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 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.

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).

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 Loughheed, 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).

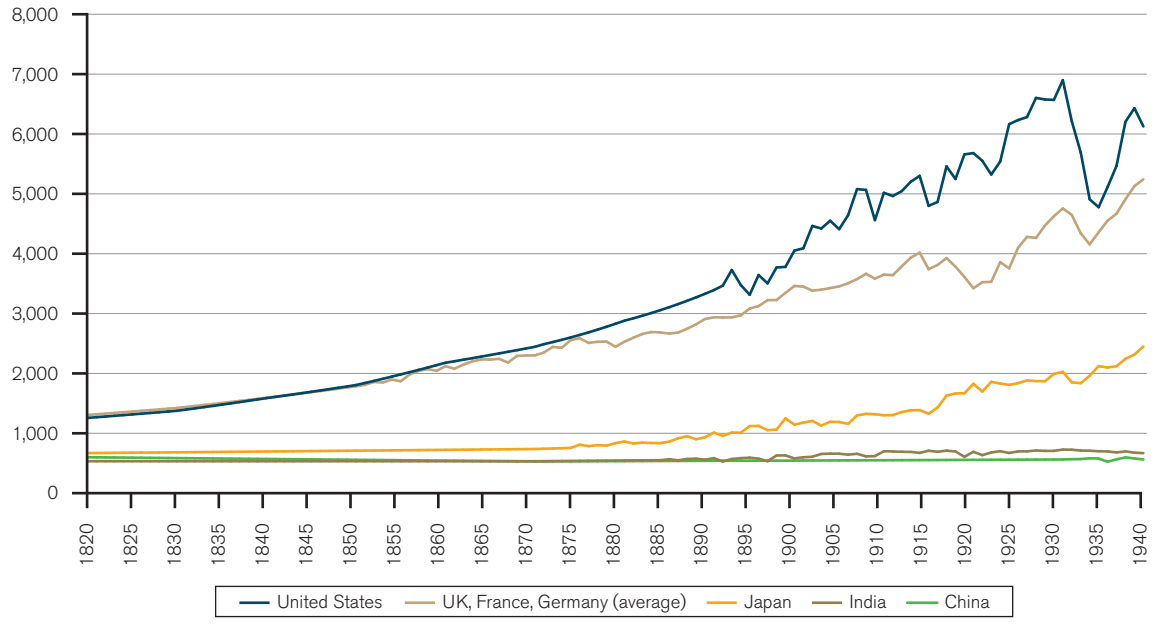
(c) Global economic cooperation and integration

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.

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

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

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.

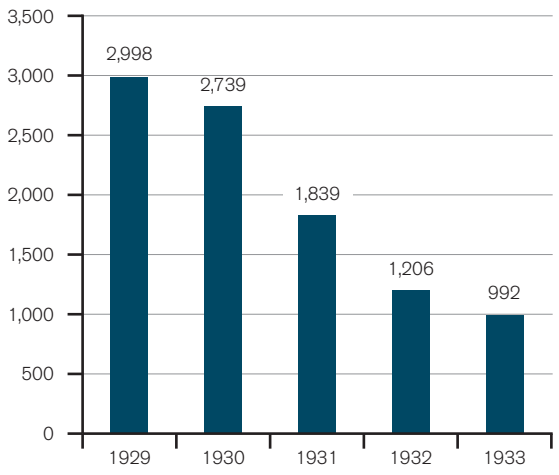
Economic challenges were compounded by financial challenges. In the face of widespread financial volatility and competitive devaluations, countries kept or re-imposed trade and exchange restrictions to slow imports and strengthen their balance of payments. When leading countries finally agreed to reinstate 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.

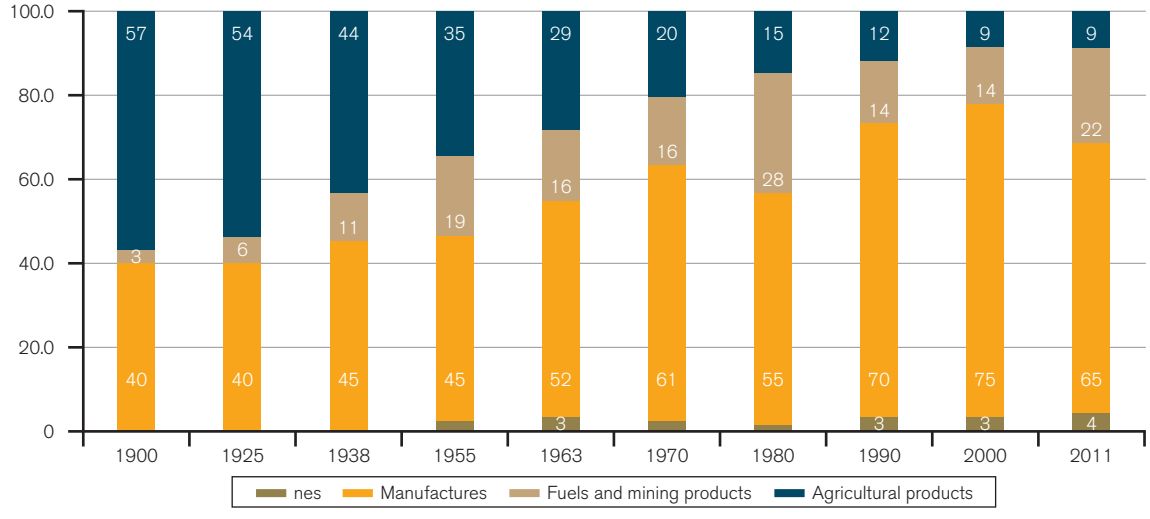
Whereas in the inter-war years, the composition of trade differed little from that of the previous century – that is, it was largely dominated by the exchange of raw materials and agricultural products for manufactured goods – since 1945, the main component of trade has been the international exchange 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.

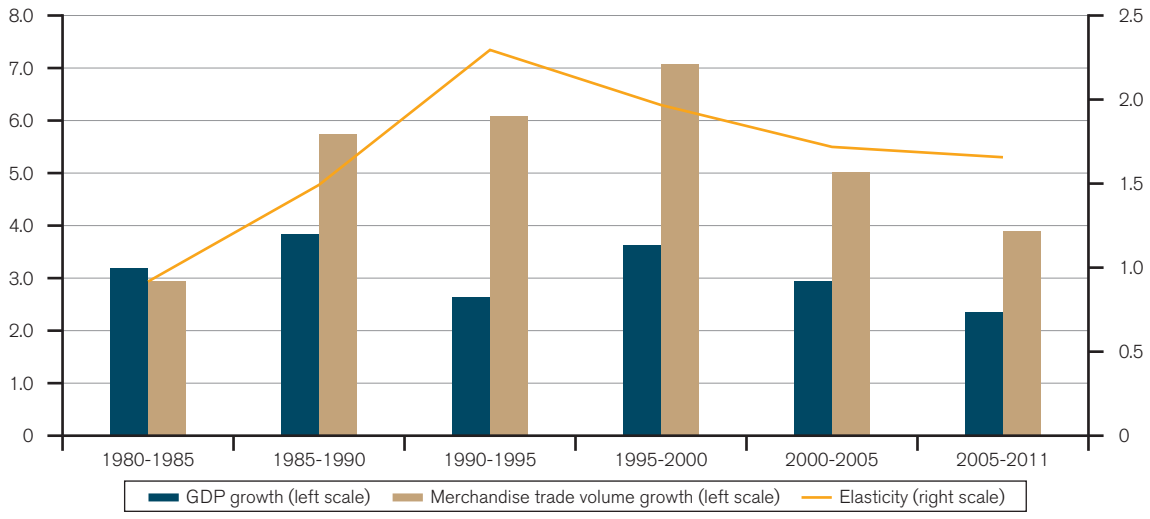
The theoretical and empirical literature documenting the positive impact of traditional forms of trade liberalization is extensive. Nevertheless, other types of trade costs, such as domestic trade costs, still present significant barriers to trade. Anderson and Van Wincoop (2004), for instance, show 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

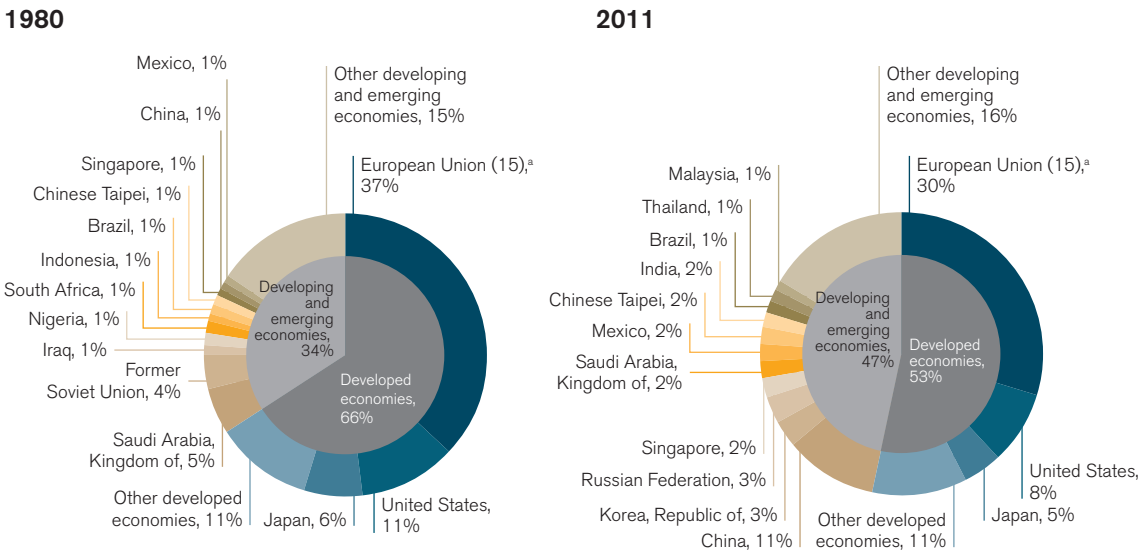
Box B.1: **Definitions of developed and developing economies**

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)

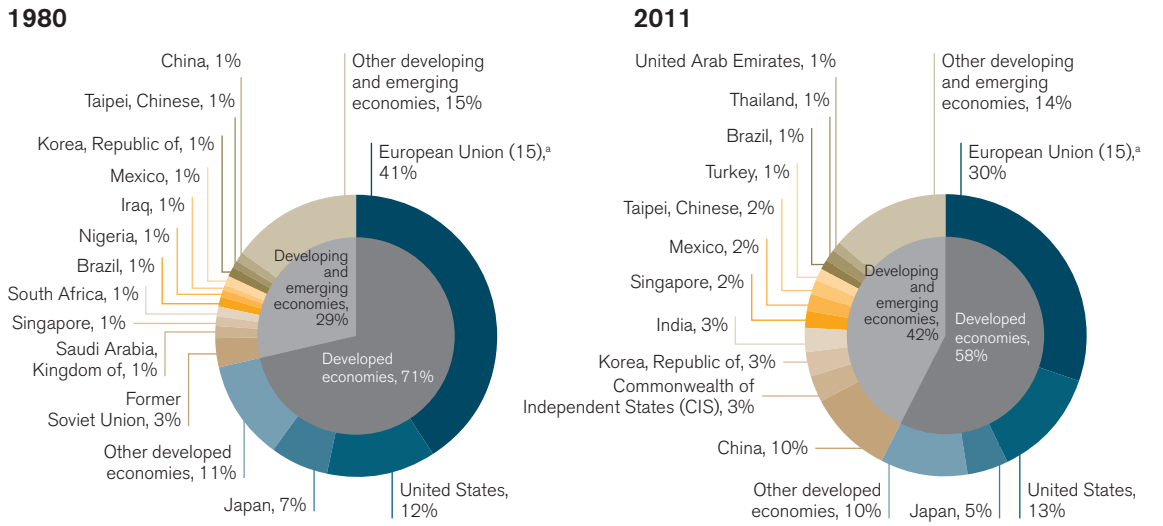


[a] Includes intra-EU trade.
Source: WTO Secretariat.

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)



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

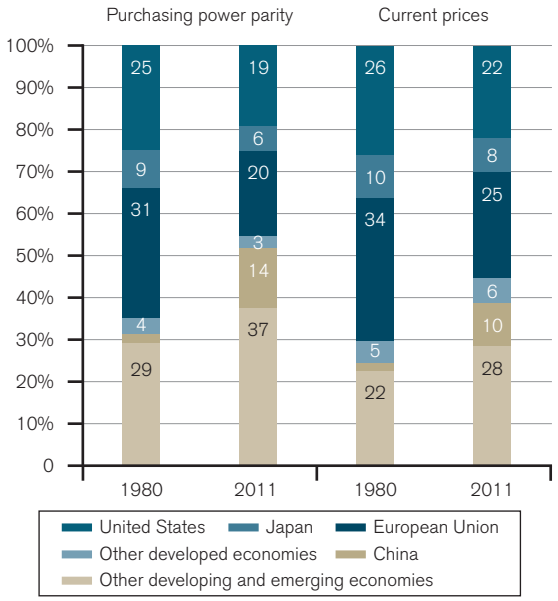
impossible to calculate the share of the current 27 country membership in 1980 since some members did not exist at that time (Czech Republic, Slovak Republic, Slovenia and the Baltic states) but the enlarged trade bloc's share in 2011 was 34 per cent, which is still less than the 1980 share of the 15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

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.

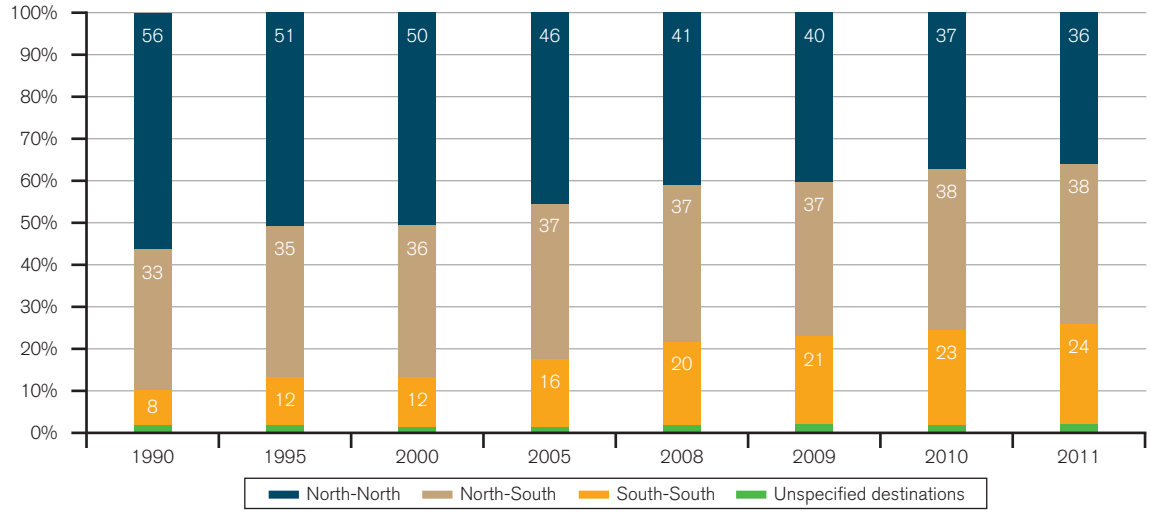
a Germany refers to West Germany in 1980.
b Belgium refers to Belgium-Luxembourg in 1980.

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.

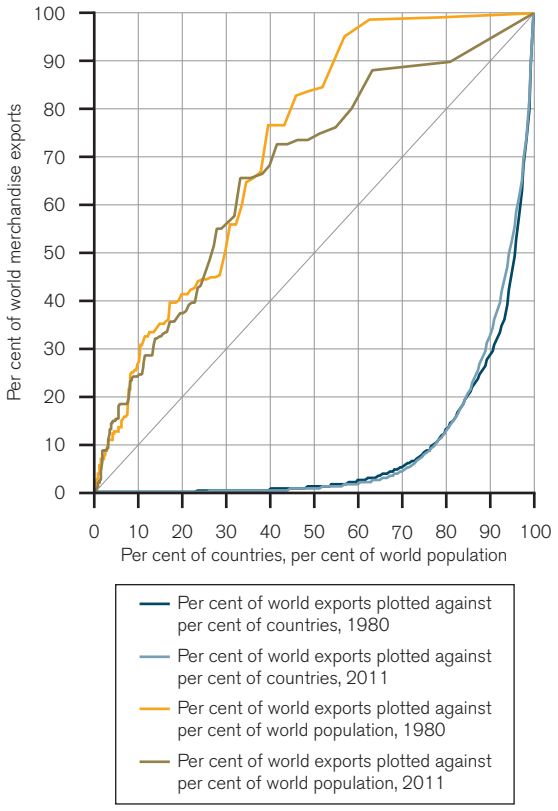
Note: South includes Central and Eastern Europe before 2000, equal to 1.6 per cent of world trade in 1995.

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.

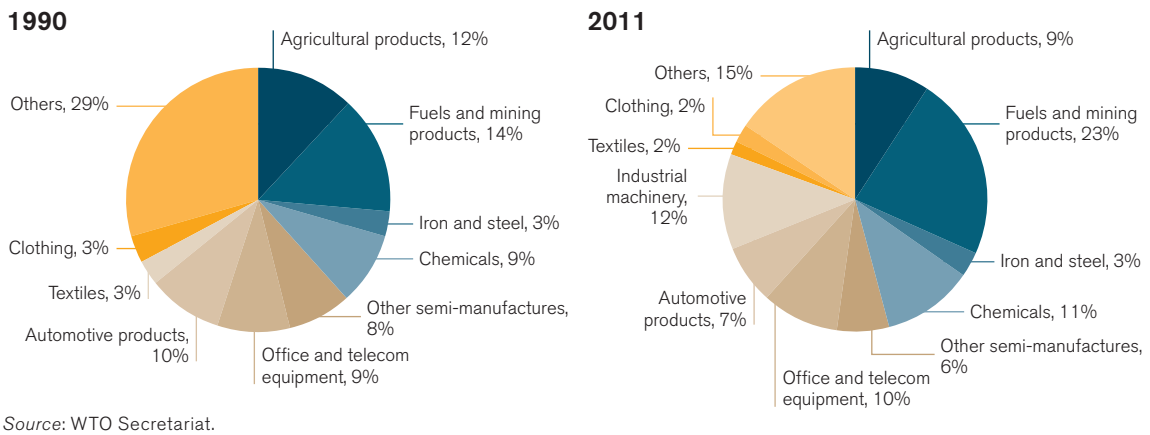
(i) Evolution of trade by major product categories

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)



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.

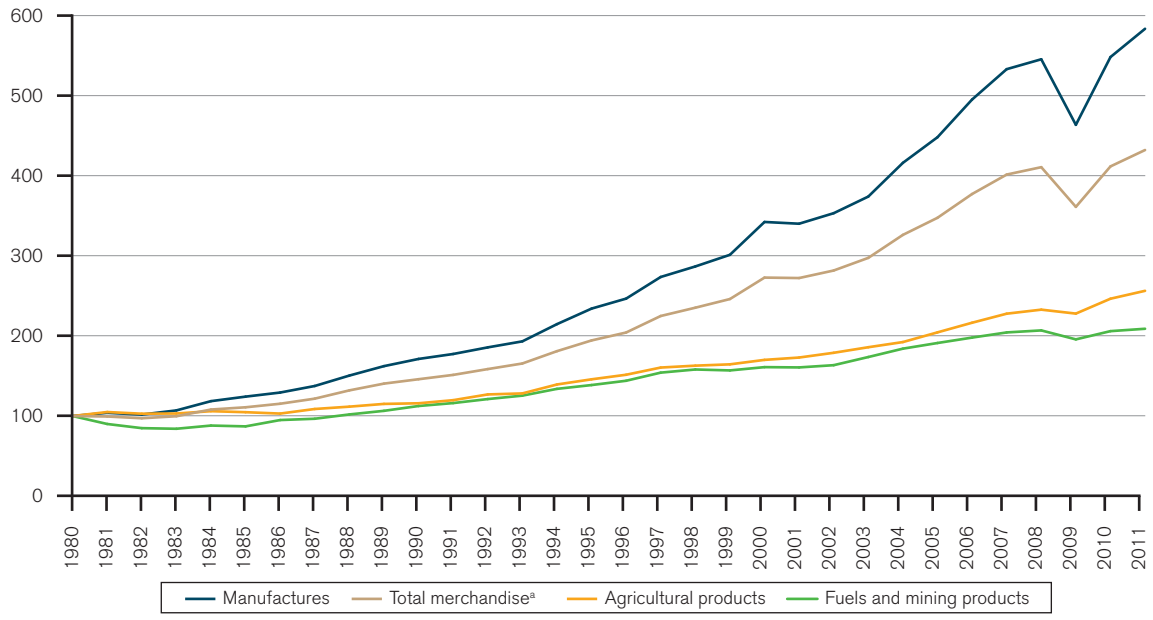
(ii) Creation and destruction of old and new products

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).

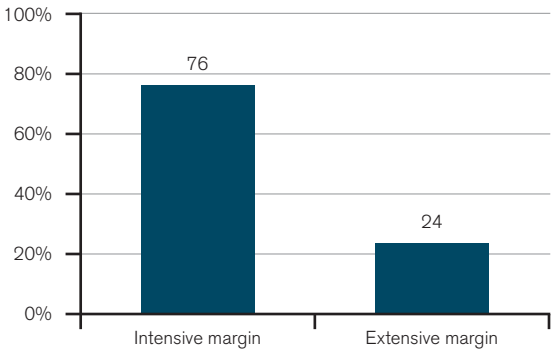
Magnetic tape-based video recorders have seen their share in world trade fall from 0.251 per cent in 1996 to 0.002 per cent in 2011, a decline of 99 per cent. Despite this collapsing share, these devices have retained their own six-digit HS sub-heading, at least till the 2007 version of the classification. 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.

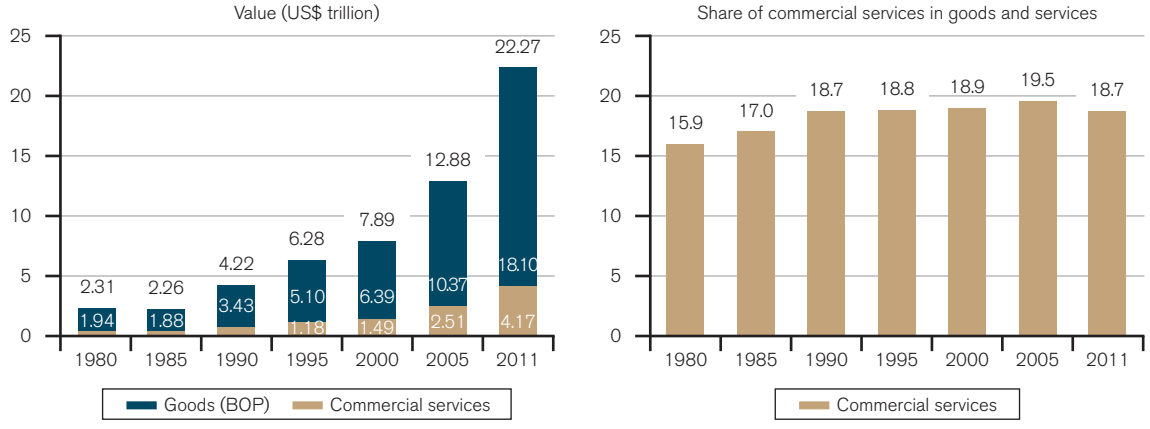
When international trade flows are measured in value-added rather than gross terms, services appear to play a larger role in world trade (see Section B.2(e) for more information on trade in value-added terms). The coverage of data on commercial services is not particularly good (see Section B.2(a)) and 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*:

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

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.

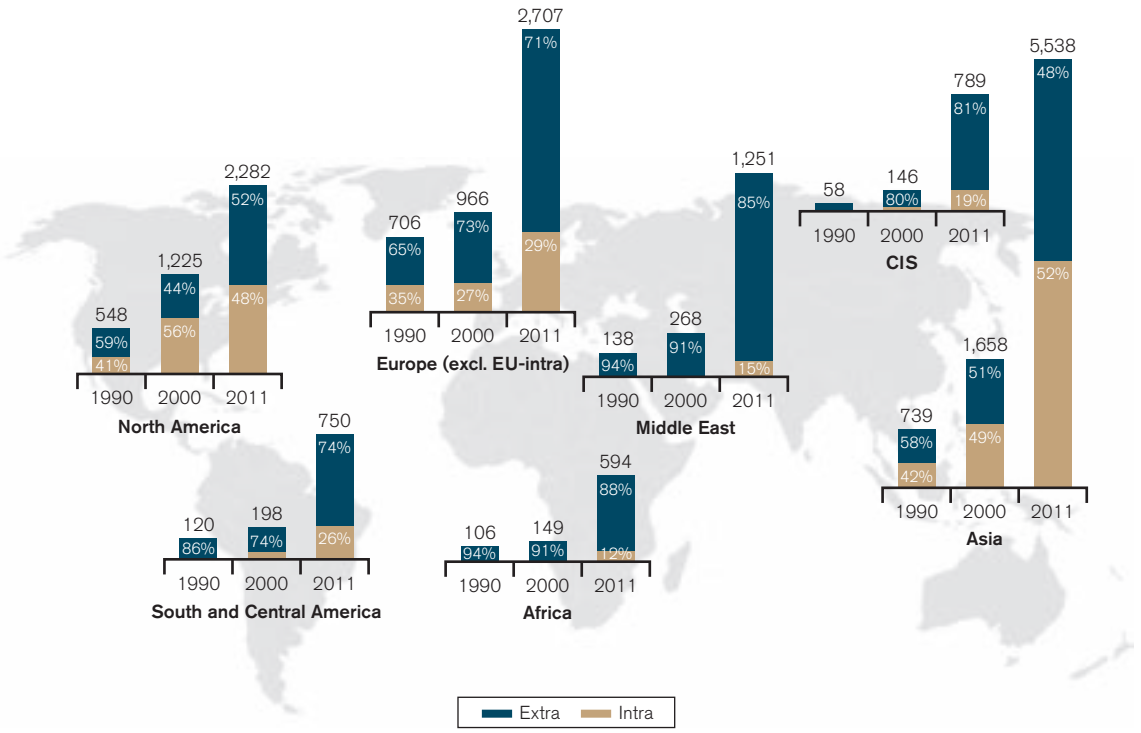
(i) Intra-regional trade

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.

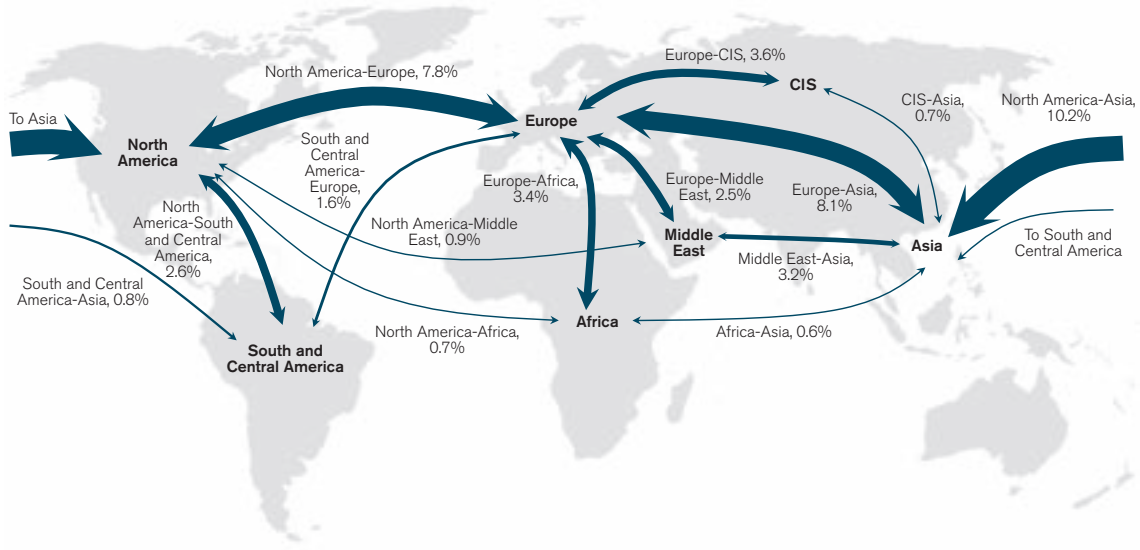
Other regions shown in the chart, all of which export significant quantities of natural resources, saw their intra-regional trade shares rise in the last 20 years but they are still extremely small in absolute terms. For example, Africa's intra-regional trade share doubled from 6 per cent to 12 per cent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

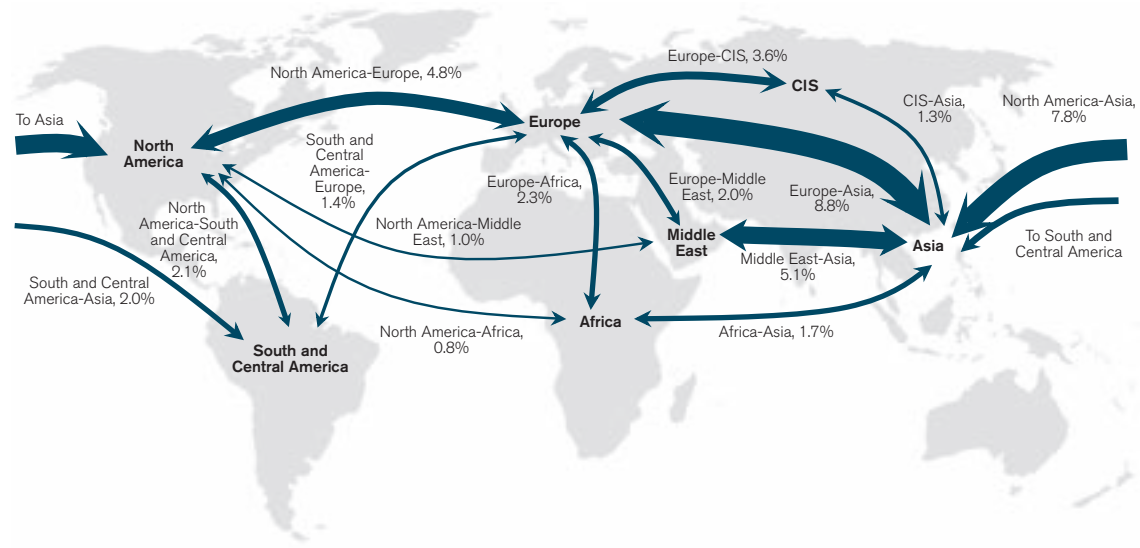
Figure B.15.A: **Share of total trade between geographic regions in world trade, 1990** (percentage)



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.

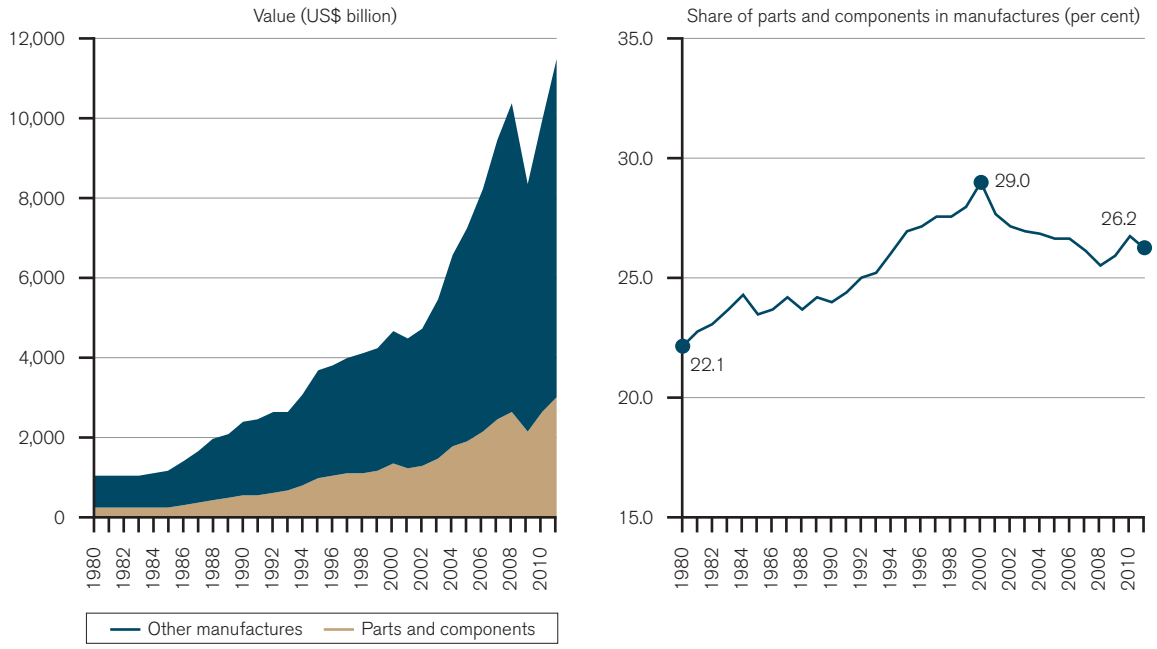
National statistical authorities have traditionally conducted surveys focused on selected firms (usually large multinationals). Another approach has been to link business and trade registers, as is being done by the European Union's EUROSTAT and Mexico's INEGI. This leads to the creation of micro-databases 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:

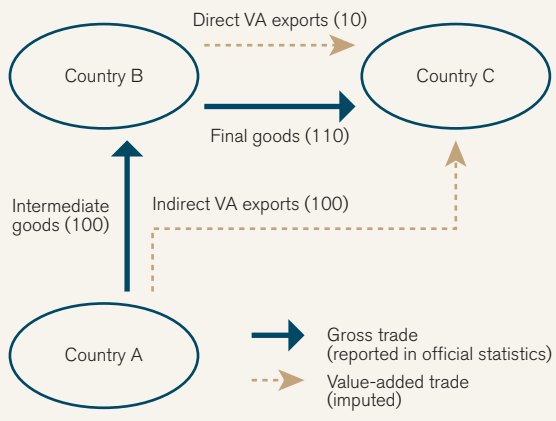
- the domestic value added directly absorbed by the importer, i.e. either consumed or invested in the domestic economy
- the domestic value added imported by the trade partner but re-exported to third countries.

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.

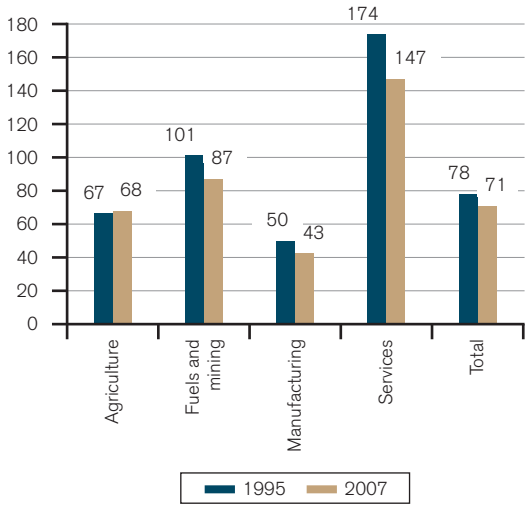
(iii) Patterns of trade in value-added terms

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.

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.

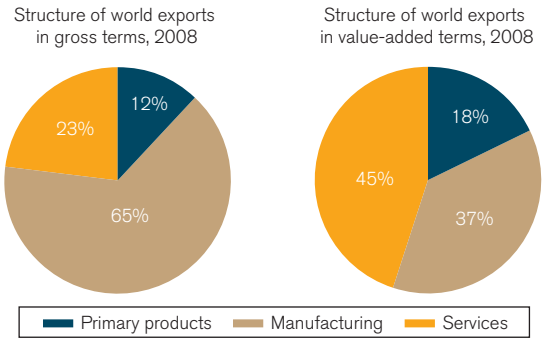
Indeed, the role of services is crucial when analysing trade in global value chains; they guarantee, for example, just-in-time delivery and sound financing of global production networks. Traditional trade statistics underestimate the contribution of services to international trade: as shown in Figure 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?

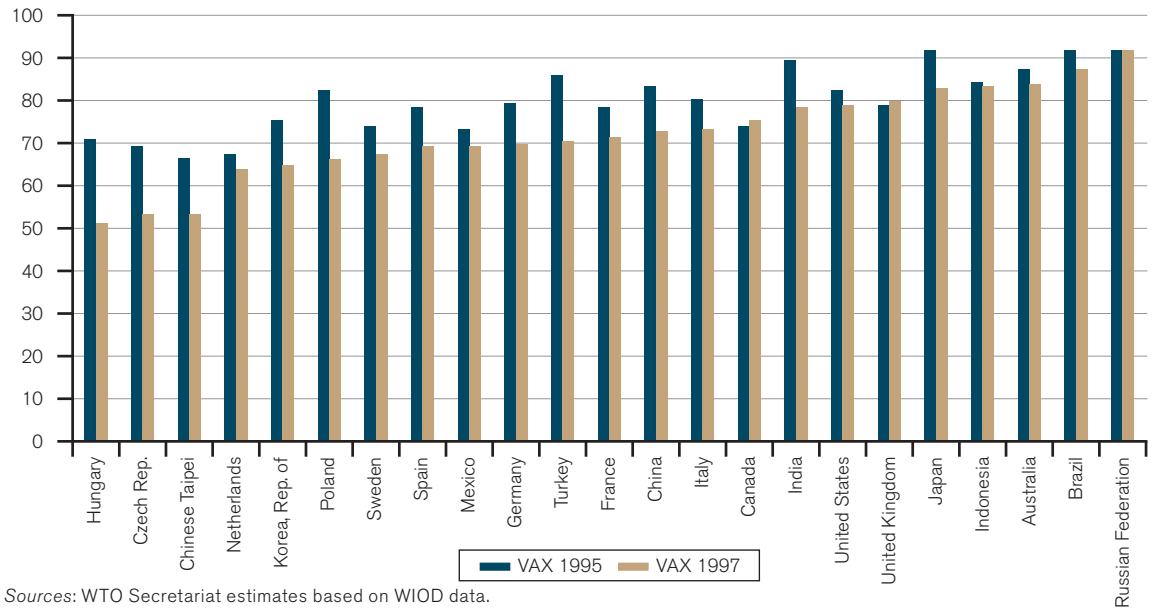
Not all countries are similarly engaged in global value chains, and significant differences can be observed between countries. Figure B.20 shows the ratio of value-added to gross exports for selected economies. It is important to mention that the WIOD input-output tables only partially take into account 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.19: **Sectoral contribution to total trade, gross and value-added measures, 2008** (percentage)



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.

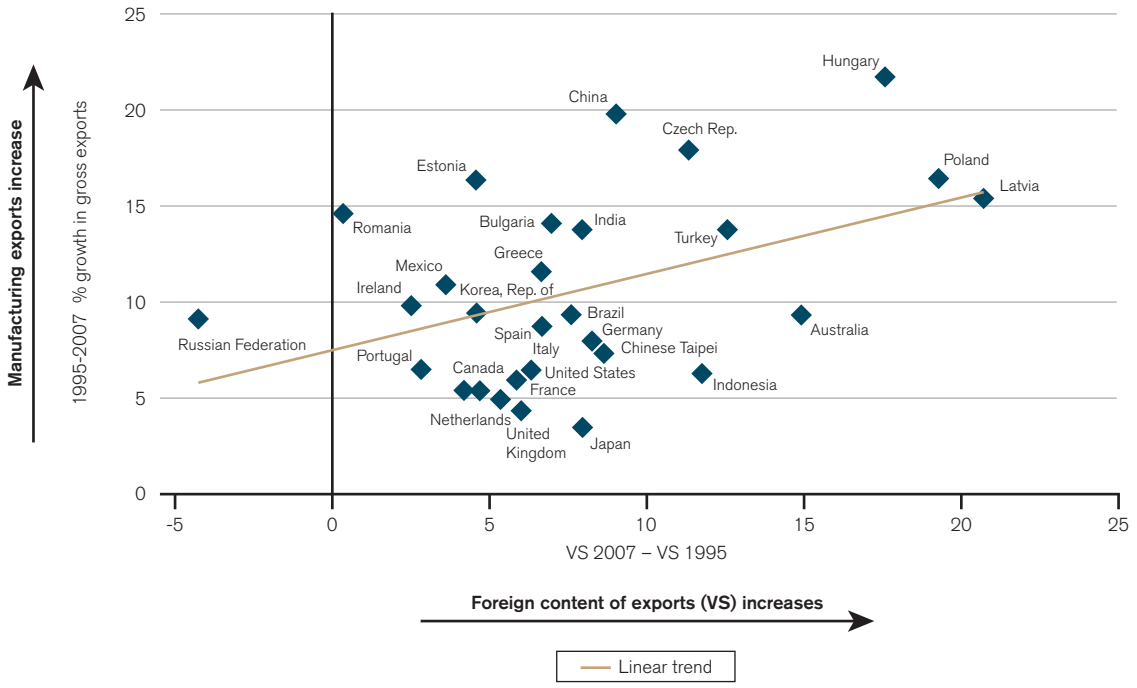
Are countries more or less specialized?

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.

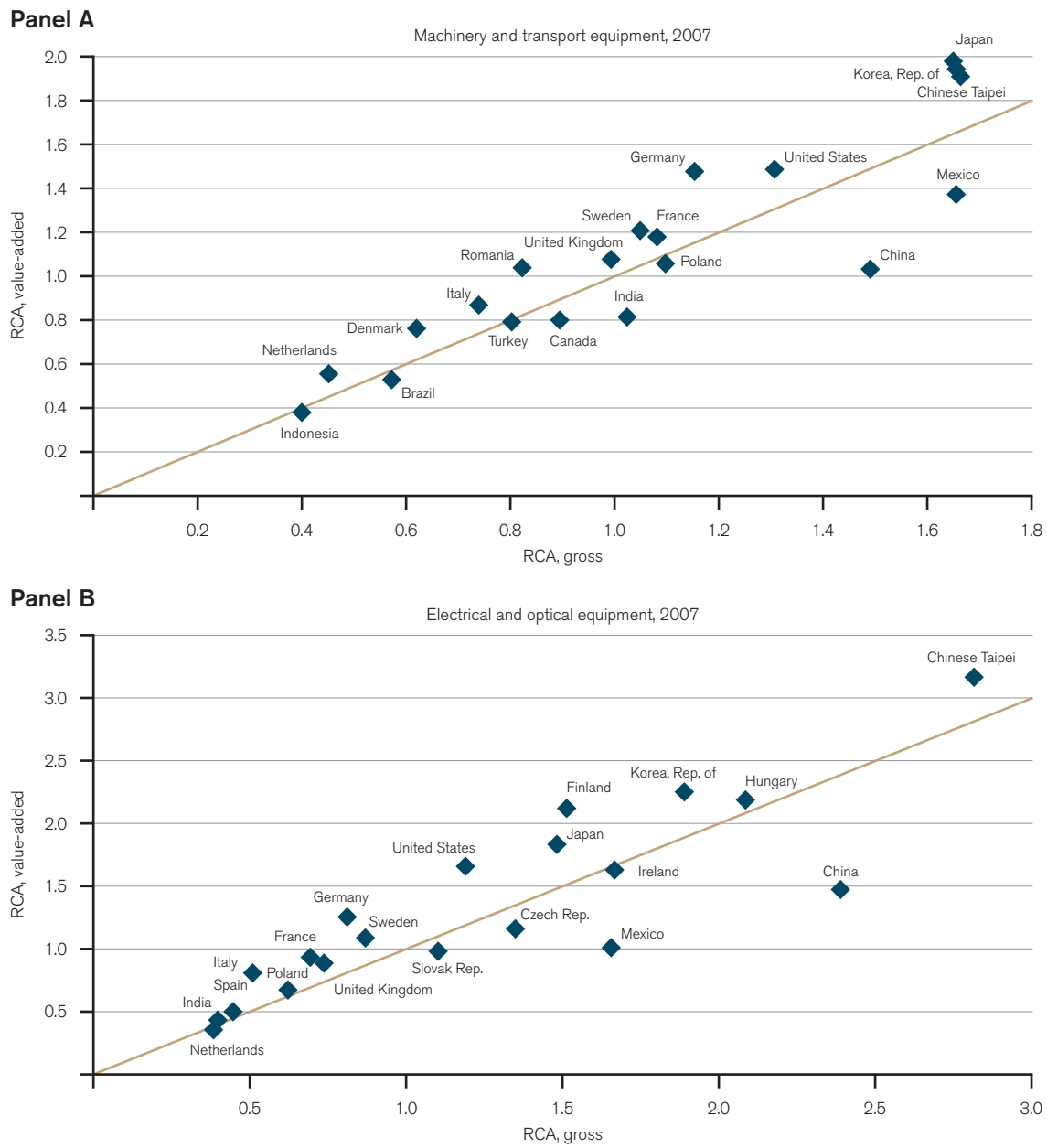
Figure B.23 shows six economies' bilateral trade balances, measured in gross and in value-added terms. Both goods and services are included, and the balances are shown with respect to five selected partners. While the calculation based on value-added does not change the total trade balance with the world, 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**



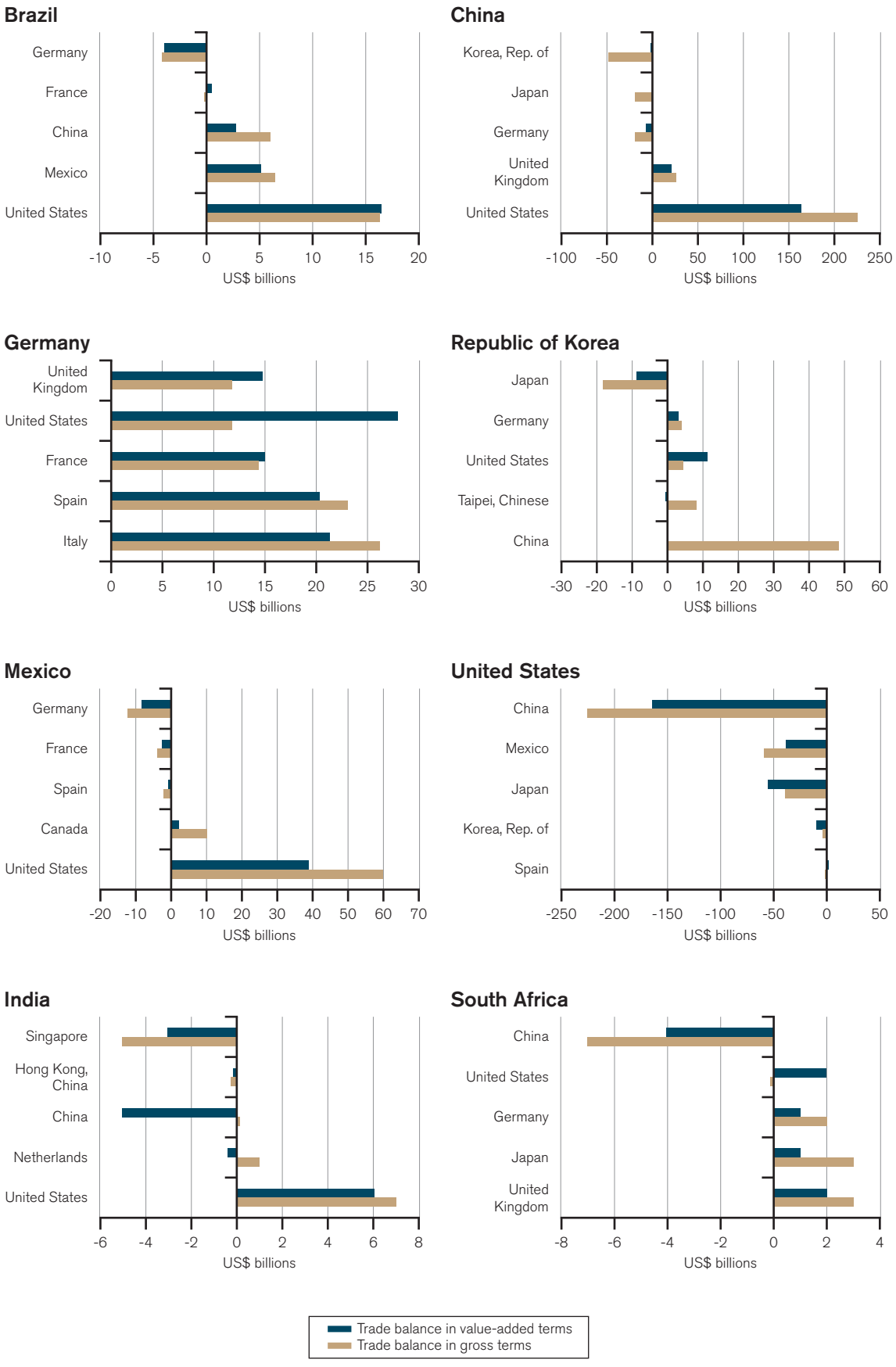
Sources: WTO Secretariat estimates based on WIOD data.

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**



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.

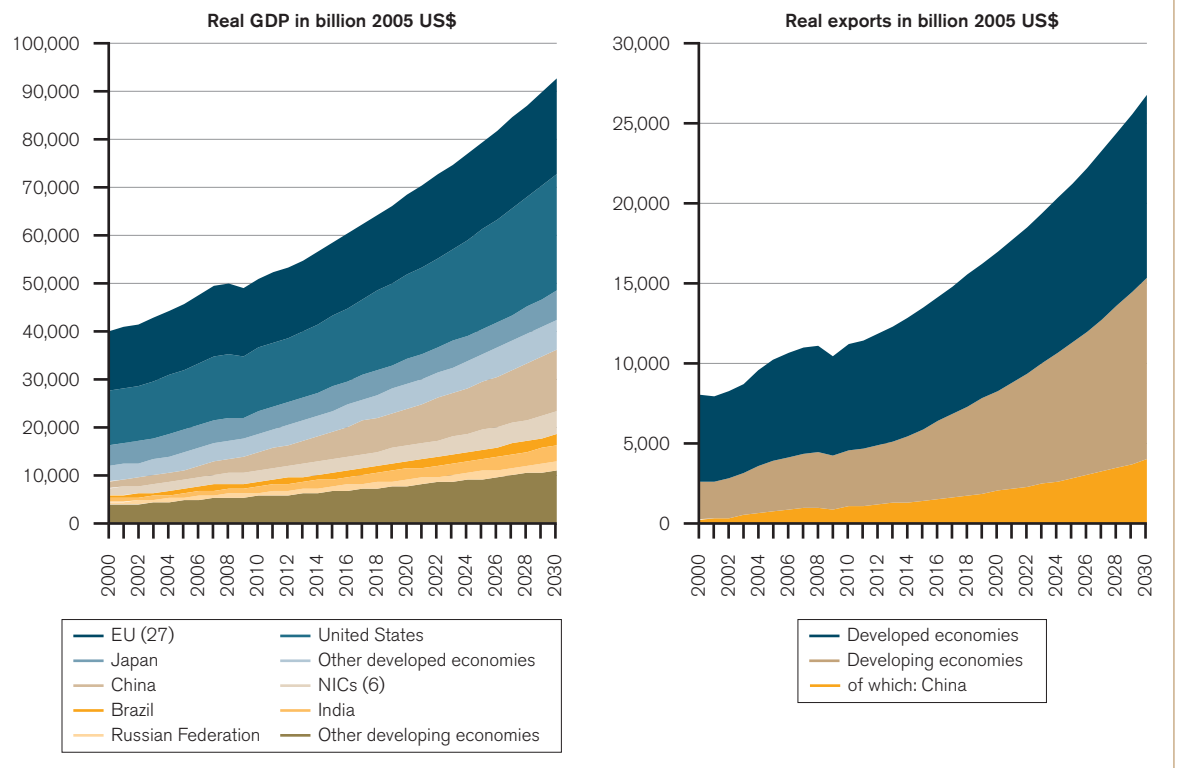
Figure B.24 shows simple projections of real (inflation-adjusted) GDP and real merchandise exports for developed and developing economies up to 2030 at 2005 prices and exchange rates. World GDP growth was estimated as the weighted average of actual and projected GDP growth rates for available countries 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]

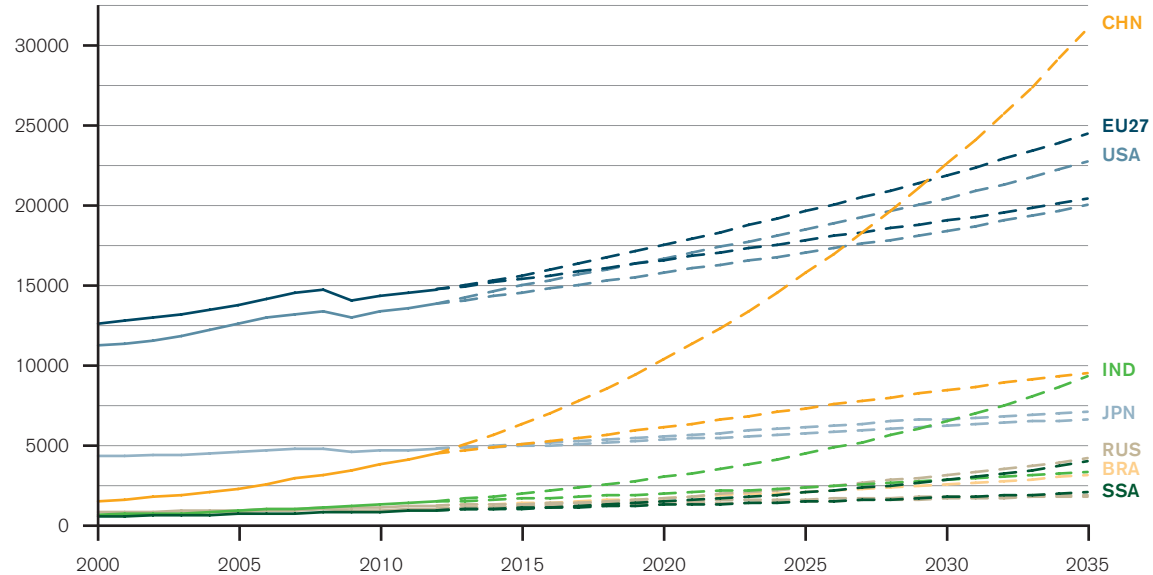
(i) Economic growth trajectories

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]

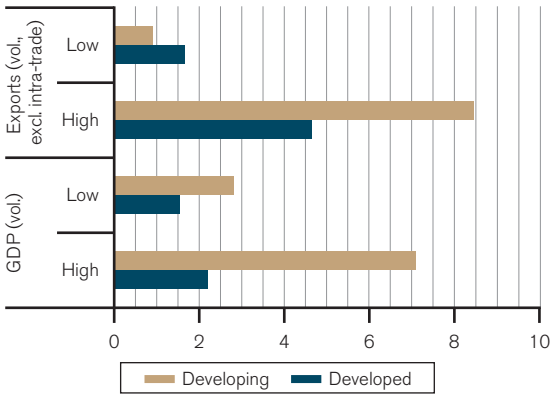
As noted in the overview in Box B.6, we consider trade policies, such as tariffs and services barriers, as well as broader transaction costs affecting goods (e.g. related to institutions, shipping charges and formalities). Again, rather stark trade cost scenarios have been chosen in order to create a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

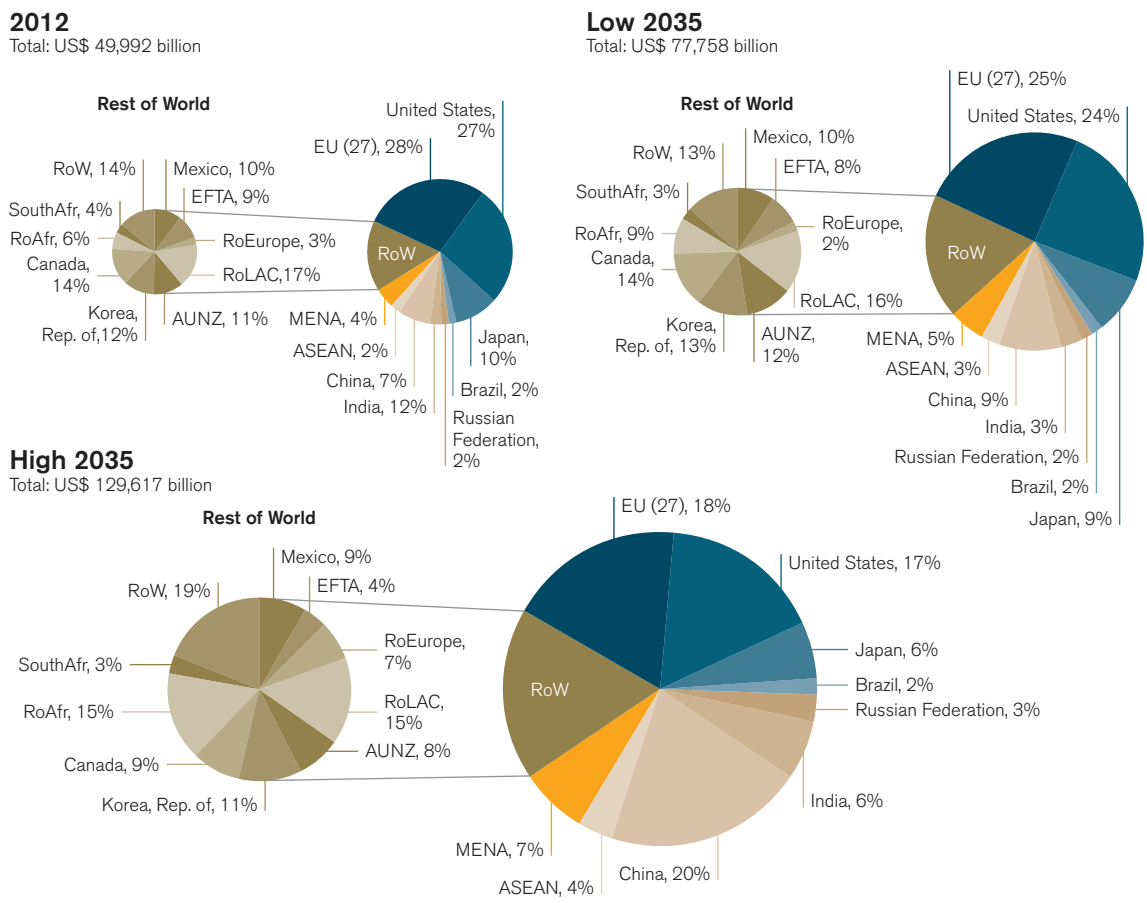
Figures B.27 and B.28 show to what extent regional/country shares in global GDP and exports may change compared with the current situation. The pie charts are proportional to the respective total value (taking the "high" scenario for 2035 as a point of reference). Clearly, the trend of new players emerging 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

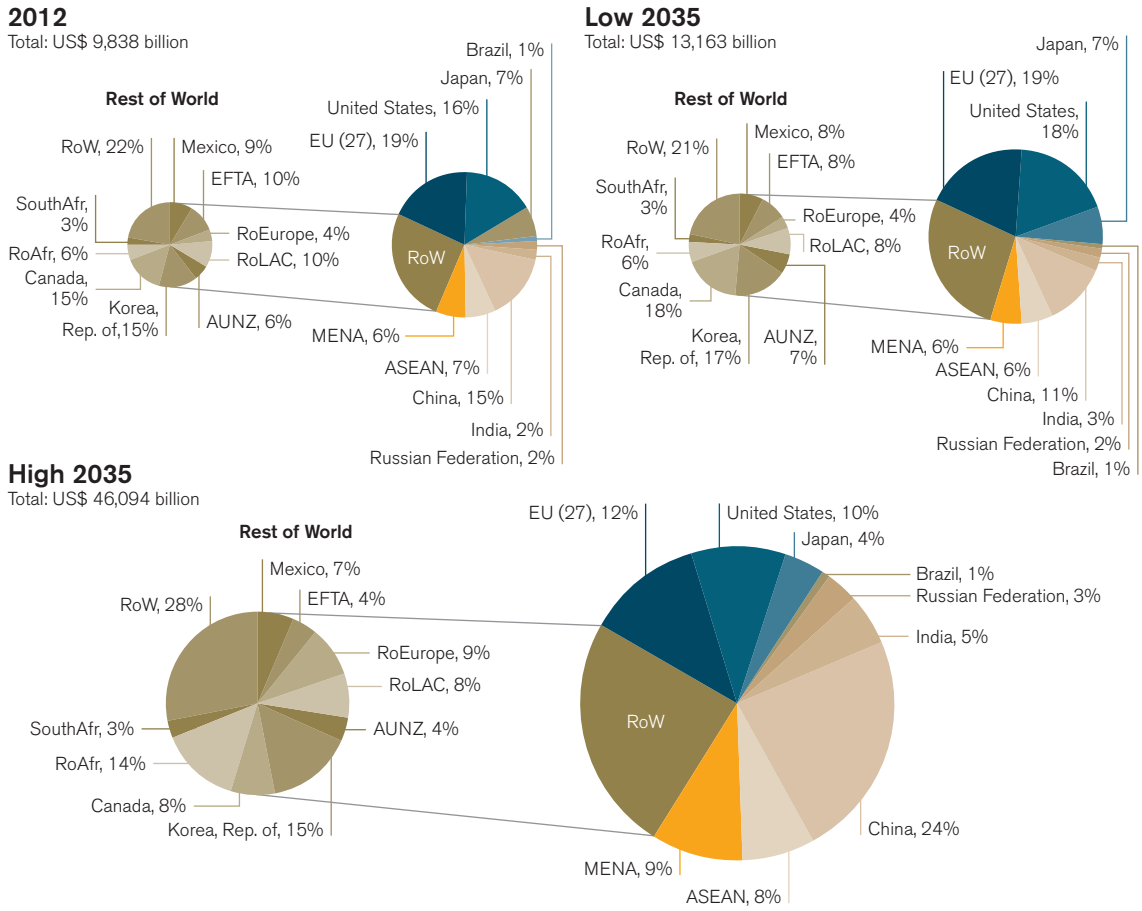
Figure B.27: **Country/regional shares in global GDP, constant 2004 prices** (percentage)



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)



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.

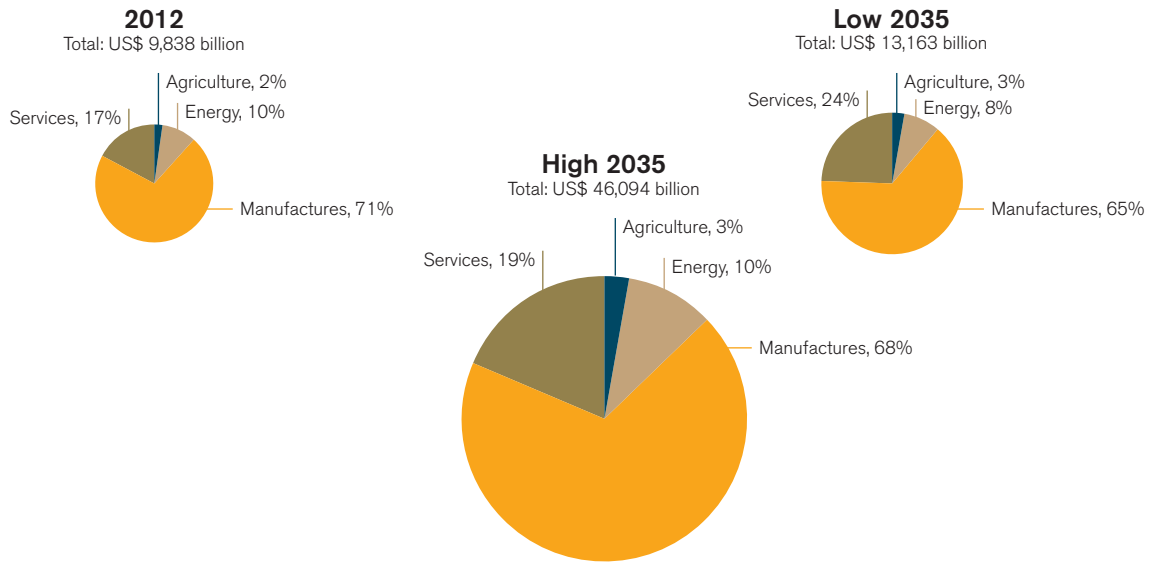
If the economic climate worsens and countries do not maintain their trade commitments, exports of manufactured goods would barely grow in the next two decades, with China and other developing countries losing market share. Despite the European Union and the United States achieving a higher market share 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.

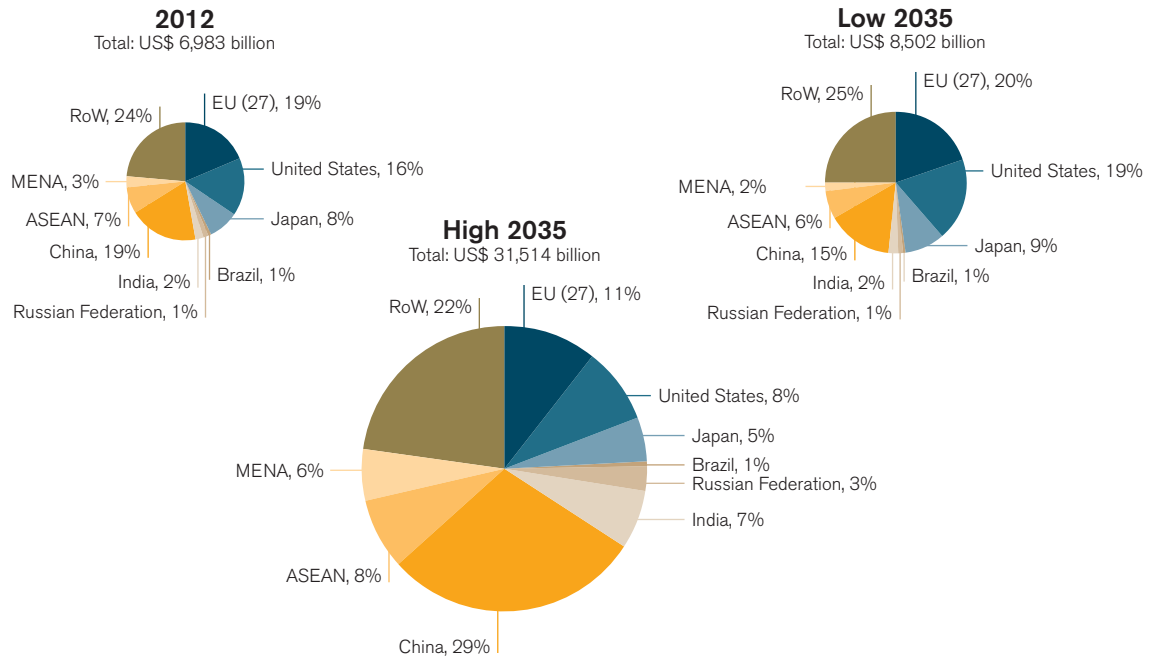
By contrast, under the "optimistic" scenario, these positions are inversed. Trade among developing countries would represent the largest part in global

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



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)



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

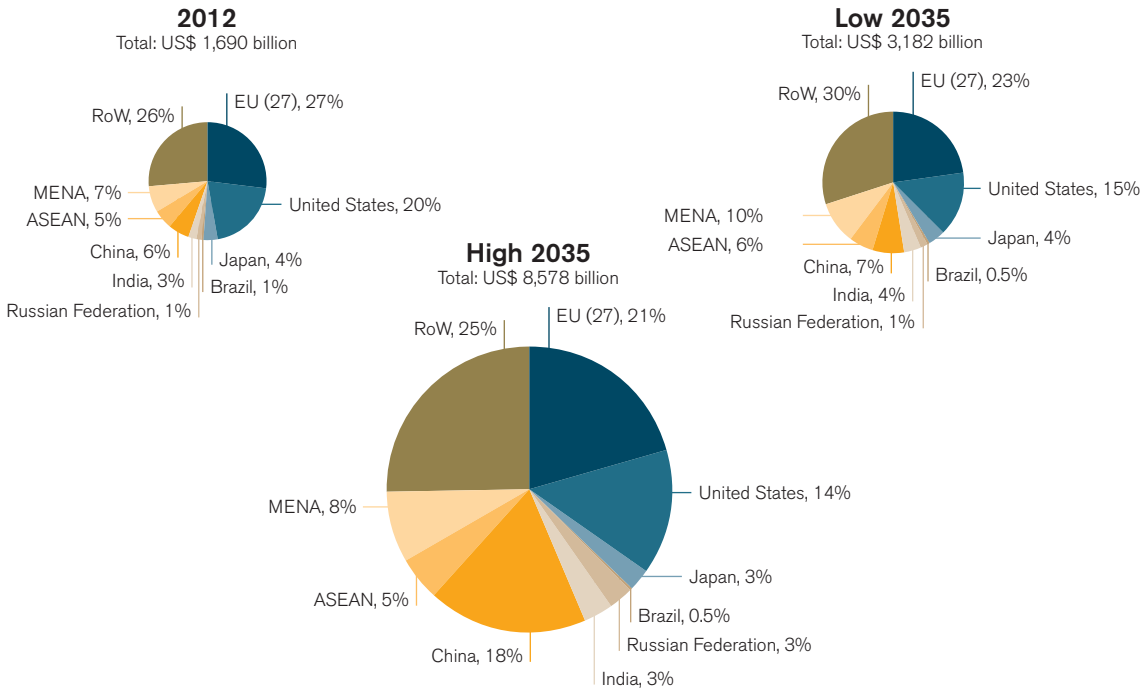
Note: MENA: Middle East and North Africa; RoW: Rest of the World.

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?

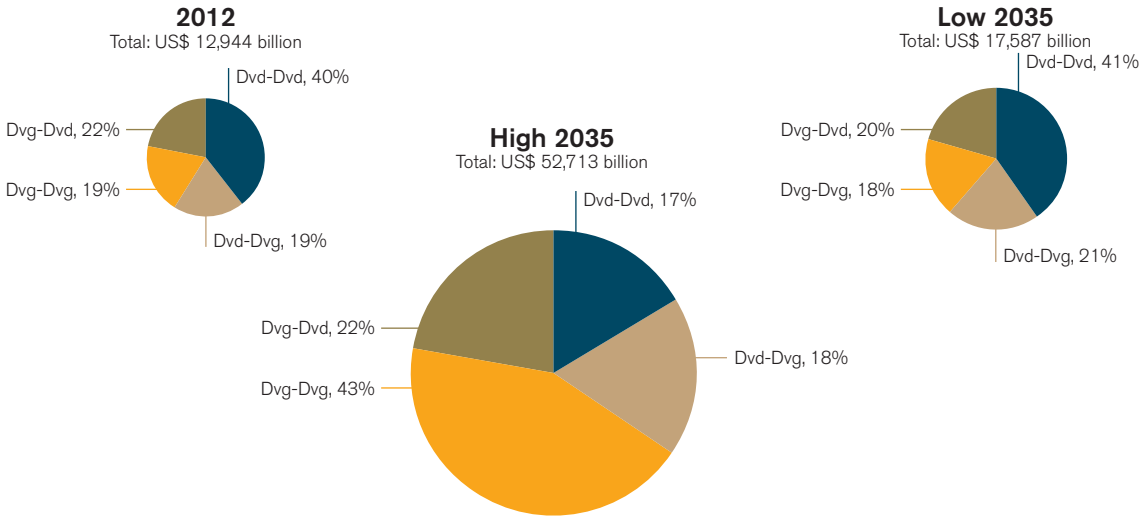
Section B.2(d) identified a trend towards further regionalization, particularly in Asia. The model simulations up to 2035 do not, however, necessarily reflect this. In fact, under an "optimistic" outlook quite the contrary seems to be the case. Trade within the major regional blocs is predicted to decline substantially compared with multilateral trade relationships

Figure B.31: **Country/regional shares in global exports of services (excluding intra-trade), constant 2004 prices**
(percentage)



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)

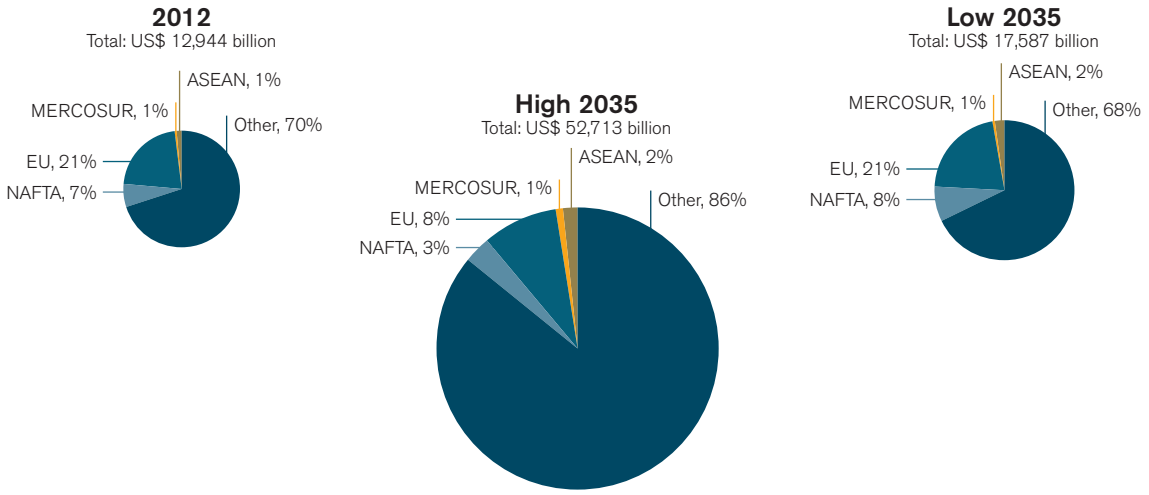


Sources: WTO Secretariat, based on Fontagné and Fouré (2013) and Fontagné et al. (2013).
Note: Dvd: developed; Dvg: developing.

(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)



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. $(\Delta T/T)/(\Delta Y/Y)$ where Δ 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

inter-industry as well as intra-industry trade, see Helpman and Krugman (1985).

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]**