

Tables B.3 and B.4 show ranks and shares in world merchandise exports and imports for selected economies between 1980 and 2011, including individual EU member states. Starting on the export side, we see that France went from being the fourth-largest exporter of goods in 1980 with a 5.7 per cent share in world trade to the sixth largest exporter with a 3.3 per cent share in 2011. The United Kingdom experienced an even steeper decline, dropping from fifth place in world exports with 5.4 per cent of world trade to 11th place and just 2.6 per cent of world trade between 1980 and 2011. Switzerland's 1.5 per cent share of world exports in 1980 was big enough to secure it 13th place in the global export rankings, but by 2011 the country's share had dropped to 1.3 per cent and its rank to 23. Most dramatic of all has been South Africa's slide in world trade. The country's exports constituted 1.3 per cent of world trade in 1980, which was good enough to earn it 16th place in world export rankings. However, by 2011 South Africa's share had plunged to just 0.5 per cent, while its rank in world exports plummeted to 41.

Turning to imports, we see that France and the United Kingdom have mostly managed to maintain their positions in world merchandise trade since 1980, but Switzerland, Austria, Sweden, the Kingdom of Saudi Arabia and Nigeria have all fallen in world rankings. The diminished importance of natural resource exporters in world imports may seem strange at first glance, considering the high prices for fuels and mining products that have prevailed in recent years, but it makes more sense when one considers that oil prices adjusted for inflation were actually higher in 1980 than they were in 2011. As for the European countries that have slid in world rankings, they simply appear to have been overtaken by developing economies with rising incomes, including Singapore, Chinese Taipei, Thailand and Brazil.

Finally, no discussion of new and old players in world trade can neglect the rise of new suppliers and consumers of commercial services in recent decades. WTO data on total commercial services exports for selected economies in 1980 and 2012 are shown in Tables B.5 and B.6, along with their ranks and shares in world trade. It should be noted that these statistics,

which are derived from balance of payments data, cover only three out of the four modes of supply defined in the General Agreement on Trade in Services (GATS). These data include information on cross-border supply of services (mode 1), consumption of services abroad (mode 2), and presence of natural persons (mode 4) but they exclude services delivered through foreign affiliates (mode 3). Information on this last category is partially captured by statistics on foreign direct investment (FDI), which are discussed in Section B.2(e).

In Table B.5, we see once again that Asian exporters have risen to prominence as China, India and Chinese Taipei have climbed in world export rankings. The Republic of Korea is also a leading exporter of commercial services but it already counted itself among the top 20 in 1980. Ireland was the 12th largest exporter of services in 2011, up from 38th position in 1980. Italy, Austria and Norway moved in the opposite direction, falling sharply in world rankings. Otherwise, the relative positions of countries in global services exports have changed little since 1980.

Table B.6 tells a similar story on the import side. Asian economies such as China, India, Singapore, the Republic of Korea and Thailand have risen sharply in world rankings, as have Ireland and the United Arab Emirates. Meanwhile, the strongest declines were recorded by Sweden and the Kingdom of Saudi Arabia.

(ii) Trade within and between developed and developing economies

Another aspect of the changing country composition of trade is the amount of trade that goes on within and between groups of countries. In this context, the developed economies are customarily referred to as North and developing/emerging economies as South, with trade between the developed and developing/emerging groups, for example, denoted by the term North-South trade.

Figure B.8 shows shares of North-North, South-South and North-South trade in exports of manufactured goods since 1990. Natural resources are excluded to avoid having fluctuations in commodity prices skew the shares. As the chart makes clear, the share of North-North trade has dropped steadily from 56 per cent in 1990 to 36 per cent in 2011. This decline coincided with rising South-South trade, which increased from 8 per cent to 24 per cent over this interval. The share of North-South trade remained remarkably steady since 2000 at around 37 per cent.

The rising share of South-South trade in world exports can be explained by a number of factors, one of which is the number of PTAs negotiated between developing economies. Such agreements actually account for the majority of new PTAs concluded since 1990 (WTR, 2011). Even if some of these PTAs are not fully

Table B.5: **Leading exporters of commercial services, 1980-2011** (US$ billion and percentage)	2011			1980	
	Value	Rank	Share	Rank	Share
World	4,168.8	-	100.00	-	100.00
United States	580.9	1	13.93	2	10.38
United Kingdom	273.7	2	6.57	3	9.34
Germany[a]	253.4	3	6.08	4	7.57
China	182.4	4	4.38	31	0.55
France	166.6	5	4.00	1	11.48
Japan	142.5	6	3.42	6	5.11
Spain	140.3	7	3.37	9	3.12
India	136.6	8	3.28	25	0.78
Netherlands	133.5	9	3.20	7	4.55
Singapore	128.9	10	3.09	17	1.30
Hong Kong, China	121.4	11	2.91	15	1.60
Ireland	109.4	12	2.62	38	0.36
Italy	105.2	13	2.52	5	5.13
Switzerland	94.3	14	2.26	14	1.88
Korea, Republic of	93.8	15	2.25	18	1.29
Belgium[b]	87.3	16	2.10	8	3.13
Sweden	76.0	17	1.82	12	2.01
Canada	74.5	18	1.79	13	1.94
Luxembourg	72.5	19	1.74	-	-
Denmark	64.8	20	1.55	19	1.28
Austria	61.2	21	1.47	10	2.35
Russian Federation	53.3	22	1.28	-	-
Australia	50.9	23	1.22	23	1.00
Taipei, Chinese	46.0	24	1.10	33	0.53
Norway	41.9	25	1.00	11	2.32

Source: WTO Secretariat.

Note: Ranks in world trade in 2011 are not comparable to ranks in 1980 due to numerous changes in national boundaries. As a result, strong conclusions should not be drawn from small changes in ranks.

a Germany refers to West Germany in 1980.
b Belgium refers to Belgium-Luxembourg in 1980.

implemented, greater openness and reduced barriers to trade between developing economies is still expected to lead to more South-South trade.

A less straightforward but more compelling explanation for the pattern observed in Figure B.8 has to do with the nature of countries' preferences: if developing economies have non-homothetic preferences (i.e. consumers desire a greater variety of goods as they become wealthier), they may start to produce and consume more and more similar bundles of goods as their incomes rise. If this is indeed the case, then rapidly growing developing economies would be expected to trade more not only with one another but also with the developed economies that they increasingly resemble. This would explain both the rising share of South-South trade and the falling share of North-North trade in global exports of manufactured goods. This result may depend strongly on how the "developed" and "developing" country groups are defined, since reclassifying newly industrialized economies in Asia as developed might instantly halt the slide in the "North-North" share in world trade.

(iii) Is world trade dominated by a few large countries?

Another question related to new and old players in world trade is whether trade is dominated by a large number of small countries or a small number of large countries. The answer to this question has important implications for beliefs about the fairness of the international trading system, since small countries may feel that they cannot benefit from trade if they are overwhelmed by a few large traders and vice versa.

The Gini coefficient is an indicator most often employed to measure income inequality, but it can also be used to measure disparities in international trade flows. The Gini coefficient is based on the Lorenz curve, which can depict the concentration of any population, for example country shares in world trade. In such a curve, exporters are ranked from smallest to largest and their cumulative rank in world exports (expressed as a percentage) is plotted against their cumulative share in world exports. The blue and light-blue curves in Figure B.9 are examples of Lorenz

Table B.6: **Leading importers of commercial services, 1980-2011** (US$ billion and percentage)					
	2011			**1980**	
	Value	**Rank**	**Share**	**Rank**	**Share**
World	3,953.0	-	100.00	-	100.00
United States	395.3	1	10.00	4	7.16
Germany[a]	289.1	2	7.31	1	10.73
China	236.5	3	5.98	41	0.51
United Kingdom	170.4	4	4.31	5	6.25
Japan	165.8	5	4.19	2	7.95
France	143.5	6	3.63	3	7.69
India	123.7	7	3.13	30	0.72
Netherlands	118.2	8	2.99	6	4.40
Ireland	114.3	9	2.89	47	0.39
Italy	114.0	10	2.88	7	3.89
Singapore	113.8	11	2.88	31	0.72
Canada	99.8	12	2.53	10	2.50
Korea, Republic of	98.2	13	2.49	27	0.89
Spain	93.2	14	2.36	17	1.34
Russian Federation	87.9	15	2.22	-	-
Belgium[b]	84.6	16	2.14	9	3.07
Brazil	73.1	17	1.85	23	1.10
Australia	59.5	18	1.51	14	1.57
Denmark	56.1	19	1.42	28	0.86
Hong Kong, China	55.7	20	1.41	25	1.00
Sweden	55.6	21	1.41	11	1.72
Saudi Arabia, Kingdom of	55.0	22	1.39	8	3.66
Thailand	50.9	23	1.29	46	0.40
United Arab Emirates	48.8	24	1.23	-	-
Switzerland	46.9	25	1.19	21	1.21

Source: WTO Secretariat.

Note: Ranks in world trade in 2011 are not comparable to ranks in 1980 due to numerous changes in national boundaries. As a result, strong conclusions should not be drawn from small changes in ranks.

a Germany refers to West Germany in 1980.
b Belgium refers to Belgium-Luxembourg in 1980.

curves for 1980 and 2011. The fact that both curves (nearly) pass through the point 78,10 means that the 78 per cent of countries with the smallest export values were only responsible for 10 per cent of world exports in both periods. Looked at from another perspective, it also means that the 22 per cent of countries with the largest export values were responsible for around 90 per cent of world exports in both years.

The diagonal line represents an equal distribution of exports across countries, such that, if the Lorenz curve were on this line, 40 per cent of exporting countries would be responsible for 40 per cent of exports, 75 per cent of exporters would account for 75 per cent of the exports, and so on. For this to be the case, each country would have to export exactly the same amount, which is clearly unrealistic. The other extreme, which would require a single country to export all of the world's goods, is equally implausible. However, a Lorenz curve that is closer to the diagonal would represent a more equal distribution of exports across countries. The Gini coefficient is defined as the area between the Lorenz

curve and the diagonal divided by the total area under the diagonal, so that a Gini score of 0 would indicate an equal distribution of exports (i.e. all countries exporting the same amount) while a Gini score of 1 would suggest perfect inequality (i.e. a single exporter).

The Gini coefficients of 0.83 for 1980 and 0.82 for 2011 derived from Figure B.9 suggest that trade is very unequally distributed and that this inequality has hardly changed at all in more than 30 years. However, a different picture emerges if we plot countries' cumulative percentages in world population (ranked from smallest to largest) against their share in world trade. In this case, the concentration curves actually reach beyond the diagonal. In principle, such a curve could even cross the diagonal, which makes interpretation difficult. What it suggests is that countries with small populations are responsible for a disproportionate share of world exports, whereas large countries' contributions to world trade are less than their contributions to the world's population. The fact that the population exports curve moved closer to the diagonal between 1980 and 2011 is indicative of the

Figure B.8: **Shares of "North-North", "North-South" and "South-South" trade in world merchandise exports, 1990-2011**
(percentage share)
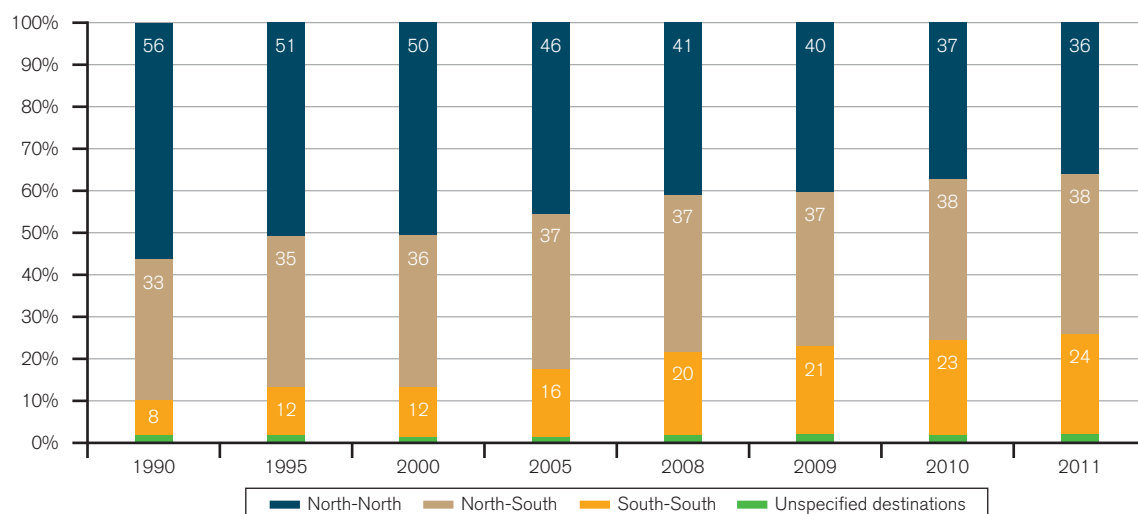
Source: WTO Secretariat.

Note: South includes Central and Eastern Europe before 2000, equal to 1.6 per cent of world trade in 1995.

fact that large countries like India and China did not export much to the rest of the world in 1980 but they were exporting much more in 2011.

Making comparisons between these curves and Gini coefficients in 1980 and 2011 is complicated by the fact that the number of traders has increased over time due to the break-up of several countries and the amalgamation of others following the end of the Cold War. As Krugman observes, "it is useful to think about world trade by imagining that it were possible to take a given geography of world production and transportation and then draw arbitrary lines on the map called national borders without affecting the underlying economic geography" (Krugman, 1995). Indeed, Cuaresma and Roser (2012) find that about 1 per cent of measured trade today is simply due to changes in national borders since the Second World War; in other words, this amount of trade, considered "international" today, would have been "domestic" trade on a map of 1946. In the same vein, Llano-Verduras et al. (2011) show that the fact that countries trade much more with themselves than with other partners (the border effect) decreases substantially once the artificial nature of geographical aggregations is properly taken into account.

The problem of changing national boundaries is accounted for in Figure B.9 by using a matched group of countries in both periods. Countries that broke up between 1980 and 2011 (e.g. the former Soviet Union) are reconstructed in the second period by taking the sum of trade flows from the successor countries and subtracting intra-trade between them. On the other hand, countries that amalgamated (e.g. East and West Germany) are rebuilt by aggregating their trade flows and subtracting trade between them in the first period.

Figure B.9: **Concentration of world merchandise exports, 1980-2011**
(cumulative percentage shares)
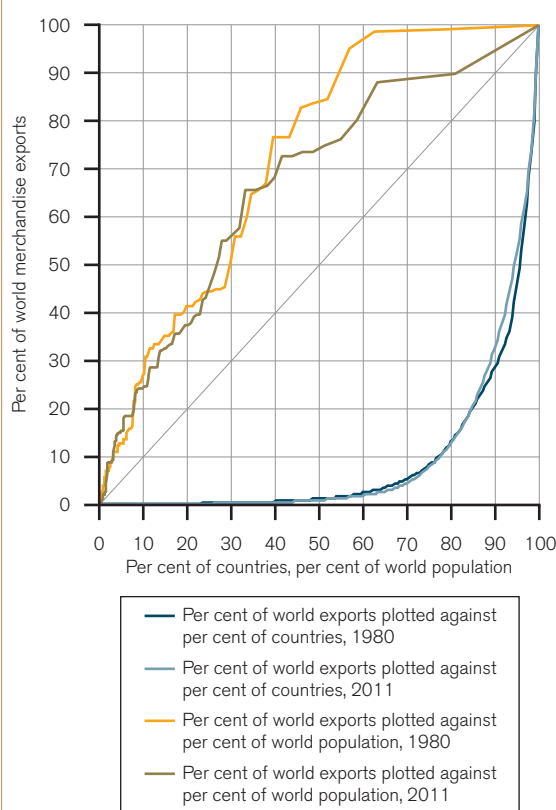
Source: WTO Secretariat estimates.

In this way, we can be fairly certain that any changes in the figures are not simply due to re-classifying certain trade flows as international rather than domestic (or vice versa).

Box B.2: **Trends in world commodity prices**

Fluctuations in primary commodity prices over time can have important implications for the export earnings of developing countries as well as for their food security and access to industrial inputs. According to the International Monetary Fund's Primary Commodity Statistics database (www.imf.org/external/np/res/commod/index.aspx, 10 January 2013), global food prices more than doubled between January 2000 and December 2012, rising 214 per cent. By comparison, the prices of agricultural raw materials only rose 40 per cent during this period. Food prices were characterized by occasional spikes and boom-bust cycles. For example, between June and December 2008 food prices fell 32 per cent, whereas they advanced 37 per cent between February 2010 and February 2011. Even more extreme fluctuations can be observed in prices of mining products, which climbed 293 per cent between January 2000 and December 2012, and fuels, which jumped 396 per cent over this period. Meanwhile, prices of manufactured goods only increased by around 20 per cent during the same period.

Although primary product prices have tended to increase since around 2000, they recorded a long-term decline during the 1980s and 1990s. Between January 1980 and January 1999, prices of metals and fuels declined by 41 per cent and 71 per cent, respectively.

For further discussion of the implications of commodity prices for food security in developing countries, see Section E.2.

(b) Has the composition of trade changed?

Just as the relative importance of countries in international trade has shifted over time, so has the mix of traded goods and services. This sub-section examines the evolving composition of trade, including the product breakdown of merchandise trade and the relative importance of commercial services trade compared with goods in recent decades.

(i) Evolution of trade by major product categories

For many years, the share of manufactured goods in world merchandise trade increased relentlessly. As was already noted in the discussion of Figure B.3, manufactures accounted for just 40 per cent of trade in 1900, but this rose to 70 per cent in 1990 and to 75 per cent in 2000 before falling back to 65 per cent in 2011. In contrast to manufactures, agricultural products saw their share in world trade fall steadily

over time, from 57 per cent at the turn of the last century to 12 per cent in 1990, and finally to 9 per cent in 2011. The advance of manufactured goods was only slowed by rising primary commodity prices, which in recent years have tended to inflate shares for fuels and mining products at the expense of manufactures. Unlike both agricultural products and manufactured goods, the share of fuels and mining products in world trade has exhibited no clear trend in the post-Second World War period, as it rises and falls in step with oil prices (see Box B.2).

Among sub-categories of manufactured goods, only chemicals and office and telecom equipment recorded higher shares in world trade in 2011 than in 1990 (see Figure B.10). Most other goods, including automotive products, textiles and clothing, saw their shares decline, but iron and steel's share was unchanged.

Product shares in world trade may paint a misleading picture of the contribution of different classes of goods

Figure B.10: **Shares in world merchandise exports by product, 1990-2011** (percentage)

1990

- Agricultural products, 12%
- Fuels and mining products, 14%
- Iron and steel, 3%
- Chemicals, 9%
- Other semi-manufactures, 8%
- Office and telecom equipment, 9%
- Automotive products, 10%
- Textiles, 3%
- Clothing, 3%
- Others, 29%

2011

- Agricultural products, 9%
- Fuels and mining products, 23%
- Iron and steel, 3%
- Chemicals, 11%
- Other semi-manufactures, 6%
- Office and telecom equipment, 10%
- Automotive products, 7%
- Industrial machinery, 12%
- Textiles, 2%
- Clothing, 2%
- Others, 15%

Source: WTO Secretariat.

to world trade growth, since they are strongly influenced by fluctuations in commodity prices and exchange rates. As a result, it makes sense to look at the data from another perspective that takes the effect of prices into account. This is provided by Figure B.11, which shows world merchandise trade volume indices by major product category since 1980. These indices are derived from export and import volume indices for individual countries, which are in turn calculated by dividing growth in nominal trade values by changes in export and import prices (see WTO *World Trade Report 2012* for detailed notes on methodology). This gives a reliable global estimate of "real" physical quantities of goods traded over time.

By this measure, the volume of world exports more than quadrupled between 1980 and 2011, with most of the growth attributable to increased shipments of manufactured goods. Indeed, manufactures recorded a near six-fold increase since 1980, while agricultural products only increased 2.6 times and fuels only 2.1 times. The main disadvantage of these volume indices is that no detailed breakdown by product is possible beyond the three broad categories of agricultural products, fuels and mining products, and manufactured goods.

(ii) Creation and destruction of old and new products

Merchandise trade statistics do not always accurately reflect the current product composition of trade because new products are constantly being created and older ones are constantly slipping into obsolescence. Statisticians from government agencies and international organizations try to keep up with

these developments by regularly updating statistical classifications on international trade, usually every five years. The World Customs Organization is charged with maintaining the most widely used classification, the Harmonized System (HS). During a revision, HS codes may be added to account for trade in new or changed products, or else they may be deleted when trade in a particular good falls to a very low level for a number of years. When codes are removed from the classification, remaining trade in that good is allocated to one or more other sub-headings, which can result in changes in scope for existing HS codes.

Table B.7 shows changes in the HS trade classification between its 1992 and 2007 revisions. New sub-headings were added during this period to account for trade in endangered species and also to track goods that are subject to international agreements (e.g. persistent environmental toxins controlled under the Stockholm Convention). For example, the sub-heading 021090 which represented "Meat and edible offal" in the HS1992 classification was replaced by the codes 021091 ("Meat and edible offal of primates"), 021092 ("Meat and edible offal of whales/dolphins/porpoises/ etc."), 021093 ("Meat and edible offal of snakes/ turtles/etc."), and 021099 ("Meat and edible offal not elsewhere specified") in HS2007. New, more detailed codes were also added for various species of fish, e.g. salmon, tuna, swordfish, etc., as well as for many varieties of plants. Significant changes have also been introduced in technology-related headings for computers, printing, etc.

In some cases, a product's share in world trade may have fallen substantially without its code being
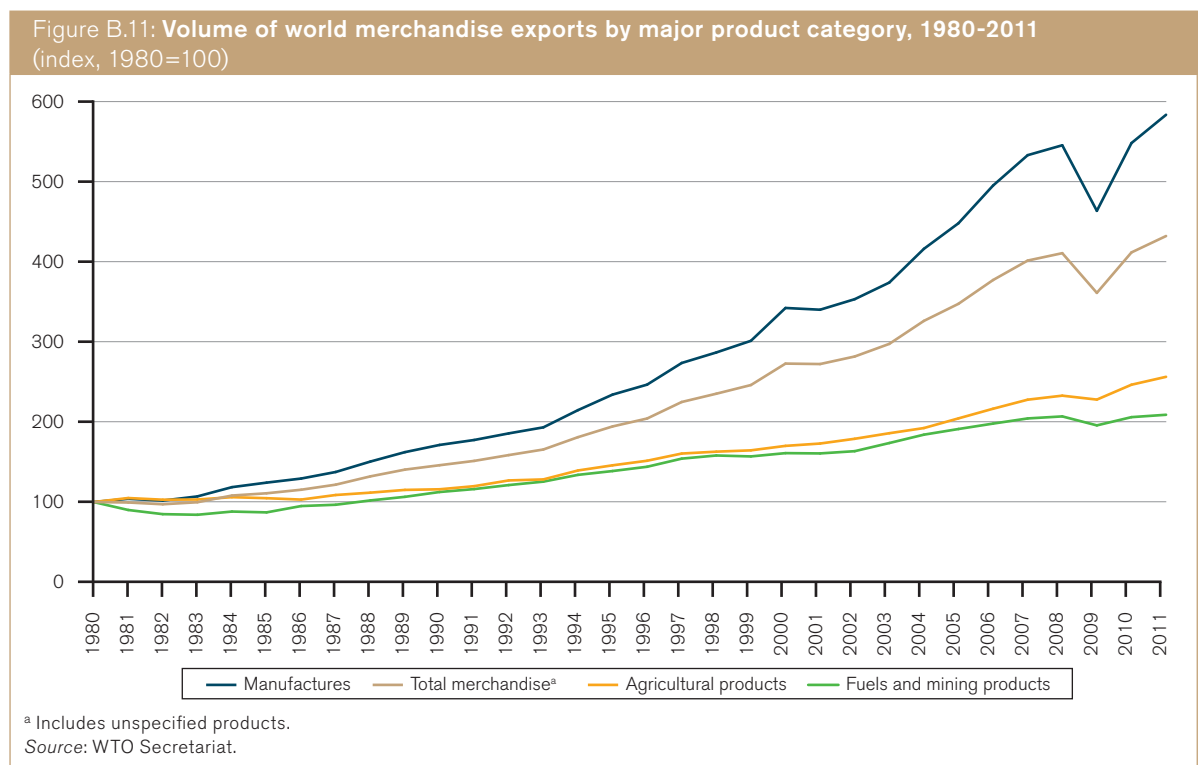
Figure B.11: **Volume of world merchandise exports by major product category, 1980-2011** (index, 1980=100)

ᵃ Includes unspecified products.
Source: WTO Secretariat.

Table B.7: **New and old products in international trade**
Products deleted due to low volume of trade between HS1992 and HS2007
Horse hair (050300), natural sponges (050900), asbestos (252400), lead carbonate (283670), rolls of instant print film (370220), photographic film in rolls (370292), equine hides/skins (410140), articles of catgut (420610), whole beaver furskins (430140), whole seal furskins (430170), carbon paper (480910 and 481610), punch cards for machine reading (482330), bow ties (611720), headgear of furskin (650692), articles containing asbestos (numerous subheadings under headings 6811 and 6812), lead pipes (780500), photo typesetting machines (844210), several products related to printing under heading 8443, shuttles for weaving machines (844841), typewriters and word-processing machines (several subheadings under heading 8469), vinyl record players (several products under hading 8519), casette tape recorders/players (several lines under heading 8520), magnetic tapes (852311-13), cigar or cigarette holders (961490)
Products retained despite reduced shares in world trade between HS1992 and HS2007
Sardines (0302610), dogfish and other sharks (030265), eels (030266), snails (030760), opium (130211), cotton seed oil (151221), natural barium carbonate (251120), waste oils containing polychlorinated biphenyls or PCBs (271091), lead monoxide (282410), heavy water or deuterium oxide (284510), carbon tetrachloride (290314), hexachlorobenzene and DDT (290362), numerous photographic film and paper products under the heading 3702-3705, anti-knock engine preparations based on lead compounds (381111), raw furskins of fox (430160), dictionaries and encyclopedias (490191), silver tableware (821591), magnetic tape video recorders (852110), photographic film cameras (900640 and 900651-59).
Additions to the HS classification to represent new/rising/regulated products in world trade
Live primates (010611), live whales/dolphins (010612), live reptiles (010620), live birds of prey (010631), detailed breakdowns for many fish products under the headings 0303 and 0304, detailed breakdowns for cut flowers under heading 0603, coca leaf (121130), semi-conductor media including "smart cards" (852351-59), dental floss (330620), pulp from recyled paper/cardboard (470620), car air conditioners (841520), various codes related to printers under the heading 8443, portable computers (847130), industrial robots (847950), machines for manufacturing semiconductors and integrated circuits (848620), machines and apparatus for the manufacture of flat panel displays (848630), wind-powered electric generating sets (850231), line telephones with cordless handsets (851711), telephones for cellular networks (851712), safety airbags (870895).
Other products whose shares in world trade have risen significantly between HS1992 and HS2007
Connectors for optical fibres (853670), color data/graphic displays (854040), other liquid crystal display devices (901380), anthracite coal (270111) as well as other grades of coal, liquified natural gas (271111), rare earth metals (280530), ethylene glycol (290531), umbrella frames (660310), household/laundry-type washing machines (845020).

Source: UN Comtrade database.

removed. This occurred between 1996 and 2011 for a number of controlled substances, such as carbon tetrachloride, demand for which has fallen sharply due to the fact that it is a precursor chemical for ozone-depleting chlorofluorocarbons (CFCs).

Magnetic tape-based video recorders have seen their share in world trade fall from 0.251 per cent in 1996 to 0.002 per cent in 2011, a decline of 99 per cent. Despite this collapsing share, these devices have retained their own six-digit HS sub-heading, at least till the 2007 version of the classification. However, obsolete products such as this will eventually be deleted, possibly in the forthcoming HS2012 classification.

Photographic film cameras, including instant film cameras and 35mm cameras (900640 and 900651-59), also saw their share in world trade drop precipitously from 0.105 per cent in 1996 to 0.002 per cent in 2011. Similar declines also occurred for other film photography related products, including slide projectors (900810), photographic enlargers (900840) and automatic film development machines (901010).

At the product level, trade growth can be attributed to changes in the intensive margin (i.e. more or less trade in existing categories of goods) or the extensive margin (i.e. more or less trade in new products, or the disappearance of old products). Contributions of these

margins to world trade in manufactured goods between 1991 and 2011 are shown in Figure B.12. The extensive and intensive margins can be defined in a number of different ways but for the purposes of this section we consider the intensive margin to be trade in products that existed in both revisions 3 and 4 of the Standard International Trade Classification (SITC) and whose share in world trade neither rose sharply (+100 per cent or more) nor fell dramatically (-75 per cent or more) between 1991 and 2011. All other changes are attributed to the extensive margin. Note that only manufactured goods are considered in Figure B.12 in order to avoid the problem of shares falling due to rising commodity prices.

It is clear from the chart that most of the growth of world trade in manufactures in recent decades was due to the intensive margin of trade (76 per cent) but the fact that nearly a quarter (24 per cent) of the increase during this period was related to the extensive margin is still significant. Unfortunately, it is not possible to say exactly which new products contributed how much to this growth, since many have yet to be included in statistical classifications. This situation may be improved in 2013 when many countries will begin reporting data in accordance with the new 2012 version of the Harmonized System. The extensive and intensive margins can also be defined in terms of firms entering new markets and producing new products. See Section B.2(f) for a discussion of this literature.

Figure B.12: **Contributions of intensive and extensive margins to growth in world trade in manufactures, 1991-2011** (percentage)

Source: WTO Secretariat estimates based on available reporters in the UN Comtrade database.
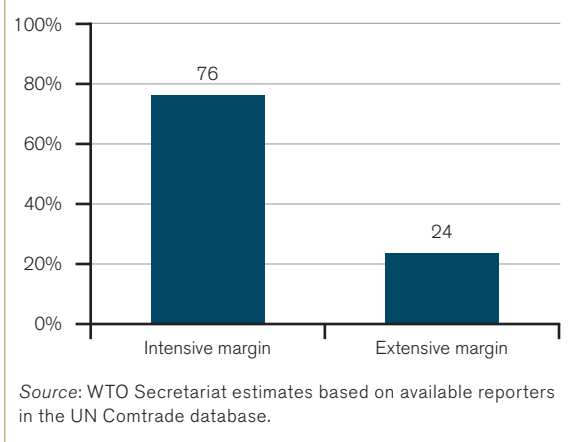
(iii) Intra-industry trade

The neoclassical trade theory, presented in Section B.2(c), is useful for explaining many aspects of international trade but it fails to capture a number of important phenomena, particularly trade within industries (intra-industry trade). For example, the fact that Germany and Japan both export cars to one another is difficult to account for in a theoretical framework where comparative advantage leads to high levels of specialization. Models that address monopolistic competition, particularly Krugman's influential (1979) model, are noteworthy due to the fact that they naturally give rise to intra-industry trade, i.e. country pairs may export and import the same types of goods.

Krugman's key assumptions are increasing returns to scale technology and "love-of-variety" preferences.[19] Increasing returns to scale[20] are modelled by introducing a fixed cost of production: when a firm expands its total output, even holding the unit cost constant, the fixed cost will be distributed over a larger number of units, and thus average cost declines. In this set-up, concentration of production is efficient. This contrasts with the existence of many producers within an industry. To reconcile these two divergent features, Krugman assumes monopolistic competition across firms. In other words, producers sell products that are slightly differentiated – different brands or quality – but not perfect substitutes. Therefore, while each firm is assumed to be a monopolist for its own variety, it is still subject to competition from other firms – it can sell less of its variety, the larger the number of other varieties sold. Krugman's model allows countries to gain from trade by accessing a greater variety of goods and by capturing economies of scale in production. This approach has firms specializing in varieties of goods but it may also be applicable to 21st-century trade where firms may instead choose to specialize in certain tasks.

A common measure of the amount of intra-industry trade that takes place between countries is the Grubel-Lloyd (GL) index which is defined as follows for a given product i:

$$GL_i = 1 - (\, |export_i - import_i| \, / \, (export_i + import_i) \,)$$

If a country only exports or imports good i, then the GL index for that sector is equal to 0. On the other hand, if a country imports exactly as much of good i as it exports, then its GL score for sector i would be 1.

In Table B.8, Grubel-Lloyd indices were calculated for all four-digit codes in the Standard International Trade Classification (SITC) for all available reporters in the UN Comtrade database against the world developed and developing economies in 1996 and 2011. The arithmetic mean was used to calculate a simple average GL score for each country and partner, which should be sufficient to provide an indication of which countries engage in relatively more or less intra-industry trade. Countries were then sorted in descending order according to overall GL scores in 2011.

The main messages from this table are that industrialized developed economies (e.g. the United States, the European Union, Canada and Switzerland) and rapidly industrializing developing economies (e.g. Hong Kong, China; Singapore; Malaysia and Thailand) tend to engage in more intra-industry trade, whereas resource-rich developing economies (e.g. Algeria, Nigeria, Bolivarian Republic of Venezuela) and LDCs (Central African Republic, Niger and Madagascar) tend to have relatively little intra-industry trade. Few significant changes in average GL scores are observed between 1996 and 2011, the main exceptions being Panama and Egypt. Developed economies such as the United States and the European Union engage in more intra-industry trade with other developed economies, whereas developing economies such as Malaysia and Thailand have more intra-industry trade with other developing countries.

Despite the fact that China and the Republic of Korea are designated as developing economies, they are actually more similar in structure to developed economies, since they have succeeded in industrializing, while many poorer and resource-rich developing economies have not. Japan is also something of an outlier in these tables in that its average GL score is quite low compared with other developed economies, and it has more intra-industry trade with developing economies. Its low overall GL score could be due to the fact that Japan has few natural resources and has to import most raw materials. The country's relatively high level of intra-industry trade with developing economies might be explained by geographic proximity to developing Asian economies and to the fact that many of these ostensibly developing economies are in fact industrialized.

As already noted in Section B.2(a), the nature of countries' preferences offers one explanation for why

Table B.8: **Average Grubel-Lloyd indices across sectors for selected economies, 1996-2011** (Index, 0-1)

	1996			2011		
	World	Developed	Developing	World	Developed	Developing
Hong Kong, China	0.70	0.29	0.65	0.66	0.30	0.61
Singapore	0.65	0.31	0.60	0.65	0.38	0.59
United States	0.61	0.65	0.47	0.62	0.68	0.51
European Union (27)	-	-	-	0.60	0.63	0.51
Malaysia	0.43	0.28	0.51	0.55	0.37	0.58
Canada	0.57	0.59	0.36	0.53	0.58	0.34
Switzerland	0.51	0.52	0.31	0.49	0.49	0.37
Thailand	0.36	0.26	0.44	0.49	0.38	0.53
Mexico	0.50	0.47	0.42	0.49	0.46	0.38
Korea, Republic of	0.42	0.35	0.35	0.48	0.43	0.42
Taipei, Chinese	0.44	0.34	0.38	0.48	0.40	0.48
India	0.34	0.30	0.34	0.44	0.39	0.43
Ukraine	0.43	0.30	0.44	0.43	0.27	0.44
South Africa[a]	0.41	0.31	0.44	0.41	0.30	0.44
Brazil	0.43	0.32	0.43	0.41	0.33	0.43
China	0.39	0.33	0.40	0.40	0.38	0.36
Panama	0.12	0.08	0.13	0.39	0.12	0.47
Turkey	0.32	0.27	0.36	0.39	0.36	0.41
Japan	0.35	0.34	0.32	0.39	0.36	0.39
Indonesia	0.29	0.23	0.33	0.38	0.30	0.40
New Zealand	0.35	0.34	0.32	0.37	0.40	0.31
Norway	0.38	0.37	0.28	0.33	0.33	0.29
Argentina	0.36	0.21	0.43	0.32	0.19	0.39
Tunisia	0.26	0.18	0.36	0.32	0.26	0.32
Costa Rica	0.26	0.14	0.31	0.32	0.18	0.34
Guatemala	0.29	0.12	0.38	0.31	0.11	0.39
Philippines	0.27	0.23	0.29	0.31	0.28	0.29
Colombia	0.29	0.16	0.39	0.31	0.18	0.36
Australia	0.39	0.38	0.39	0.30	0.34	0.31
Egypt	0.17	0.12	0.19	0.28	0.20	0.33
Chile	0.24	0.14	0.31	0.27	0.14	0.32
Russian Federation	0.38	0.26	0.47	0.26	0.20	0.33
Peru	0.18	0.13	0.21	0.26	0.16	0.29
Uganda	0.12	0.04	0.13	0.24	0.09	0.26
Pakistan	0.14	0.09	0.16	0.24	0.16	0.27
Senegal	0.11	0.06	0.20	0.21	0.10	0.26
Kyrgyz Rep.	0.34	0.07	0.36	0.20	0.06	0.23
Côte d'Ivoire	0.22	0.09	0.32	0.19	0.08	0.22
Bahrain, Kingdom of	0.17	0.05	0.28	0.19	0.05	0.24
Ghana	0.11	0.06	0.19	0.19	0.11	0.18
Ecuador	0.19	0.11	0.24	0.18	0.10	0.21
Zambia	0.18	0.08	0.18	0.17	0.04	0.18
Albania	0.15	0.14	0.11	0.17	0.16	0.14
Madagascar	0.12	0.11	0.11	0.17	0.15	0.16
Kazakhstan	0.32	0.09	0.37	0.15	0.06	0.17
Nigeria	0.09	0.09	0.08	0.14	0.11	0.13
Azerbaijan	0.20	0.05	0.19	0.14	0.04	0.15
Iceland	0.08	0.07	0.09	0.13	0.13	0.14
Nicaragua	0.14	0.07	0.15	0.12	0.09	0.16
Paraguay	0.12	0.05	0.13	0.12	0.06	0.13
Bolivia, Plurinational State of	0.13	0.07	0.17	0.12	0.09	0.11
Niger	0.16	0.02	0.18	0.08	0.06	0.10
Venezuela, Bolivarian Rep. of	0.26	0.16	0.36	0.08	0.05	0.09
Algeria	0.08	0.06	0.12	0.05	0.04	0.04
Central African Rep.	0.08	0.04	0.06	0.02	0.03	0.04

Source: WTO Secretariat estimates based on data for available reporters in the UN Comtrade database.

Note: Averages are taken across SITC Rev.3 products at the 3-digit level.

[a] South Africa refers to South African Customs Union in 1996.

similar economies often trade more with one another, and this extends to intra-industry trade as well. Simple trade models usually assume that countries have homothetic preferences, which implies that budget shares will remain constant regardless of their level of income. If this assumption is relaxed, countries with similar incomes will tend to consume and produce similar types of goods. Linder (1961), for example, shows that firms producing in a rich country that is close to a large consumer market for high-quality (or luxury) goods have a comparative advantage in producing these goods. In addition, exporting firms find more extensive markets for their high-quality goods in other rich countries.

Fieler (2011) also shows why poor countries, even if similar in terms of income, trade much less with each other compared with rich countries. Her model shows that trade volumes between similar countries depend on how differentiated products are. Countries where overall productivity is low have low wages and produce less differentiated goods. Technologically advanced countries have high wages and produce goods whose technologies are more variable across countries. In this set-up, rich countries trade a lot with each other because high-income-elastic goods are more differentiated, while poor countries do not trade much with each other because low-income-elastic goods are less differentiated.

(iv) Trade in commercial services

As Section B.1 has shown, improved information technology and reduced transport costs have made it possible for firms to split manufacturing processes into a series of tasks that can be carried out in different locations based on comparative advantage. These tasks extend to commercial services, many of which (transportation, financial services) are closely linked to trade in goods. As a result, it should not come as a surprise that trade in commercial services has grown in line with trade in goods for the last 20 years.

Figure B.13 shows world trade in commercial services exports since 1980, both as dollar values and as a share of world goods and services exports. Although services trade grew faster than goods trade in the 1980s and 1990s, the rate of increase in services slowed in the 2000s to the point where its average rate fell below that of goods. Furthermore, services trade has been much less volatile than trade in goods since the global financial crisis of 2008-09. Consequently, the share of services in the total has remained more or less constant since 1990. It is often assumed that trade in commercial services is still growing faster than goods trade, but this may not necessarily be the case.

When international trade flows are measured in value-added rather than gross terms, services appear to play a larger role in world trade (see Section B.2(e) for more information on trade in value-added terms). The coverage of data on commercial services is not particularly good (see Section B.2(a)) and there may be significant overlap between this trade and foreign direct investment (FDI) as well as with offshoring of business activities.

(c) Have countries become more or less specialized?

A major reason why countries trade is that they have different comparative advantages[21] in production and, therefore, they can gain from specialization. Comparative advantage, which can be defined as the ability of one country to produce a particular good or service at a relatively lower cost over another (Deardoff, 1998), is derived from two sources: differences in technology and differences in factor endowments.

The Ricardian model focuses on technology to explain trade patterns. In a model where labour is the only factor of production, differences in technology are represented by differences in labour productivity. In a

Figure B.13: **Composition of world goods and commercial services exports, 1980-2011**
(US$ trillion and percentage)

Source: WTO Secretariat.
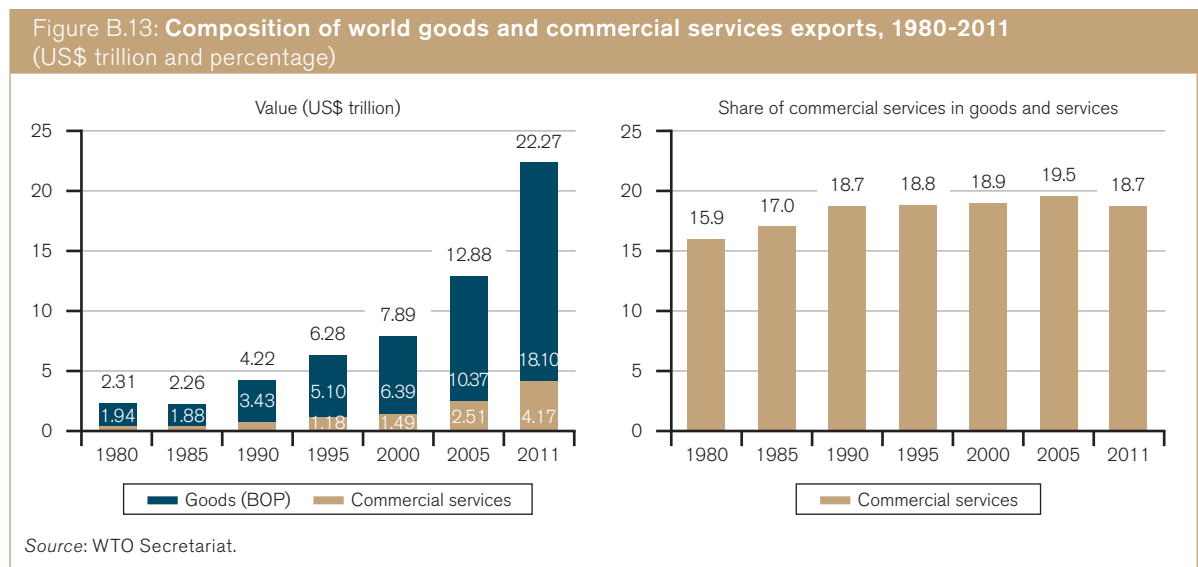
simplified world of two countries and two goods, Ricardo shows that even when one of the two countries has an absolute advantage in the production of both goods, i.e. it can produce more output with one unit of labour in both goods, there is scope for mutually beneficial trade if both countries specialize in the goods where the opportunity cost is lower (and the comparative advantage greater) relative to other countries.[22]

The Heckscher-Ohlin (HO) theory focuses on cross-country differences in the endowments of factors of production such as labour and capital. Given the different factor intensities across sectors, the price of the factor used intensively in a specific sector in a country that is abundant in that factor will be lower relative to other countries; thus this country should have a lower opportunity cost in that sector, and will specialize accordingly in an open economy.[23]

In this neoclassical framework, regardless of the motive for trade, countries will specialize in the production and export of certain goods based on comparative advantage. However, improvements in telecommunications and information technology, together with increased economic integration and greater trade openness, have enabled higher levels of technological diffusion and increased the mobility and accumulation of productive factors over time. This raises the question of whether countries may become less specialized in the export of particular products as a result, and therefore more similar in terms of their export composition. In this sub-section, the evolution of two different measures of international specialization, export concentration and Revealed Comparative Advantage (RCA), will be considered to investigate whether countries have become more or less similar in terms of their exports.

(i)　Export concentration

To capture export specialization, we first compute the level of concentration of merchandise exports for a set of countries in 1990 and 2010. Specifically, we compute the Herfindahl-Hirschmann (H) index,[24] which is defined as follows, for a certain economy i:

$$H = \frac{\sqrt{\sum_k (x_k / \sum_k x_k)^2} - \sqrt{1/n}}{1 - \sqrt{1/n}}, H$$

where $x_k / \sum_k x_k$ is the share of export line k, and n is the number of total export lines. The index has been normalized to obtain values that range between 0 and 1, with 1 being full concentration of exports.

We then compare the indices by taking the difference between the two years to reflect the patterns of export specialization across countries over this 20-year period (see Table B.9).

Today, the exports of a significant number of countries are diversified (the H index of almost 80 per cent of the countries in our sample was below 0.4 in 2010). Highly diversified countries are mainly located in Europe, North America and Asia (see Table B.9). In contrast, those with highly concentrated exports are mostly developing countries and in many cases natural resource-rich countries (for instance, Congo, Chile or Mozambique).

With respect to the evolution of specialization over time, we observe that, between 1990 and 2010, the Herfindahl-Hirschmann indices of the majority of countries either decrease, so countries have become more diversified, or experience no significant change (the changes in H indices are within [-0.025, +0.025]). Therefore, we can conclude that countries are becoming more similar over time.

(ii)　Revealed comparative advantage

To further explain patterns of international specialization, we calculated the Revealed Comparative Advantage (RCA) index for selected economies across three broad product categories (agricultural products, fuels and mining products, manufactures) and seven manufacturing sub-sectors between 1990 and 2010. The RCA index is based on Balassa's (1965) relative export performance of a certain industry (or product) and country and is computed as follows:

$$RCA_{ij} = (X_{ij}/X_{Wj})/(X_i/X_W)$$

where X_{ij} are exports of country i in industry j, X_{Wj} are world exports of industry j; X_i represents total exports of country i and X_W represent total world exports.

The data shown in Table B.10 paint an interesting picture of the evolution of RCA across countries and sectors. Some developed economies have seen their comparative advantage deteriorate in manufacturing generally (the United Kingdom, Canada) while others have experienced declines in specific manufacturing sectors (iron and steel in Australia, chemicals in Norway, automotive products in Sweden, office and telecom equipment in Japan, etc.) A few improvements in RCA have been recorded by developed economies (agricultural products in New Zealand, steel in Japan, textiles in the United States) but losers generally outnumber gainers in advanced manufacturing sectors.

Among developing economies, there is a divergence between those that are resource rich and others that are industrializing. Countries such as China, Mexico and Turkey that used to have a strong comparative advantage in primary products[25] have recently lost their advantages in these sectors and gained in manufactured goods. On the other hand, the Russian Federation, Brazil and India have either lost comparative advantage in manufacturing or gained in primary products, or both. Despite the fact that large

Table B.9: Changes in manufacturing export concentration for selected economies, 1990-2010 (index, -1 to +1)							
Country	1990	2010	Diff	Country	1990	2010	Diff
Italy	0.05	0.06	0.00	Paraguay	0.41	0.23	0.18
United States	0.11	0.07	0.04	Honduras	0.32	0.24	0.08
Indonesia	0.38	0.08	0.30	Albania	0.50	0.24	0.26
Austria	0.06	0.08	-0.02	Central African Rep.	0.85	0.24	0.61
Brazil	0.09	0.08	0.01	Malaysia	0.29	0.24	0.05
Netherlands	0.06	0.09	-0.03	Macao, China	0.21	0.25	-0.04
Turkey	0.14	0.09	0.05	Burundi	0.45	0.25	0.20
Poland	0.08	0.09	-0.01	Hong Kong, China	0.10	0.26	-0.16
Portugal	0.08	0.09	-0.01	Costa Rica	0.13	0.27	-0.15
Denmark	0.07	0.10	-0.03	Sri Lanka	0.46	0.27	0.18
Lithuania	0.12	0.10	0.01	The Gambia	0.36	0.28	0.08
Thailand	0.15	0.11	0.05	Venezuela, Bolivarian Rep. of	0.32	0.28	0.04
Kenya	0.09	0.11	-0.02	Grenada	0.25	0.28	-0.03
Germany	0.09	0.11	-0.02	Jordan	0.23	0.28	-0.05
Latvia	0.13	0.11	0.02	Mali	0.61	0.29	0.33
New Zealand	0.18	0.11	0.07	Ghana	0.46	0.29	0.17
Sweden	0.12	0.11	0.01	Djibouti	0.25	0.29	-0.04
FYR Macedonia	0.21	0.11	0.09	United Arab Emirates	0.15	0.29	-0.14
Guatemala	0.21	0.12	0.09	Kazakhstan	0.26	0.30	-0.04
Romania	0.12	0.12	0.00	Morocco	0.33	0.30	0.03
Estonia	0.10	0.12	-0.02	Cameroon	0.43	0.31	0.12
Nicaragua	0.21	0.12	0.09	Israel	0.35	0.31	0.05
Czech Rep.	0.06	0.12	-0.06	Saudi Arabia, Kingdom of	0.27	0.32	-0.05
France	0.07	0.13	-0.05	Jamaica	0.16	0.32	-0.16
Egypt	0.37	0.13	0.24	Switzerland	0.09	0.32	-0.23
Japan	0.14	0.13	0.01	Ethiopia	0.94	0.32	0.61
Greece	0.14	0.13	0.01	Guinea	0.71	0.33	0.39
Spain	0.16	0.13	0.02	Singapore	0.20	0.33	-0.14
United Kingdom	0.06	0.13	-0.07	Senegal	0.44	0.33	0.10
China	0.11	0.13	-0.02	Azerbaijan	0.20	0.34	-0.14
Colombia	0.17	0.14	0.03	Niger	0.47	0.34	0.12
Australia	0.15	0.14	0.01	Pakistan	0.38	0.35	0.03
Slovenia	0.10	0.14	-0.04	Cyprus	0.13	0.35	-0.23
Kyrgyz Rep.	0.16	0.14	0.02	Benin	0.54	0.37	0.17
Norway	0.16	0.14	0.02	Togo	0.37	0.37	-0.01
Malawi	0.30	0.15	0.15	Bahamas	0.27	0.37	-0.10
Ecuador	0.22	0.15	0.08	Georgia	0.25	0.39	-0.15
Finland	0.27	0.15	0.12	Sudan	0.80	0.40	0.41
India	0.25	0.15	0.10	Ireland	0.21	0.40	-0.19
Rwanda	0.72	0.16	0.56	Philippines	0.22	0.41	-0.19
Mexico	0.21	0.16	0.05	Barbados	0.20	0.41	-0.21
Bulgaria	0.11	0.16	-0.05	Bolivia, Plurinational State of	0.55	0.41	0.13
Russian Federation	0.16	0.16	0.00	Zimbabwe	0.31	0.43	-0.12
Korea, Rep. of	0.12	0.16	-0.03	Algeria	0.14	0.43	-0.29
Canada	0.19	0.16	0.02	Panama	0.18	0.43	-0.25
Tunisia	0.21	0.17	0.05	Bhutan	0.56	0.43	0.13
Uruguay	0.23	0.17	0.06	Peru	0.51	0.46	0.06
Hungary	0.08	0.17	-0.10	Côte d'Ivoire	0.17	0.46	-0.29
Argentina	0.13	0.17	-0.04	Kuwait, the State of	0.15	0.50	-0.35
Yemen	0.20	0.18	0.02	Gabon	0.41	0.52	-0.11
Croatia	0.17	0.18	-0.01	Nigeria	0.31	0.53	-0.22
Madagascar	0.30	0.18	0.12	Bahrain, Kingdom of	0.61	0.53	0.08
Burkina Faso	0.32	0.18	0.14	Belize	0.22	0.65	-0.43
Syrian Arab Rep.	0.50	0.19	0.31	Mauritania	0.22	0.66	-0.44
El Salvador	0.19	0.19	0.00	Montserrat	0.86	0.69	0.17
Slovak Rep.	0.11	0.19	-0.08	Dominica	0.70	0.69	0.01
Mauritius	0.27	0.20	0.07	Chile	0.80	0.75	0.05
Uganda	0.20	0.20	0.00	Iceland	0.59	0.75	-0.17

Table B.9: Changes in manufacturing export concentration for selected economies, 1990-2010 (continued)
(index, -1 to +1)

Country	1990	2010	Diff	Country	1990	2010	Diff
Dominican Rep.	0.34	0.20	0.14	Zambia	0.91	0.89	0.02
Ukraine	0.15	0.21	-0.06	Congo	0.57	0.91	-0.34
South Africa	0.10	0.21	-0.12	Mozambique	0.19	0.95	-0.76
Nepal	0.85	0.22	0.63	Myanmar	0.54	0.96	-0.42
Oman	0.31	0.23	0.08	Samoa	0.57	0.98	-0.41
Moldova, Rep. of	0.16	0.23	-0.07	Cape Verde	0.44	0.99	-0.56

Source: Authors calculations on UN Comtrade SITIC 3-digit Rev. 2 database.

Note: Export concentration is calculated with the Herfindahl-Hirschmann index (H). Changes in market concentration are calculated as the difference in Herfindahl-Hirschmann indices between 1990-2010. The H indices range from 0 to 1 (maximum concentration). Therefore, the difference in the levels of concentration ranges from -1 to 1.

Table B.10: RCA evolution for selected economies and sectors, 1990-2010

Commodity	Countries that gain RCA	Countries that lose RCA
Agricultural products	Brazil; Germany; Greece; Indonesia; Italy; Japan; New Zealand; Spain; Switzerland	Australia; China; Czech Republic; Hong Kong, China; Hungary; Ireland; Mexico; Singapore; Turkey
Fuels and mining products	Australia; Brazil; Canada; Denmark; Finland; Iceland; India; Thailand; United States	China; Czech Republic; Indonesia; Ireland; Hungary; Malaysia; Mexico; Poland; Singapore; Slovak Republic
Manufactures	Chile; China; France; Hungary; Malaysia; Mexico; Poland; Singapore; Thailand; Turkey	Australia; Brazil; Canada; Finland; India; Norway; Russian Federation; South Africa; Sweden; United Kingdom
Iron and steel	Canada; Estonia; Finland; India; Italy; Japan; Malaysia; Portugal; Thailand; United States	Australia; Brazil; Czech Republic; Hungary; Ireland; Mexico; Norway; Poland; Russian Federation; Slovak Republic
Chemicals	Greece; Iceland; Indonesia; Ireland; Italy; Japan; Republic of Korea; Malaysia; Singapore; Thailand	China; Czech Republic; Estonia; Hong Kong, China; Hungary; Mexico; Norway; Russian Federation; Slovak Republic; South Africa
Office and telecom equipment	Chile; China; Czech Republic; Greece; Hungary; Hong Kong, China; Indonesia; Mexico; Poland; Slovak Republic	Australia; Austria; Brazil; Canada; Ireland; Italy; Japan; Russian Federation; Switzerland; United Kingdom
Automotive products	Chile; Czech Republic; India; Indonesia; Republic of Korea; Poland; Slovak Republic; South Africa; Thailand; Turkey	Australia; Canada; China; Estonia; Netherlands; Norway; Russian Federation; Sweden
Other machinery	Chile; China; Estonia; Greece; Iceland; Indonesia; Republic of Korea; Mexico; Thailand; Turkey	Australia; Germany; Ireland; Israel; Poland; Russian Federation; Spain; Sweden; Switzerland; United Kingdom
Textiles	Canada; Chile; Israel; Italy; Malaysia; New Zealand; Slovenia; Spain; Turkey; United States;	Australia; Brazil; Estonia; Ireland; Republic of Korea; Russian Federation; Singapore; Slovak Republic; South Africa; Switzerland
Clothing	Canada; Chile; Denmark; France; Mexico; Netherlands; New Zealand; Spain; Sweden; United Kingdom	Brazil; Hungary; Iceland; Israel; Republic of Korea; Russian Federation; Singapore; Slovenia; South Africa; Thailand

Source: Author's calculation based on UN Comtrade database.

Note: RCA indices are calculated for major selected economies.

developing economies (including Brazil, China, the Russian Federation, India and Turkey) share a recent history of rapid economic growth, this has been achieved in different ways depending on the country. In some cases, labour and capital have been harnessed to fuel export-oriented manufacturing growth, while in others their growth has depended more on high global commodity prices, which are beyond their influence. Under these circumstances, economic growth may be more durable in the first group and subject to boom-bust cycles in the second group.

The findings outlined above are in line with more sophisticated empirical studies confirming that countries have become less specialized over time. Proudman and Redding (2000), for example, use models of income convergence based on distribution dynamics (Dornbusch et al. 1977) to assess the specialization patterns – captured with Revealed Comparative Advantage – of the United States, Japan, France, Germany and Italy between 1960 and 2010. They find substantial changes in the distribution of RCA across industries over time.

Levchenko and Zhang (2011) investigate the evolution of comparative advantage for a set of 75 developed and developing countries over the last five decades. The authors use total factor productivity[26] (TFP) by

industry to capture countries' relative technologies. The main result of their study is that in both developed and developing countries, productivity has grown faster in those industries experiencing lower relative levels of productivity.

Carrere et al. (2009) indirectly support the fact that comparative advantage has shifted across industries over time: for a set of 156 developed and developing countries, the authors find that during the period 1988-2006, exports diversify and then re-concentrate with income,[27] while at low-income levels countries diversify in both existing and new products, and rich countries re-concentrated their exports. As countries become richer, they accumulate capital and improve their production technologies; therefore, they stop exporting low-value differentiated goods, intensive in factors such as low skill labour which are not any more in line with their new set of factor endowments.

This last result is in line with models such as Romalis (2004), which predicts that countries accumulating a factor faster than the rest of the world will see their production and export structure move towards commodities that more intensively use that factor. The author confirms this in the data and finds that rapidly growing countries have seen their export structure change towards more skill- and capital-intensive industries. Heller (1976) also shows that the change in Japan's factor endowment between 1956 and 1969 strongly altered its comparative advantage in trade. The composition of its export bundle shifted towards the capital-intensive sectors. This shift was reinforced by a relatively faster deepening in the capital intensity of these sectors (see Box C.4 for further discussion).

As standard economic theory suggests, specialization in the production and export of certain goods based on comparative advantage has an impact on countries' welfare: an implication of the Stolper-Samuelson theorem is that under trade liberalization, the price of the relatively more abundant factor rises and the price of the relatively scarce factor falls. In such a context, the shifting of comparative advantage across time, highlighted in this section, will have some implications in terms of within country inequality and development. Some of these implications will be discussed in Section D.1 of the Report.

(d) Has the world become more globalized or more regionalized?

Preferential trade agreements between countries and groups of countries have increased in number and ambition in the last two decades. According to the 2011 *World Trade Report*, the number of such agreements more than tripled between 1990 and 2010, from around 70 at the beginning of the period to nearly 300 at the end (WTO, 2011a). Researchers and policy-makers have used the terms "preferential trade

agreements" (PTAs) and "regional trade agreements" (RTAs) more or less interchangeably in the past due to the fact that PTAs traditionally had a strong regional orientation. This raises the question of whether the proliferation of PTAs has caused international trade to become more or less regionalized over time.

The answer to this question is far from obvious. Recently negotiated PTAs have increasingly been cross-regional in that they involve parties in different regions. Although nearly three-quarters of PTAs were within the same region (intra-regional) in the mid-1990s, this fraction had dropped to around half by 2010 (WTR, 2011). All else being equal, more cross-regional agreements should make trade less regionalized. However, other factors may be working in the opposite direction, including the spread of supply chains in Asia (see Section B.2(e) for a discussion of the influence of supply chains on trade).

To illustrate the evolution of trade within and between regions, we mostly make use of the Network of Merchandise Trade dataset from the WTO's annual *International Trade Statistics* publication (2012).[28] These data cover exports of geographic regions by product and region of destination (including regions defined by level of development) in current US dollar terms. Network data according to current WTO product categories and country groups are available back to 2000, and back to 1990 according to the WTO's older data classifications.[29] In other cases (e.g. trade in parts and components), we have calculated estimates based on available data in the UN Comtrade database.

(i) Intra-regional trade

Figure B.14 shows total merchandise exports by geographic region from 1990 to 2011, together with shares of intra-regional and extra-regional trade. North America, Europe and Asia are shown to one scale, while other regions share a different scale. Figures for Europe exclude intra-EU trade. Export values and intra-regional trade shares for Europe are much larger if these data are included, but these are discussed in the text. More detailed breakdowns by partner region and major product group are also provided in an appendix at the end of this chapter.

As Figure B.14 makes clear, intra-regional trade represents a large and rising percentage of total exports from Asian countries. This share has grown from 42 per cent in 1990 to 52 per cent in 2011, so that it now represents a majority of Asian trade. Although the intra-regional trade share of Asia is the largest of any region in this chart, it is actually smaller than Europe's when intra-EU trade is included in the calculation.

The rise of Asia's intra-regional trade share came mostly at the expense of North America, whose share in total Asian merchandise exports fell from 26 per cent to 16 per cent between 2000 and 2011 and whose share

Figure B.14: **Intra-regional and extra-regional merchandise exports of WTO regions, 1990-2011** (US$ billion and percentage)

Sources: WTO *International Trade Statistics 2012*, supplemented with Secretariat estimates prior to 2000.

Note: Graphs for regions are not shown to scale. Colours and boundaries do not imply any judgement on the part of the WTO as to the legal status of any frontier or territory.
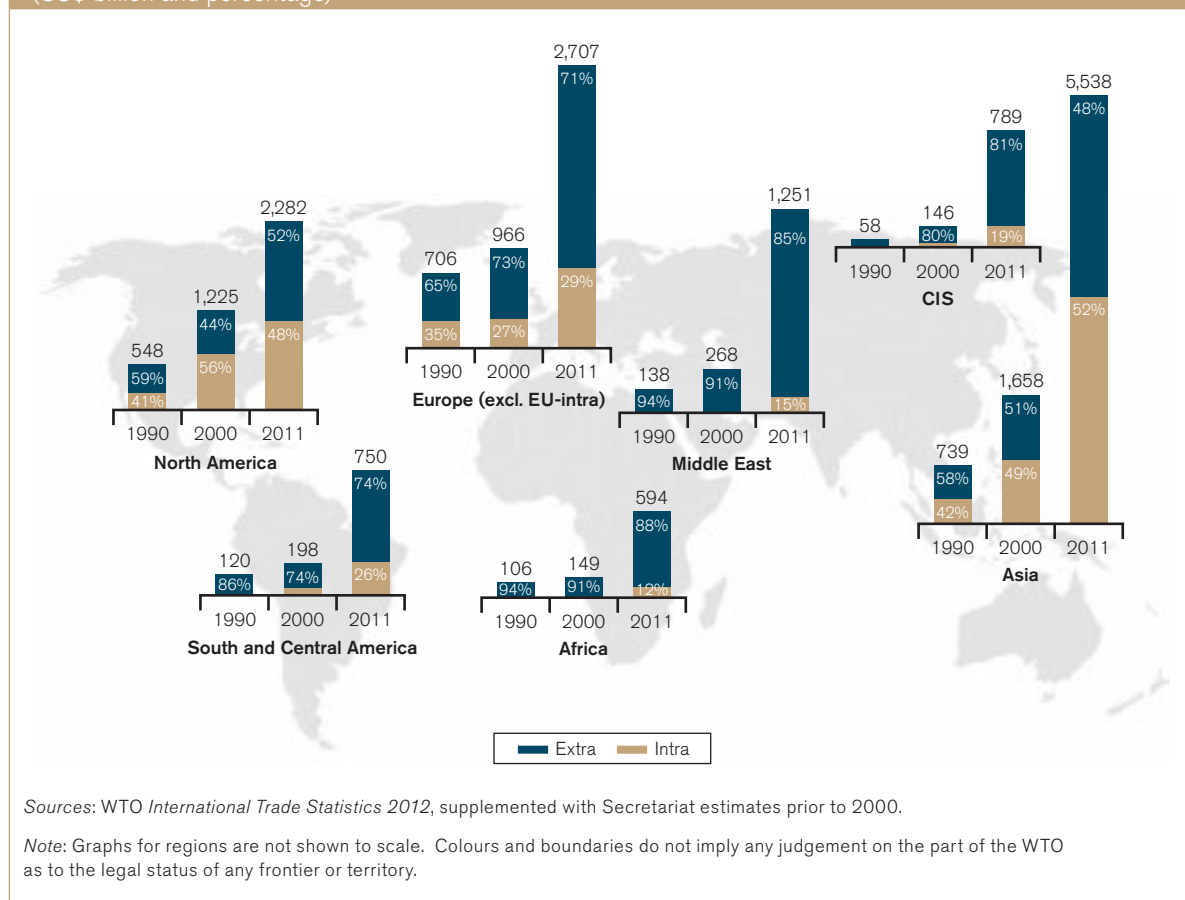
in Asian exports of manufactured goods dropped from 29 per cent to 19 per cent during the same period. Meanwhile, the share of Europe in Asia's total merchandise exports and manufactured goods exports was unchanged (17 per cent and 19 per cent, respectively, see Appendix Table B.2).

Europe's intra-regional trade share in exports fell from 35 per cent to 29 per cent between 1990 and 2011 with intra-EU trade excluded. However, the pattern is quite different when intra-EU trade is added back into the total. In this case, Europe's total exports are the largest of any region (US$ 1.7 trillion in 1990, US$ 6.6 trillion in 2011), with a relatively steady intra-regional trade share in exports of around 72 per cent. This share was slightly larger in 2000 at 73 per cent but it slipped to 71 per cent in 2011.

The share of intra-regional trade in the total exports of North America (which includes Mexico) rose from 41 per cent in 1990 to 56 per cent in 2000 before receding to 48 per cent in 2011. The decrease in the region's intra-regional trade share is mostly explained by rising exports to South and Central America (9 per cent of exports in 2011, up from 6 per cent in 2000) and Asia (21 per cent in 2011, 19 per cent in 2000), with other developing region destinations recording more modest increases, and Europe unchanged at 17 per cent.

Other regions shown in the chart, all of which export significant quantities of natural resources, saw their intra-regional trade shares rise in the last 20 years but they are still extremely small in absolute terms. For example, Africa's intra-regional trade share doubled from 6 per cent to 12 per cent between 1990 and 2011 but this remains remarkably small compared with more industrialized regions.

The rise of PTAs may explain some of the above changes in intra-regional trade shares. For example, the reduced importance of intra-regional trade in North American exports could be partly due to the United States concluding trade agreements with South and Central American countries (e.g. Chile, Colombia and Panama) but we do not observe a similarly large shift in the intra-regional trade share of Europe over the same interval (at least when intra-EU trade is included) despite the fact that the EU has also negotiated a number of trade agreements with countries in other regions since 2000.

(ii) Trade flows between regions

Figures B.15.A and B.15.B show how total merchandise trade between selected pairs of geographic regions (e.g. exports of Europe to Asia plus exports of Asia to Europe) changed between 1990 and 2011 when

Figure B.15.A: **Share of total trade between geographic regions in world trade, 1990** (percentage)
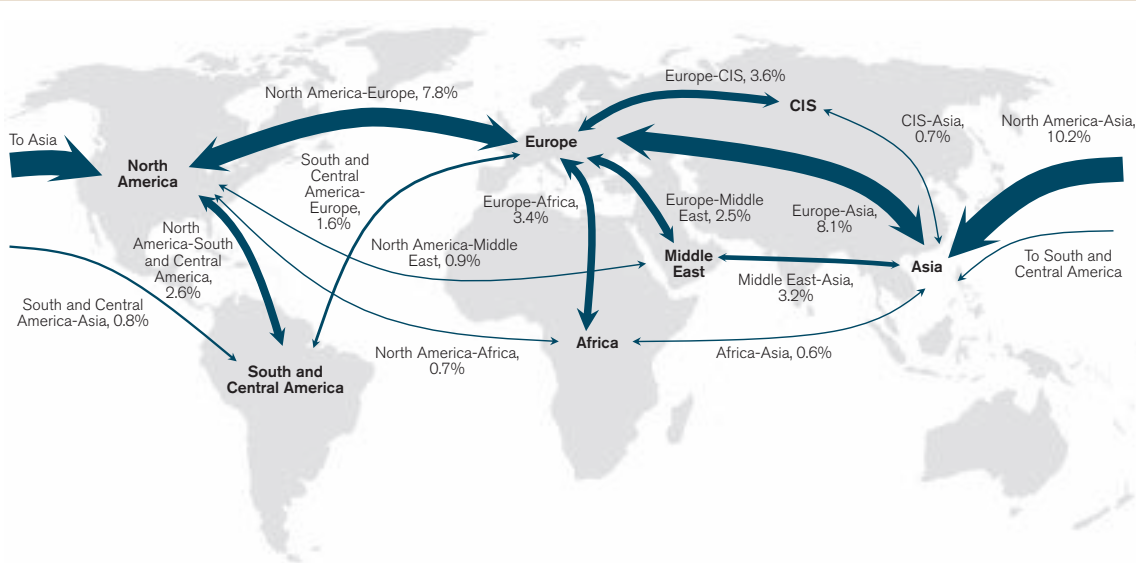
Source: WTO Secretariat estimates.

Note: World trade includes intra-EU trade. Arrow weights based on shares in 1990. Trade within regions and with unspecified destinations represented 53% of world trade in 1990.

Figure B.15.B: **Share of total trade between geographic regions in world trade, 2011** (percentage)
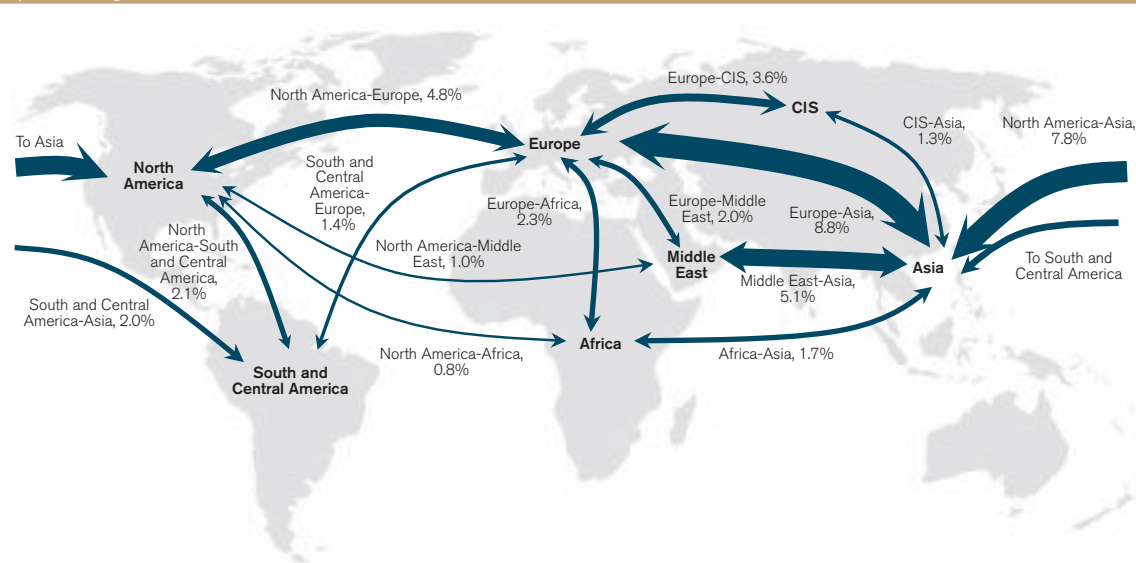
Source: WTO Secretariat estimates.

Note: World trade includes intra-EU trade. Arrow weights based on shares in 2011. Trade within regions and with unspecified destinations represented 54% of world trade in 2011.

expressed as a percentage of world trade. Weights of arrows between regions indicate the overall importance of bilateral trade relationships between pairs of regions in 1990 and 2011. The underlying data are derived from Appendix Table B.2.

What is immediately apparent from the map of trade flows is the centrality of Asia in inter-regional trade. The three most important bilateral relationships in world trade as of 2011 were those between Asia and

Europe (8.8 per cent of world trade in 2011), Asia and North America (7.8 per cent of global trade) and Asia and the Middle East (5.1 per cent of world trade).

Asia's bilateral trade with all regions increased as a share of world trade between 1990 and 2011, with the exception of trade with North America. In this case, the share of trade slipped from 10.2 per cent in 1990 to 7.8 per cent in 2011. The share of Africa-Asia trade in world trade nearly tripled during this period, driven

by shipments of oil and other natural resources to China and by exports of manufactured goods from China to resource exporters. Despite this rapid growth, the share of Africa-Asia trade in world trade remained relatively small in 2011.

In contrast to the rising importance of Asia, North America's bilateral trade flows with other regions either maintained their shares in world trade (e.g. North America-Middle East) or fell sharply (e.g. North America-Europe, which dropped from 7.8 per cent to 4.8 per cent of world trade).

(iii) Supply chains and intermediate goods

Trade in parts and components, serving as a proxy for intermediate goods more generally, may provide an indication of the development of supply chains by region. These data are provided in Table B.11, which shows the share of parts and components in exports of manufactured goods by region since 1990, with additional breakdowns by intra-regional and extra-regional trade.

The table shows that growth in the share of parts and components in manufactured goods trade was stronger for intra-Asia trade than for trade between Asia and other regions. The share of intra-regional trade in parts and components is also larger in Asia than in any other region. This suggests that Asian supply chains may be becoming more intra-regional rather than trans-regional (to the extent that trade in parts and components is indeed a reliable indicator of supply chains activity).

(e) Have supply chains changed patterns of international trade?

Over recent decades, one of the most important changes in the nature of international trade has been the growing interconnectedness of production processes across many countries, with each country specializing in particular stages of a good's production. In the trade literature, this phenomenon is referred to as "global supply chains", "global value chains", "international production networks", "vertical specialization", "offshore outsourcing" and "production fragmentation". In the Report, we will use the term "global supply chains" with the recognition that internationalised supply chains may often be regional, rather than global, in nature.

International fragmentation of production through global supply chains has been a business reality since the generalization of the so-called "Toyota" model[30] and the spread of international outsourcing in the 1980s. *The Business Guide to the World Trading System*, published by the International Trade Centre (ITC) and the Commonwealth Secretariat in 1999, says "virtually all manufactured products available in markets today are produced in more than one country".

In fact, a first attempt to formalize this phenomenon is attributed to Leontief in the 1960s (Leontief and Strout, 1963).

Yet, it is only recently that trade economists have looked into the theoretical implications of "trade in tasks". The seminal work of Grossman and Rossi-Hansberg (2006) referred to it as "the new paradigm". It is based on the idea that in order to produce a final good, several tasks have to be performed, some of which can be offshored. Consider two countries, called North and South, where firms in North have superior technology, and thus wages in North are higher. A North firm is interested in combining its better technology with the cheaper labour in South, facing a task-specific cost of offshoring. The firm will therefore offshore the task as long as the wage gap is larger than the offshoring cost. This creates trade opportunities that would not have existed in a classical trade in final goods. Moreover, productivity in North will increase since workers in North will focus on the tasks where they have a "trade-cost-adjusted" comparative advantage. A major difference between this approach and the traditional trade literature is that the technology of production is firm-specific, not country-specific.

On the empirical side, the estimation of global value chains has been a challenge for economists: statistics on international trade flows are collected in gross terms and therefore lead to a multiple-counting of trade in intermediate goods. This distorts the reality of international trade and influences public opinion and policy. Consider, for instance, the perceived comparative advantage of a country which may be different if trade is measured by the domestic content in exports rather than gross trade flows (Koopman et al., 2012). Similarly, bilateral global imbalances are influenced by the fact that countries engaged principally in completing tasks downstream have most of the value of the goods and services attributed to them. Protectionist policies designed to preserve jobs may also be rendered counter-productive. For example, a sizeable proportion of US imports from China are the result of goods and services purchased from US firms, with the final product assembled in China. Increasing tariffs would have an adverse impact on jobs for these US firms. Finally, a better understanding of value-added trade flows would enable policy-makers to identify the transmission of macroeconomic shocks, such as the recent financial crisis, and adopt the appropriate policy responses.

Given that the existence of global supply chains changes our perception of international trade and has profound implications for the analysis of trade patterns, an accurate measure of trade flows in value-added terms is necessary to correctly assess future trade scenarios. This section will first highlight the current efforts made by economists and the WTO to accurately measure trade in value-added terms. Secondly, it will

Table B.11: **Shares of parts and components in exports of manufactures by region, 1990-2011** (percentage)	Total exports of manufactures	Intra-regional exports of manufactures	Extra-regional exports of manufactures
North America			
1990	33.5	35.5	32.1
2000	35.2	32.7	38.2
2011	26.1	28.1	24.1
South and Central America			
1990	20.0	15.9	21.0
2000	19.0	16.9	20.5
2011	17.1	17.1	17.0
Europe			
1990	22.6	22.4	23.0
2000	24.2	23.1	26.9
2011	21.8	21.2	23.0
Asia			
1990	27.6	33.3	24.5
2000	35.4	43.1	28.4
2011	31.1	38.3	22.9

Sources: WTO Secretariat estimates based on the UN Comtrade database.

Note: Parts and components are defined as the SITC equivalent of BEC parts and components plus unfinished textiles in SITC section division 65.

use some recent estimates of trade in value-added to review the trends described earlier.[31]

(i) Conventional measures of trade in value-added

Besides measuring gross flows, international trade statistics should also be able to reflect value-added flows between countries. Owing to the lack of relevant data, there is little systematic evidence quantifying this. Most of the data that have been produced to date come from case studies on Apple and Nokia products or Mattel's Barbie doll, which break down the parts and accessories used to create these goods. The case studies illustrate the huge discrepancy between what was recorded under traditional rules of origin and what would be recorded on the basis of the actual value of components and manufacturing services.

National statistical authorities have traditionally conducted surveys focused on selected firms (usually large multinationals). Another approach has been to link business and trade registers, as is being done by the European Union's EUROSTAT and Mexico's INEGI. This leads to the creation of micro-databases that are both representative and detailed. Unfortunately, the implementation of such an approach is intensive in resources and access to micro-databases is often limited due to confidentiality restrictions.[32]

An alternative way to measure trade in value-added terms is to use the Classification by Broad Economic Categories (BEC) or the Standard International Trade Classification (SITC) to categorize goods as being intermediate or final. This type of analysis was initiated by Yeats (1998) and subsequently utilized by others,

including Athukorala and Yamashita (2006). Trade in intermediate goods is among the few readily available statistics to provide information on the intensity of international supply chain activity.

As was shown in Section B.2(d), trade in parts and components can be used as a proxy for intermediate goods to measure the development of supply chains by region. Using the SITC definition of parts and components from this earlier section, Figure B.16 shows that while the value of world trade in these products increased steadily over the last three decades, their share in world trade in manufactured goods peaked more than a decade ago. The share of parts and components in world exports of manufactured goods increased from 22 per cent in 1980 to 29 per cent in 2000. However, between 2000 and 2008 it declined by roughly 4 percentage points, only to recover somewhat thereafter. In 2011, the share stood at 26 per cent, roughly equal to its level in 1995. The stagnating share of parts and components may be explained in part by the economic crisis of 2001 and the more recent financial crisis. Another possibility is that trade may have experienced a one-time jump in the share of intermediate goods as a result of the internationalization of production, which is unlikely to be repeated since there are no more large countries on the scale of China or India waiting to join global production networks.

A classification of goods into "intermediate" and "final" is based on expert judgement, which is by nature subjective, and therefore may be somewhat arbitrary. Many goods might be both final and intermediate depending on the context. Hence, trade in value-added is increasingly being estimated by using international

Figure B.16: **World exports of parts and components, 1980-2011**
(US$ billion and percentage)

Source: WTO Secretariat estimates.
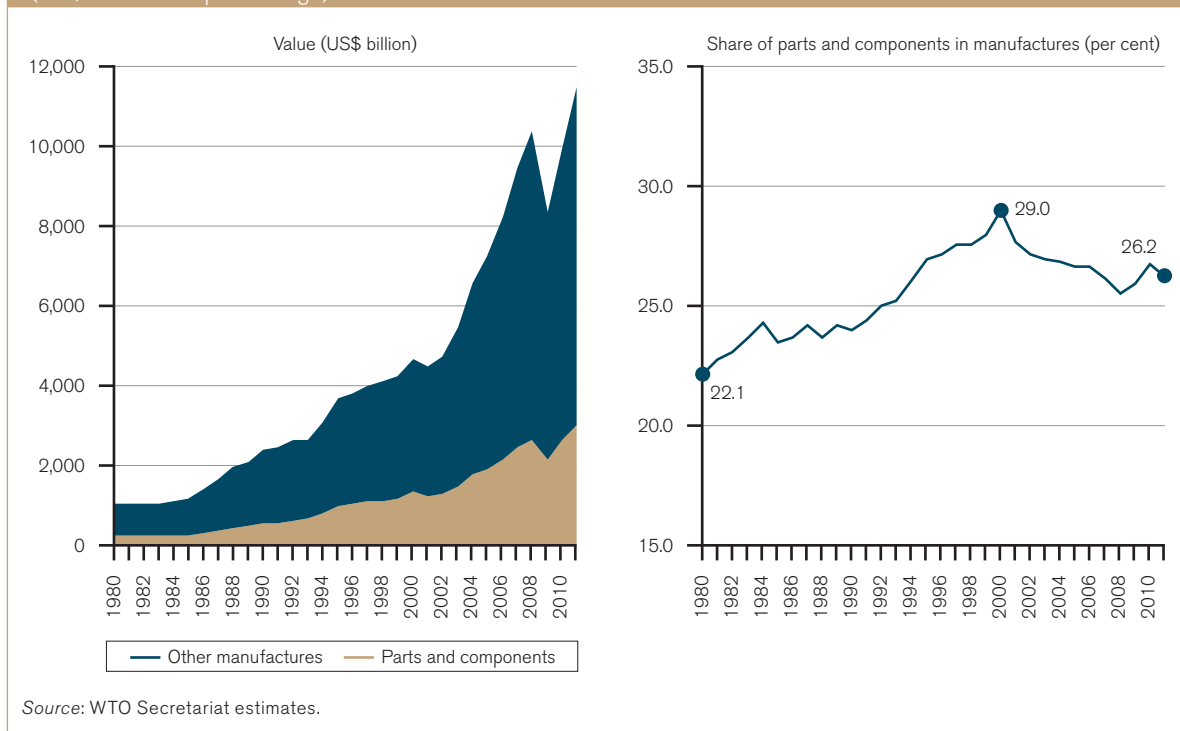
or global Input-Output (I-O) tables, which combine national I-O matrices with trade flows of intermediate and final goods and services.

A global I-O table depicts an international production structure enabling the user to trace a "value chain" for each final good or service sold in the economies covered. Building on the I-O framework, Hummels et al. (2001) developed the concept of vertical specialization, defined as the value of imported intermediate goods embodied in a country's exports. They showed that the growth in vertical specialization accounted for about one-third of the growth in overall exports for 13 OECD members and Chinese Taipei between 1970 and 1990. In a more recent study, Miroudot et al. (2009) used such an approach to show that the share of intermediate goods in OECD merchandise trade increased from just over 50 per cent in 1999 to almost 60 per cent in 2007. This suggests that while the share of trade in intermediate goods in total merchandise trade increased somewhat, trade in final goods also increased at a brisk pace. The authors also show that in 2007, over 70 per cent of services trade involved intermediate goods, i.e. it contributed to the production of products.

(ii) Developing a comprehensive dataset on value-added trade

In recent years, there have been numerous initiatives aimed at using the input-output framework to describe the interdependencies of industries between countries.

One of the first examples of international input-output tables was the Asian Input-Output (AIO) table developed by Japan's Institute of Developing Economies (IDE-JETRO) in the 1980s as an attempt to model the relationships between industries in East Asia that emerged when Japanese firms outsourced some of their industrial activity (WTO and IDE-JETRO, 2011). The AIO covers nine Asian economies as well as the United States and up to 76 sectors.

A few academic initiatives were also undertaken in the area of global I-O tables, such as the Global Trade Analysis Project (GTAP) database, a world-wide I-O table partially based on official data, or the Multi-Region Input-Output (MRIO) database, developed by the University of Sydney, which is mostly dedicated to environmental data and reliant on mathematical modelling.

However, it is only in 2012 that global I-O tables built on official statistical sources were produced. The World Input-Output Database (WIOD) project resulted in the World Input-Output Table (WIOT) in May 2012, which covers 40 economies and a "Rest of the world" aggregate for 35 sectors over the period 1995-2009.[33] The OECD also developed an Inter-Country Input-Output (ICIO) table covering 58 economies supplemented by a "Rest of the world" aggregate for 37 sectors and a set of benchmark years (1995, 2000, 2005, 2008 and 2009). Building on these OECD ICIO tables, the WTO and OECD developed a series of indicators of bilateral trade in value-added (see Box B.3).[34]

Box B.3: Trade in value-added terms: one concept, different measures

The first papers to explicitly refer to a comprehensive measurement of the value-added content of world trade based on an international input-output framework are Daudin et al. (2006, 2009), Johnson and Noguera (2011), Koopman et al. (2011) and Stehrer (2012).

Daudin et al. (2006, 2009) further developed the concept of vertical specialization as defined by Hummels et al. (2001). Using GTAP tables, they measured vertical trade as the sum of imported intermediate goods directly used as inputs for the production of exports, domestically produced inputs which enter into the production of another country's exports, and exports that are reimported in the country of origin for final use. Value-added trade, thus, is defined as standard trade minus vertical trade. Johnson and Noguera (2011) define value-added exports as the value added produced by the home country and absorbed by its trade partners, i.e. discarding any value added reflected back to the home country. They propose the ratio of value added to gross exports (or VAX ratio) as a measure of the intensity of cross-country production sharing.

Yet, intermediate exports which are returned to the home country are extremely relevant for describing some important cases of bilateral supply chains, such as between Mexico and the United States. To overcome this shortcoming, Koopman et al. (2011) provide a full decomposition of value-added exports in a single conceptual framework that encompasses all the previous measures. Exports are first decomposed into domestic value added, returned domestic value added and foreign value added. Domestic value added is split between exports absorbed by direct importers and indirect exports sent to third countries. By taking into account the returned domestic value added and the indirect exports to third countries, the decomposition is complete (thus matching standard trade data in gross terms when all the decomposed values are aggregated).

While the previous approach estimates the domestic and foreign value-added components of exports, Stehrer (2012) suggested yet another methodology, which focuses on the importer's perspective and estimates the foreign value added contained in the final demand of a country. It can be shown that while the two approaches generate different bilateral flows of value added, the results at the global level are the same.

In all the approaches above, the calculations are based on the assumption that the products that are exported do not differ substantially from those intended for domestic consumption.[35]

The notion of value-added exports in this section refers to the domestic content of exports, as defined by Johnson and Noguera (2011). It includes:

- the domestic value added directly absorbed by the importer, i.e. either consumed or invested in the domestic economy

- the domestic value added imported by the trade partner but re-exported to third countries.

This component is almost entirely trade in intermediate goods and is typical of activities taking place within international production chains.

Figure B.17 illustrates the comparison between gross trade and value-added trade.

The conventional measure of trade in this figure indicates exports between three countries totalling 210, whereas only 110 of value-added has been actually generated. Conventional measures also show that C has a trade deficit of 110 with B, and no trade at all with A. If, instead, we include value-added content, C's trade deficit with B reduces to 10 and it now runs a deficit of 100 with A.

Figure B.17: **Comparison of gross and value-added trade**

Source: WTO Secretariat.
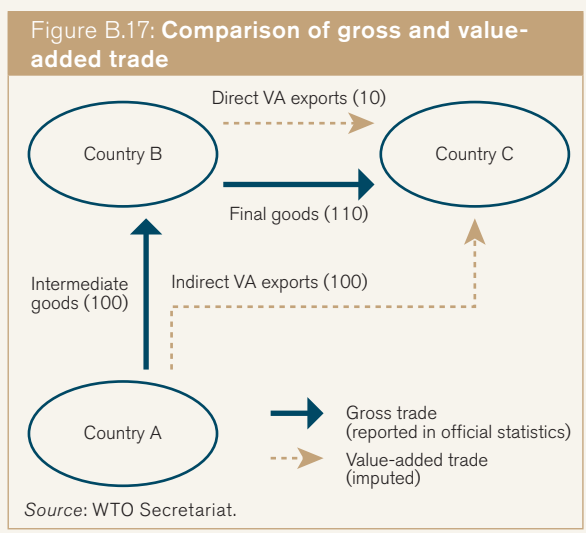
(iii) Patterns of trade in value-added terms

Composition of trade

Measuring trade in value-added terms resizes world trade figures by taking out double counting and measuring only the actual economic content. Figure B.18 shows the evolution of the ratio of value-added over gross exports (VAX ratio, see Box B.3) at world level during the years 1995-2007. The ratio decreased by around 10 percentage points during this time span, reaching 71 per cent in 2007. In other words, almost 30 per cent of total trade consists of re-exports of intermediate inputs; this suggests an increased interdependence of economies.

Sectors are not affected in a similar way, and as expected, it is trade in manufactured goods which shows the deepest vertical specialization. The manufacturing sector, which had already the lowest VAX ratio in 1995, decreased to 43 per cent in 2007, while the domestic content of exports is almost stable for agriculture, and falls only slightly for fuels and mining. Regarding the services sector, two points are worth mentioning: (i) the VAX ratio has declined for services as well, indicating that services, much like goods, are being disaggregated and traded internationally as separate "tasks"; (ii) the VAX ratio is well above 100 per cent, suggesting that in the domestic cost of production of manufactured goods, there is significant value-added purchased from suppliers in the services sector which is then embodied in trade in goods.
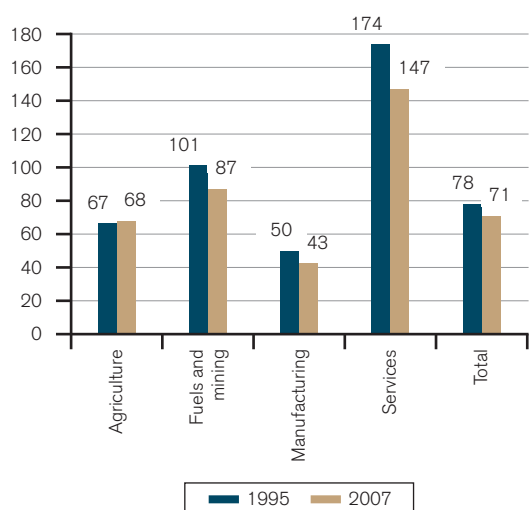
Indeed, the role of services is crucial when analysing trade in global value chains; they guarantee, for example, just-in-time delivery and sound financing of global production networks. Traditional trade statistics underestimate the contribution of services to international trade: as shown in Figure B.19, services account for about 20 per cent of world exports if considered in gross terms, while the value-added measure reveals that the contribution of services is twice as high. Symmetrically, the weight of manufacturing is reduced, while other sectors are almost unaffected.

Adequately determining the contribution of the services sector to the international trade of an economy is important for the analysis of trade and development. In advanced economies, most labour is concentrated in the services sector, which appears loosely interconnected to the world economy if we base the analysis on traditional trade statistics. However, when looking at the value-added directly and indirectly traded, the services sector becomes the most important contributor to trade, well ahead of manufactured goods. This has also an important contribution to our understanding of trade and firm heterogeneity (or differences between firms). While the literature on firm heterogeneity (the so-called "new new" trade theory) focuses on the leading role of large firms in international trade (see Box B.4), value-added data show that small and medium-sized firms are probably as important as large firms in generating value and are therefore significant when it comes to determining global competitiveness. [36]

Who are the main players?

Not all countries are similarly engaged in global value chains, and significant differences can be observed between countries. Figure B.20 shows the ratio of value-added to gross exports for selected economies. It is important to mention that the WIOD input-output tables only partially take into account the specific production technology of export processing zones; for economies with sizeable processing trade, notably China and Mexico, this means that the actual value-added to gross

Figure B.18: VAX ratio, by sector, world level (percentage)

Sources: WTO Secretariat estimates based on WIOD data.

Note: The VAX ratio can be higher than 100 per cent when a sector "indirectly" exports value-added through other sectors. This is especially true for services, which are extensively embedded in traded goods.

Figure B.19: Sectoral contribution to total trade, gross and value-added measures, 2008 (percentage)

Structure of world exports in gross terms, 2008

Structure of world exports in value-added terms, 2008
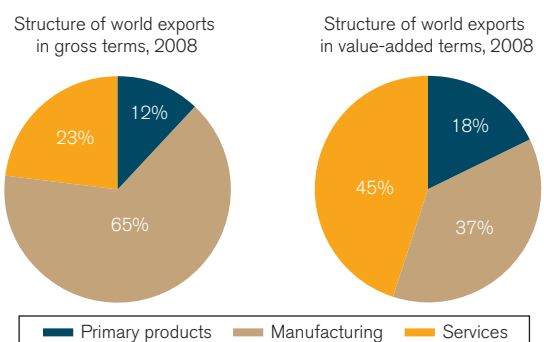
Source: WTO Secretariat estimates based on OECD-WTO 2008 data.

Figure B.20: **VAX ratio, all sectors, selected economies** (percentage)

Sources: WTO Secretariat estimates based on WIOD data.
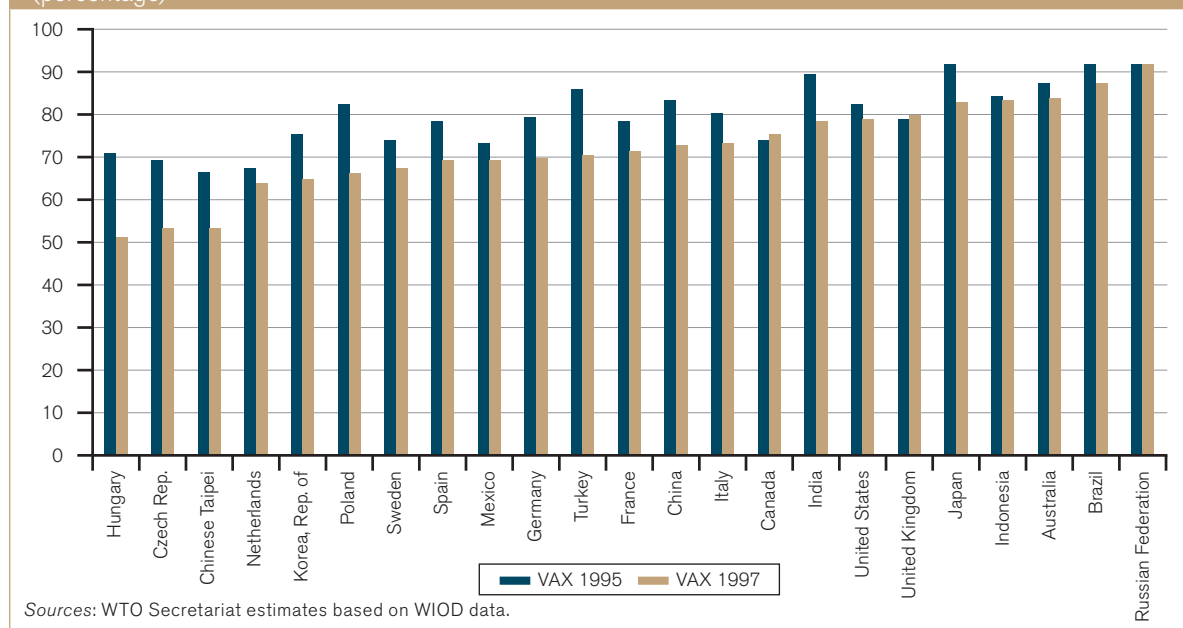
export ratio has been certainly overestimated or, conversely, that the extent of trade within global value chains is still significantly underestimated.[37]

There is substantial variety both in the level and in the variation of the ratio over time. Nevertheless, the VAX ratio has been decreasing for almost all economies in the sample, suggesting a general tendency towards more fragmented production processes. The sharpest declines occurred for Eastern European countries such as Hungary, Poland and the Czech Republic, together with Turkey, the Republic of Korea and Chinese Taipei.

The decrease in the share of domestic content of exports is a symptom of higher interdependency of economies in global supply chains. Economies are relying more and more frequently on their production partners to import intermediate inputs for the production of goods and services that they will either consume domestically or export. Because many of the industrialized economies engaging in production networks have the technical capacity to produce those inputs but chose not to do so means that access to competitive imports affect a country's export competitiveness.

Figure B.21 plots the change of the vertical specialization index (VS) from 1995 to 2007 against the export performance of the economy in the manufacturing sector in the same time span. There seems to be a positive correlation between vertical specialization and increases in gross exports: a higher integration of an economy in the global supply chain is associated with an increased export performance. In other words, more intermediate inputs are imported for the production of exports. Moreover, imports not only guarantee international competitiveness of an economy's exports but at the same time ensure domestic output at affordable prices for consumers,

thus doubly contributing to economic welfare, first by enhancing integration in the global economy, and secondly by improving households' purchasing power.

Are countries more or less specialized?

Trade in value-added alters the construction and interpretation of most indicators that are built on market shares. The Revealed Comparative Advantage (RCA) indicator is one of them. This statistical indicator is often used as a synthetic measure of international competitiveness, alone or in addition to "shift-share" analysis (Piezas-Zerbi and Nee, 2009). Traditionally, comparative advantage has been considered in terms of final goods. With the increased fragmentation of production, it is more appropriate to evaluate comparative advantage on the basis of "trade in tasks".[38]

As shown in Section B.2(c), RCA is defined as the share of a sector in a country's total exports as compared with the world average of the same sector in world exports. If the indicator is larger than 1, the economy is said to have a revealed comparative advantage in the sector considered. The issue of double counting of intermediate inputs in traditional trade statistics implies that the computation of the index in gross terms may be misleading. In particular, countries situated downstream in the supply chain may spuriously incorporate in their apparent competitive advantages the re-exported value added of upstream suppliers.

Figure B.22 is a 45-degree plot which compares the "traditional" RCA index against the same indicator calculated in value-added terms for machinery and transport equipment (Panel A) and electrical and optical equipment (Panel B), both industries having a significant degree of vertical specialization.

Figure B.21: **Relative variations of foreign content of exports versus gross exports, manufacturing sector, 1995-2007**

Source: WTO Secretariat estimates based on WIOD data.

Economies below the 45-degree line see their RCA reduced if measured in value-added terms. Economies above the line have a higher RCA in value-added terms than in gross terms; in other words, those countries are exporters of parts and components with high domestic content which are further processed or assembled in downstream countries. In the case of Panel A, India, China and Mexico, for example, see their RCA reduced when based only on domestic content; the reverse is true for Japan, the Republic of Korea and the United States. For electrical and optical equipment, China and Mexico, for example, show a reduction of their RCA. Both countries are heavily engaged in export processing zones.

(iv) Global rebalancing and trade in value-added

Accounting for intermediate goods may dramatically change bilateral trade balances between countries. Indeed, it was one of the most salient results of earlier research such as Daudin et al. (2006b). Trade statistics in gross terms, by reporting imports by final country of origin, mask the origins of the intermediate inputs and thus skew bilateral trade balances. This has been particularly relevant in the post 2008-09 global economic environment, when mounting external disequilibria during the 2000s and their underlying causes were partly blamed for triggering the crisis.

Figure B.23 shows six economies' bilateral trade balances, measured in gross and in value-added terms. Both goods and services are included, and the

balances are shown with respect to five selected partners. While the calculation based on value-added does not change the total trade balance with the world, it re-distributes it according to the actual origin of the value-added of imports and exports. For instance, China's trade surplus with the United States is reduced by almost 30 per cent if measured in value-added terms. The opposite change can also be observed: the surplus of Germany with the United States, for example, increases if considered in value-added terms.

(f) Is trade concentrated in the hands of a few global companies?

In recent years, the availability of large new data sets and the increased computational capability to process large amounts of information has allowed economists to use firm-level data to investigate trade patterns. The findings suggest that current trade is mainly driven by a few big trading firms across countries. Assessing whether export (import) concentration among a few players is a recent phenomenon or not, and whether it will persist, is still a challenge given the limited availability of historical data at firm level. However, the rich literature on the current micro-level dynamics of exporting firms, presented in this sub-section, is a good starting point to understand the determinants of aggregate trade flows and to better evaluate the future trends of international trade.

Firm participation in exporting activities is very rare (see Table B.12). For the United States, on average, 18 per cent of manufacturing firms export (Bernard

Figure B.22: **Revealed Comparative Advantage (RCA) in gross and value-added terms, selected sectors, 2007**

Panel A

Machinery and transport equipment, 2007

Panel B

Electrical and optical equipment, 2007
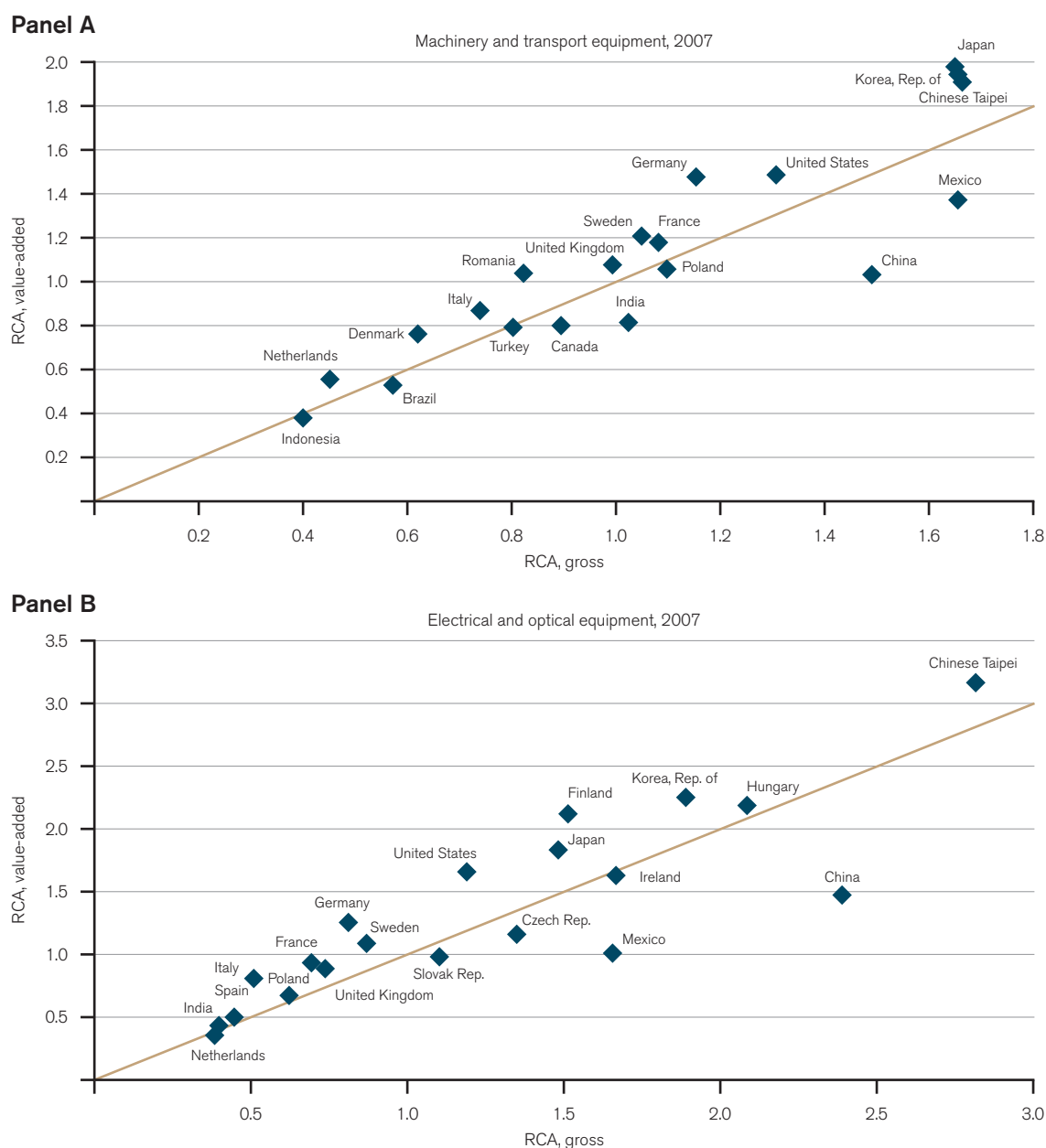
Sources: WTO Secretariat estimates based on WIOD data.

Note: Countries above/below the 45° line (in beige) have a value-added RCA higher/lower than the Gross.

and Jensen, 1995; Bernard et al., 2007). A similar pattern is found in other developed economies, such as France and Japan, as well as developing economies, such as Chile, Colombia and Indonesia. In addition, exporting firms ship a small share of their total shipments abroad (intensive margin of trade). For the United States, among exporters, exports represent less than 15 per cent of their total shipment (Bernard et al., 2007). European firms also export a relatively small share of their output: in countries such as France, the United Kingdom and Spain, the intensive margin of trade represents on average less than 30 per cent (EFIGE, 2011).[39]

From Table B.13, we can also see that exports are largely concentrated among a handful of exporters: 1 per cent of larger exporters contribute more than 80 per cent of total exports in the United States. In addition, the top 10 per cent of exporters account for more than 96 per cent of US exports (Bernard et al., 2009). For the European countries shown in the table, the average shares of the top 1 per cent and top 10 per cent of exporters are 50 per cent and 85 per cent, respectively (Mayer and Ottaviano, 2007). Developing countries show a similar pattern: on average, 81 per cent of exports are concentrated among the top five largest exporting firms (Cebeci et al., 2012).

Figure B.23: **Bilateral trade balances measured in gross and value-added terms, 2008**

Brazil

China

Germany

Republic of Korea

Mexico

United States

India

South Africa

■ Trade balance in value-added terms
■ Trade balance in gross terms
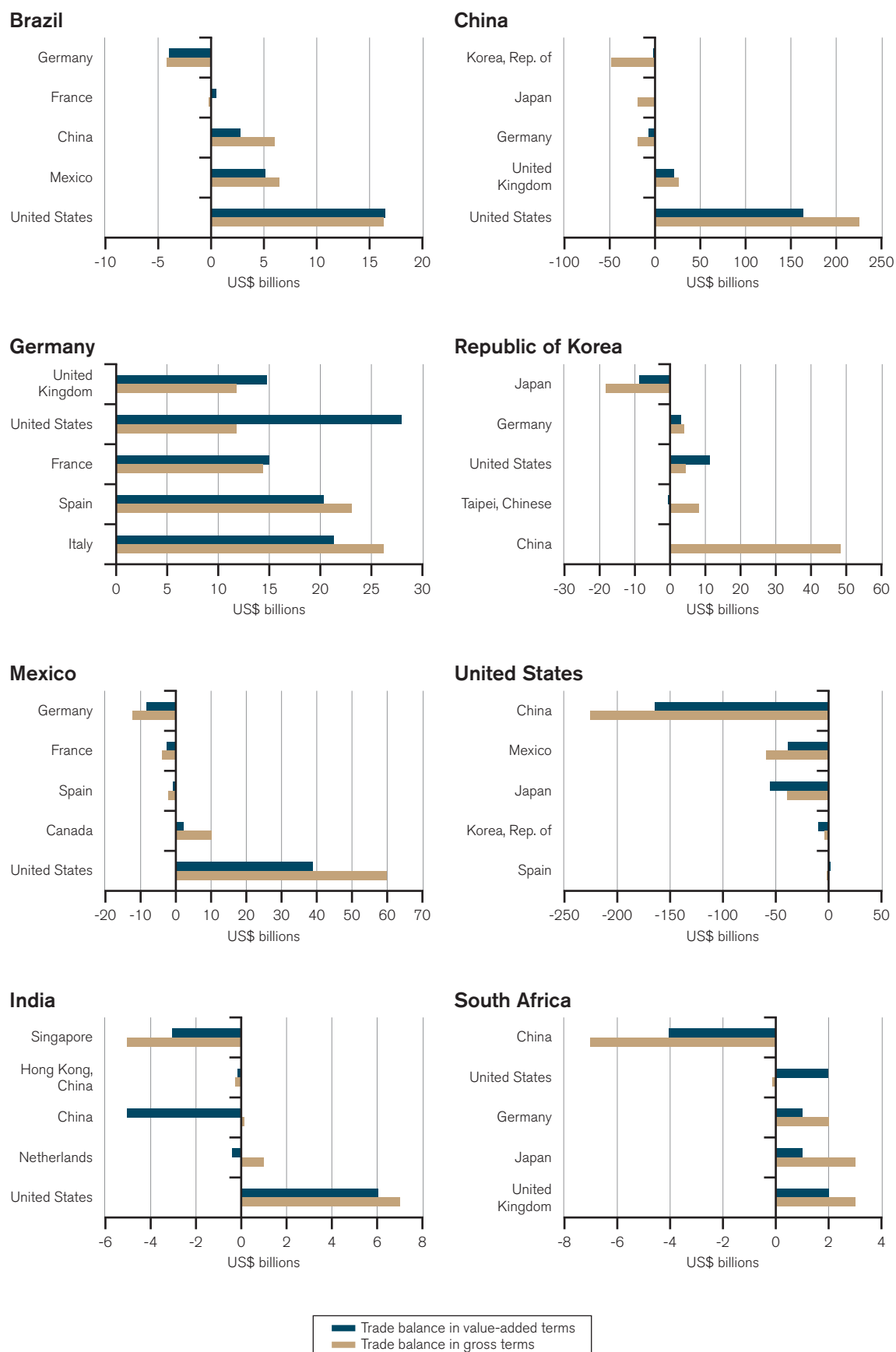
Sources: WTO Secretariat estimates based on OECD ICIO data.

Table B.12: Share of exporting firms in total number of manufacturing firms
(percentage)

	Year	Share of exporters in total number of manufacturing firms
United States	1987 and 2002	18
Norway	2003	39.2
France	1986	17.4
Japan	2000	20
Chile	1999	20.9
Colombia	1990	18.2
Indonesia	1991-2000	19

Sources: WTO (2008) and Amiti and Cameron (2012) for Indonesia.

Table B.13: Share of exports accounted for by the largest exporters
(percentage)

Country	Year	Top 1%	Top 5%	Top 10%
United States	1993	78.2	91.8	95.6
	2002	80.9	93	96.3
European Countries				
Belgium	2003	48	73	84
France	2003	44	73	84
Germany	2003	59	81	90
Hungary	2003	77	91	96
Italy	2003	32	59	72
Norway	2003	53	81	91
United Kingdom	2003	42	69	80
Developing Countries[a]				
Brazil	2009	56	82	98
Mexico	2009	67	90	99
Bangladesh	2009	22	52	90
Turkey	2009	56	78	96
South Africa	2009	75	90	99
Egypt	2009	49	76	96
Iran	2009	51	72	94

Sources: Bernard and Jensen (1995), Bernard et al. (2007), Mayer and Ottaviano (2007), Cebeci et al. (2012).

[a] For developing countries reported in the WBEDD, we report the exports share by the top 25% firms instead of top 10% firms due to data availability.

The fact that exporters are rare and concentrated among a small number of firms implies that exporting firms are essentially different from firms that only sell in domestic markets. Bernard et al. (2007) show that US exporters compared with non-exporters are larger (by 97 per cent for employment, and 108 per cent for shipments), are more productive (by 11 per cent for value-added, and 3 per cent for total factor productivity), pay higher wages (by 6 per cent) and own more capital. Also among EU member states, exporters have higher labour productivity than non-exporting firms (Mayer and Ottaviano, 2007). Bernard et al. (2011) also show that for the United States, similar conclusions can be reached for importing firms: importers are bigger, more productive, pay higher wages and are more skill- and capital-intensive than non-importers. In addition, they show that firms which both import and export (41 per cent of US exporters also import, while 79 per cent of importers also export) exhibit the largest performance differences compared with domestic firms.

The exceptional performance of exporters across countries raises the question whether exporters are already "better" even before they start exporting, or whether exporting causes productivity growth through some form of "learning by exporting". Many studies confirm that high productivity precedes entry into export markets. Das et al. (2007), for instance, show that it is the potentially large sunk cost of entering foreign markets that induces the self-selection process among firms within industries so that only the most productive firms export. In contrast, there is little evidence supporting "learning-by-exporting".[40] However, there is evidence that firms entering export markets grow faster in terms of employment and output than non-exporters.[41]

The empirical findings summarized above suggest that firms are heterogeneous or different from one another. This was ignored by traditional and new trade theories, where assumptions such as the existence of a

Box B.4: **The Melitz model of heterogeneous firms**

Melitz (2003) analyses intra-industry trade between two identical countries. On the production side, each firm produces one single variety using a single factor of production, labour, and a technology with increasing returns to scale. Firms draw their productivity level from a "lottery" after paying a one-time fixed sunk cost of entry. In addition, firms have to pay an additional fixed cost to enter the domestic and foreign market respectively. Only firms with sufficiently high productivity, or low marginal costs, will be able to sell enough to cover fixed costs. The threshold marginal cost for entering the local market depends on the fixed entry cost of entering the domestic market as well as on prices and demand conditions. Similarly, the cut-off marginal cost for entering the export market is a function of the fixed cost of entering the export market, the trade costs, the price and demand conditions.

In this set-up, we can rank firms according to their productivity level and classify them in three groups and two cut-off conditions – that is, two threshold levels of marginal cost: firms with the lowest marginal costs will find it profitable to pay the entry cost for both the domestic and export market, while firms with intermediate productivity levels will find it profitable to pay only the entry cost for the domestic market. In other words, only the most productive firms become exporters.

In a world where exporters are more productive and grow faster than non-exporters, trade liberalization will force the least productive firms to exit the market and reallocate market shares from less to more productive firms. Thus, the least productive non-exporting firms will be forced out of the market due to increased exposure to competition, but a set of new firms with higher productivities will start exporting because of increased sales from foreign markets. This process induces the reallocation of resources towards more productive firms, and thus will increase average industrial productivity.

The predictions of the Melitz model are confirmed by a series of empirical studies on the impact of trade liberalization on both firm and aggregate industry productivity.[42] In addition, the main empirical facts on firms and trade can also be found in models where the differences in productivity across firms are included in a Ricardian framework (Eaton and Kortum, 2002).

representative and consumer love of variety imply that all firms are identical and all firms export. Inspired by this, several theoretical works pioneered by Melitz (2003), combining the theoretical literature on firm heterogeneity[43] with the Krugman model, have been successful in explaining the observed facts about firms in international trade (for a more detailed analysis of the Melitz model, see Box B.4).

Finally, a growing body of literature has focused on the role of global firms: multi-product firms exporting to multiple destinations. Bernard et al. (2007) show that among US exporters, 40 per cent exported a single product to a single destination market and represented a very small portion (0.2 per cent) of total US exports in 2000. Conversely, a small number of firms (15.5 per cent of total exporters) exported more than four products to more than four destination countries and represented over 90 per cent of total exports (Panel A of Table B.14). Cebeci et al. (2012) find a similar feature among exporters from 34 developing countries (Panels B and C illustrate the cases of Mexico and Colombia): on average, 35 per cent of exporters are single-product, single-destination firms and contribute less than 3 per cent of total exports. In contrast, multi-product, multi-destination exporters, representing only 13 per cent of all exporters, contribute more than 60 per cent of total exports.

The dominant performance of global firms emphasizes the importance of these "superstar" exporters in

shaping trade patterns. Studies such as Freund and Pierola (2012), by focusing on the top 1 per cent of exporters, show that these superstars are the main driving force of the Revealed Comparative Advantage and they contribute over three-quarters of the export growth across countries. The analysis of global exporters is also useful to highlight the mechanisms behind the positive impact of trade liberalization on aggregate productivity. Baldwin and Gu (2009) and Bernard et al. (2011) find that in Canada and the United States respectively, multi-product firms, after a reduction in trade barriers (or a reduction in competition in foreign markets), stop producing the least successful products, which in turn increases firm-level productivity.

The empirical evidence summarized above focuses on manufacturing firms. A handful of studies, mainly on developed countries, have also investigated the role of services firms in trade; their main findings are in line with the previous literature. Breinlich and Crusciolo (2011) and Gourlay et al. (2005) highlight that, for UK services firms, trade participation varies significantly by sector and by firm size. In addition, larger firms are more likely to be exporters and export more types of services to more destinations. Similar patterns are found by González Sanz and Rodríguez Caloca (2010) for Spanish services firms. Evidence for German and Dutch services firms also confirms that exporters are larger, more productive and pay higher wages than non-exporters.[44] This result is also confirmed by the

Table B.14: Distribution of exporters and export value
(percentage)

Panel A. United States 2000											
	Share of exporting firms						Share of export value				
	Number of destinations						Number of destinations				
Number of products	1	2	3	4+	All	Number of products	1	2	3	4+	All
1	40.4	1.2	0.3	0.3	42.2	1	0.20	0.06	0.02	0.09	0.4
2	10.4	4.7	0.8	0.7	16.6	2	0.19	0.12	0.04	0.18	0.5
3	4.7	2.3	1.3	0.9	9.2	3	0.19	0.07	1.05	0.22	0.6
4+	8.5	4.3	3.7	15.5	32.0	4+	2.75	1.31	1.10	93.40	98.6
Total	64.0	12.5	6.1	17.4	100	Total	3.3	1.6	1.2	93.9	100
Panel B. Colombia 2009											
	Share of exporting firms						Share of export value				
	Number of destinations						Number of destinations				
Number of products	1	2	3	4+	All	Number of products	1	2	3	4+	All
1	34.5	4.4	1.6	3.0	43.5	1	3.7	3.2	0.9	5.0	12.8
2	9.0	3.9	1.3	2.6	16.8	2	4.7	2.9	0.4	5.0	13.0
3	4.3	2.1	1.2	2.0	9.6	3	1.6	1.5	1.4	5.7	10.2
4+	9.9	4.5	3.4	12.2	30.0	4+	4.5	3.1	1.2	55.2	64.0
Total	57.7	14.9	7.5	19.8	100	Total	14.5	10.7	3.9	70.9	100
Panel C. Mexico 2009											
	Share of exporting firms						Share of export value				
	Number of destinations						Number of destinations				
Number of products	1	2	3	4+	All	Number of products	1	2	3	4+	All
1	39.3	2.0	0.5	0.8	42.6	1	3.0	0.2	0.2	0.3	3.7
2	10.1	2.6	0.7	0.7	14.1	2	1.4	0.2	0.1	0.3	2.0
3	5.2	1.5	0.7	0.8	8.2	3	1.4	0.2	0.3	0.6	2.5
4+	17.4	5.0	2.8	9.9	35.1	4+	19.6	7.2	2.8	62.1	91.7
Total	72.0	11.1	4.7	12.2	100	Total	25.4	7.8	3.4	63.3	100

Source: The data for Colombia and Mexico are from the World Bank's Exporter Dynamic Database.

Note: Panel A data are from the 2000 Linked/Longitudinal Firm Trade Transaction Database. The table displays the joint distribution of US manufacturing firms that export (left panel) and their export value (right panel) according to the number of products that firms export (rows) and their number of export destinations (columns). Products are defined as ten-digit Harmonized System categories. Similar information is provided for Panels B and C.

US Trade Commission in a study of small and medium-sized enterprises.[45]

The firm-level evidence presented in this section has significant implications for future trade. First, the evolution of aggregate trade flows can be evaluated by identifying and analysing the behaviour of a handful of big exporting firms. Also, given that bigger firms export more products to more destinations, understanding the performance of such firms will shed some light on the contribution of the extensive margin of trade to the observed increase in international trade in the last decades.[46] From a policy perspective, the existence of firm heterogeneity suggests that fixed costs of exporting and not only tariffs are important in a world where firms have different levels of productivity and face economies of scale in production. Finally, the prominence of the so-called "superstar" exporters in a world characterized by an increased role of international fragmentation of production highlights

the necessity to further analyse the decisions of such firms in terms of production location and involvement in supply chain activities.

The facts about current developments in trade presented in this section will be used as guidelines to understand and evaluate future trade scenarios, which is the focus of the next section.

3. Future economic and trade scenarios

This section will provide an overview of existing long-term projections of trade, explaining briefly how these are usually made (see Box B.5). We will then provide our own projections on the basis of several scenarios, both optimistic and pessimistic, illustrating key features of the changing landscape of trade.[47] The principal purpose of these simulations is not

Box B.5: How are long-term trade projections made?

Long-term projections of trade usually proceed in two steps: first, as the volume of trade depends on countries' GDPs (as amply demonstrated in the "gravity" literature), trajectories of economic growth must be developed. This is done using a macroeconomic model. Several approaches exist, allowing for more or less country detail. Based on the extensive literature on economic growth, models usually take into account "conditional convergence", i.e. the fact that countries with a relatively low GDP per capita grow faster, subject to country-specific structural factors and policies. Fontagné and Fouré (2013), on which the simulations in this report are based, employ three factors of production (labour, capital and energy) besides technological progress.[48]

Different studies may make varying assumptions about these fundamental economic factors, how they develop and how they are interrelated. Fontagné and Fouré (2013), for instance, determine the future size and composition of the labour force as a function of population growth, ageing, labour force participation, education and migration. Similarly, they allow for different degrees of international capital mobility, energy efficiency and total factor productivity improvements. By projecting each variable forward based on estimations of past behaviour, a reference scenario is developed for all of the countries/regions in the model, taking into account interlinkages with other relevant variables. For instance, a projection of educational convergence in the future depends on both this variable's past behaviour and its interdependence with future demographic developments.

By imposing overall "closure" rules, such as global savings being required to equal global investment, the theoretical macroeconomic framework ensures that country-level baseline projections are consistent with one another and result in a coherent set of growth projections for the world economy. A simulation then consists of introducing a "shock", i.e. a defined deviation of an individual variable from its baseline projection, in order to see what difference it makes in terms of economic outcomes compared with the baseline. Not all economic "shocks" affect developed and developing countries alike and most models, including in this report, allow for differentiated, more realistic scenarios depending on levels of development.

Secondly, future trade patterns need to be modelled. Countries differ in factor endowments, technology and the relative economic importance of individual sectors, and different sectors employ factors at different intensities. In addition, the product composition of demand changes at varying levels of income. As a consequence, countries will experience structural change in terms of consumption, production and trade. Factor re-allocations and demand patterns are influenced by prices in different markets, which ultimately all need to be in equilibrium. This is why, for this second step, a traditional Computable General Equilibrium (CGE) model of the world economy can usefully be employed.[49]

Depending on the extent to which the basket of goods and services consumed differs from what is produced locally, trade flows emerge, conditional on the evolution of trade costs. Ultimately, countries specialize in various goods and services sectors, taking advantage of their factor endowments, technology and proximity to demand. In the simulations presented in this report, different types of trade costs are considered, both geography- and policy-related. The former depend on the transportation sector and the evolution of fuel prices. As far as the latter are concerned, both trade "taxes" and other non-tariff measures, such as costs related to customs clearance and inspection of goods, as well as services barriers are considered.

necessarily to provide better projections than elsewhere in the literature, but to portray results in the way in which discussions are usually framed within the WTO context (country groups, main sectors) and to demonstrate the sensitivity of outcomes to key assumptions as far as both economic fundamentals and policy scenarios are concerned. The latter discussion will also feed into the in-depth examination of those factors that will fundamentally shape world trade in the long term, notably demographics, investment, technological progress, energy/natural resources, transport, institutions as well as trade policies and related policy measures, in the remainder of the Report.

(a) Overview of long-term projections

Simple extrapolations of current trends are a first, straightforward way of making predictions about the future development of key economic parameters. Although these techniques are capable of producing adequate forecasts for world trade and output, their predictive power diminishes over time and depends crucially on the nature of their underlying assumptions. Ease of computation adds to their appeal despite a lack of analytical rigour. At best, they provide plausible initial estimates of important economic aggregates, which can then serve as benchmarks for evaluating the output of more sophisticated approaches.

Figure B.24 shows simple projections of real (inflation-adjusted) GDP and real merchandise exports for developed and developing economies up to 2030 at 2005 prices and exchange rates. World GDP growth was estimated as the weighted average of actual and projected GDP growth rates for available countries using 2005 GDP values as weights. GDP forecasts for individual countries up to 2017 were obtained from a variety of sources, including the IMF, OECD and other public and private forecasters. Next, growth rates for 2018-30 were estimated either by an ordinary least squares regression or by taking average growth rates over the last few years of the series. Finally, growth rates for the world, individual countries and country groups were applied to the 2005 base year GDP values to calculate values and shares up to 2030 in 2005 US dollars.

This approach results in some questionably large estimates for GDP growth in certain developing countries, particularly fast-growing Asian economies such as China and India. This has the effect of inflating projected GDP values for these countries to the point where the sum of individual country values in 2030 was about 10 per cent larger than a simple projection of aggregate world GDP would indicate. This suggests that output growth in these economies is likely to proceed at a slower pace in the future than in recent years.[50] To account for this expected slowdown, estimates for China, India and others were scaled down on an ad hoc basis while still remaining well above the world average.

After these adjustments, Figure B.23 has the share of developed countries in world GDP falling to 61 per cent in 2030 from 71 per cent in 2010, and the share of developing economies rising to 39 per cent from 29 per cent over the same period. If this forecast is realized, the reduced share of developed economies will come mostly at the expense of the European Union and Japan, whose respective shares in world output will fall to 22 per cent and 6 per cent in 2030, from 28 per cent and 9 per cent in 2010. Meanwhile, the share of the United States should remain relatively stable throughout the forecast period at around 25 per cent, despite the falling share for developed countries overall. On the other hand, China's share in world GDP is projected to increase from 8 per cent to 15 per cent between 2010 and 2030, while its share in developing economies output rises from 26 per cent to 37 per cent.

World trade growth was estimated up to 2030 by applying an assumed income elasticity of 1.5 to world GDP growth in line with the elasticity estimate in Figure B.4. Exports of developed countries were assumed to grow at a continuous rate estimated by least squares regression, with remaining trade growth attributed to developing countries. China's rate of future export growth was simply equated to the average rate over the last few years. Once again, this produces an unrealistically large estimate of Chinese growth in the future due to recent high growth rates. If this rate is extrapolated to 2030, the value of China's exports at the end of the period is larger than a

Figure B.24: **Simple extrapolations of world real GDP and real exports, 2000-30** (billion 2005 US$)
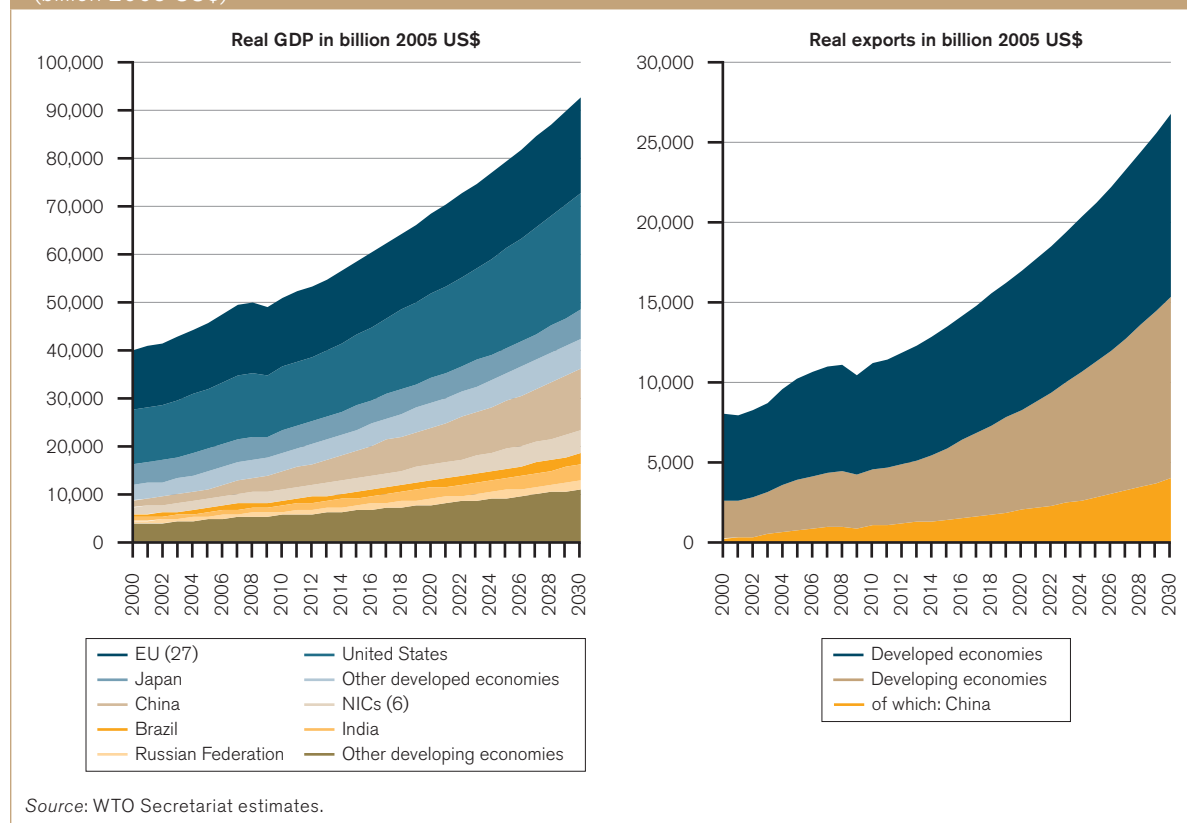
Source: WTO Secretariat estimates.

similarly extrapolated value for all developed economies taken together.

In line with the approach for GDP, we assumed that the rate of increase in Chinese exports will moderate in the future while remaining well above the world average. With this adjustment in place, we expect that developing economies will see their share in world exports rise from 41 per cent in 2010 to 57 per cent in 2030, while the share of developed economies drop from 59 per cent to 43 per cent. China's exports should increase as a percentage of both world exports (9 per cent to 15 per cent) and developing economies' exports (23 per cent to 27 per cent) over this time period.[51]

Figure B.24 paints a reasonably realistic picture of future trends in trade and output but the use of ad hoc assumptions based on informed judgement makes the results less generalizable. For more reliable estimates, theoretically grounded models are needed. As noted in Box B.5, for the task at hand it is useful to combine macroeconomic growth models with multi-sector, multi-regional models of trade.

(i) Macroeconomic projections

A number of institutions in recent years have employed macroeconomic models to make projections of long-term economic growth. Prominent examples include studies by the World Bank, the Asian Development Bank, OECD and CEPII (Centre d'Etudes Prospectives et d'Informations Internationales).[52] Not all of these studies are subsequently used to develop baseline macroeconomic projections for trade analysis in a Computable General Equilibrium (CGE) modelling framework. It is common to such macroeconomic models that assumptions need to be made on key growth determinants,[53] notably developments in the labour force and human capital, physical capital, natural resources (energy, land) as well as technological progress (here measured as "multi-factor productivity" or "total factor productivity"). Model outcomes may be sensitive to the precise assumptions made for each of these variables.

For example, OECD (2012c) assumes that countries will succeed in continuously improving access to education, which will have an overall positive influence on the size and composition of the labour force. Fontagné et al. (2012) and Fouré et al. (2010) of CEPII make a similar overall assumption but allow for differing speeds of convergence of educational attainment. Such variation often does not make it easy to compare the results of different studies and identify what drives a particular result. In particular, when one is interested in results at the country level, such differences can play an important role. However, as far as the overall economic trends and their driving forces are concerned, the main long-term macroeconomic projections broadly concur in their results.

In terms of economic outcomes, all of the studies reviewed find that differences in GDP per capita will narrow. For 2030, World Bank (2007) predicts growth in developed countries to remain at the long-term average of about 2 per cent, while growth in developing countries would accelerate from an average of 2.4 to 3.1 per cent. OECD (2012c) projects similar growth rates up until 2060 but it highlights that despite the "catching-up" process, today's rich countries would continue to lead in terms of GDP per capita.[54] However, the relative size of economies would change dramatically.

OECD (2012c) forecasts that OECD countries' share in global GDP would decline from currently two-thirds to about one-half in 2030 and to only about 44 per cent in 2060. Among the non-OECD countries, China's and India's share would increase substantially, with hardly any changes in the share of other non-OECD countries. China would expand its global share in GDP from 17 per cent in 2011 to 28 per cent in 2030 (where it would remain in 2060), while India would experience its major expansion after 2030, rising from currently 7 per cent to 11 per cent in 2030 and to 18 per cent in 2060.

As far as the drivers of economic growth are concerned, technological progress has by far the largest impact in these models. OECD (2012c), for instance, shows that productivity improvements account for more than two-thirds of average annual GDP growth for almost all of the countries considered and can explain much of the differences in growth rates among countries in the next 50 years. As emphasized by both OECD (2012c) and the Asian Development Bank (2011), the notable exception may be certain middle-income countries, which need to make the transition from a growth strategy based on a large pool of labour, capital accumulation or resource extraction towards TFP-driven growth in an attempt to ward off competition from low-income economies on the one hand and to take on advanced economies on the other. Oil producers are another exception, as their GDP largely depends on the price of energy.

Demographics also play an important role in the relative growth performance of economies, with countries such as India and South Africa benefiting from the so-called "demographic dividend" (see Section C.1 for an extensive discussion), while most advanced economies, as well as China, are likely to be weighed down by increased dependency ratios. Whether the former countries will be able to translate favourable demographics into labour force-driven growth performance will depend on a range of factors, most importantly the build-up of human capital and the participation of women in the workforce. For others, the age structure of society as well as migratory flows will be important considerations (Fouré et al., 2010; Asian Development Bank, 2011; OECD, 2012c).

Capital accumulation still remains an important factor for economic growth in many countries. With savings rates projected to decline almost everywhere (OECD, 2012c), capital mobility can play an important role in economic performance, particularly for certain developing regions (Fouré et al., 2010). In addition, capital formation drives the capital per worker ratio and hence the comparative advantage of countries – an important determinant of trade patterns in the long run.

At first sight (and somewhat surprisingly), energy price increases play a relatively minor role for economic growth prospects when ensuing improvements in energy productivity are considered on the basis of historical experience (Fouré et al., 2010). Such advances include enhanced substitution possibilities, technological progress in regard to new uses and behavioural adjustment to price developments. Similar progress will have to be made for other natural resources, for which prices are likely to increase, particularly in Asia, where consumption of primary goods will grow in line with further industrialization (Asian Development Bank, 2011).

Finally, some of these studies highlight the importance of macroeconomic policies, such as fiscal consolidation, for future growth prospects (OECD, 2012c; Asian Development Bank, 2011). OECD (2012c) also mentions improvements in product market regulation. When the focus is on trade outcomes, some of these policy assumptions and broader institutional issues are better introduced in the more detailed multi-sector, multi-region CGE framework, as will be further discussed below.

(ii) Global trade simulations

In order to move from macroeconomic projections to a more detailed analysis of future world trade flows, most studies use one of the leading global general equilibrium models that exist (Global Trade Analysis Project, Mirage, Linkage) but many confine themselves to an analysis of certain sectors or a focus on a particular region.[55]

World Bank (2007) was an early study featuring long-term predictions of trade for the time horizon considered in this report. The simulations were made in the context of the World Bank's Global Economic Prospects (GEP) Report (2007), which was devoted to the "next wave of globalization", and provided forecasts up to the year 2030. The authors of the study did not employ an explicit, independent macroeconomic growth model in a first step but directly imposed assumptions over TFP growth on the World Bank's standard multi-sectoral, multi-regional CGE model (Linkage). They also assumed an autonomous 1 per cent per year increase in energy efficiency for all regions and a 1 per cent yearly decrease in international trade costs.

The study finds that trade would continue to be more dynamic than GDP, with the level of exports more than tripling and the world economy increasing by a factor of two within the timeframe considered. This would be particularly true for developing countries, which would see their exports increase by a factor of four. These trade predictions assume no changes in policy. If universal reductions in applied protection on merchandise trade by three-quarters are added, exports by developing countries would increase by about another one-fifth.

Since then, interest in long-term trade analyses has picked up significantly, perhaps as a result of the economic crisis and perceptions of increased uncertainty. Petri and Zhai (2012) use the macroeconomic projections by the Asian Development Bank (2011) as a baseline in their own CGE model and, on this basis, analyse potential structural change and policy challenges faced by the Association of Southeast Asian Nations (ASEAN), China and India under different scenarios. As in World Bank (2007), the authors choose the year 2030 as their forecast horizon and, in the benchmark scenario, obtain similarly optimistic results for the countries examined. They find that incomes would quadruple and poverty would almost be eradicated. The region would also constitute one half of a new global middle class by the end of the forecast horizon. As far as trade is concerned, the strongest increase would take place among developing countries, reaching 36 per cent of global trade in 2030, with developed-developing country trade increasing slowly to 43 per cent of world trade and trade between developed countries falling sharply to only 21 per cent.

The authors then subject their CGE baseline projections to a number of potential "shocks" in key factors that could derail the economic outlook. They find adverse productivity shocks to be the most important factor affecting long-term economic prospects. Even if a deceleration in productivity were only to take hold in developed countries (not entirely unrealistic given the current subdued economic environment), the Asian economies examined would suffer. Another important assumption concerns advances in energy efficiency and conservation: if, unlike in the past, projected energy price increases were not matched by technological improvements, baseline economic growth prospects would be substantially reduced. On the positive side, an ambitious global trade agreement could more than compensate for most of the adverse shocks simulated, with the exception of technological slowdown in the developing countries.[56]

Anderson and Strutt (2012) also consider the year 2030, using the same macroeconomic forecast (Asian Development Bank, 2011) supplemented with projections from CEPII (Fouré et al., 2010) for countries not represented in the Asian Development

Bank sample. They also adjust developments in a number of key factors, such as labour force composition and growth, energy and land resources, using data from specialized publications. From this, they build a macroeconomic baseline projection for the Global Trade Analysis Project (GTAP) CGE model, perhaps the most widely used model for world- and economy-wide trade analysis. The bright outlook for developing countries (especially in Asia) in terms of growth in economic weight and convergence in per capita incomes is similar to Petri and Zhai (2012).

Anderson and Strutt (2012) then proceed to provide a more detailed analysis of predicted trade patterns at the country and sectoral levels. According to this study, the developing world would continue to see its manufacturing share in world exports increase from about 22 per cent in the base year (2004) to 38 per cent in 2030. As a function of their continued rapid industrialization, developing countries would import an increasing share of agriculture products, other primary products (more than quadrupling their initial share over the forecast horizon) and manufactured goods. These developments will lead to important shifts in bilateral trade patterns. In line with Petri and Zhai (2012), the share of South-South trade in total trade volumes is predicted to rise to 30 per cent, while trade among industrialized nations would fall drastically to just above one-quarter of global trade. The authors also provide additional directional details of future trade flows by constructing regional trade indices. The projections indicate a geographical dispersion of trade, with the current high intensity of intra-regional trade, particularly in Asia (see Section B.2(d)), declining and the propensity to trade with other regions becoming relatively more important.

Anderson and Strutt (2012) also implement a number of alternative scenarios in their CGE analysis. Considering the possibility of persistent subdued growth, currently an acute concern in developed economies, they show that the structural transformation of major developing countries towards non-primary sectors would be delayed. The authors also simulate various trade policy scenarios. Most notably, liberalization would further improve the South-South share in global trade. They note that other shaping factors of world trade, notably transport and communication costs, are held constant. If these were to continue their long-term decline, trade benefits should further increase. At the same time, the authors also acknowledge protectionist risks. They note, for example, that the projected increase in farm product imports, particularly by China and India, could be particularly sensitive to trade policy intervention.[57]

Finally, Fontagné et al. (2012) combine CEPII's macroeconomic model (MaGE) with its multi-sectoral dynamic CGE model of the world economy (Mirage). Their study, which considers a 2100 time horizon, is targeted mainly at evaluating policies related to environmental issues, notably CO_2 emissions that could feed into larger climate studies, rather than trade analysis. Because of the long time horizon, forecasts for certain exogenous variables require fairly keen assumptions. GDP developments are similar to other macroeconomic studies discussed above: developed countries' growth hovers around 2 per cent over the whole time horizon, while various emerging economies overtake each other in terms of growth dynamics. While initially, China's growth rates top all others, it is eventually overtaken by India which begins to grow faster after 2035. By 2100, the most dynamic region is Sub-Saharan Africa, maintaining 4 per cent annual growth on average, closely followed by Brazil which does not experience the same deceleration of growth dynamics as some of the other emerging economies.

The study presents trade results for the United States, Japan, the European Union and China. The main insight is that with certain exceptions, export specialization does not change that much. China would become a net machinery exporter and remain an important exporter of electronic devices while continuing to import primary commodities, increasingly also food and agricultural produce. Machinery export shares decline for all of the industrialized countries examined but for Japan other manufactured goods become more important exports, while the United States and the European Union increase their services exports. The United States also develops into a gas exporter.

Despite some common trends and broad insights that can be derived from these studies, no comprehensive picture emerges regarding economic activity and global trade patterns in the decades ahead, which is the focus of this report. We have therefore included a set of "tailor-made" simulations in the Report to develop consistent scenarios for the macroeconomic growth and CGE trade models at the global level until 2035. There are further advantages to conducting our own simulations, although these can hardly be said to be better or worse than existing approaches in the trade literature. In particular, assumptions can be spelt out in detail and the sensitivity of outcomes to various scenarios can be documented clearly.

Furthermore, the multitude of results can be aggregated and summarized by region and sector in the way in which discussions usually take place in the context of the WTO. The simulations presented here rely on the modelling approach introduced in Fouré et al. (2010) and Fontagné et al. (2012) but are adapted to the specific interest at hand.[58] To our knowledge, it is the only exercise conducted so far at this scale and time horizon, for which the macroeconomic baseline scenarios are fully traceable throughout the subsequent CGE simulations of trade, making the entire framework internally consistent.

(b) A simulation of the world economy over the next two decades

In order to envisage the range of possible global trade patterns in the decades ahead, it is imperative to include all the principal drivers of economic activity and international trade in the modelling framework. At the same time, the high degree of unpredictability of certain variables needs to be acknowledged. Energy prices, for instance, are not only a function of the economic laws of supply and demand but are strongly affected by geopolitical developments that are hard to predict at any level of confidence. The same is true for other factors, such as migratory flows, international capital mobility as well as technology transfer and innovation that are highly uncertain by nature and subject to developments beyond the scope of any economic model. Though less uncertain, projections regarding educational convergence must also be handled with caution. Therefore, while the simulations are undertaken in a theoretically rigorous and comprehensive modelling framework, we allow for uncertainty by developing two "extreme" trajectories for all key variables.

By combining simultaneously the "high" and "low" scenarios (depending on the expected GDP impact) respectively for each variable, we are able to develop an upper and lower boundary for our overall projections. Combining "shocks" on the down- and upsides also takes account of the fact that both adverse and positive developments tend to cluster. Most notably, it has been shown time and again that periods of economic crisis tend to go hand in hand with protectionist tendencies and vice versa. Hence, while none of these extreme trajectories may represent the most plausible scenario for the future, which is

likely to fall somewhere in between, these bands highlight risks and opportunities, setting out a range of possible tracks the world economy and trade can take in the future. Box B.6 provides an overview and short description of the scenarios chosen for each key driver of economic growth and international trade.[59]

(i) Economic growth trajectories

Table B.15 shows the projected average annual growth rates for major countries and regions in the macroeconomic model along with the GDP levels in constant dollars to be attained by 2035, which are implied by these GDP growth rates. It also shows the respective shares in global GDP. The combined effects of the "high" and "low" scenarios for all main drivers can be read from the table as a deviation from the reference scenario. Figure B.25 visually portrays these growth trajectories.

It can be seen that China is projected to overtake the United States and the European Union in terms of economic size at the latest by 2030 in the "high" scenario. The economic development of India is projected to only take off under the "high" scenario, in which case it would reach China's "low" scenario level. Similarly, for Sub-Saharan Africa, attaining the "high" scenario makes a substantial difference: rather than virtually stagnating, it could overtake Brazil in terms of economic importance even before 2030.

Overall, the level of uncertainty, as implied by the variation between high and low trajectories, is quite substantial. Whether the growth path ultimately realized is closer to one or the other "boundary" could make a big difference, particularly for developing

Figure B.25: **Simulation of GDP under two different scenarios (high, low), 2000-35** (billion 2005 US$)

Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).
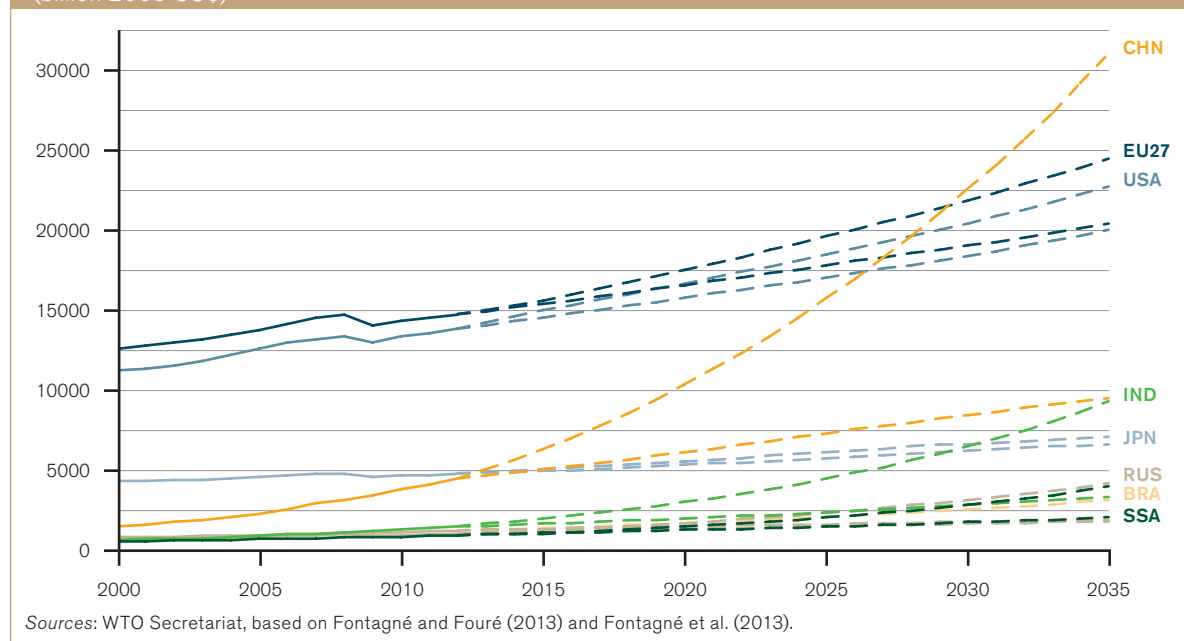
Box B.6: Overview of simulation scenarios

The table below shows the "boundary" scenarios that have been implemented in our simulation exercise to account for the uncertainty surrounding our baseline projection and to illustrate the sensitivity of economic and trade outcomes to the assumptions over potential developments in key shaping factors. The table shows the two scenarios that have been implemented for each main "driver":[60]

		Low	High
Labour			
	Demography	Reference case in high-income countries, low fertility in other (UNDP)	Reference case in high-income countries, high fertility in other (UNDP)
	Education convergence	1.5 half-life time	0.5 half-life time
	Female participation	No improvements	Reference case
	Migration	Reference case	Additional migration from SSA and MENA to EU and from SAM to US
Capital			
	Capital mobility	Convergence to I=S in 2050	Low Feldstein-Horioka correlation coefficient (as in non-OECD) for all countries
Natural resources			
	Energy price	High price scenario (EIA)	Low price scenario (EIA)
	Energy productivity	+50% high income in 2050, reference case in other	+50% low and mid income in 2050, reference case in other
Technology			
	Total Factor Productivity	-50% TFP growth rate for low- and mid-income countries, -25% for high-income	+50% TFP growth rate for low- and mid-income countries, +25% for high-income
Trade costs			
	Tariffs	"Trade war": Return to pre-Uruguay Round applied tariffs	"Trade opening": -50% in applied tariffs
	Other transaction costs on goods	+50% dgcs, +20% ddcs	-50% dgcs, -20% ddcs
	Services barriers	No change	"Trade opening": -50% in services barriers

Notes: Trade costs only vary in the trade scenarios.

"Reference case" means that a variable is projected forward on the basis of its estimated behaviour in the past, taking into account also interlinkages with other relevant variables. This is done for all countries in the model individually and may imply an improvement or deterioration depending on the estimated behaviour for the country in question. At the global level, in the reference case, Mirage is set to reproduce a conservative elasticity of world trade to income observed in the long run (with the exception of the 1990s, characterized by the expansion of global value chains and the surge of new big traders).

Regarding educational convergence, half-life time is the time a country will take to reduce its difference with the initial position of the leader by half. Here, the leader is a virtual country composed of the leaders for each age group, level of education and time period.

The Feldstein-Horioka correlation coefficient is named after two economists observing a high correlation between domestic savings and investment rates, which contradicts a presumption of perfect capital mobility, with investment taking place where the highest return can be achieved. A lower Feldstein-Horioka correlation coefficient in OECD countries here means that the correlation between domestic savings and domestic investment is assumed to be lower, as in non-OECD countries. This impacts the allocation of investment between countries, which is reduced in the former and increased in the latter.

countries, whose average annual growth rate over the forecast period may vary by as much as 2 per cent, resulting in about one-third lower or 50 per cent higher per capita incomes by 2035. For certain countries, such as China or India, the divergence of different growth paths is even larger and much will depend on how some of the main driving factors develop and may be shaped by policy.

Given the breadth of possible outcomes, it is useful to vary one "shaping factor" at a time to isolate its individual importance for deviations from the projected growth path. As in previous studies, technological progress has by far the largest impact. For developed countries, our scenarios imply barely one half of a per cent more or less growth per year, amounting to

around 9 per cent higher/lower GDP levels in 2035. Conversely, for developing countries, continued improvements in technological progress make a big difference, ranging from about plus/minus 1 per cent growth impact per annum for Brazil to over 2 per cent for China. As a result, projected GDP levels in 2035 would be about 20 per cent larger/smaller in Brazil and vary by more than 55 per cent in China.

For developing countries overall, adding/shaving off about 1.5 per cent GDP growth per annum through continued/slowed down technological progress leads to a variation of about 30 to 40 per cent in GDP by 2035. Given the heightened importance of technological progress for developing countries, in order to catch up with the developed world, the

Table B.15: Projected annual average GDP growth rates and GDP levels by 2035, by country and region
(annual percentage change, 2005 US$ billion and percentage)

	GDP growth			GDP in 2035			Share of world GDP		
	Ref	Low	High	Ref	Low	High	Ref	Low	High
United States	1.74	-0.12	0.44	20562	-2.75	10.49	20.3	2.99	-3.40
Japan	1.53	-0.12	0.20	6749	-2.63	4.53	6.7	0.99	-1.42
European Union	1.43	-0.02	0.80	20458	-0.37	19.81	20.2	3.55	-1.97
Brazil	2.97	-1.01	1.31	2299	-20.31	33.78	2.3	-0.14	0.02
Russian Federation	4.13	-1.51	2.34	2481	-28.55	66.66	2.5	-0.38	0.63
India	5.96	-2.33	2.48	5450	-40.10	70.23	5.4	-1.58	1.52
China	6.07	-2.70	2.76	17217	-44.79	80.48	17.0	-5.93	6.12
Latin America	3.34	-0.79	0.76	4674	-16.22	18.38	4.6	-0.05	-0.50
MENA	3.47	-0.57	0.79	5440	-11.86	19.05	5.4	0.21	-0.55
SSA	5.09	-1.43	1.68	2727	-27.04	43.99	2.7	-0.37	0.23
Rest of Asia	3.98	-0.91	1.37	7154	-18.24	35.05	7.1	-0.25	0.12
Rest of the World	2.69	-0.07	0.63	6039	-1.61	14.99	6.0	0.96	-0.80
Total World	2.84	-0.74	1.27	101251	-15.24	32.73	100.0	-	-
Total Developed	1.64	-0.04	0.52	52842	-0.95	12.57	52.2	8.80	-7.93
Total Developing	4.72	-1.67	2.01	48409	-30.84	54.73	47.8	-8.80	7.93

Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).

"deceleration" scenario would imply about 6 per cent higher shares in global GDP (albeit at lower overall levels) for developed countries and vice versa.[61] Section C.3 discusses in more detail what determines the rate of technological innovation and catch-up.

Another important factor shaping future economic outcomes is demography. Population growth/decline has a significant impact on the labour pool in certain developing countries, most notably in India, Sub-Saharan Africa and China.[62] Under any of our scenarios, Sub-Saharan Africa's active population is predicted to overtake China's by 2045 at the latest, and possibly several years earlier. Without further improvements in education, the demographic effect on GDP is comparatively small under our scenarios, increasing or decreasing GDP in 2035 by about 1 per cent in the countries mentioned above.

If the gap in educational attainment between rich and poor countries can be narrowed faster than what has hitherto been the case, developing countries in the Middle East and North Africa, Sub-Saharan Africa and Latin America as well as India can increase their GDP by about 3 per cent in 2035. Increased female participation in education is crucial in many countries, particularly India and the Middle East and North Africa, where a lack of action in this regard would be associated with a 4 per cent lower level of GDP.

In many developed countries, the extent of migration has by far the largest economic impact among demographic factors, as it changes not only the size and composition of the labour force but, in light of ageing societies, also plays a major role for consumption/savings behaviour. If the number of migrants into the North from regions such as the

Middle East and North Africa, as well as Sub-Saharan Africa for the European Union and South America for the United States, were to increase by around 1 million per year and region, GDP in destination countries would rise more than overall population size, increasing GDP per capita by about 2 per cent in 2035. The complex inter-relationship between different demographic developments and economic outcomes is further explored in Section C.1.

Besides demography and human capital, physical capital accumulation continues to be an important factor for future growth. While demography and domestic savings play an important role, the extent to which the most productive investment opportunities can be financed strongly depends also on international capital mobility. A scenario of increased capital mobility that would set free flows from developed countries currently invested at home (given the observed domestic bias of investment behaviour rather than exclusive focus on return on capital) would benefit strongly the vast majority of developing countries, adding up to one-third of a per cent to annual growth. This would add 8 per cent to GDP in the Russian Federation in 2035, over 6 per cent in India and China and more than 4 per cent in Brazil, Sub-Saharan Africa and the developing world overall.

Conversely, under a low capital mobility scenario, only surplus developing countries (principally the Russian Federation, India and China) could avert a negative impact on growth rates, with Brazil losing almost 4 per cent in GDP by 2035 and Sub-Saharan Africa being 1 per cent worse off. The present model does not allow for a more profound analysis of the relationship between savings, investment opportunities, sources of financing, capital accumulation and their respective

determinants, including institutional parameters. This is undertaken more extensively in Section C.2.

Finally, natural resources are an important input into production, and their availability and pricing may influence growth opportunities differently for different countries. In the simulations, the focus is on energy as a pervasive input to almost all economic activities but other natural resources, such as land, are also accounted for and can be simulated, for instance via changes in agricultural productivity.

If the high/low energy price scenarios, as developed by the US Energy Information Administration (EIA) for 2035, are looked at in isolation, their GDP impact can be quite substantial, particularly in developing countries, affecting average annual GDP growth by up to a fifth of a per cent, for instance in China and India. High-energy prices can thus cost up to almost 4 per cent of GDP in 2035 in these countries. The opposite is true for main exporters, such as the Russian Federation, parts of Latin America (Bolivarian Republic of Venezuela, Colombia and Mexico) and in particular the Middle East and North Africa, where lower prices could reduce annual growth by over one-third of a per cent, leading to a more than 7 per cent lower GDP in 2035.

However, historically improvements in energy productivity in both production and consumption have practically nullified these effects. If further reductions in energy intensity (via improved productivity and substitution) are considered, developed countries remain basically unaffected even by a high price scenario, while affected developing countries can prevent a major drag on economic growth, with India and China offsetting about 40 per cent of the price impact on economic growth. Whether or not technological progress in regard to energy (and other natural resources) production and consumption is likely to continue in the future, averting durable negative economic consequences of higher prices, as has happened in the past, along with the principal factors determining such advances will be further discussed in Section C.4.

(ii)   Combined macroeconomic and trade scenarios

We now turn to prospective trade developments using the two macroeconomic projections as a basis for constructing a high/low growth economic environment in which optimistic and pessimistic trade cost scenarios will be simulated. This will allow us to see under what conditions some of the main trends in trade identified in Section B.2 are likely to continue or change.[63]

As noted in the overview in Box B.6, we consider trade policies, such as tariffs and services barriers, as well as broader transaction costs affecting goods (e.g. related to institutions, shipping charges and formalities). Again, rather stark trade cost scenarios have been chosen in order to create a reasonably

broad range of trade outcomes so as to illustrate opportunities and threats for policy-makers. At the same time, these trade cost scenarios are necessarily simplistic and do not allow for any substantive analysis of the types of trade costs related to transportation, the institutional framework and specific policies.

The issue of transportation costs and its determinants is therefore taken up in detail in Section C.5, while Section C.6 deals with the relationship between trade and trade policy and the wider institutional framework.[64] It would be futile, of course, to seek to predict specific trade policies in the absence of any analysis of the possible reasons that may motivate policy-makers to enact such measures. As policies affecting trade may be taken in response to political economy and other societal concerns, Section D will address a range of prominent issues in the wider socio-economic context that are high on the political agenda and, therefore, likely to determine whether there will be more or less trade opening in the future.[65]

Figure B.26 summarizes our combined macroeconomic and trade simulations in terms of projected average annual growth rates of GDP and exports up to 2035. It shows that exports are likely to be much more volatile than GDP, growing more than GDP in the "optimistic" scenario and shrinking further than GDP in the "pessimistic" scenario, as witnessed already in the recent financial crisis. The variation is much greater for developing than for developed countries, which have a lot more to gain from a strong economic and open trade environment in the future and more to lose in a pessimistic protectionist scenario.

In fact, while developing countries largely outpace developed countries in terms of both GDP and exports in the optimistic scenario, their export growth falls behind developed countries' growth rate in a gloomy economic and trade environment. Also, developed

Figure B.26: **Predicted annual growth rates of exports and GDP, average 2012-2035, by country group** (per cent)

Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).
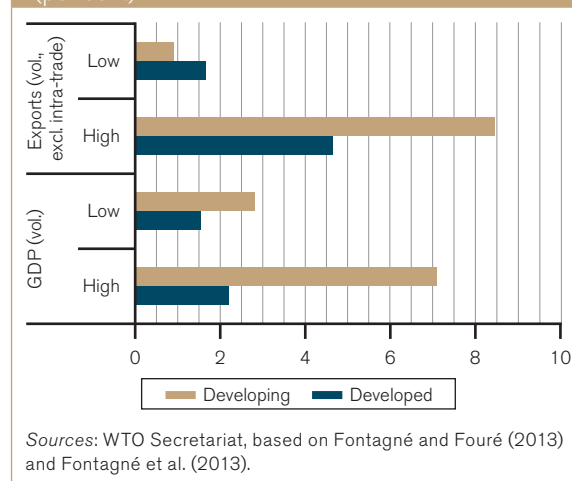
countries' growth rates of both GDP and exports are affected to a comparatively minor level by potential changes in trade costs, while these play a much more important economic role for developing countries, which can gain/lose almost half a percentage point of average annual growth in an open/restrictive trade environment.

Will the rise of new players in global trade continue?

Figures B.27 and B.28 show to what extent regional/country shares in global GDP and exports may change compared with the current situation. The pie charts are proportional to the respective total value (taking the "high" scenario for 2035 as a point of reference). Clearly, the trend of new players emerging in global trade, identified in Section B.2(a), is likely to continue if the world can sustain high growth and a more open trade environment.

Under the "high" scenario, China could increase its export share to almost one-quarter of global trade, while India could more than double its share, to 5 per cent. Although the shares of major developed countries would decline, the absolute values of both their exports and GDP would continue to increase.

Conversely, despite their substantially larger shares in a low-growth, high trade cost scenario in 2035, developed countries would be worse off in absolute terms in regards to both their GDP and exports compared with the "high" scenario, given the overall much larger "size of the pie" in the latter. China would be particularly affected in a world of decelerating growth and confrontational trade policy, losing not only in terms of export market share but also absolute export value compared with the present day.

Will services trade become more and more important, and will developing countries continue to expand their share of trade in manufactures and services?

Figure B.29 confirms the probable continuation of another trend identified above, namely the changing sectoral composition of trade (see Section B.2(b)). In fact, the trend towards an increased importance of services trade is apparent in both the "high" and "low" scenarios. While the latter may be strongly influenced by possible negative trade policy developments in the area of goods, the former scenario assumes symmetric improvements in reducing barriers for both goods and services trade (plus a further

Figure B.27: **Country/regional shares in global GDP, constant 2004 prices** (percentage)

2012
Total: US$ 49,992 billion

Low 2035
Total: US$ 77,758 billion

High 2035
Total: US$ 129,617 billion

Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).

Note: RoW: Rest of the World; RoLAC: Rest of Latin America and the Caribbean; RoAfr: Rest of Africa; ASEAN: Association of Southeast Asian Nations; AUNZ: Australia New Zealand; EFTA: European Free Trade Association; MENA: Middle East and North Africa.

Figure B.28: **Country/regional shares in global exports (excluding intra-trade), constant 2004 prices** (percentage)

2012
Total: US$ 9,838 billion

Rest of World

Brazil, 1%
Japan, 7%
United States, 16%
EU (27), 19%
RoW, 22%
Mexico, 9%
EFTA, 10%
SouthAfr, 3%
RoEurope, 4%
RoLAC, 10%
RoAfr, 6%
Canada, 15%
Korea, Rep. of,15%
AUNZ, 6%
MENA, 6%
ASEAN, 7%
China, 15%
India, 2%
Russian Federation, 2%
RoW

Low 2035
Total: US$ 13,163 billion

Rest of World

Japan, 7%
EU (27), 19%
United States, 18%
RoW, 21%
Mexico, 8%
EFTA, 8%
SouthAfr, 3%
RoEurope, 4%
RoLAC, 8%
RoAfr, 6%
Canada, 18%
Korea, Rep. of, 17%
AUNZ, 7%
MENA, 6%
ASEAN, 6%
China, 11%
India, 3%
Russian Federation, 2%
Brazil, 1%
RoW

High 2035
Total: US$ 46,094 billion

Rest of World

EU (27), 12%
United States, 10%
Japan, 4%
Mexico, 7%
EFTA, 4%
RoW, 28%
RoEurope, 9%
RoLAC, 8%
SouthAfr, 3%
AUNZ, 4%
RoAfr, 14%
Canada, 8%
Korea, Rep. of, 15%
Brazil, 1%
Russian Federation, 3%
India, 5%
China, 24%
ASEAN, 8%
MENA, 9%
RoW
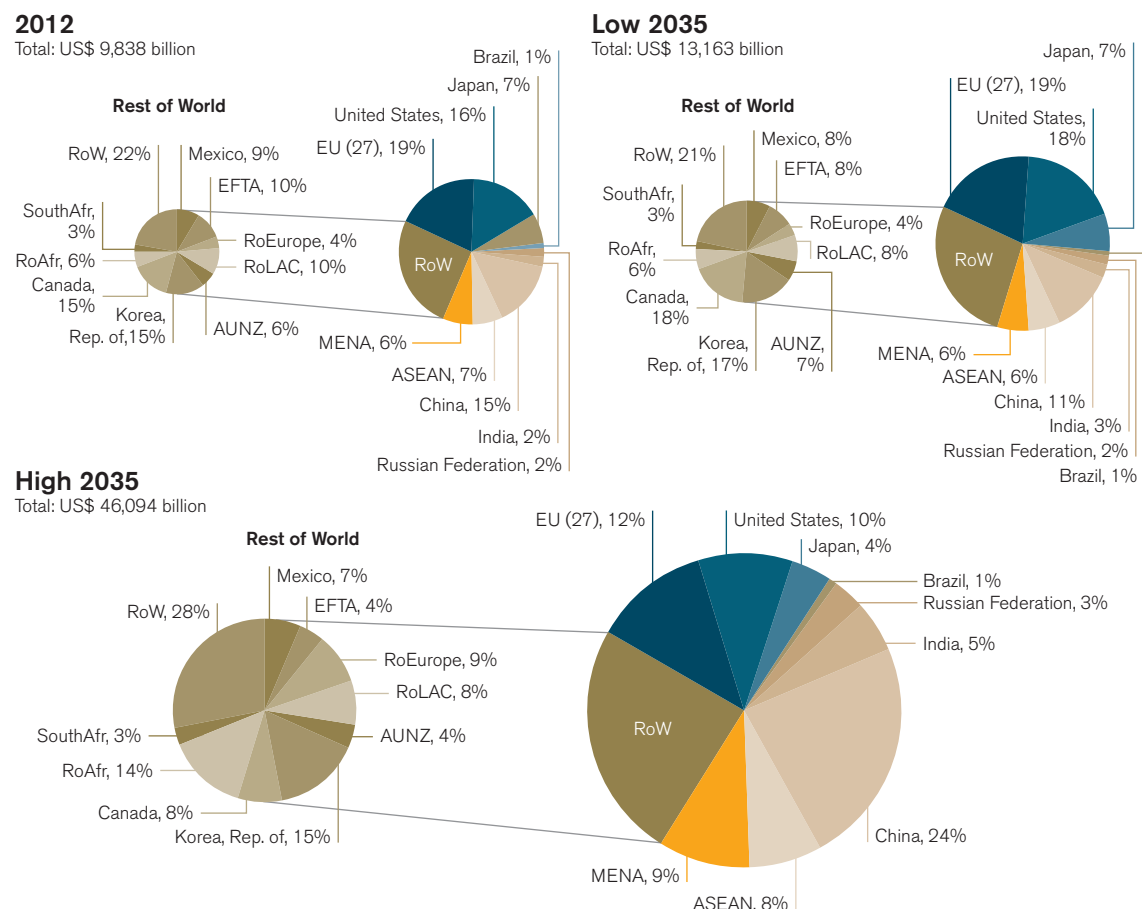
Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).

Note: RoW: Rest of the World; RoLAC: Rest of Latin America and the Caribbean; RoAfr: Rest of Africa; ASEAN: Association of Southeast Asian Nations; AUNZ: Australia New Zealand; EFTA: European Free Trade Association; MENA: Middle East and North Africa.

lowering of transaction costs affecting goods). Despite this, the changing economic environment will lead to relatively more services trade, increasing its absolute value by more than five times in 2035.

Despite a slightly lower share under the "high" scenario, manufacturing will continue to dominate international trade, accounting for over two-thirds of global exports and increasing by a factor of almost 4.5 in volume by 2035. Trade in agriculture continues to account for a minor share of global trade under any scenario.

Figures B.30 and B.31 show the predicted regional/ country shares in the export of manufactures and services respectively under the different scenarios. Overall, developing countries can improve their market shares for services exports, in particular China, under the high scenario. The same is true for exports of manufactured goods but only if the economic and trade policy outlook is bright, in which case China would approach the 30 per cent mark.

If the economic climate worsens and countries do not maintain their trade commitments, exports of manufactured goods would barely grow in the next two

decades, with China and other developing countries losing market share. Despite the European Union and the United States achieving a higher market share of exports of manufactured goods in such a gloomy environment, they would lose in absolute terms, given the dramatic shrinkage of the "overall export pie" to just over one-quarter compared with a scenario of further dynamic growth and integration.

Will developing countries continue to trade more with each other?

As far as the direction of trade is concerned, Figure B.32 shows an almost unchanged share in "North-South" trade, i.e. trade between developed and developing countries, over the next few decades under all scenarios. In fact, the structure of trade among and within country groups would barely change under the "low" scenario, with North-North remaining the vastly dominant direction of trade at over 40 per cent and South-South trade retreating slightly to just 18 per cent.

By contrast, under the "optimistic" scenario, these positions are inverted. Trade among developing countries would represent the largest part in global

Figure B.29: **Sectoral shares in global exports (excluding intra-trade), constant 2004 prices** (percentage)

2012
Total: US$ 9,838 billion

Services, 17%
Agriculture, 2%
Energy, 10%
Manufactures, 71%

High 2035
Total: US$ 46,094 billion

Services, 19%
Agriculture, 3%
Energy, 10%
Manufactures, 68%

Low 2035
Total: US$ 13,163 billion

Services, 24%
Agriculture, 3%
Energy, 8%
Manufactures, 65%
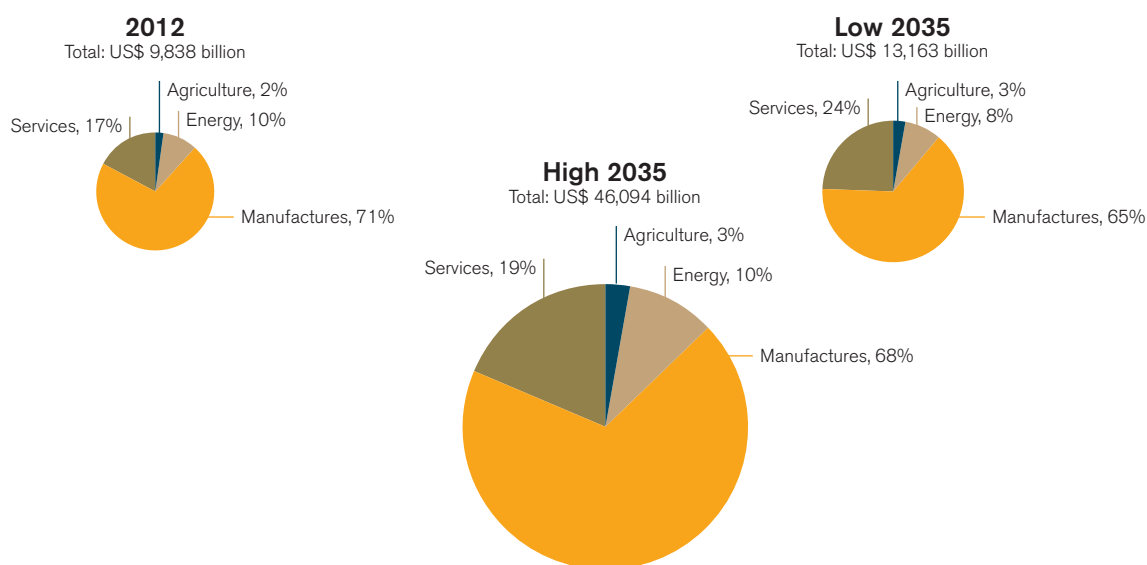
Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).

Figure B.30: **Country/regional shares in global exports of manufactures (excluding intra-trade), constant 2004 prices** (percentage)
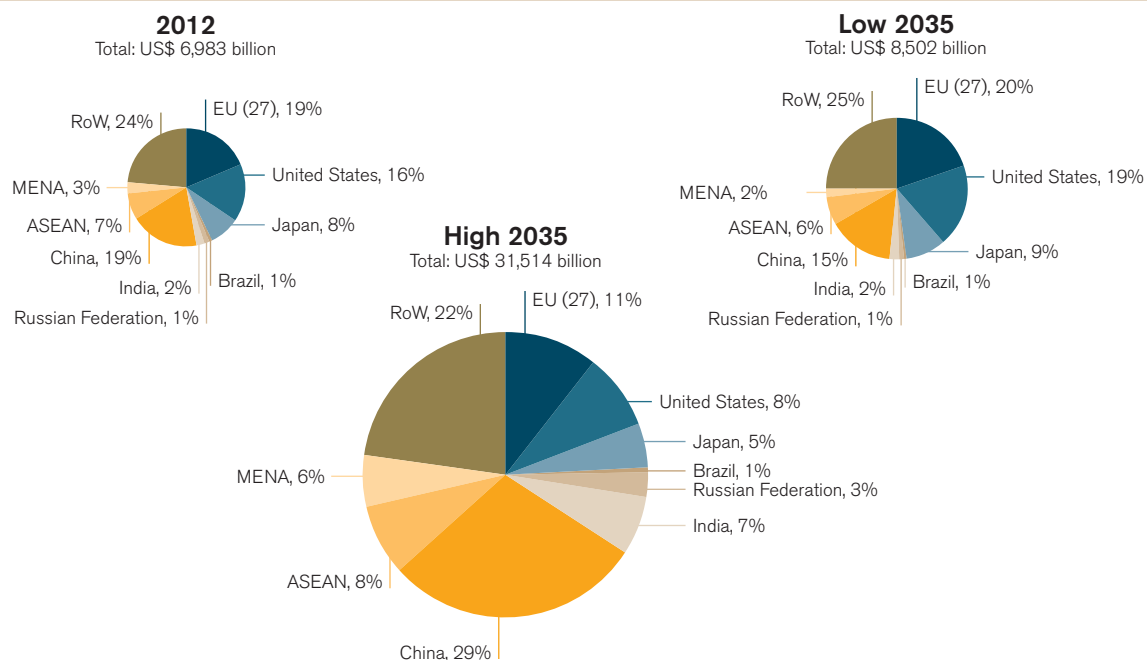
2012
Total: US$ 6,983 billion

RoW, 24%
EU (27), 19%
United States, 16%
MENA, 3%
Japan, 8%
ASEAN, 7%
China, 19%
Brazil, 1%
India, 2%
Russian Federation, 1%

High 2035
Total: US$ 31,514 billion

RoW, 22%
EU (27), 11%
United States, 8%
Japan, 5%
Brazil, 1%
Russian Federation, 3%
India, 7%
MENA, 6%
ASEAN, 8%
China, 29%

Low 2035
Total: US$ 8,502 billion

RoW, 25%
EU (27), 20%
United States, 19%
MENA, 2%
Japan, 9%
ASEAN, 6%
China, 15%
Brazil, 1%
India, 2%
Russian Federation, 1%

Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).
Note: MENA: Middle East and North Africa; RoW: Rest of the World.

trade at 43 per cent while trade among developed countries would constitute just 17 per cent. However, this is still 25 per cent larger than under the "low" scenario in value terms. These results would be in line with the trend of greater trade between developing countries identified in Section B.2(a). They would also broadly confirm the increased relevance of intra-industry trade and the similarity of countries' export baskets noted in Sections B.2(b) and B.2(c).

Will trade become more regionalized or globalized?

Section B.2(d) identified a trend towards further regionalization, particularly in Asia. The model simulations up to 2035 do not, however, necessarily reflect this. In fact, under an "optimistic" outlook quite the contrary seems to be the case. Trade within the major regional blocs is predicted to decline substantially compared with multilateral trade relationships

Figure B.31: **Country/regional shares in global exports of services (excluding intra-trade), constant 2004 prices** (percentage)
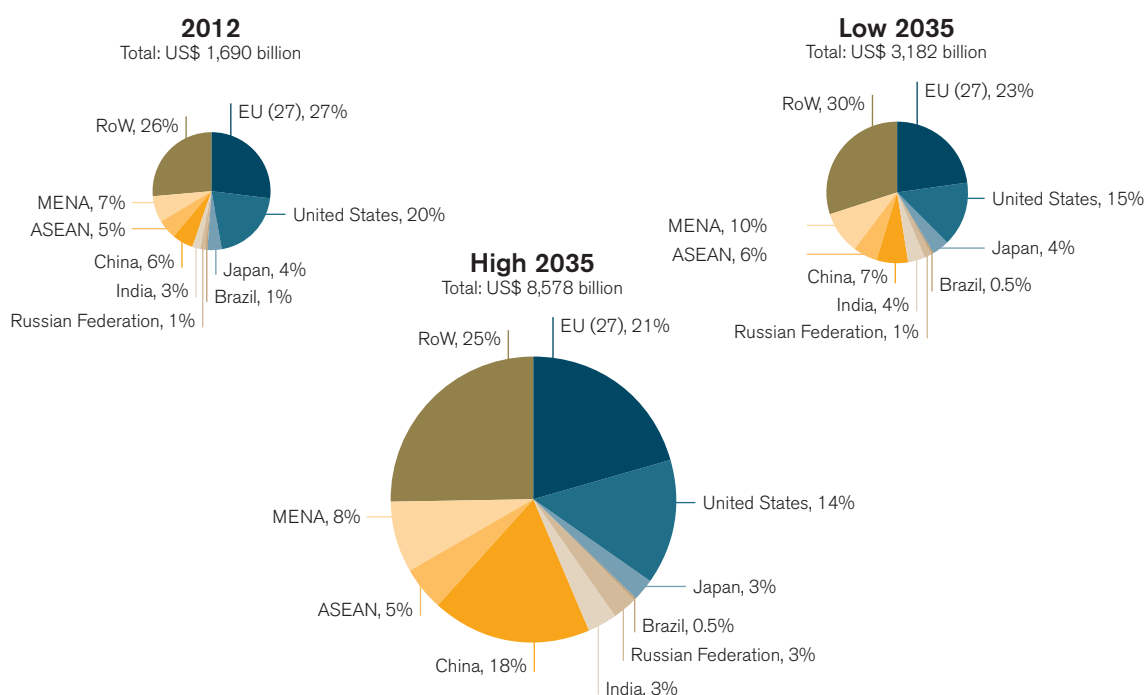
2012
Total: US$ 1,690 billion

RoW, 26%
EU (27), 27%
MENA, 7%
ASEAN, 5%
United States, 20%
China, 6%
Japan, 4%
India, 3%
Brazil, 1%
Russian Federation, 1%

Low 2035
Total: US$ 3,182 billion

RoW, 30%
EU (27), 23%
MENA, 10%
United States, 15%
ASEAN, 6%
Japan, 4%
China, 7%
Brazil, 0.5%
India, 4%
Russian Federation, 1%

High 2035
Total: US$ 8,578 billion

RoW, 25%
EU (27), 21%
MENA, 8%
United States, 14%
ASEAN, 5%
Japan, 3%
China, 18%
Brazil, 0.5%
Russian Federation, 3%
India, 3%

Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).

Note: MENA: Middle East and North Africa; RoW: Rest of the World.

Figure B.32: **Bilateral trade shares (including intra-trade), constant 2004 prices, by country group** (percentage)

2012
Total: US$ 12,944 billion

Dvd-Dvd, 40%
Dvg-Dvd, 22%
Dvg-Dvg, 19%
Dvd-Dvg, 19%

Low 2035
Total: US$ 17,587 billion

Dvd-Dvd, 41%
Dvg-Dvd, 20%
Dvg-Dvg, 18%
Dvd-Dvg, 21%

High 2035
Total: US$ 52,713 billion

Dvd-Dvd, 17%
Dvg-Dvd, 22%
Dvd-Dvg, 18%
Dvg-Dvg, 43%
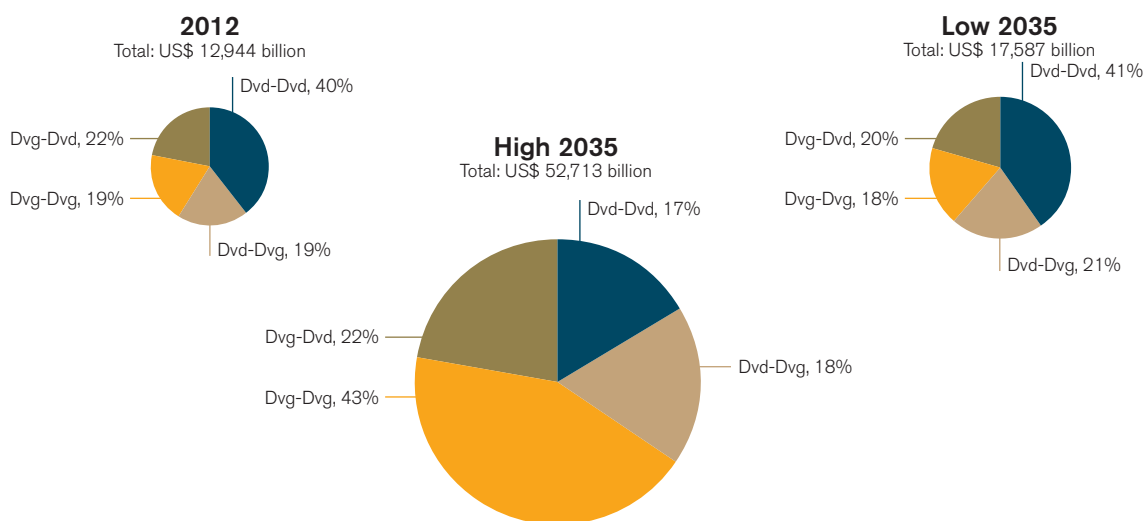
Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).

Note: Dvd: developed; Dvg: developing.

(see Figure B.33). Trade within the European Union would experience the largest decline, from 21 per cent of global trade volumes to just 8 per cent, and the North American Free Trade Agreement (NAFTA) would see its share more than halved. Conversely, trade with other regions would increase from 70 per cent to over 85 per cent of world trade, indicating the importance of further multilateral integration.

In a nutshell, the discussion in this section has shown that not all of the trends in trade presently observed will necessarily continue. The scenarios chosen here chart possible boundaries for a vast range of future trade developments. More is at stake for some countries than for others. For instance, China and India's share of world exports would increase significantly in a future scenario of high sustained growth dynamics and a more open

Figure B.33: **Intra- and extra-regional shares in global trade (including intra-trade), constant 2004 prices, by agreement** (percentage)

2012
Total: US$ 12,944 billion

MERCOSUR, 1%
ASEAN, 1%
Other, 70%
EU, 21%
NAFTA, 7%

High 2035
Total: US$ 52,713 billion

ASEAN, 2%
MERCOSUR, 1%
Other, 86%
EU, 8%
NAFTA, 3%

Low 2035
Total: US$ 17,587 billion

ASEAN, 2%
MERCOSUR, 1%
Other, 68%
EU, 21%
NAFTA, 8%

Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).
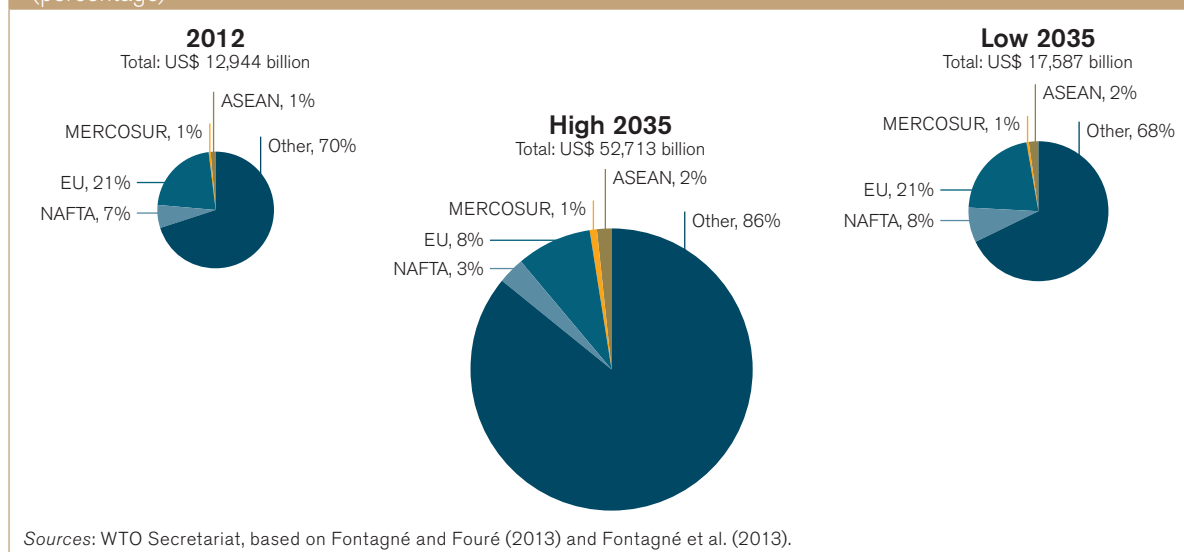
trade environment. In a world of decelerating growth dynamics and confrontational trade policy, however, India's share would increase only very modestly and China's share would decline. Similarly, for world manufactures exports, China and other developing economies would lose market share if the economic climate worsens and countries fall back on their trade commitments. Furthermore, the share of South-South trade would decline slightly in the "pessimistic" future scenario, but would more than double – constituting almost half of world trade – in the "optimistic" outlook. Outcomes will not only depend on trade policy and wider trade transaction costs but will be influenced by a range of other factors shaping the future of world trade. It will be critical to understand what drives these factors as this may give rise to policy action at both the domestic and international level in a number of areas, including at the WTO.

4. Conclusions

The industrial revolution was the main driving force for the development of the modern world trading system: significant technological advances in transportation and communication together with population and investment growth were responsible for the sustained increase of international trade during the 19th and 20th centuries. Trade liberalization had a limited role in the expansion of international trade during the first wave of globalization. After the Great Depression and the Second World War, however, political and economic cooperation across countries aimed at reducing trade barriers played a key role in maintaining the continuous growth of trade during the second wave of globalization.

This section has presented a series of facts related to the current state of international trade and highlighted the main theories that have been developed to explain

such patterns. First, WTO data show a dramatic increase in both the volumes and values of trade between 1980 and 2011, with most of this growth attributable to increased shipments of manufactured goods. However, when trade is measured in value-added terms, services play a larger role. In the last three decades world trade grew much faster than GDP. This can be explained to some extent by the increasing prominence of international supply chains in the global economy. At the product level, trade growth during this period was mostly due to changes in the intensive margin of trade (i.e. more or less trade in existing categories of goods) although the extensive margin of trade (i.e. trade in new products) also made an important contribution.

Secondly, in recent years new protagonists have emerged in the global market. The shares of trade, both in terms of manufactured goods and services, of developing countries such as China, India, the Republic of Korea and Thailand have significantly risen over time. China, in particular, has become the largest exporter in the world. In contrast, developed countries such as the United States and Japan recorded declines in their shares in world exports between 1980 and 2011. Natural resource-exporting countries and regions saw their shares in world trade rise and fall in in line with primary commodity prices, which are currently high but were weak in the late 1990s and early 2000s. As a result, despite recent gains, the share of Africa in world exports was roughly the same in 2011 as it was in 1990. Brazil falls into two categories, being a major exporter of both primary products and manufactured goods. Although the country has raised its shares in world exports and imports since 1980, its ranking for both exports and imports is relatively unchanged.

Thirdly, both developing and developed countries have become less specialized in exporting particular

products. In other words, their exports have become more diversified. Countries that have experienced a higher concentration of exports are in many cases natural resource-rich economies.

Fourthly, trade has become more regionalized in most parts of the developing world but this trend is most pronounced in Asia. In contrast, industrialized regions have seen their intra-regional trade shares either stagnate (Europe) or decline (North America) in recent years. Both of these developments may be related to the rise of China in world trade, since its ever growing share of world trade would tend to boost intra-regional trade in Asia and trade with other regions. Trade is mainly driven by a few big trading firms across countries, and the dominant performance of global firms emphasizes the importance of these "superstar" exporters in shaping trade patterns.

Finally, the increasing fragmentation of production within and across countries brings into question the traditional measures of trade flows and calls for a new system of measurement to identify where value-added is accumulated. Measuring trade in value-added terms provides a more accurate picture of the relationship between trade and economic activity.

For future trade patterns, simulations of the world economy and trade over the coming decades produce a number of insights. The rise of developing countries – some more than others – is bound to continue. Increasingly, these countries will trade with each other. Developing countries have a lot more to gain from a dynamic economic and open trade environment than developed countries and they have more to lose from a gloomy, confrontational scenario. Services will play a more important role in world trade for practically everyone. Despite the regionalization of trade being a current trend, multilateral trade relationships are unlikely to lose their importance and have the potential to increase significantly.

The predictions for future trade highlight how sensitive the results are to the underlying assumptions and justify further analysis of the main determinants of trade and economic growth: demographics, investment, technological progress, energy/natural resources, transport and institutions. The remainder of the Report is therefore devoted to an in-depth analysis of these fundamental economic factors within a broader socio-economic context and the implications that these may entail for trade policy.

Endnotes

1   Although the luxury imports of the previous centuries – sugar, tea, coffee and tobacco – had become staples in the diets of the new urban working and middle classes, their importance in European imports had shrunk relative to other commodities, notably wheat and flour, butter and vegetable oils, and meat by the end of the 19th century, which accounted for the bulk of the developing world's surging exports.

2   Not only did railways and steamships mean that grain markets became increasingly global, but refrigeration also reduced the natural protection that distance formerly provided to European meat and dairy producers, with the result that they too faced growing competition from far-away producers in Argentina, Australia and New Zealand (O'Rourke and Williamson, 1999).

3   See WTO (2010).

4   O'Rourke and Williamson argue that factor price convergence in the late 19th century, as a result of increasing trade, investment and migration, served to diminish the relative real wage and standard of living advantages of even the richest members of the New World. "Convergence was ubiquitous in the late nineteenth century, but it was mostly a story about labour-abundant Europe with lower workers' living standards catching up with the labour-scarce New World with higher workers' living standards". Relative to Britain, real wages in the United States were 106 per cent higher in 1855, 72 per cent higher in 1870 and 44 per cent higher in 1880 (O'Rourke and Williamson, 1999).

5   In 1913, these five economies had a per capital level of industrialization more than half that of the United States, by then the world's leading industrial power, illustrating how much of the US economy was still devoted to agricultural and raw material production.

6   The origins of the 19th-century gold standard lay in action by the Bank of England in 1821 to make all its notes convertible to gold (although Britain had operated a de facto gold standard from as early as 1717).

7   Bilateral tariff cutting after 1860 was particularly significant since tariffs constituted the main barrier to global trade, partly to provide revenue for governments, and partly to shield economies from the integrationist pressures of new technologies, made more necessary by the rigid constraints of the gold standard (which precluded currency devaluation as an adjustment mechanism). Beyond tariffs, however, government's impact on trade was smaller than it is today. Domestic regulation was minimal, as were fiscal and social policies: adjustment to globalization was accomplished through the blunt operation of the price mechanism, often involving dramatic wage declines and high unemployment, not through activist fiscal or social policies.

8   By 1908, France had 20 MFN agreements, Britain 46, and Germany 30 (Hornbeck, 1910).

9   Even in the nominally independent states of Latin America and East Asia, European pressure had imposed on most of them treaties in the first half of the 19th century which entailed the elimination of customs and duties, thus opening up markets to British and European manufactured exports.

10 The original 20 members of the ITU were European, but the ITU soon welcomed nations from the non-industrialized world, including India (1869), Egypt (1876), Brazil (1877), Thailand (1883), and Argentina (1889).

11 Fearful of Soviet global expansion and Europe's rapid economic deterioration in the winter of 1946-47, the US Congress passed the Economic Cooperation Act – known as the Marshall Plan – in March 1948, approving funding that would eventually rise to over US$ 12 billion for rebuilding Western Europe.

12 For example, world FDI flows declined 28 per cent between 1981 and 1983; 26 per cent between 1990 and 1991; 58 per cent between 2000 and 2003; and 39 per cent between 2007 and 2009. In contrast, trade suffered just three major declines in the post-war period: 7 per cent in 1975; 2 per cent in 1982; and 12 per cent in 2009. The multinational company has emerged as the key actor in the globalized economy.

13 For a number of economic historians, the current world trading system, far from being unprecedented, is essentially a return to the developmental trajectory of the world economy inaugurated by the birth of the industrial age. Some even argue that the world economy still has a way to go in order to achieve the comprehensive levels of global, trade, capital and labour market integration of the pre-1914 era (O'Rourke and Williamson, 1999).

14 From this the authors calculate that a "rough estimate of the tax equivalent of 'representative' trade costs for industrialized countries is 170 per cent. (2.7=1.21*1.44*1.55)" (Anderson and Van Wincoop, 2004).

15 The income elasticity of trade is defined as the percentage change in trade volume (T) corresponding to a 1 per cent change in real GDP (Y). It can be estimated by simply taking the ratio of trade growth to GDP growth for a particular period, i.e. $(\triangle T/T)/(\triangle Y/Y)$ where $\triangle$ indicates a discrete change in a variable. The point elasticity of trade, which is written as $dT/dY \times (Y/T)$ in calculus notation, is simply the limit of this expression as the change in GDP goes to zero. The latter must be estimated by ordinary least squares regression, but the results are nearly identical to the simpler discrete approach. In Table B.2 we have used a simple discrete elasticity measure, but it is helpful to understand both approaches.

16 See papers such as Feenstra and Hanson (1996), Feenstra (1998), Campa and Goldberg (1997), Hummels et al. (2001), Yeats (2001) and Borga and Zeile (2004).

17 A number of papers estimating income elasticities for trade flows generally find them to lie between 1 and 3½. See, for example, Hooper et al. (2000) and Kwack et al. (2007), Freund (2009) and Irwin (2002).

18 Empirical studies such as Freund (2009), Levchenko et al. (2009) and Berns et al. (2011) identified international fragmentation of production as one of the main reasons explaining why trade dropped much more than GDP during the recession. For a more comprehensive analysis of the causes of the great trade collapse, see Baldwin (2009).

19 Notice that the Krugman model can actually be combined with models of comparative advantage to capture both

20 In Krugman (1979) increasing returns to scale are internal to the firm. However, increasing returns to scale can also be external to the firm: firm's average costs decrease with industry output. A large and concentrated industry decrease the costs of production through channels such as labour pooling, specialized equipment or technology spillovers and therefore may give firms the incentive to cluster geographically.

21 The notion of comparative advantage is very useful to explain the current patterns of trade taking place mainly between developed and developing countries (see Figure B.8).

22 For a numerical presentation of the Ricardian model, please refer to Box 1 of the *World Trade Report 2008*.

23 Both the Ricardian and HO theories have been generalized to include multiple production factors, goods and countries and have successfully confirmed that trade conforms to comparative advantage in an average sense across industries and countries (see Deardorff, 2011; Levchenko and Zhang, 2011; Eaton and Kortum, 2002; Ethier, 1984; and Brecher, 1974).

24 The definition of the Herfindahl-Hirschmann index has been taken from UNCTAD statistics on exports concentration. The index has been computed using trade data disaggregated at three-digit group level.

25 Primary products include agricultural products and fuels and mining products.

26 Total factor productivity represents the share of output that is not explained by production inputs.

27 These results are in line with the findings of Imbs and Wacziarg (2003), which document a U-shaped relationship between the level of development and a set of measures of industry size, such as shares of sectorial employment and value added, for a set of countries between early 1960s and mid 1990s.

28 All data from the *International Trade Statistics* publication can be downloaded from the WTO statistics gateway at www.wto.org/statistics.

29 Network data for 1990-99 have been harmonized with current classification to the greatest extent possible in all tables and charts in which they are used.

30 For more details on the Toyota model, see Ohno (1988).

31 The estimations of the value-added exports presented in this section and requiring historical comparison make use of the World Input-Output Database (WIOD). The dataset consists of 40 economies (plus rest of the world), 35 ISIC rev 3 sectors, 15 years (1995-2007). All the figures are based on the sectoral classification presented in Appendix Table B.1. Other indicators refer to the OECD-WTO database on trade in value-added, available only for most recent years at the date of preparing this document. See http://www.wto.org/miwi.

32 *International Sourcing Statistics – Statistics Explained*, available at http://epp.eurostat.ec.europa.eu/statistics_explained/index.php/International_sourcing_statistics, last accessed on 17 December 2012, and (Sturgeon, 2012), Global Value Chains and Economic Globalization.

33 For WIOD, see http://www.wiod.org/.

34 See http://www.wto.org/english/res_e/statis_e/miwi_e/miwi_e.htm.

35 The homogeneity of firms is an important underlying assumption of all these approaches. It implies that the production structure is the same across all firms in a given country. This has obvious limitations, especially when firms actively engaged in trade differ significantly from those producing only for the domestic market. On-going research is looking into ways of splitting the national input-output matrices into sub-categories, in order to limit the bias. For example, the Chinese National Academy of Science has produced a measure of value-added trade based on three sub-categories: domestic firms, export-oriented firms using domestic inputs and export-processing firms. Indeed, much of the results presented in this section should be treated as first estimates, which under-estimate the vertical specialization of export-oriented firms (often by a large margin, such as in China or Mexico).

36 USITC, *Small and Medium-Sized Enterprises: US and EU Export Activities, and Barriers and Opportunities Experienced by US Firms*, USITC publication 4169, July 2010.

37 Exports processing zones (EPZs) are industrial zones with special incentives to encourage export-oriented activities. As products exported from EPZs (referred to as processing trade) employ far more foreign inputs than ordinary (or non-processing) exports, not taking into account the specificity of processing trade would overestimate the domestic value added. See Koopman et al. (2011). Considering processing trade, Johnson and Noguera (2011) estimate 59 per cent of domestic content for China and 52 per cent for Mexico.

38 See also WTO and IDE-Jetro (2011).

39 It is important to note that since the data of EFIGE come from a survey they conducted on a selected sample of firms, which are far from comprehensive, their results are not comparable with those of Bernard et al., and especially the extensive margins in EFIGE are very high across countries. In fact, the key information of the EFIGE figure is that there are obvious variations on both intensive and extensive margins of exports across these EU member states.

40 See Bernard and Jensen (1999) for the United States, Clerides, Lach and Tybout (2012) for Colombia, Mexico and Morocco and Alvarez and Lopez (2005) for Chile.

41 See Bernard and Jensen (1999), Bernard et al. (2007) and Bustos (2011).

42 See Tybout and Westbrook (1995), Pavcnik (2002), Trefler (2004), Bernard et. al (2006) and Bustos (2011).

43 See Jovanovic (1982) and Hopenhayn (1990).

44 See Minondo (2011) for Spanish services firms, Vogel (2011) for the German business sector and Masurel (2001) for Dutch architectural firms.

45 See United States International Trade Commission (2010).

46 Papers such as Hummels and Klenow (2005), for instance, find that 60 per cent of the difference in aggregate trade flows between rich and poor countries comes from differences in the number of goods traded.

47 For a more extensive description of scenarios and discussion of results, see Fontagné at al. (2013).

48 Technological progress is measured here by total factor productivity (TFP) and energy efficiency. It also captures the gains from human capital accumulation (the output of education). In MaGE, the macroeconomic model used for the growth projections, TFP is determined endogenously through a process of catching-up. In the "high" and "low" scenarios (see Box B.6), an exogenous gain or loss of TFP is added to this process. A TFP gain can result from additional technology transfer through FDI, exports or collaborative research. In the CGE model (Mirage) used for the trade simulations, which allows for sectoral detail, agricultural TFP is exogenous and set to values predicted by a separated detailed analysis of the sector. TFP in manufactured goods and services are endogenous, with the former being slightly higher than the latter, as modelled elsewhere in the literature (e.g. Van der Mensbrugghe, 2005). Also, production factors are further refined by differentiating skilled from unskilled labour and adding land and other natural resources besides energy. For more technical details, see Fontagné and Fouré (2013).

49 A less common methodology mixes the two stages in such an exercise by directly imposing assumptions on technological progress at the sectoral level in the CGE model. See the discussion of World Bank (2007).

50 Eichengreen et al. (2012) find that fast-growing developing economies tend to see growth rates slow when per capita incomes reach around US$ 16,000 at purchasing power parity.

51 For the emergence of new players in international trade to date, see Section B.2(a).

52 See World Bank (2007), Asian Development Bank (2011), OECD (2012c) and Duval and de la Maisonneuve (2010) for the OECD, as well as Fontagné et al. (2012) and Fouré et al. (2010) from CEPII.

53 These assumptions are not ad hoc. They are based on a description of the behaviour of economic agents (e.g. in terms of education, labour force participation or savings), which is used as a framework to econometrically estimate and project trajectories for aggregate variables in the medium to long run. As economic growth depends on the specific path of factor accumulation and technological progress, different studies usually take into account the same set of growth determinants and merely differ somewhat in the level of detail with which certain factors are modelled. See Fouré et al. (2012) for an overview and Fouré et al. (2010) for a more detailed presentation.

54 Fouré et al. (2010) obtain very similar results for the year 2050. They note that by 2050, China's GDP would increase 13-fold and India's economy by a factor of 10, while GDP in most industrialized countries would double or triple at best. The United States would continue to lead in terms of GDP per capita, but Japan would lose its second spot to China, with India advancing the ranks rapidly, closing in on Brazil.

55 Various institutions, such as the Economist Intelligence Unit (EIU), European Commission and US National Intelligence Council, have recently released studies on wider societal challenges that may arise by 2030 or 2050, respectively. Many of the discussions, e.g. on demography and education, technology, etc., are also covered in detail in this report with a specific focus on their relationship with trade. In contrast, these studies touch upon trade only cursorily. In particular, in as much as quantitative predictions are concerned, the studies appear to principally rely on outside material from the institutions covered in the overview here, notably CEPII and the World Bank, and otherwise do not provide much detail on methodology. See Economist Intelligence Unit (2012), European Commission (2011) and National Intelligence Council (2012).

56 As will be further discussed in Section C.3, trade openness and technological progress are highly interdependent. This is not taken into account by Petri and Zhai (2012). Other shortcomings in measuring the welfare benefits of trade opening in a CGE-type setting always need to be borne in mind as well, such as the high level of aggregation (and, hence, underestimation of intra-industry trade growth), demand developments related to the love of variety by consumers, varying scale economies in production etc.

57 Other concerns, such as macroeconomic imbalances, may also lead to policy responses seeking to constrain bilateral trade surpluses/deficits and are not further considered in the paper. With the proliferation of global supply chains, such policy action could have knock-on effects on exporters of intermediate inputs beyond the countries concerned.

58 A more extensive documentation of the methodology used and of results will be published in Fontagné and Fouré (2013) and Fontagné et al. (2013).

59 For ease of reference, these are grouped by endowment factors, technology and trade costs, although manifold interlinkages exist, including via the demand side channel. For instance, different demographic scenarios lead to different amounts of overall savings, the distribution of which into productive activities around the globe again depends on capital mobility.

60 Again, these extreme scenarios have to be treated with caution and certainly not all of them are equally likely. Some have simply been chosen for symmetry reasons, e.g. the lower bound scenario on technology compared to the higher bound scenario, in order not to distort the final outcomes by choosing vastly uneven opposite scenarios.

61 Based on historical experience, we have opted here for a more realistic "asymmetric" shock in TFP for developed versus developing countries. Results do not change much if TFP for developed countries is shocked in exactly the same way as for developing countries. This would result, for instance, in plus/minus 5 per cent deviations in global GDP shares by 2035 rather than 6 per cent.

62 As will be further discussed in Section C.1, demography not only plays a fundamental economic role in regard to labour force developments, but also via the consumption/savings channel related to changes in the age structure of society. Interestingly, lower fertility in the developing world leads to a relatively larger middle age group and higher global savings. If capital mobility is high, this also has beneficial growth effects in the developed world.

63 Given the complexity of global CGE models and their massive data requirements, certain trends discussed in Section B.2 cannot be accounted for in the simulations in view of the lack of consistent data on these phenomena at that level, in particular global supply chains and the role of firms in international trade. Also, some of the future driving forces discussed in Sections C and D, such as further digitization, robotics, shale gas discoveries and the like have not been (and mostly cannot be) addressed at any level of detail in these simulation models. However, some other issues not further examined here, such as climate change, are taken into account in more specialized studies, such as Fontagné et al. (2012).

64 Countries' institutions also affect (and are affected by) economic growth and trade (both via impacts on comparative advantage and transaction costs). It is difficult to include these factors in the global models discussed here in a straightforward manner. However, an indirect representation still occurs, notably via changes in productivity and scenarios on broader transaction costs. Trade costs related to transportation are taken into account in various other ways as well, including through energy price developments and specific productivity developments in the transportation sector.

65 Section D also discusses the determinants of public perceptions of trade and policy choices, which may include any of the factors covered in Section C. The changes in underlying conditions for trade described in Section C could also themselves have an impact on trade policy. For example, immigration has implications for trade via changes in comparative advantage and the level and composition of demand as discussed in Section C.1, but immigrants may also shape interests in trade policy-making in a particular manner. See, for instance, Peters (2012). As mentioned in Section A, the links between issues impacting trade are manifold and often bi-directional thus exceeding what can reasonably be discussed in any one study.

Appendix tables

Appendix Table B.1: **Sectoral classification of value-added trade statistics**	
Sector	ISIC Rev. 3 definition
Total	ISIC A to P
Agriculture	ISIC A, B, 15 and 16
Fuels and mining	ISIC C, 23, E
Manufacturing	ISIC 17 to 37 excl. 23
of which:	
Iron and steel	ISIC 27, 28
Textiles and clothing	ISIC 17, 18
Chemicals	ISIC 24, 25
Machinery and transport equipment	ISIC 29 to 35
Services	ISIC F to P excl. L

Source: WTO Secretariat.

Appendix Table B.2: Network of world merchandise trade by product and region, 1990-2011
(US$ billion)

Destination	World[a]			North America			South and Central America			Europe		
	1990	2000	2011	1990	2000	2011	1990	2000	2011	1990	2000	2011
Origin												
World												
Agricultural products	414.72	551.18	1,659.52	51.35	89.50	196.41	11.01	20.39	67.64	214.99	256.69	689.44
Fuels and mining products	488.32	852.63	4,007.83	92.82	188.41	611.91	16.03	31.33	155.95	217.73	319.88	1,364.06
Manufactures	2,391.15	4,692.27	11,510.95	489.51	1,232.48	2,054.77	75.23	146.88	503.51	1,213.89	2,016.28	4,630.77
Total merchandise[b]	**3,395.36**	**6,277.19**	**17,816.37**	**650.28**	**1,549.12**	**2,922.57**	**104.60**	**203.60**	**748.88**	**1,676.61**	**2,659.83**	**6,881.27**
North America												
Agricultural products	85.21	115.31	251.36	24.14	49.14	94.80	3.34	6.26	17.40	17.37	15.78	23.87
Fuels and mining products	58.79	94.34	408.87	29.51	71.17	237.84	2.57	4.05	41.09	12.01	9.22	60.41
Manufactures	375.20	963.22	1,499.02	152.33	534.99	731.11	30.89	54.66	135.67	92.71	167.33	249.79
Total merchandise[b]	**547.66**	**1,224.98**	**2,282.46**	**217.46**	**682.79**	**1102.89**	**37.66**	**67.87**	**201.23**	**130.07**	**205.16**	**382.20**
South and Central America												
Agricultural products	36.17	52.84	206.10	7.76	11.61	27.72	3.91	9.85	34.74	13.68	17.93	52.24
Fuels and mining products	37.49	67.74	322.55	16.49	32.63	95.85	5.41	15.90	70.90	7.84	9.54	49.34
Manufactures	44.30	72.96	198.09	24.97	33.53	55.07	7.47	24.72	94.65	6.52	9.89	25.55
Total merchandise[b]	**120.33**	**197.77**	**749.98**	**49.27**	**78.17**	**181.39**	**17.29**	**50.56**	**200.41**	**28.43**	**38.84**	**137.51**
Europe												
Agricultural products	194.32	244.42	669.88	9.87	13.17	26.35	2.06	3.05	6.63	154.14	193.08	520.24
Fuels and mining products	124.56	204.31	821.87	10.51	22.53	53.41	0.67	1.30	5.77	100.44	163.34	646.04
Manufactures	1,328.66	2,125.51	4,977.05	113.09	237.40	393.66	21.64	39.98	103.92	954.93	1,532.78	3,414.84
Total merchandise[b]	**1,685.82**	**2,633.98**	**6,612.32**	**135.52**	**275.77**	**480.07**	**24.38**	**45.05**	**118.75**	**1,223.39**	**1,928.08**	**4,667.31**
Commonwealth of Independent States (CIS)												
Agricultural products	6.05	13.10	58.93	0.03	0.42	0.53	0.26	0.04	0.21	4.15	3.97	13.87
Fuels and mining products	32.86	84.81	521.30	0.74	6.11	34.76	0.65	4.72	3.29	27.91	55.90	334.17
Manufactures	17.14	43.66	180.48	0.20	3.57	7.41	1.45	1.04	6.05	9.49	12.21	50.45
Total merchandise[b]	**58.13**	**145.72**	**788.76**	**0.99**	**10.16**	**43.22**	**2.59**	**5.79**	**10.75**	**42.77**	**74.70**	**408.77**
Africa												
Agricultural products	16.60	18.01	59.49	0.90	0.94	3.50	0.05	0.15	2.04	10.53	9.13	24.82
Fuels and mining products	56.22	86.41	382.21	13.92	22.26	86.92	1.25	3.22	14.65	35.21	41.74	127.34
Manufactures	21.08	36.30	110.31	1.25	3.58	10.60	0.23	0.48	2.68	13.30	21.65	48.29
Total merchandise[b]	**106.03**	**148.54**	**594.24**	**16.19**	**26.83**	**101.64**	**1.53**	**3.86**	**19.45**	**62.28**	**75.40**	**205.21**
Middle East												
Agricultural products	4.41	6.32	31.94	0.15	0.22	0.53	0.02	0.04	0.09	2.10	1.45	2.64
Fuels and mining products	112.50	194.79	847.27	15.79	25.32	80.60	4.81	1.39	5.75	29.54	33.33	104.71
Manufactures	20.22	54.28	261.23	3.40	13.48	25.58	0.25	0.60	3.88	6.69	11.72	43.52
Total merchandise[b]	**138.39**	**268.04**	**1250.61**	**19.58**	**39.67**	**107.22**	**5.16**	**2.10**	**9.76**	**38.93**	**47.81**	**158.11**
Asia												
Agricultural products	71.96	101.19	381.84	8.50	14.00	42.99	1.37	1.01	6.53	13.01	15.35	51.75
Fuels and mining products	65.91	120.23	703.76	5.87	8.40	22.54	0.66	0.76	14.51	4.78	6.81	42.05
Manufactures	584.56	1,396.35	4,284.79	194.28	405.94	831.34	13.30	25.39	156.66	130.26	260.71	798.33
Total merchandise[b]	**739.01**	**1,658.16**	**5,537.99**	**211.26**	**435.73**	**906.14**	**15.99**	**28.37**	**188.55**	**150.74**	**289.84**	**922.17**

Source: WTO Secretariat.

Note: Figures for Europe in 1990 do not include the Baltic States of Estonia, Latvia and Lithuania, while figures for CIS in 1990 do include the Baltic States.

a Includes unspecified destinations.
b Includes unspecified products

CIS			Africa			Middle East			Asia			Destination
1990	2000	2011	1990	2000	2011	1990	2000	2011	1990	2000	2011	
												Origin
												World
16.74	12.56	66.66	15.58	19.42	89.91	15.26	19.76	86.61	89.79	128.80	451.53	Agricultural products
14.42	11.66	64.95	8.83	13.17	98.40	7.16	8.91	77.81	131.33	254.74	1,525.88	Fuels and mining products
64.67	51.43	392.62	62.69	85.69	332.13	68.82	111.99	484.33	416.34	1,018.25	3,028.67	Manufactures
127.96	**76.64**	**529.70**	**88.51**	**122.36**	**538.08**	**94.60**	**145.56**	**671.92**	**652.82**	**1,433.18**	**5,132.73**	**Total merchandise^b**
												North America
3.38	1.04	2.66	2.59	3.20	9.38	2.68	3.10	7.08	31.70	36.41	95.90	Agricultural products
0.06	0.03	1.26	0.42	0.51	4.62	0.59	0.42	2.92	13.63	8.93	59.96	Fuels and mining products
1.12	2.23	11.19	5.56	7.64	21.64	8.34	15.56	49.31	84.25	180.61	299.49	Manufactures
6.17	**3.52**	**15.37**	**9.05**	**12.10**	**37.47**	**12.54**	**20.38**	**62.78**	**134.70**	**232.56**	**476.31**	**Total merchandise^b**
												South and Central America
4.68	1.18	7.77	1.00	1.61	15.16	1.22	2.04	12.77	3.91	8.37	54.34	Agricultural products
2.97	0.08	0.19	0.29	0.33	1.91	0.14	0.46	3.50	4.34	7.15	98.26	Fuels and mining products
0.23	0.03	0.50	0.72	0.82	4.26	0.64	0.32	1.49	3.76	3.55	16.13	Manufactures
9.02	**1.29**	**8.46**	**2.07**	**2.80**	**21.35**	**2.08**	**2.85**	**17.83**	**12.18**	**19.10**	**168.79**	**Total merchandise^b**
												Europe
5.16	4.84	24.00	7.69	8.00	25.30	6.04	6.12	19.42	9.36	14.90	46.60	Agricultural products
5.74	1.20	7.65	1.99	3.33	30.38	1.44	1.75	13.45	3.77	7.20	41.12	Fuels and mining products
49.59	26.98	200.02	43.78	49.90	141.39	36.99	50.80	158.35	108.63	174.13	540.61	Manufactures
78.43	**33.29**	**234.00**	**54.19**	**61.91**	**199.39**	**46.01**	**59.79**	**194.40**	**123.89**	**199.95**	**638.57**	**Total merchandise^b**
												Commonwealth of Independent States (CIS)
-	3.94	21.01	0.31	0.22	4.25	0.13	0.29	4.27	1.16	3.88	11.99	Agricultural products
-	10.03	53.60	0.26	0.15	2.97	0.35	0.97	7.14	2.95	6.75	79.40	Fuels and mining products
-	14.91	76.99	1.32	1.31	3.67	1.55	1.84	9.97	3.13	8.58	23.10	Manufactures
-	**29.13**	**154.15**	**1.91**	**1.78**	**12.49**	**2.52**	**3.12**	**23.77**	**7.35**	**20.01**	**116.95**	**Total merchandise^b**
												Africa
0.29	0.17	1.19	1.96	3.36	12.02	0.37	1.04	4.81	2.51	3.11	10.55	Agricultural products
0.26	0.06	0.37	1.83	4.12	26.84	0.43	0.68	3.48	3.32	12.83	115.24	Fuels and mining products
0.92	0.05	0.25	2.44	5.70	28.18	0.72	1.22	5.86	2.21	3.42	13.68	Manufactures
10.10	**0.29**	**1.85**	**6.25**	**14.38**	**77.03**	**1.52**	**2.98**	**21.34**	**8.17**	**20.35**	**145.84**	**Total merchandise^b**
												Middle East
0.65	0.28	1.31	0.09	0.27	1.92	1.14	2.57	14.96	0.28	0.58	5.93	Agricultural products
4.00	0.04	0.22	3.62	4.36	20.09	3.86	3.56	30.26	50.89	111.76	549.75	Fuels and mining products
1.73	1.10	4.36	0.51	2.58	15.22	3.59	7.51	60.82	4.05	12.46	91.97	Manufactures
6.40	**1.47**	**5.95**	**4.21**	**7.31**	**37.87**	**8.63**	**13.93**	**110.16**	**55.47**	**126.48**	**660.24**	**Total merchandise^b**
												Asia
2.58	1.12	8.73	1.95	2.78	21.87	3.69	4.60	23.30	40.86	61.56	226.23	Agricultural products
1.39	0.23	1.66	0.43	0.37	11.60	0.35	1.07	17.08	52.43	100.13	582.15	Fuels and mining products
11.08	6.12	99.32	8.36	17.73	117.77	16.99	34.74	198.54	210.30	635.51	2,043.69	Manufactures
17.84	**7.66**	**109.92**	**10.83**	**22.09**	**152.48**	**21.30**	**42.51**	**241.64**	**311.06**	**814.73**	**2,926.03**	**Total merchandise^b**

C. Fundamental economic factors affecting international trade

The previous section has shown that the future of trade and economic growth depends on a range of factors. Predictions may change depending on how each of these factors develops. This section discusses how the fundamental economic factors shaping the future of international trade – namely demography, investment, technology, energy and other natural resources, transportation costs and the institutional framework – are likely to evolve in the coming years.

Contents

Some key facts and findings

- Demographic change affects trade through its impact on countries' comparative advantage and on import demand. An ageing population, migration, educational improvements and women's participation in the labour force will all play a role in years to come, as will the continuing emergence of a global middle class.

- Investment in physical infrastructure can facilitate the integration of new players into international supply chains. The accumulation of capital and the build-up of knowledge and technology associated with investment, particularly foreign direct investment, can also enable countries to move up the value chain by altering their comparative advantage.

- New players have emerged among the countries driving technological progress. Countries representing 20 per cent of the world's total population accounted for about 70 per cent of research and development (R&D) expenditure in 1999, but only about 40 per cent in 2010. Technology spillovers are largely regional and stronger among countries connected by production networks. In addition to the traditionally R&D intensive manufacturing sectors, knowledge-intensive business services are emerging as key drivers of knowledge accumulation.

- The shale gas revolution portends dramatic shifts in the future pattern of energy production and trade as North America becomes energy sufficient. Increasing water scarcity in the future in large swathes of the developing world may mean that the long-term decline in the share of food and agricultural products in international trade might be arrested or even reversed.

- Ample opportunities exist for policy actions, at the national and multilateral level, to reduce transportation costs and offset the effect of higher fuel costs in the future – improving the quantity and quality of transportation infrastructure, successfully concluding the Doha Round negotiations on trade facilitation, introducing more competition on transport routes, and supporting innovation.

- Improvements in institutional quality, notably in relation to contract enforcement, can reduce the costs of trade. Institutions are also a source of comparative advantage, and trade and institutions strongly influence each other.

Various economic theories use fundamental economic factors to explain why countries trade and how trade patterns evolve. In David Ricardo's theory, for instance, technological differences between countries determine comparative advantage. In the Heckscher-Ohlin model, relative factor endowments (labour, capital and natural resources) shape trade patterns. The new trade theory predicts that countries with larger economies – as a result of growth in endowments and incomes – will develop an export edge in those goods consumed in relatively greater quantities in the home market. The "new new" trade theory identifies trade costs as a key impediment to entry into trade. Others argue that the quality of a country's political and economic institutions can be a key source of comparative advantage. This section also covers feedback effects from trade which, in turn, have an impact on the fundamental economic factors shaping trade. Trade can lead to technological spillovers, for example, allowing countries with less technological expertise to acquire much-needed know-how. Engaging in trade can also help to strengthen political and economic institutions.

This section shows how developments in demography, investment, technology, energy and other natural resources, transport costs and institutional quality are capable of changing the overall nature of trade: the role that individual countries play in international trade, how they trade and what is traded with whom and why. It explores possible future scenarios for each factor and concludes by describing their potential impact on currently observed trade trends, as discussed in Section B. The discussion foreshadows issues that could become critical for the WTO as well as for international cooperation in the future – a subject that will be taken up in greater detail in Section E of this report.

1. Demographic change

The world's population is expected to reach 8.3 billion by 2030 and 9.3 billion by 2050. Most of this increase will take place in certain developing countries that are in the early stages of their demographic transition and which will see significant increases in the young working-age population of both sexes. In other developing countries and in most developed ones, the demographic transition is already in its most advanced stage. Fertility rates are low, resulting in an ageing population and in a shrinking labour force. In some of these countries, immigration is likely to be the main source of population growth in the future. Furthermore, education and urbanization are advancing everywhere in the world. The objective of this section is to show how these long-term demographic trends are likely to affect international trade patterns through their impact on comparative advantage as well as on the level and composition of import demand.

(a) The demographic transition and ageing

The world is experiencing dramatic changes in the size and composition of its population. These are the result

of the so-called "demographic transition" – a process which involves first a decline in mortality rates and then a reduction in fertility. Countries are at different stages of their demographic transition. The data presented in the first part of this section will show that some countries are ageing quickly while others are reaping a "demographic dividend" from a younger population. These trends are likely to have an impact on trade patterns through two main channels: changes in comparative advantage and changes in the level and composition of import demand. The second part of the section discusses these two channels in more detail.

As clarified by Lee (2003), a country's demographic transition occurs in four stages. In the first stage, mortality starts declining while fertility remains high. In this phase, mortality reductions mainly affect the infant population and are mostly related to declines in contagious diseases spread by air or water, and to improvements in nutrition. Since mortality declines, the population increases and becomes relatively younger.

The second stage of the transition is characterized by a decline in fertility and an increase in the working-age population, as the younger people reached adulthood.[1] During this phase, a growing labour force and increased savings can potentially boost economic growth, generating a "demographic dividend". Next, ageing leads to rapid increases in the elderly population, while low fertility reduces the growth of the working age population, thus increasing the young- and old-age dependency ratios.[2] The demographic transition ends when the total dependency ratio is back to the pre-transition level but where the young-age dependency ratio is low while the old-age ratio is high.

The global demographic transition is apparent in Figure C.1, which shows past and projected fertility rates and life expectancy. The decrease in total fertility is clearly noticeable. *The Economist* (2012) reports that almost half the world's population – 3.2 billion – already lives in

Figure C.1: **World fertility rate and life expectancy, 1800-2050**

Source: Lee (2003).
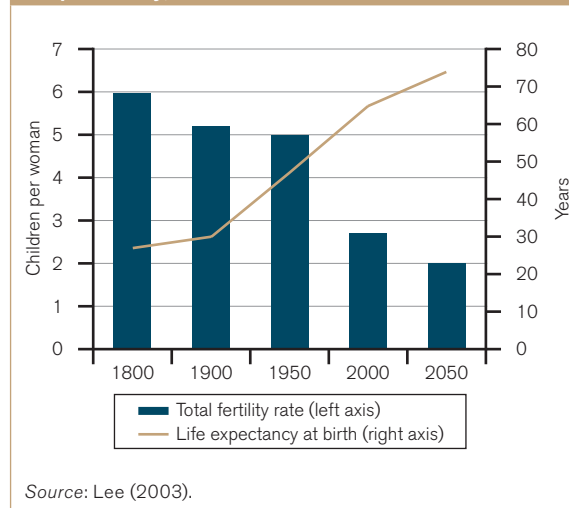
countries with a fertility rate of 2.1 or less. Conversely, life expectancy at birth has followed a clear upward trend. These developments indicate that the world as a whole reaped a demographic dividend in the 40 years to 2010 (*The Economist*, 2012). In 1970, there were 75 dependants for every 100 adults of working age. In 2010, the number of dependants dropped to just 52. Huge improvements were registered not only in China but also in South-East Asia and North Africa, where dependency ratios fell by 40 points. Even Europe and North America ended the period with fewer dependants than at the beginning.

Since 2010, however, the world population has inexorably started to become older (see Figure C.2). Its size will continue to grow but at a rate lower than the historical growth rates of the 19th and early 20th century, as shown in Figure C.3.

Countries are at different stages of their demographic transition (Eberstadt, 2012). Developed economies began the demographic transition in the 19th century. In most developing countries, the transition lagged by almost a century. However, it progressed much more rapidly, thus implying that fertility and population growth rates are converging relatively quickly at the global level (see Figure C.4). Lee (2003) notes that the process of global demographic convergence of the past 50 years is in marked contrast with the growing economic disparities over the same period.

However, these general trends mask noticeable differences within each group of countries, especially in fertility rates. Within developed countries, most European countries have very low fertility rates (for example, Germany at 1.36, Italy at 1.38 and Spain at 1.41 in 2010) but some others have higher rates

Figure C.2: **Age structure of the world population, 1800-2050** (percentage)

Source: Lee (2003).

Figure C.3: **Size and growth rate of the world population, 1800-2050**

Source: Lee (2003).

Figure C.4: **Total fertility rate (TFR) and life expectancy by country group, 1950-2050**

Source: United Nations Population Division, *World Population Prospects: The 2010 Revision database.*
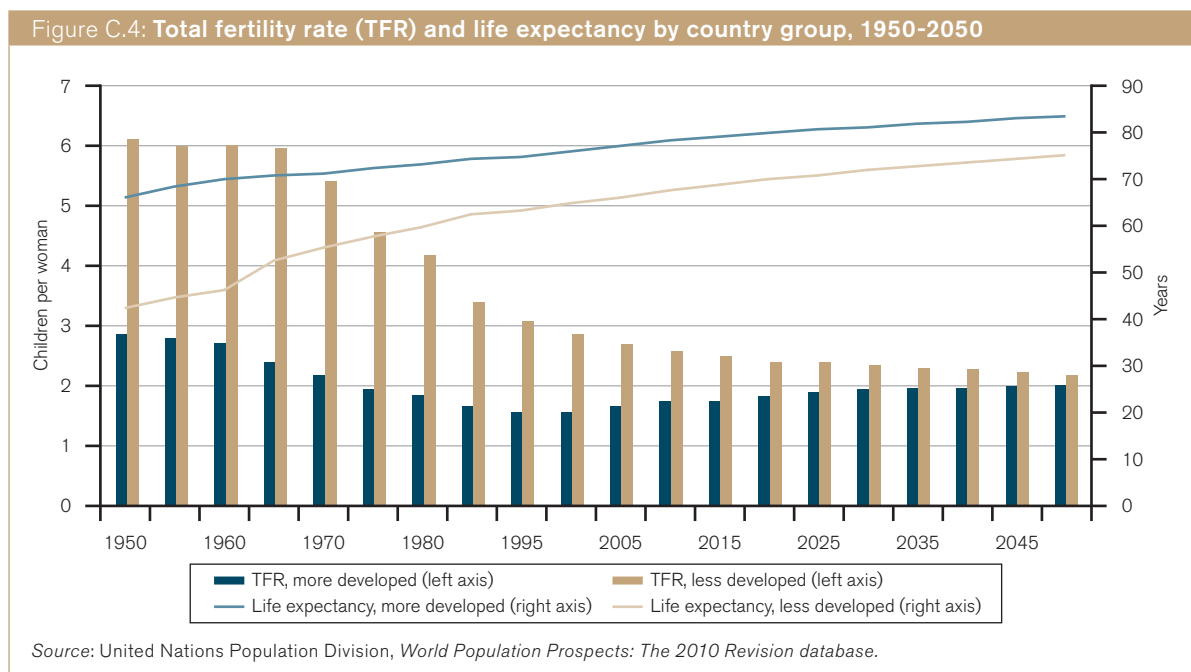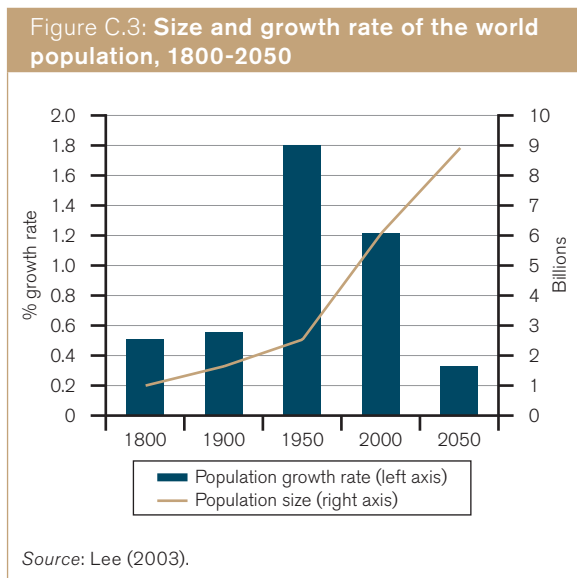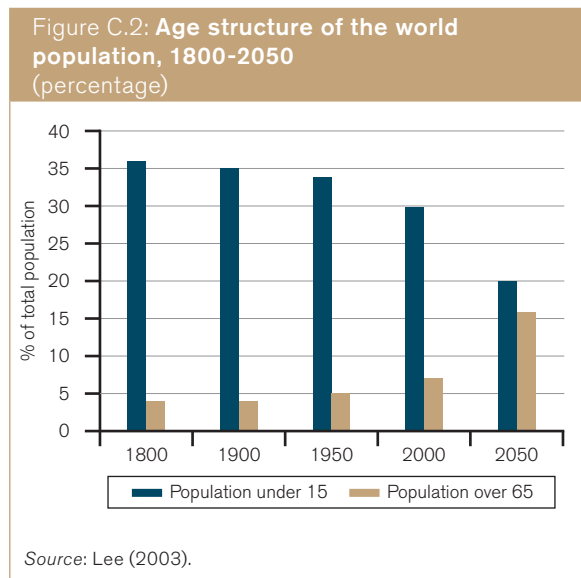
(for instance, the United Kingdom at 1.83 and France at 1.93). While the fertility rate in Japan is extremely low at 1.32, the rate in the United States is 2.07. Within developing countries, most Sub-Saharan African countries have high fertility rates, with an average of 4.8 in 2010; this is the fastest-growing region of the world in terms of population. The fertility rate in India (2.73) is also relatively high. Other populous developing countries, however, have fertility rates below 2. These include the Republic of Korea (1.29), the Russian Federation (1.44), Thailand (1.63), China (1.64), Iran (1.77) and Brazil (1.90).

One of the implications of different demographic dynamics across countries is that the distribution of world population will continue to shift towards developing and emerging economies. As shown in Figure C.5, the share of world population that lives in such economies will rise from 85 per cent in 2010 to 88 per cent in 2050. China will cease to be the most populous country in the world in 2050; its share of world population dropping from 20 to 14 per cent and being surpassed by India, which will account for 18 per cent of the world population in 2050.[3]

One of the most dramatic consequences of the demographic transition is the shift in age distribution of the population at the later stages of the transition. Two variables that are of particular interest are the dependency ratio and the median age; these are shown for some populous countries (China, India and the United States) and a range of regions (Sub-Saharan Africa, Middle East, Latin America and the European Union) in Figure C.6 in order to highlight certain patterns. Some countries and regions are shown to have a fast-ageing population and increases in the dependency ratio. China, for instance, is ageing fast: the median age was as low as 22 years in 1980 but will reach the level of the United States (around 38 years) in 2020 and the level of Europe (around 46 years) in 2040. Moreover, China's dependency ratio

will start to grow from the low level of 37.5 in 2015 to the relatively high level of 64 by 2050 – the sharpest rise in the world (see Figure C.6). According to Li et al. (2012), the decline in labour force as a share of the population will cause labour shortages and thus contribute to rising wages in China (see Section D.1). To put it more bluntly in the words of The Economist, it "will bring an abrupt end to its cheap-labour manufacturing" (*The Economist*, 2012).[4]

In countries with relatively generous welfare systems, rising dependency ratios imply formidable challenges in the provision of pensions and health care that relies on tax revenues from the working population. Countries with intermediate fertility rates, such as the United States, will find it easier to cope with these challenges than countries with low fertility rates and accelerated ageing, such as Japan. There are, conversely, countries where demographic trends represent huge opportunities, especially for India, Sub-Saharan Africa and Middle Eastern countries. Figure C.6 shows that they will have low median ages and will experience decreases in dependency ratios in the coming decades. As argued by *The Economist* (2012), if they can improve their public institutions, keep their economic policies outward-looking and invest more in education, as was the case for East Asia, then Africa, the Middle East and India could become the fastest-growing parts of the world economy within a decade or so.[5]

(i) Ageing and comparative advantage

International differences in population dynamics have been identified as a factor determining comparative advantage and the composition of trade. Some theoretical studies show that a country with slower population growth becomes relatively capital-abundant, while a country with faster population growth becomes relatively labour-abundant over time, thus registering lower capital-labour ratios ("capital shallowing"). This gives rise to differences in autarky relative prices,[6]

Figure C.5: **Share of world population, by country group, 2010 and 2050**
(percentage)

2010

Japan, 2%
United States, 4%
Other developed economies, 8%
Russian Federation, 2%
Bangladesh, 2%
Nigeria, 2%
Pakistan, 3%
Brazil, 3%
Indonesia, 3%
India, 18%
Other developing economies, 33%
Developed economies, 15%
Developing and emerging economies, 85%
China, 20%

2050

United States, 4%
Other developed economies, 8%
Congo, 2%
Philippines, 2%
Bangladesh, 2%
Brazil, 2%
Pakistan, 3%
Indonesia, 3%
Nigeria, 4%
China, 14%
Other developing economies, 38%
Developed economies, 12%
Developing and emerging economies, 88%
India, 18%

Source: United Nations Population Division, *World Population Prospects: The 2010 Revision database*.

Figure C.6: **Dependency ratio and median age, selected countries and regions, 1950-2050** (percentage and years)
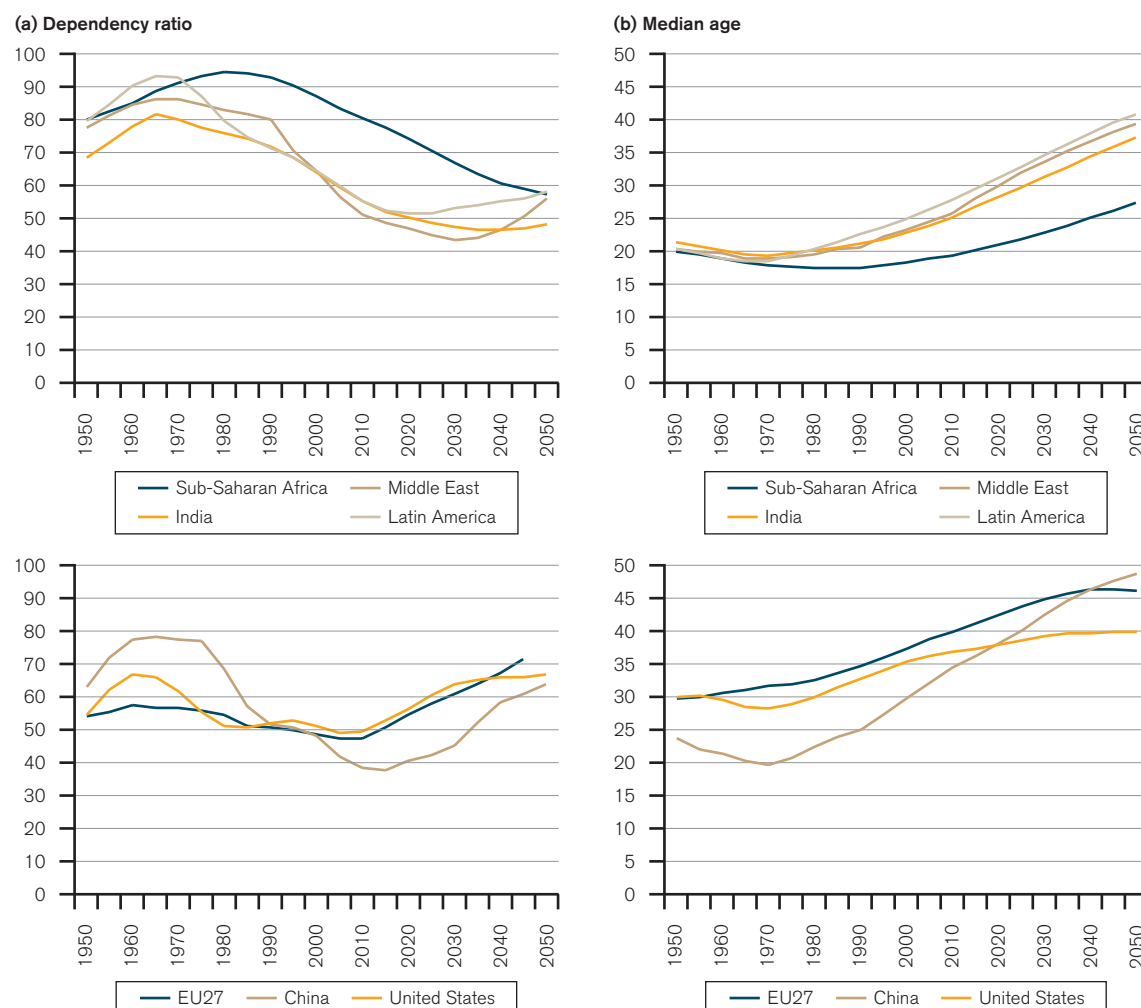
(a) Dependency ratio

Sub-Saharan Africa — Middle East
India — Latin America

EU27 — China — United States

(b) Median age

Sub-Saharan Africa — Middle East
India — Latin America

EU27 — China — United States

Source: United Nations Population Division, *World Population Prospects: The 2010 Revision database.*

creating grounds for Heckscher-Ohlin trade in which the former country specializes in capital-intensive goods and the latter country specializes in labour-intensive goods (Sayan, 2005; Naito and Zhao, 2009).[7]

However, Yakita (2012) shows that countries with an ageing population are not necessarily net exporters of capital-intensive goods. A longer retirement prompts individuals to invest more in human capital and to reduce the number of children. Moreover, a longer retirement depresses demand for consumption goods (assumed to be labour-intensive) in the working period, reducing their autarky relative price. If this relative price is below the free trade relative price, the ageing economy ends up exporting labour-intensive goods and importing capital-intensive ones.

Demographic change also has significant effects on capital flows and the trade balance.[8] However, the literature does not provide unambiguous conclusions on the direction of these effects. Some studies underline that countries which are in a relatively more

advanced stage of their demographic transition are characterized by net capital outflows and trade surpluses. These studies show that higher life expectancy determines an increase of savings for retirement, exerting pressure on the economy to export capital to "younger" economies. Likewise, a lower fertility rate reduces the size of the working population and investment demand, again inducing capital exports. On the other hand, countries that are in the initial stages of the demographic transition and have relatively higher population growth will have net capital inflows and trade deficit.[9]

However, others have shown that economies with high and rising elderly dependency ratios can register net capital inflows and trade deficits. For instance, Higgins (1998) considers the effect of demographic variables on savings, investment and the current account balance. Large, young dependent populations depress savings supply while augmenting investment demand. Savings and investment, in turn, are negatively affected by ageing. Therefore, the current account

balance is negatively affected both by large young-age and old-age dependency ratios. Lührmann (2003) also finds that a high relative share of those aged 65 or more in the population is associated with capital inflows. This can be explained by declines in savings and the repatriation of capital for consumption in old age.[10]

Overall, little can be said definitively about the prospective effects of ageing on comparative advantage. If associated with a decrease in the labour force as a share of population, ageing can lead to an erosion of comparative advantage in labour-intensive manufactured goods, as is foreseen for China. As a consequence of ageing, countries with a comparative advantage in capital-intensive sectors may see this comparative advantage become stronger, but this is not a general result. Finally, in order to assess the overall impact on trade, it is important to consider demand-side effects, in particular how ageing will affect the level and the composition of demand. This is the subject of the next section.

(ii) Demographic changes and the composition of demand

Demographic changes are affecting both the level and the composition of consumption, with subsequent effects on trade flows. The theoretical and empirical literature on consumption over the life cycle provides a useful framework to understand the likely impact of demography on future consumption and trade patterns.

The life-cycle hypothesis assumes that individuals prefer to smooth consumption over their lifetimes.[11] Hence, they save during their working age, when income is higher, and dis-save in their retirement period, when income is lower. Data on consumption and income, however, contradict the consumption and saving patterns predicted by the basic life-cycle model in several respects. First of all, there is evidence of a hump-shaped relationship between households' total consumption and age. This is mainly explained by household composition effects, according to which households' expenditure increases with the number of children (Attanasio et al., 1999; Browning and Ejrnæs, 2009). Moreover, empirical evidence shows that savings of the elderly do not decrease as much as the life-cycle model (in its simplest formulation) would predict. This mainly depends on bequest motives (Hurd, 1989), or precautionary savings, which are accumulated to accommodate unexpected health or economic shocks (Carroll, 1994; 1997).[12] Liquidity constraints might also generate a pattern of consumption which is similar to that determined by precautionary savings, with individuals accumulating resources in order to smooth consumption when facing economic shocks and impossibility to borrow (Deaton, 1991).[13]

Household composition effects are relevant to assessing the impact of demographic change on demand patterns. In particular, since a higher number of children accounts for higher household consumption expenditure, one may expect, other things being equal, increased consumption in high-fertility, high-population growth countries, such as those in Latin America and Sub-Saharan Africa. However, the ability to finance consumption growth in these countries crucially depends on their economic growth, which, in turn largely hinges on job creation (see Section D). Moreover, domestic demand and import trends also depend on other economic and institutional factors, such as financial integration and social security, which are likely to affect households' expenditure capacity.

For countries at the most advanced stage of the demographic transition, older groups will account for the largest share of consumption.[14] The effects of ageing on aggregate consumption (and, consequently, on import demand) will likely depend on the extent of the decline in consumption following retirement, also known as the "retirement consumption puzzle".[15] However, compositional effects are more relevant than level effects. Expenditures on some categories of goods, such as food, furnishing, clothing and accessories, are noticeably reduced upon retirement, while expenditures on other categories remain constant or increase (Hurst, 2008). Studies that project future consumption patterns in more advanced economies based on current demographic, economic and social trends conclude that services and high-tech sectors will gain most in the coming decades (CBI, 2012; Desvaux et al., 2010; Deutsche Bank, 2007; Lührmann, 2005; Oliveira Martins et al., 2005). In particular, consumption will increase most in communication, transport, health, financial services, tourism services as well as in entertainment and community services that target the senior citizen market. Since not all these sectors are tradeable, the impact on international trade will also depend on the change in demand for tradeable services relative to non-tradeable ones.

The gradual convergence of per capita income levels across countries, documented in Section D, is giving rise to another important phenomenon, namely the expansion of the global middle class. According to the World Bank (2007), in the period 2000-2030, the global middle class is projected to grow from about half a billion to about 1.2 billion, or from 7.6 to 16.1 per cent of the world population. However, its share of world income will remain stable at about 14 per cent, reflecting decreasing inequality across countries.[16] Because of uneven population growth across countries, the geographical distribution of the middle class will change remarkably in the coming decades. Regions with relatively higher projected population growth rates, such as South Asia and Sub-Saharan Africa, will see their share of the global middle class increase while other regions will see a decrease (Kharas and Gertz, 2010; World Bank, 2007).

The expansion of the middle class is likely to result in an increase in demand for goods and services, such as cars, mobile phones, recreational equipment and services, as well as food. Some Western food companies have already modified their products, either to cater to Asian consumers' tastes (*The Economist*, 2013) or to make them more sophisticated. As Asian consumers become richer, they are demanding higher-quality and healthier products (Atsmon et al., 2012). A decrease in the import share of low-value-added products, such as agricultural goods, and an increase in the share of higher-value-added goods, such as cars and office and telecom equipment, is already taking place in the BRIC (Brazil, Russian Federation, India, China) group (Yamakawa et al., 2009).[17]

Trade remains key to sustaining economic growth and thus the expansion of the middle class. This is particularly true of countries such as China where the share of domestic consumption in GDP is still relatively low.[18] Policies that address income inequality can also be important to expanding the middle class and thus economic growth (Kharas and Gertz, 2010).[19]

Another important trend in developing and emerging economies is the rise of education levels. Increasing demand for education, combined with technological advances, is fuelling a rise in education services trade. According to Lim and Saner (2011), education services' exports grew, on average, by 12 per cent between 2002 and 2007. The United States, Australia, the United Kingdom and Canada were among the top exporters; the Republic of Korea, the United States, Germany and India were among the top importers. Education markets are also growing in Latin America and the Middle East (Lim and Saner, 2011). Typically, international students' mobility, which corresponds to mode 2 (consumption abroad) of the General Agreement on Trade in Services (GATS), has been the main channel for educational services trade. However, long-distance education (mode 1 – cross-border supply) and the establishment of foreign branches of educational institutions (mode 3 – foreign commercial presence) are also growing.[20]

In short, demographic changes will affect trade both through their impact on comparative advantage and on patterns of demand. One might expect countries with high and rising old-age dependency ratios to switch from being net exporters to net importers of capital-intensive goods or to experience an erosion of their comparative advantage in labour-intensive manufactured goods. Ageing is also likely to be associated with a relative increase in the demand for goods and services that are disproportionately consumed by older groups of the population. The emergence of a global middle class will also have an impact on the composition of global demand. The growing number of relatively wealthy consumers in emerging and developing economies will open up new business opportunities and expand trade.

(b) Changes in labour force composition

Two other notable labour force developments, both linked to the demographic transition, are likely to affect trade flows: a rising share of educated workers and increased female labour force participation. The following section examines these trends in more detail, and then explores the channels through which they can affect comparative advantage and trade patterns.

(i) Skills

Over the last 60 years, education levels have increased substantially in most countries. Using data from 146 countries, Barro and Lee (2010) show that over the period 1950-2010 the average number of years of schooling among individuals aged 15 or over increased from 2.1 to 7.1 in developing countries and from 6.2 to 11.0 in developed countries (see Figure C.7). The highest growth rates were registered in the Middle East and North Africa, Sub-Saharan Africa and South Asia.[21]

Based on the data provided by Barro and Lee (2010), Fouré et al. (2012) project future secondary and tertiary education enrolment rates for the working age population to 2050. Their projections show that the educational attainment profile of the working population will continue to increase, especially in developing countries, producing a convergence in educational levels between both developing and developed countries (see Figure C.8). The same conclusion is reached by KC et al. (2010), who also explain the underlying causes of this convergence.[22] In countries where the old-age dependency ratio is projected to increase, such as China, progress will be

Figure C.7: **Educational attainment of the total population over age 15 by country group, 1950-2010** (years)

Source: Barro and Lee (2010).
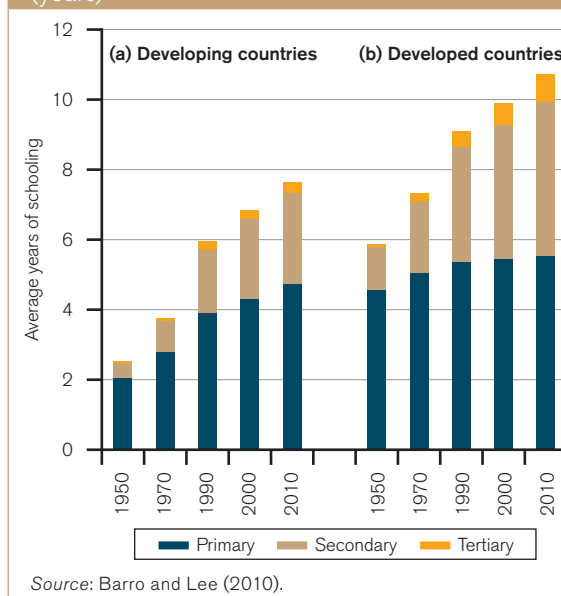
Figure C.8: **Projections of secondary and tertiary enrolment rates, 1990-2050** (percentage)

Secondary enrolment rate

Tertiary enrolment rate

United States — Russian Federation — European Union — China
Middle East — South America — India — Sub-Saharan Africa

Source: Fouré et al. (2012).
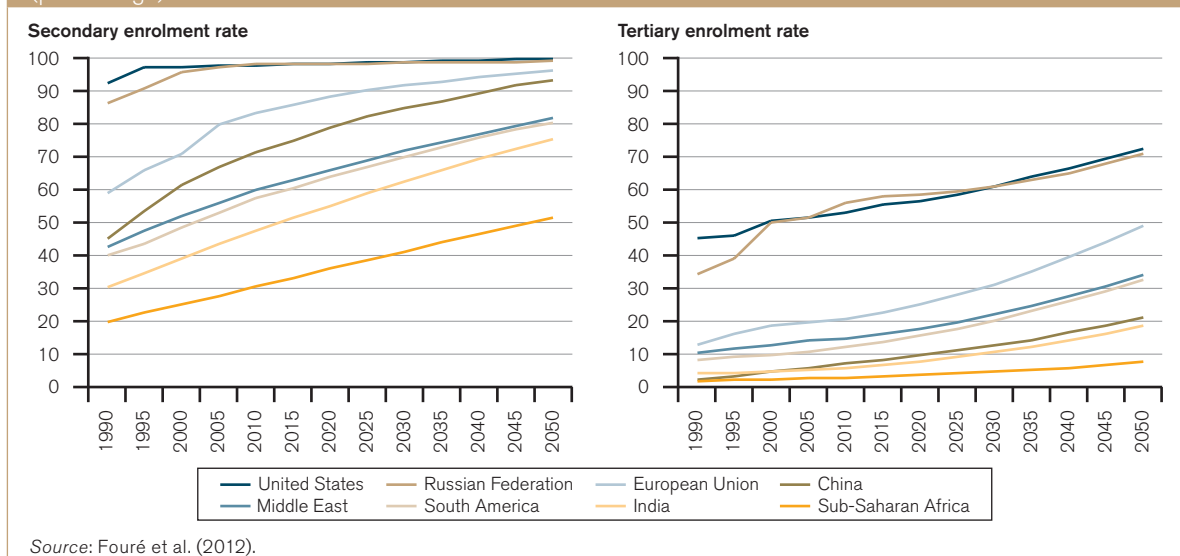
defined in terms of the composition of the working-age population. In countries where the old-age dependency ratio is projected to decrease, such as India, progress will mostly be in terms of the growing number of highly qualified people added to the potential labour force.

In addition to highlighting global educational convergence generally, these studies also reveal specific regional patterns. According to KC et al. (2010), Latin America will register the most relevant improvements in educational attainment, mainly because of the interaction between education and fertility dynamics. In several Latin American countries, increases in school enrolment preceded fertility reductions, with the result that the youngest and most educated segments of the population are also bigger. This expanding population of educated young people is found in several Asian countries, such as Nepal, Pakistan and Cambodia, and in the Middle Eastern countries, such as Jordan and the Kingdom of Saudi Arabia.

In Sub-Saharan Africa, the picture is more complex. Although education rates among 20 to 64-year-olds are expected to improve significantly, some countries, such as Ethiopia, Mali, Niger and Burkina Faso, are starting from such a low base that by 2050 large shares of the working age population (for instance, 40 per cent in the case of Ethiopia and 35 per cent in the case of Burkina Faso) will still have no education despite significant improvements in national averages (KC et al., 2010). The implication is that these countries may fall behind significantly compared with the rest of the world in terms of educational attainment of the working population by 2050.

Improving higher education enrolment rates will require substantial effort and resources, especially in countries starting from a low base and in countries where the size of the young population is projected to increase significantly (KC et al., 2010). Another crucial

educational challenge is to make progress in schooling quality, which remains uneven, even among countries with a similar level of educational attainment (Barro and Lee, 2010; Hanushek and Woessmann, 2009). To ensure that there are sufficient jobs created in high population growth countries, it will also be important to match educational supply and demand by, for instance, establishing effective public-private partnerships between business and education institutions.

These educational developments are likely to affect trade patterns because of their impact on comparative advantage. According to the Heckscher-Ohlin model, countries have a comparative advantage in sectors that make more intensive use of their relatively abundant factors (see Section B.2). Several recent studies have shown that the endowment of human capital (relative to labour) is an important determinant of comparative advantage and trade patterns.[23] Building on these observations, Costinot (2009) suggests that comparative advantage is affected by workers' endowment of efficiency units of labour. When workers are more educated, they spend a smaller fraction of their time learning. Since learning costs are relatively more important in more complex sectors, a country with educated workers has a comparative advantage in more complex sectors.[24]

Comparative advantage can also be shaped by the distribution of human capital across workers. In Grossman and Maggi (2000), for instance, there can be trade between countries with similar aggregate factor endowments, provided human capital is more widely dispersed in one country than the other. The country with a relatively similar population in terms of educational levels exports the good with a production technology characterized by complementarities between workers. The country with a diverse population, in turn, exports the good whose technology is characterized by substitutability between

employees.[25] Grossman and Maggi (2000) provide some examples in support of their theory. Countries like Japan and Germany, with a pool of relatively similar workers, have a comparative advantage in industries, such as automobiles, that require care and precision in a long series of production tasks. Conversely, countries such as the United States or Italy, with a more diverse pool of workers, tend to have a comparative advantage in industries where the input of a few very talented individuals (e.g. fashion designers in the case of Italy) matters most.[26]

Demographic changes that increase overall levels of education will affect the relative endowment of productive factors and contribute through the various channels outlined above to shaping the evolution of comparative advantage and trade patterns. Developing countries, such as China, are already exporting sophisticated goods to OECD countries (Rodrik, 2006; Schott, 2008). This generates the increased overlap in the structure and in the skill content of exports from China and the high-income countries documented in Section B. This phenomenon is partly due to processing exports (contracting manufacturing for goods that are designed elsewhere) in sectors that may be labelled as high-tech industries.[27] Wang and Wei (2010), however, report evidence that improvements in human capital (together with government policies in the form of tax-favoured, high-tech zones) appear to contribute most to the growing sophistication of China's exports. Exports of skill-intensive goods to rich countries can be a source of growth for poor countries (Mattoo and Subramanian, 2009a). Integrating a larger number of skilled workers into their labour force (and adopting technologies that most improve the productivity of skilled labour) is therefore a promising option for developing countries.

(ii)   Female employment

The demographic transition is also associated with changes in labour force participation rates (LFPRs).[28] These changes depend on country characteristics, such as labour market institutions and social norms, and individual characteristics, such as age and gender. Between 1980 and 2008, the global male LFPRs decreased from 82 to 77.7 per cent, mainly as a result of decreasing participation of young males who are staying longer in education. The global female LFPR grew in the 1980s from a starting point of 50.2 per cent, reached 52.2 per cent in 1990, but then declined between 1990 and 2008 to settle at 51.7 per cent (ILO, 2010). The limited increase in female LFPRs could be explained, among other things, by increased female education, which decreases the participation rate of young females.

The above data show the relevance of education as a determinant of female LFPRs. Other demographic and economic factors also play a role. For instance, Galor and Weil (1996) show that technological progress and the accumulation of physical capital make labour more productive and increase the opportunity cost of raising children, with negative effects on fertility and positive effects on women's participation in the labour market.[29] Moreover, Soares and Falcão (2008) emphasize the role of increases in adult life expectancy in determining female LFPRs. In particular, reductions in adult mortality increase the returns to education for women and reduce the gains from larger families, thus reducing fertility rates and increasing women's labour market activities.

Female LFPRs are also likely to depend on the country's level of development. The relationship between the two variables seems to be U-shaped (Goldin, 1995; Mammen and Paxson, 2000). Participation rates are higher in subsistence economies. Then, at the initial stage of development, education and wages increase relatively more for men than for women. As household income increases, women reduce their labour market participation (the income effect prevails).[30] At a later development stage, there are educational gains for women as well, raising the opportunity cost of child caring and increasing female labour market participation.[31]

Besides demographic and economic factors, other important determinants of female labour market participation are access to education, religious, cultural and social norms, and the institutional framework (ILO, 2010). The impact of demographic change may be reduced or offset by cultural and social norms. For instance, analysing the determinants of female LFPR in a sample of 160 countries between 1960 and 2008, Tsani et al. (2012) found that, all things being equal, Southern Mediterranean countries have significantly lower female LFPRs than other countries. The authors suggest that these results may reflect region-specific social or institutional factors that act as barriers to women's participation in the labour market.

Figure C.9 shows past and projected data (for 1990 and 2020, respectively) on female LFPRs for selected countries and regions. The data highlight some interesting patterns, which can be explained by the demographic, economic and cultural factors outlined above. In the European Union, China and India, there will be considerable reduction in LFPRs of young women which is mainly the result of increased school attendance.[32] Moreover, in the European Union there will be an increase in LFPR in more mature segments of the female labour force. This is mainly related to increased life expectancy, higher retirement ages and the introduction of age and gender anti-discrimination laws (Jaumotte, 2003). Conversely, LFPRs of the more mature segments of the female population are projected to increase only slightly in the case of China. In India, female LFPRs are expected to decrease for virtually all age groups. Several factors may explain these

Figure C.9: **Women's labour force participation rates in selected economies, 1990 and 2020** (percentage and age group)

Source: ILO, *Economically Active Population, Estimates and Projections* (EAPEP), 2011.
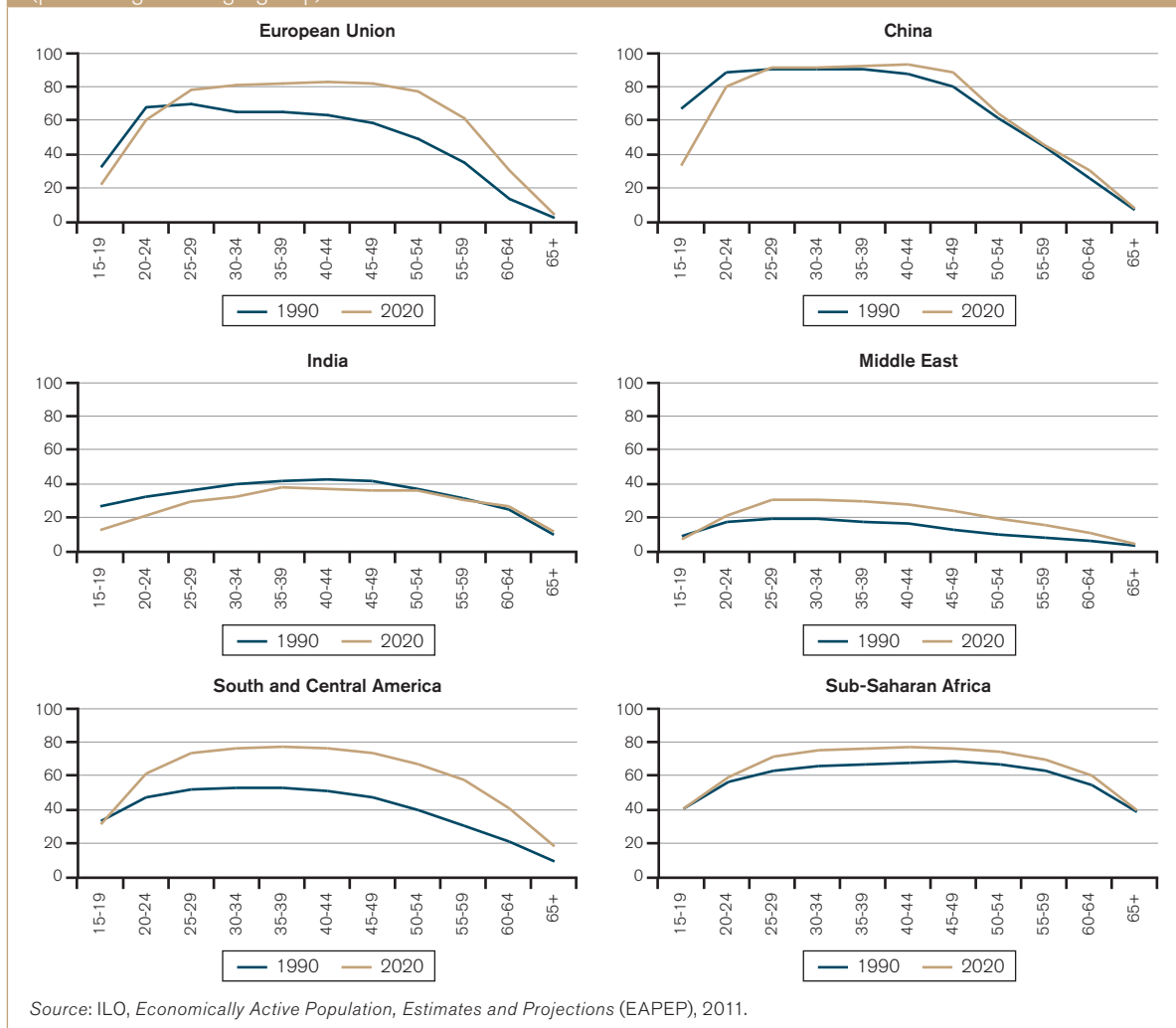
projections. First, continued economic development will lead to lower participation by women in low-income households.[33] Secondly, the specific characteristics of India's process of economic growth in the last decade imply that increases in labour productivity growth are associated with reductions in employment growth (ILO, 2012). Thirdly, according to Kingdon and Unni (2001), specific cultural and social norms, according to which women's labour is less socially acceptable in higher caste, may reduce LFPRs of women with intermediate levels of education.

Cultural and social norms may also explain the low LFPRs currently observed – and projected to continue in the future – in the Middle East (ILO, 2012).[34] Conversely, South and Central American countries will experience significant increases in LFPRs for all age groups. This increase is associated with the favourable demographic trends outlined above, especially lower fertility rates. In Sub-Saharan Africa, participation is also increasing, mainly driven by increases in the working-age population. However, Figure C.9 shows that female LFPRs were already high in 1990, reflecting

the fact that several countries in the region were at a very low level of economic development.

Women's increasing labour force participation can be a source of comparative advantage if women are disproportionately employed in particular sectors. In most developing countries, female employment is concentrated in labour-intensive exports. UNCTAD (2004) reports that women's participation in export industries such as textiles, clothing, pharmaceuticals, food processing, electronics and toy production averages between 53 per cent and 90 per cent of the labour force in African, Asian and Latin American developing countries. In South-East Asia, key export industries such as textiles and electronics relied heavily on relatively unskilled, but generally literate, women (Korinek, 2005). Between 1970 and 1995, women's share in the labour force in Indonesia, Malaysia and Singapore grew from between 26-31 per cent to 37-40 per cent. In the Republic of Korea, the share of working women in regular paid work increased from 65 per cent in 1965 to 81 per cent in 1992, and in mining and manufacturing the female to male

employment ratio rose from 0.37 to 0.68 (World Bank, 2001).[35]

Busse and Spielmann (2006) is the only empirical study that analyses the effect of various measures of gender inequality on comparative advantage. Using panel data from 29 countries over six separate years (1975, 1980, 1985, 1990, 1995 and 2000), they show that a reduction in inequality in labour force participation (i.e. higher shares of female to male labour market activity or a higher female participation rate) is associated with an improvement in the comparative advantage of labour-intensive sectors.[36] The relationship, however, loses statistical significance when high-income countries are excluded from the sample. This is surprising since, as noted above, it is especially in most developing countries that women are disproportionately employed in labour-intensive exports.

In many developing countries, women's increased labour force participation is likely to be accompanied by higher education. KC et al. (2010) report that countries such as Chile, China and South Africa often reach near universal secondary school attainment among women aged 20-39 by 2050. In India and Pakistan, secondary school attainment among women aged 20-39 is projected to increase from around 40 per cent in 2010 to more than 80 per cent in 2050. From a theoretical perspective, a reduced gender bias in educational attainment (a measure of decreasing gender inequality) may positively or negatively affect comparative advantage in labour-intensive goods. The empirical results of Busse and Spielmann (2006) indicate that a reduction in inequality in access to education (i.e. higher female literacy rates relative to male or higher female school enrolment) is associated with an improved comparative advantage in labour-intensive sectors.

However, the causal link could run in both directions. As shown by Vijaya (2003), in some developing countries, trade-related employment can lessen women's incentives to invest in higher education compared with men. Therefore, existing gender gaps in education may be reinforced and even widened by greater trade openness. The explanation for this finding is that the demand for female labour remains concentrated in low-skilled jobs, possibly because discrimination closes off other higher-skilled opportunities, thus reducing the incentive to invest in higher education.[37] However, a reduction in discrimination would give women better access to more skill-intensive occupations which would in turn shift comparative advantage from labour-intensive to skill-intensive sectors.

In conclusion, both the rising share of educated workers and increased female labour force participation have an impact on comparative advantage. In particular, a more educated workforce increases the skill content and the sophistication of exports, which has been an important source of growth for a number of developing countries, especially in East Asia. It is hoped that other developing countries, especially in Africa, will also be able to reap the trade-related benefits of increased education in the future. Labour force participation of women is intimately connected with falling fertility rates and rising life expectancy, but also with increased educational opportunities. Inclusive female labour force participation has effects on comparative advantage, can positively affect import demand and can be a source of welfare gains.

(c) Migration

International migration has an important impact on demographic change. It can influence population growth directly by adding to or subtracting from the population (both for the source and host countries) and indirectly by affecting fertility rates (United Nations, 2011a). Moreover, international migrants tend to be a unique population group in terms of age and education. This section suggests that international migration can affect patterns of comparative advantage by shifting the education and age profile of both source and host countries. This section also reviews the theoretical and empirical literature on the relationship of substitutability or complementarity between trade and migration. Finally, it considers the trade effects of urbanization, which is a consequence, among other things, of internal migration.

The global stock of international migrants grew by 38 per cent from 1990 to 2010. However, international migrants still constitute a very small fraction of the world population, just 3.1 per cent (213.9 million) in 2010. Migrants are concentrated in a few receiving countries: in 2010, ten countries hosted more than half of the global international migrants' stock.[38] The majority of international migrants reside in Europe, Asia and Northern America. Oceania and Northern America had the highest percentage of migrants relative to total population in 2010 (see Table C.1).[39]

Migration is overwhelmingly from less developed to more developed countries and regions. From 1990 to 2010, the migrant stock residing in the North (Europe and Northern America plus Australia, New Zealand and Japan) but born in the South (all other countries and regions) increased by 85 per cent, more than twice as fast as the global migrant stock (38 per cent) (United Nations, 2012a).

In traditional destinations for immigration, such as Australia, Canada, New Zealand and the United States, migrant inflows increased significantly between 1980 and 2008.[40] However, the growth rate was erratic and highly influenced by changes in immigration policies.[41] In the United States, the main host country for the world's migrants, about 1.1 million permanent residence permits were issued between 2005 and 2010 (United Nations, 2011a). Immigrants to the United States mainly originate from Asia and from

Table C.1: **International migrants by region (stocks), 1990-2010** (millions and percentage)	Number of international migrants (millions)			International migrants as percentage of the population		
	1990	**2000**	**2010**	**1990**	**2000**	**2010**
World	155.5	178.5	213.9	2.9	2.9	3.1
More developed regions	82.4	104.4	127.7	7.2	8.7	10.3
Less developed regions	73.2	74.1	86.2	1.8	1.5	1.5
Africa	16	17.1	19.3	2.5	2.1	1.9
Asia	50.9	51.9	61.3	1.6	1.4	1.5
Europe	49.4	57.6	69.8	6.9	7.9	9.5
Latin America and the Caribbean	7.1	6.5	7.5	1.6	1.2	1.3
Northern America	27.8	40.4	50	9.8	12.7	14.2
Oceania	4.4	5	6	16.2	16.1	16.8

Source: United Nations Population Division, World Migrant Stock database.

Note: For the definition of regions, see http://esa.un.org/MigAge/index.asp?panel=3.

Latin America and the Caribbean (with both regions accounting for 40 per cent of the total immigrant inflows in 2010). Mexico and China account for 13 and 7 per cent of the 2010 inflows, respectively. Asia also represents the main region of origin of migrants to Australia (share of 60 per cent of the total immigrant inflows in 2008) and Canada (share of 58 per cent of the total immigrant inflow in 2009). In Europe, Germany represents the main destination for Central and Eastern European migrants, especially after the enlargement of the European Union in 2004 and 2007.[42] The majority of immigrants to European countries in the period 2000-08 came from other countries in Europe. However, for some European host countries, such as France, the United Kingdom and Spain, immigrants mainly came from developing

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Box C.1: **Has migration become more regionalized?**

One of the trends documented in Section B of this report is the increased regionalization of merchandise trade flows. Does a similar pattern emerge for migration? Answering this question is not easy due to severe data limitations. In Figure C.10, historical data on migrants' stocks compiled by the World Bank are used for the years 1990 and 2000.[43] Some interesting facts emerge.

First, migrants from African, Asian and Commonwealth of Independent States (CIS) countries predominantly reside in their respective region of origin. Conversely, the majority of migrants residing in North America and in the Middle East come from countries outside the region. Europe falls between the two, with a share of about 60 per cent of migrants coming from within Europe.

Secondly, between 1990 and 2000, the share of intra-regional migrants increased significantly in South and Central America (from 55 to 64 per cent), and to a minor extent in North America (from 28 to 31 per cent) and Africa (from 85 to 87 per cent). Conversely, this share remained stable in Europe, and it slightly decreased in all other regions (from 32 to 31 per cent in the Middle East; from 95 to 93 per cent in CIS countries; from 85 to 84 per cent in Asia).

The high shares of intra-regional migration in Africa, Asia and the CIS can be explained mainly by movements across the borders of neighbouring states. According to Ratha and Shaw (2007), this geographically limited cross-border migration accounted for 80 per cent of the South-South migrants' stock in 2007. The same study also shows that migrants from Burkina Faso to neighbouring Côte d'Ivoire account for the highest share of South-South migrants in Africa, while migrants from Bangladesh to India represent the highest share of South-South migrants in South Asia. In the CIS region, migrants mainly move between the Russian Federation and Ukraine and between the Russian Federation and Kazakhstan. Other countries with high levels of cross-border migration are South Africa, which is the main destination for migrants from Lesotho, Mozambique and Zimbabwe, and Thailand, which is the main destination for migrants from Cambodia, Lao PDR and Myanmar (IOM, 2008).

The relevance of cross-border migration among developing countries reflects low levels of wealth and education of the population at origin, which limit individuals' and households' ability to afford long-distance migration. Since it is mainly short-distance and temporary, cross-border migration can be equated with internal migration.

Figure C.10: **Intra-regional and extra-regional migrants (stocks), 1990 and 2000** (thousands and percentage)

Extra-regional ▪ Intra-regional

Source: World Bank *Global Bilateral Migration Database* (GBMD).

Note: Graphs for regions are shown to scale, with the exception of South and Central America and Africa, which share a different scale. Colours and boundaries do not imply any judgment on the part of WTO as to the legal status of any frontier or territory.
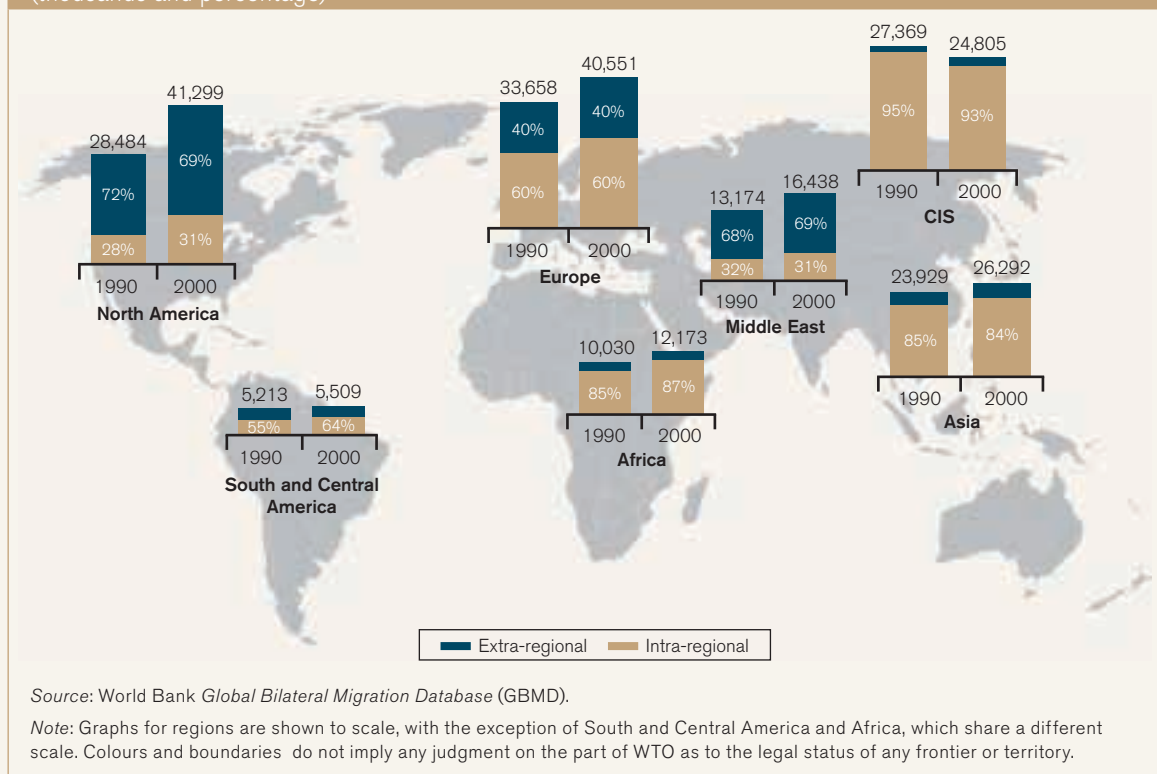
However, since it takes place between areas with relatively similar income levels, cross-border migration is likely to be driven more by the desire to reduce risk and diversify income rather than by geographical income differences (Ratha and Shaw, 2007).[44]

Institutional factors, such as the presence of preferential trade agreements (PTAs) or regional consultative processes (RCPs) on migration, may also help to explain patterns of intra-regional versus extra-regional migration.[45] A recent study by Orefice (2012) shows that PTAs have been a determinant of migration inflows for 29 OECD countries in the period 1998-2008. In particular, visa-and-asylum and labour market related provisions, when included in PTAs, stimulate bilateral migration flows. In this study, however, no distinction is made between intra- and cross-regional PTAs because of data limitations. In the future, more research should be conducted, with the aim of discerning the effects of institutional factors on intra- versus extra-regional migration.

regions.[46] A more detailed analysis of migration patterns within regions (intra-regional) and across regions (extra-regional) is presented in Box C.1.

As argued above, migration can directly influence population growth by adding to or subtracting from the population of the countries concerned. Fifty years ago, the impact of net migration on overall population growth was negligible in virtually all countries and regions. More recently, net migration has become more important to developed countries due to low fertility rates. As shown in Figure C.11, by 1990-2000 net migration was already the main driver of population growth in developed countries.[47] This trend will continue in the future. From 2010 to 2050, the net number of international migrants moving to more developed regions is projected to be 87 million. Since it is projected that deaths will exceed births by

11 million, the overall population growth will be 76 million. From 2050 to 2100, the net number of international migrants moving to more developed regions is projected to be 49 million. Given an excess of deaths over births of 24 million, this will result in an overall growth of 25 million (United Nations, 2011b).

Migration also impacts population change indirectly by influencing fertility rates in the country of origin and in the host country. However, recent evidence suggests that migrants adapt over time to the host country's fertility norms (Kulu, 2005).[48] Thus, any positive impact on host-country fertility that international migration from high- to low-fertility countries might have is likely to be temporary. Migrants' adaptation to the host country's norms affects fertility levels in the country of origin as well because the fertility norms of the host country are, to a certain degree, transferred

Figure C.11: **Contribution of natural increase and net migration to net population change in developed countries, 1950-55 to 2045-50**
(percentage)
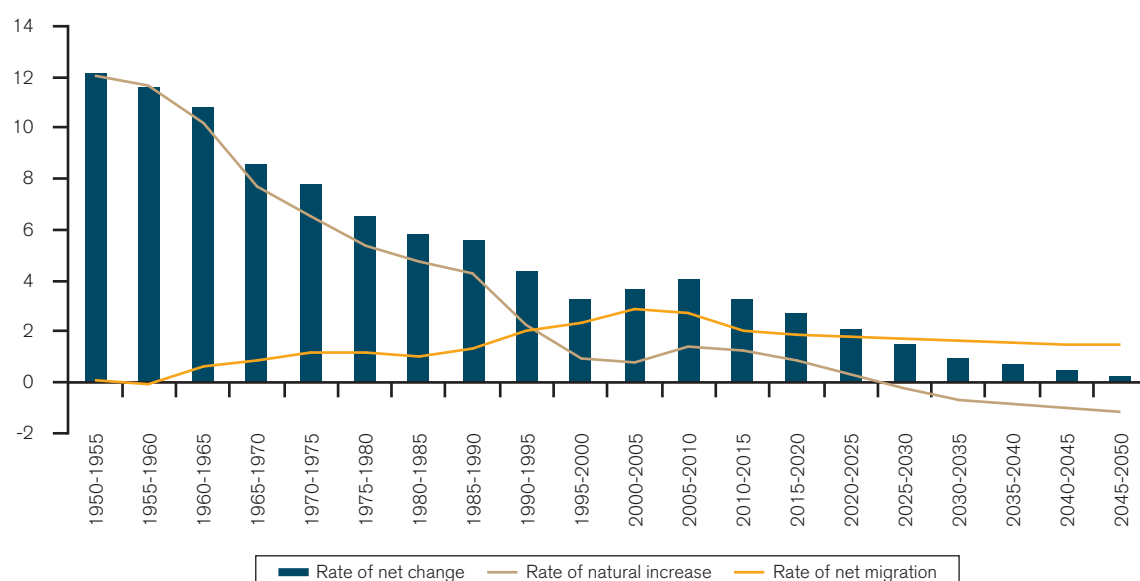
Source: United Nations Population Division, *World Population Prospects: The 2010 Revision database.*

back to the country of origin. For instance, Bertoli and Marchetta (2012) show that Egyptian couples have a significantly higher number of children when the husband returns to his home country after having been a migrant in a high-fertility Arab country. Moreover, migration's impact on fertility rates is not limited to migrants and their households but can spill over to the wider population in the country of origin. Using macro-level data for about 150 host countries in 2000, Beine et al. (2012) estimate that a 1 per cent decrease in the fertility level in the host country reduces fertility rates in the country of origin by 0.3 per cent.

Migrants are generally younger than the native population. For instance, the median age of immigrants in EU member states in 2009 ranged from 24.9 years (in Portugal) to 33.7 years (in Latvia), relative to a median age of the EU-27 population of 40.9 years.[49] More importantly, individuals of working age are over-represented among international migrants, as Figure C.12 shows for EU member states.[50]

Accordingly, migration is projected to reduce dependency ratios in a number of economies, as indicated by Table C.2.[51] The impact of migration is very noticeable in oil-exporting Middle Eastern countries, such as the United Arab Emirates, Qatar and the State of Kuwait but it is also noticeable in Hong Kong (China), Switzerland and southern European countries. However, notwithstanding a relatively greater impact in certain economies, the overall impact of migration on the age structure of the world population is likely to be modest, especially in countries where the ageing process is most advanced, such as Japan. The United Nations (2011a) concludes that migration cannot reverse the trend of population ageing.

The impact of migration on the origin and host countries crucially depends on the skills distribution between migrants and the native population. Table C.3 provides a comparison between the education structure of the native population and immigrants in OECD destinations. The last row of the table shows that, between 1990 and 2000, on average, immigrants are more educated than the native population. Thus, immigration is associated with a net "brain gain" in host countries. However, there are significant differences across countries. For instance, immigrants are more skilled than the native population in countries where the nationals' education level is low (such as Mexico and Turkey) or in countries where the immigration policy favours the entry of highly educated individuals (such as Australia, Canada and New Zealand). In contrast, immigrants are less skilled than the native population in countries where the nationals' level of education is high, such as the United States and France.

Table C.3 also shows that during the period 1990-2000 the overall share of high-skill immigrants to OECD countries increased from 30 to 35 per cent. In the same period, the number of high-skill immigrants increased by 64 per cent (from 12.6 to 20.7 million), while the number of low-skill immigrants increased by 22 per cent (from 20.1 to 25.7 million). However, most immigrants to OECD countries are medium- or low-skilled individuals (Docquier et al., 2009). As underlined by Widmaier and Dumont (2011), this is largely explained by labour needs in the so-called "3D job" sector (dirty, dangerous, difficult) and low-wage sectors, such as agriculture, construction and domestic services. Here, too, there is significant heterogeneity across OECD countries. In southern Europe, migrants are mainly low-skilled, while in Canada, Australia and New Zealand, migrants are mostly highly educated.

The emigration of skilled individuals ("brain drain") has long been a policy concern in their countries of origin (see the discussion in Docquier and Rapoport, 2012). Table C.4 shows data on the stock on high-skilled emigrants and high-skill emigration rates by region for the years 1990 and 2000. The table shows that, unlike high-skill emigration stocks, high-skill emigration rates remained fairly stable over this period.[52] In both years, there is considerable variation across countries within regions.

For instance, within East Asia and the Pacific, the rate is 3 per cent in Australia but rises to 15 per cent in South-eastern Asia and to about 47 per cent in the Pacific Islands. Within South and Central America, the rate ranges from 18 per cent in South America to 27 per cent in Central America to 65 per cent in the Caribbean (in this sub-region, the countries with the highest skilled emigration rates are Jamaica and Haiti, with rates of 85 and 83 per cent, respectively). Some African countries are also characterized by skilled emigration rates that are significantly higher than the regional average. This is the case for Gambia (68 per cent), Sierra Leone (49 per cent), Ghana (45 per cent) and Kenya (40 per cent) among others.[53] Whether the emigration of skilled individuals is harmful or beneficial for the countries of origin is a question that will be analysed in more detail below.

(i) Migration and trade

Labour migration can have distinct short- and long-run effects in the host country.[54] The short-run effects can best be understood in a specific-factor framework. Consider an economy with two sectors, agriculture

Table C.2: **Countries with the greatest increase in dependency ratio under zero-migration scenario, 2050**

Rank	Country	Dependency ratio in 2010	Dependency ratio in 2050	
			Medium variant	Zero-migration scenario
1	United Arab Emirates	25	37	104
2	Qatar	20	38	95
3	Hong Kong, China	32	78	108
4	Kuwait, the State of	34	57	79
5	Switzerland	48	72	88
6	Spain	47	87	98
7	Canada	44	70	80
8	Greece	48	82	92
9	Austria	48	77	86
10	Italy	53	88	96

Source: United Nations (2011a).

and manufacturing, and three factors of production: labour, land and capital. Labour is mobile across sectors, while land and capital are specific to the agricultural and to the manufacturing sector, respectively. At constant relative prices, an increase in the endowment of labour (due to immigration) results in an increase in the output of both sectors because more workers are employed.[55] Since capital and land cannot move between sectors, labour intensity (the amount of labour relative to the amount of the specific factor) in production increases in both sectors, leading to a fall in wage rates (under the assumption that markets are perfectly competitive and workers are paid their marginal productivity). Since the output of both sectors increases symmetrically, there is no change in the overall composition of output and on comparative advantage.

The long-run effects of immigration, however, are different due to the inter-sectoral mobility of production factors. Consider an economy with two sectors, shoes and computers, and two factors of production: labour and capital. Both factors can freely move across sectors, and the shoe sector is relatively more labour intensive than the computer sector. The Rybczynski theorem predicts that, at constant relative prices, an increase in the endowment of labour due to immigration will lead to an increase in the output of shoes and to a decrease in the output of computers. The logic is the following: in the long run, the capital-labour ratio will remain unchanged in both sectors. Therefore, not only will the additional labour be entirely absorbed by the shoe sector, but there will also be some reallocation of labour and capital from the computer to the shoe sector. Therefore, production in the shoe sector will expand while production in the computer sector will contract.[56] If the host country enjoyed a comparative advantage in the shoe sector, this comparative advantage will be strengthened. If,

Figure C.12: **Age structure of the national and non-national populations, EU, 2010** (percentage)
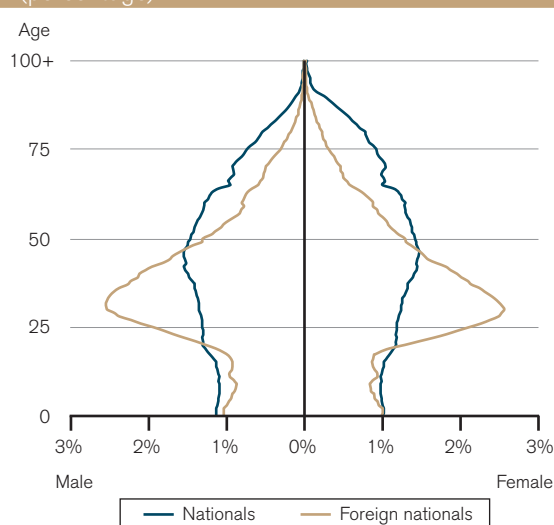
Source: Eurostat, Migration and migrant population statistics.

Note: The age distribution is based on the aggregate of all EU member states. All migrants, both from EU and non-EU member states, are considered as foreign nationals.

Table C.3: **Percentage of high-skill immigrants and nationals in OECD countries, 1990-2000**					
	1990			**2000**		
	Percentage of high skill among natives	Percentage of high skill among immigrants	Ratio immigrants/ natives	Percentage of high skill among natives	Percentage of high skill among immigrants	Ratio immigrants/ natives
Australia	31.1%	34.6%	1.11	34.0%	40.3%	1.19
Austria	11.2%	8.4%	0.75	14.4%	12.7%	0.88
Belgium	20.8%	12.7%	0.61	27.5%	19.8%	0.72
Canada	43.8%	50.7%	1.16	51.5%	58.8%	1.14
Czech Republic	8.5%	5.6%	0.66	10.8%	11.5%	1.06
Denmark	19.6%	13.8%	0.71	21.6%	17.3%	0.80
Finland	20.2%	16.0%	0.79	26.3%	23.8%	0.91
France	21.9%	9.9%	0.45	21.9%	16.4%	0.75
Germany	21.8%	16.9%	0.78	25.5%	21.8%	0.85
Greece	10.9%	15.1%	1.39	15.2%	15.0%	0.99
Hungary	10.1%	7.6%	0.75	12.0%	11.6%	0.97
Iceland	11.0%	24.0%	2.17	15.5%	31.4%	2.02
Ireland	14.6%	26.5%	1.82	19.4%	41.1%	2.12
Italy	6.3%	15.4%	2.45	8.7%	15.4%	1.78
Japan	21.2%	22.5%	1.06	24.0%	28.1%	1.17
Korea, Republic of	13.4%	33.1%	2.48	25.8%	38.1%	1.48
Luxembourg	20.8%	17.1%	0.82	27.5%	21.7%	0.79
Mexico	9.1%	33.8%	3.70	11.2%	44.9%	3.99
Netherlands	16.2%	17.3%	1.07	22.0%	22.0%	1.00
New Zealand	23.3%	43.6%	1.87	25.9%	40.9%	1.58
Norway	15.7%	25.2%	1.60	21.8%	28.7%	1.32
Poland	7.9%	12.0%	1.53	11.1%	14.0%	1.26
Portugal	6.5%	20.1%	3.08	8.8%	18.6%	2.10
Slovak Republic	9.5%	7.7%	0.81	11.6%	15.2%	1.31
South Africa	3.8%	16.0%	4.27	10.3%	22.0%	2.13
Spain	9.5%	16.7%	1.76	12.2%	18.5%	1.51
Sweden	20.5%	17.7%	0.86	27.5%	25.7%	0.93
Switzerland	17.2%	15.1%	0.88	17.2%	18.6%	1.08
Turkey	5.0%	11.4%	2.30	8.5%	21.5%	2.54
United Kingdom	13.9%	20.3%	1.46	17.8%	34.9%	1.96
United States	39.2%	41.2%	1.05	51.3%	42.7%	0.83
OECD	21.6%	29.7%	1.37	27.1%	34.8%	1.29

Source: Docquier et al. (2009).

however, its comparative advantage was in the computer sector, this will be weakened and possibly reversed by immigration.

The example can be slightly modified to understand the effects of skill-biased migration. If the composition of migrants is relatively more skilled, in the short run the wage rate of skilled labour will decrease, while in the long run the output of skilled labour-intensive sectors will increase at the expense of unskilled labour-intensive sectors. The same logic holds when immigrants are unskilled. Empirical research on adjustment at the quantity margin is limited but the few existing studies confirm the theoretical predictions. Hanson and Slaughter (2002), for instance, document the rapid growth in apparel, textiles, food products and

Table C.4: **High-skill emigrant stocks and emigration rates by region, 1990 and 2000**				
	1990		**2000**	
	Stock of high-skill emigrants (thousands)	High-skill emigration rate	Stock of high-skill emigrants (thousands)	High-skill emigration rate
Africa	742	11.5%	1,407	10.6%
Asia	3,349	4.9%	6,304	5.7%
Commonwealth of Independent States (CIS)	226	1.0%	681	2.0%
Europe	4,843	9.2%	6,535	9.2%
Middle East	479	12.3%	769	9.8%
North America	1,085	1.4%	1,900	1.7%
South and Central America	1,559	10.0%	2,735	10.1%

Source: Docquier et al. (2009).

Note: For a given region, the high-skill emigration rate is defined as the share of highly educated emigrants from the region in the total of highly educated emigrants and natives of the region.

other labour-intensive industries in California after the arrival of relatively low-skilled Mexican migrants.[57]

A closely related question is whether trade and migration are substitutes or complements. The general presumption is that they are substitutes, as predicted by the standard Heckscher-Ohlin-Samuelson (HOS) trade model. Consider the case of two countries, two goods and two factors. As shown by Mundell (1957), there is a one-to-one relationship between relative commodity prices and relative factor prices. This relationship is identical for both countries due to the assumption of equal technology. If, due to free trade, commodity prices are equalized, then factor prices are also equalized. By the same token, if, due to free factor mobility, factor prices are equalized, then commodity prices are also equalized. These factor prices and commodity prices must be the same as in the case of free trade.[58] Therefore, trade and immigration are substitutes.

As one moves away from the assumptions that define the HOS model, however, the nature of the relationship easily changes, and trade and factor mobility can be complements. Gaston and Nelson (2013) introduce a slight modification of the example discussed above, where the host country has a superior technology in the production of the labour-intensive good. This technological superiority gives rise to a comparative advantage in the labour-intensive good (for a given wage-rental, the autarky price of this good is lower in the host than in the foreign country). If, due to free trade, commodity prices are equalized, the wage-rental in the host country will exceed the wage rental in the foreign country. This will provide an incentive to migrate from the foreign to the host country. If such migration is allowed, labour will flow to the host country, increasing its comparative advantage in the

labour-intensive good through Rybczynski effects. Migration is, therefore, complementary to trade. Suppose now that, due to free factor mobility, factor prices are equalized. The relative price of the labour-intensive good will be lower in the host country than abroad. If trade is allowed, production will increase in the comparative advantage good. Migration is, therefore, complementary to trade.[59]

Ultimately, it is an empirical question whether trade and migration are substitutes or complements. Most of the empirical evidence points towards complementarity. Using data for the United States from 1948 to 1983, Wong (1988) finds that trade is a quantity complement to immigration. Using UK data for the period 1975-96, Hijzen and Wright (2010) show that skilled immigrants are quantity complements with trade. Unskilled workers are quantity substitutes but the result is statistically insignificant.[60] The large literature on the effects of migrant networks on trade (see Box C.2), while not providing a rigorous test based on general equilibrium models, also points towards complementarity between migration and trade. The policy implication is that restrictive immigration policies may not only restrict migration flows but also trade flows.

Immigration is not only a labour supply shock; it also affects total factor productivity and consequently international trade. Peri (2012) offers convincing evidence that immigration to the United States has a positive effect on total factor productivity and a negative effect on the skill-bias of production technologies (i.e. it promotes the adoption of unskilled-efficient technologies). These effects can be jointly explained by two mechanisms.

First, Acemoglu's (2002) theory of directed technical change predicts that the availability of a production

The presence of migrant networks can promote trade between their origin and host countries in at least two ways. First, they might help overcome informational barriers to international trade related to language, culture or institutions, facilitate the creation of business relationships and make valuable information on foreign sales and sourcing opportunities more readily available. Secondly, migrants boost trade if they derive higher utility from goods produced in their host countries. Felbermayr and Toubal (2012) refer to the first channel as the trade-cost channel and to the second as the preference channel.[61]

Since the seminal contribution of Gould (1994), several studies have tried to quantify the positive association between immigration and trade.[62] The "business and social network effect" of immigrants received large empirical support (see, for instance, Rauch and Trindade, 2002). In a recent paper, Aleksynska and Peri (2012) examine, as a measure of the trade business network of immigrants, the share of immigrants in managerial/sales jobs. Such immigrants are pivotal to establishing important business connections. The share of migrants in business network occupations has a large and significant effect on exports (but much less on imports), in line with previous studies. Specifically, each business network immigrant generates over ten times the value of trade as a non-business network immigrant does. Aleksynska and Peri (2012) show that business networks are especially trade-enhancing in the case of trade in differentiated goods and for trade between countries with different legal systems, while cultural similarities (linguistic, colonial origin) attenuate the effect of business networks on trade.[63]

The link between immigration and trade through networks is also affected by the composition of the immigrant base, as recently argued by Egger et al. (2012). Highly concentrated skilled or unskilled migrants produce higher trade volumes than a balanced composition of the immigrant base. This can be explained by the fact that immigrants form stronger networks within the same skill group than across skill groups. They also find evidence that a polarization of migrants (regardless of whether they are skilled or unskilled) tends to produce more trade in differentiated goods relative to non-differentiated goods. That is, the knowledge-creation effect of migrant networks is stronger when such networks are polarized.

Migrant networks (in particular, networks of graduate students) can also have a more indirect effect on trade, through the diffusion of similar political ideas. For instance, Spilimbergo (2009) finds a positive correlation between political systems in a country of origin and in the countries in which emigrant students have studied. Since forms of government and trade may be correlated (Yu, 2010; see Section C.6 for more details), migrant networks can also indirectly affect trade through their impact on political systems.

Until recently, evidence regarding the role of the preference channel has been scant. The early literature assumed the importance of such a channel because of the difference between the immigrant elasticity of imports and the immigrant elasticity of exports – given that the trade cost channel affects both imports and exports, while the preference channel only affects the exports. Of late, additional evidence has emerged.

Bronnenberg et al. (2012) show that US internal migrants tend to consume according to the prevalent choices in the state of origin. The same evidence is found for India by Atkin (2010), who shows that inter-state migrants carry their food tastes with them, consuming food less similar to that consumed in their host state and more similar to that consumed in their state of origin. Finally, Mazzolari and Neumark (2012) show that immigration is associated with increased ethnic diversity of restaurants in California, partly because immigrants are consumers with potentially different demand characteristics, and partly because they have a comparative advantage in the production of ethnic food from their country of origin.

factor induces firms to adopt technologies that are more efficient and intensive in the use of that factor.[64] Secondly, Peri and Sparber (2009) show that immigration can drive specialization according to comparative advantage at the task level. They assert that native workers and immigrants are imperfect substitutes in production, even if they have similar (limited) educational attainments. Since immigrants are likely to have imperfect communication skills, but

manual skills similar to those of native workers, they have a comparative advantage in occupations requiring manual labour, while less educated native workers have a comparative advantage in occupations demanding communication skills. Immigration, therefore, encourages workers to specialize, with consequent productivity gains. Peri and Sparber (2009) offer empirical support for this hypothesis, using US data. Their main conclusion is that, due to specialization in

different tasks, even less educated native workers may not see adverse wage consequences from low-skill immigration.

Immigration also impacts innovation in host countries. As noted above, the share of highly skilled migrants in the total number of migrants to OECD countries has increased dramatically over the last two decades. In the United States between 1995 and 2006, 67 per cent of the net increased number of scientists and engineers (almost half a million workers) was foreign-born.[65] High-skilled migration can also contribute to technological progress through increased patenting, thus helping to develop or to strengthen comparative advantage in technology-intensive sectors. Empirical evidence based on US and EU data supports this idea.[66] At the same time, however, there is evidence to suggest that immigration appears to disrupt the schooling of the native population in some host countries.[67]

In countries of origin, migration has important effects on the incentives to accumulate human capital, which in turn affects patterns of comparative advantage. As discussed above, well-educated people in certain developing countries are particularly likely to emigrate. This is especially the case in certain middle-income economies where people have both the incentives and the means to emigrate (Docquier and Rapoport, 2012). Traditionally, this type of migration has been viewed as detrimental to the country of origin because of the positive spill-over effects associated with learning.[68] However, in certain circumstances it is also possible that emigration results in a net increase in the supply of human capital in countries of origin, creating a net "brain gain". As first explained by Stark and Wang (2002), this is because the prospect of emigrating increases the returns to schooling, and therefore the incentive to investment in human capital formation. However, if only a fraction of potential migrants manage to emigrate, the result is a net increase in human capital in the country of origin.

Beine et al. (2001) show that accumulation of additional human capital in the country of origin can more than compensate for the loss in skill due to migrant outflows.[69] Recently, others have argued that an increase in the possibility of migration might not only affect the level but also the composition of human capital by encouraging a shift away from rent-seeking activities, which are less conducive to emigration, towards entrepreneurial ones, which are more conducive to emigration (Mariani, 2007). The migration of educated individuals can also imply beneficial transfer of knowledge, because migrants come back to their home countries to visit, to establish dual residence, to start businesses and universities, and, sometimes, to stay (return migration). These people bring back new ideas and skills, which are crucial ingredients to economic growth (Freschi, 2010; Nyarko and Easterly, 2009; *The Economist*, 2011).[70]

As argued above, migration can change fertility decisions in both source and host countries. Mountford and Rapoport (2011) propose a theoretical framework in which skilled migration, investment in education and fertility are analysed together. In the host country, skilled migration will have the static effect of reducing the proportion of individuals who choose to become skilled workers (because the equilibrium wage of skilled workers decreases), which will in turn increase the fertility rate. The dynamic effect is the opposite. Intuitively, the proportion of skilled labour in the economy will increase as a result of skilled immigration, which will in turn raise the growth rate and eventually lead to a reduction in fertility. If the dynamic effect prevails, the host country will accumulate human capital and have a lower fertility rate (and vice versa if the static effect prevails). In the country of origin, there is human capital accumulation due to the brain drain effect (the possibility of emigration increases the incentive to accumulate human capital, which more than compensates for the loss in human capital due to emigration). This accumulation of human capital leads to a decrease in the fertility rate.[71]

(ii) Urbanization and trade

Urbanization is one of the most important global demographic trends. As shown in Table C.5, the rate of urbanization increased by 77 per cent over the last six decades, rising from 29.6 per cent (0.75 billion people) of the global population in 1950 to 52.1 per cent (3.6 billion) in 2011. Urbanization is expected to rise further to 67.1 per cent in 2050. Developed regions are expected to see their level of urbanization increase from 77.4 to 86.3 per cent over the same period. In less developed regions, the urbanization rate is projected to increase from 46.6 per cent in 2011 to 64.1 per cent in 2050. In both groups of countries, urban areas will account for all expected population growth. Consequently, world rural population will decline by about 0.3 million by 2050 (United Nations, 2012b).

Despite the common trend towards urbanization, there are still significant differences across regions. In 2011, Northern America, Latin America and the Caribbean, and Europe had the highest percentage of urban population (82.2, 79.1 and 72.9 per cent, respectively). Conversely, Africa and Asia had the lowest percentage (39.6 and 45.0 per cent, respectively). In the coming decades, urban population growth will be especially concentrated in these two regions. Africa and Asia are expected to reach urbanization rates of 57.7 per cent and 64.4 per cent, respectively, by 2050 (United Nations, 2012b).

Besides the shift in the distribution of global population from rural to urban areas, another important trend is the emergence of larger cities. In 2011, the majority of the world's urban population lived in cities with fewer than half a million inhabitants. In the coming decades, however, urban population will be mainly concentrated

Table C.5: **Urban and rural population, 1950-2050** (billions and per cent)	1950	1970	2011	2030	2050
World population	2.53	3.70	6.97	8.32	9.31
Urban (%)	29.6	36.5	52.1	59.9	67.1
Rural (%)	70.4	63.5	47.9	40.1	32.9
Population in more developed regions	0.81	1.01	1.24	1.30	1.31
Urban (%)	54.3	66.3	77.4	81.5	86.3
Rural (%)	45.7	33.7	22.6	18.5	13.7
Population in less developed regions	1.72	2.69	5.73	7.03	7.99
Urban (%)	17.4	25.3	46.6	55.8	64.1
Rural (%)	82.6	74.7	53.4	44.2	35.9

Source: United Nations Population Division, *World Urbanization Prospects: The 2011 Revision database.*

in cities with more than half a million inhabitants. The number of mega-cities, defined as cities with more than 10 million inhabitants, will grow from 23 to 37 in the period 2011-25. However, mega-cities will still account for a relatively low percentage of the world's urban population (13.6 per cent in 2025, up from 9.9 per cent in 2011). Population growth rates will vary considerably across mega-cities, with the highest growth rates projected for Lagos in Nigeria, Dhaka in Bangladesh and Shenzhen in China. Tokyo, Osaka-Kobe and Moscow will register the lowest growth rates.

Population growth in urban areas can either be due to natural increase (birth rates in excess of death rates) or to net internal migration. Studies of 19th-century Europe (Williamson, 1988), as well as those on East Asian countries in recent decades, suggest that urbanization occurred at the same time as industrialization and was the result of migration from rural areas. However, in a number of developing countries, especially in Sub-Saharan Africa, urbanization rates have increased prior to, or sometimes in the absence of, industrialization. According to Dyson (2011), this can be explained by the fact that during the demographic transition the main driver of urbanization is not rural-urban migration but rather the natural growth of urban centres.[72]

Urbanization is among the most striking manifestations of "lumpiness" – a situation in which factors of production (land, capital, natural resources and various types of labour) are unequally distributed within a country (World Bank, 2009; Puga, 2010).[73] In a seminal contribution, Courant and Deardorff (1992) show that lumpiness can be a source of comparative advantage and therefore a determinant of trade that is distinct from other more traditional determinants of trade, such as differences in factor endowments and technologies. This is because a country tends to export the good that uses relatively intensively the factor that is more unevenly distributed across its regions. Consider a country composed of two regions. Starting from a situation in which factors are evenly distributed across the two regions, a large enough reallocation of one factor – for example, labour – between regions will bring about complete specialization.

At this point, a further reallocation of labour in the same direction can only increase the output of the labour-intensive good in the region producing it, lowering its autarky relative price. This creates comparative advantage in the labour-intensive good.[74]

Various empirical studies have tried to document whether lumpiness affects trade patterns. While the early literature tended to dismiss lumpiness, recent contributions show that it might be a relevant factor. Most of the studies are indirect tests that try to establish whether Deardorff's (1994) "lens condition" is violated. This condition requires factor endowments to vary less across countries than factor input intensities vary across goods. If the set of points (i.e. lens) defined by regional factor abundances passes outside the set of points defined by goods' factor intensities, factor price equalization is impossible and lumpiness may affect trade patterns. The lens condition is found not to be violated for Japan, the United Kingdom and India by Debaere (2004) and for OECD countries by Debaere and Demiroglu (2003).

However, more recent work using city-level (as opposed to region-level) data finds that the lens condition is violated in six European countries (France, Germany, Italy, the Netherlands, Portugal and Sweden), thereby indicating that urban lumpiness might be an important determinant of trade patterns (Brakman and van Marrewijk, 2013).[75] Bernard et al. (2010) argue that factor lumpiness is also significant in the case of Mexico. They show that regional concentration of skilled labour induces skill-abundant regions within the country to offer relatively low wages for skilled labour and thereby specialize in the production of relatively skill-intensive goods. As a result, the country becomes a net importer of labour-intensive products. In this sense, the country's overall labour abundance is undermined by regional heterogeneity.

Urbanization or, more generally, agglomeration can also influence trade patterns indirectly via its impact on productivity.[76] There is ample evidence to suggest that workers and firms are more productive in larger and denser cities (Puga, 2010). Estimated agglomeration gains differ across countries, largely

Box C.3: **Demography and trade: a complex relationship**

The relation between demography and trade is complicated by numerous factors. First, there could be variables that affect both demography and trade. An example is the quality of institutions (as shown in Section C.6).[77] Institutions can also have an indirect effect on demography through their impact on economic development (Rodrik et al., 2004; Bloom and Canning, 2004).

Secondly, causality can run in both directions. Galor and Mountford (2006; 2008) claim that trade helps explain why the timing of the demographic transition differed between technologically advanced and less technologically advanced countries. In the former, trade reinforced specialization in the production of skill-intensive industrial goods, increasing the demand for skilled labour and the incentives to invest in human capital – which, in turn, reduced fertility rates. However, in the latter trade encouraged specialization in the production of unskilled-intensive, non-industrial goods, raising the demand for unskilled labour and reducing the incentives for human capital accumulation – which, in turn, increased fertility rates.

The contrasting demographic experiences of Britain and India during the 19th century provides anecdotal evidence to support this theory (Galor, 2012). During this period, Britain traded manufactured goods for primary products from India. The processes of industrialization in Britain led to a significant increase in the demand for skilled labour in the second phase of the industrial revolution, triggering a demographic transition in the 1870s. In contrast, the lack of demand for skilled labour in India delayed the demographic transition until the second half of the 20th century. Galor and Mountford (2008) provide cross-sectional evidence that trade (measured as the trade share in GDP in 1985) reduced fertility rates (measured as the average between 1985 and 1990) in OECD countries, while it increased fertility rates in non-OECD countries (see Figure C.13).

Figure C.13: **Effect of trade on fertility rates, by group of countries**
(thousands and per cent)

Source: Galor and Mountford (2008).
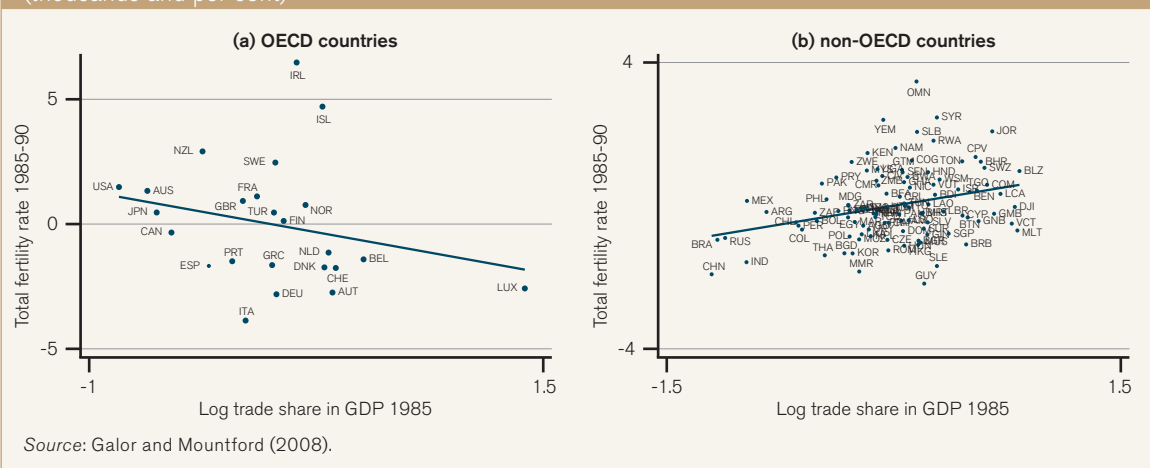
Moreover, Do et al. (2012) show that comparative advantage has an impact on fertility rates. In particular, countries with a comparative advantage in female labour-intensive goods are characterized by lower fertility rates. This is because female wages, and thus the opportunity costs of child-rearing, are higher in those countries.[78]

Causality may run in both directions in the relationship between trade and migration as well, since immigrants typically move to countries where formal or informal links are already established and where trade with their homeland is already present (Briant et al., 2009).[79] Using instrumental variable techniques, Briant et al. (2009), Peri and Requena-Silvente (2010) and Bratti et al. (2012) show that immigration leads to trade, although their analyses do not preclude the reverse channel co-existing.[80]

In the case of urbanization, the focus has been on the effect of "lumpiness" – the unequal distribution of factors of production within a country – on comparative advantage and trade patterns. A large body of literature, however, considers the reverse causal link, investigating the consequences of trade on urbanization.[81] A major research question is whether trade opening fosters concentration or dispersion of economic activity within a country. In theory, the effect is ambiguous as it depends on the relative importance of agglomeration and dispersion forces.[82] Empirical evidence shows that the distribution of economic activity prior to trade opening crucially affects the results. In general, regions with better access to foreign markets benefit. If, previous to trade opening, these regions were lagging behind, then opening leads to geographical convergence. If, however, these regions were already the most advanced, then trade opening will result in geographical divergence (Brülhart, 2010).

because of cross-country differences in factor mobility (Au and Henderson, 2006; Combes, 2000), and are generally higher for the services sector than for manufacturing. Innovation in knowledge-intensive sectors is especially affected by the geographical concentration of economic activity (Audretsch and Feldman, 2004). The implication is that comparative advantage in these sectors will also depend on agglomeration.

In summary, recent migration patterns have been characterized by significant increases in skilled migration. This has effects on innovation in the host country and on human capital formation in the country of origin that can make skilled migration beneficial for both. Traditional trade models predict that migration (movement of factors) and trade (movement of goods) are substitutes. However, with small modifications that introduce, for instance, differences in technology across countries, the relationship between trade and migration becomes complementary. The pro-trade effect of migrant networks is a good example of such complementarity. Finally, internal migration, and in particular urbanization, can also have effects on trade. Recent theories predict that the geographical concentration of a factor of production within a country can give rise to comparative advantage in the good that uses it relatively intensively. Empirical evidence is scant but recent studies suggest that this might be more than a theoretical possibility. Finally, agglomeration can indirectly affect trade through its impact on productivity.

(d)   Conclusions

This section has shown that demographic change is and will continue to be a shaping factor of international trade. Ageing, migration, educational convergence and women's growing participation in the labour force – all linked to the underlying demographic transition – help to shape countries' comparative advantage. Moreover, as the size of the working-age population increases in some countries and decreases in others – and as a global middle class emerges – the size and the composition of import demand is also changing, with further effects on trade flows. For instance, trade in services, such as health care and education, is likely to increase.

The policies that countries adopt to meet the challenges and opportunities created by demographic change will also have effects on trade patterns. Consider, for example, the various policy options facing East Asian countries, such as the Republic of Korea or China, as they grapple with ageing populations (ILO, 2012): developing the appropriate skills policies for a greying population; creating the right incentives for increasing labour force participation among women as well as among older workers; accelerating labour productivity growth in order to counterbalance projected low employment and workforce growth

rates; improving the management of labour migration regimes to help address labour shortages; and developing fiscally sustainable social protection systems. Through the various mechanisms discussed in this section, most of these policies are likely to affect the evolution of comparative advantage and therefore trade.

Moreover, improving education enrolment rates and the quality of the educational system will improve countries' integration into global supply chains and increase the sophistication of their exports. Educational policies are particularly important in the African context, where the size of the young population will increase significantly.

While it may be relatively straightforward to predict future demographic trends, the many theoretical and empirical variables discussed in this section indicate that it is more difficult to predict the trade effects of these trends. In short, the relationship between demography and trade is complex. Box C.3 concludes this section by offering some insights into the factors behind this complexity.

2.   Investment

The accumulation of physical capital can affect the nature of international trade in a variety of ways. Greater public infrastructure investment can facilitate a country's participation in world markets by, for instance, reducing trade costs and hence increasing supply capacity. Such investment in physical capital can therefore lead to the emergence of "new players" in international trade. Investment in roads, ports and other transport infrastructure can also strengthen regional trade, while investment in information and communications technology (ICT) infrastructure can enable a larger number of countries to participate in the ever-expanding international trade in services. Over time, depending on the rate of growth of capital accumulation relative to the rate of growth of the labour force, it is possible for investments in infrastructure and non-infrastructure physical capital (such as plant, machinery and equipment) to alter the comparative advantage of a country already widely engaged in international trade.

In an economy where factors of production, such as capital, cannot move across countries, investment must be financed by domestic resources. Cross-country resource flows are, however, the current reality. National Income Accounting shows that a country that does not generate savings sufficient to finance its own investment must attract surplus foreign savings in the form of a capital inflow. Such a country is a net borrower from the world. Conversely, a country invests abroad when its domestic savings are more than sufficient to finance domestic investment. It sends its surplus savings abroad in the form of foreign direct investment (FDI) or investment in foreign stocks,

bonds or real estate. This stream of surplus savings is referred to as a capital outflow, making the country a net lender to the rest of the world. Hence, foreign capital flows are the main source of finance to fill the gap between investment and domestic savings. This includes FDI, portfolio investment and bank lending from abroad. Other external resource flows, such as overseas development assistance (ODA) and remittances from migrants also play a part.

Capital flows from abroad can also affect trade in ways other than through their impact on domestic investment. FDI, for example, may lead to trade in intermediate goods by facilitating global supply chains. It may also influence a country's comparative advantage by facilitating the transfer of technology. Portfolio investment and bank lending relationships across countries can strengthen trade flows by reducing information asymmetries between exporters and importers. External resource flows, more generally, may influence a country's exports by affecting its exchange rate.

This section first illustrates how investment can affect the nature of trade, irrespective of how the investment is financed. It then describes other channels through which different sources of investment finance can affect trade directly. Finally, it analyses the financing of investment from an empirical standpoint. In doing so, it examines the relationship between domestic resources and domestic investment across countries and groups of countries. It also assesses the order of magnitude and direction of external resource flows in the world. The aim is to provide a picture of how – and whether – different countries can – or should – enhance their investment rates and use different investment flows to increase their supply capacity, change their comparative advantage and strengthen trade relationships.

(a) Impact of investment on the nature of international trade

Sub-sections (i) and (ii) outline two mechanisms through which investment affects the nature of trade, irrespective of the source of finance used. While domestic resources are naturally important, so too are some external finance flows that are likely to have a quantitatively stronger impact on domestic investment than others. This is highlighted later. Sub-sections (iii), (iv), (v) and (vi) discuss channels through which different external resource flows can directly affect trade (i.e. other than through their impact on domestic investment).

(i) Public investment in infrastructure

It is worth noting that capital accumulation in the realm of infrastructure creation is likely to be closely linked with public investment, especially in developing economies (Jimenez, 1994). Government resources

are therefore crucial to financing this investment. To the extent that overseas development assistance, bank lending from abroad and FDI are directed towards relevant sectors, such as telecommunication, they may also contribute to investment in infrastructure. It is also important to highlight the fact that public investment in both physical and human capital infrastructure is important for the structure of trade. Section C.1 examined how investment in skills and human resources can affect trade. This section is therefore limited to a discussion of physical capital accumulation.

Investment in physical capital, such as roads, ports and ICT infrastructure, is likely to reduce trade costs and hence increase countries' trade participation. In this way, capital accumulation can enable the emergence of "new players" in world trade. This is especially important in the context of global supply chains, where firms headquartered in advanced economies offshore certain tasks involved in the production of a final good to developing countries. Given that the decision to offshore revolves around finding cost-efficient suppliers of that task worldwide, wage costs are not the only relevant variable. A minimum level and quality of infrastructure, created by investment in physical capital, is also likely to play an important role (Baldwin and Lopez-Gonzalez, 2012; Kimura, 2009; Hew et al., 2009). Production networks, for instance, require fluidity, low costs and security in the transmission of information. For this, a high-quality telecommunications system is essential (Grossman and Helpman, 2005).

Better transport infrastructure reduces transport costs and hence is associated with higher volumes of trade. Using data on a cross-section of countries, Figure C.14 shows this positive association in the case of changes in road network density and changes in the share of trade in GDP. Using more rigorous statistical methods, Nordas and Piermartini (2004) estimate that doubling the kilometres of paved roads per 100 square kilometres increases trade by 13 per cent. Similarly, they show that doubling the number of paved airports per square kilometres of territory in a country boosts trade by 14 per cent. Investment in better quality and more reliable ICT infrastructure also leads to a reduction in trade costs by reducing the barriers which inhibit economic exchange over long distances (Fink et al., 2005). A more detailed discussion on the relationship between transport and ICT infrastructure, on the one hand, and international trade flows, on the other, is provided in Sections C.5 and C.3, respectively.

The lack of adequate transport infrastructure undoubtedly reduces Africa's ability to participate in the world economy. According to Nkuepo (2012), the continent has fewer kilometres of road now than it did several decades ago, with about 70 per cent of the rural population living more than two kilometres away from an all-season road. Figure C.15 shows that between 1990 and 2005, India's road network almost

Figure C.14: **Total road network and trade openness, 1990-2005**
(percentage change in kilometres and trade to GDP ratio)

Source: The World Bank, W*orld Development Indicators.*

Note: While more recent data on road networks are available, it is limited to a much smaller sub-set of countries.
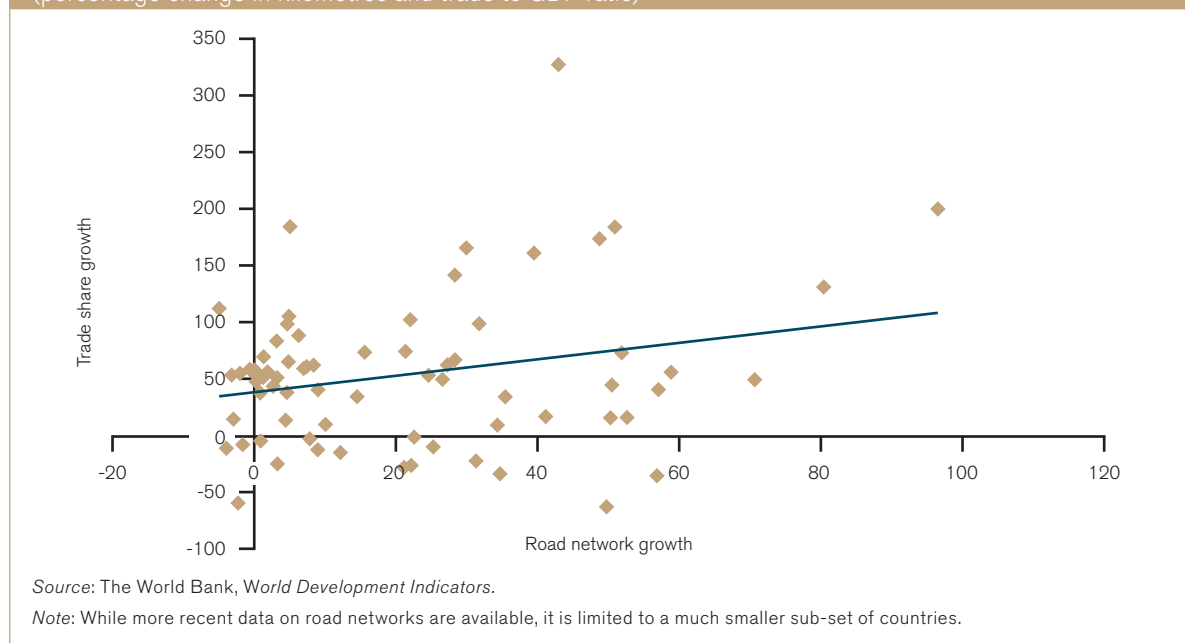
doubled, the largest percentage increase in the world. Increases in the road density of certain African countries during this 15-year period were also significant. It can be seen in Figure C.15 that the percentage increase in the road network of Nigeria, Niger and The Gambia was about 60 per cent between 1990 and 2005. It is likely that with increasing rates of economic growth[83] and a range of prospective policy reforms, a larger pool of government resources and more efficiency in public investment will enable many

Figure C.15: **Increases in total road network – top ten countries, 1990-2005**
(percentage change in kilometres)

Source: The World Bank, *World Development Indicators.*

Note: Values for Nigeria and The Gambia have been extrapolated for one year in the period under consideration. More generally, while more recent data on road networks are available, it is limited to a much smaller sub-set of countries. In order to avoid making large-scale extrapolations, we chose 2005 as the cut-off point.

more African countries to increase their road density and hence their supply capacity.

Most African countries also find it hard to compete in the world market owing to inadequate, inefficient and very expensive telecommunication services. This is reflected in Figure C.16, which shows a large gap in telecommunication investments between South Africa and the next ten countries in the continent. Even in per capita terms, it shows that along with four island economies, South Africa and other members of the Southern African Customs Union – Botswana, Namibia and Swaziland – are among the ten countries with the highest telecommunications investment in Africa. Attracting FDI through improved regulatory institutions and policies could play an important future role in this regard. In fact, Djiofack-Zebaze and Keck (2009) show that strong regulatory institutions are a key factor affecting the performance of the telecommunications sector.

Infrastructure investment is also likely to influence the regionalization of trade in the future. Consider, for instance, the case of Africa. Limao and Venables (2001) show that the low level of trade within African in the 1990s is explained to a large extent by their poor infrastructure. Even today, the transportation of goods by roads within the region is more expensive relative to other parts of the world. Flying from one country to another is expensive, and railway infrastructure barely links African countries (Nkuepo, 2012). Poor communications infrastructure continues to be regarded as a major impediment to trade within Africa as well (Mupela and Szirmai, 2012).

Initiating and encouraging more cooperation in infrastructure development projects – for example, in

Figure C.16: **Average annual investment in telecommunications in Africa, 1986-2005** (US$ million and per capita US$)

Source: World Bank, *African Development Indicators*.

Note: Angola was excluded because of insufficient data availability. While more recent data are available from the International Telecommunication Union (ITU), these include less than one-third of the countries considered above either because of data unavailability or relevant harmonization issues.
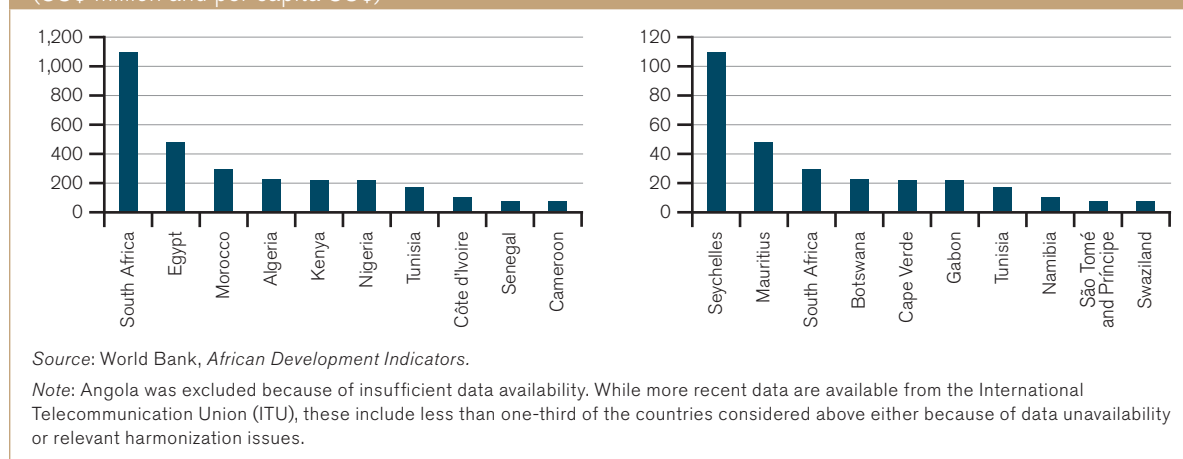
telecommunications, transportation, power generation and the provision of water – at the regional level will increase access to these facilities, thereby lowering transactions costs and boosting trade among African countries in the future (Dupasquier and Osakwe, 2006). A future COMESA-SADC-EAC (Common Market for Eastern and Southern Africa – Southern African Development Community – East African Community) tripartite preferential trade agreement (PTA) and even a pan-African PTA could therefore provide a major boost to trade within Africa.

Furthermore, investment in ICT infrastructure may give a further impetus to expansion of trade in services. Cross-border trade in services (mode 1 of the General Agreement on Trade in Services), for instance, largely depends on telecommunications as the channel for transactions. Freund and Weinhold (2004) find that access to the internet for trading partners had a significant impact on US imports of business, professional and technical services. Developing economies hitherto not involved in services trade in a significant way can utilize investments in ICT infrastructure to make initial inroads into this increasingly important world market. English-speaking African countries, for example, could become offshore locations for call-centres and business process outsourcing. South Africa has already started down this path due to the quality of its telecommunications infrastructure even though high costs remain a problem.[84] Mauritius, another recently successful country, has taken direct regulatory action to ensure that costs are not a barrier to developing services offshoring businesses.[85]

(ii) *Capital accumulation and changing comparative advantage*

If a particular sector is more sensitive than others to the quality of infrastructure, then public infrastructure investment can affect a country's comparative advantage. For example, Yeaple and Golub (2007) find

that the provision of road infrastructure consistently appears to be a significant factor in a sector's total factor productivity (TFP) growth and hence in a country's production specialization. The authors show that road infrastructure appears to be particularly important for productivity growth in the transportation equipment sector and for specializing in the production of textiles and apparel. Good telecommunication services may also influence comparative advantage and hence the pattern of international specialization.

ICT infrastructure is particularly important for information-intensive sectors. These are typically sectors that produce goods with short product cycles, experience rapid fluctuations in consumer tastes, enjoy rapid technology development, and where international vertical fragmentation is common. Consumer electronics, for example, is characterized by all these features. Fashion clothing is an example of goods for which tastes change rapidly while the automotive sector is an example of a sector where global production fragmentation is important (World Trade Organization, 2004a).

Investment in non-infrastructure creating physical capital, carried out largely by private players, can also exert an important influence on comparative advantage. According to the Hecksher-Ohlin model of trade, countries should produce and export goods that use intensively relatively abundant factors. So for a country with an abundant supply of unskilled labour, relative to capital, trade based on comparative advantage would imply specializing in the production of unskilled labour-intensive goods.

The Rybczynski theorem, however, shows that at constant relative goods prices, an increase in a country's endowment of one factor leads to a more than proportional expansion of the output of the good which uses that factor intensively and an absolute decline of the output of the other good. Hence, even in a relatively unskilled labour-intensive economy, an

increase in the supply of capital can result in an increase in the production of the relatively capital-intensive good. Over the medium to long run, the accumulation of capital may be large enough, relative to the growth of the labour force, to alter a country's comparative advantage, thereby making countries less specialized (as alluded to in Section B.2(c)). The transformation of Japan from a relatively labour-intensive to a relatively capital-intensive economy is a case in point (see Box C.4).

Figure C.17 shows that, between 1990 and 2009, several unskilled labour-intensive economies saw large increases in their capital-labour ratios. China, Viet Nam and India top the list as their capital-labour ratios increased sixfold, fourfold and threefold, respectively. These and other middle-income countries have relatively high investment rates. In fact, data show that unskilled labour-intensive economies, such as China, Viet Nam and India, were among the ten countries with the highest average investment rates between 2000 and 2010.[86] However, many of them also have high population growth rates. Whether these countries transform themselves into relatively capital-abundant economies in the future depends on how the rate of growth of physical capital compares with that of the labour force. In an emerging economy such as China, where population growth rates have slowed down but where investment in physical capital continues unabated, this may result in a change in comparative advantage in the future.

The trade literature suggests that the evolution of capital accumulation in an economy, and hence comparative advantage, is closely linked to its domestic savings rates – i.e. a country with a high savings rate exports a relatively capital-intensive good (Oniki and Uzawa, 1965; Stiglitz, 1970; Galor and Lin, 1997; Hu and Shimomura, 2007; Chen et al., 2008). The case of Japan validates this theory. While domestic resources are naturally important for domestic investment in physical capital and hence for comparative advantage, it is worth noting that resource flows from abroad can also play a part (see Box C.5 for a discussion on which of these is likely to have a strong effect on domestic investment).

For instance, in the case of Costa Rica, large-scale FDI by a number of multinationals established manufacturing plants in several high-technology electronics sectors, with Intel leading the way in semi-conductor devices (Rodríguez-Clare, 2001). This enabled the country to specialize in technologically more complex activities than apparel exports. Investment to establish a knowledge centre to develop software and contribute to Intel's design processes further strengthened this process of changing comparative advantage. Costa Rica's business-friendly economic and political institutions, together with its well-educated labour force, were instrumental in attracting this FDI (Sanchez-Ancochea, 2006).

(iii) Intertwining of trade and FDI

Economic theories of international trade and FDI have tended to develop separately. Hence, the traditional trade model, in which comparative advantage is based on differences in relative factor endowments,[87] assumes factor immobility among countries. In other words, trade and factor mobility are substitutes. For example, in lieu of capital from the capital-abundant country flowing to the capital-scarce country, capital-intensive goods are exported by the former to the latter.

However, this hypothesis is somewhat dissociated from existing economic reality, which is characterized by increasing international factor mobility, mainly in the form of FDI flows that finance investment (the relationship between trade and the mobility of labour across countries is discussed in Section C.1). Multinational firms, with their headquarters in one country, establish operations under their ownership and managerial control in another country.[88] Given that two-thirds of world exports are governed by these multinational firms, deciding where to invest is simultaneously deciding from where to trade (UNCTAD, 2012).

To the extent that local production in the "host" country replaces exports from the "home" country, FDI and trade can be substitutes. This is especially true for "horizontal" FDI, which consists of investment in production facilities abroad to produce the same goods and services as those produced at home to serve the host country market (Markusen, 1984). Increasingly, however, FDI and trade are viewed as being complements (Helpman, 1984). For horizontal FDI, this may be because affiliates or subsidiaries are used as "export platforms" – that is, investment in production capacity results in exports from that country to other third-country markets in its proximity (Grossman et al., 2006).

For example, evidence suggests that high levels of FDI in the automotive industry contributed significantly to

Figure C.17: **Capital-labour ratios, 1990-2009** (percentage change)
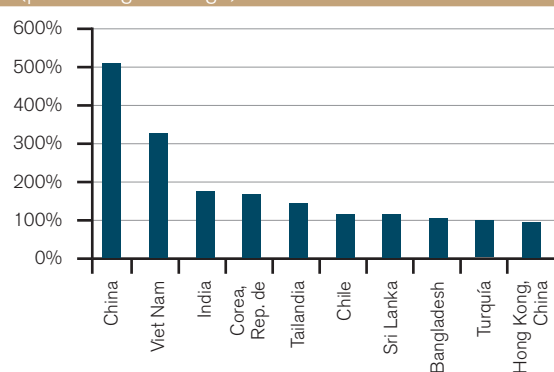
Source: Fouré et al. (2012).

Note: Only economies with GDP above US$ 10 billion are considered.

Box C.4: **Investment and changing comparative advantage – the case of Japan**

Starting as a labour-abundant country, Japan transformed itself into a leading exporter of capital-intensive products in the period after the Second World War. Heller (1976) observes that high investment rates, caused by soaring domestic savings and American aid inflows, pushed Japan into a relatively capital-abundant position between 1956 and 1969. Using data on commodity trade statistics, he finds that Japan's comparative advantage had accordingly changed as its exports were relatively more capital intensive (see Section C.1). In a later study, Balassa and Noland (1988) find that the Japanese investment rate continued to be substantially higher than those of other industrial countries, such as the United States, between 1973 and 1985. In their examination of changing trade patterns, the authors find that relative to the period between 1967 and 1983, Japan's revealed comparative advantage (RCA) in unskilled labour-intensive industries, such as apparel and leather, had diminished. In contrast, the country developed a comparative advantage in skilled labour and high-technology intensive industries. Similar results are also found in Balassa and Noland (1989) and Lee (1986).

Figure C.18 shows that the changing share of machinery and transport equipment – regarded as one of the most capital-intensive sectors – in Japan's total exports and the evolving capital-labour ratio in Japan between 1960 and 1990 are highly correlated. This evidence suggests that Japan is a good example of an investment-driven change in a country's relative factor endowments and comparative advantage.

Figure C.18: **Japan's capital-labour ratio and the share of machinery and transport equipment exports in its total exports, 1960-90**
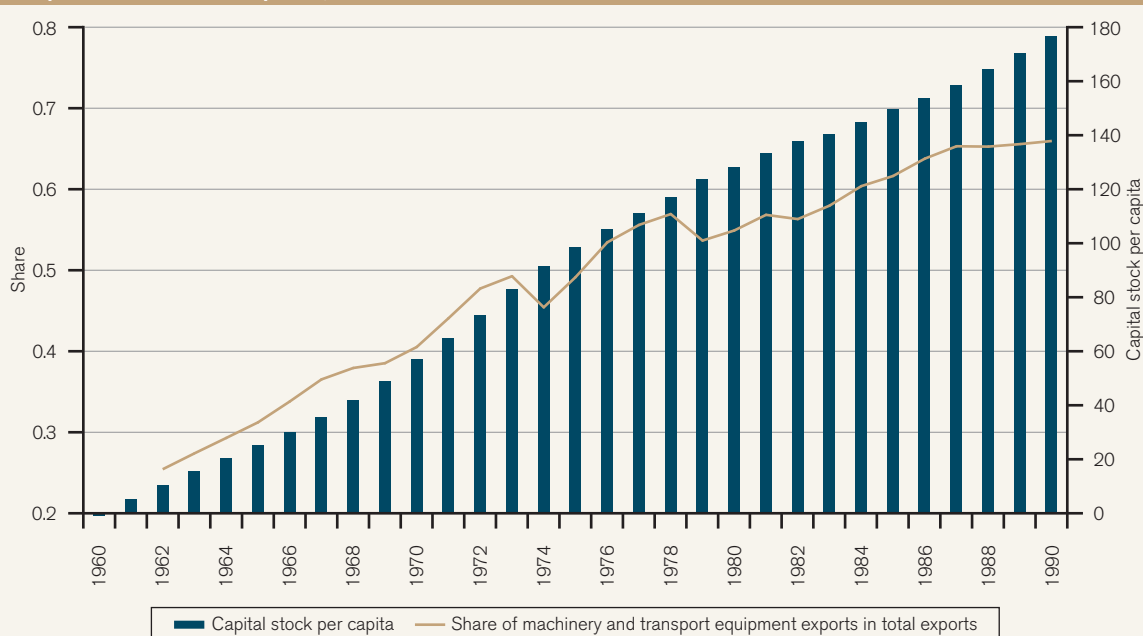
Sources: UN Comtrade and Fouré et al. (2012).

the Czech Republic's supply capacity and hence its exports to third-country markets until 2008 (Economist Intelligence Unit, 2010). Similarly, Tunea (2006) finds that NAFTA (North American Free Trade Agreement)-led foreign investment in Mexico's manufacturing sector was driven by its potential as an export platform for neighbouring countries. In the absence of FDI, these markets might have remained untapped because exporting to them directly from the home country would have entailed significant transport costs.

At the same time, home country operations of the parent firm can be linked with host country operations via "vertical" FDI, which involves the fragmentation of the production process along global supply chains. In this set-up (see Section B.2(e)), there are increased export possibilities for intermediate products, such as

capital goods, design services and research and development, from the home country. At the same time, the home country imports varieties of a final good from the host country as a result of the supply capacity created by the FDI. For instance, Arnold and Javorcik (2009) find that receiving FDI enhanced the integration of Indonesian plants into the global economy through increased export intensity and greater reliance on imports of intermediate inputs. What is more, third-country markets may also begin to import from the host country.

Consider the electronics industry where FDI inflows, especially from firms in developed and "newly industrialized" countries, have established Malaysia as a global production hub. Intermediate inputs are imported from the country of the parent firm into Malaysia. At the

<div style="background:#b08d57;color:white;padding:4px;">Box C.5: **Contribution of external resource flows to domestic investment**</div>

Capital inflows

FDI can affect domestic investment by contributing directly to new plant and equipment ("greenfield" investment) or by acquiring (or merging with) an existing local firm. FDI may also produce investment spillovers beyond the direct increase in capital stock. For example, it could "crowd-in" the host country's domestic investment through linkages among firms – multinational corporations may purchase specialized inputs from domestic suppliers, thereby encouraging new investment by local firms (Mileva, 2008). According to Borenzstein et al. (1998), FDI could also spur domestic investment by lowering the costs of adopting new technologies. For a sample of ten CIS countries and Albania, Mileva (2008) shows that FDI flows crowd-in domestic investment. At the same time, it is possible for FDI to "crowd-out" domestic investment by raising productivity and hence wages.

Inflows of portfolio investment and bank lending from abroad can complement domestic savings in promoting domestic investment by lowering the cost of capital (Levine and Zervos, 1998; Manova, 2008a).[89] In a study of 11 developing countries, for instance, Henry (2000) finds that – on average – domestic private investment grows by 22 percentage points faster in the period after stock market liberalization. In a study which analyses a larger number of countries, Henry (2003) reaffirms his earlier findings by estimating that the domestic investment rate increases by approximately one percentage point every year following capital account liberalization.

In contrast, Pal (2006) and Mileva (2008) find a weak relationship between portfolio investment flows from abroad and the real economy in the case of India and economies in transition. This may be explained, in part, by the fact that portfolio investment flows are relatively more short-term in nature. Moreover, if foreign capital is limited to stock purchases on the secondary market, equity investment increases the price of the shares but not the flow of funds to the companies that wish to increase investment (Kraay and Ventura, 1999). According to Mody and Murshid (2005), multinationals have increasingly focused on acquiring existing assets rather than purchasing newly issued equity. Such capital inflows may still contribute to capital accumulation if the new foreign owners modernize or expand their acquisitions by investing in new technology (Mileva, 2008).

Analysing a sample of 58 developing countries between 1978 and 1995, Bosworth and Collins (1999) show that while FDI appears to bring about close to a one-for-one increase in domestic investment, there is virtually no discernible relationship between portfolio inflows and investment, and the impact of bank lending is only minor. According to Mody et al. (2003), this may be attributable to an informational advantage (based on their specialized technical knowledge and market experience), which allows FDI investors to "outbid" other investor-types for the most productive opportunities. In countries with missing or inefficient markets, foreign investors will prefer to operate directly instead of relying on local financial markets.

The importance of capital inflows to domestic investment also depends on the subsequent decisions of domestic investors. If residual domestic investment opportunities offer low returns, especially since new capital inflows could indirectly reduce the risk-free rate, domestic savings may actually be channelled out of the country in search of higher returns or lower risk (Mody and Murshid, 2005). Such capital outflow may actually reduce the resources available for domestic investment. It is also likely that countries with better policies and institutions (as described in Section C.6) are likely to have greater success in absorbing foreign capital inflows for domestic investment by creating an environment conducive for the diffusion of new technologies and reducing the risk of holding domestic assets.

Other external resource flows

In the empirical literature on the subject, opinions are divided concerning the effect of overseas development assistance (ODA) on investment, with results often being a function of the choice of data sample and estimation technique. For instance, while Boone (1996) and Hansen and Tarp (2001) find a statistically significant positive impact of ODA on investment, Dollar and Easterly (1999) and Collier and Dollar (2001) do not. It is argued that aid money meant for investment is often used for disaster relief (Dollar and Easterly, 1999), financing tax cuts (Devarajan et al., 1999) or supporting consumption (Boone, 1994).

Many studies find that remittances from migrants are positively correlated with entrepreneurship and small business investment in developing economies (Woodruff and Zenteno, 2007; Mesnard, 2004). For instance, comparing expenditures in Mexican households with and without international migrants, Taylor and

Mora (2006) find that the former spent more on investment and less on consumption than other households at the same income level. Adams (2005) presents similar findings for Guatemala. There are, however, studies which show that remittances mainly contribute to higher consumption (Brown and Ahlburg, 1999). A central methodological concern in this regard is that any observed relationship between remittances and household investment may simply reflect the influence of unobserved third factors. In a recent study, Yang (2008) finds that exogenous shocks to the income of Philippine migrant households, manifested in part via changes in remittances, have large effects on relatively capital-intensive entrepreneurial activity, such as manufacturing and transport services. The author argues that remittance receipts enable investment that was previously inhibited by credit constraints.

same time, the country ranks among of the world's largest exporters of semi-conductor devices and audio-visual equipment to the FDI-source countries or other markets (Malaysian Industrial Development Authority, 2006). The same is true for the automobiles industry where FDI has resulted in increased exports of automobiles from Thailand to developed economies as well neighbours in the region (Nag et al., 2007).

What if a firm produces not one but several final goods? It results in other channels of complementarity between FDI and exports through its effect on demand. First, the establishment of a productive unit for one of its products in a foreign market creates a reputation for its brand. This can increase the demand and, consequently, the exports of other final goods for that market (Lipsey and Weiss, 1984). Secondly, the marketing, distribution and delivery capabilities created by FDI in one product might enable the home country to export all its final products that would not reach customers in the foreign market in the absence of FDI (Blonigen, 2001). Thirdly, foreign demand for a firm's other final goods can be stimulated through the supply of valuable after-sale services resulting from FDI, which represents a permanent

commitment to customers in the host country market (Head and Ries, 2001). Finally, exports from the home to the host country may also increase for the reason that FDI stimulates the host country's purchasing power for importing both intermediate and final goods from the home country.

In sum, the theory suggests that greater FDI can lead to more trade. However, can trade also boost FDI flows? Analysis suggests that it can. Exports can be a source of information on the host country and hence enhance capital flows (Portes and Rey, 2005). FDI may also follow exports in order to preserve markets that were previously established by exports (Obstfeld and Taylor, 2004). Trade associated with cross-border vertical integration, in particular, may boost FDI as it assures ownership advantages and a market.

The data show a systematic positive association between trade and FDI, thereby highlighting their complementarity (see Figure C.19). Evidence from particular sectors and countries reinforces this finding. The trade orientation of FDI is well-represented in the development experience of China

Figure C.19: **World trade and foreign direct investment, 1980-2011** (US$ billion)

Sources: WTO Secretariat, UNCTAD.
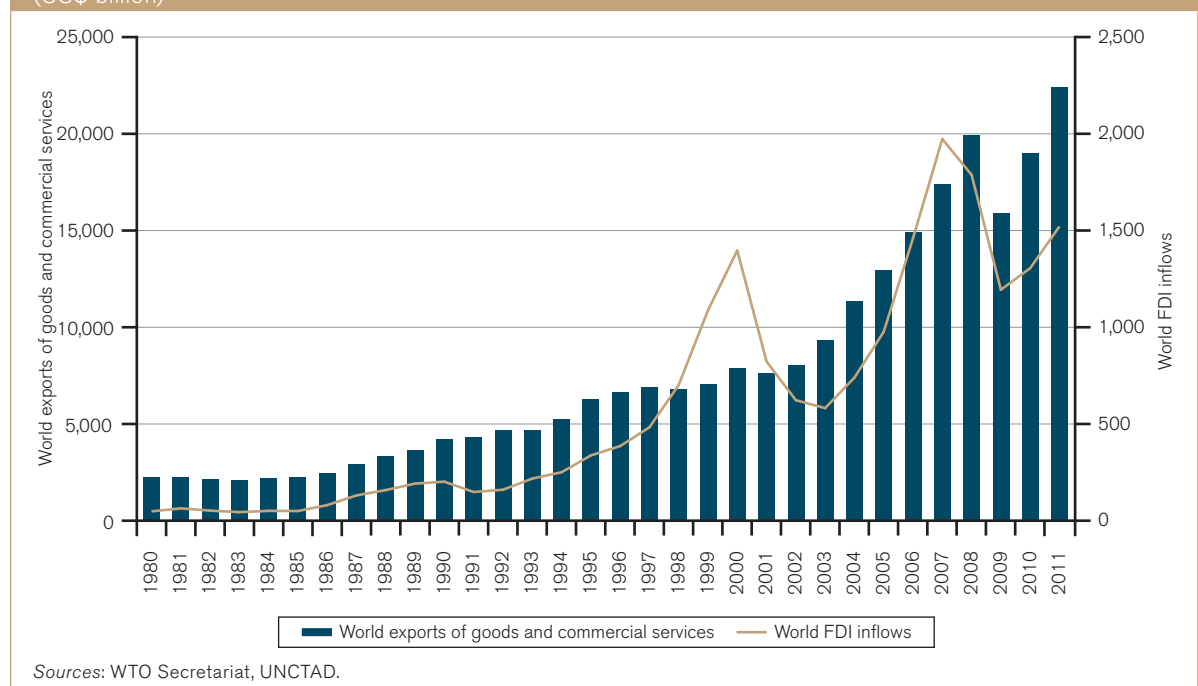
where foreign investment enterprises accounted for 58 per cent of total exports in 2005 (WTO, 2010). It is equally well-illustrated in other cases. In the textiles industry, for example, FDI from Hong Kong (China) and Chinese Taipei dominates export production in Lesotho, Madagascar and Mauritius, while FDI from the United States does so in the Dominican Republic (McNamara, 2008). Furthermore, several empirical studies find that more FDI establishing affiliates abroad is associated with more, rather than less, exports from the parent firm in the home country (Bergsten et al., 1978; Lipsey and Weiss, 1981; Blomstrom et al., 1988; Buiges and Jacquemin, 1994). Such complementarity has been found to be especially true for intra-firm exports, highlighting the importance of vertical relationships among various international affiliates (Pearce, 1990).

(iv) FDI, technology diffusion and changing comparative advantage

A country's position in a global supply chain is generally correlated with its comparative advantage. Developing countries complete low value-added unskilled labour-intensive tasks because they have a relatively abundant supply of unskilled labour. It is advanced economies where the skill and capital-intensive tasks are completed. In modern economies, however, much comparative advantage is man-made. So is it possible for a country that has a comparative advantage in unskilled labour-intensive tasks today to have a comparative advantage in high-technology-intensive tasks tomorrow?

In Asia, several firms in Japan offshored unskilled labour-intensive manufacturing tasks to the Republic of Korea, Chinese Taipei, Hong Kong (China) and Singapore, starting in the 1970s (Baldwin, 2012a). Hence, these countries entered global supply chains by specializing in component manufacturing and product assembly. As they industrialized, they began to manufacture sophisticated intermediate inputs, which they earlier imported from advanced economies. These newly industrialized countries also expanded into the design and distribution of goods and hence captured more of the total value added (Wood, 2001).

While investment in higher education is likely to have played an important role, the diffusion of technology and knowledge associated with FDI played a crucial role in upgrading. In a study of 105 countries between 1984 and 2000, for instance, Harding and Javorcik (2012) find a positive relationship between FDI and the quality of exports in developing countries. Global supply chains have made technology internationally more mobile by offshoring firm-specific technical know-how, especially via investment by multinational companies in the establishment of subsidiaries overseas. This helped to enable developing countries, such as Hong Kong (China), the Republic of Korea,

Singapore and Chinese Taipei to move up the product ladder in terms of capital intensity, technological content, design and quality. Signs of technology upgrading and changing export orientation, facilitated by FDI, are already visible in China – it has begun to produce sophisticated intermediate goods and services that previously would have been imported – and are likely to only get stronger in the future (Rodrik, 2006).

A discussion on the mechanisms through which FDI, both "horizontal" and "vertical", can lead to technology diffusion is provided in Section C.3. The following are a few examples. Evidence for direct technology transfer from multinational affiliates to local suppliers or technology upgrading due to higher quality requirements on intermediate inputs from domestic suppliers is documented in the case of vertical FDI flows into Lithuania and Indonesia (Javorcik, 2004; Blalock and Gertler, 2008).

Iacovone et al. (2011) find that following the entry of Walmex (the Mexican affiliate of Walmart), local Mexican retailers started to adopt advanced technologies, such as cold chain (a temperature-controlled supply chain), in order to catch up. This is indicative of indirect technology transfer. Knowledge spillovers are also documented in the case of Intel's FDI in Costa Rica. Intel invested heavily in the training of its employees, leading to learning-by-doing and even the creation of several "spin-off" firms. Intel also collaborated with public universities in order to improve their curriculum and teacher training in technical fields (Rodríguez-Clare, 2001).

(v) Information, capital flows from abroad and international trade

It is argued that portfolio investment and bank lending relationships between countries can generate information that leads to an increase in bilateral trade (Lane and Milesi-Ferretti, 2008; Jeanneau and Micu, 2002; Portes and Rey, 2005). The relationship between lenders abroad and borrowers at home – or vice versa – can improve the exchange of information between exporters and importers, thereby encouraging international trade. At the same time, existing trade relationships may allow foreign investors and banks to gather information about the destination country and hence serve to increase portfolio investment and bank lending to that country. This complementarity between portfolio investment and bank lending from abroad, on the one hand, and trade flows, on the other, is depicted in Figures C.20 and C.21.

Empirical evidence, generated by rigorous statistical methods, also supports this complementarity. Using data for international portfolio holdings of 67 source countries (including all major international investors) and 200 destination countries, Lane and Milesi-Ferretti (2008) find that bilateral international equity

Figure C.20: **World trade and foreign portfolio investment, 2003-10**
(US$ billion)

Sources: World Bank WDI, WTO Secretariat.

Figure C.21: **World trade and foreign claims, 1999-2011**
(US$ billion)

Sources: Bank of International Settlements, WTO Secretariat.

Note: Foreign claims represent loans extended to residents outside the country in which the banks are headquartered.
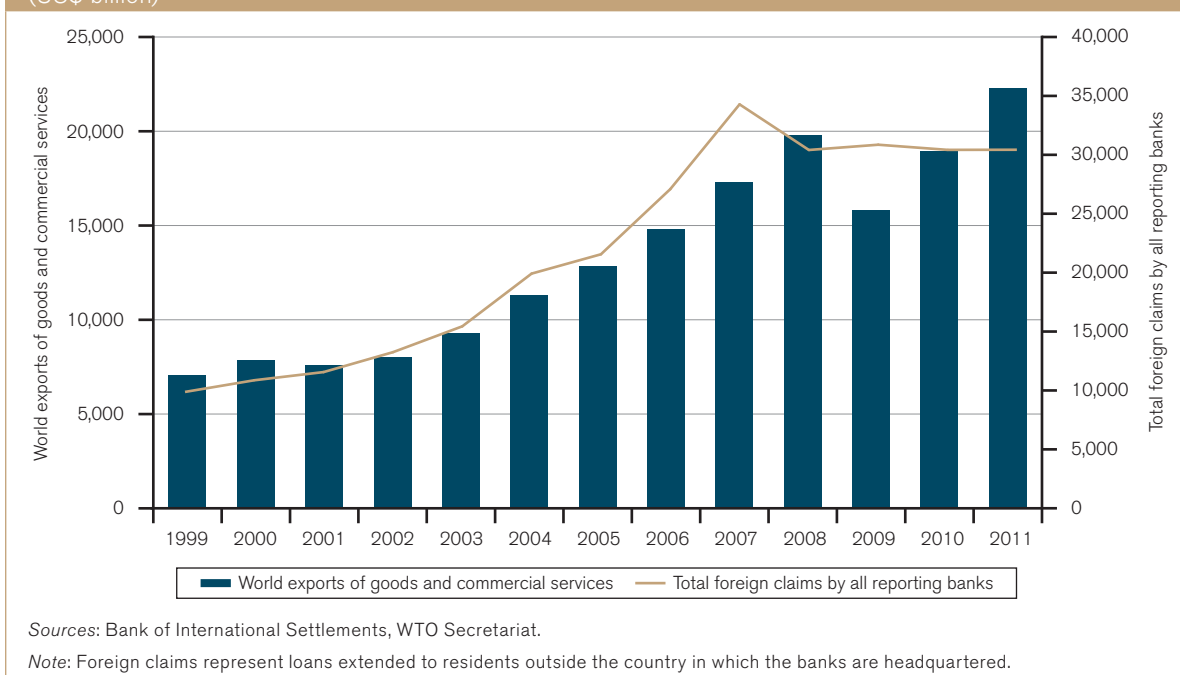
positions are strongly correlated with bilateral trade. This evidence is indicative of an information-driven relationship between trade and capital flows that is particularly strong when the collection of information is simplified. The authors find that a common language, for example, raises equity holdings by 50 per cent. Similarly, Portes and Rey (2005) show that a gravity type equation explains 70 per cent of the variation in portfolio investment for a sample of developed countries. They test explicitly for information asymmetries using proxy variables, such as telephone

traffic, and show that this channel is highly significant. Moreover, they include these proxies in trade equations and show that the results improve significantly.

Some studies in the literature use more sophisticated statistical techniques in order to establish causality in the relationship between trade and capital flows across countries. For instance, Aviat and Coeurdacier (2007) find that a 10 per cent increase in trade leads to a 6 per cent higher level of portfolio investment; causality in the other direction is weaker but still

significant. Similarly, Jeanneau and Micu (2002) find that while bilateral trade is significant and highly positive in explaining bank lending patterns from advanced economies (the United States, Japan, the United Kingdom, Germany, France, Italy and Spain) to Asian and Latin American economies (Argentina, Brazil, Chile, Indonesia, the Republic of Korea, Malaysia, Mexico, the Philippines, Thailand and Bolivarian Republic of Venezuela), there is also causality in the other direction.

(vi) Capital flows, exchange rates and international trade

Capital inflows can lead to an appreciation of the exchange rate in recipient countries, thereby hurting their export competitiveness (Corden and Neary, 1982; Agenor, 1998; Lartey, 2008). Inflows of foreign currency raise the demand for both tradable and non-tradable goods produced in an economy. In the context of a small open economy, an increase in the demand for tradable goods does not affect their prices since these are determined in world markets. At the same time, the increased demand for non-tradable goods places an upward pressure on their prices and thereby results in an appreciation of the real exchange rate. Under a flexible exchange rate mechanism, both the nominal and the real exchange rate appreciate as a reaction to the increase in the relative price of non-traded goods. Under a fixed exchange rate arrangement, the expanding money supply increases domestic prices, thereby leading to a real appreciation of the currency. It is worth noting that in most countries, exchange rate appreciation is sporadic, volatile and short-term in nature. Appreciation over a longer period occurs only in a relatively few number of cases (Sy and Tabarraei, 2010).

If policy-makers choose to dilute the effect of real exchange rate appreciation by sterilizing incoming resources through open market operations, it will lead to an increase in domestic debt along with a possible increase in the domestic interest rate. This, in turn, may further attract more inflows from abroad and create a vicious circle of expected devaluation and capital flight, thereby affecting investment and trade in the future (Calvo et al., 1993).

Several studies have shown that large capital inflows have resulted in exchange rate appreciation in developing economies (Corden, 1994; Lartey, 2007; Edwards, 1998). For instance, several countries in Latin America and Asia saw their exchange rates appreciate during the early 1990s when there was a surge of private capital inflows (Corbo and Hernandez, 1994). These included Argentina, the Republic of Korea, Mexico and the Philippines. In a more recent study, ADB (2007) finds that real effective exchange rates in the large emerging East Asian economies have appreciated against the US dollar since 2004, owing to larger private capital inflows.

In the context of least-developed countries (LDCs), especially in Africa, several cross-country empirical studies find that foreign aid inflows are associated with an appreciation of the real exchange rate (Lartey, 2007; Elbadawi, 1999). This is also reflected in country studies on Burkina Faso, Côte d'Ivoire, Senegal and Togo (Adenauer and Vagassky, 1998), Cape Verde (Bourdet and Falck, 2006), Ghana (Opoku-Afari et al., 2004) and Nigeria (Ogun, 1998). The same holds true for several oil-rich countries where exchange rate appreciation has been associated with the influx of petro-dollars (The Economist, 2007).

There is, however, a body of evidence that contradicts the results described above. For instance, countries in Latin America and Asia – Chile, Indonesia and Malaysia – that received the largest capital inflows (as a percentage of GDP), on average, between 1989 and 1992 avoided a significant real exchange rate appreciation (Corbo and Hernandez, 1994). Similarly, empirical evidence shows that foreign aid flows have often been associated with exchange rate depreciation. This includes the findings of Mongardini and Rayner (2009) for 36 sub-Saharan African countries, Issa and Ouattara (2008) for Syria, Li and Rowe (2007) for Tanzania and Sackey (2001) for Ghana.

It is argued that capital inflows associated with higher consumption put more pressure on the relative price of domestic goods than capital inflows associated with higher investment (Saborowski, 2009). Hence, by ensuring that inflows add to the productive capacity of an economy, a well-functioning financial system can attenuate the upward pressure on the relative price of non-tradables and therefore on exchange rates. Pro-cyclical capital flows for investment purposes, however, can exacerbate macroeconomic overheating and drive the real exchange rate to appreciate more. In some developing economies, for instance, pro-cyclical remittances spent on real estate have resulted in construction booms. In light of the above, countries have often used restrictive fiscal policy to counteract the exchange rate effect of capital flows from abroad (Corbo and Hernandez, 1994). The nature of the capital flow may also influence its effect on exchange rates. For example, the appreciation of the real exchange rate due to FDI is likely to be less than that due to more volatile capital flows, such as portfolio investment (Lartey, 2007).

(b) Finance for investment

(i) Domestic resources

Firms looking to make investments often draw on their retained earnings or other internally generated funds. Any industry with high growth prospects, however, is likely to experience relatively high investment demand compared with current cash flows and therefore be dependent on external financing. The supply of loanable funds comes primarily from household savings

(see Box C.6 for a brief account of its determinants). In addition, central banks can buy securities, often government bonds, in the open market by paying for them with money that they create. Given the above, a financial system that mobilizes and allocates these resources at low transaction costs to their most productive uses is crucial for promoting investment (see Box C.6 for a more detailed discussion). It is worth noting that public investment may be financed by government savings, which are defined as the excess of tax receipts over total expenditure.

The relationship between domestic savings and investment, in quantitative terms, is best captured by the seminal paper of Feldstein and Horioka (1980). Analysing a sample of 16 OECD countries between 1960 and 1974, they find that the correlation between long-run averages of the saving-output ratio and the investment-output ratio was very close to unity. Several studies using time-series data validate these findings (Coakley et al., 1999; Coakley et al., 1996; Mamingi, 1997; Miller, 1988; Obstfeld, 1986; Tesar, 1993). The same holds true for several cross-country studies (Artis and Bayoumi, 1992; Coakley et al., 1996; Feldstein, 1983; Feldstein and Bacchetta, 1991; Golub, 1990; Obstfeld, 1986, 1995; Penati and Dooley, 1984; Tesar, 1991).

Murphy (1984) finds that the saving–investment correlation was significantly lower (0.59) for the ten smallest countries in his sample than for the seven largest countries (0.98). Similarly, Dooley, Frankel and Mathieson (1987) report that the average estimate was significantly lower in non-OECD economies than in OECD economies. More recently, empirical studies which have analysed variations, both across countries and over time, find that the saving–investment association is close to unity for OECD economies but lower for developing countries (Cadoret, 2001; Coakley et al., 2004; 1999; Kim, 2001).

Figure C.22 also shows that, on average, the savings rates of middle-income countries have exceeded that of high-income countries for the last two decades, In 2010, middle-income countries had a savings rate of 30 per cent, almost double the level of high-income countries. In fact, Table C.6 shows that among the 15 countries with the highest average savings rates between 2000 and 2010, almost all belong to the middle-income category. Resource-rich countries in the Middle East and North Africa – Libya, Qatar, the State of Kuwait and Algeria – occupy the top four positions. Going forward, economic growth is likely to continue to be high in these countries. The same holds true for labour-intensive economies in Asia, where China, Singapore, Malaysia and Viet Nam were in the top 15 in the world in the context of savings rates during the last decade. With rapid population growth in some of these countries, the active workforce is also likely to grow. Hence, high savings rates should continue to provide sufficient funding sources to support the development of capital markets and spur investment in physical capital. The same cannot be said for either low- or high-income countries.

For instance, Table C.6 shows that low-income countries, such as Côte d'Ivoire, and advanced economies, such as the United States and the United Kingdom, were among the 15 countries with the lowest average savings rates between 2000 and 2010.

Figure C.22: **Investment and savings rates, 1991-2010** (percentage of GDP)

Source: World Bank.
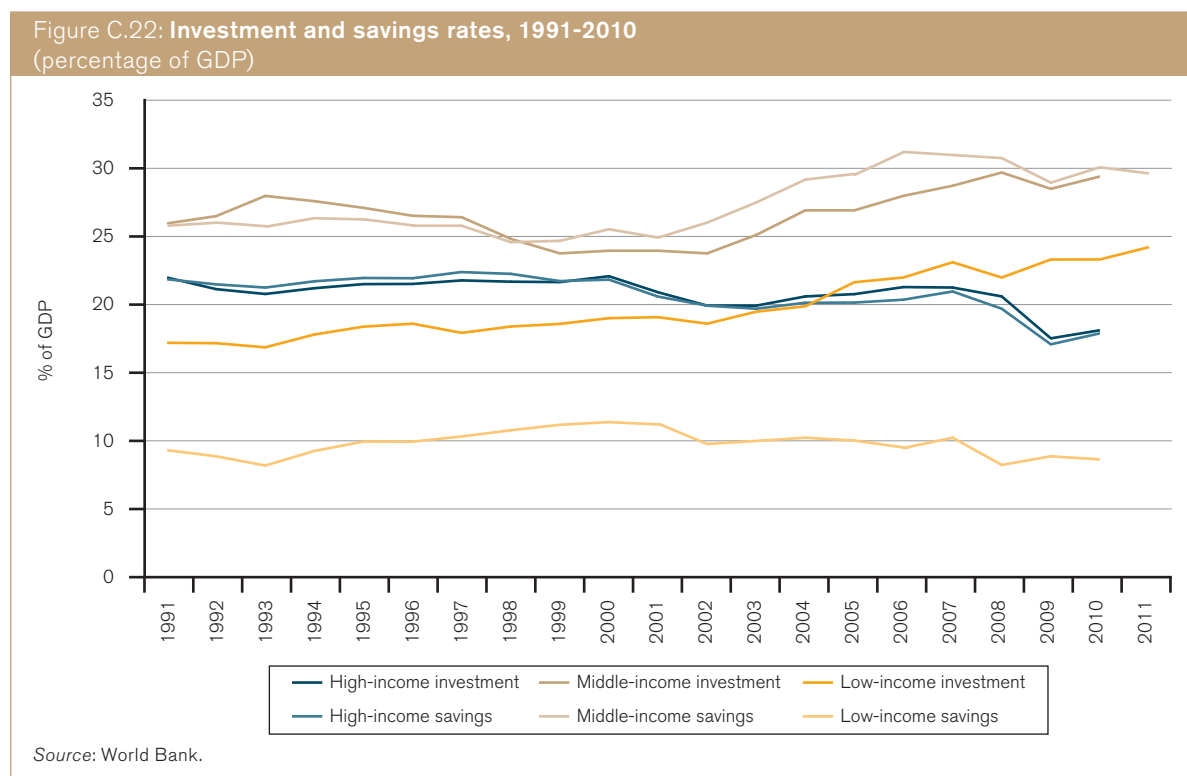
Determinants of household savings

Income is the basic determinant of saving. The poor are likely to have just enough resources to meet the social minimum level of consumption. In contrast, richer people can afford the luxury of saving to assure their future consumption. Several empirical studies find that real growth of income, measured by GDP, has a positive and significant effect on savings (Fry, 1978; 1980; Giovannini, 1985; 1983; Mason, 1988; 1987). Savings may also depend on fluctuations in the level of income.

Given the predictions of the "permanent income" hypothesis (explained in Section C.1) and recognizing credit constraints faced by low-income households, rapid but transitory income growth is likely to raise the average savings rate if the growth were concentrated in relatively rich households with high saving rates (Collins, 1991). More wealth[90] would tend to reduce saving out of current income because it enhances an individual's ability to earn income in the future (Schmidt-Hebbel, 1987; Behrman and Sussangkarn, 1989).

The demographic composition of a household and country exerts an important influence on savings rates as well. The "life-cycle hypothesis", described in Section C.1, predicts that a higher percentage of old people and children – the non-earning section of a country's population – reduces the saving capacity of a country. Several empirical studies find that the dependency ratio, defined as individuals under the age of 15 or over 65 as a share of total population, had a strong negative effect on saving (Leff, 1969; Mason, 1988; 1987; Collins, 1991; Rossi, 1989; Webb and Zia, 1990).

When interest rates rise, individuals begin to switch from current consumption towards saving because the former becomes relatively more expensive. This is the "substitution effect". At the same time, for a net saver, an increase in the interest rate would increase his or her (expected) relative income, inducing greater current consumption and hence lower savings. This is referred to as the "income effect". Given that the income and substitution effects of higher interest rates work in opposite directions, the effect of rates of return on savings is ambiguous. In addition, interest rates can also affect saving through a wealth effect. Higher real interest rates reduce the present value of future income streams from fixed-interest financial assets. Savings therefore receive a boost even if the substitution and income effects cancel each other out (Schmidt-Hebbel et al., 1992). Much of the empirical literature shows that the real interest rate has a positive effect on saving rates (McKinnon, 1973; Shaw, 1973; Gupta, 1987; Balassa, 1990).[91]

Uncertainty about future asset values introduced by inflation could encourage saving for precautionary motives. At the same time, if increases in the rate of inflation exceed increases in the nominal interest rate, this would lower the real rate of return and hence discourage saving. The empirical evidence is inconclusive (Gupta, 1987; Lahiri, 1988).

Fiscal policy changes which raise public saving may also affect private savings rates. The "Ricardian equivalence" hypothesis, as reformulated by Barro (1974), states that public debt issues are indistinguishable from tax increases in the future. Thus, a change in public saving should be offset by an equal and opposite change in private saving. The hypothesis has been widely rejected in empirical studies, with the pervasiveness of borrowing constraints cited as the main reason for households not evenly spreading their consumption-savings behaviour over their lifetime (Haque and Montiel, 1989; Rossi, 1988; Schmidt-Hebbel and Corbo, 1991).

Cultural attributes may also have a significant impact on the level of savings. Using cross-country data, Shoham and Malul (2012) find that as the level of uncertainty avoidance and collectivism increases, the level of national savings also increases.

From savings to investment

The banking sector is the principal savings-investment conduit in most financial markets and therefore is central to the mobilization of domestic resources for development. Unfortunately, it has often not catered well to the investment needs of small and medium-sized enterprises (SMEs) and those in the informal sector, especially in developing countries (Zeldes, 1989). For instance, the top five banks serving SMEs in non-OECD countries reach only 20 per cent of formal micro enterprises and SMEs. In Sub-Saharan Africa, this number is even lower, at 5 per cent (Dalberg, 2011). Public sector banks, the postal system and microfinance schemes have played a role in mobilizing resources for groups who lack collateral.

Domestic savings may also spur investment by firms through holdings in stocks, bonds and related financial instruments. In most developing countries, owing to a weak legal framework and low participation rates of institutional investors, such as mutual funds, pension funds or insurance schemes, these markets are still

relatively underdeveloped. Economies in transition are a case in point (Mileva, 2008). With recent deregulation and liberalization measures, however, stock and bond markets are becoming an increasingly important means of mobilizing funds in several emerging economies, including for high growth potential SMEs (BIS, 2012; Dalberg, 2011).

It is worth noting that to the extent that purchases of stocks take place on the secondary market and do not constitute the purchase of newly issued equity, increased stock holdings are unlikely to increase the flow of capital to firms that wish to increase investment (Kraay and Ventura, 1999). During the recent financial crisis, the most seriously affected firms were those listed on stock markets with small capitalization – which suffer from a lack of investor interest – and SMEs – which suffer from the reluctance of banks to approve new loans or to roll over existing credit lines (OECD, 2012c; Dalberg, 2011). Section D.3 shows that this also holds true for the case of trade finance.

Table C.6: **Average annual savings rate, 2000-2010** (percentage of GDP)			
Top 15		**Bottom 15**	
Libya	59.81	Serbia	10.15
Qatar	55.81	Iceland	10.38
Kuwait, the State of	48.36	Côte d'Ivoire	11.64
Algeria	47.88	El Salvador	12.07
China	46.90	Cyprus	12.12
Singapore	42.27	Lebanese Republic	12.46
Iran	40.34	Greece	12.87
Saudi Arabia, Kingdom of	36.92	Bosnia and Herzegovina	13.05
Malaysia	35.55	Portugal	13.88
Azerbaijan	35.51	Guatemala	14.29
Norway	35.32	United States	14.61
Trinidad and Tobago	34.27	Cameroon	14.67
Venezuela, Bolivarian Republic of	33.92	United Kingdom	14.72
Oman	32.93	Dominican Republic	14.89
Viet Nam	32.70	Lithuania	15.15

Source: International Monetary Fund, *World Economic Outlook Database*, October 2012.

Note: Countries with an average GDP, between 2000 and 2010, below current US$ 10 billion were excluded.

Without sufficiently broad-based economic growth, a growing middle class that can propel savings rates in low-income countries is unlikely to emerge in the near future. In some advanced economies, such as the United States, low interest rates, prospects of inflation, stagnant incomes owing to the crisis and cultural factors are likely to hinder an increase in their future savings rates.

(ii) External resource flows

Overseas development assistance and migrant remittances

Figure C.22 showed that the gap between the rate of domestic savings and domestic investment for low-income countries has been consistently high in the recent past, widening considerably between 2002 and 2010. In 2010, the savings rate in low-income countries, on average, was about one-third the investment rate. Figure C.23 shows that overseas development assistance (ODA) is likely to have played a part in financing this savings-investment gap in low-income countries.

Given the limits to the growth of ODA in the future, owing to the recessionary situation in several advanced economies, the future importance of other resource

Figure C.23: **Overseas development assistance (ODA) and investment in low-income countries, 1990-2009** (US$ billion)
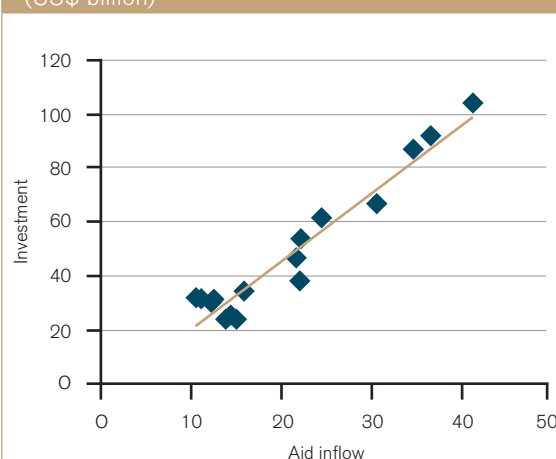
Source: World Bank.

flows from abroad in raising investment rates in low-income countries cannot be under-estimated. This is particularly significant because data reveal that low-income countries, such as Myanmar and Kenya, were among the ten countries with the lowest average investment rates between 2000 and 2010. Certain middle-income developing economies, such as Côte d'Ivoire, Angola, Cameroon, the Plurinational State of Bolivia and Yemen, were also included in this group.[92] This suggests that private external resource flows are likely to be important for enhancing physical capital accumulation in middle-income countries as well.

Officially recorded migrant remittances to developing countries, estimated at US$ 406 billion in 2012, are now more than three times the size of ODA. Compared with other private capital flows, remittances have showed remarkable resilience during the recent financial crisis (World Bank, 2012a).

In 2012, large emerging economies, such as India, China, the Philippines, Mexico, Egypt and Viet Nam, were among the top ten recipients of migrant remittances in the world (World Bank, 2012a). Figure C.24 shows that as a percentage of GDP, however, low-income countries, including Tajikistan, Haiti, the Kyrgyz Republic and Nepal, were among the top ten recipients of migrant remittances over the last decade. No Sub-Saharan African country appears in this list. This may be related to the high cost of sending remittances. For example, according to Ratha et al. (2008), the average cost of sending US$ 200 from London to Lagos, Nigeria, in mid-2006 was about 14 per cent of the amount. Their estimates suggest that halving remittance costs from 14 to 7 per cent for the London-Lagos corridor would increase remittances by 11 per cent.

Remittance costs could be reduced by lowering remittance fees and by improving access to banking for remittance senders and recipients. This is relevant because forecasts show that the growth of remittances is expected to be stronger in the near future, especially in regions that rely on remittances from the United States, the Russian Federation and the Middle East (World Bank, 2012a). Importantly, however, while migrant remittances can enable investment in physical equipment to initiate a small household business, they are unlikely to be able to sustain capital investment by larger companies.

Portfolio investment and bank lending from abroad

When an economy liberalizes its capital account, it will see an increase in portfolio investment flows and bank lending if the marginal returns to capital are high in relation to the rest of the world. In general, this would mean that capital moves from capital-abundant countries with low rates of return to capital-scarce countries with high rates of return. The large inflow of private capital into emerging economies, starting in the 1990s, can partly be explained by this rate of return differential. At the same time, risk (both actual and perceived) could narrow this differential in effective terms. Hence, the increased inflow of portfolio investment and commercial bank lending may also be attributable to factors that reduced risk (Mody and Murshid, 2005) – policy reforms, regulatory changes and more stable macroeconomic policies.

Figure C.25 shows that the top ten recipients of portfolio investment inflows among developing economies during the last decade were almost entirely in Asia or Latin America. Figure C.26 shows that the same holds true for bank lending from abroad. The continued importance of these investment flows in the future will undoubtedly be influenced by the health of global financial markets as well as the ability of recipient countries to strengthen independent

Figure C.24: **Top ten recipients of remittances from migrants as a share of GDP, 2000-10** (percentage)
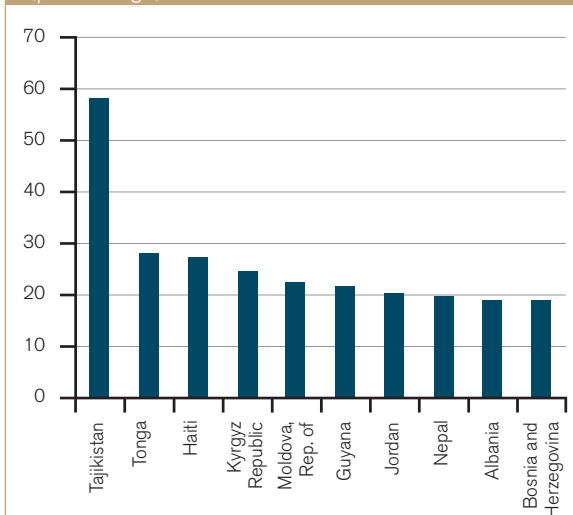
Source: World Bank, *World Development Indicators*.

Figure C.25: **Average annual foreign portfolio liabilities of developing countries – top ten, 2001-10** (US$ billion)
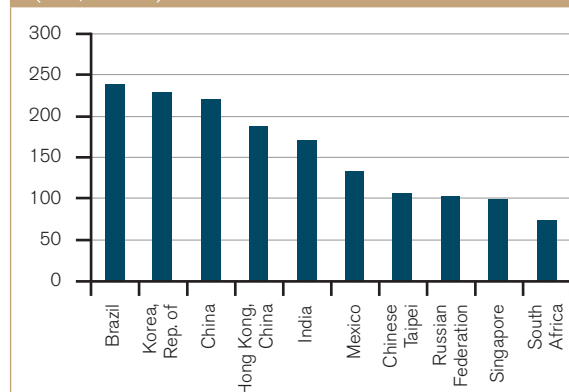
Source: International Monetary Fund, *Coordinated Portfolio Investment Survey*.

Note: Economies with an average GDP, between 2000 and 2010, below current US$ 10 billion were excluded.

Figure C.26: **Top ten recipients of bank lending from abroad amongst developing countries, 2001-10** (US$ billion)
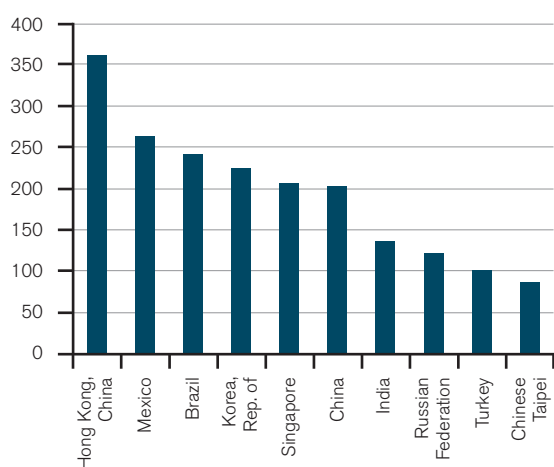
Source: Bank for International Settlements.

Note: Economies with an average GDP, between 2000 and 2010, below current US$ 10 billion were excluded.

regulation, improve transparency and conform to relevant international accounting and auditing rules. For developing countries in Africa, for example, the establishment of a strong legal framework and greater reliance on market-based credit assessment methodologies would be necessary first steps to create capital markets that can attract foreign portfolio investment and bank lending from abroad.

Foreign direct investment (FDI)

Traditionally, FDI consisted of intra-industry investment flows between similar developed countries (Forte, 2004). The latest World Investment Prospects Survey suggests that the European Union and North America

will remain among the most important regions for FDI by multinational companies in the medium run (UNCTAD, 2012). During the 1990s, FDI directed at developing countries began to grow substantially (see Figure C.27). This largely represented investments by advanced economies' firms in developing countries, whereby the former offshored unskilled labour-intensive parts of the production process to the latter in order to take advantage of lower costs (Helpman, 1984).[93] In addition to such "vertical" FDI, advanced country firms also viewed developing countries with large markets and significant barriers to trade as appropriate destinations for "horizontal FDI" (Dunning, 1980).

Much like foreign portfolio flows and bank lending from abroad, FDI flows into developing economies were largely confined to Asia and Latin America. Table C.7 shows that with the exception of Turkey, the top 15 developing country recipients of FDI inflows during the last two decades were in these two continents. East Asia did particularly well, with as many as six countries in the top 15 and China at the top of the table. This may be explained, in part, by the availability of adequate supporting infrastructure and the quality of institutions because they reduce transaction costs (see Section C.6).

Countries in South-East Asia, for example, have concentrated their public resources on the development of infrastructure, including roads, ports, electricity and telecommunication services (Ando and Kimura, 2005). The World Investment Prospects Survey outlines the continued importance of Asia and Latin America, as respondents listed China, India, Indonesia and Brazil as four of the top five most likely destinations for their FDI in the medium term (UNCTAD, 2012).

Even in Africa, where public infrastructure investment is relatively inefficient, improving infrastructure has a

Figure C.27: **Inflows of foreign direct investment, 1980-2010** (US$ billion)
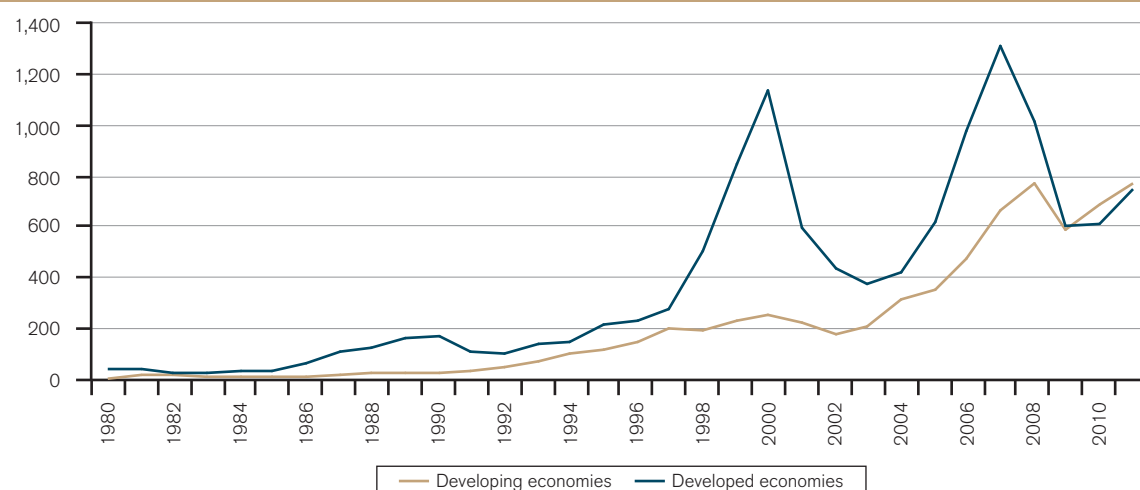
Source: UNCTAD.

Table C.7: **Average annual FDI flows of the top 15 developing countries, 1990-2011** (US$ million)			
Inward FDI		**Outward FDI**	
China	55,253	Hong Kong, China	33,146
Hong Kong, China	28,758	China	15,473
Brazil	20,635	Singapore	10,435
Singapore	19,113	Korea, Republic of	7,423
Mexico	16,378	Chinese Taipei	5,899
India	10,370	India	4,922
Saudi Arabia, Kingdom of	7,872	Malaysia	4,291
Chile	6,537	Brazil	3,660
Argentina	6,089	Mexico	3,121
Turkey	5,578	Chile	2,986
Thailand	5,286	United Arab Emirates	2,621
Malaysia	5,055	Kuwait, the State of	2,135
Korea, Republic of	4,463	Thailand	1,551
Colombia	4,262	Colombia	1,446
United Arab Emirates	3,843	Panama	1,392

Source: UNCTAD.

Note: Economies with an average GDP, between 2000-2010, below current US$ 10 billion were excluded. Indonesia was excluded because of large gaps in the data.

positive impact on FDI inflows (Asiedu, 2002; Morrisset, 2000) . It is also argued that high domestic private investment is a signal for high returns to capital, which attracts foreign investment. For instance, analysing a sample of 38 Sub-Saharan African countries between 1970 and 2005, Ndikumana and Verick (2008) find that domestic private investment has a strong positive impact on FDI inflows. This suggests that efforts to improve incentives for private investment through improving the quality of institutions will result in foreign investors viewing African countries more favourably in the future. In fact, the World Investment Prospects Survey shows that FDI in Africa is expected to pick up over the medium run owing to stronger economic growth, on-going policy reforms and high commodity prices (UNCTAD, 2012).

In recent times, high savings rates, increased capital intensity and technological progress have resulted in certain developing economies becoming sources of FDI as well. Figure C.28 shows a steady increase in FDI outflows from developing economies between 2003 and 2010. The bulk of this FDI represents flows from emerging economies to low-income countries, contributing to increased investment rates in the latter (World Bank, 2011a).

Table C.7 shows that the top five sources of FDI among developing economies over the last two decades are in East Asia (with Hong Kong, China and China occupying the top two positions). Other important source regions include India as well as countries in Latin America and the Middle East. Furthermore, much of the FDI between developing countries is intra-regional (World Bank, 2011a). Inter-regional FDI among developing economies goes primarily from Asia to Africa. China and Malaysia are among the top ten sources of FDI in Africa (UNCTAD, 2006).

The World Investment Prospects Survey reports that, in marked contrast to developed countries, nearly one-quarter of respondents in developing economies foresaw a decline in their FDI budgets in 2013 and 2014 (UNCTAD, 2012). This may be explained by the fact that multinational companies from developing economies continued to invest at near record levels during the crisis and may focus on rationalizing their investments in the medium term. In the long run, however, high expected growth in emerging economies, a familiarity with similar policy environments and the overall strengthening of trade links between developing economies is likely to enhance FDI between these countries.

(c) Conclusions

Investment in infrastructure can lead to the emergence of "new players" in world trade in the future. This may be particularly important for low-income countries in Africa, hitherto less involved in global production networks. It may also change the nature of trade in other ways. Better transport infrastructure across neighbouring countries, such as road connectivity, could strengthen regional trade in Africa. More extensive ICT infrastructure could further expand services trade and alter the pattern of international specialization. English-speaking African countries, for example, could mark a presence in the area of business process outsourcing.

Governments in these countries must therefore focus on scaling up and improving the quality of public infrastructure. This may involve enhancing domestic savings rates. The implementation of growth-promoting strategies that raise household incomes would be central to promoting savings. Altering tax systems and macroeconomic policies may also play a part. Ensuring that savings are translated into investment through improving the efficiency of capital markets is likely to be

Figure C.28: **Outflows of foreign direct investment, 1980-2010** (US$ billion)
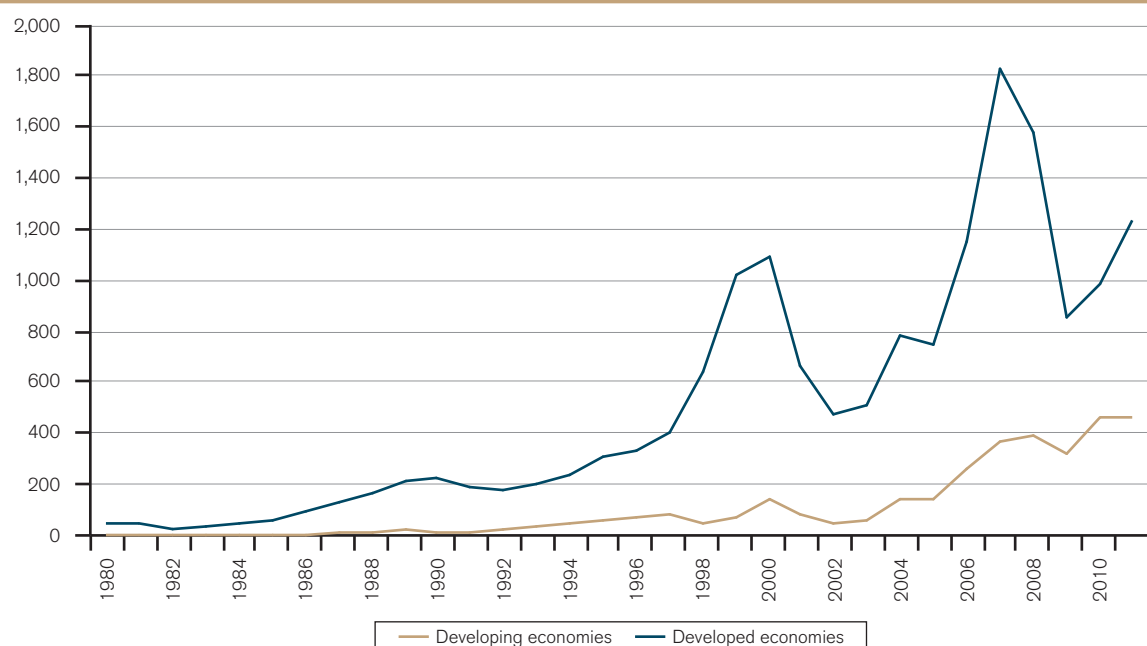
Source: UNCTAD.

equally important. Governments could utilize overseas development assistance, FDI and bank lending from abroad to increase infrastructure investment as well. The WTO's Aid for Trade initiative for developing countries is also important in this regard as it can increase a country's supply capacity and hence its participation in the world market (see Section E).

Greater public and private investment in physical capital, financed by domestic savings or capital flows from abroad, may also influence the comparative advantage of countries. There is a possibility for some unskilled labour-intensive economies, such as Chile, China and Turkey, to become capital-intensive economies in the medium to long run. Savings rates in many of these economies are already high.

Therefore, in order to move up the product ladder (in terms of capital and technology intensity), governments must concentrate on creating adequate investment opportunities for both domestic and foreign capital. This lack of opportunity is perhaps reflected in the increasing outflow of FDI from certain developing economies, such as China, Singapore, the Republic of Korea and India, to other developing and even developed economies. Of course, it is important to highlight the fact that outward FDI from developing economies is associated with the emergence of developing country-based multinational companies which, by enhancing capital and technology intensity, can itself influence comparative advantage.

It is hard to predict how capital flows across countries (and therefore their contribution to capital accumulation) will evolve in the future. Existing forecasts from the

World Investment Prospects Survey, for example, suggest that FDI flows are expected to increase at a moderate but steady pace over the medium term (UNCTAD, 2012). This baseline scenario, however, does not consider the possibility of negative macroeconomic shocks.

It is possible that the fragility of the world economy, the volatility of the business environment and uncertainties related to the sovereign debt crisis will negatively impact FDI flows in the medium term. Nevertheless, developing and strengthening institutions, such as a sound legal framework, would undoubtedly be important to attracting FDI. Preferential trade agreements with provisions for "deep integration" can play an important role in this regard. Establishing capital markets with sufficient depth is also crucial to attracting additional sources of investment finance, such as foreign portfolio investment and bank lending from abroad. This holds true for both low- and middle-income countries.

Reforms in the banking sector need to encourage financial institutions to move towards sound credit assessment methodologies. At the same time, stock and bond markets can play a larger role in domestic resource mobilization. This would require a strong legal framework, transparency requirements, financial accounting and auditing rules of international standard. The enforcement capabilities of independent regulation are also likely to play a part in reducing systemic risk and protecting investors' interests.

It is worth noting that external resource flows from abroad influence the nature of trade not only through

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their impact on domestic investment but also directly. For instance, the trade literature suggests that portfolio investment and bank lending relationships across countries can increase trade flows by reducing information asymmetries between exporters and importers. Similarly, FDI flows complement trade by facilitating global supply chains – increasing exports of intermediate products and services from the home country and those of the final good from the host country. Moreover, exports from the host country to third country markets may increase. FDI flows can also affect the comparative advantage of developing economies by facilitating the transfer of technology across countries. China is an example of such technology upgrading.

In fact, to the extent that investment and trade are complementary, an international system of investment rules can increase the flow of foreign investment by promoting predictability and security of access for foreign investors (see Section E). So can bilateral or regional agreements, which are being increasingly used to govern international investment. These agreements, however, run the risk of affecting the "level playing field"[94] in the future by creating regulatory divergence. A set of multilateral investment rules could ensure a more efficient international allocation of resources (with investment not diverted because of preferential treatment) across borders, which in turn should help trade. It could also bring greater parity between big and small countries, reducing the power imbalance which may arise if a large country negotiates with a small country on a bilateral investment agreement.

3. Technology

Technological differences between countries are an important determinant of income levels and trade. Empirical research has shown that the accumulation of physical and human capital can only partially explain different income levels across countries (Easterly and Levine, 2001; Prescott, 1998) and different trade patterns. The residual is commonly attributed to technological differences between countries, whereby technology is defined as the information or knowledge required for production.

Technological progress is undoubtedly the major factor explaining the fast growth in income in the 19th and 20th centuries. Electrification, the telephone, the internal combustion engine and other breakthroughs have dramatically changed the way the world works (see Section B.1). Likewise, technological progress will be a major factor in explaining the future patterns of trade and growth. Simulations about the future of global trade discussed in Section B.3 highlight that the assumptions about the future path of technological progress play by far the largest role in affecting overall outcomes.

A country's technological level is determined not only by domestic innovation but also by the diffusion of technology from abroad. Typically, while the former is particularly important for high-income countries, the latter mostly affects technological progress in middle- and low-income countries. This section first looks at patterns of innovation and technology transfer. Then it discusses how technological changes affect trade. Thirdly, it looks at the determinants of technological progress. Finally, it explores what these trends imply for the future of trade and trade policy.

(a) Technology patterns

Section B found that there are important emerging players in international markets, that trade is becoming more regionalized and that it is highly concentrated in few global companies. This section explores whether innovation and technology transfers can help to explain these patterns. In particular, it explores whether there is evidence of emerging new countries (that have significantly accelerated their capacity to innovate or absorb existing technologies) and new sectors (where technological knowledge has increased faster), whether innovation and technology transfers are more localized, regionalized or globalized than in the past and whether there is a relationship between these trends and offshoring. Finally, it also looks at the role of large multinational companies versus small and medium-sized enterprises in driving technological progress.

(i) Measuring technological progress

Measuring technological progress is a difficult and imperfect field of study. Widely used measures of technological progress include total factor productivity, research and development (R&D) expenditure and patent applications (Keller, 2010). However, each measure captures a different and incomplete picture of technological progress.

Total factor productivity (TFP) measures an economy's efficiency in transforming inputs into outputs. Empirically, total factor productivity is defined as the output per unit of combined inputs (usually, a weighted sum of capital and labour) and is calculated as a difference between a country's GDP and the contribution of capital and labour. The residual output that is not explained by capital and labour inputs is considered "technology". This approach suffers from important limitations due to both a lack of data and its poor quality. For example, estimations of TFP may attribute to technology what should be explained by labour or capital (physical and human capital), were the data of better quality.

R&D expenditure measures the input into technological innovation activity. A drawback of this approach is that not all research investments generate innovations;[95] and even when they do, the rate of return can vary

significantly depending on the specific investor and the way investments were made. For example, the return to publicly funded R&D is typically lower than the return to privately funded R&D (Keller, 2010). Moreover, since data are typically collected on a geographical basis, it often fails to distinguish between R&D investment in domestic firms and in foreign-owned affiliates.

Measuring patent applications addresses several of the limitations of other approaches. Unlike comparisons of R&D expenditure, patent application data captures the outputs of the innovative process (the invention) rather than its inputs (the research).[96] This approach also distinguishes between innovations generated by residents and non-residents.[97] However, a simple count of patents may be a misleading indicator of country's level of technology for several reasons. First, there is not necessarily a direct correlation between inventions and innovations. Not all innovations are patented. For example, patents tend not to capture innovations in services or organizational methods. Nor are all inventions patented in the country where they were generated.

An invention produced in a developing country, for example, might not be patented there if it is likely that the technology will be manufactured or produced elsewhere. Patents also tend to have widely different scientific and commercial values – typically a relatively small number of patents accounts for a large share of the value of the patent stock[98] – meaning that there is a tenuous link between a country's number of patents and its technological output.

Regarding technology transfers, there are two aspects that can be measured: the purchase of technology (see Box C.7)[99] and technology spillovers. Included in measures of technology purchases are royalty payments, R&D services trade, trade in technology-intensive goods, the share of foreign-owned employment in total employment, and foreign direct investment. In each case, a certain technology is made available to the importing country in exchange for payment – i.e. a licensing fee, a wage, or the price of the good. This measurement implicitly assumes that the technology embodied in these imports is not permanently available to domestic producers. If the import of that good or service stops for any reason, or the licence expires, the productivity gains are also assumed to disappear, as the importing country is unable to produce the knowledge embodied in the good, service or licence on its own.

A limitation of measuring technology transfer in terms of the monetary value of the market transaction is that it does not account for technology spillovers – i.e. the technology that is absorbed by the importing country without payment. This may happen through a variety of channels, including worker training, interaction with suppliers or reverse engineering. When an importing country acquires technology this way, the knowledge is retained even if the act of importing is interrupted or stopped.

Spillovers are difficult to distinguish empirically from knowledge flows, although there are at least two conceptual differences. First, knowledge flows, unlike spillovers, do not necessarily involve externalities; and secondly, they are consistent with a two-way interaction between actors rather than involving the one-way transfer of technology from one actor to another. One common way to estimate technology spillovers is to study the impact of foreign R&D on productivity or, alternatively, the impact of technology developed abroad on the rate of innovation of the home country. Evidence on technology spillover is discussed later in the section.

(ii) The geography of technological progress

New leaders

In recent years, there have been important changes in the geography of innovation. Although the technological gap between high- and low-income countries persists, R&D investments have become more globalized (Fu and Soete, 2010; Lundvall et al., 2009).

Figure C.29 shows the distribution of business R&D in a sample of 37 countries for 1999 and 2010.[100] It can be seen that over the sample period, R&D expenditures have become less concentrated. For example, while countries representing 20 per cent of total population accounted for about 70 per cent of R&D expenditure in 1999, these countries accounted for only about 40 per cent of R&D in 2010.

Most importantly, certain countries that traditionally have served simply as production platforms for developed countries increasingly base their economic growth on their own capacity to innovate and contribute to the technology pool (Mahmood and Singh, 2003). For example, Table C.8 provides the total number of patent applications by country of origin of the applicant. It shows that the contribution of China and other Asian countries, such as Singapore, India and the Republic of Korea, to the "pool" of technological innovation has significantly increased from 1985 to 2010.[101]

One possible explanation for the growing importance of these Asian countries in innovation is the relocation of significant manufacturing capacity to them (including the development of new and existing domestic industries as well as the location of foreign subsidiaries). As Pisano and Shih (2012) point out, producers benefit from the interaction with innovators and vice versa. The transfer from R&D into production can be complex and require significant coordination between those who design a good and those who

Box C.7: Limits of traditional measures of market- and intellectual-property-based technology transfer: a statistical perspective

Changing economic environments and business practices require statistical frameworks to adapt. Methodological research has helped clarify a number of conceptual issues which were left untackled in previous statistical frameworks. Consequently, the 1993 System of National Accounts and the fifth edition of the Balance of Payments Manual (BPM5) were both revised in 2008 to reflect better the economy and trading structure. Subsequently, the Manual on Statistics of International Trade in Services was also revised to guarantee consistency with the main frameworks and to add conceptual clarification on aspects that were not fully elaborated in the previous version, such as the measurement of international supply of services by mode of supply.

The new guidelines – the sixth edition of the Balance of Payments Manual (BPM6) and the 2010 Manual on Statistics of International Trade in Services (MSITS 2010) – also provide clearer conceptual guidance as to how to classify and measure transactions related to intellectual property, and in particular those related to technology transfer. The category "royalties and licence fees" has been replaced by "charges for the use of intellectual property not included elsewhere" and the item "research & development services" has been broken down by additional categories to allow for a clearer conceptual measurement.

Transactions relating to the right to use the results of research and development[102] are covered under charges for the use of intellectual property not included elsewhere. Transactions related to research and development services as well as the outright sales of property rights arising from research (e.g. patents, industrial processes and designs, copyrights arising from research and development) are covered under the research and development services item. MSITS 2010 proposes a breakdown of this item into "work undertaken on a systematic basis to increase the stock of knowledge" (reflecting the coverage of research and development within the national accounts) and "other". The former is further broken down into "provision of customized and non-customized research and development services" and "sale of proprietary rights arising from research and development" which is itself broken down into "patents, copyrights arising from research and development, industrial processes and designs" and "other".

To collect the respective information requires drafting of appropriate guidance for data collection systems, such as the international transaction reporting system or general trade in service surveys. For example, when considering multinational enterprises, many of the technology transfer transactions take place within this particular group of firms and consequently the valuation of trade (i.e. transactions) may be distorted as the pricing used may significantly be influenced by tax policies in the locations where these multinationals have established affiliates and therefore may significantly differ from the actual "real"-market value of transactions. Economic ownership of intellectual property assets may be an additional barrier to the appropriate measurement of transactions. Indeed, multinationals may choose to register their patent or industrial process in one country rather than another based on "tax evasion" strategies. Consequently, the country of registration is not necessarily the same as the one of the economic owner of the intellectual property – the same invention may be patented in multiple countries. For example, statistics from the World Intellectual Property Organization (WIPO) report that about 40-50 per cent of all patents are so-called secondary filings.

In other cases, firms may not be affiliated but a client enterprise may outsource completely the production of a product (i.e. virtual manufacturing), providing all the knowledge to the manufacturer for the production of these goods. Again, it is unclear how the relevant transactions, and in particular the ones pertaining to knowledge transfer, should be accounted for or not, as this may differ significantly according to the different types of arrangements which are adopted. In other words, although international guidelines clarify the conceptual classification of transactions, they fail to provide clear recommendations as to how to clearly compile the respective statistics. The compilation guidance that is currently being drafted by the UN expert group on compilation of trade in services statistics[103] should, however, help clarify the situation. In addition, a Task Force on Global Production has been established by the Conference of European Statisticians to set up clearer guidelines in relation to global production arrangements from the perspective of national accounts as well as from the perspective of the trade in services and balance of payments statistics.

Following the establishment of these more detailed guidelines, it is expected that some specially targeted surveys should help improve the situation, in particular when it comes to the more detailed information sought. Nevertheless, many countries/compilers will probably not be in a position to collect accurately such detailed information, often for budgetary reasons. A solution could be to complement their more general data collection systems with the information collected and disseminated by those countries which will engage in a more detailed and sophisticated data collection system (probably for countries which have a particular interest in this information because of significant research and development activities). However, this can only function if there is efficient cooperation between compilers of different countries. In addition, it will be necessary to have detailed bilateral information published by countries that will be engaging in detailed data collection.

Table C.8: **Patent applications by country of origin, 1985-2010** (top 30 countries)

Origin	Number of patent applications			Global ranking		
	2010	US office only		2010	US office only	
		2010	1985		2010	1985
Japan	468,320	84,017	274,404	1	2	1
United States	432,911	241,977	64,308	2	1	3
China	308,318	8,162	4,066	3	9	10
Korea, Republic of	178,644	26,040	2,703	4	4	15
Germany	173,532	27,702	32,574	5	3	4
France	65,623	10,357	12,240	6	8	6
United Kingdom	50,865	11,038	19,846	7	7	5
Switzerland	39,393	4,017	3,344	8	13	13
Netherlands	33,388	4,463	1,994	9	11	20
Russian Federation	32,835	606	3	10	26	71
Italy	27,910	4,156	2,137	11	12	18
Canada	24,209	11,685	2,110	12	6	19
Sweden	22,443	3,840	3,871	13	14	12
India	14,862	3,789	982	14	15	27
Finland	13,046	2,772	1,732	15	17	23
Belgium	11,804	2,084	807	16	18	30
Australia	11,556	3,739	21	17	16	54
Denmark	11,233	1,773	872	18	19	29
Austria	11,062	1,661	2,282	19	20	16
Israel	10,928	5,149	800	20	10	31
Spain	10,733	1,422	2,163	21	22	17
Democratic People's Republic of Korea	8,055	-	-	22	-	-
Norway	5,595	936	928	23	24	28
Singapore	4,229	1,540	4	24	21	69
Brazil	4,212	568	1,954	25	27	22
Turkey	4,211	150	132	26	36	38
Ireland	4,102	796	730	27	25	32
Poland	4,061	185	5,124	28	35	8
New Zealand	3,223	541	1,010	29	28	26
Ukraine	3,038	64	-	30	48	-

Source: Authors' calculation based on data from WIPO IP Statistics, at http://ipstatsdb.wipo.org/ipstatv2/ipstats/patentsSearch, accessed in March 2013.

manufacture it. Similarly, designing a product may be difficult if the designer does not understand how production works. Thus, as manufacturing shifts to Asia, it is likely that so too will know-how, research and eventually innovation.

However, the growing importance of Asian countries in innovation is not driven by multinational firms alone. For example, the great majority of patents and the bulk of R&D activity in China are generated by Chinese entities. R&D conducted by foreign subsidiaries still represents a relatively small share.[104] As shown in Figure C.30, the number of patent applications by residents[105] in Asia has increased significantly since 1995, as have applications in the OECD from non-residents.

Internationalization of technological progress

As discussed above, technological progress is determined not only by domestic innovation but also by international technology spillovers. In developing countries, where domestic innovation is low, spillovers acquire relatively greater importance. Understanding their geographical extent – i.e. whether the spillovers are localized or global – is crucial to determining their nature and impact. Indeed, the prevalence of international technology spillovers is a major determinant of the world's income distribution. While global technological spillovers promote income convergence worldwide, local spillovers do not.

In general, the empirical evidence supports the view that spillovers tend to be local – i.e. stronger within than across countries. Using patent citations as a measure of technological spillovers, Jaffe et al. (1993) find that US patents are more often cited in other US patents than in other foreign patents (Branstetter, 2001; Eaton and Kortum, 1999). Looking at a wider set of countries, Keller (2002) also finds that international technological spillovers are conditional on geographical distance. Measuring the impact of

Figure C.29: **R&D distribution, 1990-2010** (cumulative shares)
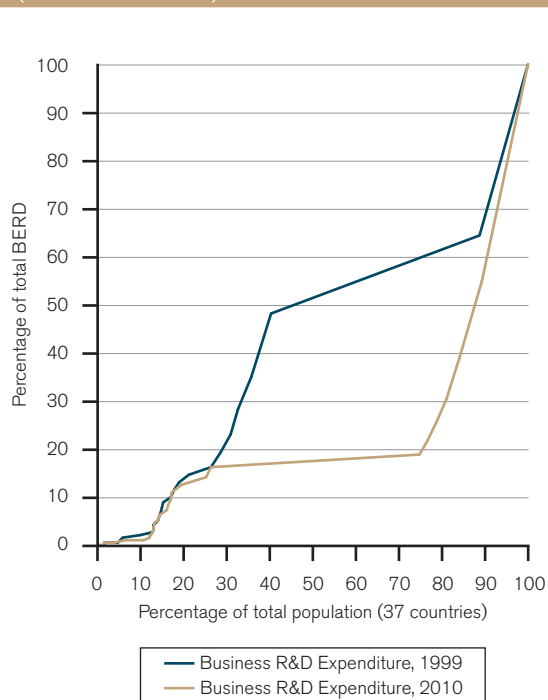
Source: Authors' computations based on R&D data from OECD Science, Technology and R&D Statistics, at http://www.oecd-ilibrary.org/science-and-technology/data/oecd-science-technology-and-r-d-statistics_strd-data-en, and population data from World Development Indicators (WDI), at http://databank.worldbank.org/

Figure C.30: **Patent applications from residents and non-residents, 1995-2010**
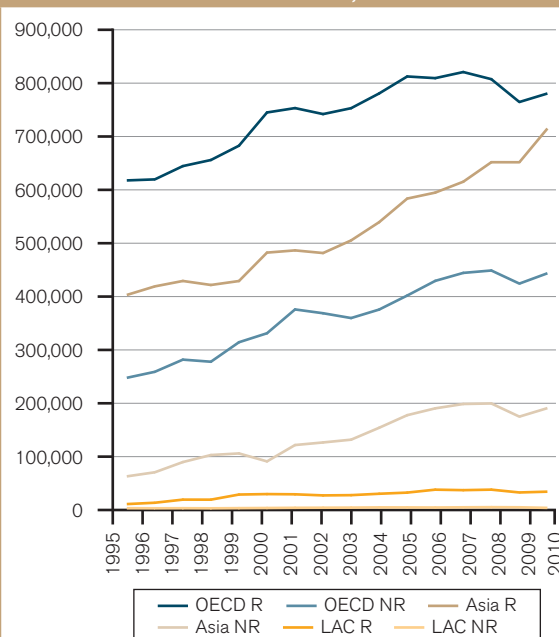
Source: Authors' computations based on data from WIPO IP Statistics Database, at http://ipstatsdb.wipo.org/ipstatv2/ipstats/patentsSearch.

Note: "R" indicates residents and "NR" non-residents. Italy is excluded from the OECD group due to the limited data availability. The regions of Asia is represented by top patent applicants. The region Asia includes China, Japan and Republic of Korea; Latin America and the Caribbean (LAC) includes Brazil, Chile and Mexico.

R&D expenditure in the five OECD countries on industry-level productivity of another nine OECD countries, he finds that the impact decreases with distance. The degree of localization, however, has decreased over time. For the period 1973-83, Keller (2002) estimates that at a distance of 2,000 kilometres between the senders and the receivers of technological knowledge only 5 per cent was actually absorbed. However, for the period 1986-95, he finds this percentage increased to 50 per cent.[106]

One possible explanation for the widening geographical radius of technology spillovers is the internationalization of the innovation process, including the growing mobility of experts and expertise, the increasing number of international co-authorships and the rising share of patents that list inventors from more than one country (WIPO, 2011). As shown in Figure C.31, one of the most interesting recent developments is the increased incidence of co-authorship between developed and developing country scientists and researchers.

A second possible factor driving the growing radius of R&D spillovers is the increased importance of production networks. The international fragmentation of the production process increases cross-border interactions, which in turn increases technological spillovers. Following the approach suggested by Keller

(2002) and Bottazzi and Peri (2003), this report also calculates how R&D spillovers decline with distance but it distinguishes between countries that are highly integrated and those that are not.[107]

As shown in Figure C.32, R&D spillovers from vertically integrated countries remain more significant over longer distances than R&D spillovers from countries that are on average less vertically integrated. Specifically, a 10 per cent increase in foreign R&D spending in countries that are located within 300 km translates on average into 0.04 per cent increase in patenting in the home country. However, the result is higher for vertically integrated country-pairs, for which a 0.08 per cent increase in patenting at home is estimated if the foreign country is highly vertically integrated with the home countries (details of the methodology used are provided in Box C.8).

Although production networks may have helped to widen the radius of technology spillovers, these networks tend to be regional rather than global – i.e. they tend to increase trade and investment flows between closer international locations than between locations farther apart. It follows that technological diffusion may also have become more regionalized rather than more globalized – an observation that is supported by the results of this report. As shown in

Figure C.31: **International co-authorship of science and engineering articles, 1995-2010** (in thousands)
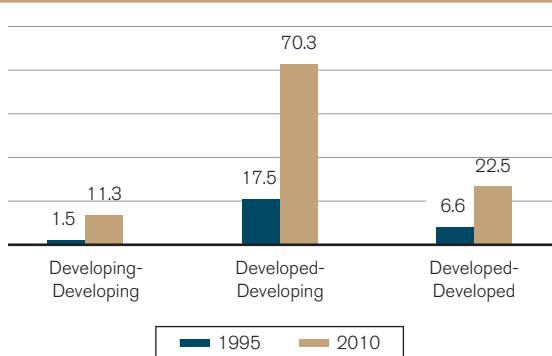
Source: Authors' computations, based on data from Appendix Table 5-41 of Science and Engineering Indicator 2012, National Science Foundation (NSF). Retrieved at: http://www.nsf.gov/statistics/seind12/append/c5/at05-41.xls

Figure C.33, technology spillovers are much higher among countries within a region than outside it.

Observed patterns of trade in high-technology products also support the idea that technology spillovers may have regionalized. Figure C.34 shows the percentage of trade in high-technology products within a region versus between regions. Interpreting an increase in trade in high-tech products as a measure of stronger technological spillovers, the increasing share of trade in high-technology goods within a region seems to point to an intensification of technology diffusion at the regional level.

One implication of the regionalization of technology spillovers is the possible emergence of "convergence

clubs", that is groups of countries that become increasingly similar in terms of technology levels, trade more among themselves, share similar economic interests and possibly engage in building stronger regional institutions.

(iii) The changing nature of technological progress

Sectoral distribution

R&D spending is highly concentrated. Nearly 90 per cent of R&D investment takes place in the manufacturing sector, and within this sector over 90 per cent of investments occur in just four industries: chemical products, electrical and non-electrical machinery (covering information communication technology – ICT) and transportation equipment (see Table C.9 and Appendix Table C.1 for details on composition).

Although most R&D takes place in the manufacturing sector, R&D in the services sector has experienced the fastest growth since the early 1990s. Table C.9 shows that R&D expenditure in services increased from 6.7 per cent of total business R&D between 1990 and 95 to nearly 17 per cent between 2005 and 2010. Within services, business services saw the biggest increase in R&D expenditure over the period (see Appendix Table C.2). In general, knowledge-intensive business services (KIBS) are emerging as key drivers of knowledge accumulation and may in the long run replace manufacturing as the engine of global innovation. Eurostat's 2008 Community Innovation Survey[108] shows that the proportion of innovative firms in some categories of KIBS, including 59 per cent

Figure C.32: **R&D spillovers by distance and degree of vertical integration**
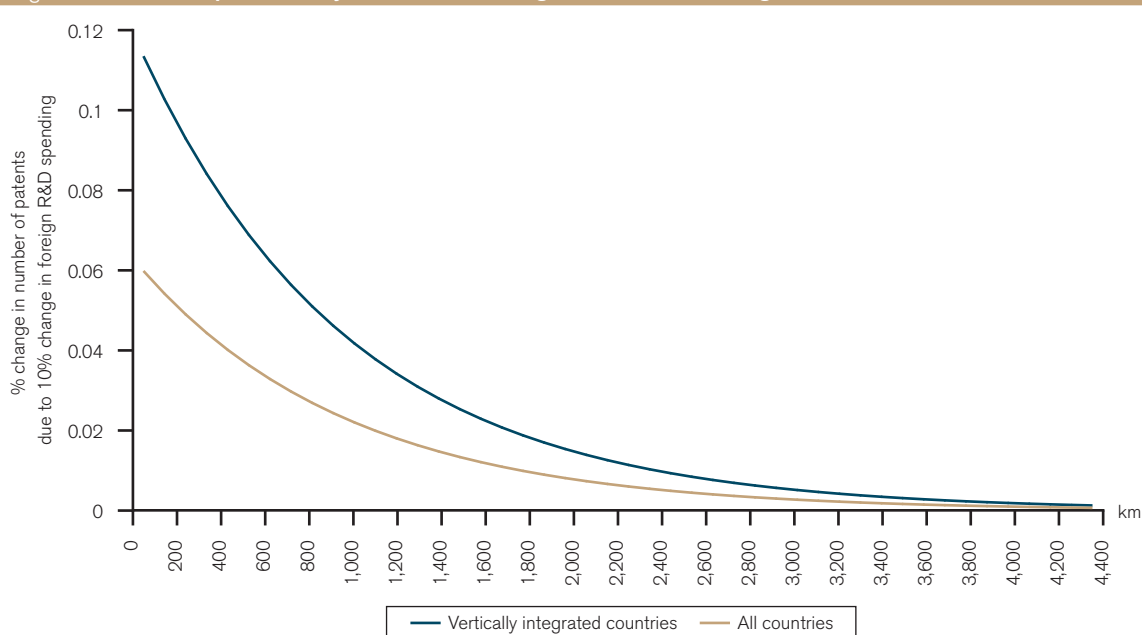
Source: Authors' calculations based on Piermartini and Rubinova (2013). See Box C.8 for details.

Note: "Vertically integrated countries" are defined as those country-pairs with a share of trade in intermediates above the median.

Box C.8: **Production network and the geography of technological spillovers: methodology**

The estimates for international R&D spillovers in Figures C.31 and C.32 were obtained through an econometric model (Piermartini and Rubinova, 2013). Following the economic literature (Keller, 2002; and Bottazzi and Peri, 2003), a country's patents applications were related to its R&D spending and the R&D undertaken in foreign countries. Intuitively, if the level of foreign R&D matters for domestic innovation, some of the technology created abroad must cross international borders.

In particular, using a panel of 41 countries over the period 1996-2007, the following equation was employed:

$$\ln(Patents)_{it} = \alpha + \beta \cdot \ln(R\&D)_{it} + \gamma \cdot PoolR\&D_{it} + X_{it} \cdot \delta + t + e_{it}$$

where *Patents* indicates the number of patent applications of country i at time t, *R&D* denotes domestic business expenditure in R&D and *PoolR&D* is the pool of R&D available to the home country and generated abroad. All variables are in logarithms (ln). In particular, the variable *PoolR&D* is calculated as a weighted average of all foreign countries' R&D expenditure, where the weights are the distances between the home country and each foreign country. The formula used to construct this variable is: $PoolR\&D_{it} = \sum_{j \neq i} \ln(R\&D)_{jt} \cdot \exp(-distance_{ij})$

A set of control variables (denoted by *X* in the equation above) was also introduced. These include population and real GDP per capita to control for a country's market size, the share of tertiary graduates in total population to capture the country's capacity to generate innovation, and the level of patent protection and the origin of the legal system to control for quality of institutions – an important determinant of the incentives to innovate.

The coefficient of interest is γ. This indicates the percentage change in domestic patenting activity due to a 1 per cent increase in the pool of foreign R&D. A positive value of this coefficient suggests international technological spillovers.

To test how production networks affect international spillovers, the variable *PoolR&D* was split into two components. One is the pool of R&D from countries that are highly vertically integrated with the home country. The other is the pool of R&D from the rest of the world. The vertical connection was defined on the basis of the share of machinery parts and components country i imports from country j relative to the total machinery imports of country i. Thus, country j is identified as a country highly vertically integrated with country i if its exports of intermediates to country i are above the median.

When the R&D spending pool was split, it was found that R&D spending only from countries that are important input suppliers has a positive and significant effect on the home country's patenting activity.

in information and communication and 52 per cent in finance and insurance activities, exceeded the 51 per cent share in the manufacturing sector (Meliciani, 2013).

Data on patent applications highlight the significant contribution of ICT-related technologies to innovation over the past three decades. Table C.10 shows the ten technology fields that experienced the fastest growth in terms of patent applications over the period 1980-2010. Among these top ten technology fields, five are related to ICT development – namely, IT methods for management, digital communication, computer technology, semiconductors and telecommunications.

The importance of the ICT sector in innovation over the past decades has led many to identify the ICT revolution as the third period of industrial innovation. This revolution began in 1960 and followed two previous waves of innovations. The first, between 1750 and 1830, created steam engines, cotton spinning and railroads. The second, between 1870 and 1900,

produced electricity, the internal combustion engine and running water with indoor plumbing. Jorgenson et al. (2005) extensively study the contribution of IT to productivity and growth. They estimate that as a group, IT-producing industries contributed more to the growth of total factor productivity between 1977 and 2000 than all other industries combined.

However, other economists have questioned whether ICT innovations have had as profound an impact on economic growth as previous technological advances, such as steam power or electrification. In a recent paper, Gordon (2012) argues that the ICT revolution has not fundamentally changed living standards and that its economic impact is already diminishing. In support of his argument, he notes the slowdown in US productivity growth since the 1970s.

Others highlight other explanations for the US productivity slowdown and are more optimistic about the potential growth impact of the ICT revolution. First, energy price shocks in the 1970s and 2000s may

Figure C.33: **Technology spillovers within a region versus spillovers into other regions**
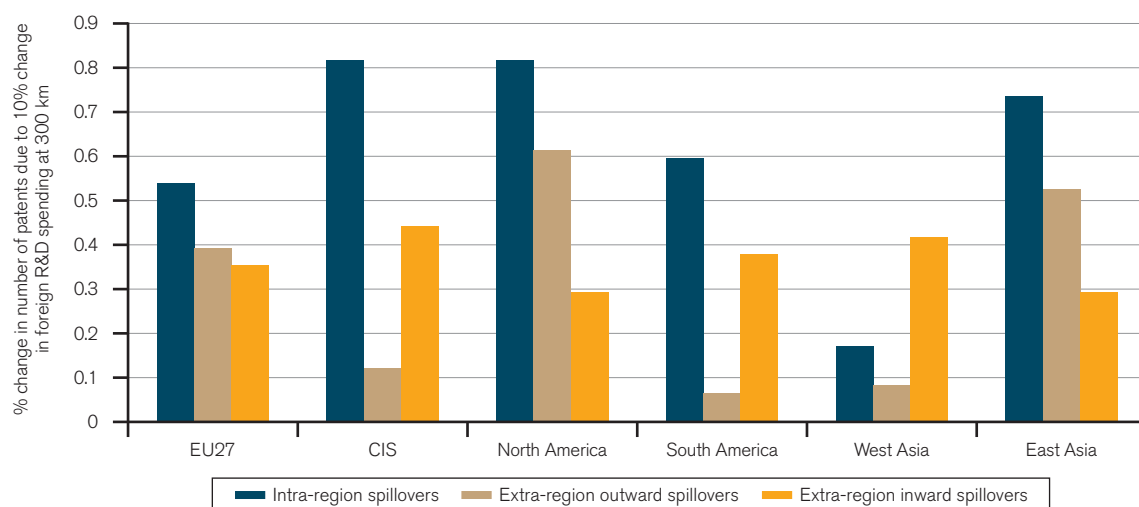
Source: Authors' calculations based on Piermartini and Rubinova, 2013. See Box C.8 for details.

Figure C.34: **Exports of high-tech products within a region versus between regions, 1998 and 2011** (US$ billion and percentage)
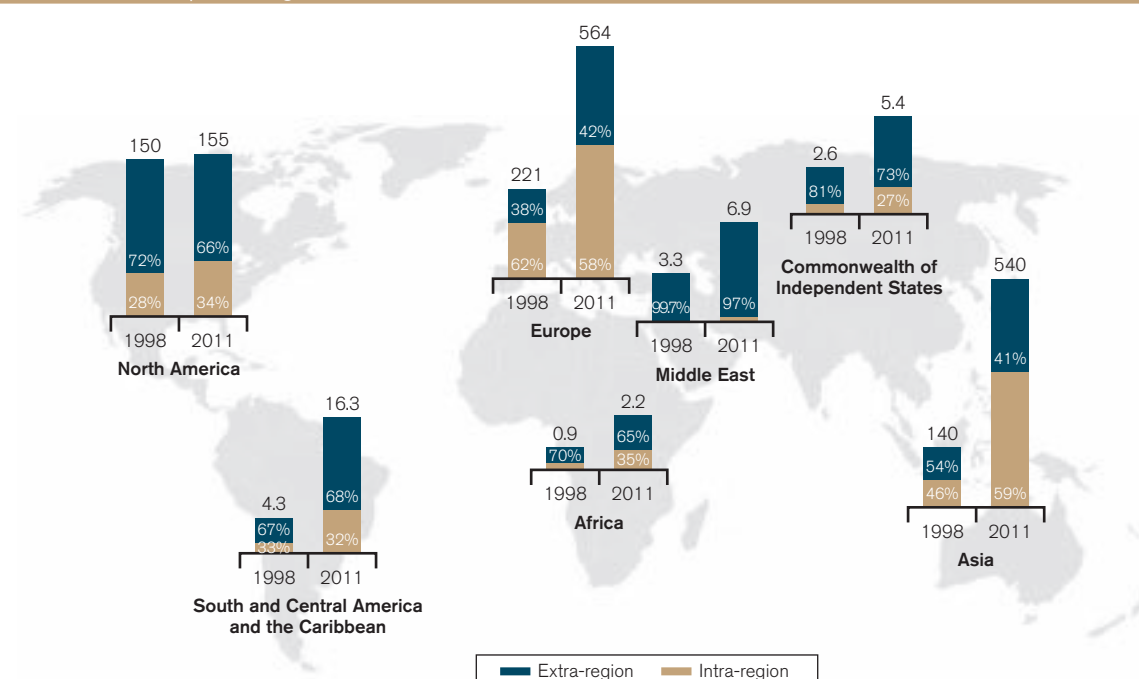
Source: Authors' computation, based on data from World Integrated Trade Solution (WITS), World Bank, at http://wits.worldbank.org/wits/. The definition of high-tech products follows OECD Working Party on International Trade in Goods and Trade in Service Statistics (2008).

Note: Boundaries do not imply any judgement on the part of the WTO as to the legal status of any frontier or territory.

better explain the productivity slowdown, which started in the 1970s and gradually spread to the wider economy via the most energy-intensive sectors. Secondly, the information technology revolution may still be in its early phase, with its major economic impacts yet to be felt. The past two major technology waves, in the early 19th century and in the early 20th century, required almost a century before their impact fully diffused throughout the economy.

Moreover, the influence of technology and innovation on the economy may be cumulative. While doubling technological capacity may not matter much when the initial level is low, it can have huge effects when the level rises.[109] The exponential growth of the internet over the past two decades, as the synergies between existing communications and information technologies are recognized and exploited, illustrates this cumulative effect.

Table C.9: **Business R&D by sector, 1990-2010**				
Sector	**1990-95 average**		**2005-10 average**	
	Value	**Share of total BERD (%)**	**Value**	**Share of total BERD (%)**
Agriculture, hunting and forestry	578.5	0.4	606.1	0.2
Manufacturing	126,442.8	88.9	200,273.1	81.0
Services	9,470.8	6.7	41,703.0	16.9

Source: Authors' computations, based on data from OECD Science, Technology and R&D Statistics, at http://www.oecd-ilibrary.org/science-and-technology/data/oecd-science-technology-and-r-d-statistics_strd-data-en

Note: Total over 24 countries; values in US$ million, PPP adjusted, 2005 constant prices, share in percentage. For the purpose of consistency and comparability, the aggregation of business R&D by sectors is done using only countries with data for all three sectors, both in the period of 1990-95 and the period of 2005-10. As a result, 24 countries are in the sample – i.e. Austria, Canada, Czech Republic, Denmark, Finland, Germany, Greece, Hungary, Iceland, Ireland, Japan, the Republic of Korea, Mexico, Netherlands, New Zealand, Norway, Portugal, Romania, Singapore, Slovak Republic, Slovenia, Spain, Sweden and Turkey.

Table C.10: **Patent publication by technology field (ten fastest growing), 1980-2010** (percentage)		
Technology field	**Average growth rate 1980-2010**	**Share of world total patent publication in 2010**
Micro-structural and nano-technology	98	0.17
IT methods for management	58	1.31
Digital communication	39	4.27
Computer technology	26	7.37
Biotechnology	24	2.28
Semiconductors	22	4.35
Medical technology	20	4.41
Telecommunications	18	3.20
Analysis of biological materials	17	0.67
Audiovisual technology	16	4.57

Source: Authors' computations, based on data from WIPO IP Statistics Database, at http://ipstatsdb.wipo.org/ipstats/patentsSearch

The role of multinationals versus SMEs

Most R&D spending is conducted by firms based in OECD countries; multinational firms in particular are major drivers of R&D spending.[110] Available data for 1999 show that in the United States 83 per cent of all manufacturing R&D was conducted by parent companies of US multinationals (NSF, 2005).

So far, small and medium-sized enterprises (SMEs) have underperformed relative to larger firms, both in terms of R&D spending and innovation. In a recent report on SMEs and innovation, the OECD (2010a) observes that "SMEs innovate less than large firms across a range of categories including product innovation, process innovation, non-technological innovation, new-to-market product innovation and collaboration in innovation activities". This observed gap still persists even after adjusting for firm size – i.e. SMEs have lower innovation rates per employee than larger firms (Audretsch, 1995). However, this statistical gap tends to obscure the fact that there is substantial interaction between large firms and SMEs in innovation. SMEs that have produced breakthrough innovations are often acquired by large firms which then build upon and commercialize the initial innovation.

There are reasons to expect that SMEs will become increasingly important in the global landscape of innovation. Recent developments in production technologies and consumer tastes suggest that economies of scale and scope in R&D and production – the competitive edge of larger firms – will become less significant and advantageous in the future. The OECD (2010a) points to two particular trends which may reduce the importance of economies of scale and scope, and potentially empower SMEs. First, some innovations, such as 3D printing, will make it possible for SMEs across numerous industries to produce on a small scale as efficiently as large-scale production. Secondly, as global consumers' incomes rise, their desire for variety increases as well. This increases the scope for SMEs to fill niche markets.

Both trends mean that the multinationals' current advantage in producing standardized products on a large scale at a low cost may diminish in the future. As a consequence, one may expect that small innovating firms will be more likely to commercialize their own innovations and to invest more in additional innovations.

(b) Technology and trade: A two-way relationship

Traditional economic theory viewed a country's level of technology as an exogenous explanatory variable of trade – that is to say, technology is taken as a given factor shaping other economic variables, including exports and imports. However, in the real world, technological change is not drawn randomly from a global pool of innovation but rather is the outcome of economic forces. When firms decide how much to invest in R&D, they consider the expected economic returns from innovation. The greater the expected rewards for a dollar spent in R&D, the greater their incentive to invest in innovation.

Several factors affect firms' incentives to innovate, one of which is trade. Thus, to understand how technological progress will affect future patterns of trade, it is also important to understand how trade itself affects technological progress.

This section first looks at how technological progress affects trade, then it discusses how trade and other factors shape technological progress.

(i) How does technology affect trade?

Shaping comparative advantage

Economic theory views technology as a factor determining the patterns of trade. According to traditional theory, trade occurs because countries are different and one of these differences is technology. In shaping comparative advantage, technological differences between countries help to shape the patterns of trade. In the simplest Ricardian model, a country exports the good which it is relatively more efficient at producing than its trading partner – that is, the good with the lowest opportunity cost.

Until recently, trade theory ignored differences across firms, and trade models assumed that all firms in a country shared the same technology. However, these traditional models failed to explain evidence that not all firms export, and that exporting firms tend to be larger and more productive than non-exporting firms. In the new trade models, firm-specific technological knowledge is seen as a key determinant of whether a firm exports or just serves the domestic market (Melitz, 2003).

A firm's relative productivity also helps to explain whether it will export its products or sell them through a foreign subsidiary – i.e. through so called "horizontal" FDI (Helpman et al., 2004). The assumption is that exporting involves lower fixed costs than FDI, while FDI requires lower variable costs than exporting. Because of existing fixed costs of exporting, only the most productive firms will export, and among these only the most productive will engage in FDI.

In a world where firms produce final goods by assembling a range of intermediate goods, technology is also an important determinant of whether a certain input or task is produced domestically and exported or whether it is offshored. In general, trade models of vertically integrated firms assume that technology can be transferred from the parent to the affiliate company (this includes recent models of trade in tasks, which then occurs in line with comparative advantage in factors of production).

However, when technology transfer is costly for a given market, technologically complex inputs will be produced at home and exported, and only the more standardized inputs will be produced abroad. This is because more complex inputs may involve higher costs of transferring the technological information needed for offshore production. Moreover, if the technology involved in the production of intermediate goods can only be transferred through face-to-face communication, inputs imported by an affiliate from its parent company will be increasingly technologically complex as the distance between the parent company and the affiliate increases. In fact, US exports show a positive relationship between the complexity of exports (measured as the average R&D intensity of exports) and the geographical distance to the destination markets (Keller and Yeaple, 2009; 2012).

The traditional Ricardian models of trade, as well as heterogeneous firms' models, do not account for technological spillovers. Imports embody foreign technology but they do not change the importer's technological know-how. Similarly, in the traditional model of vertically integrated firms, there are no technological spillovers from the affiliate company to the domestic firms. However, evidence clearly supports the view that knowledge spillovers exist.

What does this imply for trade patterns? If countries' access to technology were identical – i.e. if technological diffusion were perfect and global – trade would occur only on the basis of relative factor abundance rather than technological differences (Heckscher-Ohlin theory). However, clearly, technological diffusion is neither perfect nor global. Thus, understanding the geographical extent of technology transfers and their impact is essential to understanding which factors shape trade – relative factor abundance or technological differences.

The concepts associated with the new economic geography can provide important additional insights into the way technology diffusion has an impact on production and trade patterns (Krugman, 1991; Head and Mayer, 2004; Krugman, 1998). Since technology spillovers are greater among firms located in close proximity to one another – helping to drive down their production costs and make them more competitive in international markets – these spillovers indirectly create agglomeration forces that shape trade. To benefit from technology spillovers, industries will tend to be concentrated in certain places, especially in a country with a large domestic market for the good being produced. Locating in a large market will also benefit firms by reducing transport and trade costs. It follows that, under these circumstances, a country will export the product for which it has a home market advantage – that is to say, the product for which it has the largest domestic demand.[111]

Reducing trade costs

Trade costs are generally estimated to be a more significant obstacle to trade than policy barriers. In 2004, for example, aggregate expenditure on shipping only was three times higher than the aggregate tariff duty paid (Anderson and Van Wincoop, 2004). Thus, any change in trade costs is likely to affect trade significantly.

Technological innovation has had a major impact on trade costs. The introduction of containerization and jet engines has significantly reduced sea and air transport costs. More recently, the use of radio frequencies, identification tags and the internet has allowed firms to keep track of where a product is at any time. This has significantly improved logistics services and made possible the development of a more efficient multi-modal transport system. As will be

discussed in Section C.4, the reduction of transport costs has a significant impact on both the volume and composition of trade.

Technological advances have also significantly reduced communication costs. Exporters need information on profitable trading opportunities. Importers need information on suppliers of intermediate goods, on product specifications, and on scheduling production processes. The telephone is still a primary means of communication but the internet is becoming an increasingly important, versatile and low-cost communications tool. Mobile phones are becoming increasingly important to commerce, especially in developing countries, because they require less infrastructure and are untied to location.

Lowering the cost of communications affects trade in several ways. First, it can lower the variable costs of trade and thus help to increase trade volumes – in much the same way that lowering tariffs increases trade volumes. Secondly, it can lower the fixed costs of trade by improving exporters' or importers' access to information – everything from market intelligence to potential trade partners. As discussed above, when fixed entry costs are high, only the most productive firms can export, so a reduction in communication costs can be expected to encourage smaller, less productive firms to enter international markets.

Examining eBay transactions, a recent study by Lendle et al. (2012) shows that while most "offline" sellers export only one product to one market, most sellers on eBay export to more than five markets and in more than five product categories, suggesting that the internet has significantly lowered cross-border trade costs for small business, especially the cost of matching buyers and sellers. Thirdly, lower communication costs can affect the composition of trade. Because some tradable sectors are more information-sensitive than others – such as goods with short product cycles (e.g. consumer electronics) or ones that feed into complex production chains (e.g. automotive parts) – falling communications costs will disproportionately benefit them. Fink et al. (2003) show that the impact of a reduction in communication costs is as much as one-third higher for trade in differentiated goods (e.g. technologically advanced manufacturing goods) than for trade in homogenous products (e.g. agriculture or standardized manufacturing goods).

ICT and trade

The development and diffusion of ICT has had a particularly powerful impact on trade – including the growing importance of intermediate goods in trade, of services trade, of e-commerce and of developing countries. ICT has been an essential prerequisite to the rapid growth of global supply chains by making production coordination across borders easier.

Production chains require deep and continuous coordination between headquarters and affiliate activities. Sharing information between terminal operators, shippers and customs brokers and a wide range of other actors is essential for the efficient management of production networks, where just-in-time delivery is required. One by-product of the ICT revolution is that world trade in parts and components has increased much faster than total merchandise trade since the early 1990s.[112]

ICT developments have also underpinned the growth of services trade, including the offshoring of service activities, such as data processing, research and development and business processes to lower-cost locations around the world. Services which were non–tradable in the past – or tradable only at very high costs – have become highly tradable today. This is particularly true of knowledge-intensive business services (KIBS): legal services, accounting, tax consultancy, market research, auditing, management consultancy, architectural, engineering and technical consultancy, technical testing and analyses, advertising and other business activities.

KIBS's share of world trade grew at an annual rate of 8 per cent between 1990 and 2000, and at 10 per cent between 2000 and 2010 (National Science Board, 2012), in no small part because of the impact of ICT developments (see Section B). Particularly significant is the growth of KIBS in emerging markets. Since 1990, China, India, Indonesia and the Russian Federation have experienced particularly high growth in terms of their share of global value-added in KIBS. Specifically, China reached 5.5 per cent of global value-added in KIBS in 2010, up from 1.6 per cent in 1990; India accounted for 2 per cent in 2010, up from 0.8 per cent in 1990 (Meliciani, 2013).

ICT developments have also changed the nature of the products that are traded – from trade in physical goods to trade in digital goods, from trade in "atoms" to trade in "bits". Music and film markets, for example, are being completely transformed by e-commerce and downloading, making trade in physical CDs or DVDs increasingly obsolete. Blinder (2006) suggests that as the distinction between tradable and non-tradable goods and services becomes increasingly blurred, so too will trade theory predictions based on the traditional factor endowment of skilled and unskilled labour. In particular, he argues that as an economy becomes more service-oriented, the new trade theory should focus on personal versus impersonal services as a source of comparative advantage, as the latter can be easily offshored while the former cannot.

Given current trends, it is also likely that ICT infrastructure will become an increasingly important factor shaping trade flows in the future.[113] For example, developing countries' potential to "leap-frog" to the next level of ICT infrastructure – as many are already

doing in the case of mobile phone technology – may be a source of competitive advantage *vis-a-vis* developed countries which are burdened with the sunk costs of traditional communication infrastructures. Although the so-called "digital divide" between high and low-income countries is still large, there are clear signs that it is narrowing (see Figure C.35 and Appendix Table C.3). Over the last two decades, the growth in fixed line and mobile connections as well as in the number of internet hosts has been faster in developing than in developed countries. One reason for this is that while fixed-line communications requires a substantial investment in infrastructure, the initial investment in mobile networks is relatively modest.

Other indirect channels

Technological changes also affect trade indirectly through their impact on other factors shaping trade.

The ICT revolution provides a clear example of the many dimensions in which technology's impact on trade can be analysed. The use of the internet for banking, for buying and selling goods, for organizing travel and accommodation are a few examples of the many ways in which ICT developments increase international competition, reduce trade costs and create new markets. However, the effects of the ICT revolution go well beyond their direct impact on services trade and product market competition.

First, ICT has significantly changed the way that the labour market operates. The internet reduces search costs for a new job and vastly expands the

geographical scope, creating a better match between employers and employees, and reducing the frictional rate of unemployment. It also allows individuals to work or conduct business outside the office or company premises. New and more flexible forms of employment are opening up, improving employment prospects, especially for disadvantaged people in the job market (e.g. older workers and women).[114] These and other impacts of labour supply on trade are analysed in more detail in Section C.1.

Secondly, ICT has an impact on human capital accumulation. For example, online universities offer an expanded array of course options – from professional courses to post-educational programmes – and increase access to specialized knowledge from remote locations. The effects of human capital accumulation on trade are analysed in Section C.1.

In general, technology changes and technology transfer have a strong impact on income distribution and inequality. The effects of income inequality on trade are analysed in Section D.1.

In sum, the diffusion of ICT worldwide may be expected to yield significant changes in international trade. Not only will the trend towards lower communication costs and increased trade volumes be likely to continue, but changes in the patterns and nature of trade are also inevitable. First, the importance of e-commerce over other forms of trade will continue to increase. Secondly, the role of SMEs in exporting can be expected to assume greater importance. Thirdly, as the ICT network expands, new players will be likely to emerge in information-intensive sectors, such as consumer electronics and automotives, and the relative importance of factors of comparative advantage will change.

(ii) How does trade affect technological progress?

To understand how technological progress will affect future patterns of trade, it is also important to understand the factors shaping technological progress. One of these factors is trade itself. Trade affects technological progress in two ways: through its effect on the incentive to innovate and through technology transfers.

Trade and innovation

Trade affects firms' incentive to innovate through its effect on the size of the market in which a firm operates as well as through its effect on competition, technology transfers and institutions. Firms spend on R&D to increase profits or to keep up with competition from other innovating firms. All else being equal, the larger the market, the larger the firm's expected profits from innovation. By increasing the size of the market in which a firm operates, trade provides firms with the

Figure C.35: **Annual growth in telecommunications infrastructure by income group, 1995-2011**
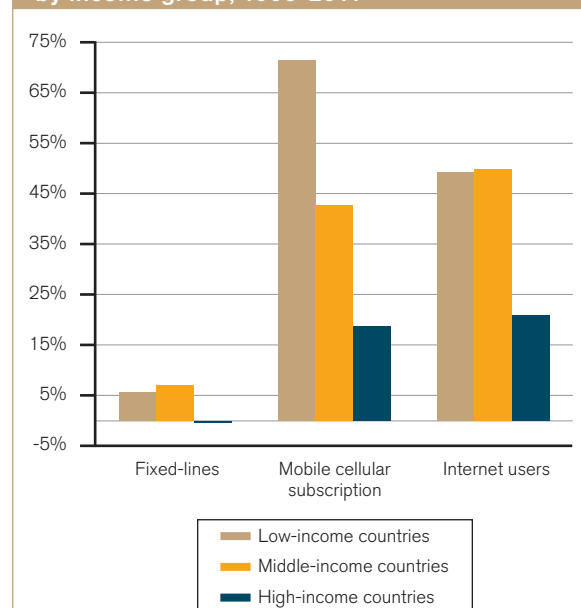
Source: Authors' computations, based on data from World Bank, *World Development Indicators.*

opportunity for greater profits, thus increasing their incentive to invest in R&D and therefore the probability of innovation – i.e. there are positive scale effects.

Trade also increases competition. The effects of competition on innovation, however, are less clear cut. On the one hand, by reducing the monopoly rents[115] associated with innovation, competition is expected to reduce incentives to innovate (Schumpeter, 1942). On the other hand, more rigorous competition may give firms a greater incentive to innovate because if a competitor innovates first, rival firms are likely to lose market share, experience losses and possibly be forced to exit the market.

Trade can also affect innovation incentives through its effects on technological spillovers. Again, the effects of technological spillovers on the innovation rate are not one-way. While imitation may foster R&D investments in an effort to rise above the competition (Helpman, 1993), the reduced returns to innovation may reduce firms' incentive to engage in R&D activity – i.e. there are ambiguous effects of imitation.

Finally, trade shapes the institutional framework, which in turn shapes the economic incentives of firms. As will be discussed in Section C.6, there is a positive correlation between trade and quality of institutions, and countries with better institutions tend to invest more in education and infrastructure. These linkages generate a positive relationship between trade and the returns to innovation, thus fostering firms' incentive to invest in R&D.

The economic literature on the empirical relationship between trade and technological progress is extensive, and includes both country-level and firm-level studies. In general, empirical evidence based on country-level data shows a correlation between trade and innovation.[116] However, one general criticism of these studies is that they do not manage to distinguish fully between cause and effect. This is because it is difficult to disentangle trade policy changes from other domestic policy changes undertaken by governments that simultaneously affect growth (Rodriguez and Rodrik, 2001).

More recent studies based on firm-level data also support the view that trade increases the incentive to innovate. Focusing on trade opening between Argentina and Brazil between 1992 and 1996, Bustos (2011) finds that Argentinian firms in sectors with the largest market access gains were more likely to increase technology spending than firms operating in sectors where trade opening was less ambitious.[117]

Trade and technology transfers

To the extent that technical knowledge is embodied in a product, it also travels with the product. In other words, imports of technologically advanced goods provide firms with access to the technologies embodied in the imported good. Such imports can increase productivity both by using the good in production processes and by providing opportunities for "reverse engineering" – learning about how an imported product is produced and imitating it. To the extent that the expense of reverse engineering is less than the expense of developing the technology independently, the importing country derives a gain from importing – or from technological spillover.

In addition, international trade provides a channel of communication that encourages cross-border learning of production methods, production design and market conditions. Through exporting, firms also interact with foreign customers. These customers may also demand higher quality standards than domestic customers while at the same time providing information on how to meet those higher standards. Thus, exporting becomes a channel for technology transmission for "learning-by-exporting".

Several empirical studies confirm that imports are an important channel of technology diffusion. In particular, the extent of technological spillovers appears to be linked to the composition of imports. Technology transfer is higher when imports come from industrial countries and are presumably characterized by a higher embodied technological content than imports from developing countries (Coe and Helpman, 1995; Coe and Hoffmaister, 1999; Keller, 2000). Furthermore, technology spillovers are stronger for imports of capital goods, machinery and ICT goods (Coe et al., 1997; Gera et al., 1999; Xu and Wang, 1999; Acharya and Keller, 2009; Van Meijl and van Tongeren, 1998). A study by Amiti and Konings (2007) also shows that technology transfers are stronger for imports of inputs than final products.

Empirical evidence supporting the existence of a learning-by-exporting effect is less extensive. This is partly because studies attempting to assess this impact face two methodological hurdles: first, how to control for self-selection of the most productive firms into export markets. Does exporting – and learning-by-exporting – make firms more productive or do only the most productive firms export? The second dilemma is how to distinguish between productivity gains that are the result of learning-by-exporting and gains that are the result of high profits from exporting and of greater incentives to invest in technology (i.e. scale effects). Despite the extensive evidence that exporting firms tend to be more productive than firms only serving the domestic market (Bernard and Jensen, 1999), this might simply reflect the fact that only the most productive firms (self-selection) export in the first place.

However, some evidence based on micro-level data supports the learning-by-exporting hypothesis. For example, using firm-level data for Slovenian

manufacturing, De Loecker (2007) finds that the productivity of exporting firms increases once they start exporting and that the productivity gap between exporters and their domestic counterparts increases over time.[118] However, while firm-level evidence takes into account self-selection, it still does not distinguish between whether productivity gains arise mainly from technology transfers or from higher incentives to innovate.

(iii) What other factors affect technological progress?

One determinant of technological progress is the strength of intellectual property (IP) rights. Theoretical arguments on the relationship between IP protection and technological progress are mixed.[119] Advocates of stronger IP protection claim it will lead to more innovation by increasing firms' rewards for undertaking research. Moreover, even if much of the research takes place in advanced economies, stronger IP protection will facilitate technology transfer by encouraging more FDI, especially from high-technology firms.[120] Others argue that strong IP protection will reduce technology transfers and may even reduce the incentive to innovate by entrenching monopolies and by diminishing the competitive-threat incentive to innovate.

The empirical evidence is equally mixed. For example, Coe et al. (2009) find that strong patent protection is associated with higher levels of total factor productivity, higher returns to domestic R&D, and larger international R&D spillovers. Using data on US multinationals, Branstetter, Fisman and Foley (2006) also support the view that there is an increase in technology transfers to countries that strengthen their IP regime. However, several studies, such as Bessen and Maskin (2000), Lerner (2002a, 2002b), Sakakibara and Branstetter (2001) and Scherer and Weisburst (1995), suggest that there is a negative correlation between strengthening IP protection, on the one hand, and increasing innovation or technology diffusion on the other.

Other important determinants of technology transfers are FDI flows, movement of people[121] and direct trade in knowledge through technology purchases or licensing. Any policy that affects these channels has an impact on technology transfer. For example, Hovhannisyan and Keller (2012) show that business travel plays an important role in diffusing innovation and suggest that lifting limits on the cross-border movement people as well as liberalizing international passenger air travel could have additional benefits in terms of increasing innovation.

A large body of literature analyses the potential spillover effects of FDI. FDI can increase technology transfer by encouraging interaction between domestic and foreign firms. One channel is vertical FDI spillovers. Linkages between upstream and downstream producers can encourage the direct transfer of technology from the multinational to the local buyer. Higher-quality requirements on intermediate inputs from suppliers can also result in technology transfers. Another channel is horizontal FDI spillover. Geographical proximity to multinationals can reduce the costs of learning or adopting a new business technology within the same industry. While older empirical studies suggest that technology spillovers were associated with more vertical rather than horizontal FDI, more recent empirical work finds significant technology spillovers from horizontal FDI too (Keller and Yeaple, 2009).[122]

It is important to note that the international diffusion of technology is not automatic. Technology transfer is not just a question of "supply" but of "demand" – and, in particular, of a firm's or country's "absorptive" capacity. For example, in order for technology to be transferred through the use of specialized and advanced machineries invented abroad, it is necessary for workers to have the skills needed to use the machinery and organize the production process. Mayer (2001) shows that it is the combination of the know-how of the workforce and the imports of machinery which has a positive effect on economic growth. Even reverse engineering requires skills. The capacity to absorb international R&D spillovers differs across countries. A recent study by Coe et al. (2009) suggests that technological spillovers increase with the ease of doing business in a country and the quality of its tertiary educational system.

(c) What do these trends mean for the future of trade?

Several trends are discernible from this analysis of the global patterns of innovation and technology transfer. One is the emergence of new players among the countries that are driving technological progress. Some countries have significantly accelerated their innovative ability and capacity to absorb existing technologies. Among these are China, the Republic of Korea and Singapore. However, there are also countries, especially in Africa, that continue to lag behind. The low quality of education and the institutional framework in these countries is primarily responsible for their low absorptive capacity.

A second trend is the regionalization of technology transfers. By reducing coordination costs, the ICT revolution has fostered the development of supply chains. Supply chains embody several related dimensions of international economic relationships – investment, competition and movement of people – all of which intensify technology transfers. However, supply chains do not increase the flow of technological knowledge at the global level. They increase it among countries with regional networks, thus encouraging the formation of regional "convergence clubs".

Thirdly, ICT developments have significantly increased the share of services in world trade. In particular, knowledge-intensive business services (KIBS) are emerging as key drivers of knowledge accumulation. These trends – together with reduced productivity growth in manufacturing – may point to a potential shift from manufacturing to services as the engine of global innovation.

Finally, SMEs appear to benefit from improved access to the international market. By dramatically reducing information, transaction and searching and matching costs, the ICT revolution has significantly reduced the fixed costs of entering markets, thus increasing opportunities for SMEs' participation.

What should we expect from these trends?

The emergence of new global players, together with technological convergence at the regional level, is likely to lead to the emergence of economic actors that no longer see countries as the unit of reference for international relationships. This could have important consequences in terms of how negotiations are conducted at the multilateral level.

Secondly, technological advancements have been key to the development of supply chains. Supply chains, in turn, have encouraged technology transfer and convergence across countries. If the process of production fragmentation continues or intensifies, governments will be pressured to adopt policies that facilitate domestic industries' integration into production chains. These can take the form of R&D subsidies, infrastructure investments and stronger IP protection to encourage FDI inflows.

Furthermore, the globalization of R&D, the fragmentation of production processes and the diffusion of digital technologies are creating a mismatch between the geographical scope of economic agents and the regulatory regime under which they operate. For example, while the internet allows consumers to shop globally, IP protection and competition laws are administered and enforced nationally.

To allow for the full potential of e-commerce and the globalization of production to materialize, IP and competition regimes will need to adapt. Pressures to extend rules beyond national borders are already manifested in the multiplication of "deep" preferential trade agreements that include IP and competition policy provisions. More generally, the link between trade and technological progress points to the need for freer flow of goods, services and ideas at the multilateral level. If technology spillovers result from trade, for example, coordinated action to reduce trade obstacles would increase economic well-being. This is further discussed in Section E.

Thirdly, while the analysis of trade patterns in Section B reveals a relocation of labour-intensive activities to developing countries and the emergence of a small number of firms as global trade players, recent innovations, such as 3D printing and robotics, are likely to challenge this status quo. 3D printing is a process of making a three-dimensional solid object from a digital model by adding material layer by layer. With only raw materials and encrypted data streams required for manufacturing, and as production becomes more individualized, access to these new technologies may make it far easier for SMEs to enter export markets. In addition, by reducing the importance of labour costs for comparative advantage, robotics and 3D printing may also shift manufacturing, together with whole supply chains, back to developed countries.

As of 2012, 3D printing technology is used for prototyping and manufacturing in sectors such as construction, aerospace, jewellery and healthcare. But, it is foreseeable that as the printing speed increases, its use may spread to households. If this happens, one may even predict a reduction of global trade in certain types of goods, if end users can easily manufacture them.

However, traditional production methods (sometime referred to as subtractive processes) and 3D printing are likely to complement each other rather than compete. 3D printing may prove advantageous for the production of components characterized by internal voids, such as tubes. But for production processes that start with a solid mass from which material is removed in order to obtain the desired design, traditional manufacturing may continue to prevail. The effect of 3D printing is therefore likely to vary significantly across sectors.

4. Energy and other natural resources

Like labour and capital, natural resources are factors of production that serve as inputs in goods and services production. While there is a broad range of natural resources that could be discussed, the focus here will be on energy and, to a limited extent, on land and water, which are the natural resources typically included in aggregate production functions (for discussion of trade and a wider variety of natural resources, see the 2010 *World Trade Report* (WTO, 2010) and Ruta and Venables (2012).

The section covers four themes – uneven geographical distribution, volatility of prices, exhaustibility and innovation, and negative environmental externalities – that correspond to fundamental characteristics of natural resources and which can affect both production and the pattern of trade.

Part (a) discusses the uneven geographical distribution of natural resources, which affects countries' comparative advantage and hence the pattern of

international trade. Differences in factor endowments confer market power on resource-abundant countries and have geopolitical implications. Part (b) describes how increases in natural resource prices can have major contractionary effects on economies, which can in turn dampen international trade. Natural resource prices also tend to be volatile. This has an impact on trade by increasing the uncertainty faced by importers and exporters.

Part (c) takes up the issue that natural resources are potentially exhaustible, which can act as a brake to future economic expansion. This also implies that comparative advantage conferred by nature can be dissipated. It also discusses the role of innovation in increasing efficiency in the use of natural resources, discovering new supplies and developing alternatives. This means human innovation can offset limited natural resources. Part (d) examines how natural resource use can be subject to environmental pressures and the role of public policy in that context. Part (e) presents possible scenarios in the future evolution of natural resource supply and costs and international trade. Part (f) offers some concluding observations.

(a) Uneven geographical distribution of natural resources

This section presents evidence of the uneven geographical distribution of natural resources in the case of energy, water and land and discusses the implications for the pattern of trade. It then describes how concentration in resource endowments confers market power on some supplying countries and how this could be exploited through the use of export restrictions. Finally, the repercussions for geopolitics are considered as resource-abundant countries make use of monopoly power to pursue their international interests and resource-scarce countries prioritize the pursuit of resource security in their international relations.

(i) Resource abundance and trade patterns

Oil, coal and natural gas were the sources of almost 90 per cent of worldwide energy use in 2011, as can be seen in Figure C.36. Of these, oil is the most important, accounting for a third of total energy use in 2011. However, this is down from its peak of 48 per cent in the mid-1970s (around the time of the first oil crisis). Coal had about as large a share as oil in the mid-1960s but then underwent a long decline. This was reversed at the turn of the millennium, with the surge in coal consumption by China and India. Natural gas has risen in importance, with its share climbing from 16 per cent in 1965 to 24 per cent in 2011. This increase is likely to continue because of new discoveries and extraction methods in North America (see the discussion on shale oil below).

The contribution of nuclear energy, hydroelectricity and other renewable sources is small but the share of renewables has picked up in the last decade, driven in part by higher energy prices (see the discussion below on changes in energy prices).

The standard Heckscher-Ohlin theory predicts that countries which are relatively abundant in a factor of production will export the commodity which uses that

Figure C.36: **World energy consumption by type, 1965-2011** (percentage)

Source: BP, *Statistical Review of World Energy*, June 2012.

Note: Oil consumption is measured in million tonnes; other fuels in million tonnes of oil equivalent. Renewables are based on gross generation from renewable sources including wind, geothermal, solar, biomass and waste. Renewables consumption is converted into million tonnes of oil equivalent on the basis of thermal equivalence assuming 38 per cent conversion efficiency in a modern thermal power station.

factor intensively. A contemporary variant of this story argues that a country will capture larger shares of world production and trade in commodities that more intensively use its abundant factor (Romalis, 2004). The factor-proportion explanation has traditionally assumed that factors of production are non-exhaustible (such as Ricardo's "indestructible powers of the soil"). Kemp and Van Long (1984) show that the prediction of the Heckscher-Ohlin theory also applies to situations when all of the factors of production are exhaustible as well as when exhaustible factors are combined with non-exhaustible factors.

The theory is about relative rather than absolute factor abundance and links that to exports of products that are intensive in those factors rather than to exports of the resource itself. Notwithstanding these caveats, Tables C.11 to C.13 corroborate the relationship between countries' endowments of natural resources and their export performance. The countries listed in Table C.11 – the most prominent being the Kingdom of Saudi Arabia, Canada and Iran – have 95 per cent of the world's proved reserves of crude oil and 86 per cent of total oil exports in 2010. Those countries in Table C.12 – with the Russian Federation, Iran and Qatar having the largest reserves – account for 91 per cent of proved reserves of natural gas and 77 per cent of all natural gas exports in 2010. Finally, the countries shown in Table C.13 – with the United States, the Russian Federation and China being the top three – have 96 per cent of total recoverable coal and 93 per cent of total exports of coal in 2010.

Water and land

The availability of land suitable for agricultural production, especially arable land, determines the patterns of agricultural production and the dependency of countries on imports of crops. Figure C.37 shows countries listed in terms of the share of land area that is arable. Most of the world's arable land is situated in Southern and Eastern Asia, North America and Sub-Saharan Africa. The share of total land area that is arable varies considerably by region, from 23 per cent in Western and Central Europe to only 4 per cent in North Africa.

There is a positive correlation between the size of a country's per capita arable land endowment and the value of its agricultural exports. This is depicted in Figure C.38, which uses data for 195 countries in 2008.

Freshwater is a renewable but scarce resource with an uneven geographical distribution. Figure C.39 shows this geographical pattern using renewable water resources per capita as a measure of availability. The most water-abundant regions are Sub-Saharan Africa and South America. The regions of North Africa, Central Asia and the Middle East are at the other end of the spectrum, with severely limited water resources.

Figure C.40 shows how water resource availability has changed over time. Reflecting their more rapid population growth, water resources per capita in

Figure C.37: **Arable land as a percentage of total land area, 2011**

<2 | 2-5 | 5-10 | 10-15 | 15-20 | 20-30 | 30-40 | 40-50 | >50

Source: FAO, Aquastat, http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en
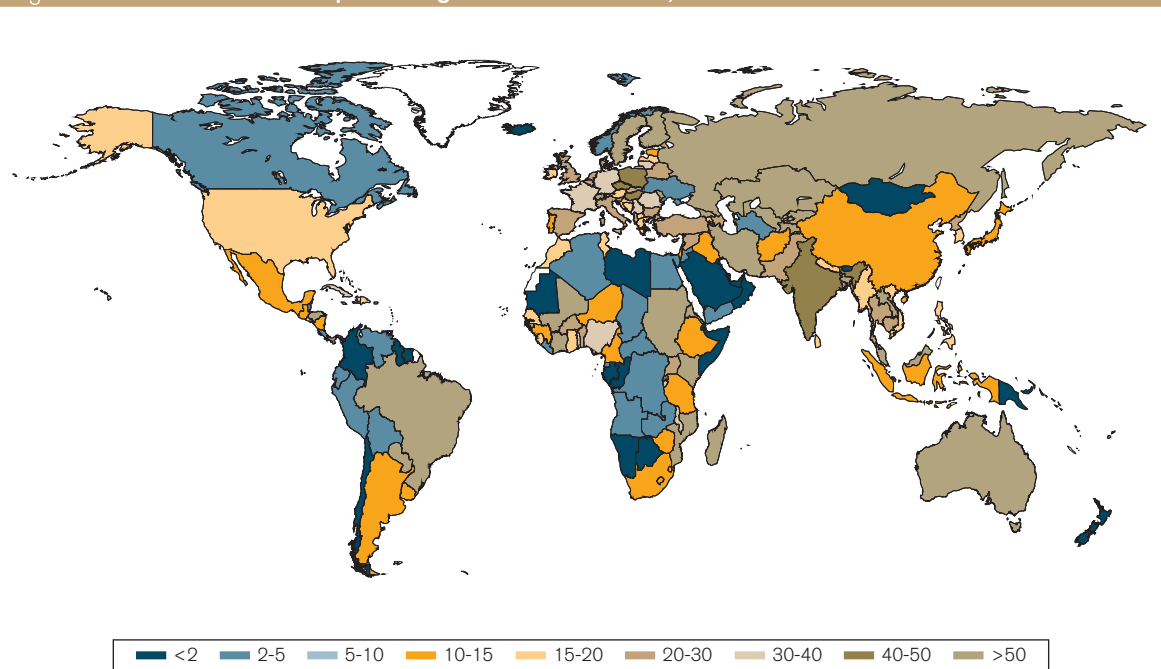
Note: Arable land is the land under temporary crops, meadows, gardens and fallow. It does not include areas under permanent crops such as coffee or cocoa. Surfaces in white: Data unavailable at the time of writing. Colours and boundaries do not imply any judgement on the part of the WTO as to the legal status of any frontier or territory.

Table C.11: Countries with the largest proved reserves of crude oil, 2008		
Country	Proved reserves (billions of barrels)	Share of world exports of oil (2010)
Saudi Arabia, Kingdom of	267	16.0%
Canada	178	3.4%
Iran	136	5.6%
Iraq	115	4.5%
Kuwait, the State of	104	3.3%
Venezuela, Bolivarian Republic of	99	3.8%
United Arab Emirates	98	5.0%
Russian Federation	60	11.4%
Libya	44	3.2%
Nigeria	36	5.5%
Kazakhstan	30	3.3%
United States	21	0.1%
China	16	0.1%
Qatar	15	2.6%
Brazil	13	1.4%
Algeria	12	2.6%
Mexico	11	3.4%
Angola	9	4.5%
Azerbaijan	7	2.1%
Norway	7	3.7%
Share of world total	95.2%	85.6%

Source: US Information Energy Administration.

Note: Amount of recoverable coal is based on 2008 data.

Table C.12: Countries with the largest proved reserves of natural gas, 2009		
Country	Proved reserves (trillions of cubic feet)	Share of world exports of natural gas (2010)
Russian Federation	1,680	22.3%
Iran	992	0.9%
Qatar	892	11.5%
United States	273	4.3%
Saudi Arabia, Kingdom of	258	0%
United Arab Emirates	214	0.5%
Nigeria	184	2.6%
Venezuela, Bolivarian Republic of	171	0%
Algeria	159	5.3%
Iraq	112	0%
Indonesia	106	3.9%
Turkmenistan	94	0%
Kazakhstan	85	1.0%
Malaysia	83	3.3%
Norway	82	9.8%
China	80	0.3%
Uzbekistan	65	1.2%
Kuwait, the State of	63	0%
Egypt	59	1.1%
Canada	58	8.9%
Share of world total	90.8%	76.9%

Source: US Information Energy Administration.

Note: Amount of proved reserves based on 2009 data.

Sub-Saharan Africa have declined at the highest rate, followed by Southern and Eastern Asia.

Agriculture accounts for 69 per cent of global freshwater withdrawals and 90 per cent of its consumptive use, i.e. water lost due to evaporation and transpiration (FAO, 2012). Thus, one might reasonably assume that the geographical distribution of water observed in the previous figures will be reflected in the pattern of agricultural trade.

However, water endowments do not seem to have a strong influence on agricultural trade patterns. Hoekstra (2010) attributes this to heavy government intervention in agriculture through, among other things, subsidies, tariffs and sanitary and phytosanitary measures as well as in domestic water markets where the resource is severely under-priced. All these policy distortions work to blunt the effect of endowments on agricultural trade. He suggests that water endowments affect trade patterns only in cases where there is absolute water shortage, which forces water-scarce countries to import water-intensive products because they simply cannot be produced domestically.

However, recent work by Blackhurst et al. (2010) and Debaere (2012) suggest that manufacturing surpasses agriculture in total water use if one accounts for the water-intensiveness of the power used in manufacturing.

Table C.13: Countries with the largest total reserves of recoverable coal, 2008		
Country	Recoverable coal (million short tons)	Share of world exports of coal (2010)
United States	260,551	6.9%
Russian Federation	173,074	10.1%
China	126,215	1.9%
Australia	84,217	27.1%
India	66,800	0.2%
Germany	44,863	0%
Ukraine	37,339	0.6%
Kazakhstan	37,038	3.0%
South Africa	33,241	6.3%
Serbia	15,179	0%
Colombia	7,436	6.3%
Canada	7,255	3.0%
Poland	6,293	1.5%
Indonesia	6,095	26.1%
Share of world total	95.5%	92.9%

Source: US Information Energy Administration.

Note: Amount of recoverable coal is based on 2008 data.

Debaere (2012) finds that countries that are relatively water abundant tend to export more water-intensive products. His results support the hypothesis that water is a source of comparative advantage. However, he also finds that water contributes significantly less to the

Figure C.38: **Agricultural exports and endowment of arable land per capita, 2008**

Source: *World Development Indicators* and UN Comtrade.
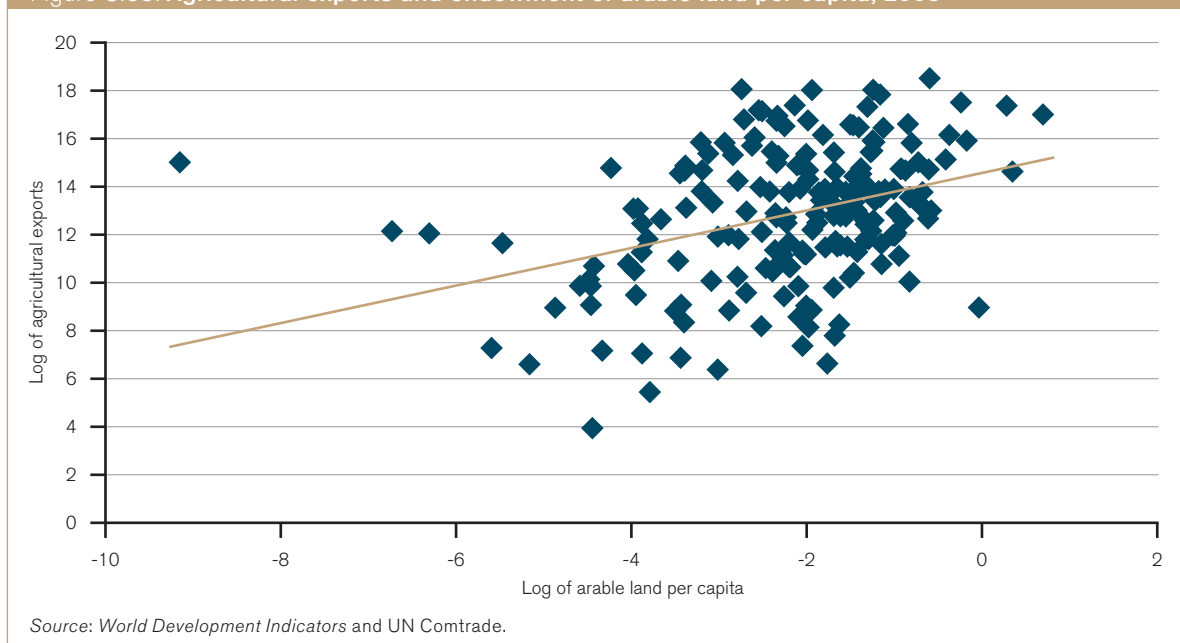
Figure C.39: **Renewable water resources per capita by region, 2011**
(1,000m³/inhabitant/year)

Source: FAO, *Aquastat*, http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en

Note: Surfaces in white: data unavailable at the time of writing. Colours and boundaries do not imply any judgement on the part of the WTO as to the legal status of any frontier or territory.
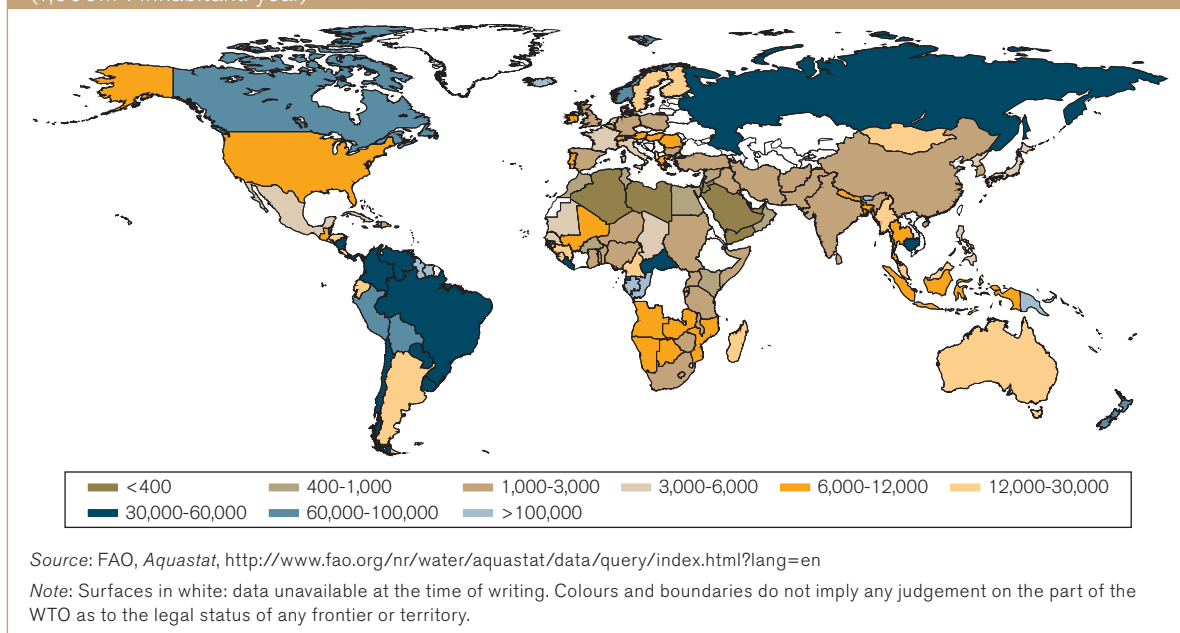
pattern of exports than the traditional production factors, such as labour and physical capital.

(ii) Market power and geopolitics

The uneven geographical distribution of natural resources means that some resource-abundant countries will have market power in trade. This may create a temptation to exploit that market power through the use of export restrictions. By reducing supply of the natural resource in international markets, the world price of the resource rises, creating a terms-of-trade gain for the exporting country and a terms-of-trade loss for the importing countries.

While the temptation to exploit market power could apply to other sectors as well, there is evidence that export taxes and other restrictions are more frequently applied to natural resources than to other merchandise goods. While just 5 per cent of world trade is covered by export taxes, the share more than doubles to 11 per cent for natural resource products (WTO, 2010). Of all export restrictions notified to the WTO, more than a third – some 2,577 out of a total of 7,328 notified – have been applied to natural resource products.

The uneven distribution of natural resources can also have geopolitical impacts – i.e., monopoly power over natural resource supplies in some countries and

Figure C.40: **Renewable water resources per capita by region, 1967-2011** (1,000m³/inhabitant/year)

Source: FAO, *Aquastat*, http://www.fao.org/nr/water/aquastat/data/query/index.html?lang=en

Note: Renewable water resources include renewable surface and ground water, internal and external.
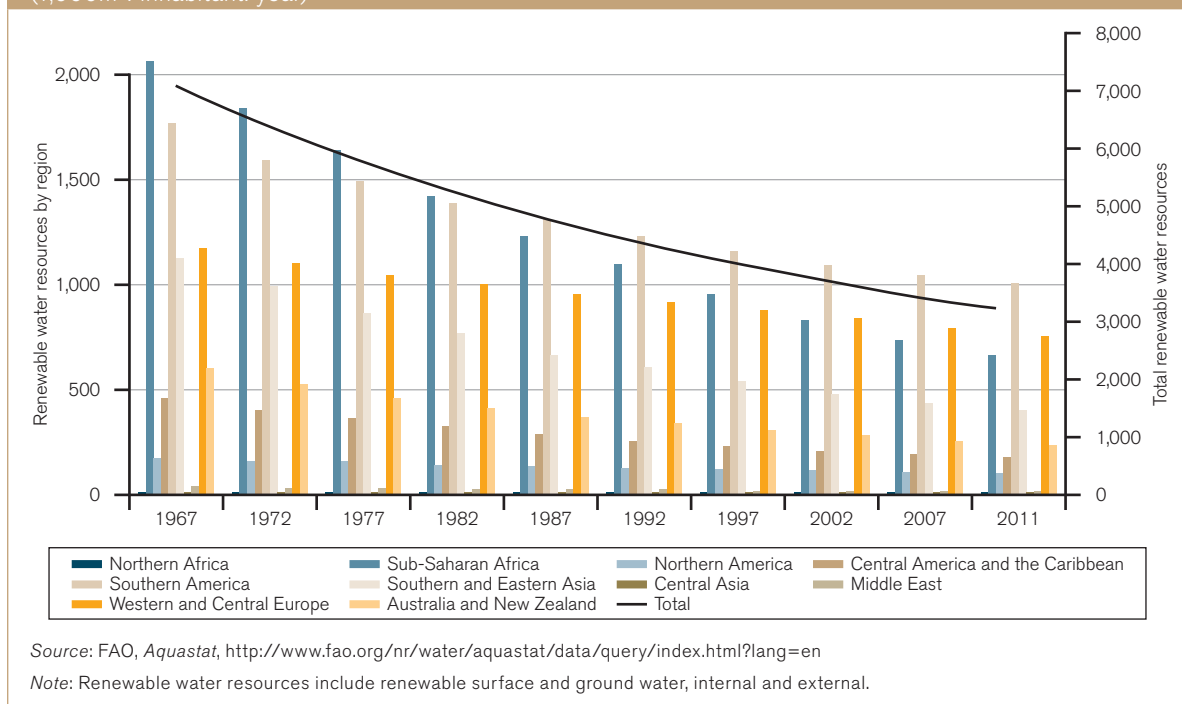
scarcity of these resources in other countries can affect their political, military, and diplomatic behaviour.

Countries with abundant supplies can use control over these resources to support their international goals and causes. In the 1973 Arab-Israeli war, Middle Eastern members of the Organization of the Petroleum Exporting Countries (OPEC) launched an oil embargo against Western countries supporting Israel. The energy infrastructure of major supplying countries can also become so crucial to the global economy that they become targets. There have been persistent attacks on energy infrastructure by insurgent groups in Algeria, Colombia, the Niger Delta and Iraq (Lacher and Kumetat, 2011). In early 2013, a massive natural gas facility in Algeria became the target of a violent takeover by terrorist forces.

Even if energy supply is not threatened, geopolitical tensions between countries can prompt some to incur additional costs. For example, in order to not become overly dependent on natural resource transit countries, some of which were once part of the Soviet Union, the Russian Federation constructed new outlets for its oil to Europe through the Baltic Pipeline System (Laurila, 2002). It is also started building a major new gas pipeline under the Black Sea to transport gas to Southern Europe.[123]

Countries threatened by scarcity make securing access to natural resource supply a priority of their international relations. China's state oil companies have several oil supply contracts with foreign firms and countries. The major Chinese oil companies have acquired a variety of holdings in Angola, Azerbaijan,

Canada, Chad, Indonesia, Iraq, Iran, Kazakhstan, Myanmar (Burma), Nigeria, Peru, the Russian Federation, the Kingdom of Saudi Arabia, Sudan, Turkmenistan, Uzbekistan and the Bolivarian Republic of Venezuela (Hayward, 2009; U.S. GAO, 2013).

Foreign investment in farm land has increased significantly over the past few years. These flows are global in scope, involving 62 countries, where such acquisitions have occurred, and 41 countries whose enterprises have made foreign land investments (Rulli et al., 2013). Although exact figures are hard to obtain, the latest estimates indicate that these farm deals range between 47 million (Rulli et al., 2013) and 56 million hectares (Deininger et al., 2011).

Table C.14 lists the top ten investors or acquirers of foreign farm land as well as the top ten destination countries for these investments. Although countries where arable land and water are particularly scarce (e.g. countries in the Middle East and countries with a growing demand for food, energy and raw materials, such as China and India) are active players, the top investors are companies from the United Kingdom and the United States. The destinations of these investments are countries in Africa, South-East Asia, South America as well as the Russian Federation and Ukraine. These investments frequently take the form of long-term leases, outright purchases or contracts, with the acquired land being devoted to raising crops for food or biofuel (von Braun and Meinzen-Dick, 2009).

To the extent that foreign investors are able to increase agricultural productivity in land and water-abundant countries, there are economic benefits from such

Table C.14: **Top ten destinations and countries of origin for foreign investment in land**			
Country of land acquisition	Area acquired (millions of hectares)	Country acquiring foreign land	Size of acquisition (millions of hectares)
Democratic Rep. of the Congo	8.1	United Kingdom	4.4
Indonesia	7.1	United States	3.7
Philippines	5.2	China	3.4
Sudan	4.7	United Arab Emirates	2.7
Australia	4.6	Israel	2.0
Russian Federation	2.8	Egypt	1.4
Brazil	2.3	Korea, Rep. of	1.3
Tanzania	2.0	India	1.2
Mozambique	1.5	South Africa	1.1
Ukraine	1.2	Malaysia	1.0

Source: Rulli et al., 2013.

investments. A major concern, however, is that property rights are often weakly enforced in the countries where such acquisitions have been made, raising the possibility that the local owners may have been unfairly or illegally displaced (Deininger et al., 2011). Clearly, the often negative attention these activities have attracted underscore how increased competition for natural resource supplies can raise international tensions, especially if the natural resource is seen as vital for food or national security by other states.

In conclusion, differences in natural resource endowments appear to explain trade patterns relatively well. In addition, more concentrated control over natural resources confers market power, which can be enhanced through the use of restrictive trade policies. Concentration may also enable resource-abundant countries to use it to pursue non-economic objectives. Countries faced with acute resource scarcity may in turn pursue natural resource security at the expense of international relations. To the extent that these geopolitical factors create or exacerbate international tension, they can increase the price of natural resources beyond what would have been created by monopoly power and also increase price volatility. Both of these can have harmful effects on the global economy and trade (see the discussion below).

(b) Changes in natural resource prices and volatility

As was noted earlier, natural resource prices tend to be volatile. The following section focuses on energy – rather than land or water – price changes and volatility because of data availability. The world economy is characterized by a group of net oil-importing industrial economies which absorb a large share of global output, on one side, and a group of net oil-exporting countries, on the other. Changes in the price of oil represent large terms-of-trade shocks that adversely affect industrial economies while benefiting oil exporters (Backus and Crucini, 2000). Because of the size of industrial countries and the importance of oil, these terms-of-trade changes reverberate throughout the global economy.

Energy is a major factor of production and it is difficult to substitute capital or another factor of production for oil in the short run, so an increase in the oil price will reduce production of net energy-importing countries and slow their rate of economic growth (Hamilton, 2009). This, in turn, leads to a lower rate of import expansion. Of course, higher oil prices should expand output and increase GDP growth of net energy exporters (Korhonen and Ledyaeva, 2010). However, for the global economy as a whole, the evidence suggests that the negative effect on output and trade tends to dominate.

Secondly, changes in the cost of energy can alter the commodity composition of a country's export and imports depending on their energy intensity (Sadorsky, 2012). Although there is no standard list of energy-intensive products or industries, information from the energy balance sheet of the European Union (Eurostat, 2011) points to these being aluminium, iron and steel, chemicals, glass, pottery and building material (e.g. cement), and pulp and paper. All things being equal, an increase in energy prices will raise the prices of these energy-intensive products. It will consequently reduce demand for them and decrease their share (in real or volume terms) in international trade. The extent of this effect will depend on, among other factors, the ability of producers to substitute other factors of production for energy and the elasticity of demand for these products – the responsiveness of buyers to higher prices. The more inelastic the demand, the less the impact of higher energy prices.

Another salient feature of global energy markets is price volatility. Figure C.41 shows the weekly nominal crude oil spot price (i.e. the price of crude oil traded on a "spot" market and available for almost immediate delivery) between 1987 and 2012 and the square of the weekly return of oil prices that is used as a rough measure of volatility.[124] Based on this, price volatility tends to cluster at specific points in time. Some of the large rises or falls in the spot price of crude oil can be linked to specific instances of economic and political crises, which have the potential to disrupt global energy supply or demand significantly.

Figure C.41: **Weekly nominal oil spot prices and squared returns (Brent, Europe), 1987-2012** (US$/barrel and weekly return[2])

Source: US Energy Information Administration (EIA), own calculations.

Note: Brent crude oil (in US$/barrel) is traded at the Intercontinental Exchange (ICE) Futures in London. Weekly prices as of closing time on Mondays.
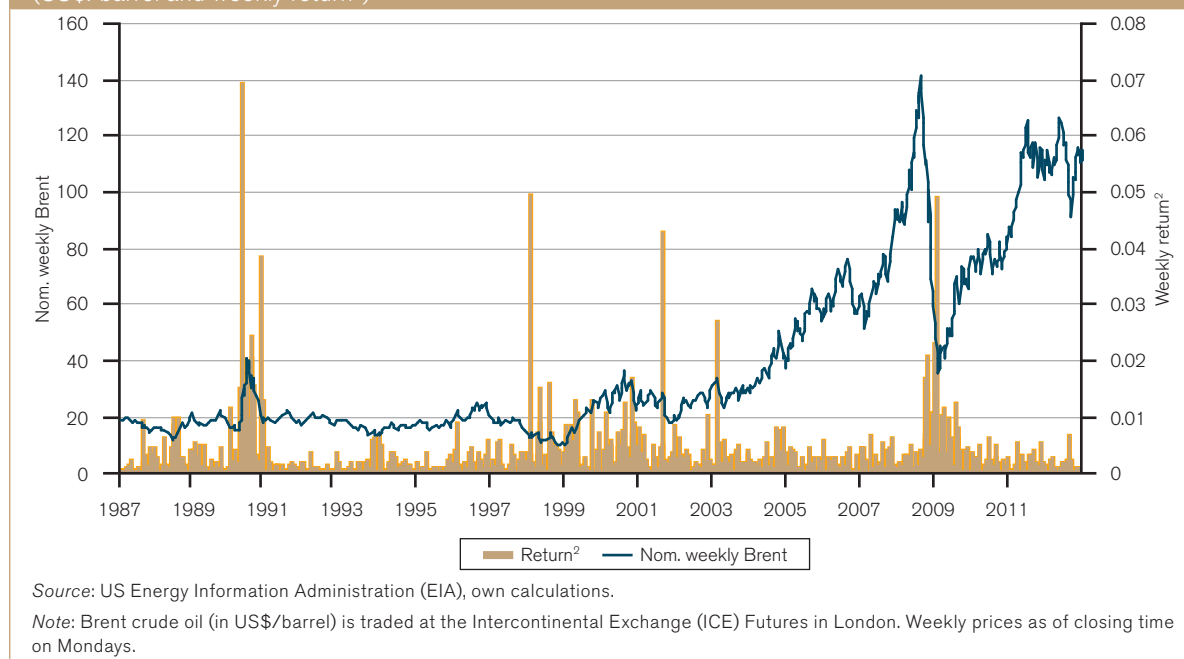
The highest peak in short-term volatility occurred in 1990-91 and is linked to Iraq's invasion of Kuwait and the first Gulf War. Other periods with large fluctuations in oil prices were the terrorist attack on the World Trade Centre in the United States in 2001 and the Iraq war that began in March 2003. Both the commodity price spike of 2007-08 and the financial crisis in 2008-09, which led to the biggest drop in oil prices that the spot market has ever experienced, are also evident.

The underlying reasons for volatility are complex, involving demand and supply factors and shocks to both. Evidence from Hamilton (2009) and Smith (2009) point to the role of low demand and supply elasticities, particularly in the short run. A longer-term explanation has been provided by Dvir and Rogoff (2009), who contend that volatility spikes whenever periods of rapid industrialization have coincided with uncertainty regarding access to energy supply. They point to 1861-78 and 1973-2009 to support their argument. These were periods of rapid industrialization – by the United States in the first period and East Asia in the latter period – as well as periods of supply uncertainty due to the monopoly of railroads on transportation in the United States and to OPEC's ability to restrict access to supply in the latter period.

Many popular accounts of the increase in oil prices in the last decade attribute it to the growing appetite of emerging China and India for energy to power their rapid development. Beyond these explanations, a number of authors have argued that speculation has played a role in the recent increases in commodity and natural resource prices (Masters, 2008; Caballero et al., 2008; Robles et al., 2009). This is discussed in some detail in the 2010 *World Trade Report* on natural resources (WTO, 2010).

Volatility of oil prices can reduce trade flows because it increases the risks faced by importers (Chen and Hsu, 2012). In oil-importing countries, fluctuations in current prices create uncertainty about the future trend for oil prices, leading households to postpone purchases of consumer durables and firms to postpone investment decisions (Elder and Serletis, 2010; Henriques and Sadorsky, 2011). This reduction in spending by both households and firms reduces aggregate demand and hence total imports as well. The empirical study by Chen and Hsu indicates that total exports by oil-importing countries also fall as a result of oil price volatility.

(c) Exhaustibility and the role of innovation

Following Sweeney (1993), exhaustible natural resources can be defined as those whose adjustment speed – or renewability – is so slow that they can meaningfully be conceived of as being made available once and only once by nature.[125] Oil or natural gas deposits are typical examples of exhaustible natural resources.

The exhaustibility of some natural resources has frequently caused alarm. In 1972, the Club of Rome – a global think tank – famously claimed that pressures from economic activities and population growth would lead to the collapse of the economy and the environment given the finite supplies of natural resources (Meadows et al., 1972). Others have proposed "peak" theories, where the extraction of exhaustible resources is predicted to follow a bell-shaped curve, initially increasing exponentially, reaching a peak, and then declining exponentially until the resources are totally exhausted (Hubbert, 1956).

It can be argued that the idea that the rate of extraction of an exhaustible resource eventually reaches a

maximum, after which it declines is basically tautological (Hamilton, 2012). What makes the peak theory sound apocalyptic is the implied prediction that the peak is either behind us or about to come. By comparison, economists tend to be more sanguine about the exhaustibility of natural resources and concerned with other questions. How will markets, whether competitive or not, determine the rate of extraction of an exhaustible resource (Hotelling, 1931)? What is the optimal way of taking inter-generational equity into account, i.e. how much should current generations consume and how much should be left behind to future generations (Solow, 1974; Hartwick, 1977; Chichilnisky, 1996)? There are several reasons for this.

First, the total amount of the exhaustible resource is not known for certain, so given sufficient economic incentives, reserves can be maintained or increased through the exploitation of deposits initially considered as not economically accessible (Pindyck, 1978). Secondly, history has shown that technological innovation offers a potent response to the problem of exhaustibility. Innovations can increase efficiency in the use of an exhaustible resource so that the amount required to produce a unit of output is reduced over time. New methods of exploration can increase the likelihood of making new geological discoveries (Arrow and Chang, 1982). Innovation can lower the extraction costs of the resource (Hamilton, 2012). Finally, technology may advance enough so that it becomes possible for reproducible or renewable resources to take the place of the exhaustible resource (Dasgupta and Heal, 1974). Ultimately, it is an open question as to how long innovation will allow us to keep one step ahead of natural resource exhaustion.

Using energy as an example, Figure C.42 shows long-run trends in energy intensity, which measures how many units of energy are needed to produce a unit of GDP. The lower the indicator, the more energy efficient an economy is. It can be seen that global energy intensity has been decreasing every year since 1970. This is true for large advanced economies, such as the United States, but interestingly, even emerging countries, such as China and India, have exhibited falling energy intensities in the last ten to 20 years, which were assumed to be periods of extensive energy use.

Geller et al. (2006) estimate that without energy efficiency improvements, the OECD countries would have used approximately 49 per cent more energy than was actually consumed as of 1998. They attribute this increased efficiency to, among other measures, the development and commercialization of a number of new energy efficiency technologies (e.g. energy-efficient building technologies, appliances, electronic lighting ballasts, etc.). Technological improvements also played an important role in reducing China's energy intensity (He and Zhang, 2006). Kiang et al. (2011) estimates

that technology improvements accounted for 40 to 60 per cent of China's energy savings.

The rise of shale gas in the United States is a good case study of how technological change can dramatically augment the supply of an exhaustible natural resource. Shale gas refers to natural gas that is trapped within fine-grained sedimentary rocks. A combination of other innovations was needed before these deposits could be commercially exploited. The extraction technology – hydraulic fracturing ("fracking") – requires pumping water, chemicals and sand underground to open cracks in the rock and allow natural gas to be released from the shale.[126] However, it could only be used productively and predictably once know-how to map shale expanses and to drill horizontally in rock formations was developed (Trembath et al., 2012). As a result of these advances, shale gas production in the United States has grown nearly twenty-two fold since the 1990s.

A more dramatic illustration of how technological change could delay or offset exhaustibility is shown in Figures C.43 and C.44. Figure C.43 shows the stock of proven oil reserves and the ratio of these reserves to world oil consumption over the last three decades. During that period, the stock of proven reserves rose by more than 140 per cent while the ratio of reserves to global consumption actually rose from 11 to 19. A similar picture can be drawn for the case of natural gas, which is shown in Figure C.44. Proven reserves rose by about 160 per cent in the last three decades

Figure C.42: **Energy intensity, 1970-2011**
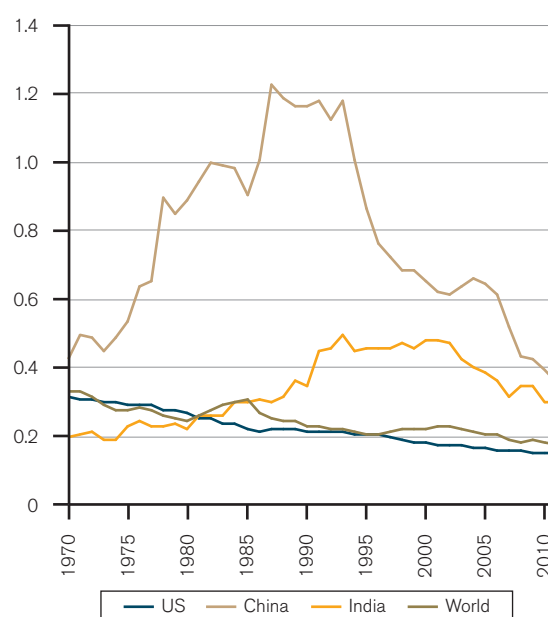
Source: BP, *Statistical Review of World Energy*, June 2012; World Bank's *World Development Indicators* (WDI); own calculations.

Note: The unit of energy intensity is defined as kilogrammes of oil equivalent per constant 2011 US$. Current GDP in US$ has been deflated to 2011 US$ levels by using the world GDP deflator provided by the WDI.

Figure C.43: **Proven oil reserves and reserves-to-consumption ratio, 1980-2011**

Source: BP (2012).
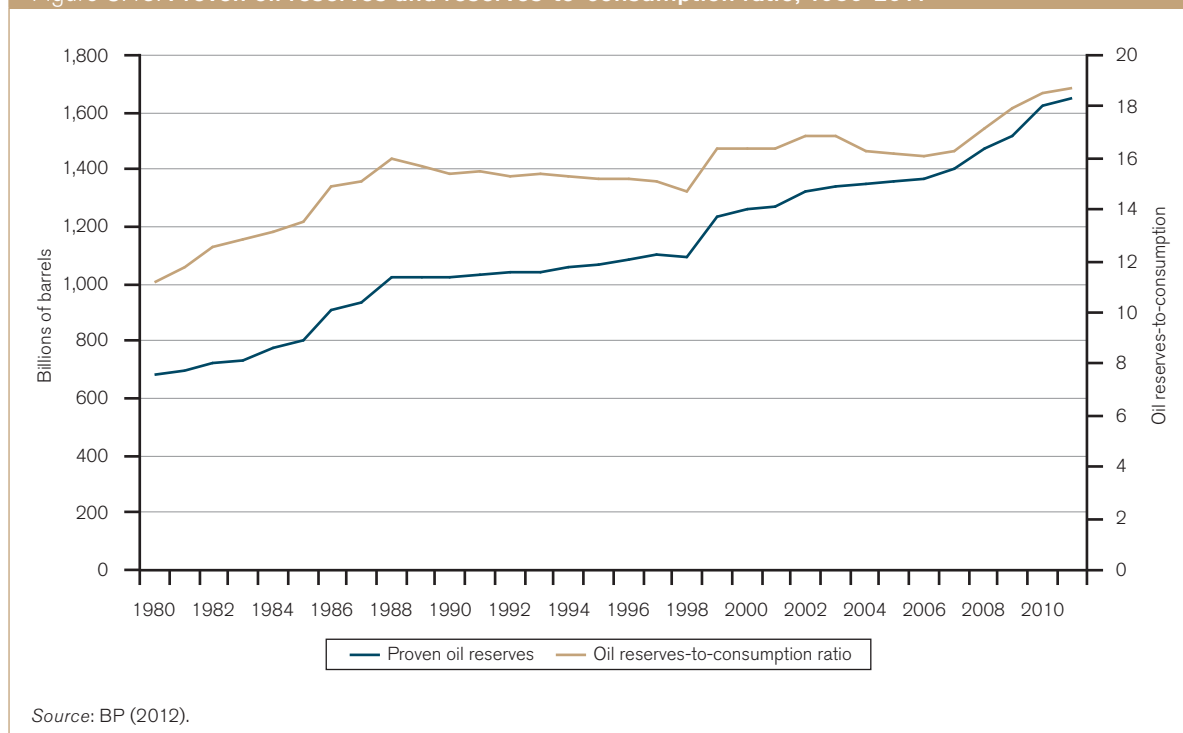
while the reserve to consumption ratio continued to rise. The pattern of rising global reserves can be shown to hold for a wider range of exhaustible resources – bauxite, copper, iron and zinc (Lomborg, 2012).

Rising energy and natural resources prices as a result of scarcity will create incentives for firms to invest in innovation. However, the level of R&D investment may still be lower than the social optimum because the potential payoffs will not be realized for decades, which is beyond the planning horizons of most firms (Sathaye et al., 2007). This market failure – the divergence between private and social benefits – can warrant the use of R&D subsidies in the energy sector to increase innovation and find technological solutions to the exhaustibility of natural resources.

Geller et al. (2006) attribute a prominent role to government-funded R&D in the long-term improvement in energy efficiency in OECD countries. Similarly, Trembath et al. (2012) have pointed to the crucial role played by the US government in the successful development of shale gas. Innovation and progress in the development of hydraulic fracturing and other key gas recovery technologies came about from public-private research and commercialization efforts. At the same time, subsidies give governments greater leeway to pursue a kind of industrial policy, where the new objects of largesse are future "winners", such as biofuels, solar and wind.[127] This gives rise to the risk of industries being promoted not for public policy reasons but in order to benefit domestic producer groups.

What are the trade implications of the exhaustibility of natural resources? First, it means that a country

favourably endowed with a large stock of exhaustible natural resources could see its comparative advantage erode over time. While empirical analysis of the dynamics of trade specialization with respect to natural resources has received little attention,[128] there are several studies that appear to demonstrate shifts in comparative advantage in natural resource-exporting countries.

Leamer (1984) shows that between 1958 and 1975, countries such as Australia, the Dominican Republic, Honduras, Paraguay and the Philippines experienced a significant increase in mineral extraction while the level of mineral extraction of Cyprus, Ghana and Yugoslavia decreased significantly. Davis (1995) finds that between 1973 and 1991, Botswana, the Democratic Republic of the Congo, Angola, Guinea, Niger, Papua New Guinea, the Syrian Arab Republic, South Africa, Cameroon, Togo and Ecuador gained comparative advantage in mineral extraction while Tunisia diversified away from mineral activities.

A recent paper by Alvarez and Fuentes (2012), using a large sample of countries between 1962 and 2000, finds that comparative advantage in raw materials tends to be less persistent than in manufactured goods. It is, however, unclear to what extent these changes are the result of the exhaustion in natural resource endowments or the result of other factors, including changes in policy (Davis, 2010). Furthermore, as this discussion of exhaustibility has highlighted, technological change is a potent force that can be harnessed by natural resource-abundant countries that wish to maintain comparative advantage in that sector.

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Figure C.44: **Proven natural gas reserves and reserves-to-consumption ratio, 1980-2011**

Source: BP (2012).
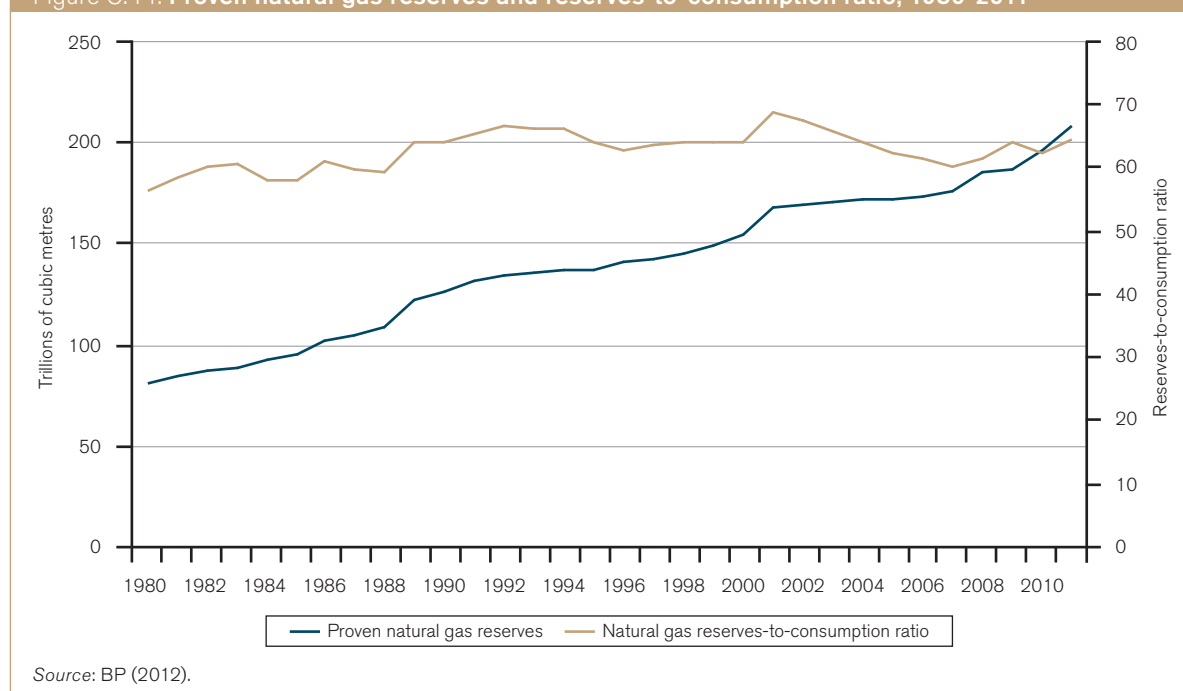
(d)   Environmental costs

Sometimes, the process of extracting natural resources or their consumption can have environmental costs. For instance, the current technology for extracting shale gas – hydraulic fracturing (fracking) – creates a number of environmental risks. Hydraulic fracturing fluid could leak into and contaminate groundwater. Methane could be accidentally released while exploiting shale gas reserves. Fracking itself could cause small earthquakes.

At present, the most serious example of negative environmental impacts associated with natural resource use is the burning of fossil fuels. This produces carbon emissions which accumulate in the atmosphere and can remain there for centuries. These carbon emissions are the main reason for the observed (and projected) increase in average global temperatures (Intergovernmental Panel on Climate Change, 2007). Climate change has adverse consequences at a physical level (rising sea levels, changes in ice cover and frequency of extreme weather events) and biological level (agriculture, forestry and human health). It is believed that the doubling of greenhouse gas emissions in the atmosphere (to 450 parts per million) relative to pre-industrial times will increase these risks dramatically.

As a result, many countries have taken steps, sometimes unilaterally and sometimes with others, to mitigate the adverse consequences of using fossil fuels. They include taxes on fuels, emission trading schemes covering sectors that are considered emission-intensive, increasing energy efficiency, spurring efforts to find alternatives to fossil fuels, etc.

The joint report of the WTO and the United Nations Environment Programme (UNEP) on trade and climate change (WTO and UNEP, 2009) contains a comprehensive account of various national and international initiatives.

Section D.2 of this report will discuss the trade effects of environmental policies, including those arising from climate change mitigation efforts. However, it is important to mention two points. First, climate change policy will be crucial to the evolution of energy prices and to the future mix of energy sources. Secondly, there may be continued differences in the stringency of climate change policies adopted by governments, thus possibly creating cost differences between countries especially in energy-intensive sectors. These points are taken up below in the discussion of future scenarios.

(e)   Future of natural resources and trade

The focus of the following section is on water and energy since much more work has been done on these natural resources than on land. Based on projections made by the OECD (2012c), the International Energy Agency (2012), the US Energy Information Administration (2012) and leading energy companies, such as BP (2012b), the potential implications of future supply and demand developments of natural resources for international trade as well as trade policy are considered.

Water and international trade

The OECD (2012c) projects that global demand for water will rise by 55 per cent between 2000 and 2050. This growth in demand will come mainly from

manufacturing, electricity and domestic use. Increasingly, the future will see agriculture and the environment competing for water with cities, energy suppliers and industries (see Figure C.45). In the face of these competing demands, there will be little scope for increasing water for irrigation, and thus, also for food and agriculture.

This pressure on water resources has two possible implications for international trade. The first implication is with respect to the pattern of agricultural trade among countries. The OECD's environmental outlook projects that, by the turn of this century, there will be severe water shortages for the entire populations of South Asia and the Middle East and large shares of China's and North Africa's population.

As noted before in the discussion on the uneven geographical distribution of natural resources, under conditions of severe water shortage, water-scarce countries will be forced to import water-intensive products. This suggests that food and agricultural products will become a larger share of the future imports of the countries in water-scarce regions. The second implication pertains to the product composition of international trade, and in particular, to the possibility that the long-term decline in the share of food and agricultural products in international trade, which was discussed in Section B, might be arrested or even reversed.

Energy and international trade

Given the rising trajectory of world GDP and population, energy needs are projected to rise by nearly a third by the year 2035 (International Energy Agency, 2012b). Most of this growth will come from increased energy demand by emerging economies, whereas there will be no significant changes in energy consumption by developed nations (BP, 2012b; International Energy Agency, 2012).

The energy mix is expected to change, with the shares of coal and oil declining while the shares of natural gas and renewable sources are expected to rise. In particular, US natural gas production is expected to increase from 21.6 trillion cubic feet in 2010 to 27.9 trillion cubic feet in 2035 (US Energy Information Administration, 2012). Almost all of this increase will be due to shale gas production, which will grow from 5 trillion cubic feet in 2010 to 13.6 trillion cubic feet in 2035. Fossil fuels will continue to meet the bulk of the world's energy needs in the future, making up 75 per cent of the world's source of energy (see Figure C.46). Natural gas will contribute the most to the estimated growth in energy demand. While the share of renewables in total energy consumption will rise to 15 per cent by 2035, it will not be able to satisfy growing energy demand on its own.

An important concern for international trade is the future evolution of energy prices. The International

Figure C.45: **Global water demand: baseline scenario, 2000 and 2050** (cubic kilometre)

Source: OECD (2012b).

Note: This graph only measures blue water demand and does not include rain-fed agriculture. (BRICS: Brazil, the Russian Federation, India, China, South Africa.)
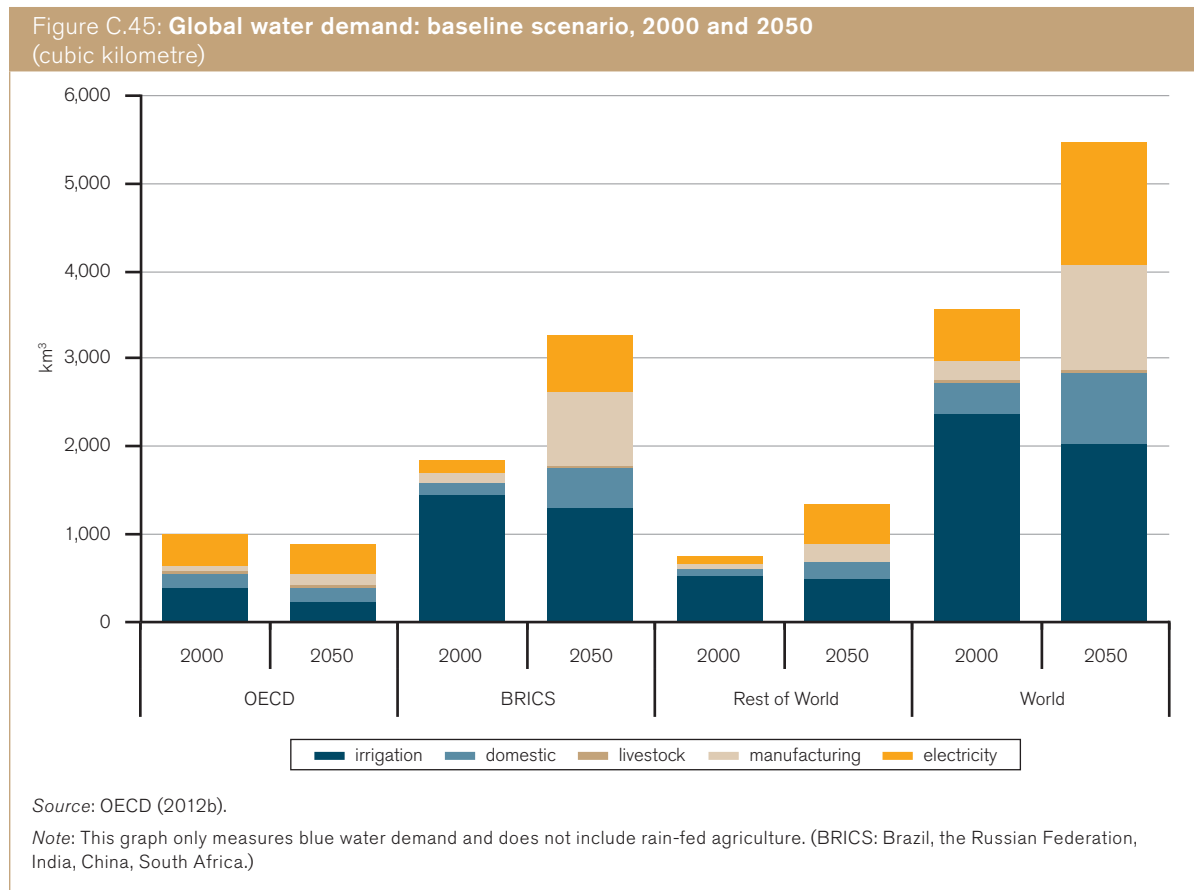
Energy Agency's latest outlook considers three scenarios in detail. These are differentiated by the kinds of policies it is assumed countries will adopt, either unilaterally or as part of international agreements. The policies of concern are those related to renewable energy, energy efficiency, fossil fuel subsidies and mitigation of climate change.

The "New Policies" scenario, which is the baseline projection in the International Energy Agency (IEA) report, assumes that policies that are in place now will continue in the future and, more importantly, that announced (but not yet implemented) governmental policy actions will be realized in the near future. The "Current Policies" scenario assumes that only current policies, and not announced policies, will be in force ("business as usual"). The third scenario is the so-called "450 Scenario",[129] in which it is assumed that new national and supranational policy actions will be adopted to limit the global average temperature increase to 2°C. Here, it is assumed that all OECD countries will eventually apply carbon taxes on CO_2 emissions.

Figure C.47 shows the resulting projections of the real price of crude oil imports, which serves as a proxy for international prices of petroleum. These have been normalized to 100 in the base year 2011. The future trend for energy prices is highest (rising by 35 per cent) under the business as usual assumption. The "New Policies" scenario would see a more modest increase in energy prices (they would rise by 16 per cent) by 2035. This is because implementation of climate-friendly policies in the New Policies scenario means energy demand is lower than in the Current Policies scenario. Therefore, there is less need to exploit very costly reserves and thus prices are lower. Finally, the forecast change in energy prices for the 450 Scenario is negative. The assumption is that stronger abatement

policies (relative to the first two scenarios) succeed in substantially limiting energy demand so that energy prices actually fall (by 8 per cent) below their level in 2011.

In terms of the likely effect on international trade, the rapid development of shale gas in the United States will create a "sea-change" in global energy flows and the pattern of international trade in oil (International Energy Agency, 2012). The United States will re-emerge as a major producer and exporter of energy rather than just consumer and importer of energy. It will become a net exporter of natural gas by 2020. As a result, North America will become self-sufficient in energy and a net oil exporter by 2035.

Another country that will have a large impact on energy markets is Iraq, with the IEA projecting that it will be the largest source of global oil export growth up to 2035. This will represent a dramatically successful rehabilitation of its energy sector driven by the country's ample reserves, low extraction costs and investor-friendly policies. Both these changes will thus require Middle East oil to find an alternative to the North America market, with the most likely scenario being that it will be redirected to consumers in Asian markets.

The higher energy prices predicted in the future may lead to shifts in the composition of trade as well. Assuming there is only limited scope for substitution in production towards other factors, such as capital or

Figure C.46: Energy mix, 2010 and 2035

Source: International Energy Agency (2012).

Note: The energy mix projected for 2035 corresponds to the "New Policies" scenario in the IEA Report.

Figure C.47: Projections for energy prices up to 2035 (percentage)

Source: International Energy Agency (2012).

Note: Real import prices for crude oil are expressed in 2011 US$ and have been normalized to 100 for the year 2011. "New Policies" scenario assumes that policies that are in place now will continue in the future and that announced (but not yet implemented) governmental policies actions will be realized in the near future. The "Current Policies" scenario assumes that only current policies will be in force. The "450 Scenario" assumes that new national and supranational policy actions will be adopted to limit the global average temperature increase to 2°C.

labour, energy-intensive industries will be penalized more than other sectors by rising energy costs. Furthermore, it is likely that countries will differ in the stringency of their climate change mitigation policies. This means that countries with tougher environmental policies might see a deterioration in their competitiveness in energy-intensive sectors relative to countries with much weaker regulations. Finally, the projected rise in energy prices also has an important bearing on fuel costs and therefore on transportation costs. These impacts and what they imply for international trade are considered more fully in Section C.5.

Beyond these impacts, a number of policy issues discussed above are likely to continue to be relevant or even grow in importance in the future. They include the use of export restrictions by resource-abundant countries to enhance their market power in international trade, the use of subsidies to provide incentives in the search for alternatives to fossil fuels and their possible misuse for industrial policy, agricultural protection and the pricing of natural resources such as water, and varying adoption of climate change mitigation measures.

(f)   Conclusions

One of the patterns identified in Section B.2(c) was the highly concentrated exports of natural resource-abundant developing countries. An important lesson that these countries can draw is that comparative advantage built on exhaustible resources can be fragile. For those countries and the world as a whole, investments in R&D are crucial if these advantages are to be maintained over time.

In the case of energy trade, a major shake-up in the next two decades is likely, with the re-emergence of the United States and, to a lesser extent, Iraq in global energy production and trade. Middle East oil exports will shift decisively to Asia. Higher population growth and a much larger global economy will push energy prices up as demand increases, possibly reducing the share of energy-intensive products in world trade. Severe water shortages in South Asia, the Middle East, North Africa and China are likely to lead to rising food and agricultural imports in those water-scarce regions. This will probably result in a continued focus on a number of trade policy issues in the natural resources sector, with the most prominent being export restrictions and subsidies. Policies in other areas, such as trade-distorting measures in agriculture and varying application of climate change mitigation measures, are likely to play important roles as well.

5.   Transportation costs

The cost of transporting goods from producers to users affects the volume, direction and pattern of trade. It determines where the line between tradable and non-tradable goods is drawn and shapes which firms are able to participate in trade and how they organize their production internationally. The cost of transportation is in turn influenced by a wide range of fundamental determinants. These include the geographical features of countries, the quantity and quality of the physical infrastructure that support transportation services, the procedures and formalities used to control the movement of goods from one country to another, the extent of competition in the transportation sector, the pace of technological innovation in the sector and the cost of fuel (Behar and Venables, 2010). The characteristics of the products being shipped also affect transportation costs.

Part (a) of this section discusses how transportation costs can affect international trade. Part (b) examines in detail each of the major determinants of transportation cost and their importance. Part (c) concludes by presenting possible scenarios in the evolution of transportation costs.

(a)   How transportation costs affect trade

After decades of significant tariff cuts around the globe, which can partly be attributed to successful negotiations within the General Agreement on Tariffs and Trade (GATT) and the WTO, average tariff barriers are now lower than many components of trade costs, including transportation costs. This is documented in a comprehensive survey of trade costs by Anderson and van Wincoop (2004) (see Section B).

Taking the United States as an example, Table C.15 compares its *ad valorem* transportation costs with its average *ad valorem* tariff rates, weighted by import values. The figures for the United States are in line with the conclusions drawn by Anderson and van Wincoop; US *ad valorem* tariff rates in most cases are lower than *ad valorem* transport costs. The measure of transport costs used in these calculations only includes the international part of transportation. If inland transportation is also included, the total costs involved will be even higher. The reversal in importance of transportation costs and tariff rates highlights the way in which transportation costs is similar to protectionist policy measures in that they lead to an "anti-trade bias" – a greater incentive to produce for, and rely on, the domestic rather than the world market.[130]

Following Samuelson (1954), most trade models that include transportation costs assume they are proportional to the price of the traded good (transportation costs are the "iceberg costs"). As a result, transportation costs drive a wedge between origin and destination prices but they do not produce changes in the relative prices of goods. Consequently, higher transportation costs reduce the volume of trade but do not necessarily change the composition of trade. However, if all or a significant part of transportation costs is additive – i.e. charged on a per

Table C.15: **Ad valorem transport costs for US imports, 1996 and 2011**					
	All modes of transport	Seaborne	Airborne	Other modes	Tariffs
1996					
Total merchandise	3.35	4.55	2.90	1.84	2.49
Agricultural products	6.93	8.32	20.92	3.87	2.94
Fuels and mining products	5.40	6.51	0.94	3.27	0.47
Manufacturing products	2.84	3.73	2.82	1.45	2.76
2011					
Total merchandise	2.63	3.48	2.34	1.11	1.38
Agricultural products	5.02	5.79	18.99	2.50	1.50
Fuels and mining products	1.94	2.15	0.61	1.28	0.82
Manufacturing products	2.75	3.96	2.39	0.96	1.59

Source: US Census Bureau's US *Imports of Merchandise*, own calculations.

Note: Average for all modes and every other aggregation is weighted by imports (data originally in HS10-digit disaggregation). The average tariff rate is constructed by weighting individual tariff lines (aggregated by TRAINS at the HS6-digit level) with respective import values.

unit basis rather than purely proportional to the price of the traded good – then the conclusion that relative prices are left unchanged no longer holds. In particular, transportation costs can be expected to have pronounced effects on the relative prices of both high-quality and low-quality products as well as goods with different weight-to-value ratios.

Since a higher-quality good will typically sell for a higher price than the low-quality good, fixed transportation costs per shipment will make up a bigger share of the price of the low-quality good. An increase in transportation costs will consequently raise the price of the low-quality good proportionately more than that of the high-quality good. This will encourage consumers in export markets to switch towards the high-quality good, thereby increasing its share in international trade.[131] A greater share of the low-quality good will be left in the home market (see Box C.9). Conversely, a reduction in transportation costs will lead to an increase in the share of low-quality products in international trade. The greater the disparity in prices between high-quality and low-quality goods, the bigger will be the impact of transportation costs on the pattern of trade.

Hummels and Skiba (2004) test whether data on transportation costs are more consistent with the additive rather than the iceberg story and whether transportation costs alter relative prices of high and low-quality products. Their study is based on imports, at the six-digit level of the Harmonized System, of a number of Latin American countries – Argentina, Brazil, Chile, Paraguay and Uruguay – and the United States from all countries. The study finds that transportation costs are not proportional to price (not of the iceberg form) and closer to being additive[132] and that the share of high-quality goods relative to low-quality goods increased when per unit freight rates rose.

Beyond quality differences, another characteristic of traded products which turns out to be important is the value-to-weight ratio (Hummels, 2007). Box C.10 discusses some estimates of the value-to-weight ratios of EU and US imports disaggregated by mode of transportation. All things being equal, transportation costs will have a smaller impact on the landed price of the good with a high value-to-weight ratio. To see this, compare the effect of shipping a metric ton of iron ore worth US$ 120 to a metric ton of gold bullion worth US$ 54.7 million.[133] Since they have the same weight, shipping costs will be very similar; only the higher insurance costs will probably be different for these shipments. However, given the vastly different value of a metric ton of these products in *ad valorem* terms, transportation costs will have a bigger impact on the delivered price of iron ore compared with the delivered price of gold. Given these relative price effects, higher transportation costs will tend to increase the share of goods with higher value-to-weight ratio in international trade.

A recent paper by McGowan and Milner (2011) provides some corroborating empirical evidence of how the composition of trade is affected by increased trade costs (of which transport cost is an important element). They focus on "trade cost intensive industries" which produce goods that have a large share of imported intermediates. These industries include: coke, petrol and nuclear fuel; pulp, paper and paper products; and electrical machinery. Using a sample of 37 industrialized and transition countries, they find that industries located in countries with low trade costs capture significantly higher shares of world exports, with this effect being stronger in trade cost-intensive industries.

Another channel through which changes in transportation costs can affect the pattern of trade is through its impact on the "extensive margin of trade" – the increase in the number of products a country trades. Not all products that a country produces are exported. However, by reducing the wedge between prices at the origin and destination, declining

Box C.9: **The mysterious case of the missing delicious red apples**

Before it became associated with corporate behemoths like Amazon, Boeing, Microsoft and Starbucks, as well as the cultural phenomenon that was grunge music, the US state of Washington was famous for its apples. To some irate state residents though, it appeared that only the small and old-looking ones remained in the state, while all the red and delicious apples were being shipped out of state. To the state residents who wrote to their local newspaper the *Seattle Times* expressing their disappointment, it was a mystery that had no obvious explanation.

However, the answer to this mystery had long been part of the lore in the economics department at the University of Washington and was even part of classroom discussions and exams. The answer to the mystery relied on the fact that a per unit transportation charge applicable to both high-quality and low-quality products lowers the relative price of the high-quality product at the point of destination. This leads consumers at the destination to purchase a greater proportion of the high-quality product than consumers in the place of origin. The explanation provided by the economists of the University of Washington to the readers of the 28 October 1975 edition of the *Seattle Times* is reproduced below:

"Suppose, for example, a good apple costs 10 cents and a poor apple 5 cents locally. Then, since the decision to eat one good apple costs the same as eating two poor apples, we can say that a good apple in essence costs two poor apples. Two good apples cost four poor apples. Suppose now that it costs 5 cents per apple (any apple) to ship apples East. Then, in the East, good apples will cost 15 cents each and poor ones 10 cents each. But now eating two good apples will cost three, not four poor apples. Though both prices are higher, good apples have become relatively cheaper, and a higher percentage of good apples will be consumed in the East than here. It is no conspiracy, just the law of demand."

Source: Borcherding and Silberberg (1978).

transportation costs can increase the range of goods available for international commerce, making goods that are currently non-traded tradable.

Moreira et al. (2008) provide estimates of the potential diversification arising from reductions in transportation costs for nine Latin American countries – Argentina, the Plurinational State of Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru and Uruguay. They note that the degree of diversification of these countries' export bundles is smaller than would be predicted from their size and below or just about average in terms of their levels of development. The authors measure the degree of product diversification by the number of tariff lines at the six-digit HS level that show positive trade flows for each pair of countries. They estimate that a 10 per cent decline in average transport costs would be associated with an expansion of more than 10 per cent in the number of products exported and with a 9 per cent increase in the number of products imported. Obviously, there are going to be differences across these countries in the extent to which falling transportation costs generate changes in the extensive margin of trade. They estimate that larger economies such as Argentina and Brazil would increase the number of products exported to other countries in the region by between 210 and 253 items whereas smaller economies such as Colombia and Peru would see an increase of about 50 items.

Beyond simply moving goods from origin to destination, transportation services have a temporal dimension as well – i.e. the time it takes to deliver a good to its destination. Figure C.48 shows that the time needed

to export varies considerably by country and level of development. The time needed to export is much shorter in Europe, North America and Australia compared with most African and landlocked Central Asian countries. For the former group, it takes less than 12 days on average to make a container ready to leave the country by ship including inland transportation, customs clearance and loading. For most Central Asian and African countries, the time to export such a container is longer than 25 days.

There are several ways to think about the cost of time or of delays in the context of trade. First, one can think of the cost in terms of the working capital that is tied up while shipments wait in the holds of ships. With this perspective, the cost of time is just the interest cost of these shipments. A second way to think about the cost of time is as the rate of depreciation or technical obsolescence of the tradable good, which could be quite significant for fresh produce, fashion items subject to fads or consumer electronics (e.g. smart phones) where innovation is extremely rapid. A third and qualitatively different way to think about the cost of time is in terms of uncertainty (Harrigan and Venables, 2006).

There are at least two sources of uncertainty. The first arises from the way that much of global production is organized. The rise of global supply chains (see Section B.2(e)), just-in-time inventory management and lean retailing is making a broader range of products more time-sensitive. For global supply chains that depend on manufacturing final products from a

Box C.10: **Value-to-weight ratios of EU and US imports**

The value-to-weight ratio of traded goods has been increasing for all modes of transportation but most strongly for air transportation during the late 20th century (Hummels, 2007). Table C.16 illustrates this relationship for EU and US imports in the last ten years, with the increase stronger for sea, rail and road transportation. This might be related to the surge in jet fuel costs in particular, which shifted parts of international trade back to these modes of transportation.

However, the huge differences in the value-to-weight ratio between air transportation and other modes as well as between different product groups seem to be similar for both the European Union and the United States. On average, goods that are moved by planes instead of vessels are about 100 times more valuable in terms of this ratio. Most of these differences can be attributed to the trade in manufactured goods, which is responsible for a major part of world trade.

Table C.16: **Value-to-weight ratios for EU and US imports, 2001 and 2011**

	Sea	Air	Rail	Road	Other modes of transport
EU 2001					
Total merchandise	364	80,323	164	2,676	448
Agricultural products	486	4,828	111	627	629
Fuels and mining products	140	18,759	87	505	166
Manufacturing products	2,042	107,911	498	5,198	4,645
EU 2011					
Total merchandise	1,080	123,546	398	5,184	952
Agricultural products	1,142	8,140	267	1,349	1,482
Fuels and mining products	600	53,606	248	1,776	677
Manufacturing products	3,935	146,445	1,210	9,100	7,178
US 2001					
Total merchandise	612	85,377	-	-	-
Agricultural products	981	5,159	-	-	-
Fuels and mining products	155	281,670	-	-	-
Manufacturing products	2,561	96,087	-	-	-
US 2011					
Total merchandise	1,497	133,167	-	-	-
Agricultural products	1,969	7,804	-	-	-
Fuels and mining products	704	293,260	-	-	-
Manufacturing products	4,495	140,344	-	-	-

Source: *Global Trade Atlas*, maintained by GTIS (Global Trade Information Services), own calculations.

Note: Value-to-weight ratios are shown in US$ per metric ton. Averages for aggregations are weighted by imports (data originally in HS6-digit and HS10-digit disaggregation, respectively). Only external imports (from outside the EU) are used. The US only reports consistent weight data for its maritime and airborne imports, other modes cannot be computed.

large array of parts and components, unsynchronized deliveries can disrupt the entire production process.[134] Uncertainty about exact delivery times can reduce trade as companies might source more of their inputs locally to reduce the risk of production interruption.

A second source of uncertainty arises from volatility in product demand (Hummels and Schaur, 2010). If a firm fails to correctly guess the tastes of foreign consumers, it will be saddled with products that no one wants. If the firm decides to be cautious by producing only a limited amount of a given design, it will fail to take full advantage of the market opportunity even if it guessed right about foreign consumer tastes. The firm can avoid this dilemma if it can move its products rapidly to international markets, allowing it to time and adjust its production to match foreign tastes.

Empirical work that attempts to measure the cost of time delays approaches the issue in several ways. Some studies estimate the cost in terms of the reduction in trade volume. Djankov et al. (2010) show that an additional day in the average time to export – meaning the time a shipment requires to move from the company grounds to being actually exported – reduces exports by more than 1 per cent. Others try to measure the percentage increase in the price of the tradable good at the point of destination.

Hummels and Schaur (2010) estimate that each day spent in transit is equivalent to charging an *ad valorem* tariff rate of 0.6 per cent to 2.3 per cent. Trade flows that consist of parts and components were found to be 60 per cent more time sensitive and hence more likely to be transported by airplanes. Air transportation is

Figure C.48: **Time needed to export goods**
(in days)

Less than 12   12 to 19   19 to 25   Greater than 25

Source: World Bank, *Doing Business – Trading Across Borders* (2013).

Note: Countries are grouped according to the time to export (in days) a standardized container, meaning how long a good on average takes from the production site to being ready to leave the exporting country by ship. Surfaces in white: Data unavailable at the time of writing. Colours and boundaries do not imply any judgement on the part of the WTO as to the legal status of any frontier or territory.

obviously faster but also more costly than sea transportation. Other studies consider the likelihood that countries may not be able to enter specific export markets or participate in global supply chains if there are lengthy delays in trade shipments (Nordas et al., 2006; Hummels and Schaur, 2012). The Hummels and Schaur study estimates that a delay of three days can reduce the probability to export by 13 per cent (see Section B.2(a)).

All in all, these estimates paint a similar picture – the cost of time delays in international trade is high. The estimates in these studies suggest that a delay of one week in shipments can reduce the volume of exports by as much as 7 per cent or raise the delivered price of goods by 16 per cent. For exceptionally time-sensitive goods, such as parts and components, the volume can be reduced by as much as 26 per cent.

(b) Determinants of transportation costs

What factors are likely to influence transportation costs? The possible determinants include product characteristics, geography, infrastructure, market competition, technological change, trade facilitation and fuel costs.

(i) Product characteristics

As discussed above, *ad valorem* transportation costs differ depending on the characteristics of the product being shipped. Two features particularly relevant in this regard are the quality of the product and its value-to-weight ratio. All things being equal, *ad valorem* transportation costs will be lower for high-quality

goods and for goods which have a higher value-to-weight ratio.

(ii) Geography: landlocked countries and distance to markets

The geographical characteristics of countries can have a significant bearing on transportation costs and hence on countries' ability to participate in international trade. One of the most salient of these geographical features is access to an ocean or ocean-accessible sea.

There are more than 40 landlocked countries in the world. Of these, 31 are developing countries, with 16 of them being least developed.[135] An important reason why being landlocked is disadvantageous to a country's trade is that the country becomes dependent on the transit states (Arvis et al., 2007) and thus the location, size and quality of the transportation infrastructure to support trade are not fully under its control. Neither are the policies or regulations that will apply to the transportation and logistics sectors. These have to be negotiated with the transit states and the outcome is not necessarily what the landlocked country would have chosen. Also, the transit countries may have political and economic incentives to impose costs on the landlocked countries (Gallup et al., 1999).

Using the difference between c.i.f (cost, insurance and freight) and f.o.b (free on board)[136] values as a measure of transportation costs, Radelet and Sachs (1998) find that landlocked countries face 63 per cent higher costs. Moreira et al. (2008) show that the cost to import goods into Paraguay, a landlocked country, is

about twice as high as the average for other Latin American countries that have access to the Atlantic or Pacific Ocean.

Using a different measure of transportation costs – shipping rates – Limao and Venables (2001) estimate that being landlocked increases transportation costs by 55 per cent, which is similar in magnitude to the estimate found by Radelet and Sachs. As a consequence of this, they estimate that being landlocked reduces trade volume by about 40 per cent on average. At the same time, recent research (Borchert et al., 2012) cautions against imputing all these estimated negative effects to geography as many landlocked countries also restrict trade in service sectors – e.g. telecommunications and air transportation – that connect them with the rest of the world.

Another important geographical feature that affects transportation costs is a country's distance to other markets and to transportation routes.[137] Hummels (2007) estimates that a 10 per cent rise in the distance between the exporting country and the destination port within the United States increases the corresponding transportation costs by 2.7 per cent for air and 1.5 per cent for sea shipments. Most other studies do not directly try to estimate the effect of distance on shipping or airline transportation charges; instead, the effect of distance is measured by how much it reduces trade volumes. These studies show a high and persistent negative impact, suggesting that claims about the declining impact of distance may be premature.

Disdier and Head (2008) review more than 1,400 gravity model estimates to systematically analyse the effect of distance on trade.[138] The objectives of this analysis are to determine the central tendency of the results indicated above as well as to identify sources of variation in the results. On the first question, they are able to conclude that the elasticity of trade to distance is about 0.9. This means that, on average, a 10 per cent increase in distance between trading partners lowers bilateral trade by about 9 per cent. On the second issue, they find a great deal of variation in the estimated impact of distance from the studies. They attribute the large variation to differences in data sets, econometric methods and, most important of all, the time period of the data used in the estimation. They find that the distance effect decreased slightly between 1870 and 1950 and then began to rise again.

One problem with most gravity estimates involving distance is that some factors which vary with distance may not be fully taken into account. For example, tastes, cultural characteristics and information costs may vary systematically with distance so that trade will decrease with distance even if transportation is costless (Feyrer, 2009; Allen, 2012). Using the closure of the Suez Canal as a natural experiment to take into

account these other factors, Feyrer (2009) estimates an elasticity of trade with respect to distance of between 0.2 and 0.5, which is half that found in the gravity model estimates reviewed by Disdier and Head.

Irrespective of the magnitude of the distance effect, why does it persist as an impediment to trade? First, technological progress may have been less important in reducing transportation costs than has been assumed. Secondly, changes in the composition of trade might be biased toward goods with high distance costs. Related to this hypothesis, as was discussed earlier, the influence of time on trade is increasing so that distance may be serving as a proxy for the increased time sensitivity of trade.

Thirdly, Hillberry and Hummels (2008) point out that a substantial part of trade is intra-industry exchange of intermediate inputs for assembled outputs. If inputs are highly specific to a producer, there may only be a very small possibility of substitution from other sources. Thus, industrial import demands will be much more sensitive to trade costs – as proxied by distance – and firms would rather respond to higher transportation costs by relocating close to the source of the inputs. Some sense of this effect can be gleaned from Figure C.49, which is taken from Hillberry and Hummels (2008). It uses US manufacturers' (both origin and destination) location at the ZIP code level and products identified at a very disaggregated level. The figure shows the value of shipments dropping very rapidly over distance, particularly within the first 200 miles, testifying to the large negative impact of distance on trade in intermediate goods.

(iii) Infrastructure

The amount and quality of transportation infrastructure in source, destination and transit countries have a major impact on transportation costs. The following discussion focuses in particular on the effect of investments in road and port infrastructure (Section C.2 discusses how investments in transportation infrastructure can lead to the emergence of new players in trade).

Although there has been a huge surge of studies documenting the importance of transportation infrastructure, their findings are quite similar – there is a critical role that infrastructure plays in reducing transportation costs and enabling trade. Unfortunately, almost all of these studies estimate the benefits from investing in transportation infrastructure based on the perspective of a single country. This is too narrow a view since a country's infrastructure investment also reduces the transportation costs incurred by its trading partners and neighbouring countries that are landlocked, allowing them to benefit as well. Thus, the magnitude of the benefits presented in the trade literature probably understates the overall gains from expanding investments in transportation infrastructure.

Figure C.49: Estimated relationship between shipments of intermediates and distance

Source: Hillberry and Hummels (2008).
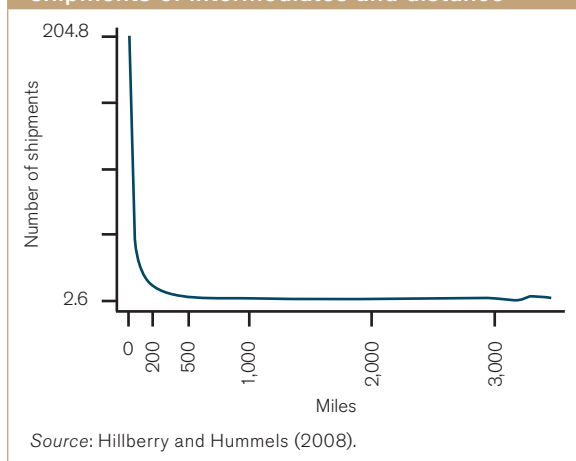
Limao and Venables (2001) rank countries using an infrastructure index designed to measure the costs of travel in and through a country. They estimate that a country whose road infrastructure quality placed it on the 75th percentile globally, i.e. three-quarters of the way down the list, had transportation costs that were 12 percentage points greater than the median country. As a consequence, its trade was on average 28 per cent lower than the median country. For landlocked countries, an improvement in own and transit countries' road infrastructure could overcome more than half of the disadvantage associated with being landlocked. Applying their estimates to Sub-Saharan Africa, Limao and Venables conclude that transportation costs there are higher and trade volumes lower than would be predicted given the economic characteristics of the countries – incomes, distance, etc. They then attribute much of this result to the poor state of transportation infrastructure in the continent.

A later study by Freund and Rocha (2010) on African exports shows that uncertainty in road transport had a negative and significant effect on a country's ability to export. Their results point to improvements in road systems – especially infrastructure, security and policies that improve competition in trucking – as key to stimulating Africa's exports. Blyde (2010) and Volpe et al. (2012) look at the impact of increasing investments in road infrastructure in a couple of Latin American countries – Colombia and Peru.

Blyde (2010) first establishes that lower domestic transportation costs in Colombia can significantly improve the prospects of exporting. He finds that regions within the country with lower transportation costs (regions in the 25th percentile) export around 2.3 times more than regions with higher transport costs (regions in the 75th percentile) once other factors are taken into account. He then simulates a reduction in transport costs that would arise if the condition of all the roads identified as "bad" and "regular" by the national road authority were improved to "good". He concludes that this simulated improvement in road conditions decreases average transport costs by about 12 per cent and boosts average exports by around 9 per cent.

Volpe et al. (2012) assess the effects of new roads constructed in Peru between 2003 and 2010 on Peruvian firms' exports. The authors conclude that exporters whose routes were shortened due to the construction of new roads had exports that were about two-thirds higher than exporters whose route length remained the same. Overall, the additional investments in road infrastructure meant Peruvian exports were 20 per cent higher in 2010 than they would have been without the new roads.

The studies by Clark et al. (2004) and Abe and Wilson (2009) look at the relationship between port infrastructure and transportation costs.[139] Clark et al. (2004) use data on all US imports transported by sea. They construct an index of port efficiency using survey measures drawn from the World Economic Forum's *Global Competitiveness Report*, which depends, among other determinants, on the general condition of the country's infrastructure: the more efficient a country's port, the higher its score in this index. Clark et al. estimate that a country which improves its ranking in port efficiency from the 25th to the 75th percentile reduces shipping costs by 12 per cent; this, in turn, implies an increase in bilateral trade of around 25 per cent.[140]

The study by Abe and Wilson (2009) focuses on the growing problem of port congestion in East Asia. This has worsened not only because of the rapid growth in East Asia's trade but also because much of that trade is seaborne. Port congestion leads to bottlenecks, which significantly increase the cost of transporting goods to and from East Asia. Their analysis suggests that expanding facilities in East Asian ports so as to cut congestion by 10 per cent could decrease transportation costs by up to 3 per cent.

(iv) Market competition

The transportation sector is a service industry whose efficiency will depend, in part, on the existing regulatory regime and the extent of competition. There are a number of reasons for a lack of competition in the transportation sector, including natural monopolies, market access barriers that prevent foreign firms from entering and competing, and the cartelization of transportation service providers. In some cases, governments may even allow practices, e.g. price-fixing, that would otherwise be illegal under anti-trust laws.

Because the literature on competition in the transportation sector is immense, the following discussion focuses on a specific sector – maritime transportation – to illustrate the scope for more competition to reduce transportation costs and expand trade volumes (see WTO Secretariat Notes

S/C/W/315 and S/WPDR/W/48 for a fuller discussion of competition issues in maritime transport).[141]

The maritime transportation market is usually subdivided into two: the tramp (or bulk) market and liner market. Tramp ships have no fixed route or schedule and can be chartered for a period of time or for a specific voyage. In contrast, liner companies operate vessels between fixed ports on a strict timetable (UNCTAD, 2010a).

In the tramp market, the carrier chases the cargo (Brooks, 2011) and price competition is generally considered intense (Clarkson Research Studies, 2004). In this unrestricted market, freight rates are volatile because capital costs are high and supply difficult to adjust in the short run (Brooks, 2011). Ships cost millions of dollars; it takes years to build one and the operating lifetime of ships is counted in decades.

In the liner market, companies typically organize themselves into a consortium, with a view to providing a joint transportation service. In stark contrast to the tramp market, operators in the liner market have been exempt from national anti-trust laws since the turn of the 20th century. Part of the reason for this exemption was the desire to reduce price volatility. If operators can fix prices and if they collude to maximize industry profits, prices will be higher – set at a mark-up to marginal cost. The size of the mark-up will vary inversely with the elasticity of demand of the good that is transported, i.e. the more inelastic is the final demand, the higher the mark-up. Thus, while this exemption from anti-trust laws may reduce price volatility, it will be at the cost of higher freight charges and lower trade volumes.

In 2010, the European Union removed the anti-trust exemption on price fixing although operational cooperation among consortia members, such as sharing space on their respective vessels, continued to be exempted.[142] Liner members are expected to market and price their services individually. There was a similar legislative effort made in the US Congress in 2010 to remove the liners' exemption from US anti-trust laws but the bill was not passed.

Beyond government policies, one of the reasons discussed above for lack of competition may simply be the existence of a natural monopoly. Hummels et al. (2009) have argued that there may be such an element operating in the case of developing countries. First, the volume of their trade – particularly of small, developing countries – is tiny compared with the capacity of modern container ships. Secondly, there may be substantial economies of scope in offering transport services over a network of ports. As a consequence, it may be difficult to sustain more than one or two operators to service shipping routes to some developing countries. A similar pattern has been highlighted in a recent report by the United Nations Conference on Trade and Development on maritime transport (UNCTAD, 2010) . Between 2004 and 2011, the average number of liner companies dropped by nearly 23 per cent while the size of the largest ship deployed nearly doubled.

A trend featuring increasing containership sizes and carrying capacities and declining competition within the industry has continued for several years. This limited competition means developing countries pay higher transportation costs and have lower trade volumes. To estimate these effects, the paper by Hummels et al. (2009) studies freight costs for the United States and a number of Latin American countries. They estimate that shipping prices on Latin American imports are, on average, 30 per cent higher than shipping prices on US imports and that one-third of this difference is explained by the small number of carriers serving Latin American importers. They also calculate that eliminating market power in shipping would increase Latin American import volumes by about 15.2 per cent.

(v) Technological change

Innovations in the transportation sector can have an important role in bringing down transportation costs (see Section C.3 for a discussion about the link between technological change and trade more broadly). Notable examples of innovation include the development of the jet engine and the adoption of containerization in maritime transportation, which also increased the efficiency of multi-modal transport.

As Gordon (1990) observes, the introduction of the jet aircraft in the 1950s created profound quality changes in both performance characteristics and operating efficiency of commercial aircraft. Compared with the piston-driven planes which it displaced, jet aircrafts are faster and have lower maintenance and fuel costs. Adjusting for these improvements in performance, Gordon (1990) estimates that the real price of jet aircrafts fell at a rate of 12.8 per cent to 16.6 per cent per year during 1958-72 when they began to be widely adopted. The reduction in quality-adjusted aircraft prices appears to have been transmitted to air transportation charges. Using the average revenue per ton-kilometre shipped as a measure of air transportation cost, Hummels (2007) estimates that costs fell more than ten times over the 50-year period since the introduction of the jet aircraft (see Figure C.50).

At its simplest, a container is nothing more than a metal box of standardized dimensions. Yet, this box enabled the unprecedented expansion of world trade in the second half of the 20th century and contributed to the rise of just-in-time manufacturing and global supply chains (Levinson, 2006). The value of the container lay not in the product itself but in the system of transportation involving container ships, trucks and

freight trains built to handle container cargo (thus facilitating multi-modal transport) and automated handling that grew around it. Its effect on trade was so profound that it is tempting to assume that maritime transportation costs must have fallen dramatically as a consequence of the widespread adoption of containers.

However, Hummels (2007) finds no strong empirical support for this presumption. As can be seen in Figure C.51, while real tramp prices declined over this 50 year span, real liner prices were almost at the same level in 2003 as they were in 1955 although there have been marked fluctuations.

There are several explanations for this apparent discrepancy. Levinson (2006) observes that most historical data on freight cost cover only the ocean voyage between two ports and do not include the total door-to-door cost of a shipment. These total costs are more likely to have declined with the adoption of containerized trade as large efficiency gains for inland transport and loading and unloading have been realized. Hummels (2007) suggests another explanation is that the available price indices do not adequately capture the quality improvement made possible by containerization. Container ships are faster and quicker in terms of cargo handling. As discussed earlier, this quicker turn-around is absolutely essential to today's just-in-time inventory systems and global supply chains. Thus, even if these prices have not declined, the fact that goods can be moved much more quickly than in the past means there has been in effect a reduction in cost for traders.

Finally, given that fuels costs are a significant component of the cost of operating ships or airplanes (see discussion below on fuel costs), current R&D efforts are being directed at improving fuel efficiency of these vessels. In the case of a jet aircraft, the three principal areas of concentration are reducing aircraft

weight, improving aerodynamic design to lessen lift-dependent and friction drag, and enhancing engine performance to cut fuel burn per unit of delivered thrust.

Aircraft weight is being reduced through greater use of advanced alloys and composite materials and by replacing hydraulic control systems with lightweight electrical ones. Aircrafts are being designed so that effective wing span extension is maximized, laminar or streamline flow is better maintained and wetted areas (areas of the aircraft in contact with the airflow) are minimized. The thermal, transmission and propulsive efficiencies of newer jet engines are superior to those of previous generations. These improvements have made new aircraft such as Boeing's 787 airliner consume about 40 per cent less fuel per passenger than their 1970s counterparts.[143]

(vi) Trade facilitation

Trade facilitation examines how procedures and controls governing the movement of goods across and within national borders can be improved and simplified to reduce delays and costs. While it is not part of transportation *per se*, the growing prominence of time-sensitive trade and global supply chains increases the importance of border or customs-related costs, and hence of trade facilitation. The potential reduction in trade costs from improvements in trade facilitation appears significant. This is why it is a major part of the WTO's Doha Round negotiations, where the subject has made rapid progress (see Box C.11).

Figure C.51: **Real tramp and liner price indices, 1955-2003**

Source: Hummels (2007).

Note: Indices are deflated using a US GDP deflator for the tramp price and a German GDP deflator for the liner price. Furthermore, indices are normalized to 100 for the year 2000.

Figure C.50: **Air revenue per ton-kilometre, 1955-2003**

Source: Hummels (2007).

Note: Index is normalized to 100 for the year 2000 and based on revenues expressed in year 2000 US$.

> ### Box C.11: **Trade facilitation negotiations in the WTO**
>
> Starting over two years after the launch of the Doha Round,[144] the negotiations on trade facilitation in the WTO have now become one of the most advanced components of the Doha Development Agenda (DDA). Intense discussions among WTO members have brought the talks to a stage where the contents of a new agreement are clearly taking shape.
>
> A first draft of the prospective agreement was tabled in 2009 and has subsequently been refined. Following discussions, members have been able to reduce the number of open questions by more than two-thirds. Structured into two main pillars, the Draft Agreement (TN/TF/W/165 and revisions) proposes a series of trade facilitation measures (Articles 1-15) and a related implementation mechanism (usually referred to as special and differential provisions for developing countries).
>
> The proposed facilitation disciplines are largely based on three existing provisions of the GATT 1994: Article V (freedom of transit), Article VIII (fees and formalities connected with importation and exportation) and Article X (publication and administration of trade regulations). An additional, non-GATT based segment seeks to enhance cooperation between customs and other relevant trade facilitation authorities.
>
> Instructed by the negotiating mandate[145] to "clarify and improve" the above-mentioned GATT disciplines, members have proposed a series of measures to strengthen the current regulatory regime. Common underlying objectives have been the simplification of border crossing procedures, the reduction of related bureaucratic obstacles and the creation of a more transparent and predictable trading environment. With the existing rules not having been revised for more than 65 years, governments agreed on the need to update a legal framework that reflects the trading realities of the 1940s as opposed to those of today's globalized, supply-chain dominated world.
>
> The expected benefits of a new agreement are widely documented and cover various aspects of the cross-border movement of goods. According to a recent OECD study by Moïsé et al. (2011), the trade facilitation measures negotiated in the WTO have the potential to reduce total trade costs by almost 10 per cent for OECD countries alone.[146] It has also been shown that successfully implemented facilitation programmes increase customs productivity, improve tax collection and attract foreign direct investment. There is also a positive impact on government revenue, with several countries having more than doubled their customs proceeds after introducing trade facilitation reforms (OECD, 2009).
>
> The benefits have been shown to be particularly significant for developing economies and least-developed countries (LDCs). Research has found that up to two-thirds of the total gains from trade facilitation are obtained by the developing world (OECD, 2009).
>
> Many developing countries suffer from border procedures that are less efficient than those of their developed counterparts, indicating a great potential for improvement. The costs of importing goods have been found to be about 20 per cent higher for low-income countries than for their middle-income competitors, and another 20 per cent higher when compared with high-income economies (Hoekman and Nicita, 2010).
>
> The recent analysis by Hoekman and Nicita (2010), which is based on the World Bank's Doing Business Indicators, concludes that the WTO discussions on trade facilitation are "perhaps of greatest relevance to low-income countries from a trade expansion perspective …".[147] The study finds that even "taking relatively limited actions to facilitate trade can boost the trade expansion effects of the Doha Round by a factor of two, three or more".[148] It also suggests that "pursuit of trade facilitation is particularly important for lower-income countries, especially LDCs, that otherwise will not benefit from the Doha market access negotiations – because they have duty-free, quota-free access to major markets and will not be asked to reform their own trade policies".[149]

Many studies use measures of trade logistics, such as the World Bank's Doing Business indicators or Logistics Performance Index. The latter is based on a worldwide survey of freight forwarders and express carriers on the logistics performance of the countries in which they operate and those with which they trade. It assesses performance in six major areas: efficiency of the clearance process by border control agencies; quality of trade- and transport-related infrastructure; ease of arranging competitively priced shipments; competence and quality of logistics services; ability to track and trace consignments; and frequency with which shipments reach the consignee within the scheduled delivery time. In 2012, Singapore, Hong Kong (China) and Finland were in the top three places in the index (see Arvis et al., 2012). OECD countries generally ranked high on the index, while countries at the bottom were typically least developed, landlocked or from Sub-Saharan Africa.

With the help of these two indices, Portugal-Perez and Wilson (2009) show that progress in trade logistics can boost the trade volumes of African countries. Even relatively small improvements in these indices that move a country towards the scores of well-performing African countries have large impacts on trade and welfare. This result is consistent with other findings about the huge trade benefits from trade facilitation for different sets of countries (see Wilson et al., 2003; 2005; 2008; Christ and Ferrantino 2011; Márquez-Ramos et al., 2012).

Other authors have investigated the effect of the WTO's Aid for Trade initiative on the costs of trading and found that it has significantly reduced those costs (Königer et al., 2011; Wilson et al., 2006). This indicates how Aid for Trade can be effective in helping developing countries improve their trade logistics capabilities. It shows that even simple reforms, whose implementation is relatively easy and cost-efficient, can have significant effects on international trade. Such reforms include the introduction of a single window, whereby all customs documents have to be submitted to only one governmental authority, or switching from paper-based to electronic submission of documents.

Ahmad (2010) describes the reform efforts in Pakistan and shows that a set of improvements that includes the two aforementioned changes reduced the share of shipments taking longer than one day to clear customs at the port of Karachi from 96 per cent to 7 per cent. As discussed above, the costs related to time delays at customs and the resulting uncertainty can represent a considerable share of the total cost of a product.

The extensive literature on trade facilitation emphasizes the importance of improving the reliability and transparency of customs and other authorities, of increasing competition in service providers in the proximity of borders and of providing advance rulings so as to reduce the uncertainty faced by traders.[150] Furthermore, most studies agree on the interdependency of the reforms, highlighting that an integrated approach magnifies the benefits and yields lasting improvements.[151] Solving one logistical problem within customs or inland transport may not produce major benefits unless other bottlenecks are tackled as well.

(vii) Fuel costs

Higher fuel costs increase transportation costs. Studies by Mirza and Zitouna (2010) and UNCTAD (2010b) find that the elasticity of transport costs with respect to fuel prices is between 0.09 and close to unity depending on the countries, timeframes, modes of transportation and products that are studied. This is quite a wide range since it means that a 1 per cent increase in fuel costs increases transportation costs by between 0.09 per cent and 1 per cent.

There are a number of explanations for this wide range of estimates, including how higher fuel charges affect various modes of transport differently.[152] However, the sensitivity of transportation costs to changes in energy prices appears to have been heightened by long-term improvements in transportation logistics, such as reduced loading times through containerization. As a result of the reduction in these non-energy components of transportation costs, fuel costs now account for almost one half of total freight costs (Rubin and Tal, 2008).

Rising energy prices adversely affect some transport modes more than others. Moreira et al. (2008) show that the increase in energy prices in the last decade raised air transportation costs relative to maritime costs for several Latin American countries and the United States. Over this period, the Chilean and US modal share for air transport decreased or at best remained constant.[153] This is in contrast to the second half of the 20th century where the trend had been for more and more products to be moved by air transport.

Energy costs also influence the composition of traded goods as they are likely to have a more adverse impact on goods with low value-to-weight ratios. For these products, soaring energy costs can quickly wipe out a comparative advantage based on differences in the costs of labour, particularly where margins are narrow. This can put pressure on those global supply chains which depend heavily on differences in labour costs across countries. This difference in value-to-weight ratios is reflected in producers' choice of transport since light and highly valuable goods are more likely to be transported by air (see Box C.12).

An analysis of maritime transportation confirms that goods with low value-to-weight ratios are likely to suffer more from higher energy costs. A study by UNCTAD (2010) estimates the elasticity of maritime freight rates with respect to oil prices to be lower for containerized products (0.19 to 0.36) than for products such as iron ore (up to 1.0), which is a bulky and low value-to-weight good. The study also finds that these elasticities seem to increase at times of sharply rising energy prices, which could be explained by the increased volatility and uncertainty that shipping companies have to deal with under such circumstances.

High oil prices can also prompt trading partners located further away to divert trade towards neighbouring regions (see the discussion on the regionalization of trade in Section B2(d)). In other words, soaring oil prices can act as tariff surcharges differentiated by origin depending on the proximity of the exporter to the importing country.

Mirza and Zitouna (2010) introduce a theoretical model, where transport costs have a fixed and a variable component, with energy prices being part of

Box C.12: **Shares of modes of transport**

The most important modes of transport used for international trade are sea and air transportation. However, rail and road transport are of particular importance for trade with neighbouring countries or within regional clusters, such as the European Union or North America. Martínez-Zarzoso and Suárez-Burguet (2005) find for certain Latin American countries in the late 1990s that air transportation is used for 12 to 25 per cent of total imports in terms of value. In contrast, seaborne transport accounts for 45 to 70 per cent of the value of imports. This pattern can be observed in Table C.17, where modal shares of European, American and Chilean imports are compared.

Depending on the product category and the specific breakdown of a country's imports, the value share of maritime transport lies between 45 and 95 per cent. In terms of its weight, most international trade is carried by maritime transport. UNCTAD (2010a) finds this share to be over 80 per cent. Moreover, Hummels (2007) shows that air transport accounts for less than 1 per cent of world trade in weight.

However, air transport has been gaining in importance as recent growth rates of ton-miles have been significantly higher than for any other mode of transport. Moreover, unlike agricultural goods and fuels and mining products, high-value goods such as manufactured goods – consumer electronics specifically – are transported primarily by air. The share of air transport becomes far more significant if world trade is measured in terms of its value instead of its weight. Table C.17 shows that in terms of value, 29 per cent of the EU's manufactured imports were transported by air but in terms of weight these same goods only account for 1.3 per cent of the EU's manufactured imports.

Table C.17: **Shares of modes of transport for imports in value and weight, 2011** (percentage)

	Shares in terms of value				
EU 2011	Sea	Air	Rail	Road	Other modes of transport
Total merchandise products	55.62	18.80	1.16	12.95	11.47
Agricultural products	77.32	3.41	1.50	14.71	3.06
Fuels and mining products	71.41	1.37	1.51	2.51	23.20
Manufactured goods	45.29	29.02	0.95	19.05	5.69
	Shares in terms of quantity				
EU 2011	Sea	Air	Rail	Road	Other modes of transport
Total merchandise products	74.50	0.22	4.23	3.62	17.43
Agricultural products	78.04	0.48	6.50	12.6	2.39
Fuels and mining products	74.00	0.02	3.78	0.88	21.32
Manufactured goods	74.84	1.29	5.12	13.61	5.15
	Shares in terms of value				
Chile 2011	Sea	Air	Rail	Road	Other modes of transport
Total merchandise products	78.24	13.03	0.00	8.63	0.10
Agricultural products	53.87	1.99	0.00	44.15	0.00
Fuels and mining products	95.94	0.21	0.00	2.27	1.58
Manufactured goods	72.89	19.44	0.00	7.65	0.03
	Shares in terms of value				
US 2011	Sea	Air	Rail	Road	Other modes of transport
Total merchandise products	52.51	22.41	-	-	25.08
Agricultural products	62.11	3.56	-	-	34.33
Fuels and mining products	77.25	1.58	-	-	21.18
Manufactured goods	45.69	29.64	-	-	24.67

Source: *Global Trade Atlas*, maintained by GTIS (Global Trade Information Services).

Note: Modal shares (in per cent) are constructed by using data on imports. For the EU, only external imports (from outside the EU) are used. Due to data limitations, "Other modes of transport" for US includes rail, road and other modes of transport. For EU and Chile "Other modes of transport" is an aggregation over all remaining modes such as inland waterways, pipelines or mail deliveries.

the latter component. One prediction of their theoretical model is that with increasing fuel costs, international trade will become more regionalized and products will be sourced more locally. Rather than through trade, distant markets may then be served by way of foreign affiliates or licensing arrangements. However, the empirical evidence is far from conclusive.

Contrary to the model prediction, Mirza and Zitouna (2010) find that the difference in the elasticity of transport costs with respect to energy prices between countries close to the importer compared with ones that are located far away from the importing market is only very small.[154] They show that in the US market, Mexican and Canadian exporters do not seem to have outperformed other exporters when the price for oil and other energy sources increased before the financial crisis. Rubin and Tal (2008) find the opposite result to Mirza and Zitouna, showing that during past oil crises the share of US non-oil imports from Europe and Asia dropped while the share of imports from the Americas went up. They calculate that at an oil price of US$ 200, imports from East Asia would be equivalent to an additional 15 per cent tariff on comparable imports from Mexico.

(c)   Conclusions

The future scenario of transportation costs will depend on how different determinants – distance to markets and transportation routes, infrastructure, trade facilitation, competition and regulation, transportation technology, and fuel costs – are likely to develop.

Section C.4 notes the IEA's baseline prediction of a long-term increase in the real price of energy of about 16 per cent. Although no similarly precise projections for the other determinants of transportation costs are available, it is possible, based on the extensive literature, to arrive at estimates of how improvements in these areas could reduce transport costs (see Table C.18). These estimates are used to perform a series of "thought experiments" to assess whether such cost reductions are likely to offset the expected rise in energy prices.

The estimates referred to in Table C.18 come from different studies and employ different countries and time periods. While the estimates are statistically significant, they are still subject to estimation error. Moreover, they do not distinguish which mode of transport is involved. Nor do they include the impact of technological change. Although technological advances can be key to reducing transportation cost, there are no available estimates of how additional investments in R&D will translate into reductions in transportation costs. Despite these caveats, the exercise can be revealing.

Based on the work by Mirza and Zitouna (2010) and UNCTAD (2010b), there is a lot of variation in the estimated elasticities of transportation costs with respect to fuel prices. If we take the maximum of their estimates – an elasticity of one – a 16 per cent rise in energy prices will translate to a 16 per cent rise in transportation costs. Rubin and Tal (2008) estimate that fuel costs represent about half of transportation

Table C.18: Estimates of potential changes to transportation costs

Determinants	Estimated impact on transportation cost	Sources	Remarks
Fuel cost	Increase transportation cost by between 8% and 16%	Mirza and Zitouna (2010)	*Future scenario*:
		UNCTAD (2010), Rubin and Tal (2008)	Energy costs rise by 16%
Infrastructure	Decrease transportation cost by up to 12%	Limao and Venables (2001)	*Assumed improvement in infrastructure*:
		Blyde (2010)	Countries make investments in transportation infrastructure that improve their ranking from the 75th to the 25th percentile.
Trade facilitation	Decrease transportation cost by 10%	Moïsé et al. (2011)	*Assumed improvement in trade facilitation*:
			Implement trade facilitation measures being negotiated in the Doha Round.
	Decrease low income countries' trade costs by 20%	Hoekman and Nicita (2010)	Improve low-income countries' trade facilitation score to the level of middle-income countries.
Competition	Decrease transportation cost by up to 10%	Hummels et al. (2009)	*Assumed increase in degree of competition*:
			Increase number of carriers serving developing country markets.

costs. If we take Rubin and Tal's estimate as the lower most projection, transportation costs will go up by 8 per cent as a result of a 16 per cent rise in energy prices.

The estimates in Table C.18 suggest that there is ample scope for improvements in trade facilitation, investments in transportation infrastructure, and introducing more competition in transportation services to offset higher energy prices in the future.

The estimates from Limao and Venables (2001) and Blyde (2010) suggest that poor countries which improve their transportation infrastructure sufficiently to raise them from the 75th percentile to the 25th percentile can expect to lower transportation costs by about 12 per cent. The Moïsé et al. (2011) study gives an estimated reduction in trade costs of about 10 per cent if the trade facilitation measures being negotiated in the Doha Round come to fruition. The study by Hoekman and Nicita (2010) suggests that the cost of importing for low-income countries could be reduced by 20 per cent if their border procedures were at a comparable level to that of middle-income countries. Based on the study by Hummels et al. (2009), there is also a large potential to be tapped from increasing competition in transportation routes serving developing countries. Their transportation costs can be cut by as much as 10 per cent, which can either wholly or significantly offset the effect of higher fuel costs.

These "thought experiments" underscore the importance of pursuing a number of policy initiatives at both the national and multilateral levels. They include improving the quantity and quality of transportation infrastructure, successfully concluding the Doha Round of negotiations and introducing more competition in routes that serve poor countries. Although the predicted cost impact of technological change is not included in the table, given the inherent difficulty of predicting future innovation, it is likely to be a powerful force for cost reduction.

If no significant progress is made on these fronts, the expected rise in energy prices may well translate into a long-run rise in transportation costs. The consequence will be slower trade growth. There may be more regionalization of trade as higher transportation costs penalize trade with more distant countries. There will be a shift in the composition of trade, which will favour high-quality goods and goods with higher value-to-weight ratios. The share of time-sensitive goods in trade will fall. The extensive margin of international trade – the quantity of goods traded – will be affected adversely. Furthermore, there might be a move away from trade in merchandise goods towards trade in services, technology and ideas since this would entail far less transportation costs (Hummels, 2009).

Among the major trends identified in Section B was the emergence of new players in international trade and the rise of global supply chains. While not the only explanation, a reduction in trade costs has been a key driver of these trends.

On the basis of various measures of transportation costs and logistics performance, least-developed countries and countries in Sub-Saharan Africa tend to fare worst, while poor, landlocked countries face unique obstacles. Not only do higher transportation costs and longer delivery time reduce these countries' overall volume of trade, they make it difficult for them to break into new markets and participate in global supply chains.

Their situation can be alleviated through improved trade facilitation, introducing greater competition and by making sizeable investments in transportation infrastructure. Given the likelihood of rising fuel costs in the future, there is some urgency in reforming and modernizing these countries' transportation infrastructure and regulatory systems. The pay-offs from infrastructure investments appear large and should justify commitment of more resources on a cost-benefit basis. Because the trade partners of these countries will also see benefits from lower trade costs, it is in their interest to provide assistance through the Aid for Trade initiative, for example. Beyond this, there may be a good reason to re-examine the subject of competition policy in the future as the available evidence suggests market power in transportation services has been particularly burdensome to a number of developing countries.

6. Institutions

This section studies the relationship between international trade and the institutional framework. Two broad questions are addressed: How do institutions shape international trade relations? And how does trade affect institutions? The key observation in this section is that, in the long run, there exists a dual relationship between these two variables (in the language of economists, they are endogenous). Put simply, institutions shape and are shaped by international commerce. Understanding this relationship can help shed some light on the future of international trade and the multilateral trading system.

What are institutions? Economists have developed a notion of institutions that incorporates practices and relationships as well as organizations. As North (1990) explains, "institutions are the rules of the game in a society or, more formally, are the humanly devised constraints that shape human interaction" (North, 1990). In economics, therefore, institutions are the deep frameworks, such as social norms, ordinary laws, political regimes or international treaties, within which policies – including trade policies – are determined and economic exchanges are structured.

Institutions can be formal or informal. Formal institutions are those that are consciously created by agents and that impose clear and visible constraints. Informal institutions are conventions and codes of behaviour. Formal institutions can be further sub-divided into political and economic institutions. The former impose constraints on government activities whereas the latter set rules that directly affect the relationship between economic agents. This section examines the two types of formal institutions, political and economic, and then focuses on informal institutions, broadly defined as culture.

Formal and informal institutions shape and are shaped by international trade. Institutional differences create transaction costs that make it more difficult to trade but they can also form the basis of comparative advantage in certain sectors or production tasks. More directly, institutions determine how trade and trade-related policies are set and negotiated, leading to a more or to a less open trading environment. In this sense, institutions are clearly a shaping factor of trade. At the same time, economic integration is an important determinant of institutional development, in the political, economic and cultural spheres. While these dynamic effects are likely to be slow to materialize, they feed back into trade relations over the longer term.

Part (a) looks at political institutions, such as the form of government. Part (b) focuses on economic institutions, such as the quality of the regulatory system. Part (c) examines cultural norms, such as those embedded in social values. Trade agreements are both political and economic institutions, in that they commit national policy makers and affect economic actors. For this reason, trade agreements are discussed throughout the entire section. Each sub-section begins with some evidence on the relationship between trade and institutions. The goal is not to have a thorough empirical analysis but rather to highlight some facts and correlations that can then be analysed in light of economic theory.

(a)   Political institutions

Political institutions shape economic interactions in two ways: first, they impose constraints on government activities; secondly, they influence the set of economic institutions that societies adopt. The economic literature has tended to focus, in particular, on the impact of the form of government and political borders on international trade. Form of government, defined by the extent of accountability, legitimacy, transparency and choice in a political system, may impact trade indirectly through economic development or directly by altering policy-makers' incentives to set trade policy. Similarly, political borders impact trade flows directly by increasing trade costs and indirectly by fragmenting the international political system.

(i)   Form of government

Democratic forms of government have been on the rise over the last half-century (Murtin and Wacziarg, 2012; Acemoglu, 2012), as has world trade. Much of this research uses data from the Polity IV Project to define and measure the form of government. The Polity scheme captures key qualities of political institutions and processes, including executive recruitment, constraints on executive action, and political competition. Individual ratings are combined into a single measure of regime governance – the "Polity score" – on a 21-point scale ranging from -10 (fully institutionalized autocracy) to +10 (fully institutionalized democracy). The measure examines concomitant qualities of democratic and autocratic authority in governing institutions, rather than discreet and mutually exclusive forms of governance. This perspective results in a spectrum of governing authority that spans "autocracies" (-10 to -6), mixed authority regimes or "anocracies" (-5 to +5), and "democracies" (+6 to +10).[155]

Figure C.52 shows that the correlation between more democratic forms of government, as measured by the "Polity score", and trade (measured as the total trade to GDP ratio) is strong and positive between 1962 and 2010.

A positive correlation between the value of imports and exports and a more democratic form of government can also be seen using a cross-section of countries in 2010 (see Figure C.53). While not shown in this report, a similar picture is evident for different years from 1962 onwards. However, if the ratio between total trade and GDP is used, rather than the value of imports and exports, the correlation (while still positive) appears to be weaker; possibly suggesting that richer countries are both more democratic and more open to trade.

The main conclusion from these figures is that countries which trade more tend to be more democratic on average, but this relationship is weak and not supported by a considerable number of individual country observations. These correlations also do not show that particular forms of government are a shaping factor of trade as the opposite could also be true – trade is a shaping factor of the choice of political systems. Moreover, both trade openness and the choice of a particular form of government could be driven by a third common factor, such as development levels. Economic analysis sheds some light on the determinants of this relationship.

A number of studies argue that more democratic regimes tend to have more liberal trade policies. The mechanism occurs through several channels. One argument is that less democratic governments are more easily "captured" by special interest groups that benefit from the economic rents associated with trade

Figure C.52: **Form of government and trade openness, 1962-2010**

Sources: Authors' calculation based on data from the Polity IV Project (http://www.systemicpeace.org/polity/polity4.htm), IMF and COMTRADE.

Note: Form of government as proxied by the Polity Score index. It ranges from -10 to 10. See text for more details.
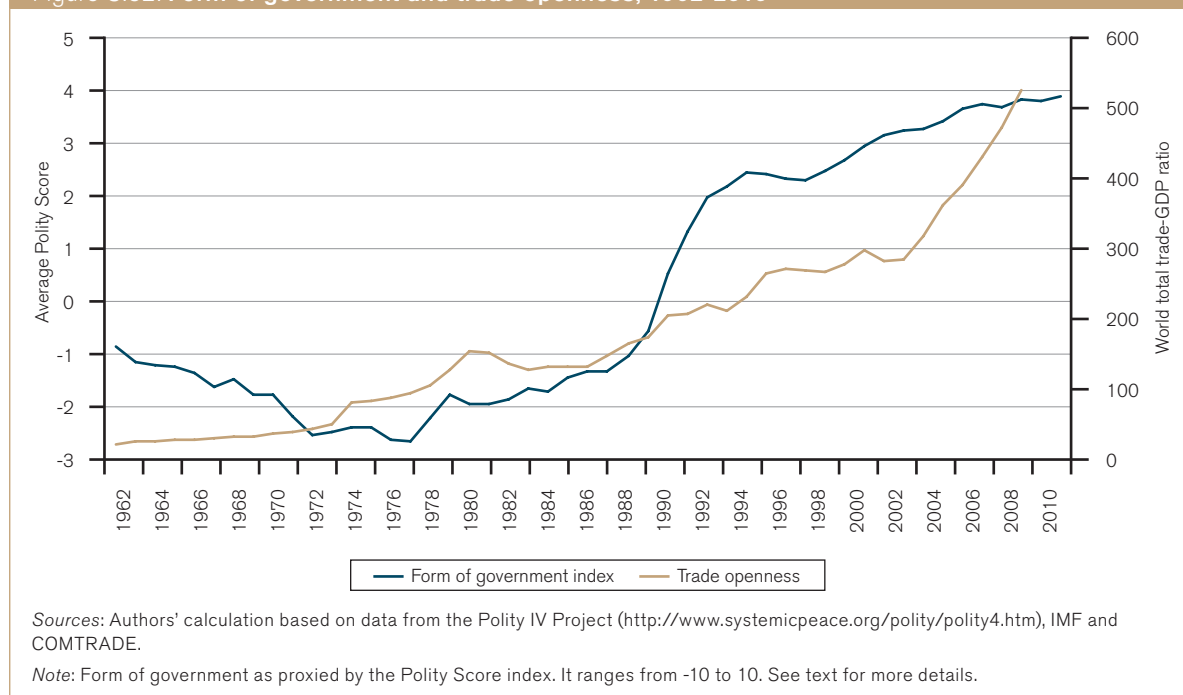
barriers. Another argument is that democratic governments are more likely to enter into trade agreements to signal to voters their commitment to open and stable trade policies.

Mansfield and Milner (2010) provide empirical evidence that the probability of a country signing a free trade agreement increases with its level of democracy. In addition, Mansfield et al. (2000) show that pairs of democratic countries establish lower trade barriers compared with pairs of countries that include an autocracy. Yu (2010) considers democracy in a standard gravity model and finds evidence consistent with the hypothesis that, on average, more democracy is associated with increased trade. Finally, the empirical results in Eichengreen and Leblang (2008) confirm that the relationship between trade and the form of government runs in both directions.

A related issue is how the transition from one form of government to another affects trade policy. From Figure C.54, it appears that the empirical relationship between trade policy and the form of government is not linear: the countries with the lowest and highest polity scores on average apply lower tariffs compared to countries with an intermediate polity score.[156] This fact may suggest that the transition towards more democratic regimes could lead to an initial surge in protectionism.

O'Rourke (2007) argues that the transition from more autocratic to more democratic regimes implies a transfer of power from a small ruling elite to the wider population. As a consequence, trade policies will change according to the preferences of the majority. In a standard Heckscher-Ohlin framework, one would

expect that more open trade policies should be observed in countries where the majority of workers gain from trade opening. Conversely, in countries where workers stand to lose from trade opening, a democratic transition might be expected to lead to an increase in trade barriers. The evidence from a sample of developed and developing countries between 1870 and 1914 confirms this basic theoretical insight. While this finding might help to explain why an intermediate level of democracy generates higher protectionism (see Figure C.54), it does not explain why further moves towards democracy result in lower protectionism. The transition to democracy has been the subject of a heated debate among social scientists in recent years. There is some anecdotal evidence that democratic reforms lead to an initial deterioration of economic policy and result in poor economic outcomes and instability (at least in the short run). The evidence in Rodrik and Wacziarg (2005), however, appears to reject the notion that nascent democracies systematically under-perform more autocratic regimes and more established democracies.[157]

Another possible explanation for the weak positive correlation between trade and more democratic forms of governments observed in Figures C.52 and C.53 runs in the opposite direction. A number of studies show that the effect of trade on the form of government is influenced by the changes in relative wealth and power among social groups. Acemoglu and Robinson (2006) provide a theory that explains how globalization affects the transition to and consolidation of more democratic regimes. The mechanism through which trade influences the political regime is a change in factor prices triggered by trade opening. They observe that poorer countries are typically less democratic (or

more easily subject to authoritarian coups) and relatively more abundant in labour. Trade opening leads to an increase in wages in poorer countries, leading to convergence in incomes and a decline in "class conflict". This, in turn, acts on the political structure because a smaller income gap between rich and poor decreases the demand for highly redistributive policies, thus making more participatory forms of government less costly for the elites.

Puga and Trefler (2012) analyse the effects of increasing trade in medieval Venice. They argue that long-distance trade allowed merchants to accumulate wealth and to impose constraints on the executive, eventually triggering a switch from a monarchy to a more liberal political system. Both studies, however, point out that the causal relationship between trade and forms of government is ultimately a question of degree. In the case of medieval Venice, the class of

merchants that imposed constraints on the absolute power of the executive later used their resources to block political competition by demanding hereditary parliamentary participation. The cross-country evidence on the impact of trade openness on the form of government is not conclusive. Rigobon and Rodrik (2005) and Milner and Mukherjee (2009) find that the relationship between trade openness and more democratic forms of government is either negative or weak, in particular for developing countries. However, López-Córdova and Meissner (2008) find that, while no relationship exists in the short run, a positive impact of trade on more representative forms of government can be detected in the long run.

A separate argument is that trade-related institutions may decrease the opportunity for rent seeking. Liu and Ornelas (2012) analyse the role played by preferential trade agreements (PTAs) in shaping domestic political

Figure C.53: **Form of government and imports/exports, 2010**
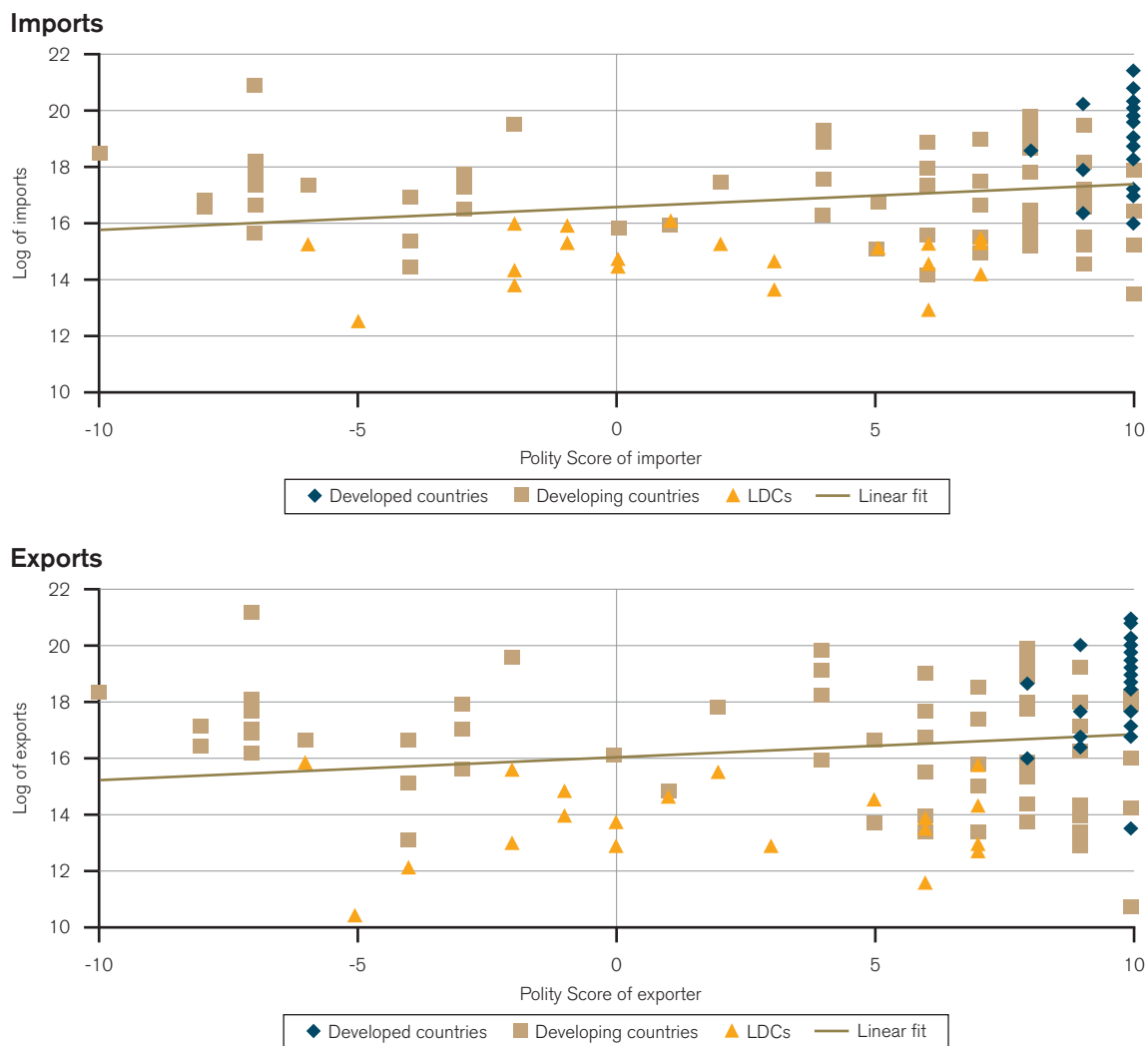
Source: Authors' calculation based on data from the Polity IV Project (http://www.systemicpeace.org/polity/polity4.htm) and COMTRADE.

Note: Imports and exports measured as the natural logarithm of the value of trade in thousand US$. Form of government as proxied by the Polity Score index. It ranges from -10 to 10. See text for more details.

Figure C.54: **Form of government and average tariffs, 2010**

Source: Authors' calculation based on data from the Polity IV Project (http://www.systemicpeace.org/polity/polity4.htm) and TRAINS.

Note: Form of government as proxied by the Polity Score index. It ranges from -10 to 10. See text for more details.
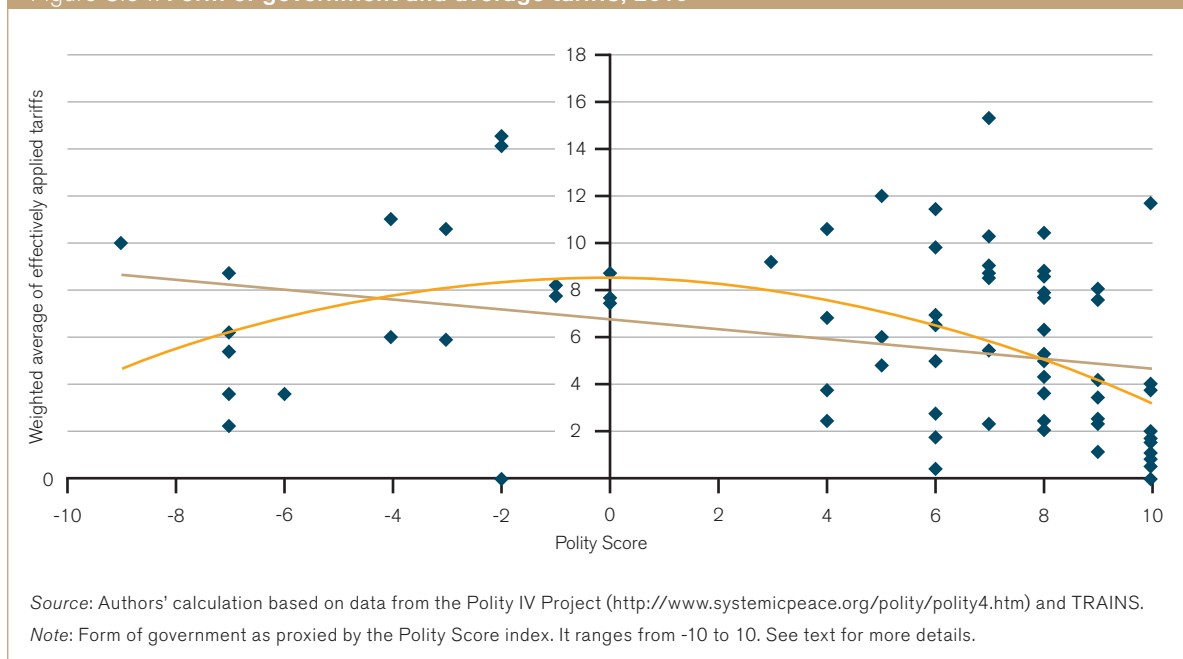
institutions through this mechanism. In particular, they show that participation in PTAs works as a commitment which helps governments to resist future pressures for protectionism from lobby groups. Therefore, organized groups seeking political power for economic gain have a lower incentive to do so if a country is "tied" by a PTA. In unstable democracies, the government has a particularly strong incentive to sign PTAs and thus weaken the position of organized groups trying to displace the incumbent. The authors find empirical support for a positive correlation between participation in PTAs and the longevity of more representative regimes.

(ii)   Political borders

International politics can have an impact on trade in a number of ways. The breakdown of international relations between the two world wars, for example, was associated with a dramatic fall in trade flows during this period. Likewise, trade flows and commercial interests can help to shape the evolution of the world's political map, as shown by the age of European colonialism beginning in the 1500s (O'Rourke and Findlay, 2007). The following sub-section focuses on how trade interacts with the Westphalian system, the political order that was born in Europe with the Treaty of Westphalia in 1648 and that gradually extended to encompass most of the world. At the core of the Westphalian system is the sovereign nation state delimited by clearly defined political borders. The question addressed here is "how does international trade and national sovereignty interact?"

The number of sovereign countries has dramatically increased over the last century, from 58 in 1904 to 196 today, with most of this increase taking place

since the Second World War. One line of research argues that political fragmentation and a significant expansion in political borders increase transaction costs, and this negatively affects trade. The bulk of the literature focuses on measurements of the "border effect", which is found to be sizeable.

In a ground-breaking paper, McCallum (1995) investigates the trade effect of the border between Canada and the United States using standard gravity equation techniques. Even though the two countries share a common language, similar legal systems and other characteristics that might render the border separating them as inconsequential, McCallum (1995) finds that the border reduces trade by a factor of 22. That is, trade between Canadian provinces is estimated to be 2,200 per cent higher than trade between Canadian provinces and US states.

Subsequent work by Anderson and van Wincoop (2003) finds that the trade effect of political borders is smaller than the finding of McCallum (1995) but still sizeable. Specifically, their estimates suggest that the border separating Canada and the United States reduces trade by 44 per cent, while borders among industrialized countries more broadly have a negative impact on trade of about 30 per cent. Finally, a recent paper by Redding and Sturm (2008) examines Germany's separation into two states after the Second World War and its reunification in the 1990s to determine the trade and development impact of changing borders. They find that the imposition of the East-West border had a large negative impact on economic activity (for instance, as measured by population growth) in towns closest to the new border by reducing market access.

While borders have a negative impact on trade, Figure C.55 shows a positive correlation between trade openness and the number of sovereign countries over time (and, hence, the number of borders). Clearly, the statistical volume of international trade increases by definition when a new sovereign nation is created (a fraction of what was measured as internal trade becomes international as a result of the creation of a new border, as discussed in Section B.2(a)). However, the relationship between the number of countries and trade openness is still positive when the latter is measured by the level of the average tariff (Alesina et al., 2000). This positive correlation suggests that an increase in trade itself may have an impact on political borders and the number of sovereign countries.

Trade openness often involves a reshaping of sovereignty, while political borders may also change in nature as well as in number. The increasing role of regional organizations, such as the European Union or the Association of Southeast Asian Nations (ASEAN), is one example. Expanding membership in the WTO, and its enhanced role in international trade dispute settlement, is another example. Figures C.56 and C.57 provide some insights into this.

Figure C.56 shows a strong positive correlation between the number of sovereign countries and the number of preferential trade agreements (PTAs). The large surge in the number of sovereign countries in the past 50 years appears to precede the formation of new PTAs. Furthermore, Figure C.57 indicates that the nature of these agreements has changed over time, with deeper forms of agreements becoming more prominent, particularly when countries engage in shared, cross-border production.[158]

A limited economic literature helps to explain these apparently conflicting facts (Alesina and Spolaore, 2003; Ruta, 2005). The studies find that economic integration changes the costs and benefits of national sovereignty, releasing centrifugal and centripetal forces. On the one hand, trade openness promotes political fragmentation. In a world of trade restrictions (at their maximum in a world where countries do not trade), large nations enjoy economic benefits because political borders determine the size of the market and the extent of economies of scale. Economic gains create incentives for political integration. However, with more open trade, the extent of the market is no longer restricted by political borders. The economic incentive for political integration wanes, and cultural, linguistic and ethnic groups within countries may choose to form smaller more homogenous sovereign states (Alesina et al., 2000).

On the other hand, trade openness requires deeper forms of institutional integration which create centripetal forces. Economic theory makes two compelling arguments that substantiate this point. First, a number of authors argue that markets need non-market institutions (political, legal and social) for their proper functioning (Casella, 1996; Padoa-Schioppa, 2001; Rodrik, 2000). These non-market

Figure C.55: **Number of countries and trade, 1962-2012**

Sources: Authors' calculation based on data from COMTRADE and Alesina et al. (2000).
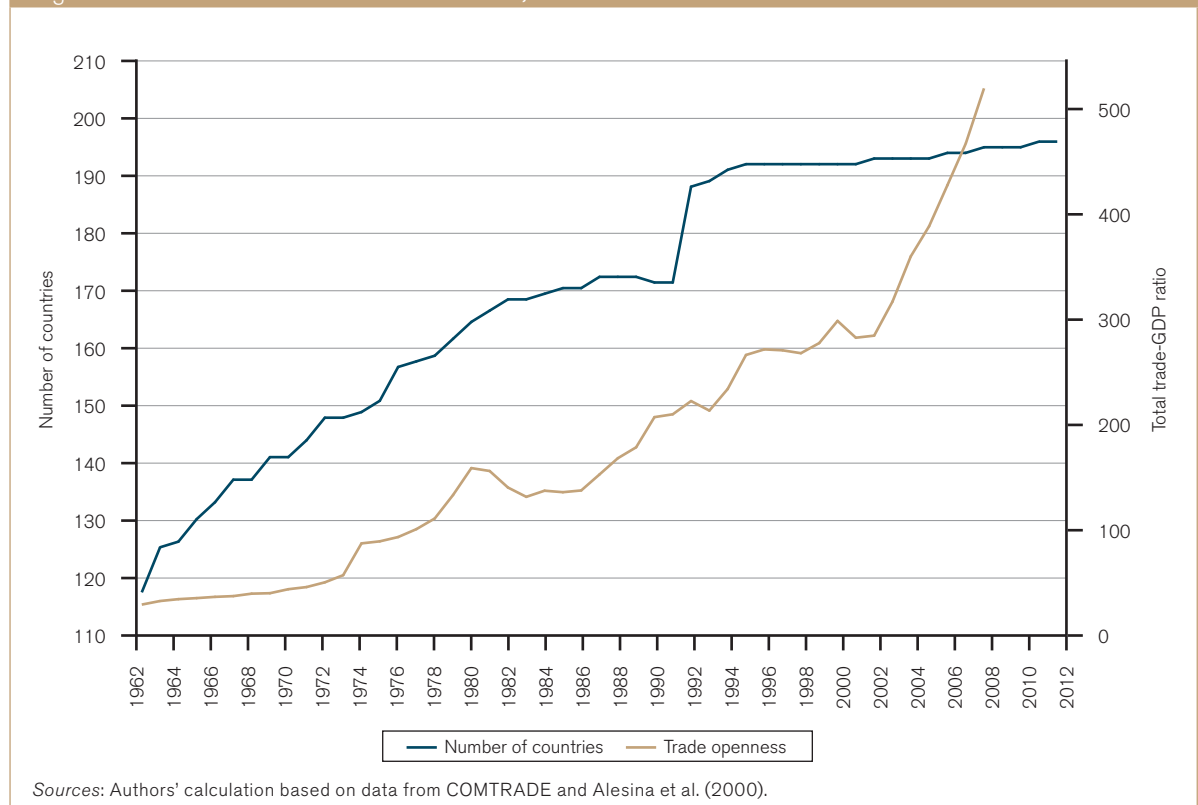
Figure C.56: **Preferential trade agreements (PTAs) and number of sovereign countries, 1950-2011**

Sources: Authors' calculation based on data from Alesina et al. (2000) and WTO Secretariat.
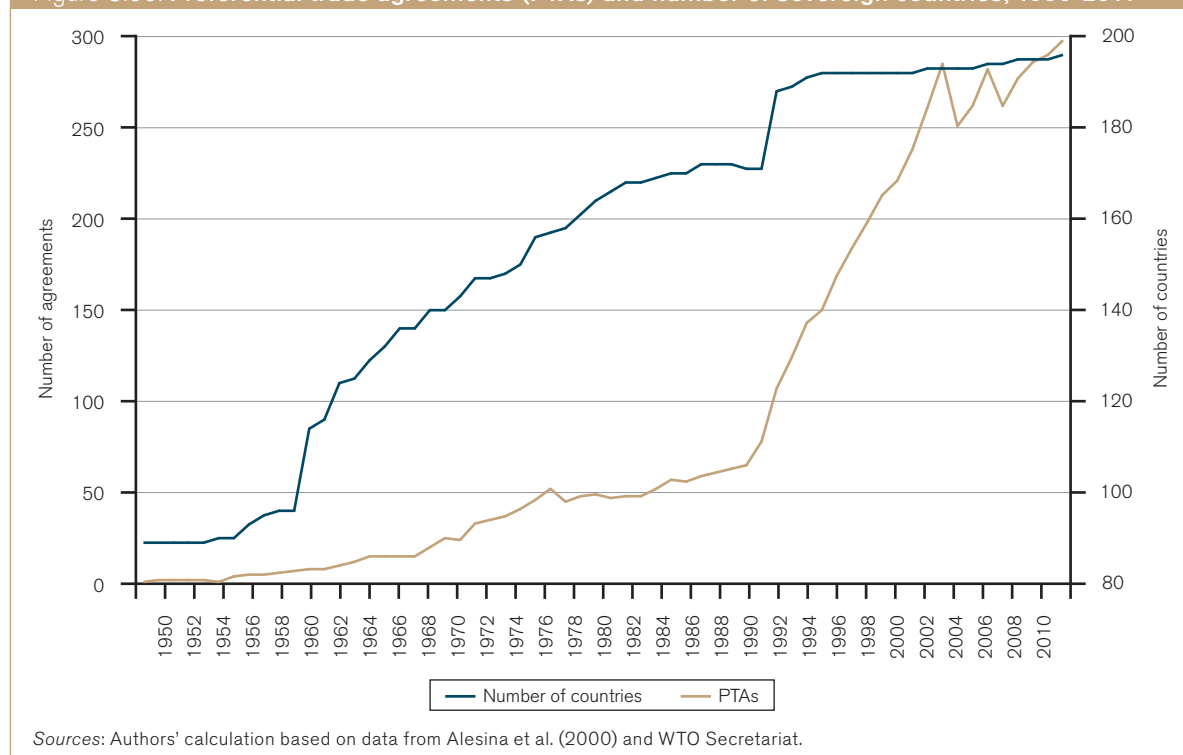
institutions are essentially public goods that markets fail to provide. Others make the point that trade openness increases the impact of trade policy on other countries, rendering unilateral decision-making inefficient compared with cooperative decision-making (Broner and Ventura, 2011; Epifani and Gancia, 2007; Brou and Ruta, 2011). The coexistence of competing centripetal and centrifugal economic forces contributes to explaining the reshaping of sovereignty/political borders described above.

An example of the dual relationship between trade and sovereignty is the new momentum that deep economic agreements have gained since 1990. As the 2011 World Trade Report (WTO, 2011a) notes, the changing nature of international trade (and, specifically, the rising importance of global supply chains) is related to the rise of deeper forms of integration. The first is both a cause and a consequence of the latter. The expansion of production networks is driving the proliferation of deep agreements that aim at filling a governance gap in areas, such as competition policy, investment and product regulation, which are essential for the smooth functioning of these networks. For these same reasons, governments undertake commitments in these policy domains that often impose constraints on national sovereignty and effectively make the political borders more porous. At the same time, deep agreements are a shaping factor of foreign investments flows and outsourcing as the institutional environment is a determinant of firms' economic decisions. This issue is discussed in more detail in the next sub-section.

(b)   Economic institutions

Economic institutions – especially the quality of regulations and the rule of law – provide a critical structure for economic interaction. According to the Worldwide Governance Indicators (2011), regulatory quality "reflects perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development". In the same way, the rule of law index "reflects perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence".

Clear, stable and enforceable rules are fundamental to international trade relations as they limit uncertainty by creating a framework within which economic exchange takes place. Moreover, economic institutions may shape trade flows by influencing the comparative advantage of countries. The following sub-section attempts to uncover the determinants of the relationship between trade and economic institutions.

(i)   *Stronger institutions promote trade*

How do economic institutions relate to international trade? The evolution of the average levels of the rule of law and regulatory quality across all countries does not show a clear pattern. Both measures of institutional quality decreased in the last half of the 1990s and improved in the following decade, returning

Figure C.57: **Trade in intermediate goods and "depth" of preferential trade agreements, 1958-2011** (thousands of US$)

Sources: WTO Secretariat and Orefice and Rocha (2011).

Note: The depth of PTAs is constructed considering the ten most important provisions using principal component analysis. See Orefice and Rocha (2011) for more details.
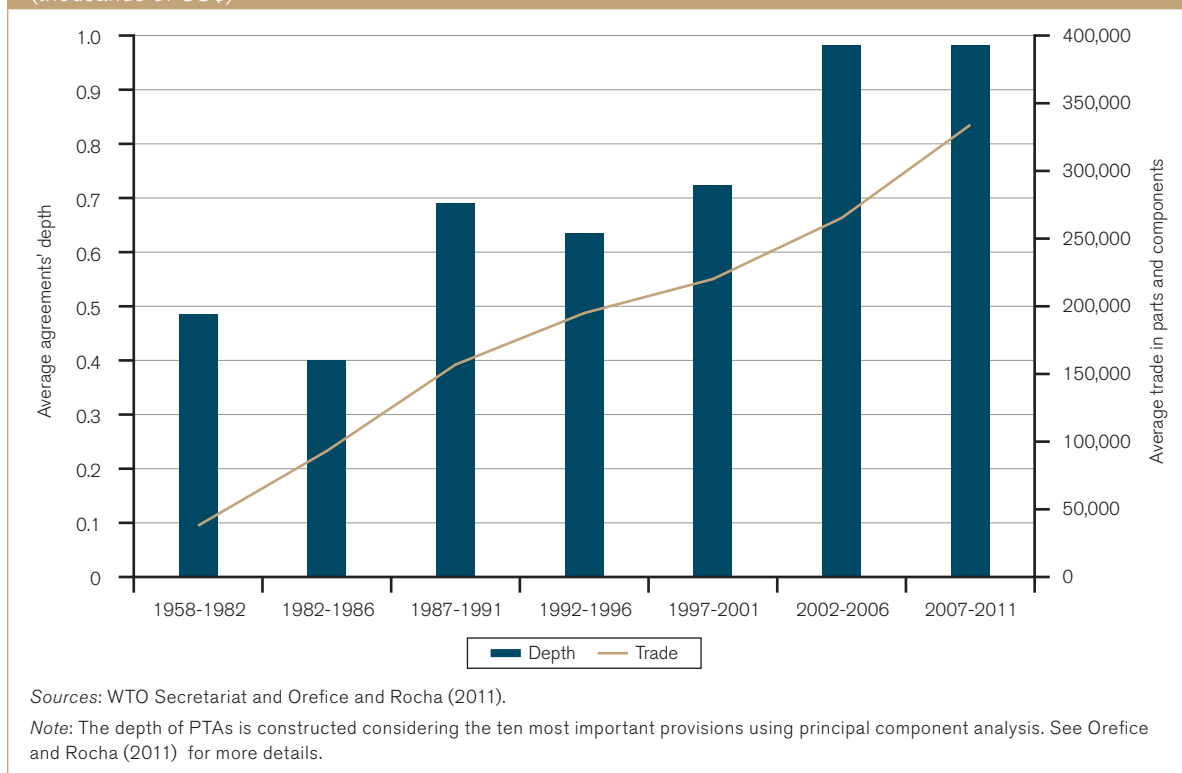
approximately to the 1990 level by 2010. Over the same time period, however, world trade increased, with the exception of the 2008-09 fall after the global financial crisis. However, this lack of any obvious positive relationship at the aggregate level can be deceiving. Figure C.58 shows the pattern of exports, rule of law and regulatory quality for best-performing exporters, i.e. for the sample of countries that registered the highest increase in exports between 1996 and 2010.[159] The growth of exports in these countries was accompanied, on average, by significant improvements in economic institutions, as measured by the two indices. Cross-country evidence for 2010 reported in Figure C.59 also confirms this positive relationship between trade openness, regulatory quality and rule of law.

Why are the quality of economic institutions and trade positively related? As already observed for political institutions and trade, the relationship runs in both directions. Property rights, efficient regulations and the rule of law allow economic actors to establish a trade relationship in which rules and individual positions are clearly understood. These institutions create incentives to exchange goods and services as they reduce transaction costs associated with uncertainty and lack of transparency. Available empirical evidence confirms the importance of this channel.

Examining the effect of corruption and imperfect contract enforcement on trade, Anderson and Marcouiller (2002) find that improvements in the quality of institutions lowers the price of traded goods and increases trade flows. They also find that institutional quality can be an alternative explanation for why high-income, capital-abundant countries trade disproportionately with each other rather than with low-income, labour-abundant countries. Indeed, they argue that efficient economic institutions in high-income countries lower the transactions costs of trading with each other relative to trade with developing countries.

At the same time, trade openness can have an impact on economic institutions in various and sometimes conflicting ways. A number of studies point out that economic institutions are inter-linked with changes in the economy. Contract enforcement and the protection of property rights, for example, can depend on a variety of factors, such as governments' incentives to act and economic actors' incentives to respect the rules. Changes in relative prices brought about by international trade are likely to influence these incentives and hence shape institutions (Copeland and Taylor, 2009; Anderson, 2008).

Consider a country with weak protection of property rights that is relatively abundant in forestry resources. As the price of forestry products increases with trade openness, poachers may be tempted to extract more forest products but the government also has an incentive to better monitor and manage an increasingly valuable resource. Copeland and Taylor (2009) offer various examples of how trade opening had either a

Figure C.58: **Exports and the quality of economic institutions in the best-performing exporters, 1996-2010**

Sources: Authors' calculation based on data from WGI and COMTRADE.

Note: Average exports are measured as the natural logarithm of the value of exports in thousands of US$. Rule of law and regulatory quality are indices ranging from -2.5 to 2.5.
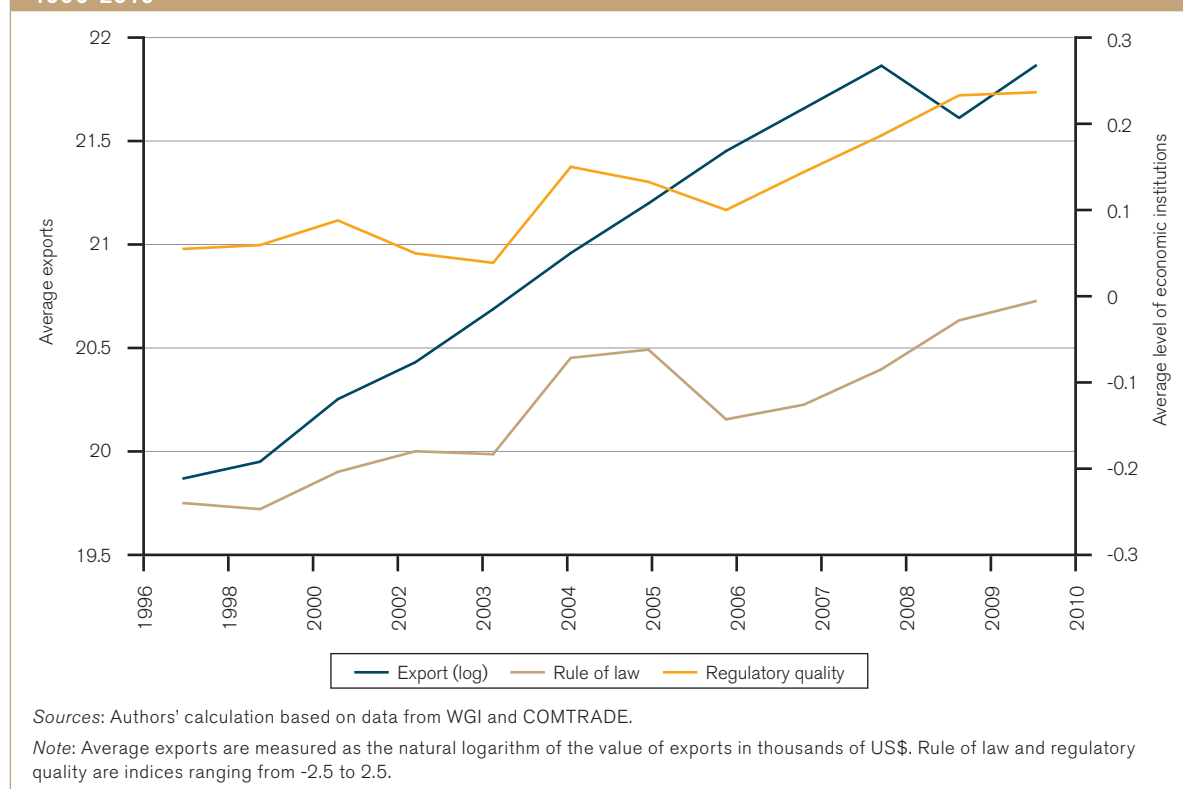
positive or negative impact on the effective protection of property rights.

Trade can also have an impact on economic institutions through more indirect channels. In the previous sub-section, it was shown how trade opening can influence the relative economic power of different social groups and thus formal political institutions that evolve. As economic institutions are established and reformed through political processes, changes in political institutions and organizations will clearly matter (Greif, 2006).[160]

Acemoglu et al. (2005) suggest that the effect of trade on economic institutions depends, especially, on initial political conditions. They argue that the varying growth patterns among European countries after 1500 are explained by how the increase in transatlantic trade affected economic reforms. In countries with more open political systems, such as Great Britain and the Netherlands, the increase in Atlantic trade strengthened and enriched merchant groups who obtained important reforms, including better protection of property rights. This, in turn, paved the way for sustained economic growth. Similar changes in economic institutions did not take place in countries that had weaker checks and balances on the monarchy, such as Spain and Portugal. This finding suggests an important and complex interaction between trade openness, political institutions and economic reforms.[161]

(ii) Institutions create comparative advantage

Economic institutions can also be a source of comparative advantage. Countries with better institutions specialize in industries for which the existence of stable and reliable institutions is more important. Figure C.60 shows a positive cross-country correlation between the rule of law and the share of exports in sectors with high institution-intensity. As discussed in more detail below, the indicator for institutional intensity measures the proportion of intermediate inputs that require relation-specific investments for each industry (Nunn, 2007): the more complex the production process required to use these intermediate inputs, the more it is reliant on strong institutions.

Economic theory and empirical evidence confirm that a country's institutional framework, in addition to its technological level or relative factor abundance, is a source of comparative advantage. Recent literature emphasizes in particular the role of cross-country differences in contract enforcement – and therefore in the degree of contract incompleteness – in shaping trade patterns (Levchenko, 2007; Nunn, 2007).

The relative need for contract-dependent inputs varies widely across sectors. For example, the automotive industry is more institution-dependent than flour milling. In fact, most of the intermediate inputs involved in automotive production are designed for a particular model and cannot be used by different car producers.

Figure C.59: **Trade openness and institutional quality, 2010**

Regulatory quality
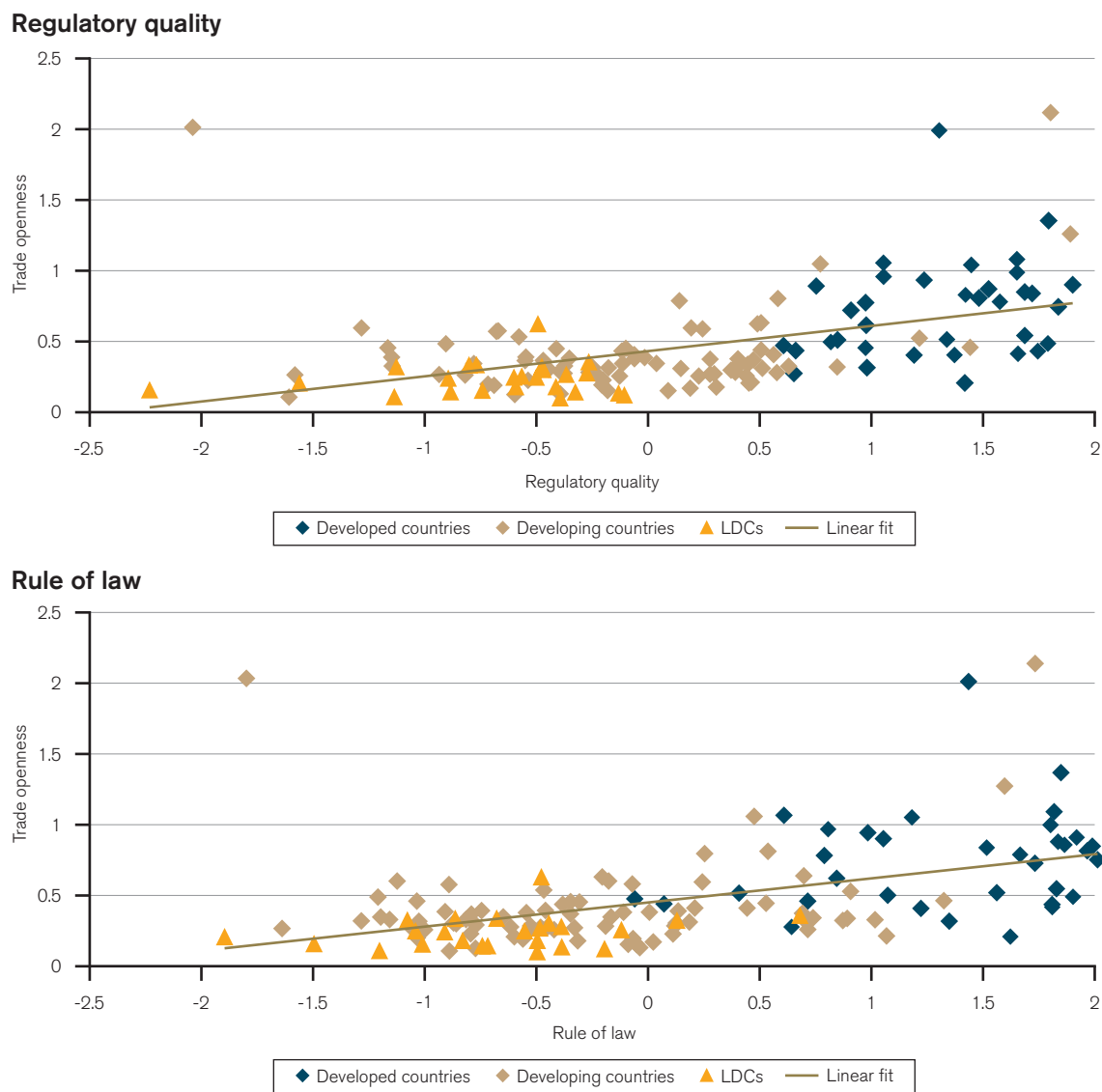
Rule of law

Sources: Authors' calculation based on data from WGI and COMTRADE.

Note: Rule of law and regulatory quality are indices ranging from -2.5 to 2.5.

In contrast, flour production requires mainly cereals that are exchanged and priced in uniform markets. Better economic institutions reduce the inefficiencies associated with contract incompleteness, which in turn will have a disproportionate impact on costs in sectors that require more contract-dependent inputs, such as the car industry. One implication is that countries with better economic institutions are more likely to have a comparative advantage in these sectors.[162]

A study by Nunn (2007) offers a convincing test of whether countries with stronger contract enforcement specialize in the production of goods for which relation-specific investments are most important.[163] He shows that the average contract intensity of exports at the country level is positively correlated with different measures of the quality of economic institutions, including judicial efficiency and contract enforcement. At the country-industry level, countries with better

contract enforcement specialize in industries where relationship-specific investments are most important.

The development of financial institutions also helps to determine trade patterns. Beck (2002) shows that economies with more developed financial sectors have a comparative advantage in manufacturing industries. Examining 65 countries over a 30-year period, he shows that financial development exerts a large impact on the level of both exports and the trade balance of manufactured goods.

Svaleryd and Vlachos (2005) find that the financial sector is a source of comparative advantage consistent with the Heckscher-Ohlin-Vanek model. Countries with well-functioning financial systems tend to specialize in industries that are highly dependent on external financing. They find that differences in financial systems are more important determinants of

Figure C.60: **Rule of law and comparative advantage, 2010** (share)

Source: Authors' calculation based on data from WGI and Nunn (2007).

Note: Rule of law is an index ranging from -2.5 to 2.5.
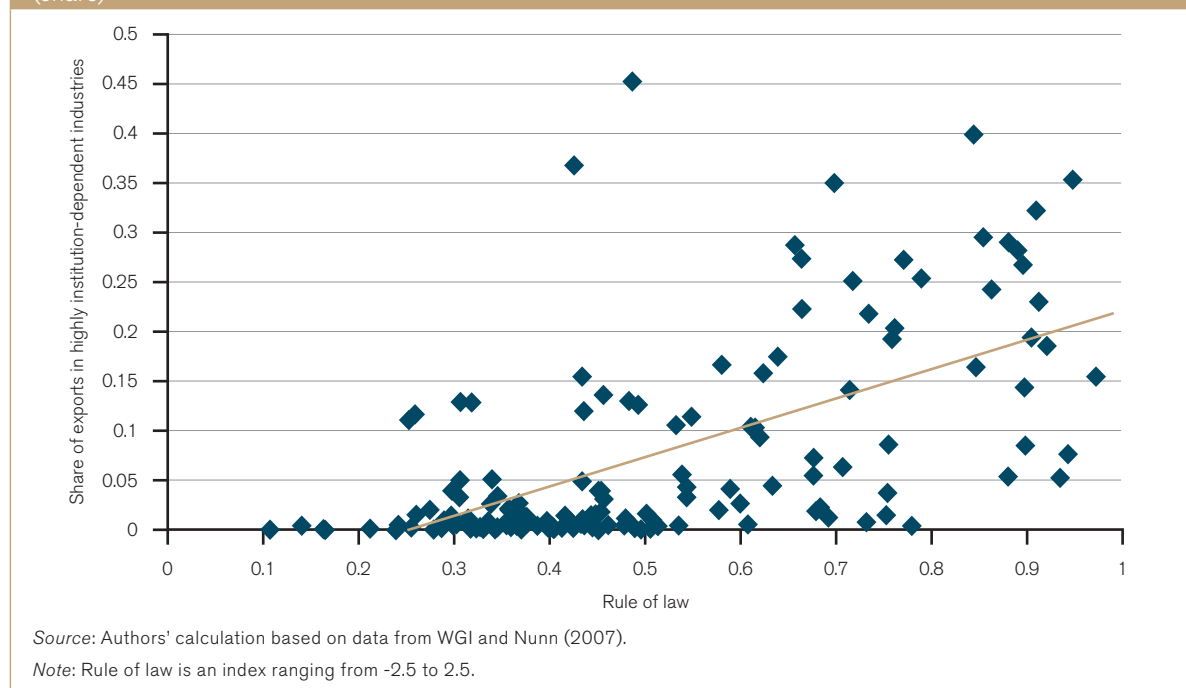
specialization among OECD countries than differences in human capital. Weak financial institutions result in larger transaction costs and other "financial frictions". These frictions also affect the volumes of trade by distorting firms' production decisions and entry into international markets.

Manova (2008b) shows that countries with weak financial institutions export fewer varieties to fewer destination markets, thus registering lower aggregate trade volumes. These distortions are amplified in financially vulnerable sectors that need more outside capital and that have fewer assets that can be collateralized. Ferguson and Formai (2011) show that countries with more developed financial systems export disproportionately more in sectors that produce complex goods and that have a high propensity for vertical integration.[164]

(iii) Institutions and the changing nature of trade

Another important issue is the association between countries' economic institutions and trade policies (including regulations, protection of intellectual property rights, and investment). Figure C.61 plots the correlation between the rule of law and average tariffs across countries in 2010. The relationship is negative, suggesting that countries that have better contract enforcement also tend to have lower tariffs. A similar negative correlation can be found between the quality of the regulatory system and tariffs.

Figure C.62 shows the relationship between economic institutions and deep preferential trade agreements.

The relationship appears to be less pronounced than the correlation between rule of law and average tariffs but the figure still shows a positive association between countries' international commitments and their domestic enforcement capacity.

What factors could explain this relationship between trade policies and economic institutions? One compelling argument is that it is shaped by the changing nature of trade and the growing importance of cross-border production (see Section B.2(e)).

The emergence of opportunities to participate in global supply chains lowers incentives to impose trade barriers. As noted by Baldwin (2010b), rather than building their own supply chains behind tariff walls over several decades, the ICT revolution allows developing economies to set up manufacturing facilities in a matter of months by joining in supply chains. In this context, tariffs and other trade-related policies that were conceived to promote import substitution become outdated. Domestic economic institutions, however, interact with the changing nature of trade in complex ways.

First, whether joining supply chains can be a successful strategy for developing countries crucially depends on the strength of domestic economic institutions. The reason is that the quality of domestic institutions determines in which country firms choose to offshore (Grossman and Helpman, 2005). In developing countries with stronger contract enforcement, there will be more investment and the costs of producing intermediate inputs will be lower than in countries with poor institutions. Hence, tariff cutting and participation in deep preferential trade agreements is more likely to

Figure C.61: **Rule of law and average tariffs, 2010**
(percentage)
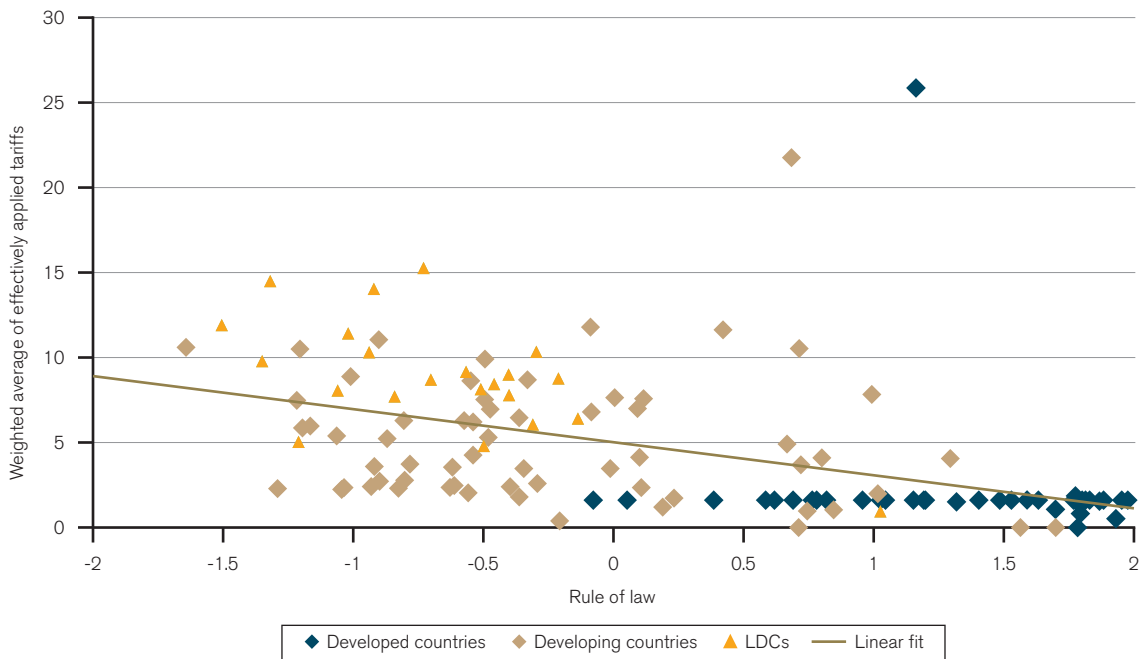
Sources: Authors' calculation based on data from WGI and TRAINS.

Note: Rule of law is an index ranging from -2.5 to 2.5.

Figure C.62: **Rule of law and "deep" preferential trade agreements, 2010**
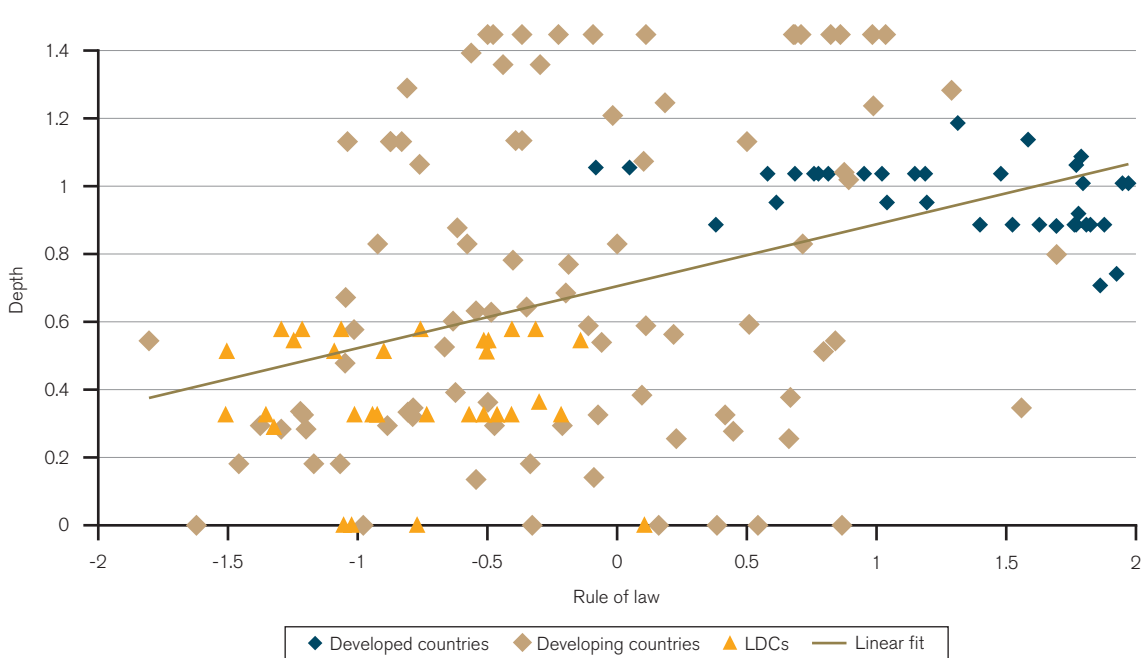
Sources: Authors' calculation based on data from WGI and WTO Secretariat.

Note: Rule of law is an index ranging from -2.5 to 2.5. The depth of PTAs is constructed considering the ten most important provisions using principal component analysis. See Orefice and Rocha (2011) for more details.

characterize the first rather than the latter group of countries, in line with the discussion above.

Secondly, the quality of the institutional framework is an important determinant of firms' choice to integrate a

particular production stage or to outsource it. Consider the case where a firm in an advanced economy has to decide whether to outsource or to integrate the production of an intermediate input in a developing country. If economic institutions in the developing

country are strong, contracts between suppliers of intermediate goods and the final good producer are more likely to be enforced. In addition to increasing the likelihood of offshoring, this implies that the strength of economic institutions affects the relative prevalence of FDI or foreign outsourcing (Antras and Helpman, 2004).

As recent evidence by Bernard et al. (2010) shows, better quality economic institutions are associated with a higher probability of offshoring. However, further strengthening of the institutional environment is associated with a relative decrease in FDI. As the authors argue, this is presumably related to the greater ease with which arm's length contracts can be written and enforced.

(c)   Culture

In addition to the formal institutions discussed above, informal institutions, such as social norms and conventions, impose constraints on and therefore influence human interactions. The multiple forms of codes of behaviour are often captured in a single word: culture. This sub-section highlights some basic facts about how differences in culture across countries are relevant to international trade. Simply put, it asks if cultural differences are a shaping factor of international trade.

The question of how international trade patterns relate to cultural differences and how this relationship evolves over time has not been of interest to economists only. In his well-known study *The Clash of Civilization and the*

Remaking of World Order, political scientist Samuel P. Huntington writes: "In the emerging world, patterns of trade will be decisively influenced by the patterns of culture. Businessmen make deals with people they can understand and trust; states surrender sovereignty to international associations composed of like-minded states they understand and trust. The roots of economic cooperation are in cultural commonality" (Huntington, 1996). The key hypothesis is that cultural identities will be a more prominent determinant of the pattern of trade and of trade agreements in the post-Cold War world.

Defining and measuring culture is not easy. Religion and language have often been used as a proxy for culture. However, each of these measures has some drawbacks. For instance, differences in religion as a measure of cultural differences has been criticized because religion has relatively more recent roots than the latter (Guiso et al., 2009). As a result, countries that have substantial cultural differences may share the same religion. For this reason, a number of recent economic studies use genetic distance as a proxy for differences in culture among countries.[165] Genetic distance measures the time since two populations have shared common ancestors. The assumption is that populations that share more recent common ancestors have had less time to diverge in a wide range of traits and characteristics, such as implicit beliefs, customs, habits, biases and conventions, which are transmitted across generations (Spolaore and Wacziarg, 2009a; 2009b).

Figure C.63 shows the correlation between total trade and cultural differences, as measured by genetic

Figure C.63: **Total trade and cultural differences, 1980-2011**
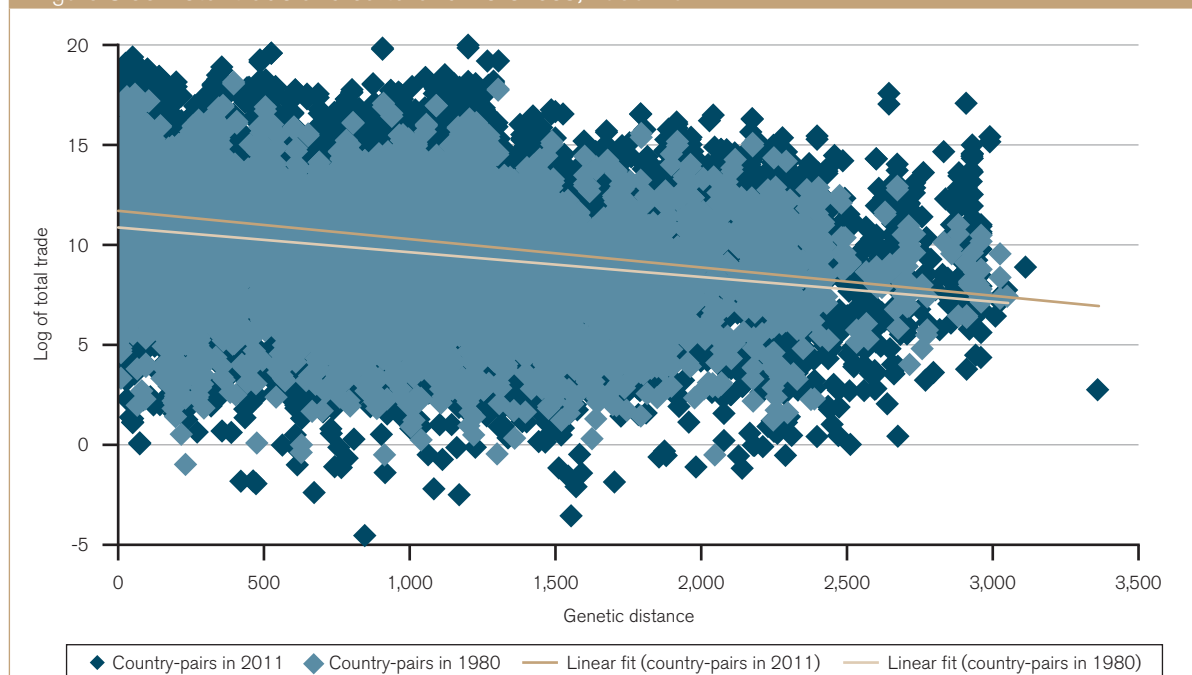
Sources: Authors' calculation based on data from Spolaore and Wacziarg (2009a) and COMTRADE.

Note: Genetic distance is used as a proxy for cultural differences. It measures how two populations are generally related to each other. The variable is an index between 0 and 10,000. It is constructed as a weighted average of a probability (between 0 and 1), weighted by the product of the shares of the population in percentage points (between 0 and 100) in any two countries. See text for more details.

distance. Each point in the figure represents a country-pair. The unconditional correlation is negative, meaning that on average countries that are more distant culturally trade less with each other compared with countries that share more similar cultural traits. Perhaps more surprisingly, it also shows that the relationship between trade and culture does not vary much over time. To the extent that a slight difference exists between international trade in 2011 and in 1980, cultural differences appear more relevant today than 30 years ago.

While Figure C.63 focuses on trade in final goods, Figure C.64 correlates cultural differences across countries (measured by genetic distance) and trade in intermediate goods. Trade in intermediate goods is a simple (if not fully accurate) proxy for the relevance of cross-border production networks. Also in this case, the correlation is negative and relatively constant across time, suggesting that cultural differences represent a cost in the development of global supply chains.

Why do cultural differences appear to negatively affect trade? Economics provides two overlapping answers. The first is that differences in informal institutions, such as cultural traits, are an implicit barrier to trade as they create transaction and information costs. The logical implication is that deeper cultural differences have a negative impact on trade. If this argument is correct, however, one should also expect that networks of people with similar cultural traits, but located in

different countries, should trade more. The available evidence supports this conclusion.

In particular, Rauch and Trindade (2002) examine how ethnic networks influence trade volumes. The study focuses on international transactions involving Chinese networks, the largest transnational network in the world. The authors find that the effect of Chinese networks is positive for all goods, and that it is stronger for bilateral trade in differentiated products, for which information frictions are likely to represent a more important barrier relative to undifferentiated goods.[166]

The second, and related, reason why cultural differences negatively affect international trade is trust. Trust is a crucial component in determining economic relationships, including trade relationships. Trust is particularly important in those societies where informal institutions, such as social norms, regulate economic exchanges between individuals. Guiso et al. (2009) provide evidence that trust is an important component in trade relationships. They show that cultural aspects, measured by religious, genetic and physical similarities, and by the history of conflicts, affect bilateral trust (and, hence, trade) between European countries.

However, the relationship between culture and trade is probably more complex than simple cross-country regressions may suggest. One reason is that over a long period of time, trade may shape cultural differences. For example, trade may act as a vehicle to increase or establish trust between culturally diverse

Figure C.64: **Trade in intermediate goods and cultural differences, 1980-2011**
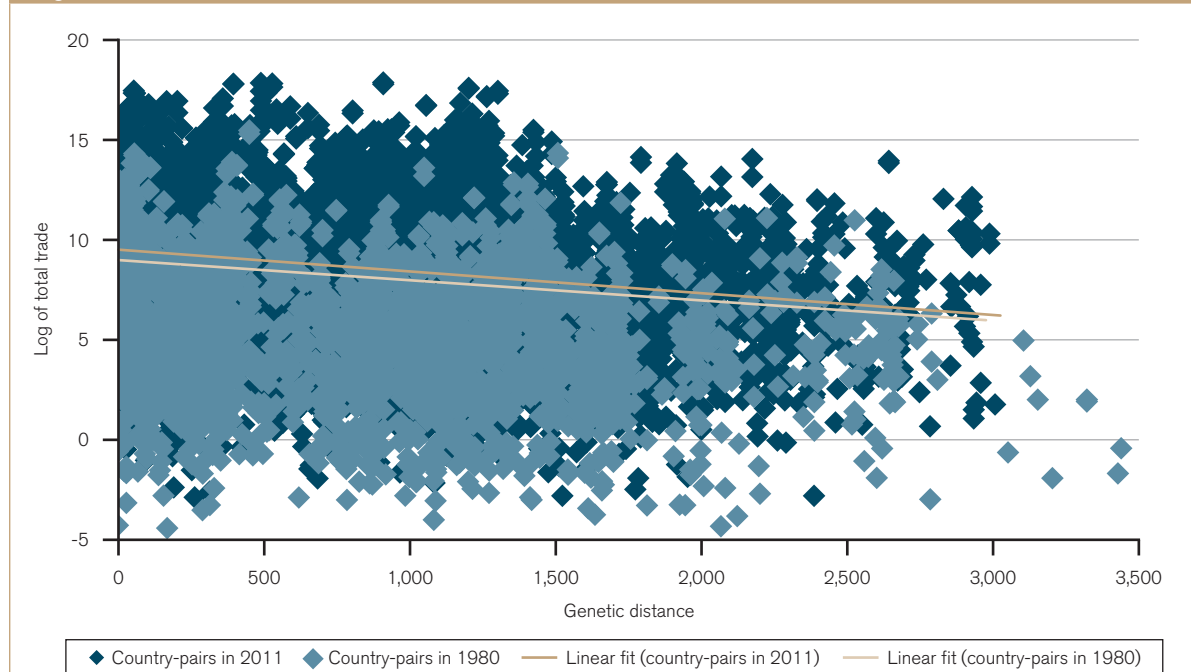
Sources: Authors' calculation based on data from Spolaore and Wacziarg (2009a) and COMTRADE.

Note: Genetic distance is used as a proxy for cultural differences. It measures how two populations are generally related to each other. The variable is an index between 0 and 10,000. It is constructed as a weighted average of a probability (between 0 and 1), weighted by the product of the shares of the population in percentage points (between 0 and 100) in any two countries. See text for more details.

Figure C.65: **Cultural differences and "deep" preferential trade agreements, 1958-2011**

Sources: Author's calculation based on data from Spolaore and Wacziarg (2009a) and WTO Secretariat.

Note: Genetic distance is used as a proxy for cultural differences. It measures how two populations are generally related to each other. The variable is an index between 0 and 10,000. It is constructed as a weighted average of a probability (between 0 and 1), weighted by the product of the shares of the population in percentage points (between 0 and 100) in any two countries. See text for more details. The depth of PTAs is constructed considering the ten most important provisions using principal component analysis. See Orefice and Rocha (2011) for more details.

agents (Tabellini, 2008).[167] Moreover, cultural differences may not only work as a trading cost but also as a trading advantage. Like formal institutions, they can be a source of comparative advantage.

Greif (1994) offers a theoretical framework in which cultural factors determine institutional structures, which in turn have an impact on the economic development and trade patterns of different societies. By comparing the Maghrebis and the Genoese roles in Mediterranean trade during the 11th and 12th centuries, the author argues that collectivist and individualist cultural beliefs shaped the institutional background in which the two traders' groups operated, leading to different patterns of trade and economic success.

One puzzling aspect of Figures C.63 and C.64 is the comparison of the relationship between cultural differences and trade in final and intermediate goods, respectively. To the extent that trade in intermediate goods captures trade in parts and components and, more generally, the importance of cross-border production between pairs of countries, one would expect that cultural differences matter more than in trade in final goods. Cultural differences are likely to be associated with different formal institutions and, other things being equal, to discourage offshoring. However, while in both charts the relationship is negative, trade in intermediate goods appears to be less – rather than more – affected by cultural differences. At first sight, this finding is at odds with basic economic intuition.

A possible explanation for why cultural differences do not appear to provide a formidable barrier to trade in intermediate goods is that states often cooperate to overcome these barriers. Put differently, formal institutions such as deep preferential trade agreements may "compensate" for the implicit trade costs created by cultural distance and divergent domestic institutions. Some evidence supporting this possibility is provided in Figure C.65.

It indicates that deeper agreements are entered into by countries that, on average, have different cultures. One explanation is that culturally distant countries are less likely to have similar formal institutions in areas such as intellectual property rights or investment that are essential to the successful development of cross-border value chains. For these countries, deeper trade agreements serve as a substitute for poor or divergent domestic institutions and may be a necessary prerequisite for taking advantage of the gains from international production.

An intriguing question is whether the Huntington hypothesis – which predicts that cultural diversity would matter more in the post-Cold War era compared with the Cold War period – is supported by the data. A recent study offers an affirmative response. Gokmen (2012), using different measures of culture, including religion, ethnicity, language, civilization and genetic distance, finds that culture affected trade more following the end of the Cold War. However, the observation that the depth of economic agreements between countries is

positively correlated with their cultural distance counters Huntington's view that a shared culture is a prerequisite for economic cooperation.

(d)   Conclusion

This section makes two key points. First, the institutional framework is an important shaping factor of trade, along with traditional factors such as technology and endowments. Secondly, the relationship between institutions and trade is complex because of the two-way nature of how one influences the other.

Institutions are a shaping factor of trade. Domestic political institutions and the international political map affect how trade and trade-related policies are set and negotiated. Stronger economic institutions facilitate international commerce and influence trade patterns, as they represent a source of comparative advantage and a determinant of firms' offshoring decisions. In addition, differences in culture can create transaction costs that may limit commercial relationships. In the coming years, institutions will continue to be an important shaping factor of trade. This is because institutions are likely to affect the flows of intermediate goods in global supply chains even more than flows of final goods. In light of this, governments are likely to pay even more attention to reforming domestic and international institutions in the near future as a way of reducing transaction costs, gaining comparative advantage in sectors with higher value-added, and linking to international production networks

Institutions, however, are also shaped by international trade. Economic integration is associated with changes in domestic political institutions and with the reshaping of sovereignty. Trade also creates incentives to improve the quality of economic institutions. The increasing importance of cross-border supply chains is a driver of deep preferential trade agreements, in part because governments need to address the new cross-border policy spillovers created by the internationalization of production. Finally, trading relationships contribute to building trust between diverse communities and are vectors for cultural influence. Institutions that shape human interactions tend to be more persistent than economic forces, such as international trade. This inconsistency between the reach of markets and the reach of regulators must be a fundamental policy concern in coming years.

What does this complex relationship between trade and institutions imply for the WTO? On the one hand, certain aspects of this relationship reinforce the multilateral trading system. As stronger commercial ties create incentives to adopt more efficient economic institutions and reinforce trust and cooperation across countries, global trade policy-making may flourish. On the other hand, there are important reasons for concern.

First, while trade openness can encourage domestic political and institutional reform, the transition may initially lead to a surge in protectionist incentives. Long-term policy commitments are needed to keep these self-defeating temptations in check. Secondly, economic integration is reshaping sovereignty but the central actors in existing global organizations remain nation states. The growing number of countries in the international system makes it more difficult to cooperate and to reach meaningful agreements. The WTO already provides a role for regional organizations (notably the European Union as a WTO member) but this role could be further promoted.

Thirdly, weak economic institutions can be a reason for inefficient specialization and the inability to join global supply chains, especially for developing countries. Deep preferential trade agreements can be an instrument to help overcome these barriers. In addition, aid programmes aimed at promoting trade should continue to focus on building institutional infrastructure. Finally, the proliferation of deep preferential trade agreements is in part an efficient response to the changing nature of trade. However, the risk of segmenting markets can be an unintended consequence of these arrangements. Improving coherence between multilateral and preferential trade systems is necessary to avoid discrimination among trading partners. These issues will be further taken up in Section E.

7.   Conclusions

This section has looked at a number of factors – demography, investment, technology, natural resources, transportation and institutions – and asked how each one is likely to shape the future of international trade. These concluding reflections will examine what implications they hold for individual countries or country groups.

Developing countries

One of the biggest stories of the past 20 years has been the successful integration of many developing countries into the global economy and their emergence as key players in international trade. Developing countries are diverse in the quality of their political and economic institutions but there are strong reasons to believe that "better" institutions give countries a competitive advantage and produce better trade outcomes. It is not clear, however, whether developing country growth will continue at the same rapid pace or taper off. Improving the quality of institutions would provide developing countries with a way of ensuring that growth continues.

A rapidly ageing population means that a key source of China's comparative advantage – its workforce – which fuelled its rapid economic rise could diminish.

At the same time, China is undergoing a process of rapid capital accumulation. If this momentum continues, China could shift the source of its comparative advantage in the direction of more capital-intensive exports. A similar process is under way in other developing countries, such as Chile and Turkey, which have seen rapid capital accumulation in recent years and rising aggregate capital-labour ratios. It is not clear whether the impetus behind China's demand for natural resources will recede or intensify. Given the likely moderation in China's future growth, there is reason to think that the need for natural resources will dissipate. At the same time, however, China faces a growing scarcity of certain key resources, especially water, that is unlikely to abate any time soon.

India and countries in the Middle East and Sub-Saharan Africa will continue to see their populations grow. Not only will median ages be low but dependency ratios will decline over the next decades. If these countries can strengthen public institutions and keep economic policies outward-looking, they could become the world's fastest-growing economies. The high rates of population growth in the Middle East and Sub-Saharan Africa also offer these countries the possibility of reducing their dependence on natural resource exports. However, this in turn depends on successfully providing their growing populations with the necessary skills.

In the case of many countries in Sub-Saharan Africa, it also requires efforts to reduce the "distance" to markets. Countries in Sub-Saharan Africa tend to fare worst on various measures of transportation costs. Since reducing transportation costs and delivery times are preconditions for successfully integrating into the global economy and global supply chains, increasing investment in transportation-related infrastructure is critical. This will involve harnessing domestic resources (public and private) and using the Aid for Trade initiative as the lynchpin to mobilize international assistance. There may be some scope to use current regional integration efforts to identify and prioritize regional infrastructure projects that can reduce trade costs and to use the current Doha Round negotiations on trade facilitation as a way of improving customs procedures and other regulations. African countries continue to lag behind in innovation and in absorbing technology transfers. These too can be addressed by improving the quality of education and training.

Developed countries

In recent decades, developed countries have grown more slowly than developing countries and have seen their share of world trade shrink. The ongoing Great Recession is likely to produce a lost decade for many advanced countries, particularly those in Europe.

Demographics in the form of an ageing and declining population will confront Japan and a number of European countries with strong headwinds to growth. This will have adverse effects on their future share of global trade exacerbating the trends outlined in Section B. Greater openness to migration may help alleviate these demographic challenges. These countries will need to maintain a highly skilled workforce, invest a high share of GDP on research and development and promote innovation. New technologies such as robotics and 3D printing may become more widespread. Their adoption is likely to vary significantly across sectors: currently they are used, for instance, in construction, aerospace, jewellery and healthcare. More importantly, these technologies are likely to prove disruptive by reducing the importance of low labour costs (provided by developing countries). This can lead manufacturing and its associated supply chains to return ("in-sourcing") to developed countries.

Compared to Japan and Europe, the United States does not face as serious a set of demographic challenges. Its population is expected to continue to grow (although at a slower rate) and it remains more open to immigrants, who now make up about a sixth of its work force. Immigrants are particularly important in agriculture and information technology, sectors where the United States is an export powerhouse. Nevertheless, the United States will need to upgrade its infrastructure and invest in its workers so they can continue to provide innovation and entrepreneurship. Dependent on oil imports for decades, technological improvements in natural gas extraction now promise the United States energy self-sufficiency in the future. Since this will lead to lower energy costs, it is likely to could give a substantial competitive boost to United States' manufacturing exports.

From "fundamentals" to other shaping factors

This assessment of the key factors shaping trade – and how they will play out among various countries and regions – is incomplete. It does not take into account how trade affects income distribution, alters the relative power of nations or creates spillovers (e.g. environmental degradation) that certain countries may find unacceptable. These effects can weaken public support for trade openness or prompt governments to adopt policies that directly or indirectly have an adverse impact on trade. We turn to these issues in Section D of this report.

Endnotes

1   There are various causes for the fall in fertility. Technological progress and the accumulation of human and physical capital make labour more productive and increase the opportunity costs of raising children (Galor and Weil, 1996). Moreover, raising income shifts the composition of demand towards non-agricultural goods and services, which are relatively more intensive in skilled labour. The related rise in the return to education leads to increased investment in education, further increasing the opportunity cost of raising children. Furthermore, parents with higher income devote more resources to each child. Since this raises the cost of each child, it also leads to fewer children (Becker, 1981).

2   The young-age (old-age) dependency ratio is defined as the ratio of individuals below 15 (above 65) to working age population (15-65). The overall dependency ratio is the sum of the young- and old-age dependency ratios.

3   The slow-down in population growth in China is partly due to the one-child policy, introduced in 1979. This policy has also contributed, in varying degrees, to a decline in fertility, an increase in the sex ratio (defined as the proportion of male to female live births) from 1.06 in 1979 to 1.19 in 2010 (World Bank Data, Gender Statistics) and an increase in the old-age dependency ratio (Hesketh et al., 2005).

4   The World Bank (2012) estimates that close to 42 million jobs will have to be generated globally by 2020 to cope with the growth in the number of older people. One-quarter of these will have to be generated in China, but by then the size of the Chinese labour force will have started to decline in absolute terms.

5   See Section C.1(b) for an account of current and projected education trends in selected countries and regions.

6   The autarky relative price is the price of the capital-intensive good relative to the price of the labour-intensive good that would be observed in a counterfactual situation of no trade.

7   See Section B.2 for an explanation of the Heckscher-Ohlin trade model. The studies by Sayan (2005) and Naito and Zhao (2009) also look at the distribution of gains across generations. In Sayan's (2005) model, trade based on differences due to unequal population dynamics does not necessarily lead to welfare gains for both countries. Naito and Zhao (2009) show that the old generation in the ageing country (a country with declining fertility rate) gains from trade, but subsequent generations lose during the transition phase. A compensation scheme consisting of country-specific lump-sum taxes (transfers) and savings subsidies (taxes) can, however, make free trade Pareto superior to autarky. Another paper on the differential effects of trade liberalization on old and young written by Gokcekus and Tower (1998) argues that retirees are capital owners. According to the Stolper-Samuelson theorem they will favour trade opening if the country has a comparative advantage in capital-intensive goods (such as the United States).

8   Standard national accounting shows that capital flows and the trade balance are closely related. The current account deficit – the excess of payments (M) to the rest of the world for goods, services, investment income, and unilateral transfers over receipts (X) from the rest of the world for similar items – equals (apart from measurement errors, which may be substantial) the excess of aggregate expenditure (E) for goods and services over national output (Y). The latter, in turn, equals the excess of investment (I) over aggregate savings S (the sum of public savings $S_G = T - G$ and private savings S_P). In symbols: $M - X = E - Y = I - S$. Thus, a current account deficit implies an excess of investment over savings. For a textbook treatment, see Mankiw (2010). On the influence of demographic factors on large and persistent United States' trade deficits, see Cooper (2008) and Ferrero (2010).

9   Another mechanism at work is that in ageing countries, due to "capital deepening" (higher capital-labour ratios), capital becomes more productive, producing capital inflows.

10 Helliwell (2004) argues that, although there is some evidence that countries with high dependency ratios tend to import more capital and run current account deficits, these effects are stronger for non-OECD than for OECD countries. In the latter, he argues that the share of the population aged 65 or more has no statistically significant effect on the current account balance.

11 The life-cycle hypothesis was first advanced by Modigliani and Brumberg (1954). It is closely related to the permanent income hypothesis of Friedman (1957), which posits that transitory income fluctuations do not affect consumption, because the latter is only influenced by changes in permanent income. In the Hall (1978) formulation of the life-cycle permanent income theory, individuals choose their consumption pattern so as to keep the expected (discounted) marginal utility of consumption constant over time.

12 As underlined by Attanasio (1999), the importance of the precautionary motive is ultimately an empirical question, depending, among other factors, on the availability of safety nets and on the characteristics of individuals' preferences and income.

13 The importance of liquidity/borrowing constraints is mainly documented in developing countries.

14 In the case of France, Desvaux et al. (2010) estimate that by 2030 mature households (aged 65 or above) and prime-earning households (aged 40 to 59) will account for about 70 per cent of total consumption. Family fragmentation is also projected to increase: average household size, equal to 2.8 in 1980, will decline to 2 by 2030.

15 The drop in consumption following retirement is a "puzzle" because it seems to contradict the consumption-smoothing prediction of the life cycle-permanent income hypothesis. The empirical evidence, however, is mixed. Using United States panel data over the period 1980-2000, Aguila at al. (2011), for instance, find no evidence of a decline in overall consumption at retirement. In the case of Italy, Miniaci et al. (2003) present evidence that work-related expenses fall after retirement, but non-durable consumption does not fall. They conclude that the retirement consumption puzzle is absent in the Italian context. Hurst (2008) argues that the observed evidence is not inconsistent with the life cycle model, once this is extended to allow for home production (see also Lührmann, 2010) and health shocks (see also Banks et al., 1998).

16 Following Milanovic and Yitzhaki (2002), World Bank (2007) uses an absolute definition of middle class, which includes individuals earning an annual per capita income between the average of Brazil and that of Italy (i.e. between about US$ 4,000 and about US$ 17,000 per year, in 2000 PPP). Other studies use wider income intervals to define the global middle class, obtaining higher projections for its size, both in absolute numbers and as a share of the global population (Kharas and Gertz, 2010; Wilson and Dragusanu, 2008).

17 China is already the world's largest auto market, with 13.6 million vehicles sold in 2009, compared with the 10.4 million sold in the United States. Moreover, the country is also the world's first cell phone market, with approximately 700 million subscribers in 2010 (Kharas and Gertz, 2010).

18 Kharas and Gertz (2010) estimate that in 2010 Chinese households' final consumption accounted for 37 per cent of total output, below the global average (61 per cent) and the percentage observed for other emerging economies such as Viet Nam (66 per cent), Indonesia (63 per cent), India (53 per cent) and Thailand (51 per cent). However, Atsmon et al. (2012) highlight that in recent years Chinese households' consumption increased, also thanks to the measures included in the country's latest five-year plan, which enhanced social security and financial integration.

19 As will be detailed in Section D.1, another recent trend which characterizes both more developed and less developed areas is the increase in inequality within countries. This trend is also influencing demand patterns, contributing to the luxury market's growth in many economies, including China (Atsmon et al., 2012; Kharas and Gertz, 2010).

20 There are, however, a number of policy barriers to trade in education, in the form both of quantitative restrictions on the number of foreign suppliers and of procedural requirements related to recognition of qualifications (Lim and Saner, 2011).

21 As can be seen in Figure C.7, for developing countries the increase in education levels was mainly achieved thorough increases in primary enrolment rates, while for developed countries it was achieved mainly through increases at the secondary and tertiary levels.

22 KC et al. (2010) provide population projections by level of education, age and sex for 120 countries, for the period 2005-50. Starting from baseline country-level survey data for the year 2000, they produce education projections for four different scenarios, among which the most realistic one assumes that countries' education will evolve according to a global upward trend.

23 In particular, Romalis (2004) argues that countries that are abundant in skilled labour and capital do capture larger shares of US imports in industries that intensively use those factors. In a similar vein, Chor (2010) shows that countries which are more skill abundant exhibit higher volumes of bilateral exports in more skill-intensive industries. Finally, Kowalski (2011) finds that, together with physical capital endowments, the length of schooling (a proxy for human capital endowment) is among the most important variables explaining industry patterns of trade flows. According to Kowalski's estimates, a standard deviation increase in years of schooling results on average in about 14-17 per cent increase in exports. He also claims that secondary and tertiary education have different impacts on trade patterns, with cross-country differences in secondary schooling being a more important explanation of industry trade flows.

24 In Costinot's (2009) model, the quality of institutions complements human capital in determining comparative advantage. Due to this complementarity, improvements in institutions have larger effects in countries with more educated workers. Similarly, improvements in education have larger effects in countries with better institutions. See Section C.6 for further discussion.

25 This is because in the former country efficient organization of production requires the matching of workers with similar talent. Conversely, in the latter country it requires hiring one, or few very talented individuals, who are complemented by several lesser talented individuals.

26 Other papers that develop the idea that worker heterogeneity matters for comparative advantage are Grossman (2004) and Ohnsorge and Trefler (2007). See also the discussion on "lumpiness" in Section C.1(c).

27 Amiti and Freund (2010), for instance, document that since 1992 China's exports were substantially reallocated away from apparel, textiles, footwear, and miscellaneous manufacturing (including toys) and toward electrical machinery, office machines (which includes computers), and telecommunications. These are precisely the sectors that rely most heavily on processing trade.

28 The labour force participation rate is defined as the ratio between labour force (employed and unemployed actively looking for a job) and population aged over 15 years.

29 The fraction of the labour force composed of women increased in every country where significant reductions in fertility were observed (Soares and Falcão, 2008).

30 In the standard model of labour supply, a higher wage rate induces two effects on labour market participation: a substitution effect (the opportunity cost of leisure increases, therefore individuals work more and reduce leisure) and an income effect (higher income opportunities increase the demand for leisure, inducing individuals to work less). See Blundell and MaCurdy (1999) for a review of the labour supply literature.

31 However, as underlined by Klasen and Pieters (2012), the U-shaped hypothesis has been documented mainly by cross-sectional analyses, while studies using panel data find more mixed results (see for instance Gaddis and Klasen, 2011). It should also be mentioned that in many developing countries, especially in Asian ones, women increase their participation in the labour market in response to adverse economic shocks. This form of women's labour force participation may create poverty traps (Bhalotra and Umaña-Aponte, 2010).

32 The United States (not shown in Figure C.9) follows a similar pattern to the European Union.

33 Klasen and Pieters (2012) for instance, show that husbands' higher income reduces female LFPRs in India.

34 The Middle East is characterized by low levels of LFPRs also for males. Indeed, increasing labour force participation is recognized as a priority by many governments in the region (ILO, 2012).

35 There is also some evidence of a positive correlation between women's share in employment and aggregate exports for developing countries such as Mauritius, Mexico, Peru, the Philippines and Sri Lanka (Nordås, 2003).

36 Comparative advantage is measured with revealed comparative advantage indices.

37 See Morrisson and Jütting (2005) for an empirical contribution using measures of discrimination based on institutional constraints.

38   In particular, the United States hosted 42.8 million migrants (20 per cent), followed by the Russian Federation (12.3 million, 5.7 per cent), Germany (10.8 million, 5 per cent), the Kingdom of Saudi Arabia and Canada (3.4 per cent each), France, the United Kingdom and Spain (3 per cent each), India and Ukraine (2.5 per cent each).

39   The average share of international migrants in the population of the ten largest hosts was 13.2 per cent in 2010. In the same year, among those with more than 1 million inhabitants, the highest proportion of international migrants were found in Qatar (87 per cent of the population), the United Arab Emirates and the State of Kuwait (about 70 per cent), Jordan and Palestine (about 45 per cent), Singapore, Israel and Hong Kong, China (about 40 per cent).

40   In Australia, the yearly average inflow of migrants increased from 154,000 between 1980 and 1989 to 318,000 between 2000 and 2008. In Canada, it increased from 126,000 between 1980 and 1989 to 241,000 between 2000 and 2009. In the United States, it increased from 633,000 between 1980 and 1989 to 1 million between 2000 and 2010. These data, as well as other data on migrant inflows reported in this section, are from the United Nations Population Division, International Migration Flows to and from Selected Countries: The 2010 Revision, database.

41   For instance, the United States' Immigration Reform and Control Act (IRCA) of 1986 accelerated the country's immigration flows, regularizing 2.7 million immigrants between 1989 and 1994 (United Nations, 2011a).

42   For instance, between 2005 and 2007, inflows from Poland to Germany registered annual net gains of 43,000 arrivals, amounting to an annual average of 146,000.

43   The World Bank Global Bilateral Migration Database (GBMD) only includes data up to 2000. Bilateral migrant stocks in 2010 are used by World Bank (2011c). However, these data, as in an update of Ratha and Shaw (2007), include a smaller set of country-pairs with respect to the GBMD data, and therefore are not precisely comparable to the latter. Nonetheless, the calculation of intra-regional shares of migrant stocks for 2010 indicates that the share of intra-regional migrants declined from 2000 to 2010 in Asia, Europe and the Middle East while it increased in the other regions.

44   Other determinants of cross-border migration are seasonal weather patterns, conflicts and natural disasters (Ratha and Shaw, 2007). Concerning the determinants of internal migration, earlier studies focused on the role of geographical income differentials in determining internal migration (Harris and Todaro, 1970; Todaro, 1969). Differently, the so-called "New Economics of Labor Migration" (NELM) underlined the role of migration as a strategy undertaken by households in poor countries to diversify and thus reduce risk (Katz and Stark, 1986; Lucas and Stark, 1985; Rosenzweig and Stark, 1989; Stark and Levhari, 1982). Hoddinott (1994) generalizes the Todaro and NELM approaches and provides evidence on the importance of both individual- and household-level determinants. For a comprehensive review of the internal migration literature, see Taylor and Martin (2001).

45   On RCPs in Africa, see IOM (2011).

46   In particular, Africa is the main source region for France (with a share of 43 per cent of the total inflow of immigrants in 2008) and the Commonwealth is the main source region for the United Kingdom (with a share of 34 per cent of the total inflow of immigrants in 2009).

47   Figure C.11 shows the average for developed countries. In the period 2005-10, net migration in countries like Italy, Portugal and Japan more than doubled the contribution of natural increase (births minus deaths) to population growth. In a further 29 countries or areas, net migration counterbalanced totally the excess of deaths over births (United Nations, 2011b).

48   The literature on migration and fertility offers four broad hypotheses to explain the observed patterns. The socialization hypothesis, emphasizing the differences in fertility between migrants and natives at destination, posits that, once at destination, migrants maintain the fertility norms to which they were "socialized" during their childhood. Studies maintaining the adaptation hypothesis stress that migrants' fertility, even though it can differ from the one of natives at destination, tends to converge to that of natives over time. According to other analyses, however, the similarities between migrants' and natives' fertility levels observed in some contexts are not due to adaptation, but instead they are related to the selection of migrants, i.e. to the fact that migrants are a non-random sample of the population at origin, characterized by fertility levels different than those of other natives at origin. Finally, according to the disruption hypothesis, the reduction in fertility observed for some migrants at destination is mainly due to the economic and psychological costs associated with relocation. Depending on the context of analysis and on the methodology used, each of these hypotheses finds some support in the literature, with more recent analyses providing relatively more support to the adaptation hypothesis. For a comprehensive review, see Kulu (2005).

49   Eurostat, Migration and migrant population statistics database.

50   At the global level, inspection of the United Nations Population Division, World Migrant Stock database reveals that, relative to the total population, the young are underrepresented among international migrants, while those of working age and over age 65 are overrepresented.

51   The projections in Table C.2 are based on the 2008 Revision of the United Nations Population Division's World Population Prospects. The figures on dependency ratio should not be compared with the ones in Figure C.4, which are from the 2010 Revision.

52   The overall stability of skilled emigration rates is confirmed if a longer time period is considered. In particular, Defoort (2008) analyses emigration rates to a subset of six OECD destinations (United States, Canada, Australia, Germany, United Kingdom and France) for each five-year period between 1975 and 2000. The author shows that overall emigration rates are stable over the period, but they increased in certain regions (especially in Sub-Saharan Africa and Central America) and decreased in others (mainly in the Caribbean and Northern Africa). Interestingly, inspection of the Docquier et al. (2009) dataset reveals that the emigration rate is higher among high-skilled women than among high-skilled men by 17 per cent on average.

53   Data from the Docquier et al. (2009) dataset. Beine et al. (2007) point out that, without controlling for age of entry, high-skill emigration rates are likely to be overestimated. This is because one could count as high-skill emigrant even individuals who moved already as children and acquired their education at destination. However, their estimates corrected for age of entry are highly correlated with the uncorrected ones.

54 This and the following paragraph draw extensively on the textbook exposition of Feenstra and Taylor (2008).

55 The assumption of constant relative price implies that both the sending and the receiving countries are "small".

56 Notice that constant capital-labour ratios imply constant factor prices. Therefore, in the long run, a shock in factor endowment is fully absorbed by changes in the composition of output that go in opposite directions in the two sectors. This is different from the short run, where changes in the composition of output go in the same direction in the two sectors and there is a fall in the return to the factor whose relative abundance increases (in the case of labour migration, the wage rate falls). The effect of migration on wages is the most researched topic in the migration literature. A review can be found in Hanson (2009).

57 Beverelli and Groppo (2013) analyse the relationship between skilled immigration and the structure of trade in skill-intensive sectors in OECD economies. Preliminary results indicate that – controlling for the relative endowment of skilled natives and capital – countries that are relatively more endowed with skilled immigrants capture a higher share of world trade in skill-intensive sectors.

58 This is because of the assumptions of symmetric demand and technology between countries.

59 Gaston and Nelson (2013) discuss various other cases in which there is complementarity between migration and trade. They suggest that intra-industry trade, trade in the presence of economies of scale and in the presence of international differences in the degree of imperfect competition all give rise to such complementarity.

60 While Wong (1988) estimates an indirect trade utility function, Hijzen and Wright (2010) treat imports and immigrants as intermediate inputs to final output. To find whether immigrants are quantity complements or substitute with trade, they estimate "Rybczynski elasticities", namely the percentage change in the demand for imports due to a percentage change in immigrants.

61 The two channels can also be denoted as "business and social network effect" and the "transplanted home-bias effect" (Bratti et al., 2012).

62 A review can be found in Bratti et al. (2012). The literature evolved from cross-country studies to panel-data ones and to recent contributions trying to establish a causal effect of immigration on trade. Not only permanent, but temporary migration has also been shown to matter (Jansen and Piermartini, 2009).

63 The larger effect of migrant networks on differentiated rather than on homogeneous goods found by Aleksynska and Peri (2012) and several other studies is in line with Rauch's (1999) hypothesis that trade-relevant information conveyed by migrant networks is especially relevant on differentiated goods.

64 Empirical evidence indeed shows that in markets with an increase in less educated immigrants there is a large proportion of sectors with a higher intensity of unskilled workers (Card and Lewis, 2007) and a slower adoption of skill-intensive techniques (Lewis, 2005).

65 Kerr and Lincoln (2010). They also show that in 2000, 47 per cent of the PhD-holders working in science and technology in the United States were foreign-born.

66 Chellaraj et al. (2008) find that larger enrollments of international graduate students, as a proportion of total graduate students, result in a significant increase in patents awarded to both university and non-university institutions, as well as in increases in total patent applications. The marginal impact of another foreign graduate student is around 0.88 patent applications and 0.57 patent grants economy-wide. Hunt and Gauthier-Loiselle (2012) find that a one percentage point rise in the share of immigrant college graduates in the population increases patents per capita by 9-18 per cent. Part of this effect reflects the positive spillover effects (crowding in) on native inventors (which may in turn be due to complementarities in innovation). Kerr and Lincoln (2010) find that increases in H-1B admissions substantially increased rates of Indian and Chinese invention in cities that rely more on immigrant scientists. A 10 per cent growth in the H-1B population corresponds to 1-4 per cent higher growth in Indian and Chinese invention for each standard deviation increase in city dependency. They also find some evidence for crowding-in effects. Turning to studies on EU member states, Ozgen et al. (2011) show that the average skill level of immigrants affects patent applications in a sample of 170 EU regions. Moreover, patent applications are positively affected by the diversity of the immigrant community. An increase in the fractionalization index by 0.1 from the regional mean of 0.5 increases patent applications per million inhabitants by about 0.2 per cent. Focusing on France, Germany and the United Kingdom, Venturini et al. (2012) find that highly educated migrants, in general, play a positive role in promoting innovation. In high-technology sectors, in particular, highly skilled foreign workers contribute positively to innovation without crowding out natives.

67 See Hanson (2009) and literature cited therein.

68 Recent contributions along these lines include Di Maria and Stryszowski (2009) and Azarnert (2012).

69 Empirical support for the brain gain hypothesis, at least in some countries including Brazil, China, India and Indonesia (representing more than 80 per cent of the sample population) is found by Beine et al. (2008; 2010).

70 There are other mechanisms through which the migration of educated individuals can have positive effects. First, the remittances sent home by migrants boost the income of those left behind. This can contribute to investment in the sending country (see Section C.2). Remittances may also compensate the amount spent on educating migrants several times over – as shown by Nyarko (2011) in the case of Ghana. Secondly, migrant networks can boost trade in various ways (see Box C.2) and help alleviate capital constraints preventing the development of small enterprises in the source country, as shown by Woodruff and Zenteno (2007) in the case of Mexico.

71 Conversely, Azarnert (2012) argues that, if prospective migrants foresee the possibility of low-skilled guest-worker employment in a higher wage foreign country, the relative attractiveness of skilled employment in the home country might be reduced, with adverse effects on human capital formation and an increase in fertility.

72 The mechanism is as follows. Before the demographic transition, the urban death rate is high due to infectious diseases and urban growth is only sustained by migration. When the demographic transition sets in, the urban death rate falls more rapidly than the rural one. The urban natural increase becomes positive and it drives the growth in urban population. Migration becomes again the main source of urban growth towards the end of the demographic transition, when, due to low fertility, the urban natural growth rate is very low (or negative).

73   Lumpiness is closely related to agglomeration, defined as the spatial concentration of economic activity. There are three main drivers of agglomeration considered in the literature. First, agglomeration has been shown to be driven by firms' objective to share inputs and facilities, and to take advantage of larger markets. Secondly, agglomeration is also guided by the benefits provided by bigger and thicker labour markets, in terms of higher labour supply, better matching between employers and employees and higher worker specialization. Finally, another major driver of agglomeration is firms' and workers' objective to benefit from the higher knowledge flows characterizing big cities.

74   As should be clear from the main text, crucial to the result that lumpiness affects comparative advantage is the violation of factor price equalization. That is, the result is obtained if factor endowments within a country are outside the "cone of diversification" (the factor price equalization set) and one region fully specializes. Factor price equalization within the country can be violated if some factors (like natural resources) are immobile in the presence of differences in the level of amenities between regions (Courant and Deardorff, 1993) and in the presence of agglomeration effects *à la* Krugman (1991) – see Brakman and van Marrewijk (2013) for a detailed explanation. Note that lumpiness can give rise to a direction of trade contrary to the one predicted by the Heckscher-Ohlin theorem.

75   In a case study using Spanish data, Requena et al. (2008) also find some evidence of lumpiness.

76   For a comprehensive review of the literature that documents the existence of agglomeration economies, including productivity gains, see Puga (2010). Melo et al. (2009) underline the distinction made in the literature between localization and urbanization economies. The former indicate gains which are mainly related to industrial concentration, while the latter represent gains from city size. Generally, both have an impact on productivity, with urbanization economies being relatively more important for light industries and knowledge-intensive services, such as finance and real estate.

77   For the effect of institutions on demographic change see, for instance, McNicoll (1980) and Bumpass (1990).

78   In the empirical analysis, Do et al. (2012) use instrumental variable techniques (in particular, geography-based instrument for trade patterns) to isolate the causal effect of comparative advantage on fertility.

79   Moreover, variables such as colonial origins and linguistic proximity can both influence trade and immigration. If not properly controlled for, they can confound the relationship between immigrants and trade flows.

80   Briant et al. (2009) use the stocks of immigrants in 1875, 1982 and 1990 as an instrument for the current stock of immigrants. Peri and Requena-Silvente (2010) and Bratti et al. (2012) use an approach *à la* Altonji and Card (1991), whereby the net inflow of immigrants (in the former study) or the stock of immigrants (in the latter study) are imputed based on historical immigration enclaves.

81   See Brülhart (2010) for a survey.

82   In Krugman and Livas Elizondo (1996), trade opening leads to dispersion of economic activity within a country. In the model, there are two agglomeration forces, forward linkages (because of a taste for variety and interregional transport costs, consumers like to locate close to as large a number of producers as possible) and backward linkages

(in order to save on transport and fixed set-up costs, monopolistically competitive producers seek to locate their single plant as close to their consumers as possible). The dispersion force is constituted by congestion costs. For low enough trade costs, the congestion force comes to dominate the backward and forward linkages, leading to dispersion of economic activity. The implication they draw is that "the giant Third World metropolis is an unintended by-product of import-substitution policies, and will tend to shrink as developing countries liberalize". However, in a model closer to Krugman (1991), where the intensity of the dispersion force falls with trade opening, Monfort and Nicolini (2000) get the result that the latter induces internal agglomeration.

83   With no change in a country's territory, this implies an increase in road density.

84   http://www.cio.com/article/123230/South_Africa_Outsourcing_Scorecard

85   http://www.icta.mu/mediaoffice/2007/IPLC_en.htm

86   Authors' calculations based on data from the International Monetary Fund.

87   Such as the Heckscher-Ohlin model of trade.

88   At times, they contract with firms in the host country to establish a joint venture (Desai et al., 2004).

89   Analysing industry-level data for 91 countries between 1980 and 1997, Manova (2008a) shows that equity market liberalization boosts exports disproportionately more in sectors that are relatively more dependent on external financing. This is indicative of a direct link between portfolio investment inflows and greater domestic investment in plant, machinery and equipment, which, in turn, increases the supply capacity of firms.

90   Both physical (shares, bonds, property) and human (education and experience).

91   A shortcoming of many of these studies is that they use combined private and public savings data.

92   Authors' calculations based on data from the International Monetary Fund.

93   In this context, a multinational firm will internalize its activities in a foreign country through FDI if the internalization cost is lower than the cost associated with establishing an arm's length contract (Buckley and Casson, 1976).

94   Rapid capital mobility has "levelled the playing field" for international business to some extent. Firms that would like to take advantage of regulatory or trade policies in a foreign country can simply move or sub-contract through a firm located there (Feenstra, 1998).

95   Several factors affect the relationship between R&D expenditure and innovations. Clearly, innovation is partially the result of chance. Therefore, the relationship between R&D and innovation is by nature stochastic. But, in addition, R&D productivity may depend on specific conditions, such as the quality of the education system. For a deeper understanding of the relationship between R&D and innovation, see Chapter 4 of *World Intellectual Property Report* (WIPO, 2011).

96   For guidelines on the collection and use of data on innovation, see *The Oslo Manual* (OECD, 2005).

97   See Khan and Wunsch-Vincent (2011) for a discussion on the different measures of patents available.

98   To address this limitation, Jaffe and Trajtenberg (2002) suggest using the number of patents weighted by their citations.

99   The balance of payments is an important source of information in this respect.

100   Hall (2010) had previously plotted a standard Lorenz curve of business R&D and GDP for 40 economies for two periods, 1999 and 2005. Due to data availability, the 37 countries in our sample include Argentina, Australia, Austria, Belgium, Canada, China, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Iceland, Israel, Italy, Japan, Republic of Korea, Luxembourg, Mexico, Netherlands, New Zealand, Norway, Poland, Portugal, Romania, Russian Federation, Singapore, Slovak Republic, Slovenia, Spain, Sweden, Switzerland, United Kingdom and United States.

101   As discussed in sub-section (a), there are several measures of technological innovation. A simple comparison of the number of patent applications does not capture the value of specific patents. One way the economic literature attempts to address this concern is by counting the number of patent applications in specific filing offices. We also perform the analysis looking at these alternative measures. While the specific ranking of a country may change, the finding that Asian countries have emerged among the major innovating countries is consistent.

102   R&D services cover those services associated with research (e.g. chemistry, biotechnology, medical sciences, applied science and technology which may be related to machinery, electricity, communications, vessels, aircraft, civil engineering, construction, information, etc.) and experimental development of new products and processes.

103   This group was established by UNSD following a request by the UN Statistical Commission to the Inter-agency task force on statistics of international trade in services to develop compilation guidance to accompany the Manual on Statistics of International Trade in Services 2010. The UN expert group includes all participating agencies to the interagency task force as well as national experts in trade in services statistics.

104   See Chapter 1 of World Intellectual Property Report (WIPO, 2011).

105   Note that foreign subsidiaries are counted as residents when they provide their local address.

106   Other studies that explore the geographical dimension of international technology include Bottazzi and Peri (2003), Branstetter (2001), Eaton and Kortum (1999), Irwin and Klenow (1994).

107   "Vertically integrated countries" are defined as those country-pairs with a share of trade in intermediate goods above the median.

108   Data are available at http://epp.eurostat.ec.europa.eu/portal/page/portal/microdata/cis.

109   See the article in The Economist (12 January 2013) "Innovation pessimism: Has the idea machine broken down?", The Economist (2013).

110   In developing countries, the role of government in research is much more pronounced. See WIPO, (2011).

111   New economic geography theory also predicts that as trade costs fall, production initially becomes more concentrated, but then becomes more dispersed. This is because as concentration increases, forces that act against agglomeration become more salient. For example, in order to persuade workers to move into the sectors, firms will have to pay higher wages. This will tend to reduce the incentive for a further expansion of the sector. The level of aggregation at which this turn in the agglomeration pattern will occur will depend on a number of factors. One of these is the technological spillover intensity and the geographical extent of knowledge spillovers. Evidence suggests that the advantage to cluster is particularly important in some knowledge-intensive sectors (Audretsch and Feldman, 1996). This is compatible with the fact that knowledge-intensive sectors have a substantial part of tacit knowledge that is less easily transferable across countries.

112   See Chart 13 in the 2008 World Trade Report (WTO, 2008).

113   Laursen and Meliciani (2010) show that ICT affects export market shares also in non-ICT sectors and that small open economies benefit more than other countries from ICT-related foreign knowledge flows.

114   Meliciani (2011).

115   Several factors affect the ability to appropriate returns from innovation. These include lead time, secrecy, complementary assets and patent protection. On the basis of a survey questionnaire administered to 1,478 R&D labs in the US manufacturing sector in 1994, Cohen et al. (2000) find that of these mechanisms patents tend to be the least emphasized by firms.

116   For example, several studies show that countries' growth rates (the ultimate result of innovation) are positively associated with the volumes of trade (Alcalá and Ciccone, 2003; Frankel and Romer, 1999; Sachs and Warner, 1995) and trade opening (Sachs and Warner, 1995; and Sala-i-Martin, 1997).

117   Also see Section B.1.

118   Other studies that point to the same direction include Clerides et al. (1998) and Van Biesebroeck (2005) for African countries, and Hallward-Driemeier et al. (2002) for East Asian countries.

119   WIPO (2011), Chapter 2 and Maskus (2012) for a review.

120   This is the view, for example, of Javorcik (2004) who finds that weak protection of intellectual property rights deters FDI in technology-intensive sectors that rely heavily on intellectual property rights.

121   See Section C.1 as well as, for example, Agrawal and Oettl (2008), Kerr (2008), Singh (2005).

122   For a review of the existing empirical evidence on FDI and technology spillovers, see Keller (2010). As an example of relevant empirical papers on the issue, see also Blalock and Gertler (2008), Javorcik (2004), Aitken and Harrison (1999), Djankov and Hoekman (2000), Haddad and Harrison (1993) and Konings (2001).

123   See http://www.bbc.co.uk/news/business-20639545 and http://www.dw.de/south-stream-pipeline-construction-begins/a-16435203.

124   There are several measures that can be used to measure volatility. Chen and Hsu (2012) use a moving average of the standard deviation of prices, realized volatility and a GARCH model as measures of energy price volatility. GARCH is the acronym for generalized autoregressive conditional heteroskedasticity and refers to econometric models that allow the variance of a time series to depend on the volatility that was realized in the preceding periods. Therefore, it can capture potential clustering of volatility around specific points in time.

125 Sweeney actually uses the term "depletable" but we treat it as synonymous with exhaustible.

126 See http://www.eia.gov/energy_in_brief/about_shale_gas.cfm.

127 In the case of biofuels for instance, a joint report by the FAO, IFAD, IMF, OECD, UNCTAD, WFP, the World Bank, IFPRI, UN HLTF and the WTO (FAO et al., 2011) observes that biofuels now account for a significant share of the global use of several crops – sugar cane, vegetable oil, coarse grains and sugar beet. Beyond the pitfall posed by industrial policy, the report also notes the environmental and social problems that have arisen from these biofuel subsidies. Growing crops for fuel can potentially emit more greenhouse gases than they save and the subsidies themselves may have played a big role in the increase in commodity prices in 2008, which was particularly harmful to food-importing developing countries (Mitchell, 2008).

128 Part of the reason lies in the difficulty of determining natural resource "abundance" although there may be scope to use environmental accounting methods here as they have been employed to measure natural capital, e.g. forestry, in the valuation of national wealth (Pearce and Atkinson, 1993; Aronsson and Lofgren, 2010).

129 The term "450" comes from the fact that climate researchers assume that the concentration of greenhouse gases in the atmosphere should not exceed 450 parts per million of carbon-dioxide equivalent to be able to have a reasonable chance of reaching the 2°C goal.

130 See the discussion in Milner (1997), Milner et al. (2000) and Milner and Zgovu (2006).

131 This is an example of what is called the "Alchian-Allen effect" or theorem after the two economists, Armen Alchian and William R. Allen, who first analysed the issue. Note that it focuses only on the pure substitution effect and ignores the income effect of the increase in cost, which could run counter to the substitution effect. However, to our knowledge there is no empirical evidence to suggest that the income effect dominates the substitution effect.

132 Strictly speaking, they estimated the dependence of freight charges on price and found an elasticity of about 0.125 to 0.716, with their "preferred" specification being 0.125. Pure iceberg transportation cost will have produced an elasticity of 1 and purely additive transportation cost will have generated an elasticity of zero. The 0.125 estimate is closer to zero.

133 As of the third week of October 2012, a metric ton of iron ore goes for US$ 120, while a troy ounce of gold is worth US$ 1,700. There are 32,151 troy ounces in a metric ton. Compare Table C.17 for average value-to-weight ratios for different product groups and modes of transportation.

134 This is related to what is termed the "O-ring" theory of production (Kremer, 1993). The accident that befell the space shuttle Challenger in 1986 has been attributed to the failure of just one of its many thousands of components – the O-ring – because the very cold weather made it too brittle to withstand the explosive pressure of the Challenger's rockets. When applied to global supply chains and trade in intermediate inputs, the "O-ring" theory says that a delay in the arrival of even one input has a cascading effect on the whole production process, with very costly consequences for the firm.

135 The list of 31 landlocked developing countries can be found at: http://www.un.org/special-rep/ohrlls/lldc/list.htm.

136 C.i.f. refers to the price invoiced by a seller that includes insurance and all other charges up to the named port of destination, while f.o.b. includes all charges up to placing the goods on board a carrier at the port of departure.

137 However, distance is not always immutable. Human action and natural processes can have a dramatic effect on it. For instance, the opening of the Suez and Panama canals dramatically reduced the maritime distance between countries (see the historical discussion in Section B on the effect of these events on trade). Moreover, Arctic warming might open up a polar route that would dramatically shorten the shipping distance between Europe and Asia.

138 A meta-analysis is a statistical analysis of a collection of prior studies, which in this case are estimates of gravity equations. The gravity equation seeks to explain the volume of trade between any pair of countries. Since the GDP of the trade partners and the distance between them are usually included as explanatory variables in the equation, it has been dubbed gravity equation in reference to the analogous role played by mass and distance in the theory of gravity.

139 The source of data on transportation costs is US customs data and its measure of "import charges". US customs defines import charges as "… the aggregate cost of all freight, insurance, and other charges (excluding US import duties) …" These costs reflect transportation between countries and exclude, in almost all cases, inland transportation.

140 Blonigen and Wilson (2008) build upon this method and refine the obtained results by using variation in port efficiency over time. They conclude that the effect of port infrastructure itself is considerably smaller than suggested by Clark et al. (2004), whose estimates are argued to include other country characteristics that are not directly related to port efficiency, such as inland infrastructure or export policies.

141 Several studies confirm that increased competition has also reduced transport prices and increase cargo quantities in air freight. The impact of bilateral open skies agreements on route offerings, air transportation prices and trade volumes are referred to in, among others, Micco and Serebrisky (2006), Zhang et al. (2011) and Cristea and Hummels (2011). Regarding air passenger flows, the study by Piermartini and Ruosova (2013) investigates the impact of air services liberalization using information on 2,300 Air Services Agreements covering 184 countries. They are able to identify provisions in these agreements that are important determinants of the degree of liberalization of the international aviation market. In increasing order of liberalization, these are (i) include multiple designations , (ii) free determination of capacity, (iii) free pricing and community of interest, and (iv) cabotage. They then simulate the effect of each provision being adopted by all country pairs whose current air traffic regulations do not include such a provision. They predict that air passenger traffic would increase by 0.5, 5, 9 and 11 per cent if all existing agreements introduced multiple designation, free determination of capacity, free pricing and community of interest and cabotage, respectively.

142 This is based on Regulation (EC) No 906/2009.

143 http://www.economist.com/node/21527035.

144 The trade facilitation talks were not added to the 2001 Doha Development Agenda before mid-2004.

145 Set out in Annex D of the General Council Decision of 1 August 2004 (WT/L/579).

146 Extending this method to non-OECD countries in the future will give a more complete picture and is likely to show that reductions for other countries are even larger as other studies like OECD (2009) showed.

147 The Aid for Trade initiative was mentioned in the same context as well.

148 Hoekman and Nicita (2010), page 77 ff.

149 Ibid, page 78.

150 See for example Arvis et al. (2007), Otsuki (2011), Wilson et al. (2003) and Wilson et al. (2005).

151 See for example Christ and Ferrantino (2011) and Arvis et al. (2007).

152 For maritime transportation, there are a lot of costs that are independent of fuel. The relative importance of fuel is greater for longer voyages. Furthermore, there is an easy technological fix to adapt to rising fuel prices as ships can slow down and burn less fuel. In the case of planes, they burn a lot of fuel on take-off and landing. For very long flights, planes have to carry more fuel adding to the weight of the plane and reducing its fuel efficiency per cargo carried. The result is a quadratic effect of distance interacting with fuel prices. While planes can slow down and burn less fuel, they have a lot less freedom in this respect than ships. Finally, rising fuel prices induce substitution away from airplanes because fuel prices represent a higher share of operating costs for planes, so the cost elasticity is greater. A switch from planes to ships for the same cargo will sharply lower freight charges, while also incurring greater time costs. This will have a bigger impact on cargoes that are time sensitive.

153 Modal shares are calculated by using import values.

154 The former elasticity is 0.088, while the latter is only 0.103.

155 For further details, see http://www.systemicpeace.org/polity/polity4.htm. This section produces a range of simple statistics using trade data and the scores from the Polity IV Project. Nothing in this section implies a judgement on the part of the WTO of any particular form of government.

156 The blue line in Figure C.54 is a simple linear fit of the data. Instead, the red curve represents the best fit of the data that allows for non-linearities.

157 It appears that to date no study has looked in a formal way at the inverted-U relationship between regime transition and trade policy observed in Figure C.54.

158 The construction of the indicator of the depth of trade agreements follows Orefice and Rocha (2011). We consider 100 trade agreements spanning from 1958 to 2011. The depth measure is constructed considering the ten most important provisions in the factor analysis, namely trade-related intellectual property rights (TRIPS), IPR, countervailing measures, movements of capital, public procurement, competition policy, anti-dumping, investment and state aid.

159 Detailed data for "rule of law" and "regulatory quality" for a broad cross-section of countries are only available after 1996 (Kaufmann et al., 2010)

160 A body of economic literature focuses on the causal effects of economic and political reforms (see, among others, Giavazzi and Tabellini (2005) and Giuliano et al. (2012)).

161 The study by Acemoglu et al. (2005) opened the way to a vast literature on the political determinants of the relationship between globalization and economic institutions. Important recent contributions include Dal Bó and Dal Bó (2011), Do and Levchenko (2009), Levchenko (forthcoming), Segura-Cayuela (2006), and Stefanadis (2010).

162 Costinot (2009) offers an alternative framework in which contract enforcement is a crucial determinant of comparative advantage. In this model, better institutions, represented by a higher probability of the enforcement of a contract, allow a country to specialize in the production of more complex goods. These are sectors that require a higher number of tasks (such as research, design, assembly) to produce a unit of the good.

163 The study introduces a measure that quantifies the importance of contract-dependent inputs in the production of final goods. In particular, for each intermediate good it is possible to determine whether it is sold in an organized market or if it is reference-priced in a trade publication or if it is none of these. Goods that are more contract-dependent are those that use a higher fraction of inputs that are not sold in organized markets and do not have a reference price, as those investments are more likely to be relation-specific.

164 For a survey of this literature, see WTO (2011b).

165 See, in particular, Giuliano et al. (2006), Guiso et al. (2009), Spolaore and Wacziarg (2009a; 2009b), Gokmen (2012). This measure is based on the work of Cavalli-Sforza et al. (1996).

166 For a broader discussion of the pro-trade effects of immigration, see Section C.1(c).

167 A related strand of literature analyses the relation between conflicts and trade. In particular, Rohner et al. (2011) provide a theory of trade and conflict where trade hinges on trust and cooperation. They show that policies that foster inter-ethnic trade increase trust between societies and reduce conflicts.

Appendix

Appendix Table C.1: **BERD in the manufacturing sector** (sum over 18 countries, values in PPP US $ million, 2005 constant prices)				
Industry	Value		Share	
	1990-95 average	**2005-10 average**	**1990-95 average**	**2005-10 average**
Fabricated metal products, machinery and equipment, instruments and transport	85,570	139,638	69.1%	72.7%
Coke, petroleum, nuclear fuel, chemicals and products, rubber and plastics	25,914	37,067	20.9%	19.3%
Basic metals	4,240	4,052	3.4%	2.1%
Food, beverages and tobacco	2,594	4,139	2.1%	2.2%
Non-metallic mineral products	2,145	2,142	1.7%	1.1%
Wood, paper, printing, publishing	1,404	1,649	1.1%	0.9%
Textiles, fur and leather	1,070	1,802	0.9%	0.9%
Furniture and other manufacturing	880	1,576	0.7%	0.8%
Manufacturing total (sum over 18 countries)	123,815	192,079		

Source: Authors' computations, based on data from OECD Science, Technology and R&D Database.

Note: For the purpose of consistency and comparability, aggregation is performed only on countries with BERD data in all industrial breakdowns of the manufacturing sector, for both the period of 1990-95 and 2005-10. As a result, 18 countries in the database satisfy these criteria, and they are: Czech Republic, Denmark, Finland, Germany, Hungary, Iceland, Ireland, Italy, Japan, Republic of Korea, Mexico, Norway, Portugal, Singapore, Slovenia, Spain, Sweden and Turkey.

Appendix Table C.2: **BERD in the services sector** (Sum over 14 countries; values in PPP US $ million, 2005 constant prices)			
Industry	1990-95 average	2005-10 average	Annualized growth
Community, social and personal service activities, etc.	436	728	3.47%
Financial intermediation (includes insurance)	414	1,465	8.79%
Real estate, renting and business activities	3,921	16,088	9.87%
Transport, storage and communications	824	1,761	5.19%
Wholesale, retail trade and motor vehicle repair	603	2,337	9.45%
Total BERD in services sector (sum of 14 countries)	5,710	22,294	9.51%

Source: Authors' computations, based on data from OECD Science, Technology and R&D Database.

Note: For the purpose of consistency and comparability, aggregation is done using only countries with data in all industries under the services sector for the periods of both 1990-95 and 2005-10. As a result, the 14 countries in the sample are Austria, Canada, Czech Republic, Germany, Greece, Hungary, Ireland, Netherlands, Norway, Portugal, Singapore, Slovak Republic, Spain and Turkey; according to the OECD database, the industry break-down of BERD does not add up to the total sectoral BERD.

Appendix Table C.3: Number of fixed-telephone subscriptions, mobile-cellular telephone subscriptions and internet users per 100 inhabitants, 2011
(Top 30 economies)

Fixed-telephone		Mobile-cellular telephone		Internet users	
Monaco	96.40	Macao, China	243.50	Iceland	95.02
Chinese Taipei	72.68	Hong Kong, China	209.64	Norway	93.97
Cayman Islands	65.63	Panama	203.88	Netherlands	92.30
Germany	63.05	Saudi Arabia, Kingdom of	191.24	Sweden	91.00
Hong Kong, China	61.06	Antigua and Barbuda	181.64	Luxembourg	90.89
Korea, Republic of	60.90	Russian Federation	179.31	Denmark	90.00
Switzerland	60.82	Suriname	178.88	Finland	89.37
St. Helena	59.65	Oman	168.97	Bermuda	88.34
San Marino	58.88	Cayman Islands	167.67	Qatar	86.20
Iceland	58.43	Anguilla	166.31	New Zealand	86.00
France	55.92	Finland	166.02	Switzerland	85.20
Malta	54.89	Maldives	165.72	Liechtenstein	85.00
Luxembourg	54.10	Dominica	164.02	Korea, Republic of	83.80
Liechtenstein	53.99	Libya	155.70	Guernsey	83.63
United Kingdom	53.24	Austria	154.78	Canada	83.00
Barbados	51.35	Italy	151.84	Germany	83.00
Japan	51.06	Lithuania	151.30	Antigua and Barbuda	82.00
Greece	49.91	Singapore	149.49	United Kingdom	82.00
Sweden	48.72	United Arab Emirates	148.62	Andorra	81.00
United States of America	47.91	Luxembourg	148.27	Faroe Islands	80.73
Canada	47.86	Seychelles	145.71	Austria	79.80
Australia	46.63	Viet Nam	143.39	France	79.58
Israel	46.28	Botswana	142.82	Japan	79.53
Ireland	45.22	Kazakhstan	142.55	Australia	79.00
Denmark	45.13	Uruguay	140.75	Belgium	78.00
Andorra	44.57	Bulgaria	140.68	United States	77.86
Belarus	44.02	Guatemala	140.38	Bahrain, Kingdom of	77.00
Montserrat	43.41	Estonia	138.98	Ireland	76.82
Belgium	43.06	Trinidad and Tobago	135.57	Estonia	76.50
Slovenia	42.89	Argentina	134.92	Singapore	75.00

Source: ITU.

D. Trade openness and the broader socio-economic context

Section C showed how fundamental economic factors – demography, investment, technology, natural resources, transportation and institutions – can affect the future of trade. But trade takes place within a broader socio-economic context. This context matters for trade and trade policy. Historically, social and macroeconomic concerns have repeatedly influenced decisions in trade policy matters. Section B of this report provided examples of such situations. Both themes are currently high on the political agenda and will undoubtedly affect policy-makers' views and positions in the area of trade reform in the future. A third factor relates to environmental concerns, an issue that has rapidly been gaining prominence in the national, regional and global policy debate. It has also been repeatedly linked to trade, notably in the context of a number of high-profile WTO disputes, in the context of regional trade agreements and as an element of the on-going Doha Development Agenda.

Contents

II D. TRADE OPENNESS AND
THE BROADER SOCIO-
ECONOMIC CONTEXT

Some key facts and findings

•   Successful integration into global markets requires the constant need for individuals and societies to cope with changes in the competitive environment. These adjustments can put labour markets under strain and can shape attitudes towards trade openness. Economies with a well-trained workforce and a business-friendly environment tend to be better placed to adjust successfully.

•   Societies' transition to a sustainable development path requires careful management of the multi-faceted relationship between trade and the environment in order to avoid "green protectionism" and to maximize the environmental benefits that open trade can bring.

•   The expansion of trade needs to be supported by a stable financial and monetary system – delivering a sufficient volume of trade finance at an affordable cost, particularly for developing countries, and macroeconomic policies that promote exchange rate stability.

1. Social concerns: inequality and unemployment

Employment has been high on policy-makers' agendas in recent years. This is the case for countries across different income levels although the reasons for concern differ. In many industrialized countries, unemployment has soared during the recent crisis and in some a recovery of the labour market is not yet in sight.[1] Emerging economies with large populations, such as China and India, do not find it straightforward to absorb large numbers of rural workers into formal labour markets, even when the economy is booming. The important role of jobs for economic and social development in least-developed countries (LDCs) has been highlighted in the most recent *World Development Report* (World Bank, 2012b).

Incomes of those who do work are also a matter of concern, especially in light of increasing income inequality within countries. In a number of industrialized countries, income inequality, measured in terms of the share in total wealth of the 1 per cent wealthiest individuals, is close to the levels prevalent in the 1920s, and more than double the levels of the 1970s. In many middle-income countries, income inequality has also increased sharply since the early 1990s.

As a result of these developments, policy reforms need to perform well on the employment and distributional front in order to obtain public support. This sub-section provides an overview of the patterns of inequality within and across countries, and of unemployment levels across countries. It then proceeds to discuss whether, and to what extent, trade has played a role in

driving the observed patterns. Lastly, this section will discuss whether the observed labour market patterns are likely to affect attitudes towards trade openness or its effects. The sub-section concludes by venturing into a discussion of the expected labour market challenges that different countries will face in the near future and how those challenges may relate to their trade performance.

(a) Income distribution and unemployment: recent trends

The two decades preceding the recent economic crisis were characterized by significant increases in trade and capital flows. Income inequality increased in most countries and regions during the same period. Data on the long-run evolution of inequality indicate that there has been a clear change in the late 1980s and early 1990s.

Figure D.1 illustrates that in a set of countries called the "U-shaped" group by Atkinson et al. (2011), inequality – measured as the percentage share of the 1 per cent richest households in total wealth – has risen quite dramatically in recent years and has achieved post First World War levels. It shows that in the United States, the richest 1 per cent of households held 19.6 per cent of national wealth in 1928. That share fell to a low of 7.7 per cent in 1973 and then steadily increased again to reach 18.3 per cent in 2007, i.e. before the start of the Great Recession. The share of income of the wealthiest households fell during the Recession but is now again on the increase.

The evolution of inequality follows a similar pattern in the other countries illustrated in Figure D.1. In the

Figure D.1: **Share of the 1 per cent richest households in total wealth: "U-shaped" countries, 1910-2010**

Source: World Top Income Database.
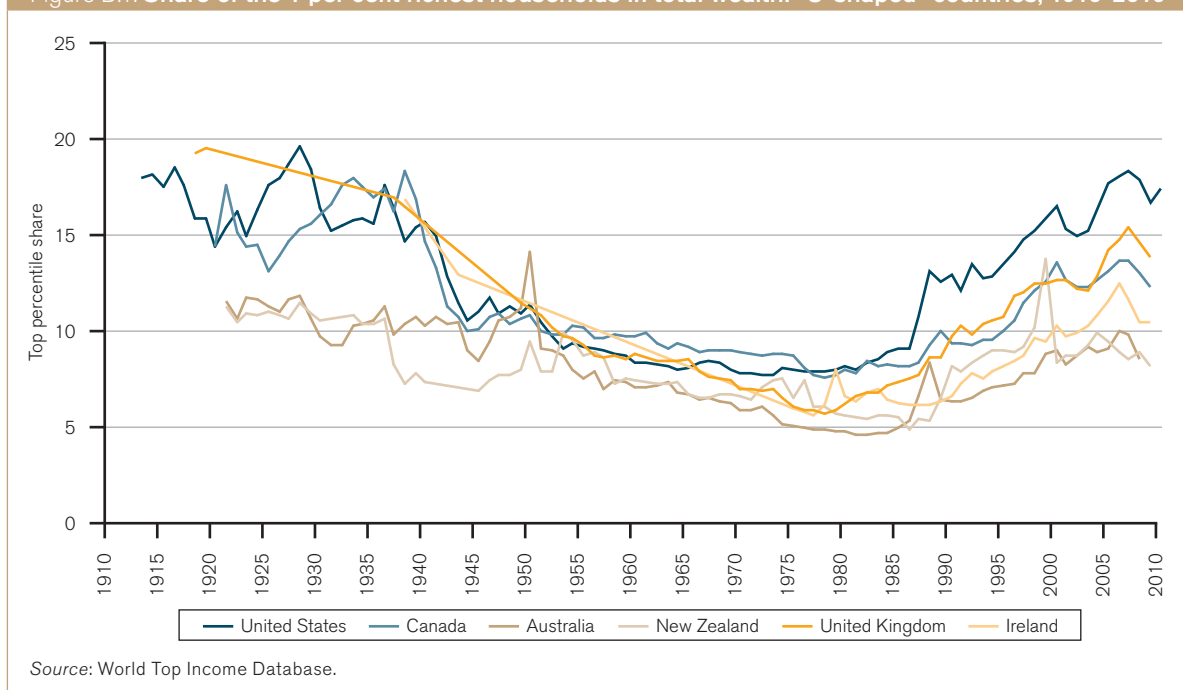
United Kingdom, inequality was higher than in the United States in the few years for which data are available in the inter-war period and just following the Second World War. Inequality then fell below 6 per cent towards the end of the 1970s and steadily increased thereafter to reach 15.4 per cent in 2007. Atkinson et al. (2011) identify another set of countries with an L-shaped evolution of inequality. These countries, including Germany, France and Japan were characterized by very high levels of inequality in the inter-war period. Inequality dropped sharply after the Second World War and remained constant thereafter until the second half of the 1990s, when the income share of the top 1 per cent of income earners started to increase, although significantly less than in countries illustrated in Figure D.1.

Figure D.2 reflects this evolution of inequality for Japan and three other Asian economies for which data are available. In all four countries, inequality started to increase in the 1990s, with the increase being sharpest in Singapore. The richest 1 per cent in China, India, Japan and Singapore, however, own a smaller share of national income than their counterparts in Canada, Ireland, the United Kingdom or the United States.[2]

Another frequently used variable to measure inequality is the Gini coefficient (explained in Section B.2). Using information on Gini coefficients during the past decade, Figure D.3 indicates that inequality is highest in much of South America and Sub-Saharan Africa. Both Brazil and South Africa have Gini coefficients above 50 per cent. China and the Russian Federation fall into the 40-49 per cent range. The United States falls into that same group. India's Gini coefficient is

lower and falls into the 30-39 per cent group. Figure D.3 also shows that many of the countries with very low inequality, i.e. Gini coefficients below 30 per cent, can be found in Europe, e.g. Germany and the Scandinavian countries.

Income distribution within countries is expected to undergo further changes in the near future. One of the most important trends affecting future income inequality is the change in the size of the middle class. While the middle class is expected to increase and become richer in emerging economies, notably in Asia, it appears to be shrinking in the United States and the European Union (see Section C.1).

A phenomenon that emerged during the economic crisis and that remains a challenge in many high-income countries is increased unemployment. The International Labour Office (ILO, 2012) highlights a general divide between the developed and developing regions, with unemployment rates remaining far above historical averages in a group of countries that they call "Developed Economies and the European Union region" (8.6 per cent in 2012 versus an average of 6.9 per cent between 1998 and 2007), while unemployment rates in 2012 were below historical averages in most developing regions.

These patterns are reflected in Table D.1, which shows unemployment rates in 2007 and 2010 for a selected number of countries. It illustrates that recent increases in unemployment have been sharpest in industrialized countries, with a number of countries in Europe and North America experiencing unemployment increases above 4 percentage points. However, this phenomenon cannot be generalized. In

Figure D.2: **Share of income of top 1 per cent income earners in selected Asian countries, 1922-2010**

Source: World Top Income Database.
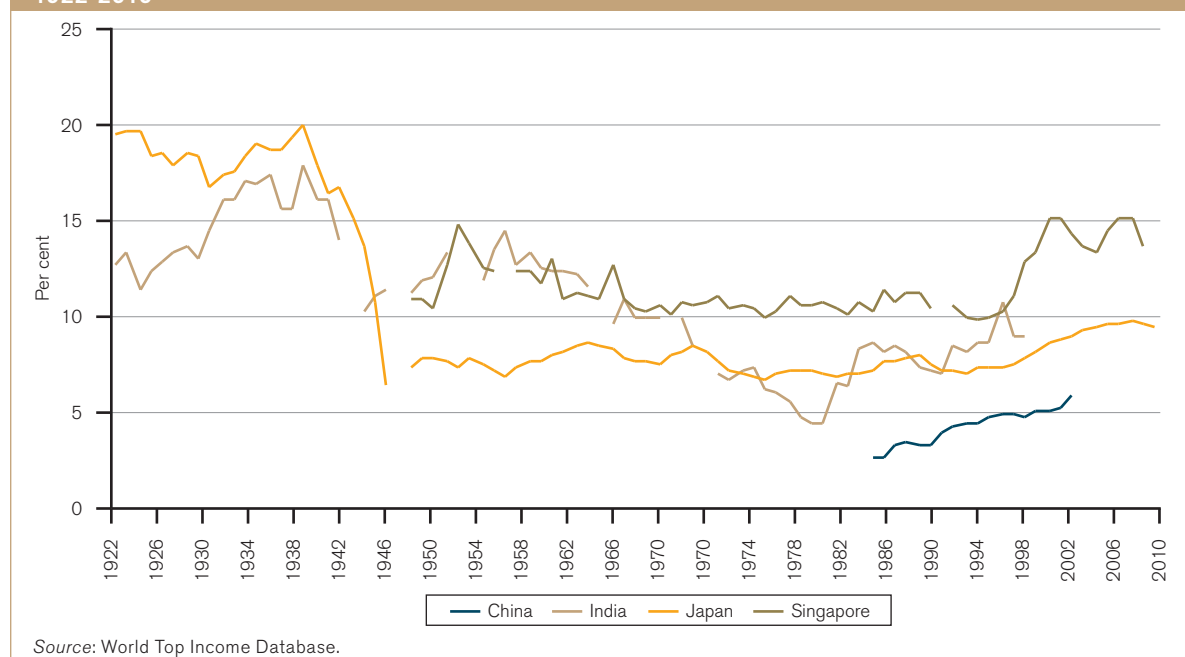
Figure D.3: **World inequality map based on Gini coefficients**

Above 60 — 50-59 — 40-49 — 30-39 — Less than 30 — Missing

Sources: Human Development Index database 2011 and CIA *World Fact Book*, 2011.

Note: Values represent the most recent data point available in the period 2000-11. The Gini coefficient takes values between 0 and 100 in this chart, with higher values reflecting higher levels of inequality.
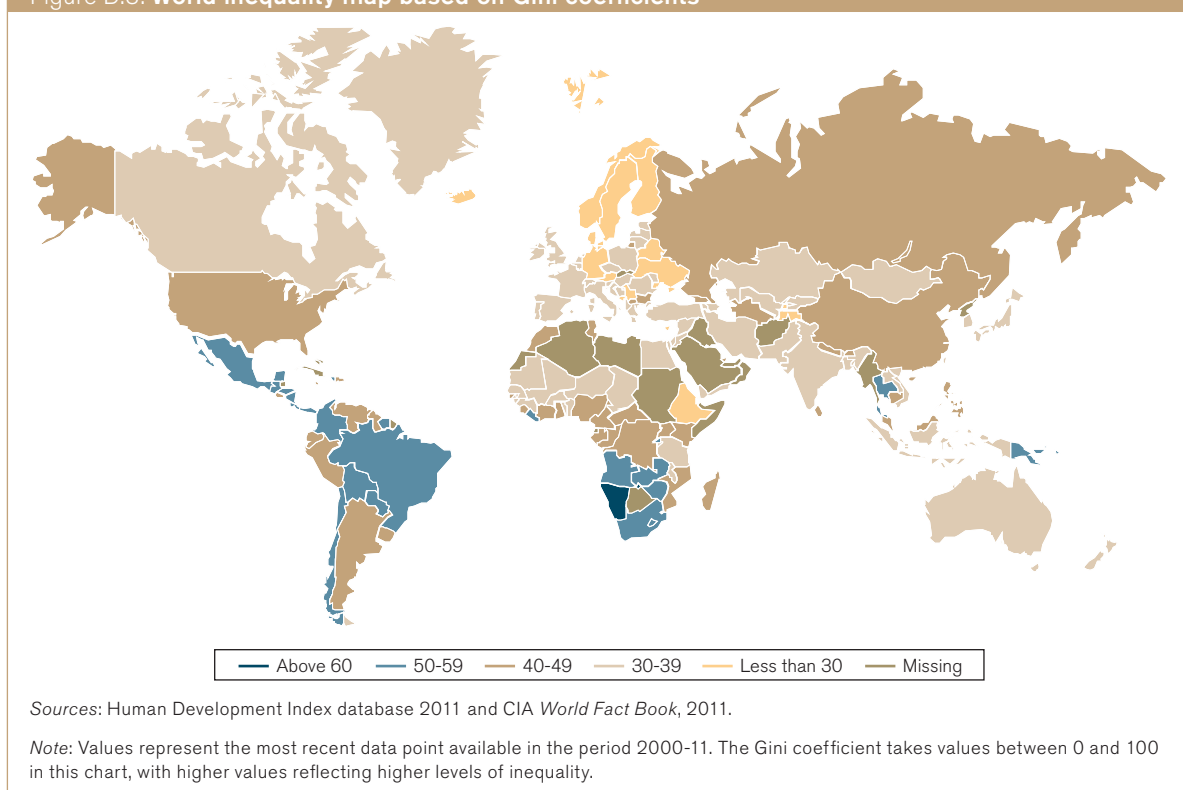
Poland, for instance, unemployment remained unchanged, while it decreased in Germany. Other developed countries, such as Japan, Mexico, the Republic of Korea and Turkey, experienced moderate increases in unemployment. Unemployment data are only available for a small number of developing countries. Table D.1 illustrates that countries such as Colombia, Indonesia or the Philippines experienced stable unemployment rates or even reductions in the 2007-10 period.

Table D.1: **Levels and changes in unemployment, 2007-2010, selected countries** (percentage)

	2007	2010	Difference
Lithuania	4.3	17.8	13.5
Spain	8.3	20.1	11.8
Ireland	4.6	13.5	8.9
United States	4.6	9.6	5.0
Greece	8.3	12.5	4.2
Mexico	3.4	5.3	1.9
Turkey	10.3	11.9	1.6
Russian Federation	6.1	7.5	1.4
Japan	3.9	5.0	1.1
Korea, Rep. of	3.2	3.7	0.5
Poland	9.6	9.6	0.0
Philippines	7.4	7.4	0.0
Colombia	12.0	11.6	-0.4
Germany	8.6	7.1	-1.5
Indonesia	9.1	7.1	-2.0

Source: World Bank.

Another element that is likely to affect trade flows and policies in the near future is the distribution of income across countries, notably because relative cross-country income levels will determine what countries consume and what they produce. Section B.2 of this report has discussed the phenomenon of "new global players". This group of countries is commonly considered to include the BRICS (Brazil, the Russian Federation, India, China and South Africa), most of which have experienced high levels of income growth in the past two decades.

Average annual real gross domestic product (GDP) per capita growth was above 10 per cent in China from 1990 to 2011 and above 6 per cent in India in the same period. GDP per capita growth was more modest but significant in Brazil (2.8 per cent) and South Africa (2.6 per cent), while it was relatively sluggish in the Russian Federation (0.7 per cent). This reflects a certain level of "catching up" in terms of GDP per capita between four of the BRICS and the wealthiest regions in the world, given that GDP per capita growth in the United States was 2.4 per cent, in the Euro area 1.7 per cent and in Japan 1.1 per cent during the same period.[3] This, together with the growth of the middle class observed in a number of emerging economies, is probably one of the main drivers behind the finding in Milanovic (2012) that global income inequality has decreased in recent decades (i.e. in the period 1988-2008). Low-income countries are, however, not necessarily reflected in this trend. In Sub-Saharan Africa, for instance, Nigeria experienced a growth rate of close to 5 per cent, while countries such as the

Democratic Republic of the Congo or Zimbabwe experienced negative GDP per capita growth between 1990 and 2011. The latter two countries and others with similar recent growth patterns therefore run the risk of "staying behind" while the rest of the world grows more closely together.

Notwithstanding the above phenomenon of "catching up", the distribution of income remains very unequal across countries, as illustrated in Figure D.4. GDP per capita in Canada, the United States, Europe, Australia and Japan continues to significantly exceed GDP per capita in South America, Africa and most of Asia. This difference will have an effect on comparative advantage and thus the labour market effects of trade.

Poorer countries with a large labour force are likely to have a comparative advantage in labour-intensive goods and services. Countries such as China, India and possibly also Indonesia and Mexico are likely to base their exports on an advantage in labour costs. As illustrated in Figure D.4, Indonesia's labour force is roughly similar in size to the labour force in the United States. The same is true for Mexico's labour force when compared to that of Germany. Yet, wages in Germany are more than six times the average wages in Mexico, while US wages exceed Indonesia's by a factor of 20. Average wages in China and India currently also exceed those in Indonesia but are significantly below those in Mexico and well below wages in Germany and the United States. At the same time, China and India are characterized by a very large labour force that by far outweighs those of other countries.

Although the productivity levels and skill composition of the labour force differ significantly across countries, Figure D.4 suggests that the labour cost advantage may remain in low and middle-income countries – and, in particular, Asian ones – for a while, even if wages in countries such as China are on the increase (e.g. Li et al., 2012). Some of the future labour market challenges that countries at different income levels are likely to face in the context of increased global integration are discussed in more detail below.

(b)   Trade and labour markets: a two-way relationship?

The economic literature on the labour market effects of trade reform has traditionally focused on the effects of trade on relative factor incomes. A significant number of studies in the 1980s and 1990s examined the impact of trade on the relative wage of high- to low-skilled labour, arguably driven by the observation that the relative wage of the highly skilled was increasing in a number of industrialized countries. A different strand of literature focused on the effect of trade reform on unemployment levels. In recent years, researchers have analysed the relationship between globalization and the wage share of GDP, a measure that has the advantage of combining information on wage levels and job numbers.[4] Neither of these measures is likely to capture everything that is going on in labour markets as a result of trade reform,[5] but together they can provide a general picture of the main mechanisms at work.

Figure D.4: **GDP per capita across countries, 2008**
(US$ at market exchange rates)

Source: Yearly average nominal monthly wages from Global Wage Database, ILO; exchange rates from *International Financial Statistics*, International Monetary Fund; labour force participation rate for 15 to 64 year-olds, total population and per capita GDP from the World Bank. All data are from 2008, the latest year for which wage data were available.

(i) Does trade affect inequality within countries?

Much has been written on the relationship between trade reform and income distribution within countries. The trade literature has focused on a variety of questions. What are the channels through which trade affects income distribution within countries? What is the relative importance of the effect of trade on income distribution when compared with other possible determinants of distribution? To what extent does the effect of trade on income distribution depend on country characteristics?

According to traditional trade theory based on comparative advantage, a country exports goods that are intensive in the use of its relatively "abundant" factor and imports goods that intensively use its relatively "scarce" factor. This implies that trade opening would increase demand for the abundant factor relative to the scarce factor. Hence, trade is expected to reduce income inequality in developing countries by creating new jobs and increasing wages for unskilled labour but increase income inequality in industrialized countries via a loss of jobs for unskilled labour due to imports from more cost-efficient producers overseas.

A number of empirical studies have analysed the relationship between trade and wage differences.[6] Evidence on the determinants of change in wages indicates that trade is only one of many determinants of wage inequality. Other determinants include technological change, de-unionization, an eroding real minimum wage and changing consumer tastes. In general, skill-biased technological change is found to be the main determinant of changes in wage inequality, while trade is only found to account for a minor share.

More recent literature deviates from traditional ways of analysing the trade-inequality nexus in a number of ways. First, there is an increasing interest in examining the determinants of the evolution of top incomes, i.e. the measure of inequality described in Figures D.1 and D.2. Theoretical contributions analysing this phenomenon refer to the concept of "super-star economics" (Rosen, 1981) and the notion that only very limited numbers of individuals reap a large share of the gains from increases in market size (Manasse and Turrini, 2001; Costinot and Vogel, 2010).

Atkinson et al. (2011) conjecture that recent changes in the evolution of the income share of top-income earners may be linked to the fact that "the expansion of scale associated with globalization and with increased communication opportunities has raised the rents of those with the very highest abilities". Haskel et al. (2012) propose a theoretical framework that explains how the combination of globalization and innovation can end up boosting the real and relative earnings of "superstars".

This last point hints at the second deviation from the traditional analyses of the globalization and inequality nexus. While the early empirical literature tried to separate the distributional effects of trade from the effects of technological change, the more recent literature focuses on the fact that trade and technological change may go hand in hand. One of the implications of this literature is that trade affects income distribution through its effect on technology choice and productivity. It also implies that positive growth effects of trade may be more systematically accompanied by inequality increases than thought in the past, and that development of new activities becomes increasingly important to guarantee sufficient job creation and avoid jobless growth traps (e.g. Burstein et al., 2011; Newfarmer and Sztajerowska, 2012).

Recent research has also begun to focus on different forms of inequality, notably the relationship between trade and increased wage inequality across firms for workers with otherwise similar characteristics (e.g. Amiti and Davis, 2011; Frias et al., 2012; Krishna et al., 2011). One of the findings of the research is that workers in exporting firms earn more than workers with otherwise similar characteristics in non-exporting firms.[7] This suggests that firms, which adjust successfully to globalization, pay higher wages and offer better working conditions (Newfarmer and Sztajerowska, 2012).

Finally, there is increased interest in how other components of globalization affect the distribution of income within countries. Foreign financial flows have been identified as a possible determinant of inequality that may often act in combination with trade flows.[8]

FDI inflows may, for instance, increase inequality in low-income countries because they increase the relative demand for skilled labour (Feenstra and Hanson, 1997). Increased mobility of capital that is not matched by a similar increase in global labour mobility is also likely to have an impact on the relative bargaining power of workers and capital owners and on taxation choices. Both have an effect on income distribution within countries (e.g. Boix, 2011). Recent empirical studies have found that increases in global financial flows have contributed to increased inequality (e.g. ILO, 2011; IMF, 2007; Jayadev, 2007; OECD, 2011).

Overall, therefore, evidence seems to indicate that trade in goods and services is unlikely to have had a significant impact on inequality through the traditional channels of shifting relative demand for production factors (Haskel et al., 2012). However, there is some evidence that trade, combined with technological change or with FDI, can significantly affect income distribution within countries. At the same time, all three factors are among the major drivers of economic growth.

(ii)   Is trade openness a determinant of unemployment levels?

Trade opening triggers economic change. It allows well-performing firms to expand their activities and to export. It also puts under-performing firms under increased competitive pressure from abroad. As a consequence, those firms may shrink or even close down. These changes brought about by trade opening are thus an inevitable and desirable part of the process that leads to improvements in economic performance and subsequently to increases in wealth. However, during the period of change, jobs are created in some parts of the economy and lost in others. Policy-makers, therefore, often consider such periods of transition as critical.[9] They are also concerned about the employment implications of changes in the competitive environment once their economy is open. This is reflected in the fact that WTO agreements contain safeguard measures that allow governments to intervene under certain conditions if unexpected surges in imports have significant negative employment effects.[10]

Economic research provides policy-makers with information on the direction of change following trade opening. In particular, it provides information on which parts of the economy are most likely to suffer job losses. In traditional trade theory, the reshuffling of resources and economic activity was expected to take place across sectors, with jobs being created in exporting sectors and being lost in import-competing sectors. More recent trade models show that firm-level adjustment following trade opening leads to job creation and job loss in all sectors, due to the fact that high-productivity firms fare better in both net-exporting and net-importing sectors, while low-productivity firms fare worse (e.g. Bernard et al., 2007). The latter implies that part of the adjustment process following trade opening takes place within sectors (Jansen and Lee, 2007), which probably makes adjustment easier than cross-sectoral adjustment.

In general, the focus of economic research in recent decades has not been on understanding the adjustment process following trade opening but rather on assessing whether trade opening has an effect on long-run unemployment rates. In this context, it is worth noting that trade opening would have no effect on unemployment rates if markets – particularly labour markets – function smoothly. In theoretical models analysing the relationship between trade and unemployment, economists assume imperfect markets where wages do not reach the market-clearing level. This may be because minimum wages put a lower bound on wage levels (e.g. Brecher, 1974; Davis, 1998), because workers' efforts on the job depend on whether they consider wages to be fair (e.g. Egger and Kreickemeier, 2009),[11] or because labour markets are characterized by matching or search frictions (e.g. Jansen and Turrini, 2004; Helpman et al., 2010; Felbermayr et al., 2011b).[12]

The impact of trade opening on unemployment will depend on whether increased trade is expected to exacerbate the impact of already existing frictions or whether it is expected to reduce the strain on a particular friction. If, for instance, trade opening puts pressure on wages of workers that are already working at minimum wage levels, increased foreign competition can lead to higher unemployment if demand for those workers is reduced further. If, on the other hand, trade opening allows companies to take advantage of scale economies, minimum wages and search frictions will become less binding and unemployment levels will go down in the long-run. As trade reform and openness are expected to trigger a combination of different effects, it is difficult to predict the effect of trade on long-run employment on the basis of economic theory alone. The empirical literature provides more clear-cut insights into the long-run effects of trade on unemployment, as will be highlighted later in this section.

One reason why theoretical research has focused on the long-run rather than the short- to medium-run effects of changes in trade flows may be that economists expect adjustment phases to be short and not very costly. Early studies attempting to assess the economic costs of adjustment following trade reform concluded that those costs were low and around 5 per cent of the total benefits of trade (Magee, 1972; Baldwin et al., 1980).

It is therefore reasonable to assume that changes in trade flows do not necessarily have a significant impact on macroeconomic measures, such as the overall employment rates, when the value of trade is small compared with the size of the overall economy. In a country such as the United States, the ratio of imports to GDP was around 15 per cent in the years preceding the economic crisis. When measured in terms of value added, i.e. if only the foreign value added embodied in imports is taken into account, imports represented less than 14 per cent of the United States' GDP in 2008 and around 11 per cent in 2009.[13]

Figure D.5, however, suggests that an increase in competition may affect a country's economic structure, even in economies as large as the United States. It reflects structural change, measured by the so-called structural change index (SCI), which captures changes in the relative size of sectors. The index ranges from zero to 100, with higher values reflecting more important changes in the relative size of sectors, changes that typically go hand in hand with the reshuffling of resources. The individual bars in Figure D.5 illustrate the extent to which the economic structure of an economy in a given year differs from the economic structure ten years earlier. The period of ten years has been chosen because such a period would typically be expected to cover two business cycles. Structural changes in terms of the sectoral composition of value-added and in terms of employment are reflected separately.

Figure D.5: **The rise of new competitors and structural change in the United States, 1979-2010**

Sources: United Nations, National Accounts main aggregates (gross value added by economic activity, current US dollars), LABORSTA, UN COMTRADE.

Note: The Structural Change Index (SCI) is computed using five year averages at the beginning and the end of each ten-year period. It is typically measured as half the sum of the absolute value of the differences in value-added sectoral shares over time:

$$SCI = \frac{1}{2} \sum_i |x_{i,t} - x_{i,t-1}|$$

Different levels of sectoral disaggregation can be used with higher disaggregation leading to higher SCI values. The SCI in this figure was constructed using a disaggregation into five sectors: agriculture, hunting, forestry and fishing; mining and utilities; manufacturing; services; and other activities. The SCI was previously used in Productivity Commission (1998) and Bacchetta and Jansen (2003). Francois et al. (2011) also refer to the measure.

Figure D.5 shows that observed levels of structural change differ over time, with some periods being characterized by high levels of change and others by lower levels. It also demonstrates that the measured rate of structural change has increased over time in the United States, as both the peaks and troughs reflected in the chart increase over the years. Figure D.5 even indicates that structural change may have something to do with trade. The two lines reflect the share of world exports of Japan and China, respectively. It is striking to see how the rise of these trading powers, for example, has coincided with periods of increased structural change in the United States. The figure illustrates that adjustments in terms of employment appear to take place later than value-added adjustments, perhaps reflecting that firm-level productivity adjustments pre-date adjustments in terms of staffing. Furthermore, the difference in timing between labour and production adjustments is larger in recent decades than in the 1980s and early 1990s. The employment adjustments are also significantly larger in the more recent period. This discussion, however, cannot claim to reflect any causal link between increases in exports from major traders and structural change in their trading partners. It is also

the case that the nature of the reshuffling process following trade reform is likely to be country specific and to depend on the timing of trade reform and the nature of trade shocks (e.g. Haltiwanger, 2011).

The story reflected in Figure D.5 seems to be in line with findings in recent trade literature: the adjustment phase following trade shocks can be challenging.[14] Cosar (2011), for instance, points out that it may be particularly difficult for older workers to adjust.[15] Autor et al. (2012) highlight that the medium-run efficiency losses associated with adjustment to trade shocks can be significant. Davidson and Matusz (2004b) show in a theoretical set-up that unemployment levels following trade shocks can be lower or higher depending on the adjustment path that an economy takes.

The existing empirical literature on the determinants of unemployment finds that trade opening is likely to decrease unemployment in the long-run, while it may lead to increases in unemployment in the short-run. Using information on 92 countries for the period 1990-2000, Dutt et al. (2009) find that unemployment increases immediately after trade opening, but decreases in the first and second year after trade

opening. The decline more than outweighs the original surge in unemployment.[16] Görg (2011) echoes this finding in a literature overview where he concludes that globalization may lead to higher job turnover in the short run but that there is no indication that trade or offshoring lead to higher unemployment overall. In a paper focusing on the long run, Felbermayr et al. (2011a) find that greater trade openness is consistently associated with a lower structural rate of unemployment. The empirical literature thus appears to suggest that in the long run, trade does not increase unemployment or it contributes to reducing it. Where trade contributes to increased unemployment, this is likely to be only a short-run phenomenon.

Actual or expected economic difficulties during phases of transition may, however, create important challenges for policy-makers, particularly if they affect the public's attitude towards trade or put long-run structural adjustment processes at risk. Fear of job loss may, for instance, affect voters' attitude towards trade reform independent of whether relevant individuals actually end up losing their job. This issue will be discussed in the next sub-section. Adjustment periods following trade opening may also affect long-run trade and growth patterns (e.g. Mussa, 1978; Davidson and Matusz, 2004b; Francois et al., 2011), because they set the stage for the resulting structural composition of employment and production. The challenges that different types of countries face in this context are discussed below.

(iii) Effect of unemployment and income distribution on trade policy

This sub-section discusses how the actual or perceived impact of trade on jobs and the distribution of income is likely to affect policy-making, with a particular focus on trade policy. It also discusses how income inequality within countries can affect the benefits that these countries draw from trade opening.

Perceived impact of trade on labour markets and potential rises in protectionism

Income inequality has risen within most countries and regions over the past two decades. Since this period has also been characterized by unprecedented international trade, it is often perceived that the benefits of rising living standards associated with globalization have not been shared equally across all segments of the population. There is a risk that such concerns may translate into protectionist sentiment and ultimately affect trade policies and trade flows.

Based on traditional trade theory, it would be expected that individuals employed in import-competing industries are sceptical about trade opening. People with a skill that will be less in demand after reform are also likely to lose and, according to the most recent literature, those employed in small firms are more likely

to experience negative consequences from trade than those employed in large firms.[17]

In industrialized countries (i.e. countries well-endowed with high-skilled labour), low-skilled labour has traditionally been expected to lose (in relative terms) from trade. Econometric analysis of survey information has confirmed that attitudes towards trade opening are indeed in line with theoretical predictions. Mayda and Rodrik (2005) find that individuals working in non-trade sectors tend to be the most pro-trade, while those in import-competing sectors are the most protectionist.[18] They also find that individuals with higher levels of educational attainment oppose trade restrictions in countries well-endowed with human capital. Based on the above, standard political economy considerations would predict that policy decisions would take a protectionist tendency if sufficiently large numbers of individuals consider themselves to be losers from trade opening (Boix, 2011; Mayer, 1987; Dutt and Mitra, 2002 and 2006). If the distribution of gains from trade is sufficiently skewed, protectionist sentiments may prevail even when the overall effect on the economy's welfare is positive.

While most economic analyses of this question have focused on the actual distributional effects of trade on income, perceptions and uncertainty about individual outcomes matter. Individuals who suffer from job or income loss may be hostile to trade opening if they perceive trade to be the source of their problems independent of whether this is actually the case. Individuals may also nurture protectionist sentiments if they fear the loss of their jobs as a result of trade opening even if they end up keeping their job or finding a better one. The latter phenomenon has been examined in Fernandez and Rodrik (1991) who show that individuals prefer to maintain the status quo if they do not know in advance who is going to be affected by possible negative consequences of reform.

An analysis of survey data, collected in the year 2000, suggests that individuals may evaluate differently individual employment perspectives and the employment perspectives for their country as a whole. In the survey, Asian and European interviewees in 18 countries were asked about their views regarding their personal work situation, unemployment in their country and the need to limit imports of foreign products. Interviewees were asked:

- whether they believe that globalization has a bad effect on job security (globalization 1)

- whether they believe that globalization has a bad effect on standards of living (globalization 2)

- whether they agreed that their country should limit imports of foreign products (trade)

- whether they were worried about their personal work situation (job 1)

- whether they were worried about unemployment in their country (job 2).

Figures D.6 and D.7 reflect how concerns about jobs are related to views on trade or globalization by representing relevant correlations across individual replies for the 18 countries. Only statistically significant correlations are presented. Figure D.6 illustrates that individuals who are concerned about their personal work situation also believe that globalization is bad for job security and standards of living. This pattern holds across countries, with correlations being somewhat higher in European than in Asian countries. Individuals who are concerned about their personal work situation also tend to have stronger protectionist views when it comes to trade. This again holds for all countries in both regions, with the exception of the United Kingdom.

This pattern of correlations is reversed when individuals are asked about employment outcomes at the national level. Figure D.7 reveals that in all countries, individual responses regarding concerns about globalization are systematically negatively correlated with individual concerns about unemployment in their country.[19] Combining the information shown in Figures D.6 and D.7 suggests that interviewees who tend to believe that globalization

has negative effects on job security and the standard of living fear their own employment perspectives while acknowledging that the country's overall employment perspectives may be positive.

The above distinction between overall and individual effects is also reflected in other survey evidence from European countries. This indicates that a majority of respondents believe that globalization provides opportunities for economic growth but increases social inequalities.[20] Figure D.8 looks more closely at survey information regarding inequality and compares country responses regarding two questions:

- Do you consider that differences in incomes are too large?

- Do you consider that globalization represents a threat to national employment and companies?

The first question was asked in the Eurobarometer survey of 2009, while the second question was contained in the Eurobarometer survey of 2012. Figure D.8 reflects the percentage of respondents who replied positively to the two questions in individual countries. It reflects a positive correlation between concerns about inequality and concerns about globalization. This correlation may reflect a Europe-specific phenomenon as similar exercises for a dataset covering global attitudes did not find positive correlations of a comparable significance.[21]

Figure D.6: **Attitude towards job insecurity (personal work situation)** (correlation with attitudes towards trade and globalization)
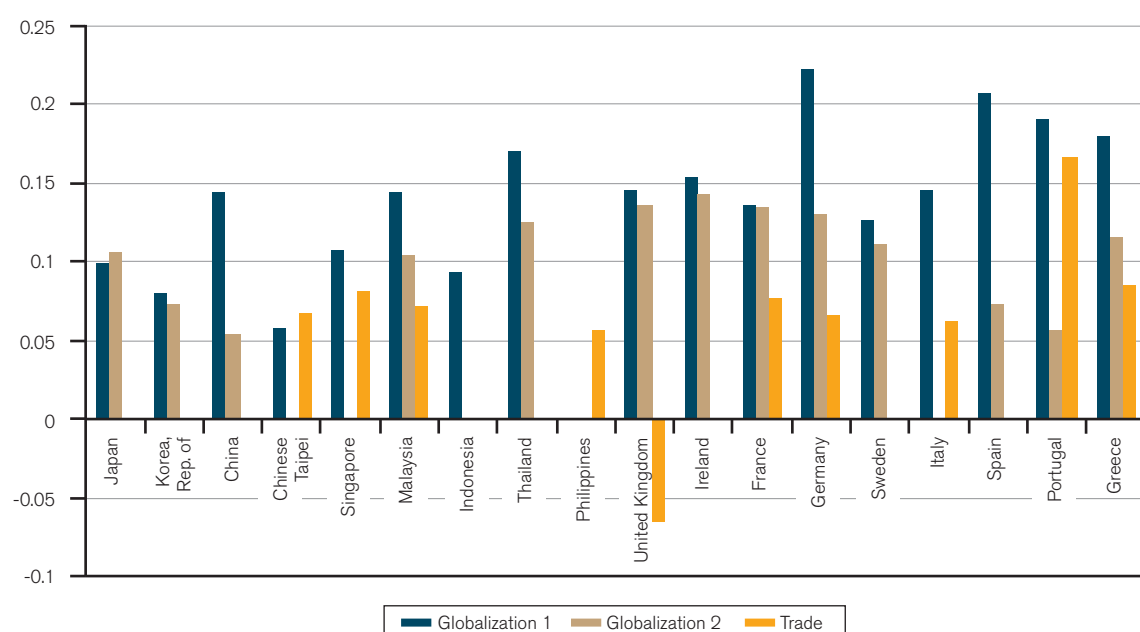
Source: Authors' calculations based on Inoguchi (2001).

Note: Globalization 1 – Does globalization have a bad effect on job security? Globalization 2 – Does globalization have a bad effect on standards of living? Trade – Should your country limit imports of foreign products?
Only statistically significant correlations are represented in the figure.

Figure D.7: **Attitudes towards job insecurity (unemployment in the country)**
(correlation with attitudes towards trade and globalization)

Source: Authors' calculations based on Inoguchi (2001).

Note: Globalization 1 – Does globalization have a bad effect on job security? Globalization 2 – Does globalization have a bad effect on standards of living? Trade – Should your country limit imports of foreign products?
Only statistically significant correlations are represented in the figure.
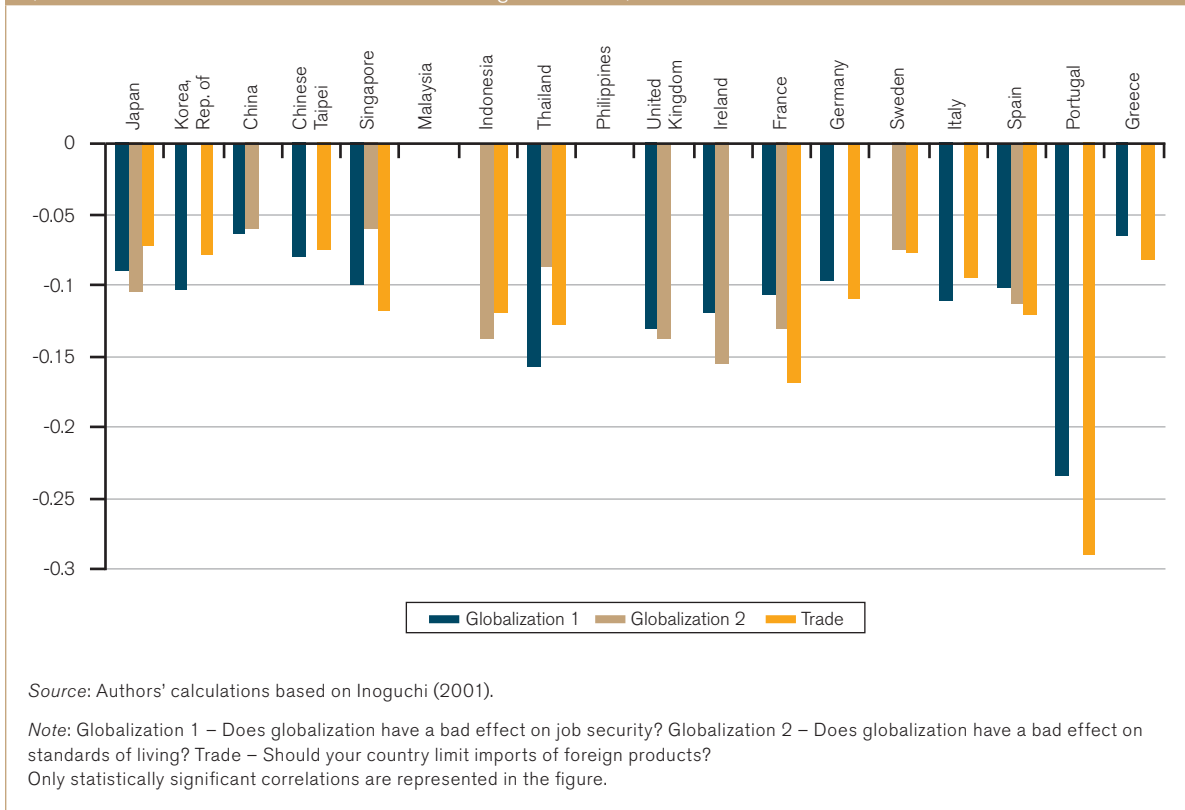
Figure D.8: **Attitudes towards globalization (2012) and inequality (2009) in Europe**
(percentage of respondents that agree or agree strongly with the statements shown on the axes)

Source: Authors' calculations based on Eurobarometer 2009 and 2012.
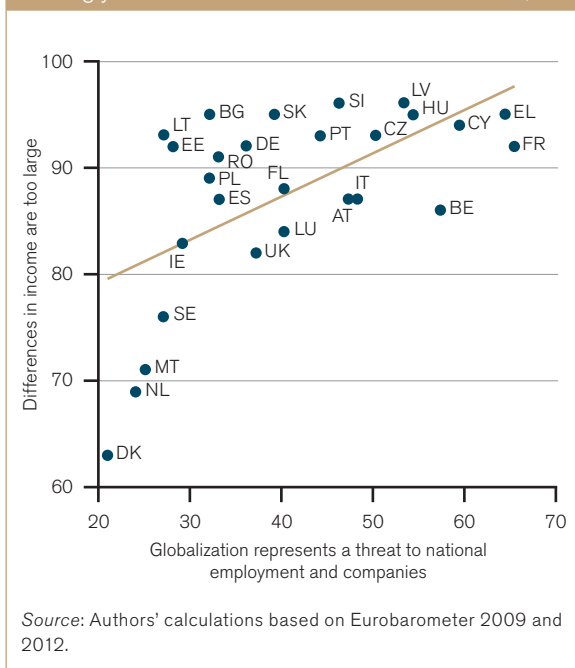
Overall, the survey evidence discussed above seems to suggest that individuals perceive globalization as entailing risks for their personal job situation. As predicted in Fernandez and Rodrik (1991), individuals may take these risks very seriously even when they acknowledge the likely positive effects of globalization for the overall job market. One of the possible consequences is that individuals may increasingly "vote" against globalization.

Inequality and the benefits of trade reform

Actual or perceived inequality may not only affect trade through its possible impact on trade policy decisions; inequality is also likely to affect trade directly through its effect on consumption and production patterns. Wealthy individuals consume different products from poor individuals and high-income countries produce different goods from low-income countries.[22]

As consumers become wealthier, they will spend lower shares of their income on so-called necessity goods such as food and increasing shares of income on goods such as household furniture and services such as education. As their income increases further, other luxury goods such as jewellery and cars start to play a more important role in their consumption basket. Economists refer to this phenomenon as the "income elasticity of demand": as consumers become richer, they spend more money on goods that have a high-income elasticity of demand. Businesses use this concept to predict future sales of their products depending on expected changes in income levels or income distribution in the markets they serve.

In line with the above, Grigg (1994) shows that spending on food ranged from 64 per cent of household income in Tanzania to less than 15 per cent in Australia and North America in the early 1980s.[23] Box D.1 illustrates why such differences in consumption patterns may affect countries' positions in trade negotiations. Consumption patterns do not only differ across countries, they also differ within countries and depend on income distribution within countries. Dalgin et al. (2008) find that imports of luxury goods increase with countries' level of inequality.

Income inequality is also likely to affect production. Linder (1961) argues that proximity to a large consumer market for high-quality goods gives firms in wealthy countries a comparative advantage in producing those goods. When exporting, these firms find larger markets for high-quality goods in other high-income countries. Accordingly, Linder predicted that trade volumes are larger among countries with similar income levels. More recent research has confirmed that the richer and the more similar countries are, the more they trade among each other, and the larger the share of intra-industry trade – that is, the larger the share of differentiated goods (e.g. Bergstrand, 1990).

As low- and middle-income countries grow richer, they are likely to consume, produce and export increasingly sophisticated goods. If inequality continues to increase in line with recently observed trends, this will be particularly beneficial for trade in "luxury goods", i.e. goods with high-income elasticities of demand. Fieler (2011), for instance, predicts that continued growth due to productivity increases in China will go hand in hand with a significant increase in the consumption of luxury goods.

In Fieler's model, China's production of luxury goods also increases but by much less, because the country's comparative advantage remains in the production of less sophisticated goods.[24] Indeed, Chinese production of less sophisticated goods is expected to take significant advantage of the productivity increases mentioned before. Fieler (2011) predicts that world prices of "basic" goods will decrease in relative terms as a consequence of Chinese increases in supply. Relative prices of luxury goods are predicted to increase because of the demand surge in China. According to Fieler, rich countries that are net exporters of luxury goods would take advantage of this change. Poor countries that are large consumers of "basic" products would take advantage of the decrease in their prices. Middle-income countries that are net importers of luxury goods could be negatively affected by such changes in relative prices.

Fieler (2011) does not provide a separate analysis for consumers of different income groups within countries. In line with the discussion in previous paragraphs, it is not unreasonable to expect that the relative price changes may end up benefiting lower-income households who consume more basic goods and the highest-income households if they are owners of production factors involved in producing luxury goods. Fieler's paper and most of the literature discussed so far assumes that global and national markets function relatively smoothly. If this is not the case, inequality within countries can have a significantly stronger effect on the distribution of gains from trade within and across countries.[25]

The work by Foellmi and Oechslin (2010; 2012) illustrates that if financial markets are characterized by

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Box D.1: Food security versus food safety

Cross-country differences in consumption patterns may affect trade policy-makers' negotiation positions. In recent debates related to agricultural trade, for instance, representatives of low-income countries have tended to emphasize the need for secure access to food while representatives of industrialized countries are paying increasing attention to the need to guarantee the quality of food.

The last decade has been characterized by high levels of price volatility in agricultural commodities. Given that poor households tend to spend a large share of their income on food, they are particularly vulnerable to price hikes in agricultural commodities. The World Bank (2011) has estimated that rises in food prices between June and December 2010 pushed an additional 44 million people below the US$ 1.25 poverty line. As a consequence, concerns about food security have been high on the agenda of policy-makers, particularly in developing countries. In order to ensure adequate food supply at acceptable prices, policy-makers have turned to interventions such as subsidizing the consumption of food or restrictions on the exports of locally produced food.

Although volatility in commodity prices has also affected industrialized country consumers, concerns about food safety rather than food security have been prominent in the public debate in those countries (Cheong et al., 2013). Indeed, as consumers become rich enough not to worry about basic access to food, the quality of food starts gaining in importance for them. The bovine spongiform encephalopathy (BSE) crisis in the late 1990s, the 2011 E-coli outbreak and bird flu transmission through poultry trade in recent decades have contributed to concerns about the safety of imported food. In this context, demands for stricter food safety regulation have increased and have resulted in new forms of non-tariff measures (NTMs) or in private labelling schemes.

market imperfections, inequality may exclude some parts of the economy from trade. In particular, they show that trade opening may widen income differences among firm owners in LDCs since shrinking profit margins make it difficult, if not impossible, for these entrepreneurs to access credit (Foellmi and Oechslin, 2010). If investments in new technologies are necessary to be competitive at the global level, imperfect financial markets are likely to impede small and medium-sized enterprises (SMEs) in LDCs from making the necessary investments (Foellmi and Oechslin, 2012). This suggests that policies targeted towards facilitating access to credit would allow a larger part of an LDC's economy to participate in trade and would thus increase the gains from trade.[26]

In the set-up proposed by Foellmi and Oechslin (2012), targeting companies that are relatively less credit constrained, i.e. the larger companies among the credit-constrained ones, is likely to bring the largest benefits in terms of increases in trade. As such, the findings of Foellmi and Oechslin (2012) may provide useful insights for the debate on strengthening developing countries' supply response to trade reform in the context of Aid for Trade.

(c) Trade and labour markets: different challenges at different stages of development

Whether and how inequality will affect future trade flows and the resulting economic benefits, and whether concerns about jobs or inequality will affect trade negotiators' future decisions, is to a large extent dependent on country-specific situations. As described above, GDP per capita still differs significantly across countries and these cross-country differences will contribute to differences in national consumption patterns. They will also determine comparative advantage and thus the global distribution of production.

What the future brings will very much depend on whether fast growing developing countries will continue to catch up, and whether those who did not manage to catch up in the past are more successful in the future. Another factor will be how current high-income countries cope with the emergence of new competitors. Much has been written about how policy-makers can influence the development path of individual economies.[27] The simulations in Section B.3 provided some illustration of how policy decisions can influence future trade and growth paths. This section adds to this discussion by examining how labour market challenges may interact with growth challenges encountered by different types of countries.

In particular, this sub-section discusses three stages of integration in global markets that may determine the future challenges to be faced by individual countries in their labour markets. First, numerous low-income countries, in particular LDCs, have not managed to successfully integrate into global markets and need to find ways to overcome existing obstacles. Secondly, with increasing GDP per capita and wages, a number of low and middle-income countries that have successfully integrated into global markets as providers of low-wage exports may wish to move into the production of higher value-added segments. Thirdly, in the past two decades, advanced economies have had to cope with the rise of new competitors, which has often put labour markets under strain. If the new competitors manage to move into new product niches in the near future, further labour market adjustments may be necessary in the industrialized world.

(i) Not staying behind

Developing economies, especially in Africa, are abundant in raw materials and have become important sources of global supply to meet the strong demand arising from the rapid urbanization and industrialization in other developing countries, such as China and India. Will an increase in the terms of trade resulting from these demand increases spur income growth for commodity exporters, notably in Sub-Saharan Africa? Or will the dependence on commodity exports lead such countries to fall further behind other regions, in particular Asia?

One of the consequences of the recent increase in commodity prices has been an increased level of specialization in commodity exports by many African countries, including the LDCs among them (see Section B.2). It is likely that this increased economic importance of commodity exports has gone hand in hand with increases in GDP in the short run. However, evidence shows that over time countries that become richer also tend to diversify their exports (Cadot et al., 2011). It suggests that a focus of policy-makers on increasing economic diversification in low-income countries appears to be justified.

The debate about ways to promote diversification can provide useful insights for the multilateral trading system and in particular for the capacity-building activities within this system. Brenton et al. (2009) emphasize two points that may be relevant for policy-makers concerned about diversification. First, low-income countries experience a much higher "death rate" of new exports than middle or high-income countries. This indicates that firms in these countries find it hard to sustain and increase exports of potentially viable products. Policy-makers may therefore want to pay attention to market failures, institutional obstacles and policy shortcomings that are strangling product lines in their infancy. Secondly, low-income countries tend to serve only a small portion of potential overseas markets for the products that they already export. A proactive role of governments to help introduce prospective

exporters to foreign markets or link them up to global supply chains can therefore have a high pay-off. Lederman et al. (2009) describe the role that export promotion agencies can play in this context and emphasize the importance of the institutional set-up of such agencies for their success.

Any effort to increase diversification will have to take into account one important labour market characteristic of LDCs. On average, agricultural employment represents 72 per cent of total employment in LDCs, compared to only 4 per cent in high-income and highly diversified economies. Any moves towards more diversification and better integration in world markets is therefore likely to go hand in hand with migration from rural to urban areas (World Bank, 2012). Measures to facilitate integration in urban areas could include providing information on accommodation or job opportunities (Cheong et al., 2013). Because of the size of the agricultural sector, it could also make sense to direct at least some effort towards the strengthening of certain branches of that sector in order, for instance, to follow a number of LDCs that managed to enter high value-added niche markets with their agricultural exports. The success stories of Kenyan cut flower exports and Rwandan coffee exports are among the best-known examples. Aid for Trade has the potential to play an important role in this context, as illustrated in Box D.2.

(ii) Catching up with the front-runners

Global supply chains have increased trade between developed and developing economies and have also rekindled interest in the role of comparative advantage in international production. Countries export different types of parts and components at different stages of development, with developing countries completing low-skill labour-intensive tasks. It is the advanced economies, where skill and capital-intensive tasks, that capture most of the value-added trade are completed. Intra-firm trade, facilitated by investment in the establishment of subsidiaries overseas, is becoming increasingly important in this context.

The transfer of technology and knowledge facilitated through such trade and FDI has made it possible for developing countries to move up the product ladder in terms of capital intensity and quality more rapidly than in the past. A number of emerging economies have been rather successful in taking advantage of these opportunities (see Sections C.2 and C.3). For China, there is already some evidence of deepening productive capacity and of a move up the product ladders (Rodrik, 2006; Hausmann et al., 2007). India's export basket is sophisticated relative to its GDP per capita, albeit to a lesser extent than China's (Hausmann et al., 2007; Tian and Yu, 2012).

Table D.2 indicates that the labour market challenges that emerging economies will face in this context differ significantly across countries. While the sectoral distribution of employment in the Russian Federation and South Africa already resembles that in industrialized countries, China and India still employ the majority of their labour force in the agricultural sector. Both countries will therefore be able to rely on a sizeable quantity of cheap and relatively low-skilled labour. Yet, if they manage to shift production to a higher-technology and higher-quality mix, it is the relative demand for skilled labour that will rise. Both countries will therefore face the dual challenge of absorbing large numbers of relatively low-skilled rural workers into the labour markets and of educating large numbers of workers to prepare them for the next generation of jobs in the manufacturing and services sectors. Given the divergent demographic patterns in the two countries, this challenge may be more formidable for India than for China.

(iii) Adjusting to new competitors

With the rise of new major global players (for example, Brazil, China and India; see Section B.2), other traders had to adjust to a new situation in global markets. OECD imports from China have increased significantly over the past two decades, replacing local production and imports from other countries. At the same time,

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Box D.2: Entering niche markets with agricultural exports: Rwandan coffee

"Rwanda has a 'National Coffee Strategy'. Rwandan specialty coffee is winning international competitions, commands some of the world's highest prices and is sought out by Starbucks, Green Mountain Coffee, Intelligentsia, and Counter Culture Coffee. There is preliminary evidence that the coffee industry is creating jobs, boosting small farmer expenditure and consumption and possibly even fostering social reconciliation by reducing "ethnic distance" among the Hutus and Tutsis who work together growing and washing coffee.

How did this happen? First, the Rwandan government lowered trade barriers and lifted restrictions on coffee farmers. Second, Rwanda developed a strategy of targeting production of high-quality coffee, a specialty product whose prices remain stable even when industrial-quality coffee prices fall. Third, international donors provided funding, technical assistance and training, creating programs such as the USAID-funded Sustaining Partnerships to Enhance Rural Enterprise and Agribusiness Development (SPREAD). SPREAD's predecessor started the first Rwandan coffee cooperative as an experiment in 2001, and the project continues its work improving each link in newly-identified high-value coffee supply chains."

Source: Easterly and Freschi, AidWatch, May 2010.

Table D.2: **Evolution of the share of employment per sector, BRICS** (percentage)				
	Share of world exports	**Share of employment**		
		Agriculture	**Industry**	**Services**
Brazil 1995	0.9	26.1	19.6	54.3
Brazil 2009	1.2	17.0	22.1	60.7
China 1995	2.9	52.2	23.0	24.8
China 2008	8.9	34.6	27.2	33.2
India 1994	0.6	61.9	15.7	22.4
India 2010	1.5	51.1	22.4	26.5
Russian Federation 1995	1.6	15.7	34.0	50.0
Russian Federation 2008	2.9	8.6	28.9	62.4
South Africa 2000	0.5	15.6	24.2	59.4
South Africa 2009	0.5	5.7	25.7	68.6

Source: ILO KILM (Key indicators of the labour market) database and WTO.

Table D.3: **Evolution of the share of employment per sector, major OECD exporters** (percentage)				
	Share of world exports	**Share of employment**		
		Agriculture	**Industry**	**Services**
Germany 1995	10.1	3.2	36.0	60.8
Germany 2010	8.2	1.6	28.4	70.0
Japan 1995	8.6	5.7	33.6	60.4
Japan 2010	5.0	3.7	25.3	69.7
United States 1995	11.3	2.9	24.3	72.8
United States 2010	8.4	1.6	16.7	81.2

Source: ILO KILM (Key indicators of the labour market) database and WTO.

access to the Chinese market has also provided opportunities for OECD exporters. The result has been a repositioning of numerous producers and exporters with regard to global markets.

Most OECD countries have lost in terms of global market share in the past two decades. Table D.3 provides details for Germany, Japan and the United States, the three main export powers before the rise of China. Employment patterns have also changed over this period, with industrial employment declining markedly everywhere. In 2010, while industrial employment represented more than a quarter of total employment in Germany and Japan, it had shrunk to around 17 per cent in the United States. In all three OECD countries, services employment now represents by far the largest share in employment. Some observers consider that the extent and speed at which this change has taken place is a matter for concern (e.g. Spence, 2011), notably because of the role of manufacturing as a driver of innovation. Pisano and Shih (2012), for instance, argue that production and research and development (R&D) activities in manufacturing need to take place in the same or in neighbouring locations in order for R&D to be effective. According to their argument, countries losing their production base in manufacturing would also run the risk of losing their innovative capacity (see Section C.3).

Employment in advanced economies is being increasingly concentrated in the services sector. It consists of a number of sub-sectors that are associated with high qualifications and high pay (e.g. finance, legal affairs) and others where employment tends to be associated with low qualifications and low pay (e.g. retail, hospitality, construction, day care). The latter group of sub-sectors is also often characterized by high levels of informal employment.

In order to understand whether restructuring of employment leads to better or worse employment outcomes, it would be necessary to understand what types of services jobs are created. Until recently, studies analysing labour market changes following trade reform only took into account the manufacturing sector and failed to account for the services industry or the informal economy. The availability of new datasets makes it possible to analyse potential labour flows out of manufacturing. Ebenstein et al. (2009) find that workers who leave manufacturing, as a result of trade reform or offshoring, to take jobs in the services sector suffer from a wage decline of between 6 and 22 per cent.[28] The growth of the services sector in terms of employment may therefore be one of the drivers of the observed patterns of inequality increase in industrialized economies that was discussed above.

The current employment structure in industrialized countries has arisen following the emergence of new players in global markets. As mentioned above, emerging economies may seek to climb up the value chain in order to sustain growth. If China and possibly

other large emerging economies such as Brazil and India do so, it is possible that industrialized economies will have to withstand another wave of major labour market adjustments. It cannot be excluded that this adjustment would contribute to a further polarization within labour markets, whereby there is growth in employment in the highest- and lowest-skilled occupations, with declining employment in the middle range of the skill distribution.[29] With greater competitiveness across all skill levels, matching firm level strategies with education and training policies is likely to become increasingly important (see Box D.3).

(d)   Conclusions

Employment has been high on policy-makers' agendas in the past years and may remain there for a while. The reasons for this differ across countries. Some countries need to find ways to absorb a growing population into the labour market or to absorb a large rural population into formal and urban activities. Other countries have been plagued by high unemployment rates since the recent economic crisis. In addition, there appears to be a growing discomfort across the globe with increasing levels of income inequality. The share of income of the 1 per cent wealthiest individuals has increased significantly in many countries since the 1990s. While there is no conclusive evidence that trade contributes significantly to changes in long-run unemployment or in inequality, public perceptions imply that policy reforms have to be seen to do well on

these two fronts in order to receive public support in the coming years.

In the public debate, "globalization" has often been associated with increases in inequality observed in recent decades. Research has tried to disentangle the effect of different components of globalization on income distribution and has also tried to understand whether different components of globalization act jointly. Available evidence suggests that trade is unlikely to have had a significant impact on inequality through the traditional channels of shifting relative demand for production factors. However, there is some evidence that trade goes hand in hand with technological change and that the combination of the two contributes to increased inequality. Recent evidence also suggests that global financial flows may play a role in explaining observed increases in inequality. Given that FDI, technological change and trade are among the main drivers of growth, this therefore hints at a possible challenge for policy-makers to ensure that growth is maintained but also balanced in terms of income distribution.

The relationship between trade and employment has received a significant amount of attention from policy-makers in recent years. Evidence suggests that trade opening can contribute to job creation. At the same time, as it tends to go hand in hand with the adoption of new technologies and productivity increases, successful integration in terms of export growth may

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Box D.3: Relevance of education and training policies for integration in global markets

In today's rapidly changing and highly integrated world, skills at all levels of the firm become extremely critical for performance and global competitiveness. Access to a skilled labour force will make it easier for firms to enter new markets abroad, to integrate into global supply chains, to survive and thrive in the domestic market and to adjust to changing conditions in global markets (e.g. Gregg et al., 2012; Froy et al., 2012).

Education and skills policies also have the potential to contribute to two objectives discussed in this section: job creation (in particular for the young) and reducing inequality (because the highly skilled tend to cope better in modern economies than the low skilled).

One way to prepare the young for the challenges of their future working environment is to ensure that they have a good basic knowledge and the ability to employ this knowledge in different settings (Almeida et al., 2012; Woessmann, 2011). However, ensuring that young people have a skill set that makes them "adaptable" is unlikely to be enough for them to find a job, in particular when they first enter the job market.

In hiring processes, employers are typically looking for candidates that have a set of skills specific to the job, or to the sector or sub-sector in which the company is active. Given that education and training decisions are taken well – often years – ahead of the moment of labour market entry, time-inconsistency problems may arise, i.e. situations where education and training decisions today do not match the skills demand of tomorrow (e.g. Almeida et al., 2012).

To minimize this problem and to reduce the occurrence of skills mismatches, it will be increasingly important for governments to strengthen skill anticipation mechanisms in their economy. This implies strengthening the collection of information about current and possible future skill demand by employers and to ensure that this information is passed on to students. It also implies that the transmitted information should influence education and training supply. Employers are well placed to know about current and possible future skill demand and their involvement is therefore likely to be important for skills anticipation policies to be successful.

not lead to large-scale job creation unless the supply response is significant in exporting firms and the domestic supply chain supporting them.

More generally, globalization facilitates the spread of ideas and innovations, which is likely to contribute to an increased speed of technological change. The latter implies that firms and workers need to constantly adjust to new technologies. Those competing in global markets also need to constantly adjust to changes in the competitive environment, as has been evident during the past two decades that have been characterized by the rise of new major players in global markets.

In order to fare well in an increasingly integrated world, economies need to have a strong capacity to adjust. This is true for many aspects of the economy but in particular for their labour markets. The nature and the extent of labour market challenges will differ across countries. For many low-income countries not yet well integrated into global markets, successful integration will imply significant economic restructuring, most likely from agricultural to industrial and services employment.

A number of emerging economies may face the dual challenge of having to employ large numbers of rural workers while simultaneously moving into higher value-added activities. In order to successfully do this, these countries will need to maintain exports in a number of low-skilled activities while at the same time expanding employment rapidly in new, higher value-added activities. If growth in emerging economies is sustained and the relative weight of individual exporters continues to change, labour markets in industrialized countries may continue to be under pressure to adjust.

Survey evidence reveals that individuals in industrialized and emerging economies alike are concerned about their individual employment perspectives, even when they have optimistic views about the economic perspectives for their country as a whole in a globalized world. Taking into account the extent of such fears and the fact that they often coincide with concerns about the distributional effects of globalization, negative views of globalization may persist or even increase. It would be very risky to reach a point where deteriorating perceptions of job security and income distribution within countries become a pressure point for countries to resort to protectionism.

In the short run, policy-makers can address these fears by providing social protection to individuals during periods of unemployment.[30] In the medium to long run, education and training policies are likely to play an important role for all countries. Access to a skilled labour force will make it easier for firms to access new markets and for firms and workers alike to adjust to changing market conditions. Education and training policies can also play a role in addressing possible distributional concerns, as high-skilled workers will find it easier to take advantage of new opportunities than low-skilled workers.

In addition, active labour market policies that help displaced workers to find new jobs can contribute to reducing fears about job loss. Policies that strengthen the enabling environment for enterprises can positively contribute to job creation. Initiatives to strengthen domestic financial markets can have particularly high pay-offs, to the extent that they succeed in facilitating investments necessary to raise firms' competitiveness. More generally, initiatives, such as Aid for Trade, that aim to strengthen supply response in developing countries can contribute in this regard.

2. Environmental concerns

Open trade and environmental protection are key elements of sustainable development.[31] This was recognized at the Rio Earth Summit 20 years ago, when the international community emphasized the importance of cooperation "to promote a supportive and open international economic system that would lead to economic growth and sustainable development in all countries, to better address the problems of environmental degradation".[32] When the WTO was established a few years later, WTO members affirmed their commitment to sustainable development and identified environmental protection and the sustainable use of the world's resources as essential goals of the multilateral trading system.[33]

Both open trade and sound environmental policies should work to utilize existing resources better (UNEP, 2013). Openness to trade allows countries to specialize in the productive activities in which they have a comparative advantage. It also extends the market for domestic producers, enabling them to exploit economies of scale. Environmental policy seeks to increase the efficiency of the economic system by ensuring that the full costs of production and consumption, including environmental costs, are reflected in economic decisions.

Beyond this broad level of commonality, trade and the environment interact in complex ways, with multiple links and feedback effects between them. Thus, managing the interface between trade and the environment poses multiple challenges, including for the WTO. Based on this recognition, the section explores selected aspects of the relationship between trade and the environment, and identifies possible future challenges. Specifically, it examines the impact of trade openness on the environment, and the related question of how trade may be influenced by public perceptions of its environmental impacts. This section then explores the multiple interactions between environmental policy and trade, as illustrated by two sets of climate change policies (border carbon

adjustments and incentive schemes for renewable energy). The analysis reveals that, if not managed carefully, the interaction between trade and the environment may give rise to trade and other tensions, which may undermine the future contribution of trade openness to economic growth and sustainable development.

(a) Patterns of environmental degradation

The environment and the economy are two interdependent systems. In recent decades, the scale of growth has led to significant environmental transformations and problems (Dittrich et al., 2012) (see Figure D.9). For instance, more than 50 per cent of the planet's land surface has been modified by human activities (Hooke and Martín-Duque, 2012). Increased pressure on biodiversity has led to significant loss of wild species and increased risk of extinction (Secretariat of the Convention on Biological Diversity, 2012).

Environmental degradation is complex and can take multiple (non-mutually exclusive) forms, such as air pollution (e.g. outdoor and indoor air pollution, stratospheric ozone depletion, climate change), water pollution (e.g. groundwater depletion, freshwater pollution, marine pollution, coral loss), changes in land use (e.g. soil erosion, desertification, drought, wetlands loss), biodiversity loss (e.g. species extinction, natural habitat loss, invasive species, overfishing), or chemicals and waste pollution (heavy metals, persistent organic pollutants, radioactive waste) (United Nations Environment Programme, 2012).

Environmental degradation poses direct risks to long-term economic development (Dell et al., 2012), national security (Matthew, 2000) and political stability (O'Loughlin et al., 2012). In addition, environmental pollution has various harmful and adverse health effects. It has been suggested that almost one-quarter of all deaths and the total disease burden (up to one-third of the disease burden of children) can be attributed to environmental risk factors (World Health Organization, 1997; Prüss-Üstün and Corvalán, 2006).

Economic theory suggests that environmental degradation is the result of market failures, such as the difficulty to define, allocate and enforce property rights of environmental resources. Environmental degradation is a typical negative externality, which arises when producers or consumers who use environmental resources and generate pollution do not take into account the harmful effects of their activities on the rest of society, which leads to social costs in excess of private costs.

Depending on their scope and range, environmental problems may be local, regional or global (Ramanathan and Feng, 2009). If the polluting activity and its associated environmental impact occur in the same geographical location, pollution is considered local. Examples include water pollution, emissions of particulate matter, and land degradation. Regional pollution (e.g. emissions of sulphur dioxide (SO_2) or contamination of large rivers) involves a polluting activity whose effects straddle an entire region and possibly multiple jurisdictions. Global pollution (e.g. emissions of carbon dioxide (CO_2) or ozone-depleting

Figure D.9: **Trends in output, trade and pollution, 1970-2008**

Living Planet Index — SO$_2$ Emissions Index — GDP (constant 2000 US$) Index
CO$_2$ Emissions Index — NO$_x$ Emissions Index — Merchandise Trade (% GDP) Index
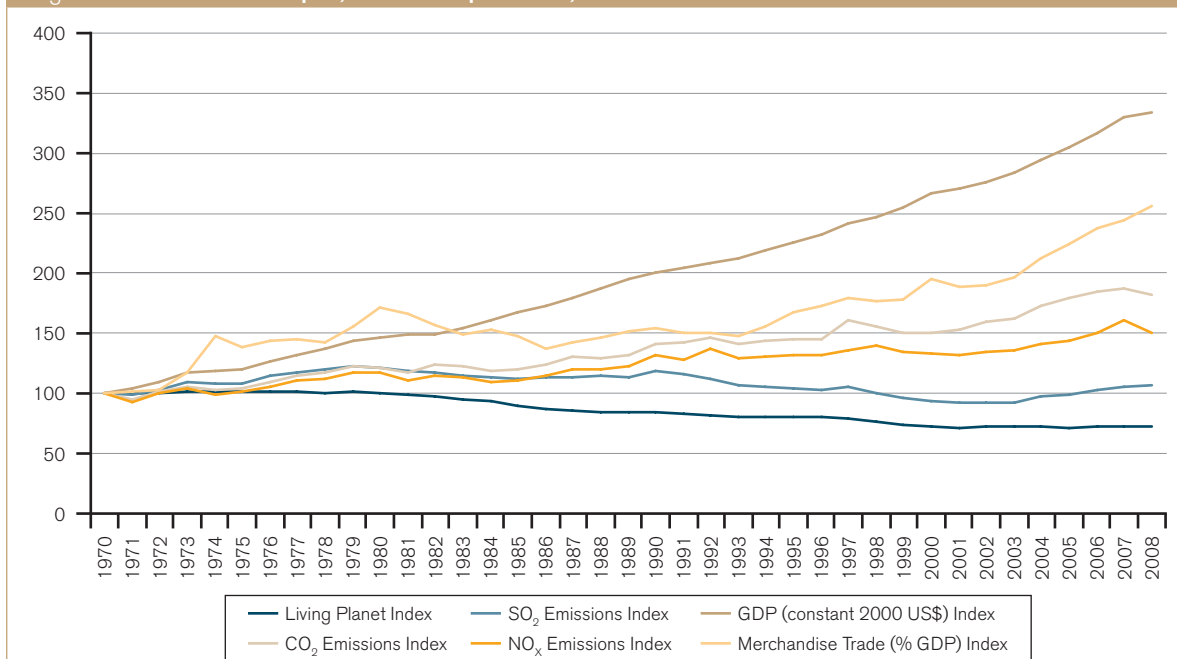
Sources: WTO Secretariat, based on European Commission Joint Research Center (2011), WWF (2012) and World Bank (2012c).

Note: Data have been transformed into indices (1970 base year).

substances) refers to a polluting activity with worldwide impacts. Global pollution does not necessarily entail homogenous consequences; for example, one of the features of climate change is that all countries will be affected, but not in the same way.

Due to the multi-faceted nature of countries' impact on the environment, it is difficult to define a single set of environmental indicators comparable across time and countries. Several sets of indicators have been developed; some integrate economic and social variables to reflect sustainability. Besides data on emissions of CO_2, SO_2 and nitrogen oxide (NO_x),[34] and biodiversity measures,[35] there are several sets of broad environmental indicators, including Adjusted Net Saving, Environmental Performance Index, Ecological Footprint, and Environmental Impact.[36]

A descriptive analysis of these data indicates that countries' impact on the environment at the worldwide level is characterized by strong heterogeneity and asymmetry (see Figure D.10). Developed and developing countries perform differently in terms of environmental impact, yet both can perform better or poorly. For example, in terms of emissions, eight developed and 11 developing countries[37] generate more than three-quarters of global CO_2 emissions. Similarly, 17 countries (13 developing countries among them)[38] generate more than three-quarters of global SO_2 emissions while seven countries[39] represent more than half of global emissions of NO_x. The strong variation in the rankings could partly reflect differences in the methodologies and environmental coverage of the indices and measures as well as different

Figure D.10: **Comparison of environmental performance indices**
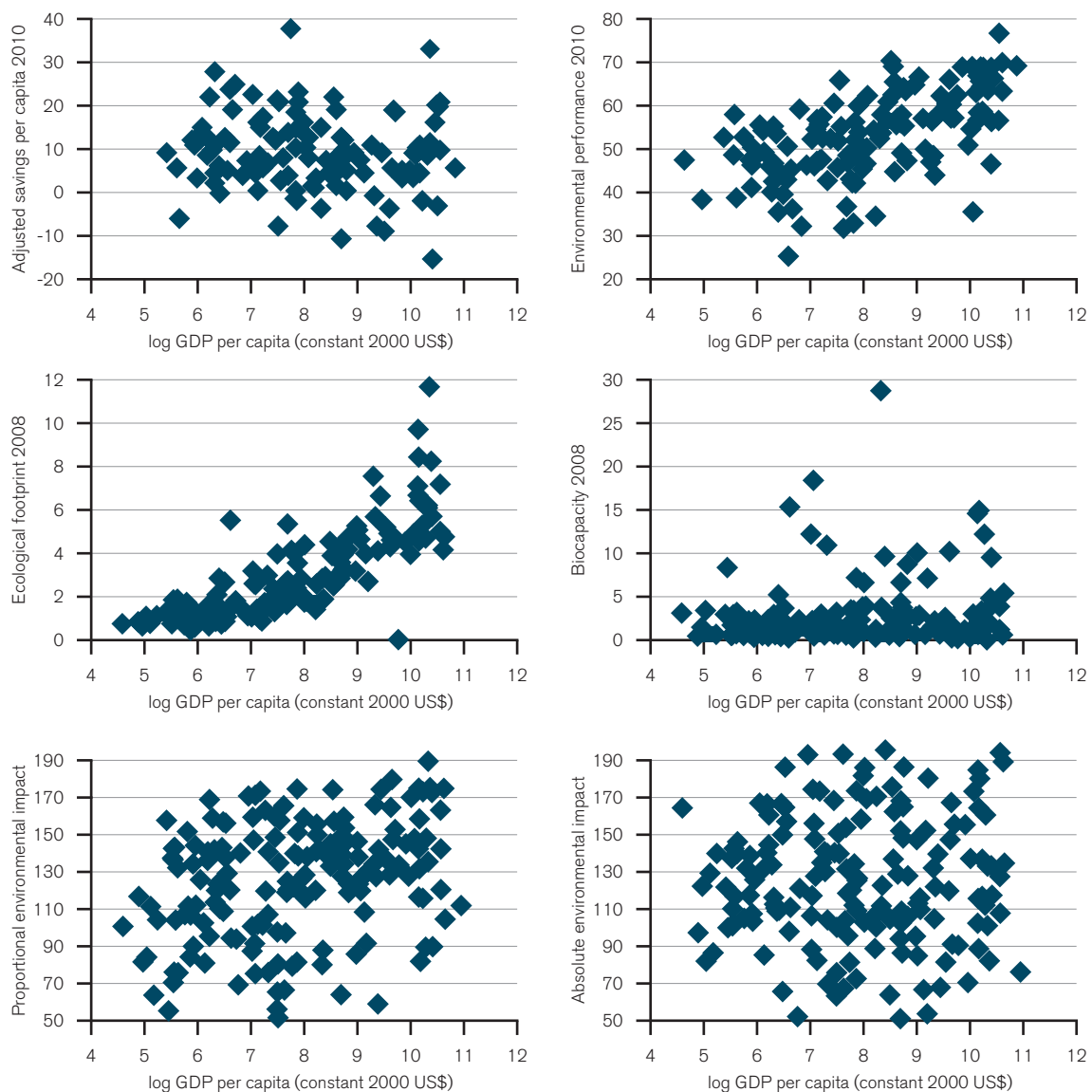
Sources: WTO Secretariat, based on World Bank (2012c), Yale Center for Environmental Law and Policy and Center for International Earth Science Information Network (2012), Borucke et al. (2013) and Bradshaw et al. (2010).

Note: The logarithm of GDP per capita (constant 2000 US$) was used to mitigate skewedness.

environmental challenges faced by countries. Several countries, developed and developing, are outliers (i.e. significantly above or below the average) in terms of positive or negative impact on the environment, reflecting the specific relationship between economic development and environmental performance.

The so-called environmental Kuznets curve hypothesizes an inverted-U shape relationship between environmental degradation and economic growth: environmental degradation increases with economic growth for low levels of income per capita but eventually improves beyond a given threshold (Grossman and Krueger, 1993). This pattern of pollution and income may be related to consumers' income-elastic demand for environmental protection, which entails an improvement in pollution abatement policies and environmental quality as income increases. The empirical evidence in support of the environmental Kuznets curve remains controversial, in part due to the lack of appropriate data and several econometric issues. While some studies find evidence of an inverted U-shape curve for specific pollutants (e.g. SO_2 emissions), others produce inconsistent results (e.g. CO_2 emissions).

Recent empirical estimates that rely on more representative datasets, higher-quality data and more appropriate econometric techniques suggest that countries' environmental performance depends not only on the level of economic development but also on several factors that are related to income, including political institutions, good governance and the diffusion of technological innovation. Regarding trade, the key question is to what extent production, transport and consumption related to trade contributes to additional pressure on the environment. This is discussed in the next section.

(b) Trade, the environment and public perceptions

As noted, international trade flows have increased dramatically during the past three decades, a period that has coincided with significant environmental degradation. This has raised concerns about the possible contribution of trade to environmental degradation, and has sparked a large literature on the subject of whether trade is good or bad for the environment. The answer to this question has important implications for the future of international trade, reflecting in part the two-way relationship between trade and the environment, and the multiple feedback effects between these two interconnected systems. The following discussion illustrates possible policy challenges that arise from this dual relationship by examining the effect of trade on the environment and the influence on trade of public perceptions about its environmental consequences.

(i) How are trade and the environment linked?

One way in which economists have examined how trade affects the environment is by breaking down the impact of a marginal change in trade into three "effects": scale, composition and technique (Grossman and Krueger, 1993). The magnitude and sometimes the direction of the individual effects depend on the particular circumstances of each country, and must therefore be determined empirically. The net result of the three effects provides the overall impact of trade opening on the environment in a given economy. In what follows, this framework is used to help uncover the main "drivers" underlying the relationship between trade and environmental conditions, a necessary first step in examining the future evolution of this relationship.

Scale effect

The scale effect refers to the increase in the level of economic activity due to trade opening, and its impact on the environment. Unless production becomes cleaner and less resource intensive, and consumers change their behaviour, for example by becoming more willing to recycle waste, the increase in the level of production, transport and consumption associated with trade opening leads to environmental degradation.

The contribution of transport to the scale effect of trade has received considerable attention. Reflecting the heavy reliance of transport on petroleum as a source of energy, much of the attention has focused on the impact of transport on climate change. Although the bulk of international trade is transported by sea, which is the most efficient mode of transport in terms of carbon emissions and represents a relatively minor share of worldwide carbon emissions, trade-related transport activity is projected to increase sharply during the next few decades, as are emissions from transport.

It has been estimated that emissions from international shipping represent approximately 3 per cent of world CO_2 emissions from fossil fuel combustion (International Transport Forum, 2010).[40] Regarding the more CO_2-intensive modes of transport, their contribution has been estimated at 1.4 per cent of global carbon emissions from fuel combustion for air and 17 per cent for road. These numbers overestimate the contribution of trade, given that they include emissions generated by the transport of people besides freight. In addition, the figure for road transport comprises both domestic and international transport.

Relative to emissions generated by trade (i.e. emissions from the production and transport of goods traded internationally), transport is estimated to represent approximately one-third of worldwide carbon emissions

(Cristea et al., 2011). This average masks large differences in the contribution of different economic sectors and countries to trade-related transport emissions. For example, the share of transport-related emissions in total emissions from exports ranges from 14 per cent for South Asia to 55 per cent for North America (see Figure D.11). This largely reflects the heavy reliance of North American exports on air and road transport.[41] Regarding economic sectors, the share of transport-related emissions in total emissions from exports of agricultural, mining and other bulk products that rely on maritime shipping are often less than 5 per cent, compared with 75 per cent for transport equipment, electronic equipment, machinery and some manufactured goods.

Between 2010 and 2050, carbon emissions from international freight transport are projected to increase by a factor of four outside the OECD, and by a factor of 1.5 in the OECD area, assuming that the modal composition remains constant (International Transport Forum, 2012). These projections highlight the importance of multilateral efforts that seek to internalize environmental costs in the prices of international air and maritime transport, including through taxes and other market-based measures.

The future evolution of the trends identified in Section B.2 may affect the projected patterns of CO_2 emissions from transport. For example, the growing importance of cross-regional instead of intra-regional preferential trade agreements should make trade more globalized, implying a shift towards more distant trading partners. This could result in higher levels of greenhouse gas emissions from trade-related transport, especially if accompanied by heavier

reliance on air instead of sea transport. The spread of regional instead of global supply chains, as is occurring in Asia (see Section B.2(e)), would work in the opposite direction.

Composition effect

The composition effect refers to the changes in relative prices and levels of pollution brought about by trade opening. Trade opening causes some sectors to expand and others to contract, in line with a country's comparative advantage. Holding constant the scale of economic activity and methods of production, trade opening reduces domestic pollution if the expanding (export) sector is less pollution-intensive than the contracting (import-competing) sector. The composition effect works against the scale effect in countries with a comparative advantage in clean sectors, while the two effects reinforce each other in countries with a comparative advantage in dirty sectors.

What determines whether a country specializes in clean or dirty production? The so-called "factor endowments hypothesis", which is based on the Heckscher-Ohlin model, predicts that trade opening will cause capital-abundant (developed) countries to specialize in the production of capital-intensive (dirty) goods, while developing countries specialize in labour-intensive (clean) production.[42]

An alternative hypothesis, known as the "pollution haven hypothesis", is based on the idea that environmental policy is the main source of comparative advantage. The hypothesis posits that trade opening will lead to the relocation of pollution-intensive production from countries with stringent environmental

Figure D.11: **Transport-related emissions from exports, 2004** (percentage)
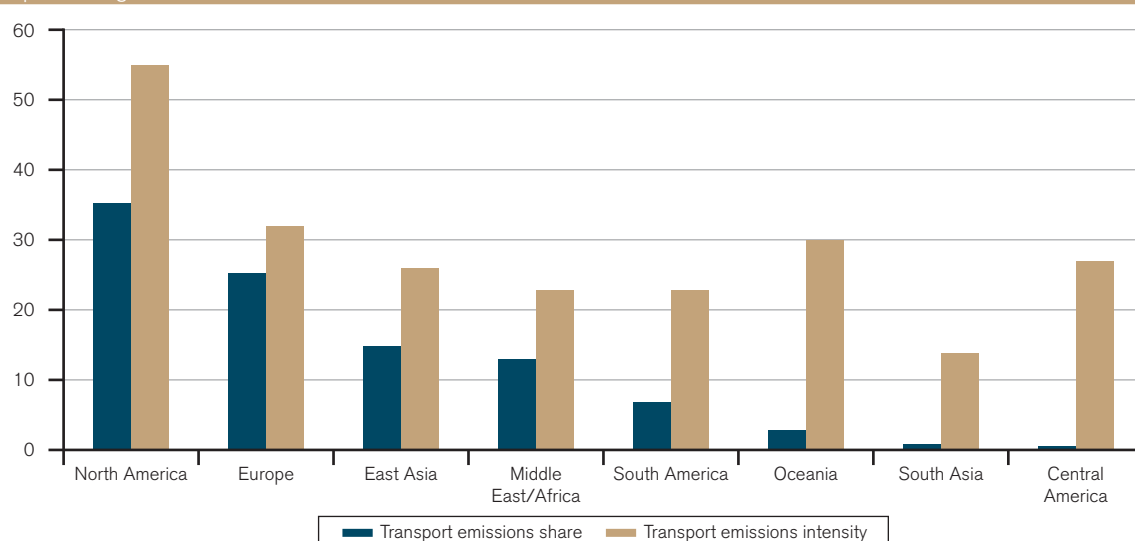
Source: WTO Secretariat, based on Cristea et al. (2011).

Note: "Transport emissions intensity" refers to the share of transport-related emissions in total emissions from exports. For perspective, the figure also displays transport emissions for each region as a share of total transport emissions ("transport emissions share").

policy to countries with relatively lax environmental policy (Taylor, 2005).[43] This implies the specialization of developing countries (which are assumed to have lower than average levels of environmental policy stringency) in dirty production, while developed countries specialize in clean production.[44] Whether the factor endowments hypothesis prevails over the pollution haven hypothesis or vice versa in a particular economy is an empirical question (see Section D.2(c)).

Technique effect

The technique effect refers to the improvements in environmental conditions that result from trade-induced changes in the methods by which goods and services are produced.[45] It implies a reduction in the pollution intensity of individual firms as a result of trade opening (see Box D.4). Although the impact of the technique effect on the environment is always positive, nothing in the literature suggests that the technique effect will happen by compelling necessity, or that its magnitude will be sufficiently large to offset the negative environmental impact of the scale (and possibly, composition) effects. One reason that has been advanced is that without proper incentives, private agents are unlikely to adopt the technologies needed to improve production methods (Copeland, 2012). Given the key role of environmental policy in providing incentives for the adoption of new technologies, it would appear that the magnitude of the technique effect will depend in large measure on the existence and adequate implementation of sound environmental policy.

The economics literature has identified at least two ways in which trade may improve production methods. First, the increase in per capita income associated with open trade can give rise to greater demand by the public for a cleaner environment. Provided that the political process is not "captured" by polluting industries or otherwise compromised, the demand for improved environmental quality should result in a more

stringent environmental policy that entices producers to reduce the pollution intensity of output (Nordström and Vaughan, 1995).

Secondly, eliminating tariffs and other trade barriers tends to increase the availability and lower the cost of environmentally friendly technologies embodied in imported capital goods or in the form of knowledge-based processes diffused by the movement of personnel. For example, a study cited in Dutz and Sharma (2012) finds that if the top 18 developing countries ranked by greenhouse gas emissions would eliminate tariffs and non-tariff barriers on renewable energy goods, their imports would increase by 63 per cent for energy efficient lighting, 23 per cent for wind power generation, 14 per cent for solar power generation and close to 5 per cent for clean coal technology.

The potential environmental benefits of trade highlight the critical importance of the first ever WTO negotiations on trade and environment. The mandate of these negotiations stipulates "the reduction, or as appropriate, elimination of tariff and non-tariff barriers to environmental goods and services" (WTO, 2001). These negotiations could result in fewer and lower barriers to trade in environmental goods and services, thereby improving market access conditions worldwide to more efficient, diverse and less expensive green technologies embodied in such goods and services (see Section E.2).

A closely related issue is the possibility that foreign direct investment (FDI) will result in "environmental spillovers". It has been argued that multinational enterprises may impose particular environmental requirements on their supply chain subsidiaries and external suppliers (for example, due to concerns about their reputation or economies of scale), inducing them to adopt environmentally friendly technologies (Albornoz et al., 2009). The movement of trained workers from foreign to domestic firms has been

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Box D.4: The technique effect in a world where trade is concentrated in a few global companies

As discussed in Section B.2(f), empirical evidence suggests that trade is mainly driven by a few big firms across countries. A recent study by Kreickemeier and Richter (2012) explores the implications of this finding for the environmental impact of trade through the technique effect.

The authors develop a trade model with monopolistic competition and heterogeneous firms that shows how openness to trade reallocates production from the least productive (and more pollution-intensive) firms, which are forced to exit the market due to increased competition from abroad, to the more productive (and least pollution-intensive) firms. The increase in aggregate productivity caused by trade opening leads to a reduction in overall domestic pollution if firm-specific pollution intensity decreases strongly with increasing firm productivity.

The link made in Kreickemeier and Richter's model between the productivity of firms and their environmental efficiency finds some support in the empirical literature. For example, Cole et al. (2008) use data on 15 industries in China during the period 1997-2003 and find evidence of a negative link between total factor productivity and emissions of three air pollutants. Mazzanti and Zoboli (2009) find a positive relationship between labour productivity and emissions efficiency for several types of air emissions in Italy.

identified as an additional channel through which FDI may encourage the dissemination of environmentally friendly knowledge and technologies.

In sum, the scale-composition-technique framework has revealed at least three drivers of the relationship between trade and the environment that seem to be particularly important. The first is the role of technology in minimizing or possibly offsetting any negative environmental effects that occur through the scale and possibly the composition effects. Adequately designed and enforced environmental policy and an open trade regime have been identified as key conditions to facilitate the adoption of new technologies necessary to improve production methods.

The second driver is trade-related transport, and its contribution to greenhouse gas emissions. Whether this becomes a pressure point for the multilateral trading system depends in large measure on the results of cooperative efforts to internalize environmental costs in international transport prices, and on the future evolution of the geographical scope of preferential trade agreements and supply chains, among other factors. An additional driver pertains to the significance of environmental policy (relative to "traditional" factors, such as endowments of capital and labour) in determining countries' comparative advantage in dirty or clean production. Deriving appropriate policy conclusions from this aspect is hampered by the divergence of views on the difficulty of analysing the relationship between environmental policy and trade (see Section D.2(c)).

(ii) What is the net effect of trade on the environment?

Starting with Grossman and Krueger (1993), several econometric studies have examined the environmental impact of trade mostly by seeking to assess empirically the net result of the scale, composition and technique effects (Antweiler et al., 2001; Cole and Elliott, 2003). The ambiguity in the results of this literature may partly reflect differences in underlying conceptual frameworks, data sources and proxies, and econometric methodologies. Broadly, the studies suggest that total pollution may increase or decrease depending on whether the technique effect overrides the scale effect. The type of pollutant is among the factors that influence the net result. For a global pollutant such as CO_2, it appears that the scale effect tends to dominate the technique and composition effects. For some local pollutants, the technique effect is likely to exceed the scale effect. Moreover, some studies find differences in the impact of trade on the environment depending on countries' income levels (Managi, 2012).

Given that trade separates production and consumption across space, a set of studies have developed concepts describing how trade distributes environmental degradation between countries. These studies remain largely descriptive and do not imply any causality between international trade and evidence of specialization in "dirty" production. Because of large data requirements in terms of comparable input-output tables and environmental impact measures, they usually consider a single country (Weber and Matthews, 2007; Jungbluth et al., 2011) or a small group of countries (Nakano et al., 2009). While several of these studies assess the environmental impacts embodied in trade for air pollutants such as CO_2 and SO_2 (Antweiler, 1996), others do this for water (Hoekstra and Hung, 2005), land use (Hubacek and Giljum, 2003), material extraction (biomass, fossil fuels, metals, and industrial minerals and construction minerals) (Bruckner et al., 2012), and pressure on biodiversity (Lenzen et al., 2012). None of these studies takes into account the energy and emissions associated with international freight transport.

Although empirical evidence suggests that most developed countries have increased their consumption-based environmental impacts faster than their domestic environmental impacts, making developing and emerging countries net exporters of embodied environmental impacts, there is no single pattern with respect to embodied environmental impacts (Ghertner and Fripp, 2007; Peters and Hertwich, 2008; Bruckner et al., 2012; Douglas and Nishioka, 2012; Lenzen et al., 2012; Peters et al., 2012). In fact, several developed and developing countries appear to be net exporters and importers, respectively. As noted, environmental impacts embodied in trade depend on many factors, including factor endowments, production technologies, trade balance, energy intensity and trade specialization (Jakob and Marschinski, 2012). Institutional factors may play an important role too.

Pressures on the environment caused by the rapidly growing weight of emerging economies in international trade has attracted much attention, and will probably continue to do so in the future. Looking ahead, a critical issue seems to be the extent to which the scale effects associated with the rapid rate of trade growth in emerging economies will be accompanied by changes in production methods that lower the pollution and energy intensity of their production and trade. One additional issue is the extent to which FDI into emerging economies results in positive environmental spillovers. Some empirical studies have sought to examine these factors with respect to particular countries. For example, Dean and Lovely (2008) find that China's increasing participation in global supply chains generated composition and technique effects that may have played a role in reducing the pollution content of its trade.

(iii) How do environmental concerns affect trade?

In the absence of robust empirical evidence on the environmental effects of trade, there is a risk that public perceptions of the environmental consequences of trade will be shaped predominantly by narrow examples of harmful effects, which tend to carry strong emotional appeal and attract considerable media attention. This raises concerns that the perceived negative impact of trade on the environment could exacerbate existing protectionist sentiment caused by economic uncertainty and the perceived contribution of trade openness to growing unemployment and income disparities within and across countries (see Section D.1(b)). The following discussion reviews the available evidence on public perceptions of the environmental consequences of trade, and their possible influence on trade policy.

Data on how individuals perceive the environmental effects of trade are scarce. A 2007 survey of attitudes about globalization in 18 economies (comprising around 56 per cent of the world's population) reveals significant differences in attitudes across countries, with individuals in open economies displaying a more positive perception about the environmental impacts of trade than those in less open ones (see Figure D.12). Differences across countries are also evident in a survey of the 27 EU member states (European Commission, 2010). The share of respondents in the EU who consider environmental harm to be one of the major negative consequences of international trade ranged from 4 per cent in Bulgaria to 42 per cent in Austria. For the EU as a whole, environmental harm ranks well below unemployment among the perceived harmful consequences of international trade.

Relatively few studies have dealt with the interaction between environmental concerns and public attitudes towards trade. Among them, Bechtel et al. (2011) find that individuals in Switzerland who express a higher level of concern for the environment tend to perceive globalization negatively, favour the use of trade-restrictive measures to protect jobs endangered by import competition, and consider factors that go beyond price and quality in their purchasing decisions. Additional empirical research is needed to determine whether these results apply more widely.

In a related set of studies, political economists have drawn a link between the growing tendency to include environmental provisions in regional trade agreements and individuals' environmental concerns. Specifically, this literature argues that some countries may be relying on environmental provisions in regional trade agreements to appease voters who fear the negative effects of trade on the environment (Bechtel et al., 2011). This argument would seem to be particularly relevant for one type of environmental

Figure D.12: **Public perceptions about the environmental impact of trade** (percentage of respondents that agree with the statement shown on the vertical axis)
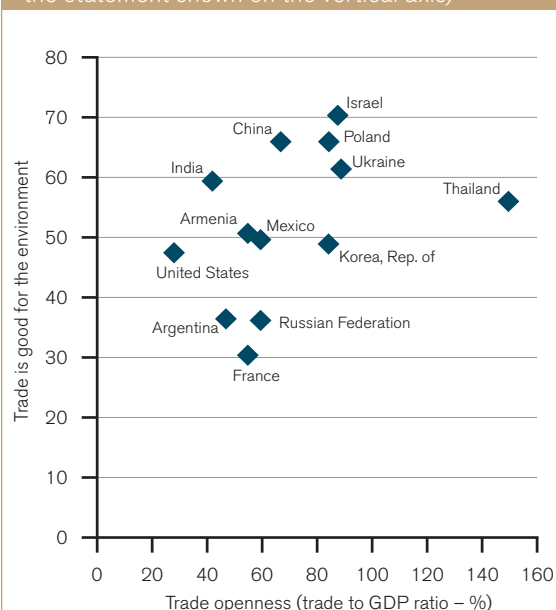
Source: Authors' calculations based on the Chicago Council on Global Affairs and WorldPublicOpinion.org (2007).

Note: The vertical axis shows the share of survey respondents that answered "good" to the following question: "Overall, do you think that trade is good or bad for the environment?", weighted by the share of population that answered either "good" or bad".

provision found in a growing number of regional trade agreements, namely the commitment by the parties to not lower environmental standards as a means to gain a trade advantage or attract investment (see Box D.5).

The overall conclusions in this strand of the literature may be applicable to other features of trade policy besides environmental provisions in regional trade agreements. For example, the proliferation of private standards could be seen as an indication of the influence on trade policy of concerns about the environmental effects of trade.

Private standards are developed by non-governmental entities, including businesses, trade associations, consumer groups and standardizing bodies, in response to rising consumer demand for information about the environmental and other characteristics of goods and services. They seek to strengthen markets for goods and services whose environmentally friendly attributes are "invisible" to consumers. While some of these standards focus solely on environmental criteria (related to a good or the way it is produced), others may incorporate food safety and social criteria.

Private standards have been developed with respect to several environmental indicators, including carbon

Box D.5: **Environmental provisions of regional trade agreements**

Prior to the entry into force of the North American Free Trade Agreement (NAFTA) in 1994, environmental provisions in regional trade agreements (RTAs) were relatively limited in scope. References to the environment appeared mostly in the preamble to RTAs and the rules on general exceptions, largely mirroring the approach followed at the multilateral level.

Since NAFTA, the scope of environmental provisions in RTAs has expanded. Of the 194 RTAs that have been notified to the WTO (up to end-2010), close to 60 per cent contain environmental provisions other than those in the preamble or the general exceptions. Of the RTAs with more extensive environmental provisions, 55 per cent involved RTAs between developed and developing countries, 38 per cent RTAs between developing countries, and 7 per cent RTAs between developed countries.

Figure D.13: **Environmental provisions of regional trade agreements**

RTAs with environmental provisions but no environmental exceptions/rights, 1, (0.5%)

RTAs with environmental provisions beyond exceptions/rights, 131, (62%)

RTAs with environmental provisions beyond exceptions/rights and preamble language, 121, (92%)

RTAs with only environmental exceptions/rights, 75, (36%)

RTAs with no environmental provisions, 4, (2%)

RTAs with only environmental exceptions/rights and preamble language, 10, (8%)

Source: WTO Secretariat.

The expansion of the "environment dimension" of RTAs notably comprises the decision to include commitments on the level and stringency of domestic environmental laws and standards. Of all RTAs notified to the WTO, 46 contain such provisions. These provisions take the form of commitments to not lower environmental standards as a means to attract investment, to enforce domestic environmental laws and standards effectively, to raise environmental standards or even to harmonize them among the parties to the RTA. Although provisions on environmental laws and standards are most commonly found in RTAs between developed and developing countries, several agreements between developing countries contain such provisions too.

Cooperation on environmental matters is an additional subject often covered in RTAs. Some 70 notified RTAs cover environmental cooperation. There is significant variation in approaches to this issue. While some RTAs outline general principles, others identify specific issues or sectors for cooperation. Provisions on environmental cooperation found in RTAs between developed and developing countries tend to focus on building capacity and strengthening the design and implementation of environmental laws, while RTAs involving only developing countries stress the need to tackle common environmental problems.

Parties to RTAs sometimes establish institutional arrangements specifically targeted at facilitating the implementation of environmental provisions contained in the agreement. These arrangements may include review and monitoring bodies, dialogue and consultation mechanisms, or formal dispute settlement procedures. Increasingly, RTAs provide opportunities for public participation (e.g. access to information and documents, representation in committees, and submissions on enforcement matters) as part of the implementation arrangements related to environmental provisions.

footprints, food miles and embodied water use. They span a widening range of products, including food, household appliances, forestry products and services such as tourism. Although these standards are cast as "voluntary" in nature (because they are imposed by private entities), they may nevertheless have significant

impacts on trade, an issue that has been of particular concern to developing countries (WTO, 2012b).

In sum, there is insufficient evidence to draw a definitive conclusion about the future interaction between public perceptions of the environmental consequences of

trade on the one hand and trade policy on the other. More research is needed on the question of how widespread negative perceptions are about the environmental effects of trade, and whether such perceptions could result in a protectionist backlash.

Pending more robust empirical results, the available evidence would seem to suggest that people's concerns about trade and the environment do exert an influence on trade policy, albeit in other ways than outright protectionism. For example, concerns about the environmental impact of trade are reflected in the growing tendency to include environmental provisions in regional trade agreements; such concerns could also be seen as partly fuelling the proliferation of private standards that seek to respond to rising consumer demand for information on the environmental and other characteristics of goods and services.

(c)   Environmental policy and trade

A key aspect of the relationship between trade and the environment is the impact of the environment on trade through the channel of environmental policies. When referring to "stringent" environmental policies, the following discussion assumes that the stringency level in law is matched by correspondingly stringent enforcement. In practice, this may not always be the case, as adequate implementation may be impaired by weak institutional capacity in many countries (Poelhekke and Ploeg, 2012).

The interaction between environmental policy and trade is probably two-way. In other words, efforts to tackle impact on the environment through environmental policies may influence the direction and composition of trade flows, while openness to trade may affect the willingness and ability of governments to adopt environmental policies. The complex and multidirectional interaction between environmental policies and trade poses challenges for the multilateral trading system. A key question from the perspective of this report is whether these challenges will intensify in the future. The following discussion considers this question by examining two sets of policies related to climate change. Given that concerns about competitiveness strongly permeate policy and academic discussions on the effects of environmental policies and trade, we begin with an overview of this issue.

(i)   The competitiveness consequences of environmental policy

When evaluating the impact of environmental policy on trade, a useful starting point is to recognize that the magnitude of the impact can vary quite drastically depending on whether the measure in question is targeted at pollution from consumption or production (Copeland, 2012). An environmental policy measure that is targeted at pollution from consumption will

normally increase costs for both domestic and foreign producers. One example would be a requirement setting a minimum level for the energy efficiency of household appliances. If the cost of complying with such a requirement is higher for domestic producers than foreign producers, imports of household appliances would increase and domestic production decrease.

By contrast, environmental policy measures that are targeted at pollution from production instead of consumption (e.g. a limit on waste-water discharges to surface waters by domestic producers of chemicals) could negatively affect the competitiveness of domestic producers by driving up their costs relative to foreign producers. This could result in a decrease in output of domestic chemicals, or put domestic producers of chemicals at a disadvantage relative to foreign producers.

Much of the economics literature assumes that environmental policies entail costs for particular firms and sectors (Pasurka, 2008). However, some observers have argued that these costs need not always result in competitiveness losses for affected firms and industries.[46] Porter and Linde (1995) postulate that properly designed environmental policy can lead to "innovation offsets" that will not only improve environmental performance but also partially or fully offset the additional cost of those policies. This is known as the Porter hypothesis, which has sparked an abundant empirical literature. Following Ambec et al. (2011), it appears that the "weak" version of the hypothesis (i.e. stricter policy leads to more innovation) is fairly well supported by the data, while the empirical evidence on the "strong" version (i.e. stricter policy enhances business performance) is mixed.

Assessing the competitiveness consequences of environmental policy is fraught with difficulties, partly because of the lack of data on the costs of compliance with such policies. The United States has published some relevant data, which suggests that the direct cost of pollution control is relatively minor. In 2005 (latest year available), US industry spent close to US$ 21 billion on operational costs to reduce pollution. For most industries, pollution abatement operation costs represent 0.5 per cent or less of revenue (see Figure D.14). This share can reach up to 1.1 per cent for pollution-intensive industries, such as primary metal and paper. Regarding capital expenditures to reduce pollution, the share of these expenditures in total new capital expenditures is usually below 5 per cent except for a handful of pollution-intensive industries, such as paper, petroleum and coal, chemicals and primary metals. The amount spent by US industry on pollution abatement capital expenditures in 2005 totalled around US$ 6 billion, slightly less than one-third of the total spent on pollution abatement operating costs that same year.

Figure D.14: **Pollution abatement costs in the United States, 2005** (percentage)

Source: Authors' calculations, based on US Census Bureau (2008).

Note: PAOC – Pollution abatement operation costs – as a share of the value of shipments. PACE – pollution abatement capital expenditures – as a share of new capital expenditures.
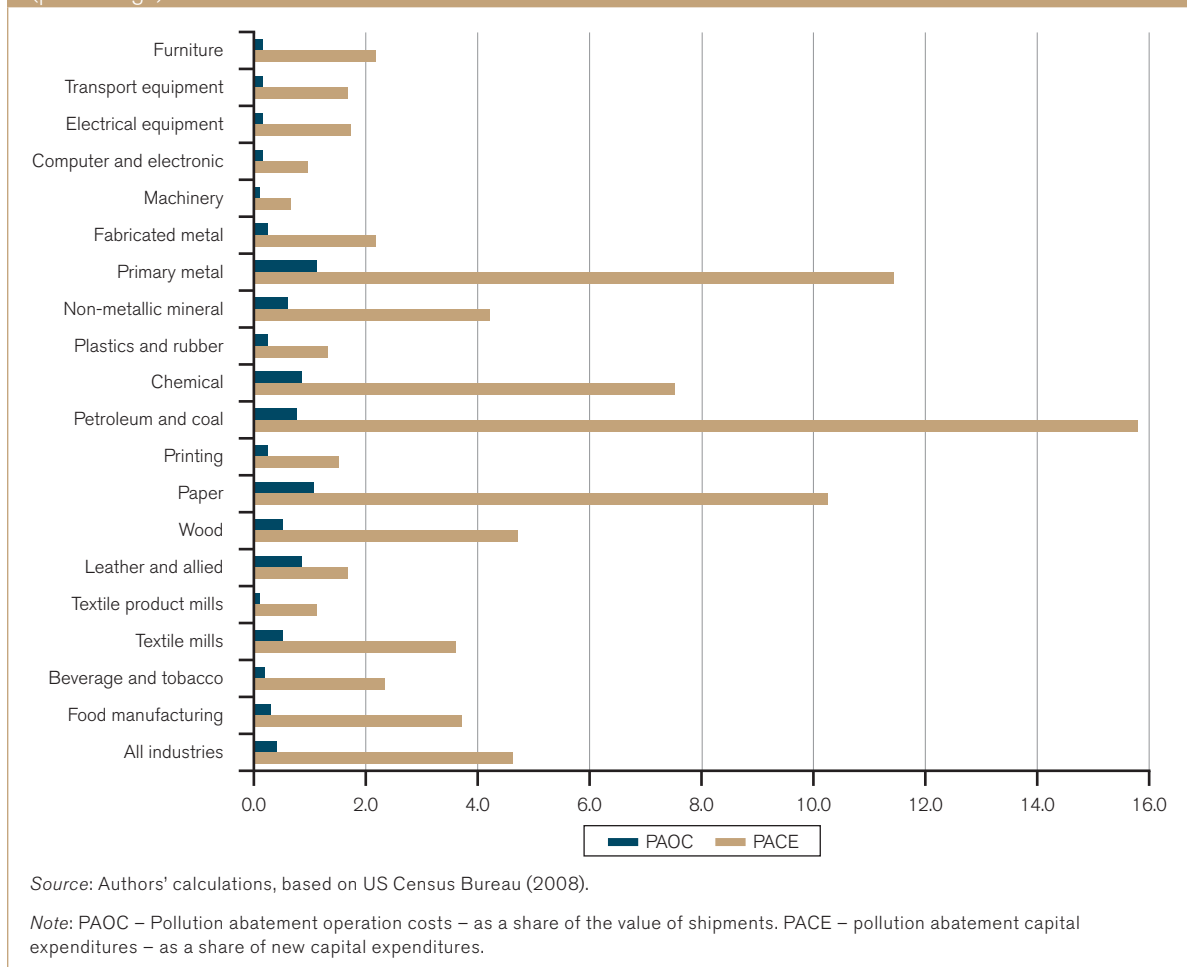
Economists have sought to assess the competitiveness consequences of environmental policy by testing whether the "pollution haven" hypothesis holds in practice. As noted, the pollution haven hypothesis predicts that trade (and capital) openness results in the relocation of pollution-intensive production from countries with stringent environmental policy to countries with lax environmental policy. Although the hypothesis is relatively simple, empirical studies designed to test it have yielded conflicting evidence, partly reflecting the use of different conceptual frameworks, data sources and proxies, and econometric methodologies. Following Copeland and Taylor (2004), recent studies in this area have found that differences in the degree of stringency of environmental policies tend to influence the distribution of "dirty" production across countries, suggesting that more stringent environmental policy has a "deterrent effect" on the production of "dirty" goods. Nonetheless, there is no robust evidence that this deterrent effect is "strong enough to be the primary determinant of the direction of trade or investment flows".

This general result implies that there may be negative competitiveness effects associated with more stringent environmental policy for particular firms and sectors, depending on their pollution intensity and degree of geographical mobility, among other factors. This raises the possibility that affected firms and sectors (and possibly others) may appeal to (real or perceived) competitiveness concerns when lobbying against environmental policies. Governments may in turn respond by incorporating trade-restrictive elements into environmental policies ("green protectionism") as a way both to compensate affected sectors and overcome resistance to environmental policy reform.

It has been suggested that the growing fragmentation of the production process along global supply chains (see Section B.2(e)) could ease competitiveness concerns associated with stringent environmental policy. With global supply chains, it is possible for only certain parts of the production process to be relocated in response to stringent environmental policy at home. Using a large sample of Japanese manufacturing firms, Cole et al. (2011) find evidence that firms outsource the dirty part of their production process. They suggest that "increases in environmental regulations can increase the health of local citizens without the massive job losses associated with wholesale relocation or closure predicted by industry lobby groups".

Nonetheless, the prospect of governments using green protectionism in exchange for political support for more stringent environmental policies remains a possibility, which could, if realized, complicate future efforts to open trade. As illustrated in the following discussion of the trade implications of specific environmental policies, much will depend on whether competitiveness concerns associated with environmental policy prompt governments to seek cooperative solutions to common environmental problems instead of resorting to green protectionism.

(ii) Interaction between environmental policies and trade

Coping with carbon leakage

Some of the more complicated and contentious environmental issues are global in nature – that is, they involve countries whose economic activities pollute or reduce a common resource, damaging all other countries. The absence of cooperative solutions to correct these cross-border effects poses challenges for tackling global environmental problems and managing the interface between environmental policies and trade. Challenges are particularly evident in the area of climate change, where the emergence of a patchwork of regional, national and sub-national climate change regimes may lead to concerns about the loss of competitiveness of certain firms and sectors, and the possibility of "carbon leakage". This refers to a situation in which reductions of greenhouse gas emissions by one set of countries ("constrained" countries) are offset by increased emissions in countries which do not take mitigation actions ("unconstrained" countries). Openness to trade and investment are two of the channels through which carbon leakage can occur.[47]

Until now, there has been no robust evidence of carbon leakage, in part because many carbon pricing policies are relatively recent, and carbon prices relatively low. The available literature, most of which relies on computable general equilibrium models, suggests that carbon leakage is modest overall.[48] Nonetheless, with high carbon prices, leakage would become relatively large for sectors that are energy and emissions intensive and exposed to international trade.

Most governments that have put in place carbon emissions trading schemes have sought to allay competitiveness fears and reduce the perceived risk of carbon leakage by allocating emissions allowances freely to participants.[49] Examples include Australia, the European Union, the Republic of Korea and New Zealand. A key issue with implications for the future of trade and the multilateral trading system is how countries will manage the perceived threats of competitiveness losses and carbon leakage during future implementation stages of their emissions trading schemes. Among the possible instruments to manage these twin threats are border carbon adjustments, which involve the extension of carbon pricing to imports and have therefore received significant attention in trade policy circles.

No country with an emissions trading scheme has yet put in place border adjustments but some proposals have been considered. Most of them focus on imports and would take the form of a tax on imported goods, or a requirement for importers to purchase emission permits or allowances for their imports. On the export side, border adjustments could take the form of an export rebate, where exporters shipping items to unconstrained countries are compensated for the cost of complying with emission requirements.

Although border adjustments may be justified as a second-best measure to complement carbon pricing schemes if no agreement on global carbon pricing can be reached, their practical implementation may be a source of trade friction. There are several practical difficulties involved in the implementation of a border tax adjustment in relation to a carbon pricing scheme, and further difficulties in designing a mechanism to adjust the cost of emission allowances and calculate the proper level of border adjustment (WTO and UNEP, 2009). The main challenges relate to the difficulty in assessing product-specific emissions and the fluctuations of the carbon price (or allowance price) in the context of an emissions trading scheme. An additional difficulty may arise in cases where imported products are subject, in the country of origin, to other climate change regulations, such as technical regulations, rather than price mechanisms such as taxes. Compliance with certain regulations, such as a fuel efficiency standard, may involve a cost (e.g. investment in more energy-efficient technologies) that may be complex to evaluate and transform into an adjustable price or a "comparable action".

Furthermore, although there is widespread interest in reducing carbon leakage and countries can have environmental reasons for using trade measures to prevent such leakage, there is a risk that these measures may be used to manipulate the terms of trade and protect domestic producers. The possible "dual use" of anti-leakage policies may blur the distinction between policies that seek to pursue a legitimate policy objective (e.g. tackling climate change) and those that are used as a means of supporting competitively challenged domestic firms and industries. This underlines the practical challenge of distinguishing between "legitimate" and protectionist motivations for anti-leakage measures and of identifying instances where they create trade barriers.

Promoting green technologies

A growing number of governments have put in place or are considering incentives for green technologies, in particular renewable energy. Some of these policies

(often referred to as "market-pull policies") seek to create demand for these technologies while others aim to increase supply or foster innovation (so-called "technology-push policies"). Common market-pull instruments include quota systems, feed-in tariffs and premiums, and a wide range of tax incentives.[50] Technology-push policies usually take the form of support for research and development at early stages of innovation, and for product development and manufacturing at later stages, mostly through financial and tax incentives.

Incentives to promote innovation and adoption of renewable energy technologies have been justified on the basis of particular hurdles facing renewable energy, including those related to the energy market structure, infrastructure, learning curves and future climate policy uncertainty (Popp, 2012; Serres et al., 2010). Nonetheless, the empirical evidence on the effectiveness of incentives for renewable energy remains relatively limited, in part due to issues of data availability affecting some recently enacted incentives (Fischer and Preonas, 2010). A study assessing the role of incentives in promoting the deployment of renewable energy technologies in 35 countries during the period 2000-05 found that only a small subset of countries had implemented policies that succeeded in accelerating deployment during that period (International Energy Agency, 2008). Several other studies on the effectiveness of incentives for renewable energy focus on selected instruments, limiting the extent to which policy alternatives can be compared (e.g. Klaassen et al., 2005). Moreover, some of the studies that examine the experience with incentives tend to avoid the question of whether the benefits of these policies exceed their costs (e.g. Buen, 2006).

The motivations for renewable energy incentives reach well beyond purely environmental concerns. Governments increasingly cast renewable energy incentives within the broader framework of "green competitiveness" – that is, as tools not only to achieve environmental (e.g. climate change mitigation) goals but also to stimulate economic growth, spur job creation and promote exports and diversification. For example, in 2007, the European Union put in place policies to increase the share of renewable energy in total energy consumption as a way to diversify EU energy supply and create new industries, jobs, economic growth and export opportunities (European Commission, 2012).

The Republic of Korea has identified several energy technologies as "new growth engines" in its National Strategy for Green Growth. The decision whether to include a particular technology in the list was based on its potential contribution to economic growth and environmental sustainability, and its "strategic importance" (OECD, 2010b). The 27 technologies selected are the focus of increased public spending on research and development. Under its strategic roadmap for 2011-15 (known as the 12th Five-Year Plan), China has identified for support several strategic export industries, including clean energy technology and clean cars.

The rapid proliferation of renewable energy incentives in both developed and developing countries and the growing tendency to link these measures to green competitiveness pose significant challenges for the management of the interface between trade and the environment. Although the trade effects of incentive measures will vary according to the magnitude of support provided and the measure's design features, including the question of how close the supported research or goods are to commercial application, some types of incentive policies may assist domestic firms in taking market share and profits away from more efficient foreign competitors or may otherwise distort trade so the risk of regulatory "capture" cannot be easily dismissed (WTO, 2012b).

The intertwining of environmental and green competitiveness objectives could increase the vulnerability of renewable energy incentives to powerful lobbies and rent-seeking behaviour. It could also result in flawed policy design due to the insufficient information to achieve multiple (and often vaguely defined) policy objectives (World Bank, 2012b). Some evidence lends support to concerns about the possible influence of political economy considerations in the design of renewable energy incentives. For example, Fischer et al. (2012) conduct simulations of the electricity sector and find that the magnitude of observed renewable energy technology incentives exceeds, probably by a wide margin, what would be justified by the positive effects generated by research and development or learning by doing. This result holds even assuming high spillover rates into other areas from learning by doing. Other work finds that certain renewable energy policies are driven by, among other factors, the presence of well-organized interest groups instead of environmental considerations (Lyon and Yin, 2010).

A related concern about renewable energy incentives stems from the decision by some countries to incorporate into such incentive schemes trade-restrictive policies, such as local content requirements. For example, under some national or sub-national programmes, participation in a feed-in tariff scheme (or the availability of additional benefits under such a scheme) is contingent on the use of domestically manufactured components of renewable energy technologies. These local content requirements may channel the additional demand for inputs created by the renewable energy incentive to domestic producers, possibly at the expense of more efficient foreign producers, causing distortions to international trade.

(d) Conclusions

Trade openness and environmental protection are key elements of sustainable development, and policies in both fields should work to utilize existing resources better. There is no inherent conflict between trade openness and environmental sustainability and there are many instances where measures that promote one objective promote the other too. This was recognized at the time of the WTO's creation in 1995, when WTO members stressed that trade and the environment can and should be mutually supportive, and that trade policies should be conducted in accordance with sustainable development objectives and should seek to protect and preserve the environment.

Trade and the environment interact in complex ways, with multiple feedback effects between them. If not managed carefully, the multifaceted relationship between these two interconnected systems may give rise to tensions, which can weaken the positive contribution of trade to economic growth and sustainable development.

The dramatic increase in world trade during the past three decades, which has coincided with a period of significant environmental transformations and problems, has drawn attention to the growing scale effects of trade. Most of this attention has been directed at large emerging economies, given their rapidly growing weight in international trade. Conclusive empirical evidence on the global, average or net effect of trade opening on the environment, however, remains elusive.

Looking ahead, there remain many unexploited opportunities to bolster the environmental gains from trade. Trade has the potential to prompt changes in production methods, which offset the scale effects of trade. However, the so-called technique effect may be contingent on many conditions, including an open trade regime, sound environmental policies and sound institutions. This highlights the importance and urgency of the first-ever multilateral negotiations on trade and the environment, where WTO members are seeking to reduce or eliminate the barriers affecting trade in green goods and services.

Transport, which is an additional driver of the scale effects of trade, has come under increased scrutiny too, largely because of its contribution to carbon emissions. Although the bulk of trade relies on maritime transport, which is the most efficient mode of transportation in terms of carbon emissions, trade-related transport is projected to increase sharply during the next few decades, as are transport-related emissions costs. These projections may be affected by the future importance of cross-regional relative to intra-regional preferential trade agreements and the evolution of international supply chains. An additional factor to be considered is the outcome of multilateral efforts to align the private and social costs of international transport, including through market-based measures that incorporate environmental costs in international air and maritime transport prices.

In principle, the scale effects of trade could play an important role in shaping public perceptions and attitudes towards trade, thereby heightening protectionist sentiment. Nonetheless, drawing a definitive conclusion on how public perceptions related to the environment are affecting trade must await additional research. The available evidence would seem to suggest that individuals' concerns about the environment do exert an influence on trade policy in ways other than protectionism. For example, concerns about the environmental impact of trade have been implicated in the growing tendency to include environmental provisions in regional trade agreements or in the proliferation of private standards.

Besides the scale effects of trade, the competitiveness effects of environmental policy are sometimes perceived as holding back environmental policy reform. There is no robust empirical evidence on the so-called pollution haven hypothesis. Still, environmental policies inevitably affect production and consumption patterns, and may therefore have adverse effects on the competitiveness of particular firms or sectors, which may then appeal to (real or perceived) competitiveness concerns when lobbying against environmental policies. Governments, in turn, may respond by incorporating trade-restrictive elements into environmental policies.

In an effort to boost "green competitiveness", a growing number of governments have put in place incentive packages for green technologies, with a focus on renewable energy. From the perspective of future trade and the multilateral trading system, the risk is that the intertwining of environmental and green competitiveness objectives may increase the vulnerability of renewable energy incentives to powerful lobbies. It may also result in flawed policy design due to the lack of sufficient information to achieve multiple (and often vaguely defined) policy objectives. This could exacerbate the possible adverse trade effects of some types of incentive measures, and undermine their environmental effectiveness.

Global environmental problems are likely to pose additional challenges for trade and the multilateral trading system. This is particularly evident in the area of climate change, where the emergence of a patchwork of regional, national and sub-national climate change regimes may lead to concerns about the loss of competitiveness of energy-intensive and trade-exposed firms and sectors, and the related possibility of "carbon leakage". Although border adjustments may be seen as a second-best measure to prevent these effects, if no agreement on global carbon pricing can be reached, their practical implementation may be a source of trade friction. In

addition, there is a risk that these measures may be used for manipulating the terms of trade and protecting domestic producers. The possible "dual use" of these measures underlines the practical challenge of distinguishing between "legitimate" and protectionist motivations for anti-leakage measures and of identifying instances where they create trade barriers.

The individual and collective decisions by open economies in managing the relationship between trade and the environment carry significant implications for the future of international trade and the WTO. The future evolution of this relationship will depend in large measure on how governments respond to competitiveness and other concerns related to environmental pressures and policies. Collective efforts that result in agreed policy approaches towards global environmental problems may limit the scope for negative competitiveness consequences, thereby reducing the risk that individual countries will favour protectionist policies. This underlines the importance of improved multilateral cooperation at the WTO as much as within the global environmental governance regime.

3. Macroeconomic and financial concerns

As destabilizing as they may be in the short run, macroeconomic and financial shocks only affect long-term trends when the underlying factors of growth are negatively and durably altered, for example in the form of severe changes in the supply of labour and capital. The 2008-09 financial crisis, and its relative similarity to the 1929 crisis (a financial crisis having global effects on production and trade), is a reminder that macroeconomic and financial shocks can have strong, recurrent and global, if not durable, effects on trade and growth.

Two channels of particular interest to the WTO through which macroeconomic and financial shocks influence international trade are credit crunches, which reduce the amount of finance available to traders, and exchange rate shifts, which divert trade flows and strain trade relations. While exchange rates eventually adjust and credit crunches are generally associated with the "purge" of over-leveraged financial sectors, they may nonetheless derail both the trend and the rate of expansion of world trade. This section reviews the problems that excess exchange rate variability and shortages of trade finance pose to trade expansion and discusses how they may contribute to shaping the macro-financial environment impacting trade in the future.

(a) Trade finance

Finance is the "oil" of commerce. Most trade transactions are supported by short-term trade credit – according to

IMF-BAFT (2009), 80 per cent of all trade finance is in the form of either structured finance (letters of credit or similar commitments, using the merchandise as collateral) or open account liquidity supplied against receivables.[51] In principle, while the commercial risks involved in an international trade transaction seem to be larger than in a domestic trade transaction (risk of non-payment, risk of loss or alteration of the merchandise during shipment, exchange rate risk), trade finance is generally considered to be a particularly safe form of finance, as it is underwritten by strong collateral and documented credit operations.

According to the International Chamber of Commerce's (ICC's) "trade finance loss register", the average default rate on short-term international trade credit is no larger than 0.2 per cent, of which 60 per cent is recovered (ICC, 2011). Despite trade finance being a routine task, it is vital for trade. Until the financial crises of the 1990s and of 2008-09, trade finance had been taken for granted. The crisis periods created distortions in the trade finance market which made policy interventions necessary. Below is a discussion of the link between trade and trade finance and of key drivers of trends in trade finance.

(i) Clarifying the link between trade finance and trade

During the Asian financial crisis, policy institutions, such as the IMF and the WTO, had revealed elements of market failure in explaining the trade credit crunch. These included herd behaviour, increased gap between the level of risk and its perception, market concentration and confusion between country and counterparty risk (IMF, 2003; WTO, 2004b). Academic research on the role of trade finance has grown in the context of the 2008-09 financial crisis and the subsequent economic downturn, when global trade outpaced the decline in real GDP by a factor of 12 – a figure much larger than anticipated under standard models. As summarized by Eichengreen and O'Rourke (2012), "the roots of this trade collapse remain to be fully understood, although recent research has begun to shed light on some of the causes (see Baldwin, 2009; Chor and Manova, 2012)". While most authors agree that the fall in demand has been largely responsible for the decline in trade flows, the debate has focused on the extent to which other potential factors, such as trade restrictions, a lack of trade finance, vertical specialization and the composition of trade, may have played a role.

Empirical work on trade finance has been limited by the lack of a comprehensive dataset, despite the availability of qualitative information provided by surveys on market trends and structure (ICC 2009; IMF-BAFT 2009). However, progress has been made in highlighting some links between financial conditions, trade credits and trade at the firm level.

Amiti and Weinstein (2011) establish causality between firms' exports, their ability to obtain credit and the health of their banks. Using firm-level data from 1990 to 2010, they suggest that the trade finance channel accounted for approximately 20 per cent of the decline in Japan's exports during the financial crisis of 2008-09. The authors show that exporters are more reliant on trade credit and guarantees than domestic producers, and that firms working with troubled banks saw their foreign sales drop by more than that of their competitors. Multinational enterprises seem less affected, notably because a large part of multinational trade is intra-firm, which exhibits less risk. Multinationals are also able to optimize the production-to-trade cycle, thereby minimizing working capital needs: the shorter the lag between production and payment, the less finance is a problem.

In the same vein, Bricongne et al. (2012) find that sectors highly dependent on external finance have been most severely hit by the financial crisis and experienced the largest decline in their export activity. Using monthly data for individual French exporters at the product and destination level, the authors also found that both small and large firms had been similarly affected by the crisis. Using data on US imports, Chor and Manova (2012) find that credit conditions were one channel through which the crisis led to the collapse in trade. Countries with tighter credit markets, measured by their interbank interest rates, exported less to the United States during the financial crisis. This effect was especially strong for financially vulnerable industries. These industries, categorized by Chor and Manova (2012) as those that require extensive external financing, had limited access to

trade credit. Access was especially limited during the peak of the financial crisis. Some studies, however, have not found any significant role played by trade finance in the "Great Trade Collapse" (for example, Paravisini et al., 2011 and Levchenko et al., 2010).

At the macro level, Korinek et al. (2010) find a strong statistical relationship between insured short-term trade credit, as a proxy for total trade finance, and trade flows. When extending the same dataset over a full business cycle, 2005-12, this strong correlation is confirmed (see Figure D.15).

(ii) Key drivers of recent developments in trade finance markets

Risk aversion and market failures during recent financial crises

As indicated above, trade finance is one of the safest financial activities, with low credit default rates. However, as a short-term lending activity, it is heavily reliant on re-financing on the inter-bank market for wholesale, short-term funds. In the 2009 financial crisis and in the Asian financial crisis of 1997-99, the overall tightening of liquidity on inter-bank markets appears to have had an impact on trade credit supply through a contagion effect: not only was liquidity insufficient to finance all requests for lending but trade lending was additionally affected by the general re-assessment of risk linked to the worsening of global economic activities.

In the last quarter of 2008, notably at a time when central banks injected large amounts of liquidity, the

Figure D.15: **Relation between imports and insured trade credits, 2005-2012**
(US$ million, averaged over all countries)
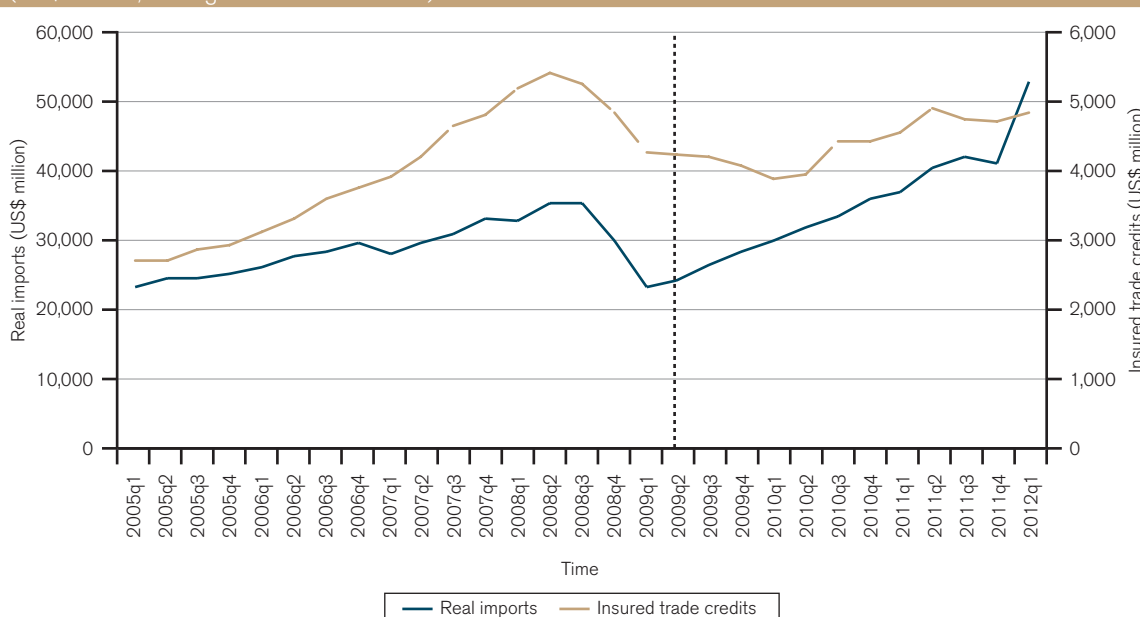
Source: Auboin and Engemann (2012).

G20 discussed whether a specific, tailor-made trade finance "package" was required to address the lack of trade finance. The problem was two-fold. A large share of the additional liquidity provided by central banks at the time was not intermediated into new loans. Hence, it did not finance "new" trade transactions. Secondly, the liquidity injection by the central banks did not resolve the growing problem of risk aversion, as the crisis spread.

The perception of risk of non-payment increased disproportionately relative to the actual level of risk. This manifested itself in a sharp increase in the demand by traders for short-term trade credit insurance or guarantees. The G20 responded to this by committing to supply greater "capacity" through export credit agencies. The question arose whether the G20 package carried an element of "moral hazard", i.e. whether such insurance might lead to imprudent lending decisions.

The 2008-09 financial crisis revealed many market failures, starting with the failure by credit rating agencies and all other market surveillance mechanisms to detect early signs of deterioration of the general soundness of banks, in particular the multiplication of off-balance sheet operations and the subsequent deterioration of their risk profiles. Another failure was the absence of a proper "learning curve" to allow for a better differentiation between "ill" market segments and "healthy" ones.

By the time of the London G20 Summit in April 2009, surveys by the International Chamber of Commerce (ICC) Banking Commission and the Bankers' Association for Finance and Trade (BAFT) on current trade finance market trends (ICC, 2009; IMF-BAFT, 2009) had provided confirmation of the sharp deterioration (lower volumes, higher prices) of markets and evidence of shortages in some regions.[52] This prompted the G20 to provide US$ 250 billion of trade finance for two years (Auboin, 2009; Chauffour and Malouche, 2011).

The G20 package provided temporary trade finance support in a way that would not result in the long-run displacement of private market activity. This package comprised a mix of instruments that allowed for greater co-lending and risk co-sharing between banks and public-backed international and national institutions. The working group that was established by the G20 to monitor the implementation of the package found that after one year, some US$ 150 billion of the funding had been used.

Specific problems of low-income countries

The problems faced by traders in low-income countries in accessing affordable trade finance are to a large extent structural and have worsened since the crisis. For example, a recent survey by the Netherlands' Centre for the Promotion of Imports from Developing Countries (CBI) revealed that a majority of small and medium-sized enterprise (SME) exporters in Africa consider that trade finance costs have increased in the last three years, and that access to trade finance has become more difficult (CBI, 2013).

SMEs in developing countries are generally faced with a mix of "structural" constraints. These range from a lack of know-how in local banks to a lack of trust, reflected in traders being required to set aside very large collateral against a trade loan and to pay high fees for these loans. This is despite the fact that the rate of default on trade payments in low-income countries is not much higher than in other parts of the world.

Multilateral development banks have developed a network of trade finance facilitation programmes aimed at supporting trade transactions at the "lower end" of such trade finance markets – transactions ranging from a few thousand dollars to a maximum of a few million. These programmes provide risk mitigation capacity (guarantees) to both issuing and confirming banks to allow, in particular, for rapid endorsement of letters of credit – a major instrument used to finance trade transactions between developing country players and between developed and developing countries. In the midst of the financial crisis, during the autumn of 2008, and with support from the WTO and the G20, the guarantee limits of these programmes were increased to support trade transactions in these markets and to reduce the "structural confidence gap" between the existing level of risk and its perception. The demand for these programmes continues to be strong.

Challenging regulatory requirements

The expansion of world trade depends on the stable and predictable functioning of the financial system. As a result, the strengthening of prudential rules is beneficial for both the financial system and for world trade. In a joint letter sent to G20 leaders in Seoul in November 2010, the heads of the World Bank and the WTO raised the issue of the potential unintended consequences of new global prudential rules (so-called Basel II and III frameworks) on the availability of trade finance in low-income countries.

While trade finance received preferential regulatory treatment under the Basel I framework in recognition of its safe, mostly short-term character, the implementation of some provisions of Basel II proved difficult for trade. Basel III added a leverage tax on letters of credit to these requirements. The letter pointed out that given the systemic importance of trade finance for trade and development, the application of excessively stringent regulatory requirements could reduce incentives in the financial sector to engage in trade finance (relative to other asset categories).

As a result, these issues were discussed by the Basel Committee on Banking Supervision Policy

Development Group and the institutions concerned with trade finance, notably the WTO, the World Bank and the ICC. Based on proposals made by the WTO and the World Bank, the Basel Committee decided in October 2011 to waive the obligation to capitalize short-term letters of credit for one full year as the average maturity is between 90 and 115 days. This measure has the potential to unblock hundreds of millions of US dollars to finance more trade transactions. In January 2013, the Basel Committee also decided to alter the liquidity requirements for short-term lending, particularly those used by developing country traders.

(iii) Challenges for trade finance in a context of financial deleveraging

A key question is whether a downsizing of the financial sector as a whole could potentially lead to a reduction in the supply of trade finance as well – and hence hamper the future expansion of trade.

The 2012 *Annual Report of the Bank for International Settlements* (BIS) indicates that the European and US banking sectors are currently undergoing a period of "de-leveraging" of bank balance sheets that might result in a "welcome downsizing of the banking sector over the long run" (BIS, 2012). This may lead to more sustainable and sound financial conditions in the global economy. Considering that the expansion of the global financial industry in the 2000s (measured by its share in GDP or the share of total credit to incomes) had been encouraged by excessive "leveraging" of banks and risk-taking, a period of credit moderation and more realistic returns on capital would yield substantial economic benefits. These include more prudent lending policies,

declining debt to income ratios and a return to a more usual allocation of capital resources, with less diverted from other sectors because of artificially high returns in the financial sector.

However, financial crises, when triggered by the bursting of asset bubbles (real estate or financial assets), may lead to significant and lengthy corrections in the financial sector, with long-lasting effects on the economy. Downsizing can be a long and bumpy process, which may also lead to adverse macro- and micro-economic consequences. Figure D.16 shows that after the credit crunch in 2008-09, year-on-year growth in claims on non-financial sectors remained mainly negative from 2010 to the beginning of 2012 for the Euro area as well as for advanced economies more generally, i.e. that banks were lending less to the real economy. Only emerging country banks increased their lending activities over this period.

At the macro level, financial crises can have negative spillovers in several ways. Banks may reduce the supply of new credit to economic agents in an effort to contain, or even reduce, the size of their assets in order to meet prudential ratios.[53] Existing, over-valued assets may have to be written off or sold at a loss, with the effect of reducing bank profitability.[54] Secondly, the combination of reduced profitability on bank assets and reduced new lending may be a source of contraction for the economy's overall investment rate – both for the financial sector and for the economy as a whole (through reduced lending). If capital accumulation were to be impaired for an extended period of time, potential output would be reduced.

According to Irving Fisher's debt-deflation mechanism, financial crises usually lead to a collapse in credit and

Figure D.16: **Year-on-year growth of claims on non-financial sectors, 2006-2012** (percentage)

Source: Authors' calculations based on BIS Locational Banking Statistics.
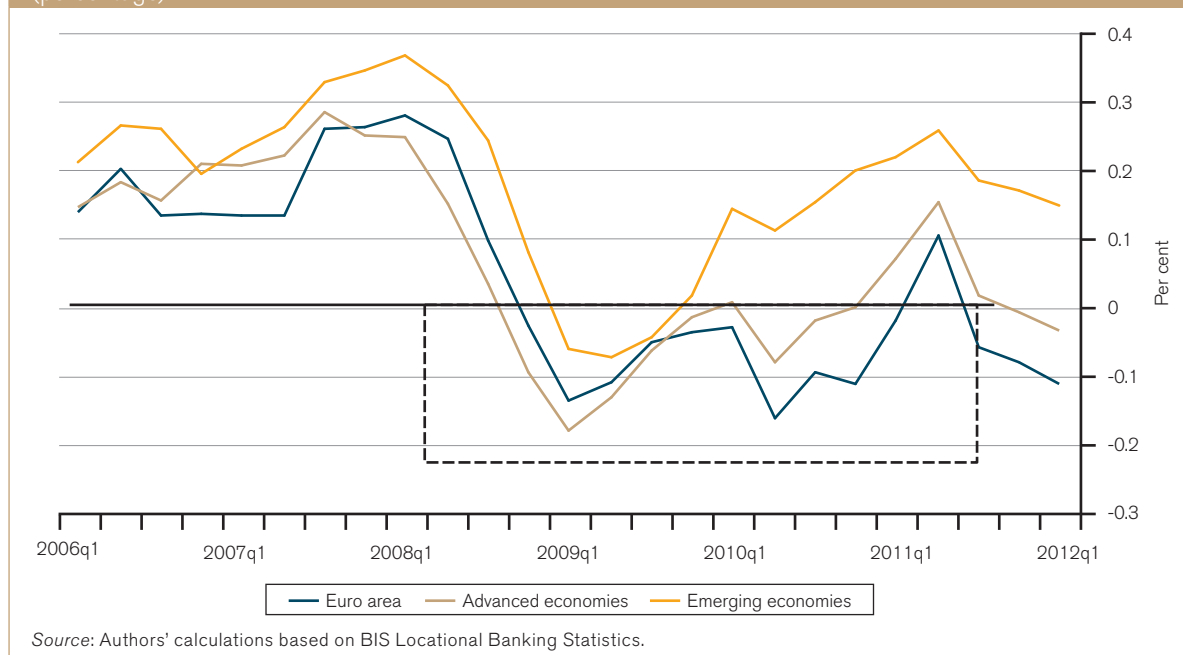
a decline in price levels, hence deflation (Fisher, 1933). Both high debt ratios and deflation generally cause depressions because debt burdens become even higher in real terms. As Fisher (1933) put it, "each dollar of debt still unpaid becomes a bigger dollar, and if the over-indebtedness with which we started was great enough, the liquidation of debts cannot keep up with the fall of prices which it causes."

During the recent financial crisis, high debt and high leverage ratios have been the main topics of discussion, with deflation being discussed less. Figure D.17 shows that annual growth in consumer prices decreased during this period, but it was only negative in 2009 for the United States and China, while for Europe it remained positive. In 2010 and 2011, consumer prices for the United States, China and Europe rose again. Central banks provided the necessary liquidity to allow banks to deleverage. However, the problem of long deleveraging periods is not necessarily deflation but a misallocation of resources. New loans are displaced by old loans, which may induce a long period of credit crunch leading to stagnation.

At the micro level, a long period of financial retrenchment may also lead to substantial negative effects, in particular for trade finance and hence trade. Explicitly, the allocation of capital resources may not improve if there is less credit.

Long periods of credit crunch can affect certain categories of economic agents or credit, such as trade credit, disproportionately – despite their good credit or safety record. Amiti and Weinstein (2011) argue that the decade-long downward adjustment of the Japanese financial industry has not had a neutral effect on the financing of Japanese exporters. Firms working with troubled banks saw their export performance decline in absolute terms. SMEs, in particular exporting ones,

were the most affected because they were the most dependent on trade credit.

The question arises as to whether the access of SMEs to credit in general, and to trade credit in particular, will be negatively affected in a context of increased competition within the credit committees of banks who arbitrate on the different categories of loans. One potential pitfall of a process of greater "selectivity of risk" is the possible allocation by banks of scarce capital resources to the most profitable credit segments, thereby reducing their involvement in lower-profitability products such as short-term trade finance. Another pitfall is that banks may focus on their most profitable customers – the larger ones. Hence, a downsizing of the financial sector and greater selectivity in risk-tasking may not act automatically in favour of an improved allocation of resources in the financial industry.

Trade finance may be used as a prime instrument for reducing the size of a bank's balance sheet, hence achieving rapid deleveraging. Because of its short-term, roll-over nature, most trade credit lines expire after 90 days, the average duration of transactions. By not renewing (rolling-over) or by reducing these credit lines, banking intermediaries can achieve a quick reduction of their lending (deleveraging) when needed. At the end of 2011, a few European banks announced a reduction of trade credit lines in an effort to restructure their balance sheets. This approach proved to be short-lived.

Trade finance may also be negatively affected if the re-scaling of the financial sector is accompanied by "re-nationalisation" of lending activities at the expense of cross-border lending. Many international banks have already scaled back international activities. As indicated by the BIS, "in addition to write downs of cross-border assets during the crisis, the more expensive debt and equity funding also led to reductions in the flow of cross-border credit. As a result, credit to foreign borrowers has fallen as a share of internationally active banks' total assets (see Figure D.18). For European banks, the share has declined by almost 30 percentage points since early 2008. Not all banks have reduced foreign activities, with notable exceptions being Asian-based banks and banks in other emerging countries. However a re-composition of the banking landscape, with shifts in market share, may be at play.

(iv) Looking ahead

The future direction of the international banking industry is difficult to predict, although some reduction of its share in GDP, at least in advanced economies, may be expected. Much depends on the incentives provided by a new, reformed financial system. Normally, bank lending should be re-oriented towards more sustainable forms of finance. If balance sheet shrinkage works at the expense of "leverage

Figure D.17: **Annual inflation – year-on-year change in consumer prices of all items, 2005-2011** (percentage)
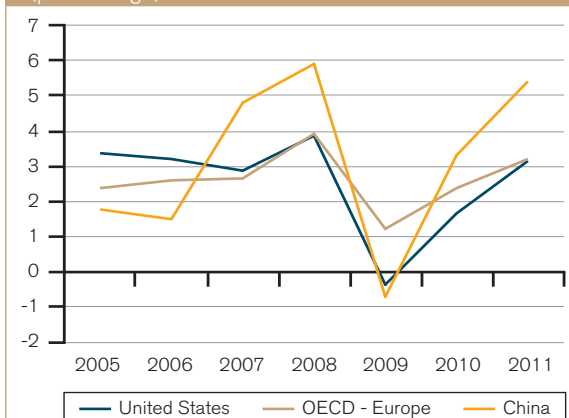
Source: OECD.

Figure D.18: **Ratio of foreign to total assets, 2006-2011**

Source: IMF *International Financial Statistics*, BIS international banking statistics, WTO calculations.

Note: Total foreign claims of BIS reporting banks headquartered in Canada, France, Germany, Italy, Japan, the Netherlands and the United States as a percentage of total assets, where domestic claims are obtained from IMF *International Financial Statistics*.

finance and off-balance sheet toxic investment", traditional forms of finance might benefit. In that case, lending would be re-oriented towards real economy financing, including trade finance, which is an important factor of trade, not only in periods of crisis (Auboin and Engemann, 2012). At the same time, if rationalization of the sector works in favour of higher-yielding forms of lending, as opposed to cross-border lending, the question as to whether to stay engaged in trade finance will be posed by many financial intermediaries.

The question of entering or exiting trade finance is not an easy one to answer. Trade finance bears "fixed costs" of doing business, particularly costs of origination of trade finance transactions (investing in back offices, customers and sales relations, opening foreign branches, being acquainted with international trade finance procedures). Of course, the decision to stay engaged in trade finance depends largely on the demand for real trade transactions – and hence the continuation of production sharing and trade relations. Multilateral agencies will need to remain engaged in trade finance, at least to help fill the gap at the "lower end" of the market, notably in low-income countries. Dialogue with regulatory agencies will need to be pursued to ensure that trade finance is recognized as a development-friendly and low-risk form of finance.

(b)   Currency movements

Exchange rates can influence international trade in many ways. Real exchange rates (the relative prices of tradable to non-tradable products) can affect the incentive to allocate resources between sectors producing such tradable and non-tradable goods. The trade impact of exchange rates can be analysed through two effects: the fluctuations of exchange rates, which can be a source of frustration for individual producers and traders, as they may impose high uncertainty costs; and prolonged deviations of currencies from their equilibrium levels – so-called misalignments – which are regarded as important distortions in international price competition. In the short run, they may negatively impact the allocation of resources between countries. In the longer run, the situation is less clear.

Economic theory suggests that when markets are free of distortions, an exchange rate misalignment has no long-run effect on trade flows as it does not change relative prices. However, long-run effects are predicted in models that assume market distortions, such as information problems or product market failures. In the short run, when some prices in the economy are less likely to adjust, movements in nominal exchange rates can alter relative prices and affect international trade flows, although this depends on several factors, including the pricing strategy of trading firms and the importance of global production networks. Thus, these short-run trade effects are not straightforward.

Even if longer-run economic effects of currency misalignments cannot be fully established for all countries and in all circumstances, persistent misalignments in exchange rates are a systemic irritant in international trade because they fuel perceptions of unfair monetary competition. This, in turn, creates pressure on the use of trade policy measures, such as tariffs and trade "defence" instruments, to redress perceived monetary imbalances. For this reason in particular, the world trading system needs an international monetary system promoting exchange rate stability and adjustments. Progress in monetary cooperation is uneven, however. The exchange rate issue can, therefore, be expected to remain with the world trading system for some time.

Figures D.19 and D.20 show trends in the volatility and levels, respectively, of real effective exchange rates for selected regions and countries over time.

(i)   Exchange rate volatility and trade

After a period of 30 years of relative stability of both nominal and real exchange rates under the Bretton Woods system, increased volatility of exchange rates from the early 1970s triggered a lively debate on the channels through which such increased volatility could affect the real economy (Figure D.19).

Particularly strong concerns were expressed by the trading community, which had negotiated substantial reductions in border protection when the Gold Exchange Standard determined exchange rates. At the request of the then Director-General of the General Agreement on Tariffs and Trade (GATT) (on behalf of

Figure D.19: **Volatility of real effective exchange rates, 1975-2012**
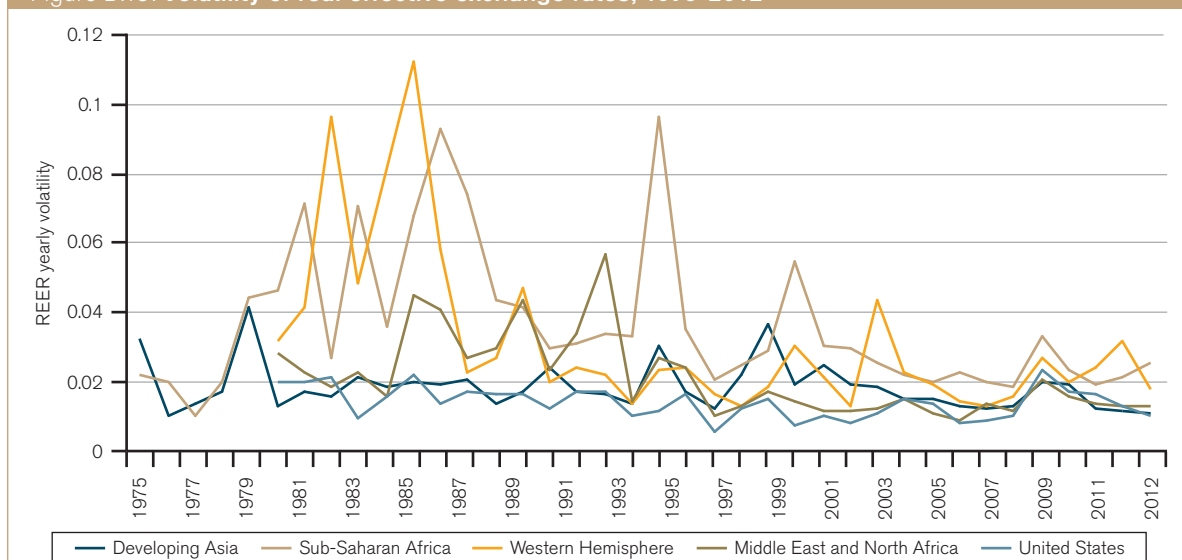
Source: IMF *International Financial Statistics*.

Note: Volatility is computed as the yearly standard deviation of monthly growth in real exchange rates.

Figure D.20: **Levels of real effective exchange rates, 1995-2012**
(index, 1995 = 100)
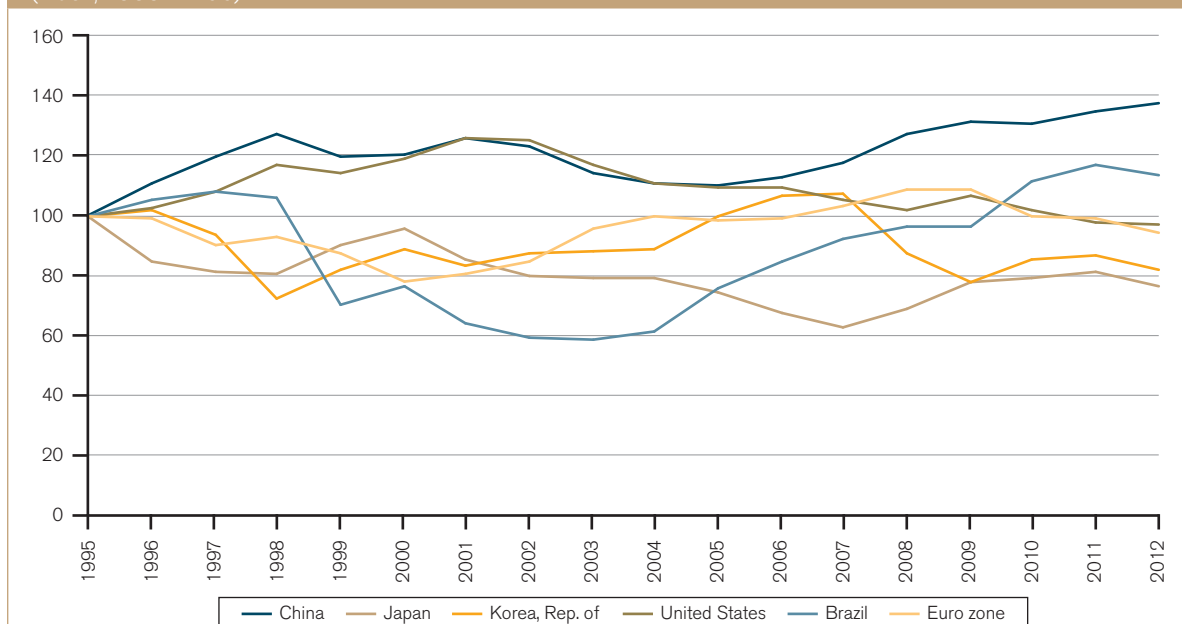
Source: Bruegel Institute – Real Effective Exchange Rate Database.

the General Council), the International Monetary Fund (IMF) examined the effects of greater exchange rate volatility on global trade.

While concluding that the evidence concerning a negative effect of the increased volatility of exchange rates on global trade was slim, the IMF (1984) highlighted the role of exchange rate risk. This was in line with earlier (1970s and 1980s) theoretical analyses of the relationship between exchange rates and international trade. These studies focused primarily on the commercial risk involved in conducting

international transactions and the uncertainty generated by short-term or long-term exchange rate volatility. The question of how this uncertainty affected the decision to trade, its expected profitability and eventually the allocation of resources between tradable and non-tradable goods and services was the main focus of these studies.

A simple explanation of how exchange rate volatility affects trade is provided by Clark (1973). He explains how the uncertainty about future exchange rates translates directly into uncertainty about future

receipts in domestic currency and how producers adjust production and exports downwards to reduce exposure to exchange rate risk. The view that an increase in exchange rate volatility will have adverse effects on the volume of international trade is relatively widespread in studies conducted throughout the 1970s and 1980s (see also Baron, 1976; Cushman, 1983; De Grauwe and Verfaille, 1988; Giovannini, 1988; Bini-Smaghi, 1991). However, these conclusions rest on relatively firm assumptions, which have been scrutinized and adapted by other authors – notably the assumption of perfect competition, the large role of the invoicing currency, the absence of imported inputs, the high aversion to risk and the absence of exchange rate hedging financial instruments. This has led to more sophisticated multi-country models with diversified firms, in which the relationship between exchange rates, the supply of goods and the decision to trade become more ambiguous (see Box D.6).

Reflecting the relatively inconclusive state of early theoretical models regarding the effects of exchange rate variability on trade, the vast empirical work produces equally ambiguous results. As argued by Taglioni (2002), "it is customarily presumed that the adverse effect of exchange rate volatility on trade flows, if it exists, is certainly not large". This conclusion is generally shared by Ozturk (2006), who reveals a wide range of empirical evidence, some supporting and some contradicting the hypothesis of a negative relationship between exchange rate volatility and trade.

As aptly summarized by Coric and Pugh (2010), "on average, exchange rate variability exerts a negative effect on international trade. Yet, […] this result is highly conditional. […] Average trade effects are not sufficiently robust to generalize across countries." Results are conditional for the same reasons as identified in theoretical models: the existence of hedging instruments, the presence of imported inputs, the possibility of invoicing in local currency and the capacity to absorb losses due to exchange rate changes and other factors in profit margins. The firms most sensitive to exchange rate volatility may not be the large ones but rather the smaller firms (as shown in Section B.2(f)). In addition, empirical studies tend to find a significant effect mainly in the case of trade with close neighbours, particularly in the case of very integrated economies.

(ii) Exchange rate misalignments

The debate on the trade impact of exchange rates has resurfaced in the past decade, with the build-up of large external global imbalances. After the 2009 global recession, concerns about unemployment and slow recovery have increased the suspicion that some countries are seeking to "export" their way out of the crisis at the expense of trading partners. Hence, the policy debate has shifted from the impact of exchange rate volatility on trade towards the effects of sustained currency misalignment. This means that the emphasis is less on the effects of variability and more on the level of real exchange rates.

Exchange rates can depart from their equilibrium level for two reasons. First, this may be due to government intervention directly aimed at altering the real exchange rate (currency manipulation). In this respect, governments and/or central banks possess a number of policy instruments that can affect the real value of the exchange rate, including the introduction of capital controls or targeted intervention in foreign exchange markets. Secondly, misalignments can be the unintended side effect of macroeconomic policies aimed at achieving domestic objectives or the result of distortions in the international financial architecture or in domestic structural conditions.

The academic and policy debate on currency misalignments concerns two important points. The first is the extent to which the real exchange rate is a variable that policy-makers can influence (Eichengreen, 2007; Rodrik, 2008). The consensus view is that the real exchange rate, being the relative price of traded to non-traded goods, is not under the direct control of policy-makers. However, its level can be influenced by policy in the short to medium term. Eichengreen (2007) provides an illustration by outlining the experience of the Republic of Korea in the 1960s, where a nominal devaluation was combined with fiscal consolidation. The latter helped maintain a lower level of the real exchange rate.

The second point relates to the measurement of the equilibrium exchange rate. Ascertaining the equilibrium exchange rates – hence, the cause of a currency misalignment – is difficult in theory and in practice. It is difficult in theory because the exchange rate is a variable determined by a variety of macroeconomic, financial and trade factors. It is difficult in practice because there are a number of different methodologies measuring equilibrium exchange rates, with none being "better" than others. The main methodologies used for the assessment of exchange rates are based on the competitiveness of the tradable goods sector (so-called purchasing power parity), general equilibrium model calculations and estimates required to achieve the equilibrium of the balance of payments (so-called fundamental equilibrium exchange rates). They may lead to a relatively wide range of estimates. The IMF uses a range of such estimates to make its own assessment of equilibrium exchange rates.[55]

Another question concerns trade effects in the long run versus the short run. According to standard economic theory, long run prices are fully flexible and adjust to any policy change (or any other shock). In particular, when markets have no distortions, an exchange rate misalignment – such as a devaluation of

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Box D.6: Overview of the literature on exchange rate volatility and trade

There are five main strands of literature extending the model of Clark (1973), which only focused on the uncertainty created by exchange rate volatility.

First, the effect of increased volatility of exchange rates on trade depends heavily on the level of risk aversion of traders (De Grauwe, 1988; Dellas and Zilberfarb, 1993). Risk-neutral traders are unlikely to be affected by exchange rate uncertainty but risk-averse traders will be affected, albeit to different degrees. As indicated by De Grauwe (1988), for very risk-averse traders, paradoxically, exporting more could be a response to increased volatility in order to compensate for the expected fall in revenue per exported unit. The existence of such a relationship was later confirmed theoretically by Broll and Eckwert (1999).

A second set of studies account for the possibility of firms hedging against exchange rate risks. The availability of financial hedging through forward exchange markets helps reduce the uncertainty generated by fluctuations of nominal exchange rates although firms have unequal access to hedging facilities and may display different behaviour according to which side of the hedging position they stand. Viaene and de Vries (1992) suggest that forward markets create "losers" and "winners" among exporters and importers that are on opposite sides of the forward transactions. Besides, as noted by the IMF (1984), foreign exchange hedging contracts are not necessarily available in all countries and to all categories of firms. Contracts are typically relatively large, maturities short and fees high. In addition, they only cover a limited share of possible fluctuations during the proposed maturities as it is hard, by definition, to anticipate the magnitude of such fluctuations. Hence, it is generally accepted that larger exporting firms are in a better position than smaller firms to benefit from exchange rate hedging.

A third extension of the literature focuses on adjustment costs. The assumption that exchange rates affect trade because firms cannot adjust inputs according to exchange rate fluctuations has also been relaxed by several authors. De Grauwe (1992) has worked with a wider spectrum of cases than those described by Clark (1973). If firms can adjust factors of production upwards and downwards according to world prices, they are likely to sell more when international prices in foreign currency are high (with a limit set by the production capacity of the "flexible" factor) and less when such prices are low. However, this will depend on risk aversion towards profit uncertainty. The more risk averse firms are, the less likely they are to export more in light of higher profit variance from exchange rate volatility. On the other hand, less risk-averse firms will sell more even with profit uncertainty because the opportunity from price variability can offset the uncertainty.

A fourth set of studies analyses the effect of exchange rate volatility on the composition of trade rather than its gross volume. Some models focus on the extensive rather than the intensive margin of trade (i.e. the number of products traded rather than the volume of trade of a given number of products). Specifically, models of persistence or path dependence in global trade show that the high variability of exchange rates and associated uncertainty can influence the decision to enter or exit foreign trade markets (in particular, Dixit, 1989; Krugman, 1986; Franke, 1991).

Finally, a group of studies removes the assumption that exchange rate uncertainty is exogenous. Bacchetta and Wincoop (2000) examine the impact of volatility on the levels of trade and welfare in a context of both fixed and flexible arrangements. One interesting outcome illustrating the complexity of the exchange rate-trade relationship is that monetary stimulus in one country may lead to the depreciation of the exchange rate of that country without much effect on trade. This is because the depreciation of the exchange rate may on the one hand reduce imports while on the other hand the increase in domestic demand would boost imports in an offsetting movement. Of course, the net effect will depend on a whole set of variables, from demand elasticities for imports to supply-side factors, such as the desire or ability of domestic producers to adjust prices to the depreciation of the currency.

Since 2000, empirical work on the trade impact of exchange rate volatility has continued, notably with cross-country analysis. For example, an OECD study (Huchet-Bourdon and Korinek, 2012) examines the impact of exchange rate volatility on trade in two small open economies, Chile and New Zealand. The study concludes that smaller, open economies tend to be more affected than larger ones by exchange rate changes.

the currency – has no long-run effect on trade flows or on real economic activity, as it would not change relative prices. The short run and medium run, however, can be different. The reason is that, if some prices in the economy take time to adjust (i.e. are "sticky"), movements in nominal exchange rates can alter

relative prices and affect both the allocation of resources between non-tradable and tradable sectors and international trade flows.

Open macro-economy models embed the short-term effects of exchange rate misalignments (e.g. Krugman

and Obstfeld, 2009). In particular, when prices are "sticky", a nominal depreciation of the home currency results in a real depreciation of the exchange rate, thereby increasing the price of the foreign good relative to that of the domestic one. This change in relative prices prompts the home economy to import less, as home consumers switch to less expensive domestic goods, and export more, as foreign consumers turn to less expensive home goods. Under these standard macroeconomic models, all other things being equal, the trade balance of the home countries would improve, with increasing exports and falling imports, as a function of this short-term depreciation of the exchange rate.

There are two important assumptions which must hold in this case: the nominal depreciation ought to result in a real depreciation, thus raising the price of foreign goods relative to home goods; the relative price change must have rapid effects on the quantities imported and exported, and hence on the trade balance. In practice, however, the short-term effects of exchange rate misalignments may be more complex, as these two assumptions may not always apply (depending, for example, on the demand or substitution elasticities for each good). In addition, the trade balance depends on a wide range of others factors, such as income in the home country and the rest of the world.

On the first assumption, recent literature shows that these effects depend, among other things, on the currency in which domestic producers invoice their products. This is, in part, because the currency of denomination affects the extent to which a nominal depreciation results (or not) in a real depreciation of the exchange rate. For example, if producers set their price in the home currency (as generally assumed by standard trade models), there is a good "pass-through" from changes in the nominal exchange rate to the real exchange rate, and an unanticipated devaluation lowers the price of domestic goods relative to foreign goods, as noted above.

However, the trade effect of a devaluation would be different if domestic producers were to set their price in the buyers' currency or in a vehicle currency, such as the US dollar or the euro. This is because the pass-through effect would be less than "perfect" in these cases. For example, the theory suggests that while a devaluation would still have real effects, such consequences would not be equivalent to export promotion but rather to import restrictions (Staiger and Sykes, 2010).

The second assumption, i.e. the short-term impact of currency misalignments, can be questioned. Under the "J-curve effect", the depreciation of the real exchange rate is often synonymous with an immediate deterioration of the trade balance and a subsequent (rapid) improvement. Part of this mechanism assumes that the devaluation is unexpected (hence the change

in prices is unanticipated) and that a certain share of trade is pre-ordered (some share of imports and export orders are placed several months in advance). The value of the pre-contracted level of imports rises in terms of domestic products, which implies that there is an initial fall in the trade balance. The increase in import prices may be partly or fully offset by the substitution, if available, of imported goods by local goods but this implies an adjustment in the capacity of domestic firms which requires time. When these changes have taken place, a real exchange rate depreciation will improve the trade balance relative to its pre-depreciation level. In brief, understanding the short-term impact of an exchange rate devaluation on trade flows and the trade balance in the short and medium run is conceptually more complex than it initially appears.

The above argument does not take into account the possibility of market failures. For instance, in the presence of information problems (e.g. the quality of export goods is unknown to foreign consumers), it has been argued that the level of exports may be inefficiently low (Bagwell and Staiger, 1989; Bagwell, 1992). A high-quality exporter may need to signal quality, which is costly. Firms may also have common uncertainty about the profitability of exporting (Freund and Pierola, 2010). In this context, the undervaluation of the exchange rate may have long-run effects if it allows exporters to enter foreign markets, thus overcoming the initial inefficiency. If this logic is correct, one would expect currency depreciation to be associated with entry into new markets and new product lines (i.e. the extensive margin of trade), and for it not (or not completely) to be undone in the long run when prices adjust. Moreover, as market failures are considered to play a more prominent role in developing as opposed to developed economies, one should expect that these long-run effects are weaker for the latter.

(iii) Looking ahead

Whether exchange rate volatility and misalignment can have a real effect on trade in the short and long run is an empirical question. And the empirics yield mixed findings. As indicated above, a currency undervaluation is sometimes found to have a positive impact on exports but the presence, size and persistence of these effects are not consistent across different studies. As described in Section B.2(e), the complexity of this relationship is not likely to be reduced as global production networks become more prominent in international trade and as business cycles between countries become increasingly interdependent.

For the world trading system, exchange rates are likely to remain a systemic issue. GATT/WTO members have consistently argued that an international monetary system promoting the stability of exchange rates is key to establishing an enabling environment for world trade (see Box D.7).

Box D.7: **Coherence in global policy-making**

At the end of the Bretton Woods arrangement for fixed but adjustable exchange rates, GATT ministers indicated in the Declaration opening the Tokyo Round in 1973 that "the policy of liberalizing world trade cannot be carried out successfully in the absence of parallel efforts to set up a monetary system which shields the world economy from the shocks and imbalances which have previously occurred. The Ministers will not lose sight of the fact that the efforts which are made in the trade field imply continuing efforts to maintain orderly conditions and to establish a durable and equitable monetary system".

These words are mirrored in the 1994 Ministerial Declaration on the WTO's Contribution to Coherence in Global Policy Making: "successful cooperation in each area of economic policy contributes to progress in other areas. Greater exchange rate stability, based on more orderly underlying economic and financial conditions, should contribute towards the expansion of trade, sustainable growth and development, and the correction of external imbalances."

The debate on the trade impact of exchange rates has surged again recently in the WTO,[56] and is likely to do so each time that it is felt, rightly or wrongly, that the present state of international monetary cooperation does not allow for orderly exchange rate adjustment reflecting balance of payments positions and does allow a particular member, or several members, to enjoy competitive advantages as a result of such a lack of cooperation. While the influence of macroeconomic and structural policies in determining exchange rates is acknowledged (Eichengreen, 2007), the world trading system must regularly "deflect" tensions associated with the perceived trade impact of exchange rates. This has become more frequent in recent years, as growing international inflows and outflows of foreign exchange have the potential to destabilize domestic economic policies and reduce the efficacy of traditional controls (notably restrictions on capital movements).

The question for the WTO is also systemic because exchange rate shifts increase or weaken the desired or perceived level of protection of domestic operators – and thus seem to have a role in the definition of trade policy. At the multilateral level, the erratic movement of exchange rates is frustrating the desired levels of protection that are negotiated by WTO members through long-term commitments – precisely because policies are aimed at setting predictable conditions of access for producers and traders. In turn, members may seek a way to address cyclical development or exchange rate changes in the trade policy toolkit.

Some empirical studies suggest that contingent trade measures are used in response to trading partners' currency depreciations. For example, Knetter and Prusa (2003) and Niels and Francois (2006) establish a link between anti-dumping cases and the exchange rates for a number of countries: the number of anti-dumping complaints against partners tends to increase when the local currency appreciates relative to the partner's currency and when the current account deficit widens.

In a world of large capital markets, a problem arises for traders and policy-makers alike when exchange rates behave in a disorderly way and do not adjust to economic fundamentals. During the Bretton Woods era, part of the international trading community found a system of orderly adjustment of real exchange rates. The system was not ideal. However, the international trading community felt that there was a system, providing, at least in the early stages, for a sense of organized governance in the international monetary system.

The need for greater coherence for trade and exchange rate policies was included in the GATT rule book at the outset (see Section E.3(c)). The IMF and GATT were created in response to a lack of coordination of economic policies during the Great Economic Depression – these new institutions aimed at dealing with trade and exchange rate policies as a matter of common interest, with the introduction of disciplines to avoid competitive devaluations, to maintain exchange rate stability, to reduce balance of payments crises and to fight protectionism. From the outset, the international monetary and trading systems were linked by a coherent set of rules aimed at the progressive opening of trade and payments. GATT provisions on coherence reflected two things: the attachment of the trade community to exchange rate stability; and the need for that community to ensure that the trading system was not frustrated by the undisciplined use of exchange restrictions or multiple exchange rates. The institutional set-up remains very much one of coherence – and not of conflict – between the two systems.

In the 1994 Ministerial Declaration on the WTO's Contribution to Coherence in Global Policy Making, WTO ministers "recognized, however, that difficulties the origins of which lie outside the trade field cannot be redressed through measures in the trade field alone". This means that the trading system cannot bear excessive expectations with respect to ensuring or contributing to stable and cooperative monetary and macroeconomic conditions. A number of institutions and policy processes are in place to enforce better surveillance of exchange rates and to reduce global imbalances (for example, the G20 and the IMF's Mutual Assessment Process). The question as to

Table D.4: **Currency distribution of foreign exchange transactions, 2001-2010** (percentage shares of average daily turnover in April of the 20 most used currencies)				
Currency	**2001**	**2004**	**2007**	**2010**
US dollar	89.9	88.0	85.6	84.9
Euro	37.9	37.4	37.0	39.1
Japanese yen	23.5	20.8	17.2	19.0
Pound sterling	13.0	16.5	14.9	12.9
Australian dollar	4.3	6.0	6.6	7.6
Swiss franc	6.0	6.0	6.8	6.4
Canadian dollar	4.5	4.2	4.3	5.3
Hong Kong dollar	2.2	1.8	2.7	2.4
Swedish krona	2.5	2.2	2.7	2.2
New Zealand dollar	0.6	1.1	1.9	1.6
Korean won	0.8	1.1	1.2	1.5
Singapore dollar	1.1	0.9	1.2	1.4
Norwegian krone	1.5	1.4	2.1	1.3
Mexican peso	0.8	1.1	1.3	1.3
Indian rupee	0.2	0.3	0.7	0.9
Russian rouble	0.3	0.6	0.7	0.9
Chinese renminbi	0.0	0.1	0.5	0.9
Polish zloty	0.5	0.4	0.8	0.8
Turkish lira	0.0	0.1	0.2	0.7
South African rand	0.9	0.7	0.9	0.7

Source: BIS Triennial Central Bank Survey 2010.

Note: The sum of percentage shares of individual currencies equals 200 per cent as two currencies are involved in each transaction.

whether conditions will be met to set up a more cooperative or binding system of exchange rates at the international level remains open. Some authors (Mundell, 1961; Williamson, 2009) have suggested that international cooperation is enhanced in optimal currency areas and/or when regional currencies reach comparable weights and status. At present, international trade and financial markets are dominated by the US dollar and the euro much more than other currencies (Auboin, 2012).

The current prudent expansion of the Chinese renminbi (RMB) as a trade currency raises the probability that the Chinese currency will play an important role in tomorrow's international monetary system. China has made steady progress to promote the international use of the RMB lately, particularly in international trade transactions. To some extent, the willingness of trade partners to adopt the RMB may reflect a preference to reduce reliance on the US dollar and the euro within the global monetary system as well as an opportunity to cut transaction costs for bilateral trade. However, as pointed out in Section B.2(a), there is still a large discrepancy between China's importance in world trade flows (some 11 per cent of imports) and that of the RMB in trade payments (some 1 per cent).

To be successful at the international level, the market for a currency needs to be large, liquid and global – even if used for trade purposes only (international traders ask routinely for currency hedging, requiring a development of the derivatives markets). In 2010, according to the BIS, the US dollar accounted for

85 per cent of foreign exchange transactions followed by the euro which accounted for 40 per cent. The RMB accounted for only 0.9 per cent of global foreign exchange transactions in 2010 (see Table D.4; BIS, 2010). There is little doubt, however, that in the medium to long term the RMB will expand as one of the world's key currencies. The gradual lifting of restrictions on the use of the RMB in other transactions – in particular, inward and outward investment and international fund raising – will also push forward the RMB's internationalization.

4. Conclusions

The future of global trade will, to a significant extent, depend on the socio-economic context at the national, regional and global level. This section has provided a detailed discussion of the possible environmental, social and macroeconomic challenges that lie ahead. The nature of the challenges differs substantially across the three domains and their relationship with the multilateral trading system has evolved differently over time. Yet, each of these concerns has been high on policy-makers' agendas in many countries. It is possible that public perceptions of the relationship between trade and these concerns can turn into a pressure point for protectionism. Decisions in these three areas will therefore undoubtedly affect trade flows in the future, either directly or through their effect on trade policy decisions.

In this rapidly changing global environment, it will be crucial to ensure that policies in socio-economic

domains, such as labour markets, environment and finance, are well aligned with trade policies. Openness is likely to generate greater benefits in economies characterized by a strong enabling environment for enterprises and well-designed education and training policies. Individuals find it easier to cope with changes in the competitive environment in economies equipped with social protection systems. Well-designed environmental policies can be both economically and environmentally beneficial. Open economies flourish when appropriate regulation guarantees stability in financial markets and when access to finance, including trade finance, is facilitated, particularly for SMEs.

In many areas, the desirable alignment across policies can be achieved by cooperation between relevant ministries at the national level. However, in other areas, greater cooperation at the global level may be necessary. In the area of environment, for instance, collective efforts that result in agreed policy approaches towards global environmental problems may limit the scope for environmental policies to unnecessarily distort trade.

The interconnectedness between trade, the labour market and macroeconomic policies was already on the mind of negotiators when the original GATT legal texts were designed.[57] Indeed, the need for greater coherence between trade and exchange rate policies has been explicitly reflected in the GATT legal texts. Current concerns about jobs and inequality, macroeconomic stability and environmental sustainability may give a new relevance to this interconnectedness.

The recent period of economic turmoil has also created a situation that may lead to increased calls for protectionism. This highlights the importance of the WTO's monitoring and surveillance role as well as its place in the institutional framework of global governance, as will be further discussion in Section E.

Endnotes

1   See Jansen and Von Uexkull (2010) for a discussion of the employment effects of trade in low and middle-income countries during the Great Recession.

2   When this Report was written, the World Top Incomes Database contained information on the income share of the top 1 per cent of income earners for 27 countries, of which most were OECD countries. China, India and South Africa were the only BRICS countries represented in the database. Information on China and India is reflected in Figure D.2. In South Africa, the share of the top 1 per cent income earners increased from 9.9 per cent in 1990 to 16.6 per cent in 2010.

3   Authors' calculations based on World Bank, World Development Indicators.

4   See, for instance, Milberg and Winkler (2011).

5   Autor et al. (2012), for instance, find evidence regarding an increase in the use of invalidity insurance in reaction to increased imports from China.

6   See Goldberg and Pavcnik (2007) and Pavcnik (2011) for overviews of the relevant literature.

7   The presence of an export wage premium may depend on workers' skill levels. Klein et al. (2010), for instance, find that low-skilled workers in German manufacturing have an export wage discount, while higher-skilled workers have an export wage premium.

8   Different components of globalization may also interact through political economy mechanisms. Peters (2012), for instance, argues that increased possibilities to invest abroad and offshore production has reduced US firms' lobbying efforts to facilitate immigration.

9   See the opening quote in Bacchetta and Jansen (2003).

10 See WTO (2009) and specifically adjustment to trade reform in Bacchetta and Jansen (2003).

11 Under this so-called "fair wage" hypothesis, workers are assumed to expect higher wages from firms that are economically successful.

12 These frictions occur when looking for jobs and or looking for potential employees is associated with costs.

13 Based on the OECD-WTO Trade in Value Added (TIVA) database available at: http://stats.oecd.org/Index. aspx?DataSetCode=TIVA_OECD_WTO.

14 See Francois et al. (2011) and Davidson and Matusz (2010) for overviews.

15 Individuals affected by job loss during adjustment periods are likely to suffer both in the short run (unemployment) and possibly in the medium to long run (lower wages). See, for instance, the work by Kletzer (2000; 2001) and by Ebenstein et al. (2009).

16 Hasan et al. (2012) use state and industry-level data for India. They do not find any evidence of unemployment increasing following trade reform. Their state-level analysis reveals that urban unemployment declines with trade opening in states with flexible labour markets and larger employment shares in net exporter industries.

17 The expectation that opposition to opening is determined by the sector of employment stems from the so-called "specific factor model". The Heckscher-Ohlin model predicts that factors that are relatively scarce in a country lose from trade and may thus oppose opening . Firm size matters in the

so-called new-new trade models and one of the specificities in these models is that factors employed in relatively small firms are more likely to lose from trade opening.

18 Mayda and Rodrik (2005) use information contained in the International Social Survey Programme (ISSP) that covers more than 20,000 individuals in 23 countries.

19 Other survey evidence indicates that individuals may also be concerned about the country-wide employment effects of globalization. Anderson and Gascon (2007), for instance, report that 75 per cent of respondents in a US survey replied that "outsourcing hurts American workers". Another survey shows that about half of North Americans and Europeans think that "freer trade" results in more job destruction than job creation (German Marshall Fund, 2007).

20 See evidence from Eurobarometer discussed in Bacchetta and Jansen (2011).

21 Authors' calculations based on a larger set of countries in the PEW Research Global Attitudes Project database.

22 See Bertola et al. (2006) for an extensive discussion of the role of inequality in macroeconomic frameworks.

23 Grigg (1994) as cited in Fieler (2011).

24 This may change in the future as the country's production of high-end manufactured goods is well under way.

25 In the light of disruptions in financial markets in the wake of and during the Great Recession, numerous recent research projects have drawn attention to the role of inequality in a world where financial markets are imperfect. It has, for instance, been argued that inequality can act as an amplification channel for trade-related aggregate shocks (Pothier and Puy, 2012). Kumhof and Ranciere (2010) illustrate that inequality can even be the main trigger of major financial crises.

26 This is in line with Haltiwanger (2011) who emphasizes the importance of functioning credit markets to ensure smooth adjustment to trade reform.

27 Lin (2010) and Pisano and Shih (2012) are only two examples of a vast recent literature on the role of public and private sector actors in determining growth paths. While Lin (2010) focuses on developing country challenges, Pisano and Shih (2012) analyse relevant challenges from an industrialized country's point of view. Bourguignon et al. (2006) examine whether international policies on aid, trade or factor movements can affect the international distribution of income. They find that trade opening in high-income countries can contribute to a better distribution of income at the global level.

28 Casacuberta and Gandelman (2010) and Muendler (2010) show that trade opening in Uruguay and Brazil resulted in higher job destruction than job creation. Displaced workers were not absorbed by the most competitive industries but moved into non-trading sectors or out of formal employment.

29 See Goos and Manning (2007) and Autor et al. (2006) on job polarization.

30 See also Mitra and Ranjan (2011), Paci et al. (2009) and Jansen and von Uexkull (2010) on the role of social protection in open economies.

31 The so-called Brundtland Report defines sustainable development as progress that "meets the needs of the present without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987).

32 Principle 12 of United Nations Conference on Environment and Development (1992).

33 Preamble to the Marrakesh Agreement Establishing the World Trade Organization. Available at: www.wto.org.

34 Emissions data are taken from European Commission Joint Research Centre (2011). More recent emissions data are not yet available at the worldwide level.

35 Biodiversity measures are taken from World Bank (2012c).

36 Adjusted Net Saving, an indicator developed by the World Bank, captures the economy's true savings rate once investments in human capital, depletion of natural resources and damage caused by pollution are taken into account. The Environmental Performance Index, developed by Yale and Columbia Universities in the United States, is a composite index that covers 22 variables, including child mortality, SO_2 emissions per capita, pesticide regulation, forest loss and CO_2 emissions per capita (Yale Center for Environmental Law and Policy and Center for International Earth Science Information Network, 2012). The Ecological Footprint, developed by the Global Footprint Network, measures the ratio of land and water requirements to available resources in order to sustain the living standard of a country. The (absolute and proportional) Environmental Impact indices, developed by Bradshaw et al. (2010), measure the proportional and absolute environmental impact with respect to each country's (and the world's) available resources in terms of natural forest loss, natural habitat conversion, marine capture, fertilizer use, water pollution, threatened species, and carbon emissions. In order to facilitate interpretation, the Environmental Impact indices measures have been transformed as follows: -Environmental Impact + 200.

37 The top CO_2 emitters in 2008 were China, United States, the Russian Federation, Indonesia, India, Japan, Democratic Republic of the Congo, Germany, Brazil, Canada, United Kingdom, the Republic of Korea, Mexico, Italy, Australia, France, Kingdom of Saudi Arabia, Iran and South Africa.

38 The top SO_2 emitters in 2008 were China, United States, India, the Russian Federation, Australia, Kazakhstan, Indonesia, Japan, South Africa, Canada, Kingdom of Saudi Arabia, Brazil, Mexico, Chile, Turkey, Chinese Taipei and Peru.

39 The top NO_x emitters in 2008 were China, United States, India, the Russian Federation, Central African Republic, Brazil, and Sudan.

40 Data for 2007, which is the latest available year.

41 Cristea et al. (2011) note that one kilogramme of cargo flown one kilometre on a plane generates between 50 and 200 times the emissions of that same kilogramme/ kilometre on a bulk cargo carrier.

42 The factor endowments hypothesis is based on the following stylized facts: developed countries tend to be capital abundant relative to developing countries; and the pollution intensity of an economic sector tends to go hand in hand with its capital intensity.

43 The relocation of pollution-intensive production could entail a relocation of pollution-intensive industries from countries with stringent environmental policy to countries with lax environmental policies, or an increase in the production (and net exports) of pollution-intensive goods in countries with lax environmental policies.

44 Under the pollution haven hypothesis, the higher a country's per capita income level, the more stringent its environmental policy, see Copeland et al. (2003).

45 The method or "technique" used in production can be loosely defined as pollution per unit of output.

46 For example, McAusland (2004) uses a partial equilibrium model of trade to illustrate a so-called "California effect", through which domestic firms see an increase in their rents following a requirement to use cleaner inputs. Even if the stricter requirement does not apply overseas, foreign firms have an incentive to comply with it. Since production is subject to increasing returns and demand in the country with the stricter requirement is large, it is cheaper for foreign firms to comply with the requirement to use cleaner inputs. Nonetheless, using cleaner inputs drives up the production costs of foreign firms by more than those of domestic firms and shifts world demand towards domestic firms.

47 A "fossil fuel channel" has been suggested as an additional channel for carbon leakage. This involves a decline in international fossil fuel prices (due to a decrease in demand for fossil fuels in constrained countries), which may trigger additional energy demand and emissions in unconstrained countries (Morgenstern et al., 2007).

48 Studies often express carbon leakage as a ratio of the increase in CO_2 emissions of unconstrained countries and the reduction in the emissions of constrained countries. Most estimates of carbon leakage range from 5 per cent to 20 per cent (Elliott et al., 2010).

49 The most common form of emissions trading scheme is known as cap-and-trade. Under this system, an overall limit on the amount of carbon emissions is set by a central authority, which then issues pollution allowances or permits equivalent to that ceiling. The permits are allocated to entities whose activities contribute to emissions in accordance with specific rules and conditions, and may be traded among participants. Emissions allowances may be auctioned off or distributed at no cost to the recipient. See Serres et al. (2010).

50 Feed-in tariff schemes offer a guaranteed price or premium (on the market price for electricity) for each unit of electricity fed into the grid and produced from renewable energy. Under quota systems, governments typically establish an obligation on a utility company or group of companies to provide a pre-determined minimum share of renewable energy of either installed capacity or electricity generated. Quota systems are variously known as renewable portfolio standards, renewable electricity standards, renewables obligation and renewable energy targets. Previous dispute settlement cases show that WTO rules give space for countries to adopt a wide range of policies in pursuit of legitimate environmental objectives. At the same time, such space is disciplined by specific conditions aimed at ensuring measures are not applied arbitrarily and are not disguised restrictions on international trade. For instance, the use of a domestic content requirement in the operation of a feed-in-tariff was found to be inconsistent with WTO Members' obligations under the TRIMS Agreement in the recent Canada – Renewable Energy / FIT Program cases (WT/DS412/AB/R; WT/DS426/AB/R, Canada – Certain Measures Affecting the Renewable Energy Generation Sector – Canada – Measures Relating to the Feed-In Tariff Program – AB-2013-1 – Reports of the Appellate Body, 6 May 2013).

51 Short-term finance is necessary for most international trade transaction because a time-lag exists between the production of the goods and their shipment by the exporter, on the one hand, and reception by the importer, on the other. Generally, exporters would require payment, at the latest, upon shipment (at the earliest upon ordering), while importers would expect to pay, at the earliest, upon reception. This time lag generally justifies the existence of a credit or a guarantee of payment. The credit can either be extended directly between firms – a supplier or a buyer's credit, or by banking intermediaries, which may offer the exporter or the importer to carry for them part of payment risk (and some other risks involved in the international trade transaction) for a fee. For example, under a letter of credit, the bank of the buyer provides a guarantee to the seller that it will be paid regardless of whether the buyer ultimately fails to pay. The risk that the buyer will fail to pay is hence transferred from the seller to the letter of credit's issuer.

52 For example, the 2009 IMF-BAFT survey covering the period from the third quarter of 2008 to the first quarter of 2009 indicates that the flows of secured or unsecured trade finance to developing countries had fallen more than the flows of trade in 2008, calculated on a year-on-year basis.

53 In its Financial Stability Review of June 2012, the European Central Bank (ECB) is concerned that the deleveraging process could adversely affect the supply of credit to the real economy in the Euro area. According to the ECB, such concerns are more relevant for the Euro area than for other large economies, owing to the predominant role of banks in the financing of the economy.

54 In its 2010 *Annual Report*, the BIS estimated that in the two years between the onset of the financial crisis and the publication of that report, international banks had experienced cumulated losses on write-downs of assets of some US$ 1.3 trillion, met by total recapitalization of US$ 1.2 trillion. Since then, the BIS no longer reports this figure but it is likely to have increased.

55 More details on the IMF normative estimates of equilibrium exchange rates can be obtained on the IMF website (www.imf.org). Of particular interest is the 2012 methodological note: "External Balance Assessment (EBA): Technical Background of the Pilot Methodology".

56 See in particular the seminar held by the WTO Working Group on Trade, Debt and Finance, available at http://www.wto.org/english/news_e/news12_e/devel_27mar12_e.htm.

57 See also Section D.7 of WTO (2007) on this issue.

E. Prospects for multilateral trade cooperation

This section explores the relevance of current trade rules – as well as the need for new approaches to trade cooperation – in light of the forces that are currently re-shaping international trade. It suggests that the multilateral trading system will need to adjust to developments in trade and in the trading environment – as it has done repeatedly in the past – and reviews proposals for updating the WTO's agenda and governance. The section starts with a short overview of key trade developments within the broader socio-economic context – especially the rise of global supply chains, the general shift of trade power away from the West and towards Asia and other emerging economies, as well as the changing nature, composition and direction of trade. It then highlights some of the main challenges facing the WTO and how they could be addressed.

Contents

Some key facts and findings

- Some of the main trends which will affect world trade in the coming decades are the emergence of international supply chains, the rise of new forms of regionalism, the growth of trade in services, higher and more volatile commodity prices, the rise of emerging economies, and evolving perceptions about the link between trade, jobs and the environment.

- These trends will raise a number of challenges for the WTO. A considerable amount of trade opening is taking place outside of the WTO. Interdependence between trade in goods and trade in services is increasing. Frictions in natural resource markets expose some regulatory gaps. The emergence of new players affects global trade governance in ways that need to be better understood. Coherence between WTO rules and non-trade regulations in other multilateral fora needs to be maintained.

- Addressing these challenges will involve reviewing and possibly expanding the WTO agenda. Traditional market access issues will not disappear but new issues are emerging. Internal governance matters as well as the role of the WTO in global governance may need to be addressed. An important issue will be how to "multilateralize" the gains made in preferential trade agreements and to secure regulatory convergence.

1. Main trends in trade

This sub-section provides a short summary of some of the main findings of Sections B, C and D that may have implications for the WTO.

(a) Trends in the nature of trade

A trend emphasized throughout this report and that has a major impact on other developments is the emergence of global supply chains. Countries and producers increasingly specialize in certain stages of production depending on their particular comparative advantage. Section B stresses the importance and magnitude of this development for international trade. In particular, its impact on trade statistics is analysed in detail. In Section C, several important factors influencing these supply chains are discussed. Transport and energy costs, for instance, are reasons why these chains remain more regional than global.

A related trend is the new form of regionalism that is sometimes referred to as "deep" integration (Baldwin, 2012a). The need for firms to organize their supply chains across different countries has led to a demand for regional agreements that cover more than preferential tariffs. The harmonization of standards and rules on investment, intellectual property and services has become a standard part of new trade agreements (WTO, 2011a).

Section B also discusses the differences among firms involved in trade. The picture that arises from the trade literature and the data is that even if many firms are indirectly involved in trade-related activities, only relatively few are exporting or importing and these firms tend to be larger and more productive than others. Such firms also have a role in technology advancement and the diffusion of know-how through supply chains.

(b) Trends in the composition of trade

Section B shows that trade in services has grown faster than trade in goods over the last two decades, while Section C describes how advances in information and communication technology have enabled a rapid expansion of services trade. This trend might in the future be spurred by rising energy costs. Moreover, the share of services in both manufacturing firms' inputs and outputs has increased and the "frontier" between goods and services is increasingly blurred. Digitalization and 3D printing are examples of the increasing grey zone between goods and services. Whether they are classified as one or the other is significant as different regulatory regimes might apply.

With regard to natural resources, Section B shows that their price has increased and that the price of food products has become more volatile. Section C explores in more detail the reasons behind the trends in the price of energy. Section D discusses how higher and more volatile agricultural commodity prices raise concerns regarding food security in developing countries.

(c) Trends in the geography of trade

Another major trend in international trade is the rise of a number of emerging economies and the associated increase in their shares in world trade. Especially China but also India and Brazil have transformed the balance of power in the multilateral trading system. Section B describes the growth in the share of world trade of China and other emerging economies. Between 1980 and 2011, for example, China's share in world merchandise exports and imports increased tenfold, making the country the largest exporter of the world.

Section C finds that a comparable development has occurred in foreign direct investment. Inflows into developing countries and outflows from these countries now represent a major share of total foreign direct investment (FDI), and FDI between developing countries is rapidly expanding. Related to this development is the industrialization of developing countries and de-industrialization of developed countries which, once again, is closely interconnected with global supply chains. However, this growth is limited to only a few economies. It has caused greater differences among developing countries, with growing emerging economies and struggling least-developed countries (LDCs).

(d) Trends in the broader socio-economic context

Section D looks at trends in the broader socio-economic context within which trade takes place. Distributional effects of trade play an important role here. The section examines the extent to which the recent sharp increase in the unemployment rates of developed countries may be linked to trade and what this could mean for attitudes towards trade. While there is no conclusive evidence that trade contributes significantly to changes in long-run unemployment or in income inequality, public concerns about current levels of unemployment and income distribution in a number of countries are likely to have a bearing on trade policy-making.

Another ongoing trend is the increasing importance of consumer concerns (regarding the environment or food safety, for example) which has led to a proliferation of public policy measures that affect trade (WTO, 2012b). Global supply chains might exacerbate the issue when large firms impose private standards throughout their respective supply chains. A further trend is the fierce competition for scarce natural

resources that leads to a more frequent use of export restrictions, as examined in the 2010 *World Trade Report* (WTO, 2010).

2. Challenges for the WTO

A number of developments identified in this report raise a transparency challenge for the multilateral trading system. First, as explained in Section B, the expansion of supply chains is difficult to quantify with the available trade statistics, which are collected in gross terms. Efforts are being made to generate statistics on trade in value-added terms but more information will be needed on various other aspects of supply chains. The key role of services, for example, is not adequately captured by existing statistics. Similarly, more and better information on FDI is needed to assess the effect of offshoring. Secondly, as discussed in Section D, non-tariff measures (NTMs) related to public policy, which have proliferated in recent years, are particularly opaque.[1] This opaqueness raises problems not only for businesses but also for the multilateral trading system. Existing WTO transparency mechanisms and efforts undertaken by other institutions shed some light in a number of areas but more remains to be done.

(a) Internationalization of supply chains

One major development that has substantially transformed – and is likely to continue to transform – world trade and the world economy as a whole is the emergence and expansion of global supply chains. According to some economists, the significance of this internationalization of supply chains goes beyond increasing trade in parts and components; in some ways, it is the most important development in the world economy since the beginnings of globalization (Baldwin, 2012a).

The industrialization and spectacular growth of emerging economies, together with the fast expansion of services trade and of FDI, are inextricably related to what Baldwin calls the "second unbundling" of production. The focus here will be on how the rise of global supply chains has had an impact on the political economy of trade and countries' motivations for cooperating on trade policies. There is both theory and evidence suggesting that participation in global supply chains tends to strengthen anti-protectionist forces. These forces have helped to drive some multilateral trade opening in the WTO, both in specific sectoral as well as in broader accession-related negotiations (with 32 governments joining the WTO since its creation in 1995). The main impact, however, has been on unilateral tariff reductions (mostly among developing countries) and the proliferation of preferential trade agreements (PTAs) and bilateral investment treaties (WTO, 2011a). A considerable amount of trade opening has thus taken place outside the WTO.

(i) Unilateral tariff reductions

The internationalization of supply chains has opened up an alternative industrialization path for developing countries (Baldwin, 2011a). Before the emergence of supply chains – and the information and communication technology (ICT) revolution that underpinned it – industrialization involved building a strong industrial base often behind the protection of tariffs and other NTMs. The unbundling of global production made it possible for countries to industrialize by joining international supply chains. This process also changed the political economy of trade policy, creating in many developing countries a strong incentive to undertake unilateral tariff reductions.

Baldwin (2011a) identifies three mechanisms through which production unbundling can lead to unilateral tariff reductions. First, the offshoring of production is likely to alter lobbying over trade policy in the host country. The relocation of production transforms importers of the products concerned into exporters. As a result, lobbying in favour of import tariffs on these goods decreases and pressure to reduce upstream tariffs increases.[2] This effect, however, is more limited in cases where governments set up export processing zones to exploit the growing industrialization opportunities offered by supply chains.

Secondly, a fall in coordination and communication costs may also have an impact on lobbying. With high "frictional" trade costs, producers of final products may support infant industry protection of intermediate products if they believe that it could lower the price of domestically produced intermediate goods compared with imports. However, a fall in coordination and communication costs can break the coalition of interests behind high trade barriers, and lead downstream producers to lobby against tariffs on intermediate goods.

Thirdly, offshoring improves the competitiveness of developed countries' products by reducing their costs, thus undermining import substitution strategies in developing countries. Developing country governments may either respond by lowering the tariffs on final goods, or, alternatively, by lowering upstream tariffs to improve the competitiveness of domestic final goods.

Empirical evidence seems to confirm that lobbying is indeed an important determinant of trade policy (Gawande et al., 2012). In particular, there is evidence suggesting that supply chains can explain why the recent financial crisis did not lead to significant protectionism despite the fact that many countries had "water" in their applied tariffs, meaning they could raise them without violating their "bound" WTO commitments (Gawande et al., 2011).

While unilateral tariff reductions have clearly been a positive step in the direction of more open trade, they

may also have complicated multilateral, reciprocity-based tariff reductions in the WTO. Baldwin (2010a) argues that developing countries have already significantly reduced their applied tariffs, giving developed country exporters less to fight for in multilateral negotiations. Developed country exporters also see less value in asking developing countries to commit to lower tariffs because they do not believe that developing country governments have strong incentives to raise them.[3] In Baldwin's view, because multilateral tariff reductions are driven by the exchange of market access, the fact that developing countries have less to offer has weakened the logic of further negotiations.[4]

Blanchard (2010) makes a related point, arguing that foreign investment may lead governments to unilaterally reduce tariffs, thereby lowering the incentive to exchange tariff reductions in the WTO. Existing theoretical work suggests that a government's optimal tariff decreases when its constituents hold an ownership stake in a foreign market, leaving it with less incentive to manipulate the terms of trade. Extending a terms-of-trade model of trade agreements to account for international ownership, Blanchard shows that by eroding large countries' motives to improve terms of trade by raising tariffs, international ownership can also reduce their incentive to sign trade agreements. Blanchard also suggests that calculations of reciprocity in tariff negotiations should consider patterns of international ownership as well as trade flows.

Unilateral tariff reductions, in as much as they were not bound in the WTO,[5] have tended to increase the level of "water" in developing countries' tariffs – i.e. the difference between the level at which tariffs are bound and the level at which they are applied – which has in turn complicated the Doha Development Agenda (DDA) non-agricultural market access negotiations. In the DDA's early days, discussion focused on the question of whether and how credit should be granted for autonomous trade opening (Mattoo and Olarreaga, 2001). Even when WTO members "agreed" to negotiate reductions of their bound, rather than applied, tariff rates, the underlying problem did not disappear but merely reappeared under a different guise. Members started arguing about the value of so-called "paper cuts", i.e. reductions of bound rates that do not imply equivalent reductions of the corresponding applied rate.

(ii) Reciprocal trade opening

The changing dynamics of trade policy brought about by the internationalization of supply chains have not only resulted in unilateral tariff reductions but also in negotiated tariff reductions in the WTO (e.g. the Information Technology Agreement) and, even more significantly, in fast-proliferating PTAs (WTO, 2011a). While in many cases, particularly in Asia, these PTAs are aimed at "deep" integration and rule-making, they typically also include a traditional tariff component. In other cases, such as PTAs in Africa, tariffs are central to the agreements.

Preferential tariffs raise several challenges for the multilateral trading system. One concern, extensively discussed in the economic literature, on the systemic effects of preferential tariff reductions relates to the linkages between discriminatory and non-discriminatory tariff reductions.[6] A number of different mechanisms have been identified through which PTAs either foster or hinder multilateral trade opening. While the evidence on the relative size of these effects is inconclusive, there is a shared sense among observers that the coherence between PTAs and the WTO needs to be improved (WTO, 2011a).

(iii) Deep integration at the regional/bilateral level

In order for international supply chains to operate smoothly, certain national policies need to be harmonized – or rendered mutually compatible – to facilitate business activities across borders.[7] This generates a demand for deep forms of integration.[8] Developed countries were the first to sign regional agreements aimed at providing rules to accommodate internationally fragmented production.

With the expansion of international production sharing, developing countries too began to enter into deep integration agreements, especially at the regional level.[9] Both North-South agreements (between developed and developing countries), such as the North American Free Trade Agreement or the Euro-Mediterranean agreements, and South-South agreements (between developing countries), mostly in Asia, include provisions that go beyond preferential tariff reductions. As suggested by the current Trans-Pacific Partnership negotiations and the Pacific Alliance initiative in Latin America, this trend is unlikely to change.

The fact that governments respond to the internationalization of supply chains by signing deep integration agreements at the regional level is broadly consistent with the limited amount of theory available on this topic (WTO, 2012b). According to Antràs and Staiger, deep rather than shallow integration agreements and more individualized rules are needed to address the policy problems associated with the internationalization of supply chains (Antràs and Staiger, 2012). Countries intensively involved in supply chain trade may find it increasingly difficult to rely on broad GATT/WTO principles alone to address their trade-related problems, and may turn to more narrowly focused PTAs to achieve the deep and customized bargains they need.

An important result of the terms-of-trade theory is that shallow integration, i.e. tariff commitments plus an

effective "market access preservation rule", can achieve internationally efficient policies (Bagwell and Staiger, 1999; 2001). However, Antràs and Staiger (2012) find that this result does not hold in the presence of offshoring and, more generally, when international prices are determined through bargaining. If producers are locked into trade relationships with foreign firms – and prices are set via bargaining – there are incentives to manipulate the markets of both the intermediate and the final product to shift the bargaining surplus. Governments might also try to pursue redistributive goals via a trading partner's policies. Deep integration agreements are needed to resist these pressures. However, this in turn means that negotiations must cover a wider array of internal/ domestic measures than are typically covered in "shallow" trade agreements.

Thus, the rise of offshoring raises both a direct and an indirect challenge for the WTO. It puts direct pressure on the WTO to evolve towards deeper integration and more individualized agreements. It also puts indirect pressure on the WTO to evolve in this direction, as member governments increasingly turn to PTAs to solve their trade-related problems. As a result, Baldwin (2012b) argues that the WTO runs the risk of becoming irrelevant.

The 2011 *World Trade Report* (WTO, 2011a) explored the effect of proliferating deep regional agreements on coherence in international trade governance. It suggested that new international trade rules are being negotiated and decided outside the WTO where power differences are greater and where the principles of non-discrimination and reciprocity are absent. It also argued that PTAs are here to stay. Governments will need to ensure that regional agreements and the multilateral trading system are complementary and that multilateral disciplines minimize any negative effects from PTAs.

While the available literature suggests that deep integration rules are often non-discriminatory – for instance, provisions in the services or competition policy areas are often extended to non-members[10] – certain provisions in regional agreements can contain discriminatory aspects that clash with the multilateral trading system. It has been shown that PTAs which make it more difficult to apply contingency measures to PTA partners may divert protectionist measures towards non-members (Prusa and Teh, 2010). Deep provisions can also have a number of adverse systemic effects. For example, the "lock-in" effects of regional regulatory harmonization can make it more difficult to multilateralize rules. PTAs may not include third-party most-favoured nation (MFN) clauses, thus effectively discriminating against other countries. Developed country exporters may view bilateral and regional rather than multilateral agreements as faster and easier routes for achieving their objectives, further weakening the principle of non-discrimination.[11]

With regard to services supply chains, some argue that their growth creates an additional need to re-examine and modernize current rules for services trade, as these rules were designed for a world where services were exported as final products from national firms, not a world where multiple firms supply stages of services production from multiple locations (Stephenson, 2012). This argument is discussed in more detail in Section E.2(b).

Recent research (see Box E.1) on how differences in firms have an impact on trade policies reveals a related concern.[12] Section B pointed out that a few multinational firms are responsible for a major share of world trade. On the one hand, these firms should support regulatory harmonization across different PTAs in order to lower trade costs. On the other hand, they might also resist harmonization – and encourage certain non-tariff measures – in order to prevent new competitors from entering markets. This may partly explain the persistence of regulatory divergence, and suggests that the political economy of regulatory convergence may be more complex than is sometimes suggested.

(iv) Bilateral investment agreements

As argued by Baldwin (2012b), the internationalization of supply chains has created a "trade-investment-service nexus" which requires new, more complex rules, including on investment. Rules regulating FDI are mainly embodied in bilateral investment treaties (BITs), which have proliferated since the mid-1980s, and more recently in preferential trade agreements (WTO, 2011a). There is significant variation among investment treaties. For example, many include only post-establishment obligations and thus result in limited trade opening. Another question is whether bilateral and regional approaches are optimal for governing investment flows.[13] While there is some potential for third-party investment discrimination through BITs and regional agreements (WTO, 2011a), opinions regarding the benefits of, and the need for, multilateral cooperation seem to diverge.[14] Since 2003, when WTO members failed to achieve explicit consensus on negotiating modalities for trade and investment and to convert the mandate from the 1996 Ministerial Conference from a study process to a negotiating one, trade and investment is no longer on the WTO negotiating agenda.

(b) Services and "servicification"

Based on a study of the Swedish manufacturing sector, Kommerskollegium (2010a; 2010b) has identified a trend of the "servicification" of manufacturing. In particular, the study identifies two developments. First, it notes that purchases of services account for an increasing share of a manufactured product's total cost. In other words, manufacturing companies are purchasing more and more services.[15]

Box E.1: **Firm heterogeneity and the political economy of NTMs**

Firm-level evidence shows that a few extremely successful multinational companies account for most of a country's trade (see Section B). In addition, there is conclusive evidence that large firms lobby harder than small and medium-sized enterprises (SMEs) because they can more easily accommodate the fixed costs of political contributions and acquire the necessary information for directed contributions (Bombardini, 2008; Kerr et al., 2011; Sadrieh and Annavarjula, 2005). Consequently, it is necessary to look at the preferences of large firms to decide whether "superstar" exporters create tensions for the multilateral trading system. Since the early 2000s, the development of various firm models has made it possible to explore the effects of differences in firms on the political economy of trade.

Trade opening has two opposing effects on domestic firms within the same industry. First, the cost of exporting decreases, which allows more firms to export and increases the sales of established exporters. Secondly, competition increases, which harms domestic firms. Which of these channels dominates for an individual firm depends on firm characteristics, such as size. As a result, lobbying competition arises not only between sectors but also within sectors in which some firms benefit and some lose due to trade. This effect might especially arise in the context of fixed costs because they raise entry costs and thereby shield existing producers or exporters from competition.

Abel-Koch (2010) analyses domestic non-tariff measures and their effect on the fixed costs of exporting for foreign firms. She makes a distinction between NTMs which affect only foreign competitors (e.g. customs procedures) and NTMs that affect all firms equally (e.g. labelling requirements). The former only reduce competition and, therefore, benefit all domestic firms. The latter reduce profits of all firms but also protect the most productive firms from domestic and foreign competition. Consequentially, they are opposed by SMEs but promoted by large firms and might therefore be introduced despite their welfare-reducing impact because these large firms lobby more than SMEs.

A number of factors determine the degree of lobbying competition within an industry. According to Osgood (2012), key determinants are the degree of reciprocity, the mode of trade opening (NTM vs. tariff), country-specific characteristics such as market size, and the degree of product differentiation. As in Abel-Koch (2010), he shows that the least and most productive firms oppose more open trade when it comes to a reduction of NTMs because the competition effect outweighs the sales effect. It is the firms close to the export cut-off, i.e. those that just break even taking into account the costs of exporting, which benefit from trade opening and support it. Osgood (2012) uses these results to explain a persistent feature of trade policy, namely the reluctance to accept opening trade in homogeneous goods.

The emergence of supply chains exacerbates the issue and might weaken reciprocity in trade negotiations. Gulotty (2012) states that as the largest firms are engaged in global production networks, they support NTMs to protect their foreign affiliates. The mechanism is similar to the one described above: multinational affiliates have fewer problems to overcome fixed exporting costs compared with less productive competitors. Hence, large firms promote NTMs not only to reduce domestic competition but also to shield their foreign affiliates from export competition. One implication of the argument in Gulotty (2012) is that market access based rules of reciprocity might be insufficient to address the distributional effects of NTMs because reciprocal tariff concessions cannot account for them.

Overall, these theoretical studies suggest that while the largest firms benefit from tariff reductions, they may not support the reduction of NTMs that have an effect on fixed costs. Large firms can more easily pay the sunk costs of adapting products to different specifications and benefit afterwards from less competition. Trade opening in combination with firm heterogeneity amplifies this problem because it shifts even more resources to large producers that might promote the use of NTMs.

Secondly, the study finds that services account for an increasing amount of manufacturing firms' sales. Put differently, manufacturing firms are selling more and more services.

According to Kommerskollegium (2010a; 2010b), these developments mean that trade in services and trade in manufacturing are becoming more interdependent. Services negotiations and an improved regulatory environment are increasingly important to manufacturers. More information on these inter-linkages as well as a better understanding of the position of manufacturers in services negotiations is needed. From the WTO's perspective, the challenge is to move away from the current situation in which opening trade in services and goods are discussed separately, with commitments in one area traded against commitments in the other. Instead, the negotiations should be viewed as a "package", reflecting the increasing importance of services for

the manufacturing sector. Finally, the study argues in favour of persuading the manufacturing sector of the importance of being more engaged in services negotiations given how such negotiations can affect their competitiveness.

The internationalization of supply chains and the rapid advance of technology — especially the emergence of the internet — have brought important challenges in terms of the coverage and application of the General Agreement on Trade in Services (GATS). First, in a context where production-sharing arrangements are increasingly internationalized, the consequences of definitional uncertainties surrounding the status of "contract manufacturing" operations under the currently used classification system may increase in importance (Adlung and Zhang, 2013). Such uncertainties could prompt companies to (re-)define the ownership conditions of otherwise identical production activities, with a view to achieving cover under the GATS rather than the GATT disciplines.

Secondly, as Tuthill and Roy (2012) note, services that once could only be provided through a foreign commercial presence (mode 3) can now be provided remotely. New services have also emerged thanks to advances in technology. These developments have given rise to questions about how certain services are to be classified in WTO members' schedules of commitments. Given that technological change is unlikely to slow down, this uncertainty is something that will continue to affect GATS commitments in the future, be they prior commitments or new ones.

It has been suggested that the principle of "technology neutrality" applies under the GATS. Application of this principle would mean ensuring a level playing field for all services irrespective of the technological platform used to deliver them (Weber and Burri, 2013). WTO dispute settlement rulings relating to the GATS would seem to be consistent with the application of this principle. In the cases "US – Gambling" and "China – Audiovisual Services", GATS commitments were found to be applicable to electronically delivered services. Technological developments may also affect the characterization of a service. A new "integrated" service may be found to exist as a result of the bundling of several services, as was the case in "China – Electronic Payment Services". Therefore, technological progress will continue to raise challenges in relation to the GATS framework, either with respect to the classification of a service or to other matters that affect the agreement's coverage or application.

(c) Natural resources

Demand for natural resources is increasing, leading to frictions in their markets (see Sections B.2 and C.4). Resource-poor countries wish to secure access to the resources they need, while resource-rich countries restrict access to their resources – for example, through export taxes. WTO rules were not drafted specifically to regulate international trade in natural resources. This has arguably led in some cases to regulatory gaps, or at the very least to a lack of clarity about how precisely the rules apply in the particular circumstances that characterize natural resources trade. This raises a number of challenges.

One challenge is to manage the regulatory failures implicit in beggar-thy-neighbour policies. As discussed in the 2010 *World Trade Report* (WTO, 2010), the economic theory of trade agreements shows how two large countries acting non-cooperatively may restrict their exports to each other and thereby end up in a "Prisoners' Dilemma" situation, whereby acting in pursuit of their own best interests does not ultimately result in the best outcome.[16] Because export taxes are the mirror image of tariffs, it is not surprising that the same terms-of-trade argument for international cooperation that applies to import tariffs also applies to export taxes. A large country can improve its terms of trade at the expense of its trading partners by imposing export restrictions. The reduction in supply will push up the world price. As in the tariff case, two large countries restricting their exports to each other could end up in a suboptimal situation if they did not cooperate. If this is the case, a trade agreement that allows trading partners to commit to export tax reductions would be beneficial.

Another set of challenges arises from growing concerns over the sustainability of the management of certain natural resources. Certain subsidies can secure better management of a resource or of environmental damage associated with its extraction and use. Questions have been raised about how such subsidies would be treated under WTO rules, particularly in the light of the different rules that apply to agricultural and industrial goods. Other areas where existing WTO rules interact with conservation policies include domestic regulations and the design and implementation of intellectual property rights.

The 2010 *World Trade Report* (WTO, 2010) also explains how certain domestic and trade measures are subject to different disciplines, even though they have the same economic impact. Given the geographical concentration of natural resources – and hence the fact that resource-scarce countries depend on imports for much of their supply and resource-rich countries export nearly all their production – cases arise where trade measures are close substitutes for domestic regulatory measures. In these cases, regulating the trade measure to achieve undistorted trade in natural resources is a necessary but not sufficient condition. For instance, a consumption tax in an importing country may be equivalent to an import tariff. A production restriction in a resource-rich country may have the equivalent effect to an export restriction. Similarly, an export tax has effects comparable to a

domestic subsidy in terms of the consumption of the resource. In the presence of such equivalence, there is no economic basis for regulating these policies differently.

An additional challenge is to improve the regulation of beggar-thyself policies. As noted in the 2010 *World Trade Report* (WTO, 2010), a measure might be beneficial in the short run, possibly for political economy reasons, but might carry significant long-run costs. This would be the case, for example, with a subsidy provided in connection with the exploitation of a resource that has unrestricted access. Another example is that in the absence of international rules on investment, resource-rich countries may be exposed to the "hold-up" problem, whereby parties do not cooperate for fear of losing their bargaining power. Improved investment disciplines could help these countries improve the credibility of their policies towards investments as they underwrite a commitment to agreed-upon rules.

The 2010 *World Trade Report* (WTO, 2010) also highlights that a narrow understanding of WTO obligations in the area of transit could exclude from their scope transport via fixed infrastructure, such as pipelines, and create regulatory uncertainty. This uncertainty can have consequences for access to supplies of resources.

Finally, the 2010 *World Trade Report* (WTO, 2010) notes that many aspects of natural resources are regulated by international rules outside the WTO. A continuing and growing reliance on natural resources in the world economy, the exhaustibility of those resources and the need to mitigate the negative spillover effects relating to their exploitation and consumption are challenges that can only be effectively confronted through international cooperation and better global governance.

Another issue in regard to primary commodities relates to food prices and food security. Current WTO disciplines on trade in agricultural products were drafted at a time of surpluses and declining prices. The focus was on reigning in the domestic farm policies of industrial countries. The last decade, in contrast, has been characterized by growing demand and higher real prices for many agricultural commodities.[17] In this context, most developed countries have been reducing support and protection to their agricultural sectors, and many have been shifting to more decoupled, less distorting measures. Nevertheless, support remains significant and a considerable share of it is delivered in ways that distort competition and trade.

Agricultural prices have not risen smoothly and progressively. Agricultural markets went through several episodes of high and volatile prices. These episodes raised serious concerns regarding food security in a number of food-importing developing countries. These concerns were reinforced by the trade policy responses of a number of food exporters who took measures to restrict their exports. Developing and emerging economies seem to be less confident that trade is a reliable source of food supplies. This raises a challenge for the WTO. Confidence in trade as a mechanism that can contribute to food security needs to be reinforced. As explained by Josling (2012), WTO rules allow policy responses when prices fall but do not help much when prices are high. They constrain export subsidies and bind tariffs but do not limit export taxes. As with natural resources, negotiations aimed at binding export taxes could deliver mutually beneficial outcomes. In addition, there may be a need to adjust the rules to ensure that the new measures taken by governments to mitigate the risks associated with high price volatility are not used in a protectionist manner.

The emergence of new agricultural products such as biomass for ethanol and biodiesel, one of the most significant developments in agricultural trade, is also raising a number of challenges.[18] Domestic biofuels markets are often protected from international competition (Josling, 2012). Ethanol, which is classified as an agricultural product, is subject to higher tariffs than biodiesel and mineral fuels (Moreno Caiado, 2011; Yanovich, 2011). Various subsidy programmes are in place providing support to producers of biofuels or consumers (Moreno Caiado, 2011).

Questions have also been raised concerning the different subsidy rules applicable to agricultural and industrial products. Concerns relate not only to the trade-distorting potential of some of these subsidies but also to the lack of transparency (Josling, 2012). In addition, the consistency with the national treatment obligation and the WTO's Subsidies and Countervailing Measures Agreement of mandates requiring the blending of biofuels with mineral fuels has been questioned.[19] Domestic policies incorporating life cycle analysis have given rise to discussions about the appropriateness of differentiating products by methods of production (Josling, 2012).

(d) New players and small players

As discussed in Section E.1, a major development that has affected the world trading system is the emergence of new trading powers. The question arises as to whether and how the addition of new countries to the world trading system as a result of accessions to the WTO or the growing role of other countries as a result of economic development may affect global trade governance. At the other end of the spectrum, there is some evidence of an enduring marginalization of the smallest and poorest economies (see Section B.2). Addressing this marginalization is considered by many as a key challenge for the multilateral trading system.

Understanding precisely how changes in the geography of trade affect governance in this area is not straightforward. Many commentators somewhat superficially establish links between changes in the number of WTO members or their relative size and the "crisis" of the multilateral trading system. However, few studies rely on an analytical framework to link a specific cause, such as the change in the geography of trade, to a specific problem affecting WTO governance which could explain the failure to conclude the Doha Round. In this sub-section, efforts are made to embed the discussion of the governance challenges raised by the emergence of new trading powers and the enduring marginalization of the poorest members in a broad analytical framework.

(i) New players

Several commentators have discussed the rise of emerging economies and the evolution of their role in the WTO. Most of them focus on China, India or Brazil.[20] They examine these countries' conduct in the GATT/WTO and on this basis try to predict how they will behave in the future. They document how an increase in their share of trade has translated into increased influence in the WTO and confirm that there are now more players at the table and that there is greater variety among the major players. However, they do not shed much light on the effects of these changes on trade governance.

Other commentators have focused their attention on the reasons behind the stalemate of the WTO negotiations. While most of them mention the size and variety of WTO membership as a possible factor that could explain deadlocks, they typically find that other factors have played a more important role. Odell (2009) examines the reasons that lay behind the deadlock at the 1999 Ministerial Conference in Seattle and the breakthrough agreement at the 2001 Ministerial Conference in Doha. His analysis suggests that the negotiation process among delegations played a crucial role. In his view, the different strategies and tactics employed by negotiators and mediators explain the difference in outcomes.

Wolfe (2010) conducts a counterfactual analysis of the various explanations that have been offered for the failure of the July 2008 ministerial meeting in Geneva. He concludes that emerging players did not contribute much to the impasse which, in his view, resulted from the fact that the ministerial meeting was a failed attempt to accelerate the negotiations process ("sprint during a marathon"). Other contributions suggest that the problems of the DDA and of the WTO are part of a broader systemic malaise which stems from profound shifts in geopolitics (De Joncquières, 2011).

The idea that the larger and more diverse WTO membership challenges decision-making in the WTO is intuitively appealing, even if the precise reasons why

this should be the case have not been spelled out clearly. According to Low (2011), for example, the rise of new powers has placed the "practice" of consensus decision-making under greater strain, and this is reflected in the growing difficulty of reaching decisions and closing negotiations. The underlying reasoning is that consensus can be interpreted as a hidden system of weighted voting, since larger countries find it easier to influence implicit voting outcomes than smaller ones (Low, 2011). As has been argued by a number of commentators, some emerging economies have acquired the status of *de facto* veto players, while some developing countries have improved their negotiating capacity and shown that they can exert an influence on decisions (Elsig and Cottier, 2011; Narlikar, 2007; Odell, 2007).

Theoretical approaches that provide a rationale for trade agreements offer interesting insights into the impact of emerging new trading powers. An early contribution in this area was made by Krasner (1976). He analyses the linkage between particular distributions of potential economic power, defined by the size and level of development of individual states, and the structure of the international trading system, defined in terms of openness. He argues that while a hegemonic system (in which one dominant player holds sway of smaller states) is likely to lead to an open trading system, a system composed of a few very large but unequally developed states is likely to lead to a closed structure. Since Krasner, however, the open economy politics literature has been largely silent on how the rise of emerging powers in the 21st century is affecting international economic relations (Lake, 2009).

On the economic side, recent research by Bagwell and Staiger (2012) examines the conditions under which multilateral trade negotiations could deliver trade gains to developing countries in light of the economic theory of trade agreements. If the problem being addressed by international trade negotiations is the terms-of-trade driven Prisoners' Dilemma that arises when governments can shift a portion of the cost of their trade protection on to foreign trading partners by depressing foreign exporter prices, then the main benefit from trade negotiations may only be available to large countries. If this is the case, the growth of some developing countries should not raise problems; rather the contrary.

As argued by Bagwell and Staiger, however, there may be a problem with the increased participation of emerging economies related not to size, numbers or diversity but to timing, i.e. a "latecomers" problem. Over the last 60 years, developed countries have negotiated deep reductions in their tariff commitments on manufactured goods while, as a result of the exception to the reciprocity principle that has been extended to them in the form of "special and differential treatment", developing countries have committed to fewer tariff cuts in multilateral negotiations.[21] Special and

differential treatment was meant to ensure that developing countries would free ride on the MFN tariff cuts that developed countries negotiated with each other.

Bagwell and Staiger (2012), however, show that because a country's own tariff cuts stimulate its exports, what you get in a tariff negotiation is what you give. This has two important implications. First, it means that without reciprocity, tariff negotiations did not deliver meaningful trade gains to developing countries – and are unlikely to do so now or in the future. Secondly, the WTO may now face a "latecomers" problem as developed and emerging economies attempt to negotiate further tariff cuts. Developed countries may have preserved an inadequate amount of bargaining power with which to engage developing countries in reciprocal bargains. In addition, a kind of "globalization fatigue" may be present in the developed world, whereby the existing MFN tariff levels of developed countries may be too low for a world in which developing countries are fully integrated into the world trading system. In other words, the politically optimal tariffs of developed countries may be higher in today's globalized world than they were in the early 1980s.

(ii) Small players

A major challenge for the WTO, but one that is not new, concerns differences in power and the participation of smaller and poorer developing countries.[22] A number of changes have already been introduced since the creation of the WTO, with the aim of improving the representation of smaller and poorer developing countries. Views differ on whether such changes have been sufficient (Deere-Birkbeck, 2011). A number of proposals aimed at further improving the representation of smaller and poorer developing economies in the WTO are discussed in Section E.3.

A question that arises is whether the emergence of a number of new large traders among developing countries and the resulting increase in diversity among those countries have changed the situation of the smaller and poorer countries. As explained above, the economic theory of trade agreements suggests that the situation may have changed for emerging economies but not for small economies. The central component of the benefit of trade negotiations may now be available to the former, especially if the "latecomers" problem can be addressed. According to this theory, "what you get is what you give" and the large countries, because they are the ones which adopt unilateral trade policies that are the most internationally inefficient, should negotiate the most substantial tariff bindings and get the largest benefits.

For the developing countries that are truly "small" in their relevant markets, however, the emergence of some new large players should not have changed the

situation dramatically. Theory suggests that, with no influence on the terms of trade, they should not be expected to offer tariff concessions in a trade agreement; therefore, the central benefit from negotiations may not be available to them. As explained by Staiger (2006), in the light of the theory, their role in the WTO is essentially to prevent the bigger countries from discriminating against them as these bigger countries use the WTO to find solutions to their problems. The needs and expectations of small developing countries with regard to the WTO may thus diverge from those of the big developing countries. This suggests that the current treatment of developing countries as a single group, notably in the context of special and differential treatment, may not be optimal.

(e) Developments in the policy context

(i) Public policies

Higher incomes, together with a growing awareness of health, safety or environmental issues, have led to an increase in the demand for regulations aimed at protecting consumers, or at addressing climate change or the depletion of natural resources. At the same time, non-tariff measures related to domestic public policies have become a major source of concern for both firms and governments, a trend that is likely to continue in the near future.

The 2012 *World Trade Report* (WTO, 2012b) discussed a number of challenges raised by the proliferation of public policy related non-tariff measures. First, non-tariff measures raise a transparency issue. The quantity and quality of information available on the prevalence of such measures and on their effects is insufficient. For the WTO more specifically, the priority is to improve the functioning of existing transparency mechanisms.

Secondly, while regulations do not necessarily restrict trade, regulatory divergence can result in important trade frictions. This raises the question of how and where regulatory convergence should take place. This is a challenging dilemma given the trade-off between respecting differences in national preferences and exploiting the efficiency gains from regulatory convergence. For the WTO, one question that arises is whether the existing deeper integration provisions in the Technical Barriers to Trade (TBT) Agreement and the Sanitary and Phytosanitary Measures (SPS) Agreement ensure sufficient regulatory convergence to maximize the gains from trade while allowing governments to pursue their public policy objectives. There is tension, for instance, between encouraging the use of international standards and respecting members' fundamental right to adopt and implement their own domestic standards. Choosing not to adopt international standards, while legitimate, may reduce the incentive for international cooperation on, and negotiation of, such standards.[23]

A third challenge identified in the 2012 *World Trade Report* (WTO, 2012b) is the difficulty of drawing a line between those measures that should be allowed and those that should be forbidden. In particular, what relevance and weight should be given to the rationale or purpose of a measure when assessing the extent to which it discriminates against the imported product. Finally, concerns have been raised in the WTO – mainly by developing countries – regarding the fact that private standards are proliferating, that they are sometimes more stringent than government regulations and that there is no recourse to discipline them. The growing predominance of private standards as systems of governance in global agri-food systems in particular is attracting considerable attention.[24] The question that arises is whether there is a role for the WTO in addressing these problems and, if so, what this role should be.[25]

At the very least, the WTO may be called upon to decide whether a measure is a private standard or a government regulation subject to the TBT Agreement, as was the case in a recent dispute ("US – Tuna II (Mexico)"). Along similar lines, regulation arising from other international organizations, such as the World Health Organization (WHO) which may advocate policies regulating food that is otherwise safe under the SPS Agreement (e.g. to reduce obesity), raises the issue of coherence. This will be discussed in more detail below.

(ii) Distribution and labour-market related concerns

As discussed in Section D.1, in many countries, rising labour market tensions and growing income inequality are adversely affecting public attitudes towards globalization and trade. If trade is perceived by a majority of voters as causing unemployment and/or increasing inequality, governments could refrain from pursuing further trade opening and may even be tempted by protectionism. This creates obvious challenges for the WTO.

With regard to increased pressure for protectionism, there is some evidence that the WTO has played a significant role in recent years in preventing a protectionist backlash (Wolfe, 2012). WTO rules and governments' commitments, together with reinforced monitoring mechanisms, may account at least in part for the limited protectionist reactions to the crisis. One problem that may arise in the future is if governments turn to measures that are currently undisciplined or untested by WTO rules. Pressure on the WTO to impose or apply disciplines in new areas would increase, as is the case now with regard to exchange rate misalignments. Another possibility would be for governments to use more intensively public policies for protectionist purposes. For reasons discussed in the 2012 *World Trade Report* (WTO, 2012b), this may lead to an increase in the number and the complexity of disputes.

With regard to trade negotiations, focusing exclusively on the efficiency effect of trade opening may no longer be possible. Distribution and labour-market effects will also need to be considered and accompanying measures may need to be proposed in order to win the support of a majority of voters for open trade. Although most accompanying measures fall outside the remit of the WTO, mechanisms available under the WTO to facilitate adjustment, such as implementation periods and flexibilities, may have a role to play.

(iii) Need for more coherence with other international institutions

Trade interfaces with many other policy areas, such as macroeconomic policy, intellectual property, environmental protection, health and employment. In some of these policy areas, there are well-developed multilateral regimes, while in other areas multilateral cooperation is more incipient and institutional frameworks are less developed. The challenge facing the WTO – and the global community more broadly – is maintaining coherence between WTO trade regulations and initiatives and non-trade regulations and initiatives in other multilateral fora. Although the fragmented, decentralized and non-hierarchical nature of the international system makes the pursuit of coherence particularly challenging, fragmentation has the advantage of allowing for experimentation as different policies can be tested at the bilateral, regional and multilateral levels.

To the extent that the actors in other fora are states that are also members of the WTO, the risk of incoherence should be low. Nevertheless, the membership of other multilateral fora does not always coincide with the WTO's membership. Furthermore, some multilateral fora also include participation by non-state actors. Even when the membership is the same, weak coordination at the domestic level can result in incoherence at the international level.

WTO Director-General Lamy (2012) observes that attempts have been made to narrow the "coherence gap" that currently exists in the international system by establishing links between international regimes, yet these remain weak. In the case of the WTO, he contrasts the relatively strong links with the intellectual property regime administered by the World Intellectual Property Organization (WIPO) and the weaker links that currently exist between the WTO and the environmental regime, the relatively outdated links with the International Monetary Fund (IMF) and the almost non-existent links with the International Labour Organisation (ILO).

As discussed in Section D.3, until the financial crises of the 1990s and 2000s, trade finance, which serves as the "grease" of the trading system, was taken for granted. However, these crises created distortions in the trade finance market which made policy

interventions necessary. In this context, cooperation between multilateral institutions and other stakeholders turned out to be of crucial importance. The joint effort to ensure continued access to trade finance for all firms, large and small, in all countries involved the IMF, the World Bank, the Bank of International Settlements, regional development banks, the International Chamber of Commerce Banking Commission and others.

As explained in Section D.3, persistent exchange rate misalignments are a "systemic irritant" for international trade because they fuel perceptions of unfair monetary competition and create pressure to use trade policy measures to redress perceived monetary imbalances. Although this underscores the importance of an international monetary system that promotes exchange rate stability and adjustment, progress in monetary cooperation has been uneven. A number of institutions and policy processes are in place to enforce better surveillance of exchange rates and reduce global imbalances (see Section D.3). However, the question arises as to whether these will be used to set up a more cooperative system of exchange rates at the international level, and what role the WTO will play in this system.

The need to maintain coherence between the trade and environmental regimes was recognized in the 1994 WTO Decision on Trade and the Environment and in a number of environmental discussions (e.g. the 1992 Rio Declaration on Environment and Development). This objective was recently reiterated at the 2012 Rio+20 Summit, where it was agreed that green economy policies should "[not] constitute a means of arbitrary or unjustifiable discrimination or a disguised restriction on international trade, avoid unilateral actions to deal with environmental challenges outside the jurisdiction of the importing country, and ensure that environmental measures addressing trans-boundary or global environmental problems, as far as possible, are based on an international consensus" (United Nations General Assembly, 2012: 10).

Another area where there is a growing interface with the WTO is health regulation. For example, the WHO has adopted a Framework Convention on Tobacco Control and pursues a number of other related tobacco control policies. The WHO is also developing a global strategy to reduce the harmful use of alcohol (WHO, 2010). Domestic measures relating to tobacco control are discussed frequently in WTO committees and have been the subject of dispute settlement proceedings. Similarly, domestic measures relating to alcoholic beverages are increasingly being raised as specific trade concerns in the WTO TBT Committee.

The WTO, WHO and WIPO recently released a joint study examining the interplay between public health, trade and intellectual property, and how these policy domains affect medical innovation and access to medical technologies (WHO-WIPO-WTO, 2013). As Lamy (2013) explains, the 2001 Doha Declaration on the Trade-related Aspects of Intellectual Property Rights (TRIPs) Agreement and Public Health "helped catalyse the growing understanding that access to medicines requires the right mix of health policies, intellectual property rules and trade policy settings, and involves the judicious and informed use of a range of measures including competition policy, procurement strategies, attention to tariffs and other trade related drivers of cost, and choices within the IP system." Sustainable solutions will require coherence between these rules and policies.

WTO members have acknowledged the importance of a set of internationally recognized "core" labour standards – that is, freedom of association, no forced labour, no child labour and no discrimination at work (including gender discrimination) but have significant disagreements on establishing linkages between trade and labour issues in the WTO. At the 1996 Singapore Ministerial Conference, WTO members defined the WTO's role on this issue, identifying the ILO as the competent body to negotiate labour standards. While there is no work on this subject in the WTO's councils and committees, there is a mandate for collaboration and exchange of information between the WTO and ILO secretariats. This mandate was reaffirmed at the 2001 WTO Doha Ministerial Conference. In line with this mandate, the WTO and ILO secretariats have conducted several research projects. The most recent is a joint study that examines the various channels through which globalization affects jobs and wages in developing and developed countries and discusses how trade and labour market policies can be designed to make globalization socially sustainable (Bacchetta and Jansen, 2011).

The interface of the WTO and other multilateral regimes often touches on contentious issues on which countries hold widely divergent views. The lack of multilateral consensus on such issues makes coordination more difficult. For example, Bernstein and Hannah (2012) see few prospects for coordination between the WTO and the IMF on broader macroeconomic policies given the disagreement between countries on exchange rates and imbalances. The interface between the trade and environmental regimes offers other examples. For instance, Cosbey (2012) worries about the lack of agreement over what is appropriate behaviour in the pursuit of a green economy.

As a result, policy-makers face uncertainties about the legality of the policy tools at their disposal. Countries' implementing measures do not consider the impact of such measures on their trading partners, and countries resort to measures that may be inconsistent with their WTO obligations. There are a growing number of WTO disputes involving measures relating to environmental

goods or policies. The challenge of securing agreement is made more acute by the need to resolve difficult questions about the effectiveness of different policies and their impact on trading partners, the answers to which depend on a number of factors, such as the technology involved, the characteristics of the sector and the markets at issue.

Fragmentation is not only horizontal but also vertical. Under a model of "multi-level governance", which was originally developed in the context of European integration, policy-making can take place at many different levels (international, national and various sub-national levels) and involve diverse actors (including non-state actors) (Cottier et al., 2011). While these additional layers of governance – and the resulting policy dispersion – can better target policies and encourage policy experimentation, they can also make coordination more difficult.

Peel et al. (2012) provide an illustration of multi-level governance at work in the environmental context and discuss the coordination challenges that it raises. They note that as multilateral discussions under the auspices of the United Nations Framework Convention on Climate Change (UNFCCC) falter or progress slowly, environmental policy is steadily advancing in a "bottom-up" approach. Such an approach is likely to result in a wide, diverse and increasing array of environmental policies being pursued at both the national and sub-national levels. Some of these measures will have an impact on trade. Without some kind of agreement at the multilateral level, the trade impact of these national or domestic measures is likely to lead to frictions between WTO members and may eventually result in formal disputes being brought to the WTO. Therefore, Peel et al. argue that some mechanism for coordination and evaluation of different regulatory policies – most likely situated at a "higher" level of governance – will be required if multi-level governance in the environmental area is to realize its potential.

3. What could the WTO do to address the challenges?

This section reviews a number of proposals that would address the challenges identified above. The proposals are grouped under three headings: WTO agenda; governance and institutional reform; and the role of the WTO in global governance.

(a) Review/expand the agenda of the WTO

Previous sections of this report have explained how the trade debate has moved beyond traditional market access issues – a shift that is likely to continue into the future. Over the years, the GATT/WTO's reach has progressively extended beyond traditional border concerns to grapple with the trade effects of "inside

the border" measures.[26] The following sub-sections discuss the traditional issues and the new issues before examining several proposals for how the WTO's negotiating function can be improved to make it possible to move forward more quickly on all of these concerns.

(i) Multilateralizing preferential tariffs

There is broad agreement among commentators that the challenges arising from the growing number of preferential trade agreements must be high on the agenda of the WTO. Section E.2 made a distinction between the issues raised by "deep" integration agreements, which focus mostly on regulatory convergence, and those raised by shallow integration agreements, which focus mostly on preferential tariffs. This sub-section examines the latter while proposals addressing the former are discussed in subsequent sub-sections.

The successful completion of an ambitious multilateral tariff reduction package is often mentioned as the most effective means of overcoming any negative effects resulting from the proliferation of preferential tariffs (Lamy, 2009). The logic of this is that as MFN tariffs approach zero, the relevance of any preferential tariff treatment disappears (Suominen et al., 2007).

In the absence of an agreement to further reduce MFN tariffs, proposals have focused on preferential rules of origin (i.e. laws, regulations and administrative procedures which determine a product's country of origin) which are often blamed for exacerbating the "spaghetti bowl" effect of preferential trade agreements (PTAs). A decision by a customs authority on origin can determine whether a shipment falls within a quota limitation, qualifies for a preferential tariff or is affected by an anti-dumping duty.

Suominen et al. (2007) explain that there are basically two concerns over rules of origin: restrictiveness and divergence. Rules of origin that are restrictive can result in trade barriers between PTA members and non-members.[27] Divergent rules of origin across PTAs can increase transactions costs to firms which have to conform to different rules. Proposals to reduce the trade distortive effects of preferential rules of origin generally involve harmonization of the rules of origin, convergence and/or some kind of cumulation (Baldwin and Thornton, 2008; Suominen et al., 2007).

Harmonization is technically and politically difficult, and it could result in increased restrictiveness (Suominen et al., 2007). Convergence would imply unification of PTAs with overlapping membership into a single cumulation zone with common rules of origin. Achieving this would not only require negotiating common rules of origin but also the elimination of tariffs for any bilateral relationships within the zone where this had not already taken place. The risk of

convergence is that there is a natural tendency for large cumulation zones to erect more restrictive rules of origin (Suominen et al., 2007). This could lead to the segmentation of markets. In other words, convergence would increase trade among the members of the expanded cumulation zone but reduce trade with non-members.

The optimal approach, according to Suominen et al. (2007), would be what they call a "cap-con" strategy that combines convergence with multilateral limitations – or "caps" – on preferential rules of origin. Gasiorek et al. (2007) propose an alternative approach that would involve using a value-added criterion for determining origin, combined with full cumulation. This approach, however, is not without difficulties. For one thing, variations in exchange rates could mean that an imported product qualifies for origin one year but not the next.

While some of the actions foreseen in these proposals would have to take place at the PTA level (bottom-up), several proposals see the need for a complementary top-down approach in which the WTO could have a central role (Baldwin and Thornton, 2008). The WTO would be a natural forum for the negotiation of harmonized preferential rules of origin if a decision were made to undertake such negotiations. The WTO's current agenda already includes non-preferential rules of origin, though admittedly these negotiations are taking longer than originally agreed. The WTO would also be the logical forum for discussions of a multilateral "cap" on preferential rules of origin which would supplement the convergence process foreseen in Suominen et al.'s (2007) "cap-con" proposal. Some even see a role for the WTO guiding or encouraging the convergence process at the PTA level (Baldwin and Thornton, 2008). The process ultimately could be taken one step further. The WTO would serve as the forum for the full harmonization of PTA rules of origin.[28]

(ii) Breaking the market access impasse

As explained in Section E.2(d), the emergence of a new group of large trading powers raises a "latecomers" problem. Bagwell and Staiger (2012) make some suggestions on how "latecomers" could be accommodated and, more generally, how developing country members could be better integrated into the world trading system. They argue that the "latecomers" problem could be addressed through negotiated reductions in agricultural export subsidies. This reduction could be used both as a bargaining chip by developed countries and as a device to mitigate the overall trade effects of integrating developing countries into the world trading system by ensuring trade volume gains for developing country members.

More generally, Bagwell and Staiger (2012) argue that if developing countries want to draw any benefit from market access negotiations, they need to move away from their focus on achieving non-reciprocal special and differential treatment. In markets where they are large players, they could benefit from reciprocal negotiations with each other and with developed countries. Only by "finding ways to harness reciprocity as a means to achieve meaningful market access commitments for emerging/developing economies" (Bagwell and Staiger, 2012: 25) will negotiators break the current stalemate in the Doha Round and deliver substantial trade gains for developing countries, the fundamental objective of the negotiations. This idea may not be as incompatible as it seems with the majority view that SDT is crucial in achieving the goals of the WTO membership as a whole but that it needs a revision (Mitchell and Voon, 2009).

When ministers launched the Doha Round in 2001, they mandated a review of all special and differential treatment provisions, "with a view to strengthening them and making them more precise, effective and operational."[29] However, as explained in the Warwick Commission Report (Warwick Commission, 2007), one of the main reasons why these provisions need to be operationalized is because they did not adequately reflect the differences among developing countries in the WTO. Along the same lines, Pauwelyn (2013) argues that treating all developing countries as a single group for all matters is neither effective nor equitable. In his view, special and differential treatment provisions do not say that all developing countries must be treated alike, even less that no developing country should ever shoulder any responsibility. More differentiation among developing countries could serve to advance the underlying objectives of these provisions.

Economic theory suggests that an important distinction should be drawn between small and large countries, especially with regard to non-reciprocity. Mitchell and Voon (2009) review some key proposals from economic and legal scholars for operationalizing special and differential treatment provisions and assess members' progress on this issue in the Doha negotiations. It is worth noting that the trade facilitation negotiations have moved beyond a traditional "one-size-fits-all" approach to special and differential treatment to consider a more tailor-made country-by-country opt-in approach with provisions for technical assistance.

Another challenge is to ascertain the value of WTO tariff commitments when there is so much "water" between applied and bound tariff rates. Messerlin argues that "the real gold mine in the Doha negotiations is the increased certainty that would flow from large cuts to bound tariff rates" (Messerlin, 2008). From this perspective, economists' recent efforts to assess the value of tariff bindings – and the related costs of tariff "uncertainty" – are encouraging (Bacchetta and Piermartini, 2011; Beshkar et al., 2012; Pierce and Schott, 2012).

(iii) Responding to the proliferation of NTMs

As discussed in the 2012 *World Trade Report* (WTO, 2012b), although a coordinated effort of all international organizations active in the trade area will be needed to shed more light on non-tariff measures (NTMs), the WTO should play a lead role in this effort. The efficiency of existing transparency mechanisms, and in particular notifications by WTO members, needs to be progressively enhanced. In the case of notifications, this means that both the quality of the information collected and compliance with notification requirements need to be augmented. The key to success may involve changing members' incentives to abide by their notification obligations. The WTO will also need to refine the "tests" that are currently used to distinguish between legitimate and protectionist measures (WTO, 2012b).

Addressing NTMs may also require deeper rules among countries. At the multilateral level, only the SPS and TBT agreements include such provisions, mostly in the form of strong encouragement to follow existing international standards, and even these can create tensions. The 2012 *World Trade Report* (WTO, 2012b) discusses these tensions and explores the scope for expanding multilateral cooperation on NTMs. Differences in regulatory preferences among countries – together with differing capacities to influence desired outcomes – has meant that regulatory convergence has so far largely taken place at the regional level. However, some deep provisions in PTAs can be discriminatory and create conflicts with the multilateral trading system. In the years to come, WTO members may have to examine whether existing provisions ensure the right balance between international commitments and domestic flexibility in setting NTMs, and whether there is a need for multilateral disciplines to ensure better regional and multilateral convergence.

A number of commentators have argued that there may be scope for multilateralizing deeper PTA commitments to help ensure their coherence with the multilateral trading system.[30] Using a methodology developed by Horn et al. (2009), the 2011 *World Trade Report* (WTO, 2011a) lists the commitments in deep PTAs signed by the United States, the European Union and Japan, making a distinction between, on the one hand, areas of deeper PTA commitments that fall under the current WTO mandate (such as trade in services, customs cooperation, TRIPS, trade-related investment measures (TRIMS) or government procurement) and, on the other hand, areas that fall outside of the current WTO mandate (such as competition policy or investment rules).[31] The dataset also indicates whether or not measures are legally binding. Measures in the areas of services, TRIPS, TRIMS, customs cooperation, intellectual property rights, investment and the free movement of capital are the ones most consistently included in the relevant

PTAs. Baldwin (2012b) suggests that these measures, which can be thought of as those necessary for supply chain trade, should be addressed by the WTO. Several of these issues are discussed in more detail below.

The above list should certainly not be seen as exhaustive. Baldwin (2012b) suggests that government procurement, visa requirements, labour and environmental issues – which only some outsourcing countries include in their agreements – are among the issues that the WTO will be under growing pressure to address. Plans currently under way for so-called "mega-regional" trade agreements also reveal negotiating priorities. According to press reports (*Inside US Trade*), the Trans-Pacific Partnership negotiations, for example, have produced a draft chapter on regulatory coherence. Another proposal is to require parties to conduct regulatory impact assessments when developing new regulatory measures. These assessments would examine whether a policy objective requires new regulations or can be met by non-regulatory or voluntary means. They would also examine the costs and benefits of each available alternative and provide an explanation of why one approach is superior to another, including the scientific, technical, economic or other grounds on which the decision was based. While the draft chapter is a negotiating document that may not reflect the views of all participating countries, it has attracted significant public criticisms from a number of non-governmental organizations.

(iv) Services

The "servicification" of manufacturing (whereby the distinction between services and manufacturing is becoming blurred), the internationalization of supply chains and the proliferation of domestic services regulation all pose challenges to the WTO. In order to better address servicification, it has been proposed that manufacturers' interests be taken into account in WTO services negotiations and that services and goods negotiations should not take place along separate tracks, with trade opening commitments in one area traded against commitments in the other.

As regards the internationalization of supply chains or the proliferation of public policies, proposals have focused on increasing transparency, limiting the discrimination resulting from regional integration and ensuring the appropriate level of regulatory convergence at the multilateral level (WTO, 2011a; 2012b). As a first step towards greater regulatory cooperation, Hoekman and Mattoo (2011) propose developing a "services knowledge platform" – that is, a forum which would encourage a substantive, evidence-based discussion of the impact of domestic regulation and identify good practices.

Regarding services value chains specifically, some observers have called for a reform of the normative

framework, thus providing a firmer basis for modal neutrality in the GATS and strong provisions on competition policy and regulatory coherence (Drake-Brockman and Stephenson, 2012; Stephenson, 2012). Another proposal is to adopt a "whole of the supply chain" approach (Hoekman, 2012), which would involve complementing the negotiations on trade facilitation and regulatory convergence with new negotiations on logistics, thus bringing together a variety of services sectors and subsectors that are relevant to logistics.[32]

One issue that has gained prominence in the light of production fragmentation is the cross-border movement of people. The GATS includes commitments on market access and national treatment regarding the temporary movement of natural persons in services sectors. Nonetheless, several studies have shown that while all WTO members have undertaken such commitments, they are typically extremely shallow (see WTO document S/C/W/301).

(v) Investment

Investment is not strictly speaking a new topic. The link between trade and investment has been recognized for some time. Trade and investment allow firms to specialize in producing what they can produce most efficiently. Trade allows an economy to specialize in production and then to exchange it for the goods and services imports its nationals want to consume. Foreign direct investment allows capital and technology, including organizational, managerial and marketing skills, to move to where it can be used most efficiently (WTO, 1996).

The original plans in the 1940s for an international institution for trade, to be known as the International Trade Organization, foresaw the establishment of multilateral investment disciplines. Several WTO rules (such as the GATS, the TRIPS Agreement and the Government Procurement Agreement) place important obligations on governments with respect to the treatment of foreign nationals or companies within their territories (WTO, 1996). The GATS mode 3 commitments (foreign commercial presence) are often described as obligations that address foreign investment in the services sector. A WTO Working Group on Trade and Investment was established in 1996. The Group undertook analytical work until 2004, when members decided not to proceed further with the topic of investment in the Doha Round negotiations. Efforts to negotiate multilateral investment disciplines were also undertaken in the Organisation for Economic Co-operation and Development (OECD).

The literature on global supply chains has brought a renewed focus on the importance of the link between trade and investment rules (Baldwin, 2011b). Furthermore, some of the other trends identified in this report are mirrored in the field of investment. There has been a diversification of the geography of investment flows and investment law. Emerging economies have become capital exporters and flows of investment between developing countries are rising (see Section C.2). The number of bilateral investment treaties between developing countries has also been growing in recent years, especially in relation to China, India and Japan (Schill and Jacob, 2013). Investment rules, moreover, are increasingly being incorporated in preferential trade agreements, and regional rule-making is gaining importance (UNCTAD, 2012).

The fragmentation and complexity of investment rules means that there are still calls for a multilateral initiative that can promote coherence, although this need not necessarily take the form of binding rules (UNCTAD, 2009). Indeed, the "more pluralistic universe" of international investment agreements reflects a desire for differentiated solutions while at the same time reflecting recurrent principles and a degree of standardization (Schill and Jacob, 2013). Ultimately, there would appear to be a need for new research on how some of the trends discussed in this report affect the case for multilateral rules on investment and more specifically for the negotiation of such rules in the WTO.

(vi) Competition policy

Like investment, discussions of the relationship between competition policy and trade go back to the birth of the multilateral trading system and were most recently the subject of analytical work in a working group established in 1996 and discontinued in 2004. Several provisions in the WTO agreements reflect the importance of ensuring the competitive operation of markets in what Anderson and Holmes (2002) describe as an "ad hoc integration" of competition policy and concepts into the multilateral trading system. Examples of competition-related provisions in WTO agreements include Article 11.3 of the Agreement on Safeguards, Article 40 of the TRIPS Agreement and the Reference Paper adopted as part of the negotiations on basic telecommunications services.

Anderson and Holmes (2002) summarize the case for and against incorporating a multilateral framework on competition policy into the WTO. The case in favour takes the view that competition policy and trade opening pursue the common objectives of economic efficiency and consumer welfare, and that a lack of competition can undermine the gains from trade opening. The case against questions whether competition policy and trade opening can be approached within the same operational framework, especially given the WTO's focus on market access. However, Holmes and Anderson suggest that, just before WTO competition policy discussions were discontinued, there was a shift in proposals away from

a "hard law" approach focused on developing a harmonized code of competition law towards a "soft law" approach that would see WTO members adhere to certain core principles and modalities for cooperation.

As with investment, competition policy is frequently covered in "deep" preferential trade agreements, albeit not necessarily through binding rules (Baldwin, 2012b; WTO, 2011a). Disciplines on competition policy have also been mentioned in the trade literature as an example of the type of disciplines that facilitate supply chain trade (Baldwin, 2012b). This suggests a need for further research on how current and future trade trends identified in this report affect the case for multilateral rules on competition policy, and for future negotiations in the WTO.

(vii) Disciplining export duties

Another NTM-related issue identified for possible inclusion in the WTO's agenda is export restrictions. This issue has gained more prominence in recent years because of concerns over food and natural resources scarcity.[33] As discussed in Section E.2, binding WTO commitments on export duties could be mutually beneficial. As with all trade negotiations, trade-offs would be possible in a wider context – and not only among members applying such measures. For example, reductions in export taxes on natural resources could be exchanged for reductions in import tariffs on higher value-added products, especially when these involve tariff escalation, i.e. higher import duties on increasingly processed goods.

As noted in the 2010 *World Trade Report* (WTO, 2010), WTO rules prohibit the use of quantitative export restrictions (with some exceptions) but there are no equivalent restrictions on export duties. WTO members are free to make binding commitments to reduce export taxes but most have not (several countries have recently committed to "schedule" export duties in the context of their WTO accession). Proposals to discipline export taxes have been tabled in the Doha negotiations although discussions of these proposals showed divergent interests among members. Export taxes have also been discussed in the Doha agricultural negotiations. There is also a G20 initiative to limit export restrictions on food items destined for food aid. At the regional or bilateral level, a number of PTAs prohibit the application of export taxes or other measures of equivalent effects.

(viii) Energy and climate change

Concerns over climate change and environmental degradation more generally have moved to the forefront of the multilateral agenda in recent years and are expected to remain there for the foreseeable future. Cottier (2012) notes that until relatively recently, international law developed and operated under the assumption that natural resources were endless and bountiful. That assumption is now viewed as manifestly incorrect. It is hardly surprising that climate change and environmental sustainability have gained greater prominence within WTO debates as well. Of particular concern are trade policies related to energy sectors and energy security (WTO, 2010).

Different approaches have been proposed to ensure coherence between WTO rules and climate change mitigation measures. Under one approach, the WTO would remain focused on trade measures, while policies relating to climate change mitigation would be discussed in the proper multilateral fora, such as the United Nations Climate Change Convention. The problem with this approach is that it is difficult to see how the WTO can avoid these issues, at least in the medium term. Whether adopted unilaterally or multilaterally, members whose trade is affected by climate change mitigation measures (for example, border tax adjustments or subsidies for renewable energy) may seek to challenge them in the WTO. If the WTO were to rule against such measures, it could be characterized as obstructing climate change solutions. Similar issues could arise with other environmental measures.

Others see a more positive and constructive role for the WTO. Esty and Moffa (2012) emphasize the importance of managing ecological interdependence alongside economic interdependence. For example, they see the WTO as playing a supporting role alongside a new Global Environmental Organization, ensuring that gains from economic integration are made available only to those who share the burdens of ecological interdependence. For Esty and Moffa, incorporating environmental issues more fully into the international trading system is also the correct normative approach because economic efficiency and environmental sustainability are mutually reinforcing and interdependent. Absent this approach, the WTO risks a backlash against further economic integration.

Cottier et al. (2011) argue that existing WTO rules are inadequate to deal with the challenges specific to the energy sector, and that a new comprehensive sectoral agreement on energy is needed to promote energy security and climate change mitigation policies. This sectoral agreement would include, among other things, clarification of how WTO subsidy rules apply to the energy sector. As a preliminary step, members would need to collect more information on subsidies provided to the energy sector by establishing a committee responsible for examining whether each member's energy subsidy notifications sufficiently represent the level of support in the sector. Once reliable data are collected, members would be given a deadline to prepare and submit a national roadmap in which they would commit to phase out environmentally harmful energy subsidies. The subsidy-watch committee could play a role in identifying environmentally harmful

subsidies and time lines for phasing them out. The proposed sectoral agreement would also resolve the problem of fragmentation resulting from different energy activities being classified under separate GATS schedules.

Because the energy industry is a chain of interconnected activities, Cottier et al. (2011) argue that service operators in the sector need a coherent set of market access rights. Members should identify core and related energy services to facilitate making additional commitments in the energy sector. Finally, the sectoral agreement would include some modification of the Government Procurement Agreement to make the recognition of climate-related measures more explicit. Instead of a member proving that its environmental policies fall under an exception to the Government Procurement Agreement, a member challenging these policies would need to demonstrate that the policies were discriminatory or unrelated to climate change.[34]

(ix) Exchange rates and macroeconomic policies

Some commentators argue that undervalued currencies have effects equivalent to both an import tax and an export subsidy, and propose that the WTO should be used to regulate exchange rates. Mattoo and Subramanian (2009b), for example, favour creating new WTO rules on exchange rates that would be parallel to those on export subsidies and import taxes. They propose using the WTO dispute settlement mechanism to enforce these rules, with the IMF providing inputs on technical matters. Other suggestions include a WTO plurilateral agreement on exchange rates (including IMF participation), allowing participating members to file a complaint against another member if the latter's currency was seriously undervalued against a relevant basket of currencies for a prolonged period of time (Hufbauer and Schott, 2012). Eventually this could lead to tariff retaliation.

As argued by Marchetti et al. (2012), addressing the challenges raised by exchange rate misalignments and global imbalances involves addressing a "coherence gap" in global governance. These authors argue that WTO-triggered trade actions should form part of a broader solution but that trade rules alone cannot provide an efficient instrument to compensate for the weaknesses in international cooperation in macroeconomic, exchange rate and structural policies. They discuss the potential role for multilateral trade cooperation in the three traditional areas of the WTO: market access negotiations, rule-making and dispute settlement.

As regards market access, Marchetti et al. (2012) suggest that market opening in services, particularly in financial services, could reduce some of the policy-related distortions and market imperfections that lead to the build-up of unsustainable imbalances. With respect to rule-making, they note that the first-best solution is international cooperation on macroeconomic, exchange rate and structural policies. They nevertheless recognize that sanctions could play a role to deter countries from either free-riding or defecting from the cooperative outcome. However, they make clear that sanctions should apply to both surplus and deficit countries. Furthermore, they consider that other policies which also contribute to imbalances would have to be subject to international scrutiny and suggest that penalties would have to go beyond trade sanctions. Finally, in relation to dispute settlement, Marchetti et al. underline the difficulties in identifying currency manipulation and in establishing the trade effects of exchange rates.

(b) Governance reforms

Since the creation of the WTO in 1995, debate on the need to reform its governance has been intense (Hoekman, 2011), with proposals covering the "legislative", "executive" and "judicial" functions of the WTO. The arguments in favour of institutional reform are diverse – sometimes even contradictory – reflecting the wide range of objectives and concerns of the various stakeholders in the trade regime. Moreover, because of the Doha Round stalemate, proposals have increasingly focused on the WTO's legislative function. Since reviewing all these proposals is clearly beyond the scope of this report, it examines instead some of the main proposals in the light of the challenges identified in Section E.2.

It has been argued that the rise of emerging economies and therefore the increasing number of veto players in the WTO is straining the practice of consensus decision-making (see Section E.2(d)). Many proposals for reforming the WTO's decision-making procedure focus not on abandoning the consensus norm but on reforming the way it operates.[35] One group wants to keep consensus as the basic principle but to introduce procedural changes that would require blocking countries to explain their actions (2004 Sutherland Report). Another group would replace consensus with weighted voting (Cottier and Takenoshita, 2003) or a "critical mass" approach (Jackson, 2001).[36] Another group advocates an Executive Board or Committee to help steer the broader membership (Blackhurst and Hartridge, 2004; Blackhurst, 2001; Steger, 2009). Finally, a number of proposals envisage a combination of the above measures (Elsig, 2010).

Several of these proposals address not so much the challenge posed by the increasing number of large players in the system but the problem of a small minority of members blocking decisions. While a discussion of the strengths and weaknesses of each proposal is beyond the scope of this report, it is important to note that most commentators are aware of the advantages of consensus decision-making and believe that it should continue to apply in certain circumstances.

A number of the proposals for reforming the WTO's decision-making procedure have devoted specific attention to the decentralized, bottom-up, agenda-setting process of the WTO. These proposals aim at addressing the "endless cycling dilemma" that arises as a result of the absence of any clear institutionalized agenda setting (Elsig, 2010). As summarized in the 2004 Sutherland Report, the WTO system suffers from "a proliferation of back-seat drivers, each seeking a different destination, with no map and no intention of asking the way" (2004: 76). One approach to address this problem that has been proposed is to allocate agenda-setting power to an Executive Board or Committee.

Other proposals have focused on the role of the WTO Secretariat in supporting the decision-making process. The WTO Secretariat and Director-General have limited power, and the idea would be to give them greater power of initiative without diluting the authority of the membership to decide. A study of the role and powers of the various secretariats and heads of international organizations could help trigger discussion and reform in this area.[37]

There are also numerous proposals which focus on the so-called single undertaking approach[38] – i.e. the concept that "nothing is agreed until everything is agreed" in a negotiation – which is another core element of WTO decision-making.[39] As Hoekman (2011) notes, a single undertaking approach has the advantage of creating issue linkages but has the disadvantage of creating a hold-up problem. Several commentators have proposed abandoning the single undertaking and shifting to a variable geometry model (Jones, 2010; Lawrence, 2006a; Levy, 2006; Martin and Messerlin, 2007; Messerlin, 2010). Such a shift, which can also be seen as a way to revisit the consensus rule, would allow sub-groups of members to move forward on an issue while others abstain. One key issue is whether an agreement concluded under a variable geometry approach would apply only to signatories or be extended to other WTO members through the application of the most-favoured nation (MFN) principle.

Variable geometry with MFN typically takes the form of the so-called critical mass approach whereby a sufficiently large subset of the entire WTO membership agrees to cooperate, allowing the remaining members to free-ride. A critical mass approach was used for the post-Uruguay Round agreements on basic telecommunications and financial services as well as for the Information Technology Agreement. Commentators have noted that a form of critical mass approach has typically been used for market access negotiations in the GATT/WTO (Hoekman, 2011; Low, 2011). The proposal is to use the critical mass approach for the negotiation of new or modified rules.

As argued by Low (2011; 2012) and the 2011 *World Trade Report* (WTO, 2011a), a critical mass approach could also be used to address the challenges raised by preferential trade agreements (see Section E.2(a)). When "deep" integration takes place at the regional level in the form of preferential trade agreements, international trade rules are being negotiated and decided outside of the WTO in a setting where differences in power are greater and the basic principles of non-discrimination and reciprocity are absent. A critical mass approach would make it possible to multilateralize trade rules without involving the entire WTO membership. Low argues that "it could facilitate the adoption of a forward-moving agenda, which under the right circumstances would not compromise the integrity and coherence of the multilateral trading system" (2012: 311). A number of commentators have raised doubts about the additional scope for using a critical mass approach largely because they do not see many areas where it could be applied (Elsig, 2010; Wolfe, 2009).

Variable geometry without MFN can take the form of "plurilateral agreements" – i.e. agreements concluded by a subset of WTO members whose obligations and benefits are not extended to non-participants.[40] Hoekman (2011) observes that a shift to critical mass with MFN does not really imply a change in *modus operandi* and suggests that if/where the non-discrimination constraint can be relaxed, a plurilateral agreement provides an alternative. Hoekman and Mavroidis (2012) make a comparative analysis of the case for trade opening through plurilateral agreements and preferential trade agreements. They conclude that facilitating greater use of plurilateral agreements would be a Pareto improvement (i.e. an action that harms no one and helps at least one party) over the status quo because plurilateral agreements would fall under the WTO umbrella and would be subject to more WTO disciplines than preferential trade agreements.

While plurilateral agreements under the WTO may be preferable to preferential trade agreements outside of the WTO, they clearly impose more stress on the multilateral system than the critical mass approach.[41] The multiplication of such agreements may threaten the integrity of the multilateral system and the core non-discrimination principle. Moreover, once the "insiders" define the rules of the game in a specific area, it will be harder for the "outsiders" to alter the rules if and when they decide to participate.

A concern with most of these proposals is that efforts to increase efficiency may come at the expense of legitimacy. Smaller and poorer countries see the consensus rule as protection against decisions that may be detrimental to their interests.[42] Ismail and Vickers (2011) argue that the consensus rule should not be abandoned but rather strengthened. In their view, consensus and the single undertaking are not responsible for the stalemate of the Doha Round. Instead, they attribute the negotiations' difficulties to the hangover from previous imbalances in negotiating

outcomes, substantive divergences of interests among trading partners, and domestic politics within major players. To address the challenge of small and poor countries' participation, they propose improving the representation of developing country coalitions. With regard to variable geometry and critical mass proposals, Deere-Birkbeck (2011) notes that to date, only a few contributions to this debate seriously consider their implications for small and poor countries.

A key issue that cuts through all of these proposals to improve WTO governance is transparency – and the need to strengthen the functioning of existing WTO transparency mechanisms. For example, there is a broad consensus that the notifications mechanism for WTO members, a core transparency tool, should be improved – and that the key to improving it starts with a better understanding of its weaknesses.[43] There is also a broad consensus that the WTO's trade monitoring exercise has been a success, and that it needs to be continued and strengthened.

With regard to WTO committee work, the role of consultations could be expanded, following the example of the specific trade concerns mechanism of the SPS and TBT committees (Wolfe, 2013). Reinforcing the WTO's surveillance and monitoring functions may involve additional resources.[44] In particular, as suggested in the 2004 Sutherland Report, the WTO Secretariat needs stronger research, analysis and dissemination capacity so it can be a major source of trade and trade policy data, and more effectively support the objectives of the trading system (Hoekman, 2011). Efforts already undertaken in this area should be sustained.[45]

(c)   What role will the WTO play in global governance?

The existing international system is often described as fragmented, decentralized and non-hierarchical. A number of legal regimes co-exist, reflecting diverse attempts at finding cooperative solutions to common problems. The number of legal regimes is expanding and their degree of specialization is increasing. States remain prominent in the system but new actors are now playing important roles. These new actors include international organizations (such as the WTO), non-governmental organizations, multinational corporations and individuals. Challenges are increasing in complexity and, in some cases, urgency.

The WTO, like the GATT before it, plays a central role in global trade governance. For many years, there has been an intense debate about the potential challenge to the WTO from an ever expanding number of preferential trade agreements (PTAs). This debate has intensified in recent years as the number of PTAs – and the number of members pursuing them – has increased, and as the new PTAs increasingly move beyond preferential tariffs to focus on regulatory

cooperation. An interesting literature has emerged about "multilateralizing" PTAs (both in terms of preferential tariffs and regulatory cooperation) and several proposals have been put forward to this effect.

One of the key trends identified in this report is the emergence of global supply chains. This trend has led to calls for the WTO to focus on issues that are more relevant to supply chain trade, such as trade facilitation, investment, competition policy or the movement of persons. The fact that WTO members are agreeing to new disciplines on these issues in the context of deep PTAs – and possibly "mega" PTAs covering a large share of global trade – has led some to raise alarms about the growing risk of the WTO losing its "centricity" in trade governance. In particular, Baldwin (2012b) notes that the new rules and disciplines that underpin supply chain trade are being written outside the WTO in deep PTAs, bilateral investment agreements and as part of autonomous reforms being carried out by emerging economies. Baldwin also identifies efforts to harmonize some of these new disciplines in the context of mega-regional or -bilateral PTAs that are being negotiated or are under discussion.

In the meantime, the WTO is unable to engage with the new issues raised by supply chain trade because of the Doha Round's lack of progress. In these circumstances, Baldwin predicts that multilateralism will remain strong for traditional trade, but fragmentation and exclusion are the more likely outcomes for supply chain trade, which happens to be the most dynamic sector of international trade. Baldwin believes that at present the WTO is unable to address the current trend of fragmentation and exclusion. Therefore, he proposes the establishment of a second trade organization, which he calls "WTO 2.0". This organization would have a more limited membership comprised primarily of those countries involved in supply chains. He also proposes a list of issues to be covered based on a review of deep PTAs (see Section E.3(a)).

Baldwin does not explain how these new WTO 2.0 rules would relate to members' existing WTO obligations or how the potential policy frictions arising from the additional layer of rules (applicable to some WTO members, but not all) would be mitigated. He also neglects recent progress under the current WTO framework on the issue of government procurement, where a revised text of the Agreement on Government Procurement has been negotiated and several accession negotiations are actively being pursued.

Baldwin's alarm over the WTO losing "centricity" is not shared by everyone. Lester (2013) argues that global governance may not be necessary on the new supply chain issues that Baldwin proposes be addressed by WTO 2.0. Lester points to autonomous or unilateral reforms adopted by several WTO members and believes that leaving such new issues to domestic

governments is an effective way of encouraging good governance. The reason for this is that governments that fail to attract investment will copy the policies of those who succeed in attracting it. He also asserts that the interest of the business community for more international disciplines on these new issues must be weighed against the opposition from other sectors of civil society who are concerned about the higher degree of intrusion into domestic regulatory autonomy that international rules on such issues would entail.

Turning back to the multilateral trading system, Lester (2013) observes that it may be that the WTO as it currently stands gets the balance right between global trade governance and domestic regulatory autonomy. Consequently, there would not be a need for the WTO to catch up. Instead, the WTO should continue to focus on reducing protectionist trade barriers, while regulation generally should be left to domestic governments.

Recent discussions about the WTO's role in global trade governance have also focused on exchange rate policies. The use of WTO provisions to counteract the effects of currency manipulation – and proposals to give the WTO a more active role with respect to exchange rate policies – are highly contentious and will likely remain so in the coming years.

As the Doha Round negotiations have waned, other functions of the WTO are receiving greater attention and their value to global economic governance is getting more recognition. These functions include dispute settlement, promoting transparency, trade monitoring and surveillance, conducting economic research, capacity building and technical assistance for developing countries (see Section E.3(b)). WTO Director-General Lamy has referred to the need to fill in the WTO's "missing middle" – that is, the sphere of activity that lies between negotiations and dispute settlement.[46] This involves scaling up the WTO's trade surveillance activities, capacity building and the day-to-day technical work that is critical to strengthening the system's foundations. The WTO took an important step in this direction when it implemented the trade monitoring mechanism in the wake of the global financial and economic crisis that began in 2008.

The information collected and provided by the WTO on trade measures and policy has long been recognized as a public good. Yet for some, it is a public good that is currently under-provided, particularly with respect to non-tariff measures and measures relating to services (Hoekman, 2012). As explained, efforts to enhance the information supplied by the WTO would have to include stronger notification obligations for WTO members. It could also include giving the WTO Secretariat more scope for analysis of the information collected. For example, it has been suggested that more could be done with the information collected under the PTA transparency mechanism. This

information could be used by members to learn from each other's experiences with PTAs and to explore ways to incorporate into the multilateral trading system the trade opening achieved through PTAs (GMF/ECIPE, 2012).

Current trends indicate that the WTO is likely to continue to play a key role in the peaceful settlement of trade disputes. While all PTAs have their own dispute settlement mechanism, there is little, if any, evidence that they are eroding the relevance of the WTO's dispute settlement mechanism. On the contrary, an important share of disputes brought to the WTO are between PTA partners (WTO, 2011a). With a few exceptions, PTA dispute settlement mechanisms show little use to date.

There are reasons to believe that non-tariff measures will make up an increasing share of disputes brought to the WTO, and a good proportion of those disputes will involve measures that touch on public policy issues, such as health, consumer safety and the environment (WTO, 2012b). As noted in Section E.2, distinguishing between measures that pursue legitimate public policies and measures that are protectionist is seldom straightforward. These measures, moreover, raise difficult questions about the degree to which the multilateral system should defer to members' regulatory autonomy or regulatory preferences. International consensus on proper policies can both simplify and complicate matters. Some WTO agreements, such as the SPS Agreement and the TBT Agreement, assign a privileged role to international standards. However, in other contexts, the reliance on international norms agreed outside the WTO is more contentious. This issue acquires an additional layer of complication when the international norm is one to which not all WTO members have consented.

It is unrealistic to believe that the WTO can stand aloof from broader issues of global governance beyond trade and economic policy. Many non-trade measures have trade effects and, for that reason, can fall within the purview of the WTO. At the same time, there are pressures to use trade policy to further non-trade goals, such as the protection of the environment or the promotion of labour standards.

A few commentators see a more ambitious role for the WTO in framing the discussions on global governance. Chaisse and Matsushita (2013) propose using the Trade Policy Review Mechanism (TPRM) to collect information about, and to promote harmonization and coordination between, PTAs, to promote convergence of climate mitigation measures, and to coordinate policies on other matters. They see advantages to using the TPRM because its reports are non-binding and because it could operate as an informal network of government authorities. Chaisse and Matsushita, however, do not explain why similar discussions could

not take place within the WTO committees dealing with the specific subjects, namely the Committee on Regional Trade Agreements and the Committee on Trade and the Environment. Their preference may have to do with the WTO Secretariat's role preparing detailed reports for each trade policy review.

Messerlin (2012) would like to see members take advantage of the WTO's institutional and substantive capacity as a forum for a broader discussion of global governance. These discussions would go beyond trade and would cover other issues where multilateral cooperation is facing difficulties, such as climate change, water and fisheries. Messerlin proposes that the WTO host a series of worldwide, "totally open-minded" conferences on all of these related issues. He suggests that such conferences would reveal the deep similarities and the converging interests among these various world communities struggling for functioning multilateral governance.

Regardless of whether the WTO takes on a more prominent role in global governance, its relationship with other specialized international regimes will remain a key issue in global governance debates. Coherence among regimes is an elusive objective. Although there is a growing recognition that the WTO cannot remain oblivious to developments in other regimes, there are diverse views about the extent to which the WTO (and its rules) should interact with those regimes.

Endnotes

1   For a detailed discussion, see WTO (2012b).

2   As discussed elsewhere in this sub-section, Blanchard (2010) makes a similar but more general point.

3   In some cases, PTAs deepened and locked in unilateral tariff reductions, further reducing the perceived risk of future tariff increases.

4   Note that from the perspective of the terms-of-trade theory of trade agreements, unilateral tariff cuts would most likely leave the terms-of-trade motivated component of tariffs in place and therefore would not affect the chances of success of further tariff negotiations.

5   Tariff reductions in the context of WTO accession, which can be viewed as unilateral, are bound.

6   See the overview of the literature in the 2011 *World Trade Report* (WTO, 2011a).

7   Areas where regulatory convergence is needed include investment, capital flows, intellectual property protection, competition policy, services trade, and industrial standards and regulations. See the 2011 *World Trade Report* (WTO, 2011b).

8   The positive association between deep integration and production networks is confirmed by empirical analysis (WTO, 2011a).

9   See Orefice and Rocha (2011).

10 Note, however, that a large number of PTAs contain so-called "GATS-minus" elements which are disconnected from and difficult to reconcile with WTO obligations (Adlung and Miroudot, 2012).

11 See the discussion in WTO (2011a).

12 Ciuriak et al. (2011) point at another difference between deep integration at the regional and at the multilateral level. While heterogeneous firms trade models suggest that more importance should be granted to extensive than to intensive margin responses to trade opening, there is evidence suggesting that PTAs have positive effects at the intensive margin and negative effects at the extensive margin, whereas the opposite is true of opening in the multilateral context.

13 Note that about two-thirds of the world's FDI stock is in services and that BITs are already covered by GATS disciplines insofar as they affect trade in services and meet the definition of mode 3. Consequently, the relevant provisions are multilateralized by virtue of the MFN clause in GATS Art. II whenever the member concerned has not listed an MFN exemption (Adlung and Soprana, 2012).

14 Proponents of a multilateral investment agreement (MIA) have argued that the spread of BITs has created uncertainty, high transaction costs and distortions due to diverging systems of BITs (Brunner and Folly, 2007; Leal-Arcas, 2009; Urban, 2006). However, MFN clauses and other factors within these treaties have caused a degree of coherence that alleviates this problem (Chalamish, 2009; Schill, 2009) and reduces potential gains from an MIA (Bubb and Rose-Ackerman, 2007). In addition, it has been pointed out that despite the alleged divergence of BITs, FDI is rising fast and that BITs allow significantly more flexibility to account for the needs of developing countries (e.g. Hoekman and Saggi, 2000; Kennedy, 2003; Nunnenkamp and Pant, 2003).

15 See also Figure B.17 in Section B.2(e).

16 It also shows that such a situation may similarly arise as a result of rent-shifting between exporters and importers of natural resources when the latter uses consumer taxes and the former uses production quotas.

17 This trend may persist in the longer term in light of demographic developments and constraints in the natural resources sector. See Sections C.1 and C.4.

18 More broadly, concerns have been raised about the impact of biofuels on food prices and, consequently, on efforts to fight hunger (United Nations Special Rapporteur on the Right to Food, 2011).

19 See Moreno Caiado (2011). See also the complaint brought by Argentina against the European Union and Spain, WT/DS443.

20 A number of papers discuss the rise of emerging economies in the multilateral system over time. See for example Lawrence (2006), Arrighi (2007), Narlikar (2007), Jacques (2009), Hopewell (2010), Gao (2011), Mattoo and Subramanian (2011), Subramanian (2011).

21 As discussed elsewhere in this report, however, developing countries have considerably reduced their tariffs unilaterally and in PTAs and there have also been significant tariff reductions in the context of WTO accessions, but not on a reciprocal basis.

22 See for example the reports by the Consultative Board to the Director-General Supachai Panitchpakdi (2004) (the so-called "Sutherland Report", named after Chairman Peter Sutherland) and by the Warwick Commission (2007).

23 For a discussion of the challenges raised by the deep integration provisions of the TBT and SPS Agreements, see the 2012 *World Trade Report* (WTO, 2012b).

24 See Henson and Humphrey (2008) and Von Schlippenbach and Teichmann (2012) for example.

25 Josling (2012), for example, asks whether the SPS Agreement should be amended to allow government regulation to respond to consumer concerns that have not been found to have scientific merit. While some exporting countries fear that this would make the SPS Agreement a less effective constraint, others are concerned that in the absence of solution the SPS Agreement might increasingly become irrelevant for global food trade as more use is made of private standards. It should be noted that the TBT Agreement allows members to adopt technical regulations to address consumer or environmental concerns.

26 The 2007 *World Trade Report* (WTO, 2007) discusses the deepening of the multilateral trade agenda.

27 Restrictive rules of origin can also curb preferential trade and end up nullifying the tariff reduction benefits of the PTA.

28 There have been initiatives in the past to harmonize rules of origin in the GATT/WTO. An incipient initiative was pursued in 1982, although ultimately members agreed in the Uruguay Round only to launch a work programme on non-preferential rules of origin. Members were unable to complete the work programme by the agreed deadline. More recently, there have been discussions in connection with Generalized System of Preferences (GSP) schemes and duty-free quota-free treatment for LDCs.

29 See document WT/MIN(01)/DEC/1, para 44.

30 See Baldwin et al. (2009) and WTO (2011a).

31 Areas that fall under the current WTO mandate are typically called WTO+ areas, while areas that fall outside of the current mandate are termed WTO-X areas. For a comprehensive list of WTO+ and WTO-X areas, see the 2011 *World Trade Report* (WTO, 2011a).

32 Some progress in this direction has been made in the Trans-Pacific Partnership negotiations.

33 OECD has compiled a comprehensive inventory of restrictions on exports of raw materials. See http://www.oecd.org/tad/benefitlib/exportrestrictionsonrawmaterials.htm.

34 It should be noted that a revised Government Procurement Agreement was negotiated after these proposals were made. The revised GPA (and more specifically Article X:6) expressly states that parties may apply technical specifications to promote the conservation of natural resources or protect the environment. Parties to the revised GPA also agreed to initiate a Work Programme on sustainable procurement (GPA/113, Annex E).

35 For a discussion of the pros and cons of the consensus norm, see Hoekman (2011) and the references therein.

36 The notion of critical mass used in this context is different from the one that refers to the adoption of consensus decisions that involve a subset of large players taking on additional commitments.

37 See Kuijper (2009), Elsig (2010) and an address by WTO Director-General Lamy at Bilkent University, Ankara, on 15 March 2013, available at http://www.wto.org/english/news_e/sppl_e/sppl272_e.htm. Specifically, WTO Director-General Lamy observes: "In a number of other international organizations, the Secretariat plays a bigger role in leveraging its experience while remaining neutral. It has a 'right of initiative'; in other words, the capacity to table proposals to facilitate negotiations and to broker compromises. In the WTO, that role is virtually non-existent, and when coupled with the need for consensus, can make it significantly more difficult to generate expert solutions to problems".

38 Many proposals address several dimensions of the decision-making process simultaneously. See Elsig and Cottier (2011), for example, who list five elements (including consensus and the single undertaking) which they think need to be addressed simultaneously.

39 Interpretation of the concept of the single undertaking can differ between commentators. It has been interpreted variously as the "analogue to consensus in negotiations" (Hoekman, 2011), as a simple procedural rule in negotiations (Low, 2011), as one corner of the WTO decision making triangle (Elsig and Cottier, 2011) or as a constitutional metaphor (Wolfe, 2009).

40 Only two such agreements are in effect: the Agreement on Government Procurement and the Agreement on Trade in Civil Aircraft.

41 See the discussion in Hoekman and Mavroidis (2012).

42 See the discussion of the value of consensus to smaller and poorer members in Hoekman (2011).

43 See Wolfe (2013); 2012 *World Trade Report* (WTO, 2012b).

44 See Hoekman (2011).

45 See 2012 *World Trade Report* (WTO, 2012b).

46 See for example his 2010 speech entitled "The Doha Round marks a transition from the old governance of the old trade order to the new governance of a new trade order" http://www.wto.org/english/news_e/sppl_e/sppl173_e.htm.

F. Conclusions

This report has examined the forces that will shape the future of world trade. These forces are complex and numerous. They interact with trade itself and with each other, as well as being influenced by government policy. One thing seems clear: the landscape and nature of world trade are changing fast. As trade evolves, new policy challenges will arise. If properly managed, international trade will further increase prosperity around the globe. What are the main issues, therefore, that policy-makers need to take into account?

First of all, a country's position in international trade is in constant flux. New players continue to emerge. In certain respects, the so-called "emerging economies" are similar to industrialized countries. In other ways, they still confront developing country challenges, especially in certain sectors. Others, sometimes called the "Next-11", are pushing from behind and have the potential to become leading players in the 21st century. At the same time, a range of poor countries risk being further marginalized. Competitiveness depends on a range of factors, some of which can be more easily influenced by policy than others.

China has been the major success story of recent times. In a matter of decades, the country has catapulted itself to the top for merchandise exports. However, a declining and ageing population over the next decades means that a major source of China's dynamism will disappear. At the same time, as it rapidly accumulates capital and upgrades its technology, the source of its comparative advantage could move in the direction of more capital-intensive and higher-value exports. By contrast, India, countries in the Middle East and Sub-Saharan Africa and others will enjoy favourable demographics over the next decades and could become the fastest-growing parts of the world economy. For these labour-abundant developing economies, education policy will play a key role in determining workers' skill sets, their chances of integrating into the labour force and their capacity to absorb new technology.

Improvements in public institutions will influence investment decisions and the rise of new centres of innovation in the developing world. For natural resource-rich economies, diversification offers the possibility of reducing dependence on commodity exports and of diminishing the threat of exhaustion of resources, increased extraction costs, environmental pressures and substitution of resources. In order to increase their participation in world trade, however, many of these developing countries, especially in Sub-Saharan Africa, need to "move closer" to international markets by reducing transportation costs and delivery times.

Industrialized countries need to rekindle a new dynamic of their own. A declining and rapidly ageing population already poses a challenge to Japan and many European countries. Technological advances and the influx of workers from other countries offer them a chance to escape a potentially stagnant future. The United States does not face a similar demographic challenge and remains more open to worker migration than other developed nations. It is also unparalleled as an incubator of innovation. Furthermore, the shale gas revolution promises reductions in energy dependency and may give industrial activities in the country a competitive boost.

Secondly, policy-makers need to take into account the changing nature and composition of trade. The spread of global supply chains has facilitated a more extensive participation in international trade, allowing for the separation of production into specialized tasks delivered competitively from multiple locations as well as increased technology transfers and spillovers. As a result, countries have become more diversified across sectors and export to an increasing number of destinations. Although a large part of this trade is within firms, with large firms accounting for the majority of exports, global supply chains can improve the trade prospects for small and medium-sized enterprises (SMEs), particularly for those located within a sound institutional environment.

With parts and components crossing multiple borders – and the cost of imports increasingly determining export competitiveness – anti-protectionist tendencies have dominated. Regulatory cooperation has intensified, leading to deeper integration at the regional level. The fragmentation of production has also given new emphasis to the role of services in international trade, such as "manufacturing" services, sales of services alongside goods or international transport and logistics. Measuring trade in value-added terms reveals more clearly the importance of trade in services but their true contribution is still under-estimated. Moreover, services have become an important engine of growth in many economies, with knowledge-intensive business services being characterized by increasingly high rates of research and development (R&D) activity.

These developments in the nature and composition of trade have been good news for many countries and firms. An important factor in determining if they will last is the evolution of transport costs. Higher fuel prices, due to geopolitical uncertainties for example, may favour the geographical proximity of suppliers. Other trade costs, relating for instance to contractual and regulatory uncertainty in trading partners, may lead to "on-shoring" or "re-shoring". Furthermore, a reduction in income variation across countries will continue to reduce the wage advantage of developing economies that has led to many offshoring decisions. This may not necessarily reduce the reach of international supply chains but their nature may change from vertical, labour-driven relationships to horizontal supply chains based on learning-by-doing and scale economies realized by highly specialized firms.

Rising incomes may result in a concentration of economic activities in dynamic regions. Proximity advantages may be further strengthened, with technological spillovers being largely regionalized. Moreover, the concentration of R&D activity (and consequent knowledge spillovers) in certain manufacturing sectors may intensify existing political pressures in advanced economies to retain domestic manufacturing activity and jobs.

Technological progress in production and coordination will play a role. Technological advances, such as 3D

printing and robotics, may further reduce the relative importance of locational advantages, while improvements in coordination and logistics technology could facilitate the continued proliferation of supply chains. The extent to which countries will adjust to change and take advantage of trading opportunities depends in no small part on government policy. In many areas, action needs to be taken at the national level in areas such as education policy, infrastructure investment, innovation incentives, legal certainty or social protection. In other areas, joint action at the international level is required in order to coordinate regulatory approaches, mobilize political support and develop resources.

Finally, in a rapidly changing international trade environment, policy-makers may re-think current models of trade cooperation. This relates both to form and content. The reality of current practices has overtaken the way trade negotiation agendas have traditionally been set. In today's world, it is increasingly hard to separate goods from services, and trade from investment. Barriers to merchandise trade, be they tariffs or non-tariff measures (NTMs), frustrate the delivery of a "package" by "servicified" manufacturing firms and vice versa. Barriers to investment as well as differences and weaknesses in regulatory regimes affect location decisions of production facilities, trade within a firm and the flow of technology. Thus far, governments have addressed these issues through the negotiation of "deep" preferential trade agreements (PTAs). This is despite the fact that many of these developments call for multilateral disciplines in order to avoid duplication and divergence, to ensure fairness and balance and to create a level playing field. However, WTO agenda-setting and negotiations have proven cumbersome – too slow for business and those countries heavily involved in complex trade transactions. Other models of trade cooperation – sectoral or issue-specific agreements, for instance – may gain support, with uncertain outcomes for those excluded.

Inertia within WTO trade negotiations is becoming an increasing burden for a large number of countries. What needs to be done? First, governments need to move forward on the existing agenda addressing market access conditions for both goods and services with equal determination as well as other trade costs covered by the talks on trade facilitation.

Secondly, other sources of uneven competition and limitations on the open flow of trade need to be addressed at the global rather than regional level. Analysing the information provided under the WTO's PTA transparency mechanism and further strengthening the WTO's other transparency and monitoring functions may help to identify issues of concern that are already addressed in one way or another at the WTO, such as various types of NTMs. Additionally, new issues are likely to emerge, such as investment and competition policy, where multilateral action may be beneficial.

Thirdly, areas for international action that will shape the future of trade but reach beyond the mandate of the WTO must be addressed, including in terms of their impact on trade cooperation. Climate change and macroeconomic policies are two examples. Further reflection and discussion is needed on the role of the WTO in the institutional framework of global governance in order to ensure policy coherence and fruitful working relationships.

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Technical notes

Composition of regions and other economic groupings
Regions

North America

Bermuda	Canada*	Mexico*	United States of America*	

Other territories in the region not elsewhere specified (n.e.s.)

South and Central America and the Caribbean

Antigua and Barbuda*	Chile*	El Salvador*	Netherlands Antilles	Saint Vincent and the Grenadines*
Argentina*	Colombia*	Grenada*	Nicaragua*	Suriname*
Bahamas**	Costa Rica*	Guatemala*	Panama*	Trinidad and Tobago*
Barbados*	Cuba*	Guyana*	Paraguay*	Uruguay*
Belize*	Dominica*	Haiti*	Peru*	Bolivarian Rep. of Venezuela*
Bolivia, Plurinational State of*	Dominican Republic*	Honduras*	Saint Kitts and Nevis*	
Brazil*	Ecuador*	Jamaica*	Saint Lucia*	

Other territories in the region n.e.s.

Europe

Albania*	Czech Republic*	Hungary*	Malta*	Slovak Republic*
Andorra**	Denmark*	Iceland*	Montenegro*	Slovenia*
Austria*	Estonia*	Ireland*	Netherlands*	Spain*
Belgium*	Finland*	Italy*	Norway*	Sweden*
Bosnia and Herzegovina**	France*	Latvia*	Poland*	Switzerland*
Bulgaria*	FYR Macedonia*	Liechtenstein*	Portugal*	Turkey*
Croatia*	Germany*	Lithuania*	Romania*	United Kingdom*
Cyprus*	Greece*	Luxembourg*	Serbia**	

Other territories in the region n.e.s.

Commonwealth of Independent States (CIS)[a]

Armenia*	Georgia*[a]	Moldova, Republic of*	Turkmenistan
Azerbaijan**	Kazakhstan**	Russian Federation*	Ukraine*
Belarus**	Kyrgyz Republic*	Tajikistan*	Uzbekistan**

Other territories in the region n.e.s.

Africa

Algeria**	Congo*	Guinea*	Morocco*	South Africa*
Angola*	Côte d'Ivoire*	Guinea-Bissau*	Mozambique*	Sudan**
Benin*	Dem. Rep. of the Congo*	Kenya*	Namibia*	Swaziland*
Botswana*	Djibouti*	Lesotho*	Niger*	Tanzania*
Burkina Faso*	Egypt*	Liberia, Republic of**	Nigeria*	Togo*
Burundi*	Equatorial Guinea**	Libya**	Rwanda*	Tunisia*
Cameroon*	Eritrea	Madagascar*	São Tomé and Príncipe**	Uganda*
Cape Verde*	Ethiopia**	Malawi*	Senegal*	Zambia*
Central African Republic*	Gabon*	Mali*	Seychelles**	Zimbabwe*
Chad*	Gambia*	Mauritania*	Sierra Leone*	
Comoros**	Ghana*	Mauritius*	Somalia	

Other territories in the region n.e.s.

Middle East

Bahrain, Kingdom of*	Israel*	Lebanese Republic**	Saudi Arabia, Kingdom of*	Yemen**
Iran**	Jordan*	Oman*	Syrian Arab Republic**	
Iraq**	Kuwait, the State of*	Qatar*	United Arab Emirates*	

Other territories in the region n.e.s.

Asia

Afghanistan**	Hong Kong, China*	Malaysia*	Papua New Guinea*	Timor-Leste
Australia*	India*	Maldives*	Philippines*	Tonga*
Bangladesh*	Indonesia*	Mongolia*	Samoa*	Tuvalu
Bhutan**	Japan*	Myanmar*	Singapore*	Vanuatu*
Brunei Darussalam*	Kiribati	Nepal*	Solomon Islands*	Viet Nam*
Cambodia*	Korea, Republic of*	New Zealand*	Sri Lanka*	
China*	Lao People's Dem. Rep.*	Pakistan*	Taipei, Chinese*	
Fiji*	Macao, China*	Palau	Thailand*	

Other territories in the region n.e.s.

*WTO members

**Observer governments

a. Georgia is not a member of the Commonwealth of Independent States but is included in this group for reasons of geography and similarities in economic structure.

Other Groups				
ACP (African, Caribbean and Pacific countries)				
Angola	Cuba	Haiti	Niger	South Africa
Antigua and Barbuda	Dem. Rep. of the Congo	Jamaica	Nigeria	Sudan
Bahamas	Djibouti	Kenya	Niue	Suriname
Barbados	Dominica	Kiribati	Palau	Swaziland
Belize	Dominican Republic	Lesotho	Papua New Guinea	Tanzania
Benin	Equatorial Guinea	Liberia, Republic of	Rwanda	Timor-Leste
Botswana	Eritrea	Madagascar	Saint Kitts and Nevis	Togo
Burkina Faso	Ethiopia	Malawi	Saint Lucia	Tonga
Burundi	Fiji	Mali	Saint Vincent and the Grenadines	Trinidad and Tobago
Cameroon	Gabon	Marshall Islands	Samoa	Tuvalu
Central African Republic	Gambia	Mauritania	São Tomé and Príncipe	Uganda
Chad	Ghana	Mauritius	Senegal	Vanuatu
Comoros	Grenada	Micronesia	Seychelles	Zambia
Congo	Guinea	Mozambique	Sierra Leone	Zimbabwe
Cook Islands	Guinea-Bissau	Namibia	Solomon Islands	
Côte d'Ivoire	Guyana	Nauru	Somalia	
Africa				
North Africa				
Algeria	Egypt	Libya	Morocco	Tunisia
Sub-Saharan Africa				
Western Africa				
Benin	Gambia	Guinea-Bissau	Mauritania	Senegal
Burkina Faso	Ghana	Liberia, Republic of	Niger	Sierra Leone
Cape Verde	Guinea	Mali	Nigeria	Togo
Côte d'Ivoire				
Central Africa				
Burundi	Central African Republic	Congo	Equatorial Guinea	Rwanda
Cameroon	Chad	Dem. Rep. of the Congo	Gabon	São Tomé and Príncipe
Eastern Africa				
Comoros	Ethiopia	Mauritius	Somalia	Tanzania
Djibouti	Kenya	Seychelles	Sudan	Uganda
Eritrea	Madagascar			
Southern Africa				
Angola	Lesotho	Mozambique	South Africa	Zambia
Botswana	Malawi	Namibia	Swaziland	Zimbabwe
Territories in Africa not elsewhere specified				
Asia				
East Asia (including Oceania)				
Australia	Indonesia	Mongolia	Samoa	Tuvalu
Brunei Darussalam	Japan	Myanmar	Singapore	Vanuatu
Cambodia	Kiribati	New Zealand	Solomon Islands	Viet Nam
China	Lao People's Dem. Rep.	Papua New Guinea	Taipei, Chinese	
Fiji	Macao, China	Philippines	Thailand	
Hong Kong, China	Malaysia	Republic of Korea	Tonga	
West Asia				
Afghanistan	Bhutan	Maldives	Pakistan	Sri Lanka
Bangladesh	India	Nepal		
Other countries and territories in Asia and the Pacific not elsewhere specified				
LDCs (Least-developed countries)				
Afghanistan	Comoros	Kiribati	Myanmar	Sudan
Angola	Dem. Rep. of the Congo	Lao People's Dem. Rep.	Nepal	Timor-Leste
Bangladesh	Djibouti	Lesotho	Niger	Togo
Benin	Equatorial Guinea	Liberia, Republic of	Rwanda	Tuvalu
Bhutan	Eritrea	Madagascar	Samoa	Uganda
Burkina Faso	Ethiopia	Malawi	São Tomé and Príncipe	Tanzania
Burundi	Gambia	Maldives	Senegal	Vanuatu
Cambodia	Guinea	Mali	Sierra Leone	Yemen
Central African Republic	Guinea-Bissau	Mauritania	Solomon Islands	Zambia
Chad	Haiti	Mozambique	Somalia	
Six East Asian traders				
Hong Kong, China	Republic of Korea	Singapore	Taipei, Chinese	Thailand
Malaysia				

Regional Integration Agreements				
Andean Community (CAN)				
Bolivia, Plurinational State of	Colombia	Ecuador	Peru	
ASEAN (Association of South East Asian Nations) / AFTA (ASEAN Free Trade Area)				
Brunei Darussalam	Indonesia	Malaysia	Philippines	Thailand
Cambodia	Lao People's Dem. Rep.	Myanmar	Singapore	Viet Nam
CACM (Central American Common market)				
Costa Rica	El Salvador	Guatemala	Honduras	Nicaragua
CARICOM (Caribbean Community and Common Market)				
Antigua and Barbuda	Belize	Guyana	Montserrat	Saint Vincent and the Grenadines
Bahamas	Dominica	Haiti	Saint Kitts and Nevis	Suriname
Barbados	Grenada	Jamaica	Saint Lucia	Trinidad and Tobago
CEMAC (Economic and Monetary Community of Central Africa)				
Cameroon	Chad	Congo	Equatorial Guinea	Gabon
Central African Republic				
COMESA (Common Market for Eastern and Southern Africa)				
Burundi	Egypt	Libya	Rwanda	Uganda
Comoros	Eritrea	Madagascar	Seychelles	Zambia
Dem. Rep. of the Congo	Ethiopia	Malawi	Sudan	Zimbabwe
Djibouti	Kenya	Mauritius	Swaziland	
ECCAS (Economic Community of Central African States)				
Angola	Central African Republic	Dem. Rep. of the Congo	Gabon	São Tomé and Príncipe
Burundi	Chad	Equatorial Guinea	Rwanda	
Cameroon	Congo			
ECOWAS (Economic Community of West African States)				
Benin	Côte d'Ivoire	Guinea	Mali	Senegal
Burkina Faso	Gambia	Guinea-Bissau	Niger	Sierra Leone
Cape Verde	Ghana	Liberia, Republic of	Nigeria	Togo
EFTA (European Free Trade Association)				
Iceland	Liechtenstein	Norway	Switzerland	
European Union (27)				
Austria	Estonia	Ireland	Netherlands	Spain
Belgium	Finland	Italy	Poland	Sweden
Bulgaria	France	Latvia	Portugal	United Kingdom
Cyprus	Germany	Lithuania	Romania	
Czech Republic	Greece	Luxembourg	Slovak Republic	
Denmark	Hungary	Malta	Slovenia	
GCC (Gulf Cooperation Council)				
Bahrain, Kingdom of	Oman	Qatar	Saudi Arabia, Kingdom of	United Arab Emirates
Kuwait, the State of				
MERCOSUR (Southern Common Market)				
Argentina	Brazil	Paraguay	Uruguay	
NAFTA (North American Free Trade Agreement)				
Canada	Mexico	United States		
SAPTA (South Asian Preferential Trade Arrangement)				
Bangladesh	India	Nepal	Pakistan	Sri Lanka
Bhutan	Maldives			
SADC (Southern African Development Community)				
Angola	Lesotho	Mauritius	South Africa	Zambia
Botswana	Madagascar	Mozambique	Swaziland	Zimbabwe
Dem. Rep. of the Congo	Malawi	Namibia	Tanzania	
WAEMU (West African Economic and Monetary Union)				
Benin	Côte d'Ivoire	Mali	Senegal	Togo
Burkina Faso	Guinea-Bissau	Niger		

WTO members are frequently referred to as "countries", although some members are not countries in the usual sense of the word but are officially "customs territories". The definition of geographical and other groupings in this report does not imply an expression of opinion by the Secretariat concerning the status of any country or territory, the delimitation of its frontiers, nor the rights and obligations of any WTO member in respect of WTO agreements. The colours, boundaries, denominations and classifications in the maps of the publication do not imply, on the part of the WTO, any judgement on the legal or other status of any territory, or any endorsement or acceptance of any boundary.

Throughout this report, South and Central America and the Caribbean is referred to as South and Central America. The Bolivarian Republic of Venezuela; Hong Kong Special Administrative Region of China; the Republic of Korea; and the Separate Customs Territory of Taiwan, Penghu, Kinmen and Matsu are referenced as Bolivarian Rep. of Venezuela; Hong Kong, China; Korea, Rep. of; and Taipei, Chinese respectively.

The data supplied in the World Trade Report 2013 are valid as of 10 April 2013.

Abbreviations and symbols

ADB	Asian Development Bank
AIO	Asian Input-Output
ASEAN	Association of Southeast Nations
BAFT	Bankers Association for Finance and Trade
BEC	broad economic categories
BERD	business expenditure R&D
BIS	Bank for International Settlements
BITs	bilateral investment treaties
BPM	Balance of Payments Manual
BRICS Group	Brazil, Russia, India, China, South Africa
CBI	Centre for the Promotion of Imports from developing countries (Agency of the Netherlands Ministry of Foreign Affairs)
CEPII	Centre d'études prospectives et d'informations internationales (French Research Center in International Economics)
CFCs	chlorofluorocarbons
CGE	Computable General Equilibrium
CIA	Central Intelligence Agency
CIS	Commonwealth of Independent States
COMESA	Common Market for Eastern and Southern Africa
DDA	Doha Development Agenda
DSM	dispute settlement mechanism
EAC	East African Community
EAPEP	economically active population estimates and projections
EBA	external balance assessment
ECB	European Central Bank
EEC	European Economic Community
EFIGE	European firms in a global economy
EIA	energy information administration
EIU	Economist Intelligence Unit
EPZs	exports processing zones
EU	European Union
FAO	Food and Agriculture Organization
FDI	foreign direct investment
FTA	Free Trade Agreement
GATS	General Agreement on Trade in Services
GATT	General Agreement on Tariffs and Trade
GBMD	global bilateral migration database (World Bank)
GDP	gross domestic product
GEP	global economic prospects
GL index	Grubel-Lloyd index
GPA	Government Procurement Agreement
GSP	generalized system of preferences
GTAP	global trade analysis project
GTIS	global trade information services
HO	Heckscher-Ohlin theory
HS	harmonized system
ICC	International Chamber of Commerce

ICE	intercontinental exchange
ICIO	Inter-Country Input-Output
ICT	information and communication technology
IDE-JETRO	Institute of Developing Economies - Japan External Trade Organization
IEA	International Energy Agency
IFS	International Financial Statistics
ILO	International Labour Office
IMF	International Monetary Fund
INEGI	Instituto Nacional de Estadística y Geografía
IOM	International Organization for Migration
IP	intellectual property
IPR	intellectual property right
IRCA	Immigration Reform and Control Act
ISSP	international social survey programme
IT	information technology
ITA	information technology agreement
ITC	International Trade Centre
ITO	International Trade Organization
ITS	International Trade Statistics
ITU	International Telecommunications Union
KIBS	knowledge-intensive business services
LAC	Latin America and the Caribbean
LDCs	least-developed countries
LFPR	labour force participation rates
LFTTD	linked/longitudinal firm trade transaction database
LPI	logistics performance index
MaGE	Macroeconometrics of the Global Economy
MDG	United Nations Millennium Development Goals
MENA	Middle East and North Africa
MFN	most-favoured nation
MIA	multilateral investment agreement
MNC	multinational corporation
MRIO	Multi-Region Input-Output
MSITS	Manual on Statistics of International Trade in Services
NAFTA	North American Free Trade Agreement
NELM	New Economics of Labor Migration
nes	not elsewhere specified
NICs	newly industrialized countries
NSF	National Science Foundation
NTMs	non-tariff measures
ODA	overseas development assistance
OECD	Organisation for Economic Co-operation and Development
OPEC	Organization of the Petroleum Exporting Countries
PACE	pollution abatement capital expenditures
PAOC	pollution abatement operation costs
PPP	purchasing power parity
PTA	preferential trade agreement
R&D	research and development
RCA	revealed comparative advantage

RCP	regional consultative process
REER	real effective exchange rate
RMB	Renminbi (Chinese currency)
RTAs	regional trade agreements
SADC	Southern African Development Community
SCI	structural change index
SCM	subsidies and countervailing measures
SDT	special and differential treatment
SITC	Standard International Trade Classification
SME	small and medium-sized enterprises
SPS	sanitary and phytosanitary
SSA	Sub-Saharan Africa
TBT	technical barriers to trade
TF	Trade Facilitation
TFP	total factor productivity
TPRM	Trade Policy Review Mechanism
TRAINS	trade analysis and information system
TRIMs	trade-related investment measures
TRIPS	trade-related aspects of intellectual property rights
UK	United Kingdom
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNEP	United Nations Environment Programme
UNFCCC	United Nations Framework Convention on Climate Change
UNSD	United Nations Statistics Division
US	United States
USAID	United States Agency for International Development
USITC	United States International Trade Commission
VAX ratio	value-added exports to gross exports ratio
WCO	World Customs Organization
WDI	world development indicators
WHO	World Health Organization
WIOD	World Input-Output Database
WIOT	World Input-Output Table
WIPO	World Intellectual Property
WITS	World Integrated Trade Solution
WTO	World Trade Organization
WTR	World Trade Report
WWF	World Wildlife Fund

The following symbols are used in this publication:

…	not available
0	figure is zero or became zero due to rounding
-	not applicable
$	United States dollars
£	UK pound

List of figures, tables and boxes

Boxes

Appendix tables

C Fundamental economic factors affecting international trade

Figures

D   Trade openness and the broader socio-economic context

Boxes

E   Prospects for multilateral trade cooperation

Box

WTO members

(As of 2 March 2013)

Albania
Angola
Antigua and Barbuda
Argentina
Armenia
Australia
Austria
Bahrain, Kingdom of
Bangladesh
Barbados
Belgium
Belize
Benin
Bolivia, Plurinational State of
Botswana
Brazil
Brunei Darussalam
Bulgaria
Burkina Faso
Burundi
Cambodia
Cameroon
Canada
Cape Verde
Central African Republic
Chad
Chile
China
Colombia
Congo
Costa Rica
Côte d'Ivoire
Croatia
Cuba
Cyprus
Czech Republic
Democratic Republic of the Congo
Denmark
Djibouti
Dominica
Dominican Republic
Ecuador
Egypt
El Salvador
Estonia
European Union
Fiji
Finland
Former Yugoslav Republic of
Macedonia (FYROM)
France
Gabon
The Gambia
Georgia

Germany
Ghana
Greece
Grenada
Guatemala
Guinea
Guinea-Bissau
Guyana
Haiti
Honduras
Hong Kong, China
Hungary
Iceland
India
Indonesia
Ireland
Israel
Italy
Jamaica
Japan
Jordan
Kenya
Korea, Republic of
Kuwait, the State of
Kyrgyz Republic
Lao People's Democratic Republic
Latvia
Lesotho
Liechtenstein
Lithuania
Luxembourg
Macao, China
Madagascar
Malawi
Malaysia
Maldives
Mali
Malta
Mauritania
Mauritius
Mexico
Moldova, Republic of
Mongolia
Montenegro
Morocco
Mozambique
Myanmar
Namibia
Nepal
Netherlands
New Zealand
Nicaragua
Niger

Nigeria
Norway
Oman
Pakistan
Panama
Papua New Guinea
Paraguay
Peru
Philippines
Poland
Portugal
Qatar
Romania
Russian Federation
Rwanda
Saint Kitts and Nevis
Saint Lucia
Saint Vincent and the Grenadines
Samoa
Saudi Arabia, Kingdom of
Senegal
Sierra Leone
Singapore
Slovak Republic
Slovenia
Solomon Islands
South Africa
Spain
Sri Lanka
Suriname
Swaziland
Sweden
Switzerland
Chinese Taipei
Tajikistan
Tanzania
Thailand
Togo
Tonga
Trinidad and Tobago
Tunisia
Turkey
Uganda
Ukraine
United Arab Emirates
United Kingdom
United States of America
Uruguay
Vanuatu
Venezuela, Bolivarian Republic of
Viet Nam
Zambia
Zimbabwe

Previous World Trade Reports

Trade and public policies: A closer look at non-tariff measures in the 21st century

2012 Regulatory measures for trade in goods and services raise challenges for international cooperation in the 21st century. The *World Trade Report 2012* examines why governments use non-tariff measures and services measures and the extent to which these measures may distort international trade.

## The WTO and preferential trade agreements: From co-existence to coherence

2011 The ever-growing number of preferential trade agreements (PTAs) is a prominent feature of international trade. The Report describes the historical development of PTAs and the current landscape of agreements. It examines why PTAs are established, their economic effects, the contents of the agreements themselves, and the interaction between PTAs and the multilateral trading system.

Trade in natural resources
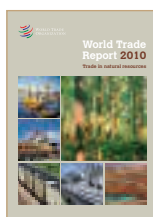
2010 The World Trade Report 2010 focuses on trade in natural resources, such as fuels, forestry, mining and fisheries. The Report examines the characteristics of trade in natural resources, the policy choices available to governments and the role of international cooperation, particularly of the WTO, in the proper management of trade in this sector.

Trade policy commitments and contingency measures
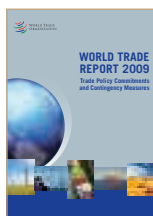
2009 The 2009 Report examines the range and role of contingency measures available in trade agreements. One of the Report's main objectives is to analyse whether WTO provisions provide a balance between supplying governments with the necessary flexibility to face difficult economic situations and adequately defining these in a way that limits their use for protectionist purposes.

Trade in a globalizing world
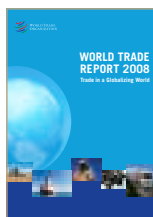
2008 The 2008 Report provides a reminder of what we know about the gains from international trade and highlights the challenges arising from higher levels of integration. It addresses the question of what constitutes globalization, what drives it, what benefits it brings, what challenges it poses and what role trade plays in this world of ever-growing inter-dependency.

Sixty years of the multilateral trading system: achievements and challenges
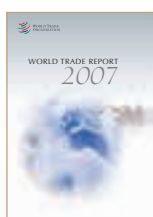
2007 On 1 January 2008 the multilateral trading system celebrated its 60th anniversary. The World Trade Report 2007 celebrates this landmark anniversary with an in-depth look at the General Agreement on Tariffs and Trade (GATT) and its successor the World Trade Organization — their origins, achievements, the challenges they have faced and what the future holds.

WORLD TRADE REPORT 2013

## Exploring the links between subsidies, trade and the WTO

2006
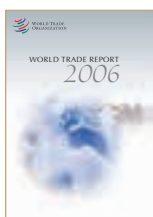
The World Trade Report 2006 focuses on how subsidies are defined, what economic theory can tell us about subsidies, why governments use subsidies, the most prominent sectors in which subsidies are applied and the role of the WTO Agreement in regulating subsidies in international trade. The Report also provides brief analytical commentaries on certain topical trade issues.

Trade, standards and the WTO

2005
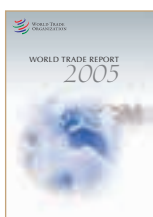
The World Trade Report 2005 seeks to shed light on the various functions and consequences of standards, focusing on the economics of standards in international trade, the institutional setting for standard-setting and conformity assessment, and the role of WTO agreements in reconciling the legitimate policy uses of standards with an open, non-discriminatory trading system.

Coherence

2004
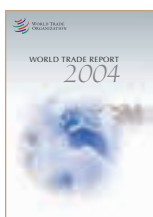
The World Trade Report 2004 focuses on the notion of coherence in the analysis of interdependent policies: the interaction between trade and macroeconomic policy, the role of infrastructure in trade and economic development, domestic market structures, governance and institutions, and the role of international cooperation in promoting policy coherence.

Trade and development

2003
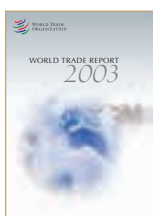
The World Trade Report 2003 focuses on development. It explains the origin of this issue and offers a framework within which to address the question of the relationship between trade and development, thereby contributing to more informed discussion.

World Trade Report 2013

The world is changing with extraordinary rapidity, driven by many influences, including shifts in production and consumption patterns, continuing technological innovation, new ways of doing business and, of course, policy. The *World Trade Report 2013* focuses on how trade is both a cause and an effect of change and looks into the factors shaping the future of world trade.

One of the most significant drivers of change is technology. Not only have revolutions in transport and communications transformed our world but new developments, such as 3D printing, and the continuing spread of information technology will continue to do so. Trade and foreign direct investment, together with a greater geographical spread of income growth and opportunity, will integrate a growing number of countries into more extensive international exchange. Higher incomes and larger populations will put new strains on both renewable and non-renewable resources, calling for careful resource management. Environmental issues will also call for increasing attention.

Economic and political institutions along with the interplay of cultural customs among countries all help to shape international cooperation, including in the trade field. The future of trade will also be affected by the extent to which politics and policies successfully address issues of growing social concern, such as the availability of jobs and persistent income inequality. These and other factors are all examined in the *World Trade Report 2013*.
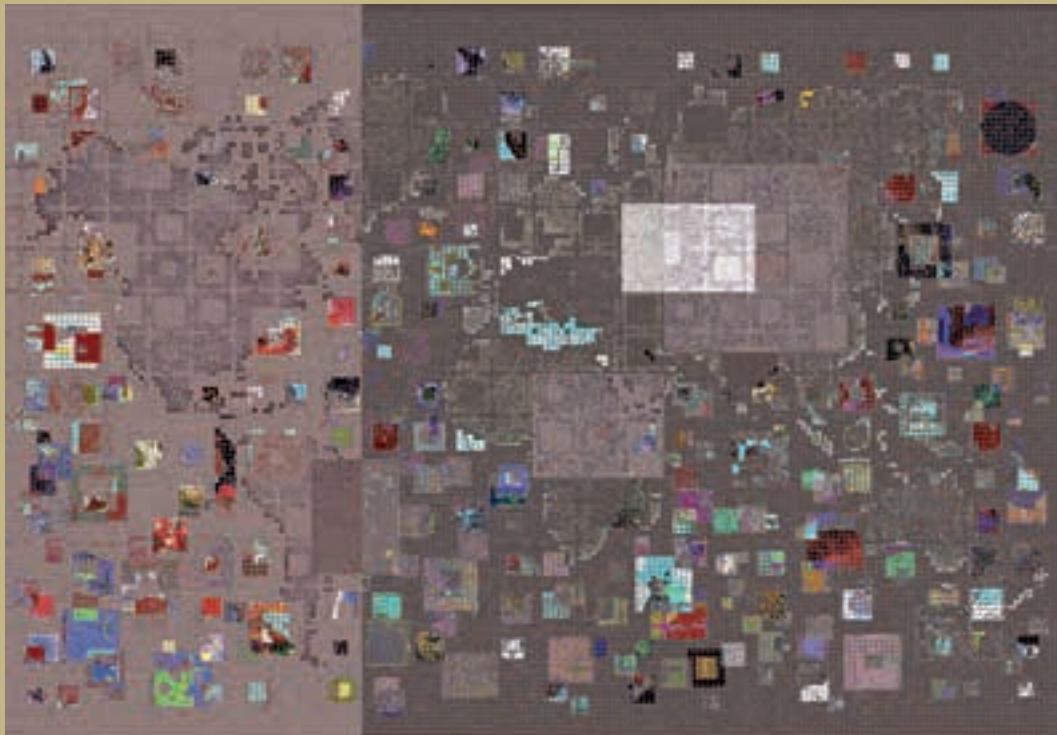
Images (front and back covers)

Jean-Claude Prêtre, *DANAÉ WORLD SUITE*, 2001.
In this series (from which two prints are reproduced here), the artist wishes symbolically to portray a "movement" towards geopolitical peace. The full collection of 49 works is on display at the WTO. For more information, please visit the artist's website at www.jcpretre.ch.