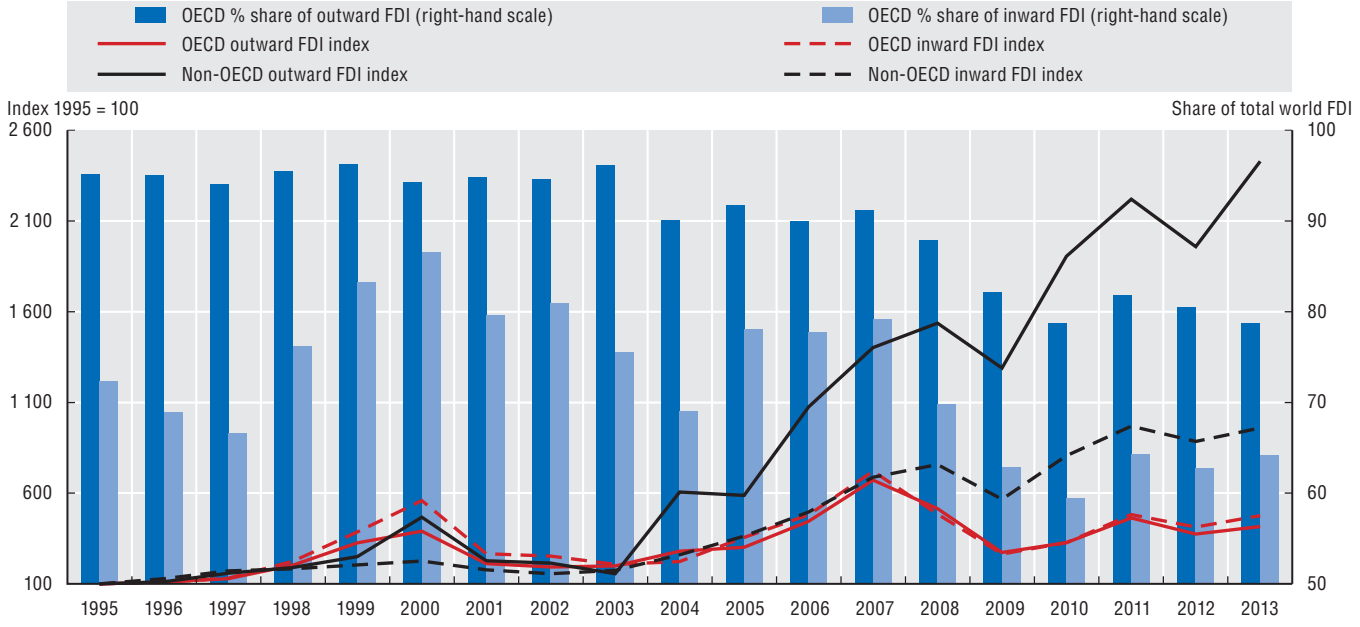
The new geography of innovation and growth

FDI shifting East

Foreign direct investment (FDI) may provide recipient countries with access to new technologies and generate employment opportunities and knowledge spillovers for domestic firms. Since the mid-1990s, foreign direct investment (FDI) has grown at a faster pace than international trade in goods and services. Although most flows still take place within the OECD, the landscape has changed dramatically in the past decade. Until 2003, around 95% of FDI outflows originated from OECD countries, but over the past decade their share has fallen below 80% owing to the spectacular rise in overseas investment by emerging economies. The impact of the 2008 crisis on FDI flows varied across countries. Non-OECD economies overall experienced a sharp reduction (about 20%) in inward and outward flows in 2009, followed by an immediate recovery. In the OECD area as a whole, inward and outward flows fell in 2008 and still remained short of pre-crisis levels in 2013, despite a smooth recovery in 2011. The OECD share of total world outward FDI decreased following 2011, while the share of inward flows remained relatively stable.

30. Trends in world foreign direct investment flows, 1995-2013



Source: IMF, *Balance of Payments Database*, July 2015. See chapter notes.

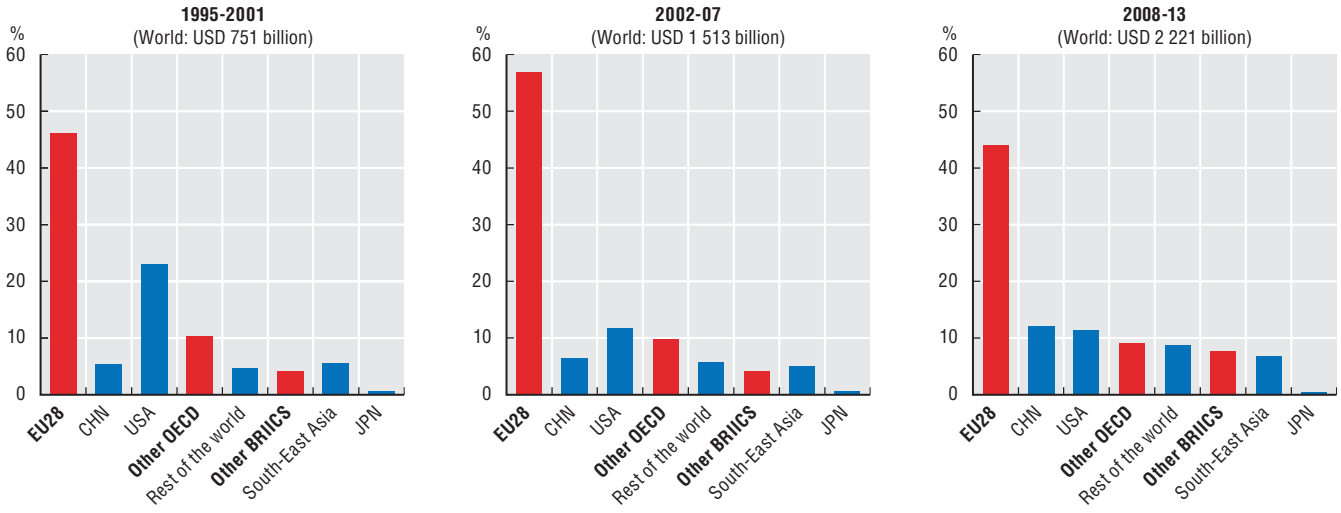
StatLink http://dx.doi.org/10.1787/888933273057

FDI shifting East

FDI flows worldwide have tripled over the past two decades. FDI inflows to Europe today still exceed those to the rest of the world, but FDI flows to China and the rest of Southeast Asia have risen from an average of about USD 83 billion a year in 1995-2001 to about USD 417 billion a year in 2008-13. China was the largest non-OECD FDI recipient in 2013, with a twofold increase in average annual inflows over 2008-13. Since 2009, the total amount of FDI inflows to China has exceeded those to the United States at about USD 350 billion against USD 300 billion in 2013. Rising global FDI outflows are still driven mostly by OECD countries, however FDI outflows from BRIICS increased substantially as they have become more integrated into the global economy. Overall, outward flows from BRIICS have more than tripled between 2002-07 and 2008-13.

31. Foreign direct investment inflows, yearly averages, 1995-2001, 2002-07 and 2008-13

As a percentage of world total FDI inflows

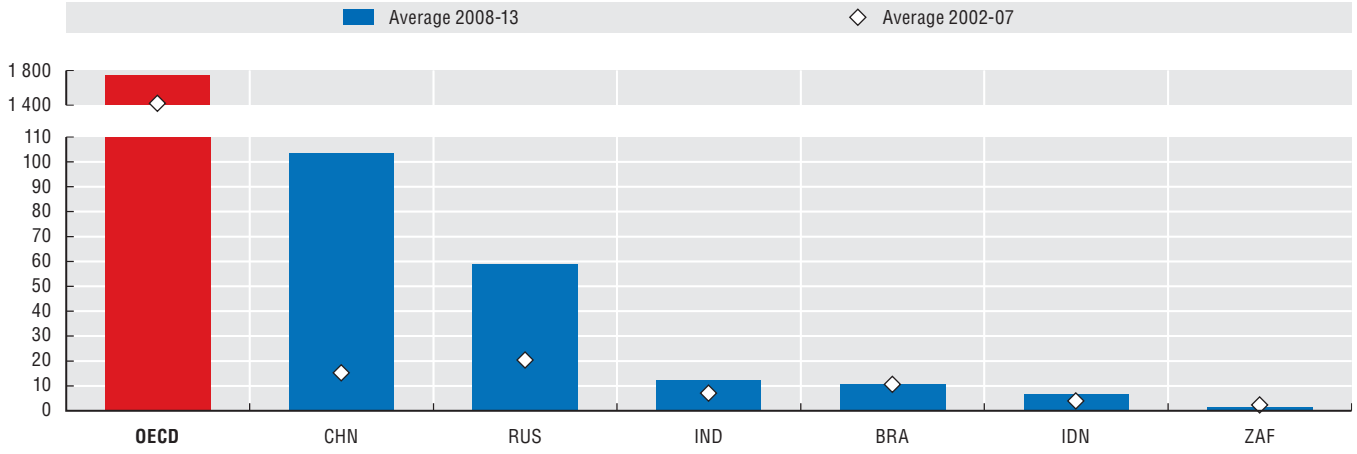


Source: IMF, *Balance of Payments Database*, July 2015. StatLink contains more data. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273065

32. Foreign direct investment, outward flows from BRIICS, 2002-07 and 2008-13

Billions of USD, current exchange rates, yearly averages



Source: IMF, *Balance of Payments Database*, July 2015. See chapter notes.

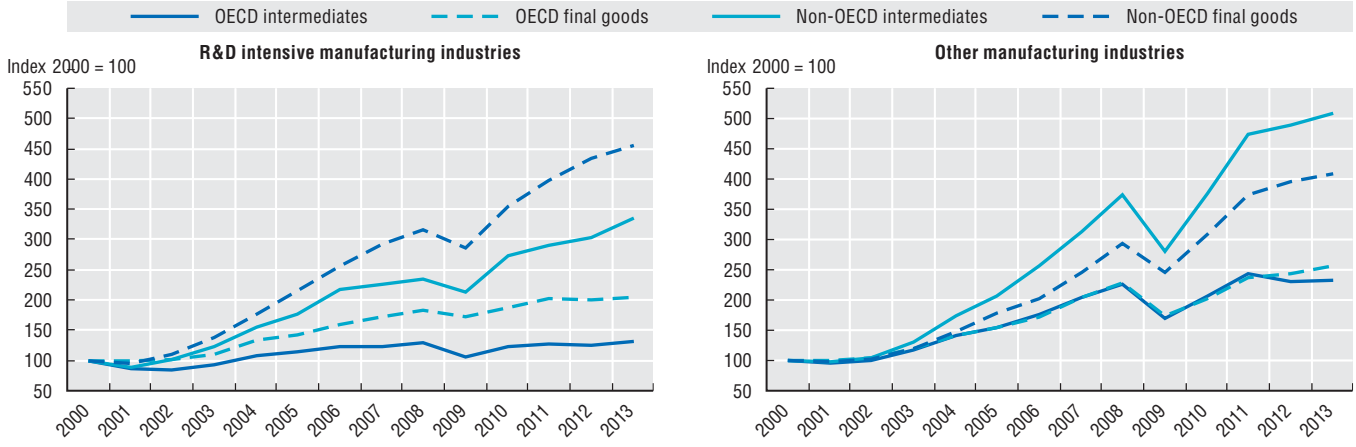
StatLink http://dx.doi.org/10.1787/888933273072

The fragmentation of production

Despite the 2009 slump in world trade triggered by the financial crisis, the value of global exports of manufactured goods increased nearly threefold between 2000 and 2013, with growth in exports from emerging economies easily outpacing that of OECD countries. This was particularly the case for R&D-intensive manufacturing industries, with the OECD member countries' share falling from 73% to 55% between 2000 and 2013, due mainly to a decline in exports of intermediate products from R&D-intensive industries. The sharp increase in global trade in intermediates since 2000 has been driven by the activities of non-OECD economies and, for R&D-intensive intermediate manufactured goods, the value of exports from non-OECD economies now outweighs exports for the total OECD area. While increasing international fragmentation of production over the last two decades has led overall to faster growth in trade for intermediates than final goods, this has not been the case for R&D-intensive manufacturing. A possible indication that, while fragmentation of production of upstream inputs has increased, R&D-intensive industries themselves tend to be more concentrated than other industries, and that the faster growth in the value of R&D-intensive final products reflects the increasing knowledge intensive services used in their production.

33. Exports of intermediate and final goods from R&D-intensive manufacturing industries, 2000-13

Index 2000 = 100



Source: OECD, *Bilateral Trade Database by Industry and End-use (BTDIxE)*, *http://oe.cd/btd*, June 2015. StatLink contains more data. See chapter notes.

StatLink *http://dx.doi.org/10.1787/888933273084*

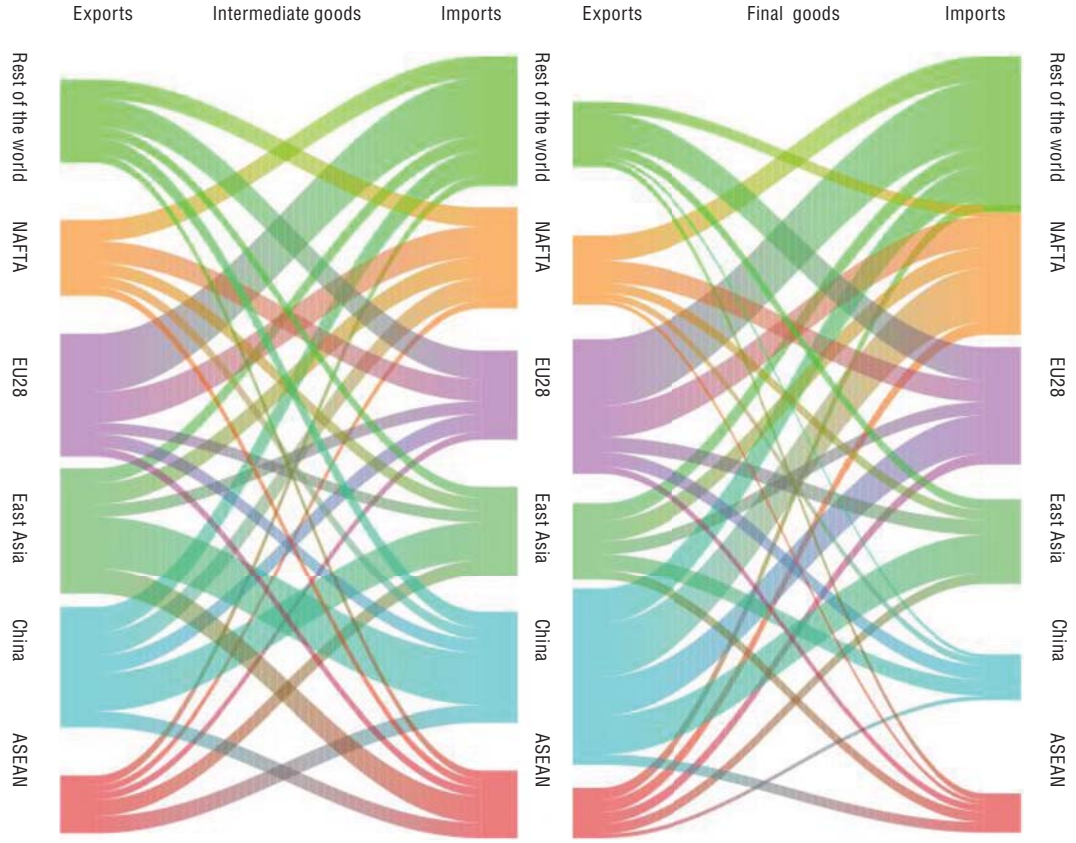
Measuring bilateral trade by industry and end use

Bilateral merchandise trade statistics are generally compiled at detailed product levels according to classifications such as the Harmonised System (HS) which are regularly revised to take account of changing technologies and other emerging needs. To estimate bilateral trade in goods by industry and end-use categories (i.e. intermediate, consumption and investment), standard conversion keys can be applied to map merchandise trade data to industry and end-use classifications. This approach is followed to generate the OECD's *Bilateral Trade Database by Industry and End-use* (BTDIxE). The conversion keys map each 6-digit HS product to the single industrial activity, defined according to the International Standard Industrial Classification of All Economic Activities (ISIC), which is considered as the typical source of the product. This approach may induce biases, as firms allocated to a particular ISIC industry according to principle activity may export a wide range of products. Furthermore, it may prove difficult to separate some final products into consumption and investment goods. For this reason, mixed end-use categories are used in BTDIxE to cover, for example, personal computers and passenger vehicles. Certain traded products allocated as final goods (e.g. shirts) may also be considered as intermediates when imported (e.g. to add brand labels). Despite these caveats, BTDIxE can provide insights into the international fragmentation of production by tracking flows of intermediate and final goods by detailed levels of industry. R&D-intensive industries are defined according to ISIC Rev. 4: Pharmaceuticals (Division 21), Computer, electronic and optical products (Division 26) and Air and spacecraft and related machinery (Group 303). For more information please refer to OECD, Bilateral Trade Database by Industry and End-use Category (BTDIxE), OECD, February 2015: *www.oecd.org/sti/ind/BTDIxE_2014.pdf*.

Fragmentation of production

International fragmentation of production has expanded rapidly over the last two decades with production processes in many economies specialising in specific tasks and activities. Tracking trade in manufactured goods separated into intermediate and final products can provide an overview of how these processes translate into inter-regional linkages. Visualisation of these networks reveals that the largest inter-regional flows of intermediate goods occur between East Asia, China and ASEAN economies, as "Factory Asia" consolidates its role in the global economy. China is the dominant supplier of manufactured final goods to East Asia, the European Union and North America. Meanwhile, the European Union and North America remain strong trading partners in both intermediate and final goods. For China and the European Union, the value of exports of final manufactured goods is greater than their intermediate imports, while for ASEAN, East Asia and North America, exports of final products are less than their imported intermediates. This reflects variations in the import content of exports to other regions and variations in imported intermediates to meet intra-regional demand for final goods. Indicators of Trade in Value Added (TiVA) provide deeper insights into these phenomena, but detailed gross bilateral trade by industry statistics can still highlight the magnitude and complexity of networks induced by global production.

34. Global manufacturing trade networks: Flows of intermediate and final manufactured goods by area, 2013



Source: OECD, *Bilateral Trade Database by Industry and End-use (BTDIxE)*, *http://oe.cd/btd*, June 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273094

How to read this figure

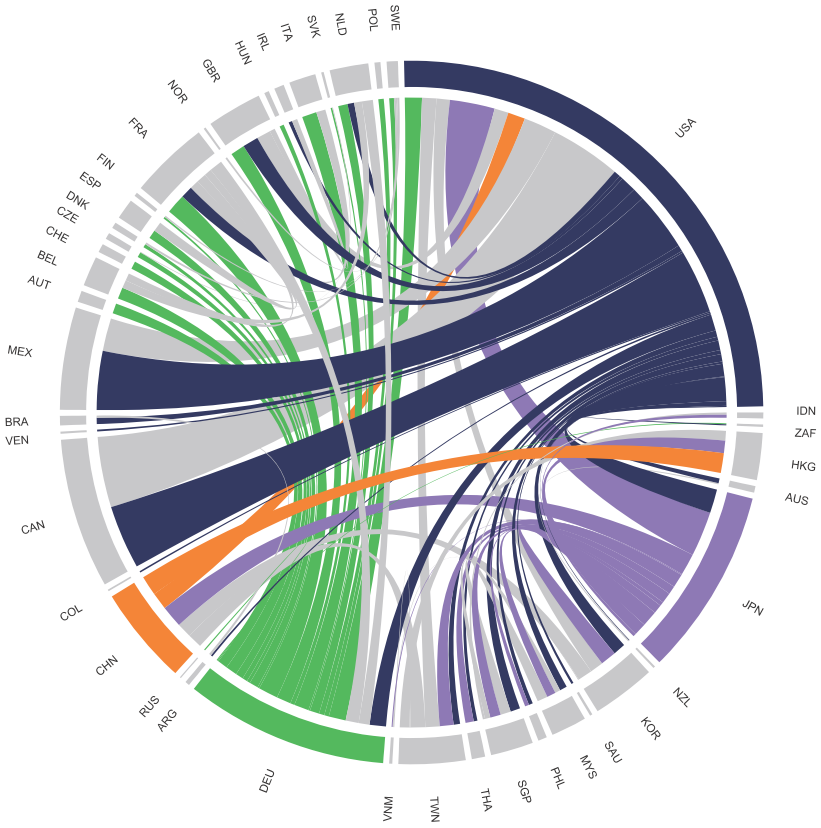
The figure is based on reported USD values for imports of manufactured goods by region. Only inter-regional flows are considered while intra-regional flows are excluded. The width of each connection is proportional to the size of the trade flow. For example, the EU28 to China connections represent about USD 100 billion, while the flow of final goods from China to NAFTA represents about USD 400 billion.

Global manufacturing networks

Comparing major bilateral flows of manufactured intermediate goods over the past 10-15 years can provide insights into the evolution of global value chains. Bilateral trade by industry and end-use data allow structural changes in international production networks to be highlighted across countries and regions. Each region has dominant suppliers providing manufactured parts and components to neighbouring economies. At the beginning of the 21st century, Germany, Japan and the United States were the major suppliers of intermediate goods. The United States reached beyond its North American partners to provide significant inputs into production in many European and East and Southeast Asian economies. Aside from being major suppliers to the United States, the main markets for intermediates produced in Germany and Japan were regional neighbours. In 2000, China was already a notable supplier of intermediates to the United States, on par with Germany but behind Japan.

35. Global manufacturing trade networks, major bilateral flows of manufactured intermediate goods, 2000

Selected flows by source country/region, USD at current prices



Source: OECD, *Bilateral Trade Database by Industry and End-use (BTDIxE)*, *http://oe.cd/btd*, June 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273106

How to read these figure

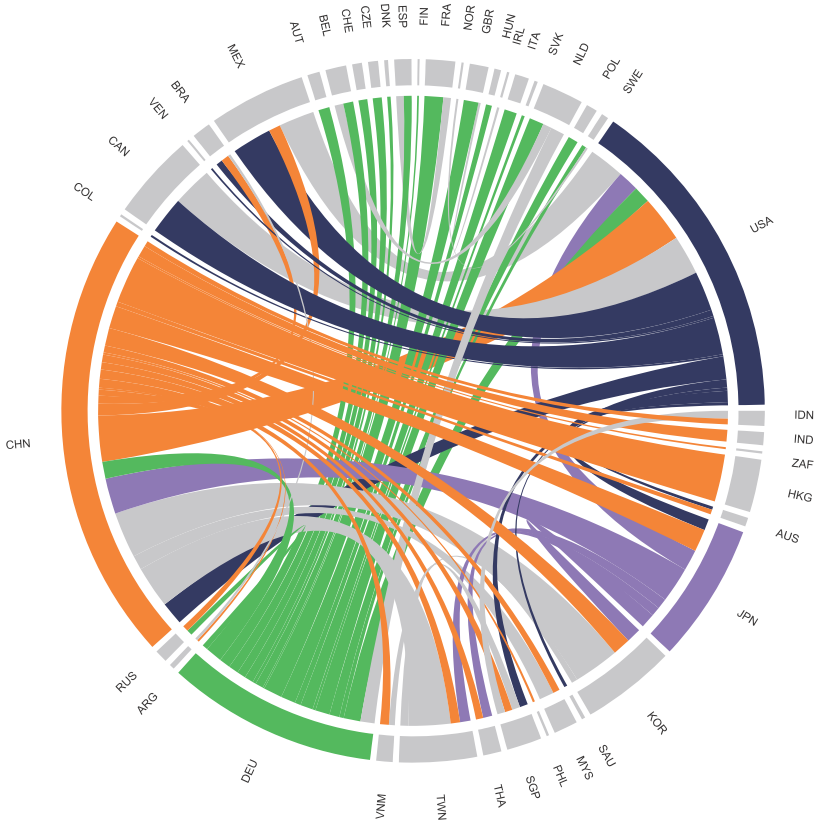
The flows are based on import data. For 2000, the flows shown represent partner country imports that are higher than USD 15 billion, or for which the partner share in a country's total imports is higher than 12%. Only significant import flows from China, Germany, Japan and the United States are highlighted with colour in these figures. For each country shown, the width of the arc on the circle is proportional to the sum of the export and import flows chosen according to the criteria.

Global manufacturing networks

By 2014, China had become a major supplier of manufactured intermediates for many countries, even surpassing Canada and Mexico to become the biggest supplier to the United States. As "Factory Asia" became more integrated and a major player in global production, China became a principal supplier of intermediates to many Southeast Asian economies further downstream in production chains, while remaining a major importer of intermediates from neighbouring economies (e.g. Japan, Korea, Chinese Taipei and Malaysia). Meanwhile, Japan and the United States have seen their relative role as global suppliers of intermediates reduced, while Germany has retained its role as the main supplier in Europe. These dynamic inter- and intra-regional movements of intermediate goods, representing about 50% of world trade in manufactures, highlight the importance of developing metrics to understand the true origins of final goods, and explain recent efforts to measure international Trade in Value Added (TiVA).

36. Global manufacturing trade networks, major bilateral flows of manufactured intermediate goods, 2014

Selected flows by source country/region, USD at current prices



Source: OECD, *Bilateral Trade Database by Industry and End-use (BTDIxE)*, *http://oe.cd/btd*, June 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273116

How to read this figure

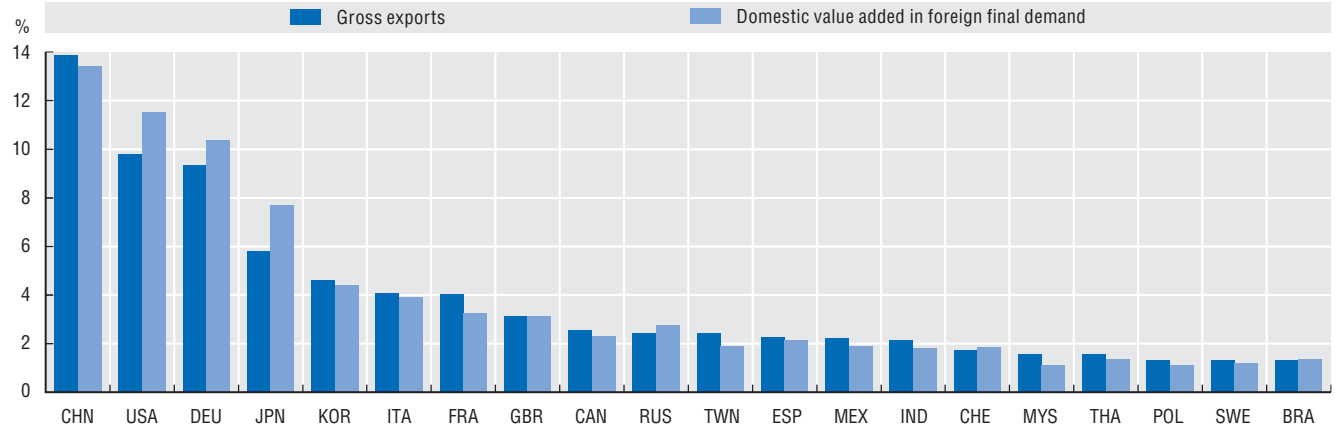
The flows are based on import data. For 2014, the flows shown represent partner country imports that are higher than USD 40 billion, or for which the partner share in a country's total imports is higher than 12%. Only significant import flows from China, Germany, Japan and the United States are highlighted with colour in these figures. For each country shown, the width of the arc on the circle is proportional to the sum of the export and import flows chosen according to the criteria.

Globalisation of manufacturing and services

The globalisation of production over the last 20 years has seen China emerge as the top exporter of manufactured goods. However, exporting firms not only import raw materials, parts and components to produce goods for export, but also purchase components from domestic producers which in turn import intermediate inputs for their production processes. It is therefore useful to supplement comparisons of gross exports with comparisons of international flows of value added. The latest release of the *Trade in Value Added (TiVA) Database* shows that China has also become the leading source of manufacturing value added for meeting foreign demand (i.e. when comparing economies' *domestic* value added from manufacturing activities embodied in *foreign* final demand). The United States, Germany and Japan have higher shares of global manufacturing exports when measured in value added terms owing to their exports of high-quality parts and components, which are subsequently embodied in other countries' exports.

37. Top 20 international suppliers of manufactured goods in gross export and value added terms, 2011

Percentage shares of total world manufactured goods



Source: OECD, *Trade in Value Added (TiVA) Database*, *http://oe.cd/tiva*, June 2015.

StatLink http://dx.doi.org/10.1787/888933273121

How to read this figure

The dark blue bars represent economies' shares of world gross exports of manufactured goods. Gross exports reflect traditional measures of exports which not only include value generated domestically, but also value originating from abroad embodied in imported intermediate goods and services used for production. The light blue bars represent economies' shares of domestic value added from manufacturing activities that meet foreign final demand. Often interpreted as "exports of value added" this indicator reveals the full upstream impact of final demand in foreign markets on domestic output.

What is the *Trade in Value Added (TiVA) Database?*

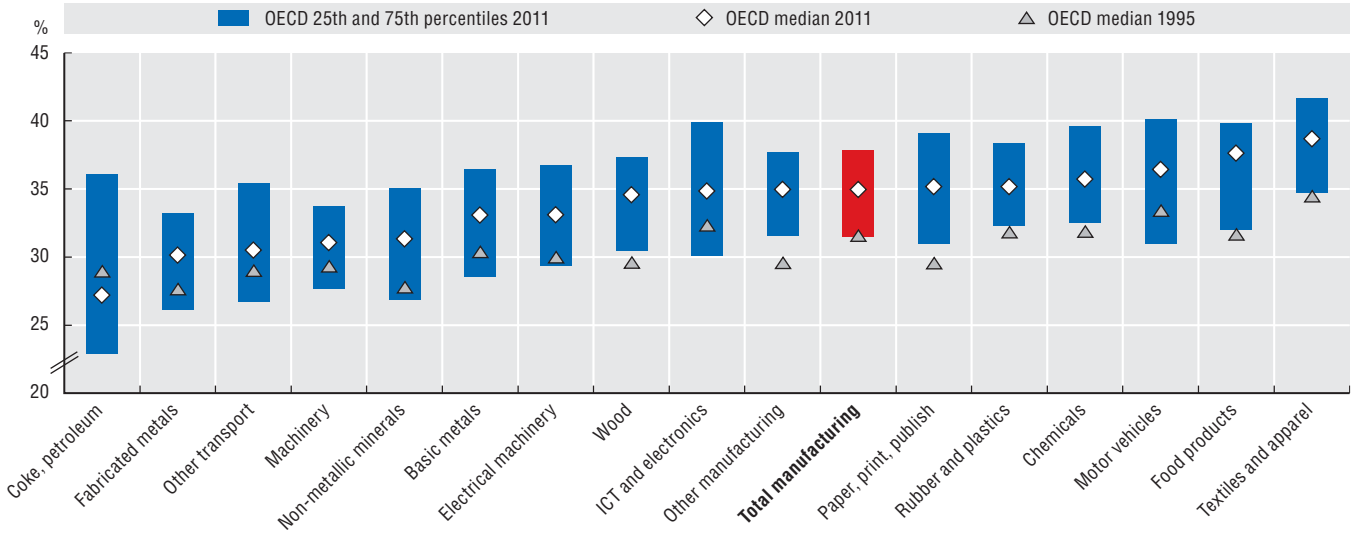
The *Trade in Value Added (TiVA) Database* facilitates analysis of global value chains by measuring trade in value added terms with a view to generating new insights about the commercial relations among economies and the process of value creation. The database is essentially a collection of indicators revealing the country and industry origins of value added embodied in exports of, and final demand for, goods and services. The calculations are based on the OECD's Inter-Country Input-Output (ICIO) tables (*http://oe.cd/icio*), which describe inter-industry and inter-country flows of goods and services for 34 industries and 61 countries, for the period 1995-2011, consistently linking production around the world to the final consumption of all countries. By applying country and industry-specific value added to output ratios it is possible to estimate value added content by industry and country along global production chains.

Globalisation of manufacturing and services

Services represent over 70% of GDP in most OECD countries, while reported exports of services account for just over one quarter of total OECD exports of goods and services. Accounting for the value added by services in the production of goods, however, shows that service sectors play a much more significant role in international trade. On average, the service value added content of total OECD gross exports is about 54% and exceeds 60% in some countries, such as France and the United Kingdom. The TiVA database provides insights into the role of services in global value chains by revealing, for example, the extent to which exports of manufactured goods depend on inputs from various service activities required to produce them. In 2011, over one third of the value of OECD exports of manufactured goods could be attributed to business sector services, having risen steadily since 1995. Business sector services content, which can be domestic or foreign in origin, varies across manufacturing industries and countries, but is generally within the range of 25% to 40% for OECD countries. Notable increases in business sector services content since 1995 are apparent across nearly all manufacturing sectors.

38. Business sector services value added in OECD manufacturing exports, by industry, 1995 and 2011

Range of values as a percentage of gross exports



Source: OECD, *Trade in Value Added (TiVA) Database*, *http://oe.cd/tiva*, June 2015. StatLink contains more data. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273134

How to read this figure

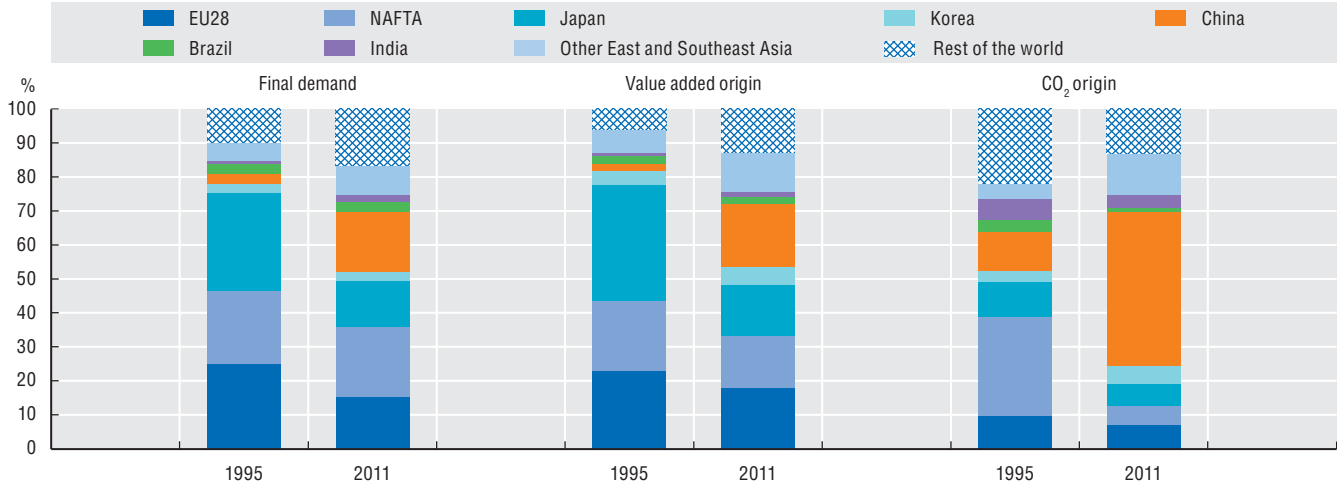
Business sector services value added content of manufacturing exports reflects the value of services, such as wholesale, transport and communications, finance and insurance, IT and other business services, that are required as inputs for the domestic production of manufactured goods. The diamonds represent the median business sector services content of manufactured exports of the 34 OECD countries and the blue bars represent the inter-quartile range (i.e. between the 25th and 75th percentiles), providing an indication of dispersion. In general, half of the OECD economies differ by only 5 to 10 percentage points. The range in shares across OECD countries is relatively narrow for manufacturing of machinery (ISIC Division 29), but relatively wide for ICT and electronic equipment (30, 32 and 33).

Sectoral value chains

A consequence of global value chains (GVCs) is that patterns of regional demand for certain products can appear very different from patterns of regional production. Comparing the locations of final demand for products with the origins of value added generated, as well as the carbon dioxide emitted, along GVCs can provide insights into global industry structures. Three sectors with high foreign value added shares in OECD final demand are *Textiles and apparel*, *Computer, electronic and optical equipment* and *Motor vehicles* (see Section 5.9). For these products the majority of global final demand comes from OECD countries, even though this share has declined significantly since 1995. Much of the value added embodied in these products is being generated by OECD countries although this share has also declined. Meanwhile, the share of carbon dioxide emitted by OECD countries has declined compared to non-OECD economies such as India, China and other East and Southeast Asian countries that experienced significant increases in shares between 1995 and 2011.

39. Global demand for Computer, electronic and optical equipment, percentage shares of total, 1995 and 2011

By country and region of final demand, origin of value added and origin of carbon emissions



Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*, June 2015; and International Energy Agency (2014), *CO_2 Emissions from Fuel Combustion 2014*, *http://oe.cd/io-co2*; StatLink contains more data. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273142

How to read these figures

The figures display countries' and regions' share of global demand for three types of manufactured goods with high foreign value added content, as well as the shares of the origin of value added and CO_2 emissions generated along GVCs to produce these final goods. The value added and emissions embodied in the final products come not only from the associated industry (such as Motor vehicles), but also from any upstream industrial activity. Comparing the bars of 1995 and 2011 clearly shows a global shift towards emerging economies in all aspects of production and demand.

Extending the Trade in Value Added indicators with emissions data

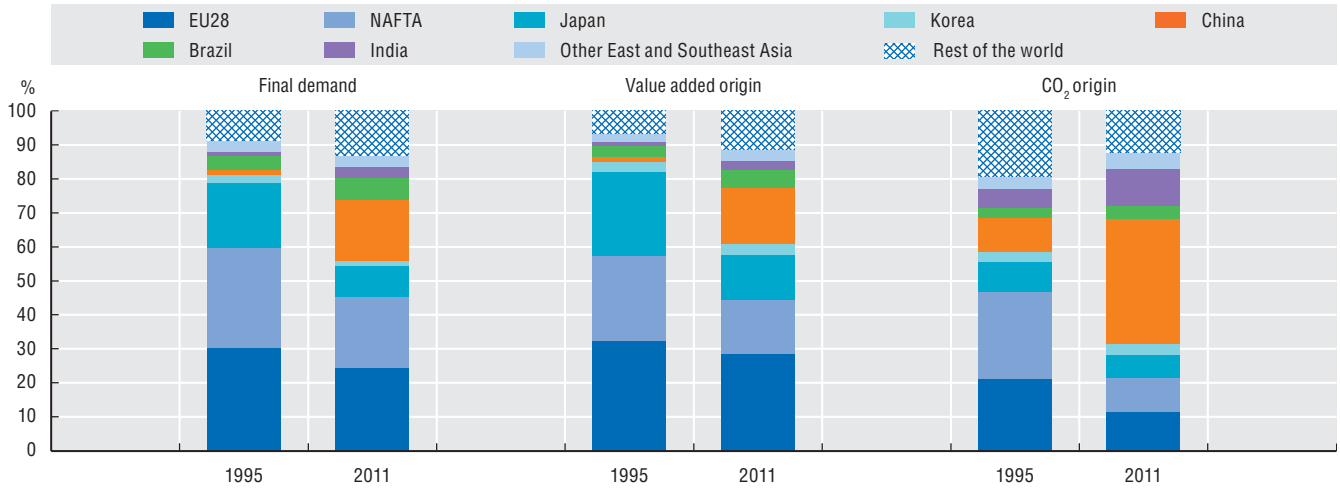
The approach for calculating pollution (CO_2 emissions) impacts along GVCs is the same as the approach underlying estimation of value added along GVCs. Instead of applying country and industry-specific value added to output ratios, country and industry-specific CO_2 emissions to output ratios are used. A key challenge in producing such estimates is allocating the International Energy Agency's CO_2 emissions from fuel combustion data (*www.iea.org/statistics/topics/co2emissions/*) to the ISIC Rev. 3-based industries used in the Inter-Country Input-Output (ICIO) tables. Some of the categories of CO_2 emitters in the reported emissions data do not correspond directly to particular ISIC activities (e.g. road emissions).

Sectoral value chains

More than half the global demand for *Computer, electronic and optical equipment* and *Motor vehicles*, came from OECD countries in 2011, while slightly more than half of global demand for *Textiles and apparel* came from non-OECD economies. When considering the origin of value added, the regional distribution for *Computer, electronic and optical equipment* is similar to that for final demand. For motor vehicles the European Union and Japan have higher shares of global value added origin compared to final demand, while for *Textiles and apparel* China is the dominant source of value added, with the OECD having very low shares of global value added compared to final demand. The emergence of China as a principal source of CO_2 emissions is evident across all three sectors shown.

40. Global demand for Motor vehicles, percentage shares of total, 1995 and 2011

By country and region of final demand, origin of value added and origin of carbon emissions

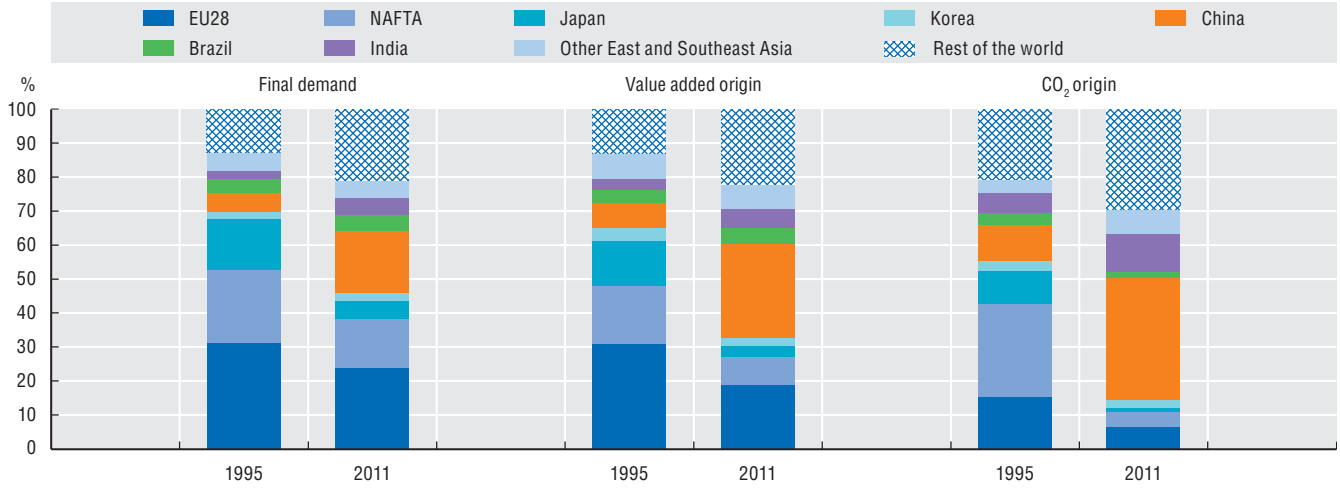


Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*, June 2015; and International Energy Agency (2014), *CO_2 Emissions from Fuel Combustion 2014*, *http://oe.cd/io-co2*. StatLink contains more data. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273150

41. Global demand for Textiles and apparel, percentage shares of total, 1995 and 2011

By country and region of final demand, origin of value added and origin of carbon emissions



Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*, June 2015; and International Energy Agency (2014), *CO_2 Emissions from Fuel Combustion 2014*, *http://oe.cd/io-co2*. StatLink contains more data. See chapter notes.

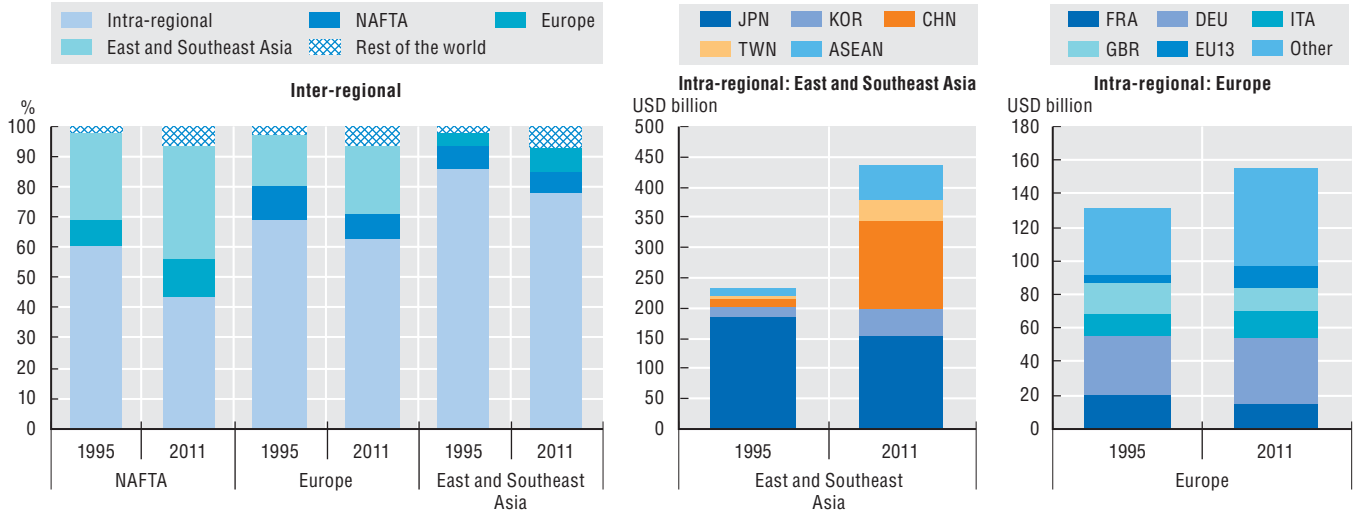
StatLink http://dx.doi.org/10.1787/888933273162

Regional value chains

Tracking the origins of value added in final demand for goods and services around the world can reveal the nature of *inter*-regional and *intra*-regional linkages and how they have changed over time. The *Trade in Value Added (TiVA) Database* allows analysis of flows of value added between and within three major regions: East and Southeast Asia, Europe and North America (NAFTA). Analysis of demand for *Computer, electronic and optical equipment*, *Motor vehicles* and *Textiles and apparel* reveals that the majority of regional final demand is met by intra-regional production. However, in general, intra-regional shares of GVCs have fallen since 1995, notably for *Computer, electronic and optical equipment*, where, for example, more than half of NAFTA demand in 2011 was met by value added generated in other regions. The intra-regional shares of GVCs are highest for East and Southeast Asia – reaching more than 80% for *Motor vehicles* and *Textiles and apparel* – due in part to high levels of domestic value added to meet domestic demand (e.g. China) and the presence of strong intra-regional production networks. NAFTA's reliance on other regions to meet demand has increased significantly in many industries. Although demand for *Motor vehicles* tends to be met mostly by intra-regional activities, East and Southeast Asia and Europe nevertheless made significant inroads in meeting NAFTA demand accounting for about one third of value added content by 2011.

42. Regional demand for Computer, electronic and optical equipment, 1995 and 2011

By country or region of value added origin



Source: OECD, *Trade in Value Added (TiVA) Database*, *http://oe.cd/tiva*, June 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273179

How to read these figures

The left-hand figure shows the distribution of value added origin by demand region with the Rest of the world included for completeness. The lighter bars represent intra-regional value added (i.e. the share of value added originating from the same region where the goods are eventually consumed), enabling comparisons across East and Southeast Asia, Europe and NAFTA. The two graphs on the right present intra-regional demand for East and Southeast Asia and Europe, revealing the value added contributions of selected countries within these regions. Note that intra-regional flows include domestic value added embodied in domestic demand.

Measuring final demand by origin of value added

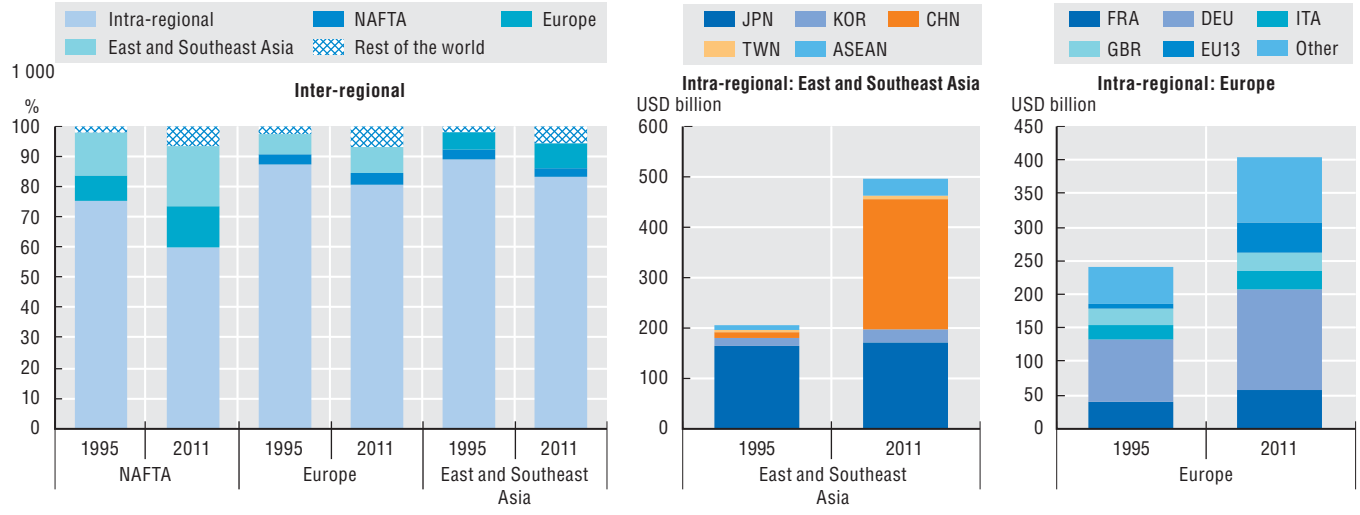
There are four factors to consider when decomposing final demand by origin of value added: the final demand country/region, the final demand industry (or product group), the country/region origin of value added and the industry origin of value added. For this analysis, the industries considered represent final demand industries with value added content originating from all industries. In other words, value added embodied in final products may also come from other upstream industries (a demand perspective). An alternative approach is to consider value added originating from a particular industry to meet final demand for all products (e.g. output from the *Computer, electronic and optical equipment industry* can be found in a range of final products). The TiVA database provides tools that allow analysis from both perspectives.

Regional value chains

Dynamics of value added flows vary within regions. Significant increases in East and Southeast Asian demand for manufactured products between 1995 and 2011 mainly embodied Chinese value added, although the share of value added from ASEAN countries also increased for *Computer, electronic and optical equipment* and *Textiles and apparel*. While domestic value added in domestic demand makes up a significant share of intra-regional flows, the proportion can vary across industries. For example, China's large share for *Motor vehicles* reflects production to meet domestic demand, while a sizeable proportion of Chinese value added for *Computer, electronic and optical equipment* and *Textiles and apparel* reflects demand from other countries within the region. Within Europe, Germany still dominates value chains in the *Motor vehicles* industry, although the younger EU members (EU13) have increased their share. Italy remains the largest source of European value added meeting European demand for *Textiles and apparel*.

43. Regional demand for Motor vehicles, 1995 and 2011

By country or region of value added origin

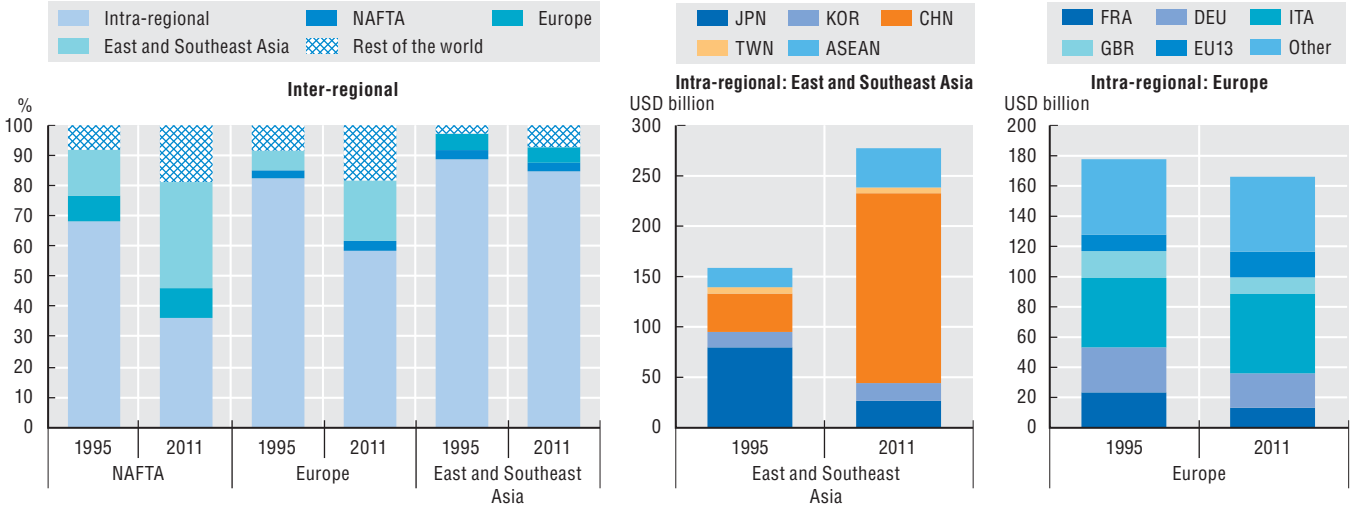


Source: OECD, *Trade in Value Added (TiVA) Database*, *http://oe.cd/tiva*, June 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273187

44. Regional demand for Textiles and apparel, 1995 and 2011

By country or region of value added origin



Source: OECD, *Trade in Value Added (TiVA) Database*, *http://oe.cd/tiva*, June 2015. See chapter notes.

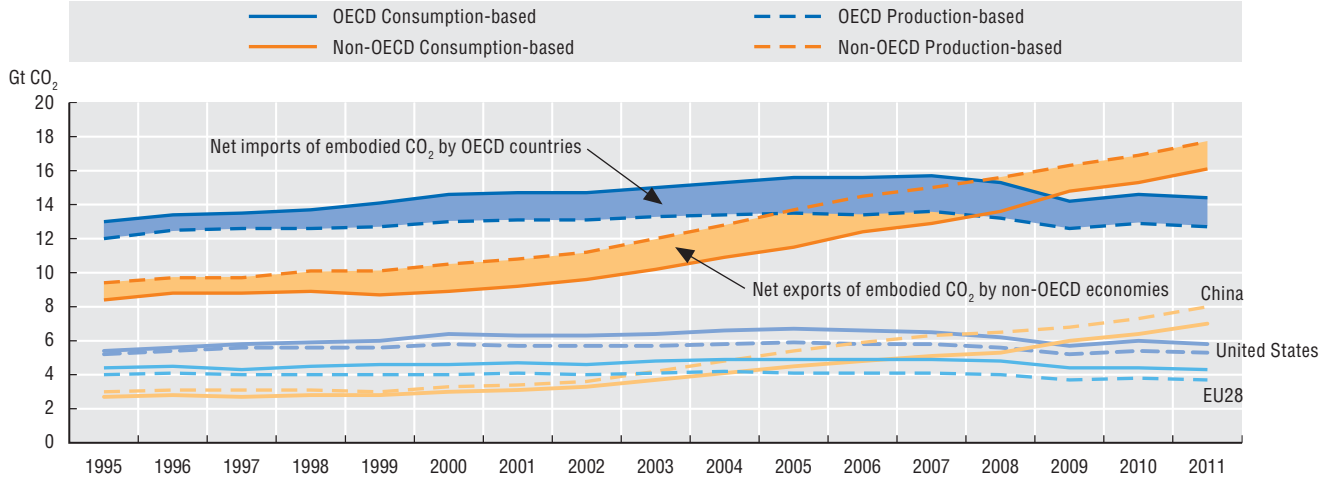
StatLink http://dx.doi.org/10.1787/888933273195

Sustainable production chains

The increasing fragmentation of global production requires the examination of CO_2 emissions from a consumption, as opposed to an exclusively production, perspective. Rather than allocating emissions to the country where they are produced, the consumption approach allocates them to the country in which the goods and services that embody the emissions are eventually consumed. In the OECD area, consumption-based emissions have been significantly higher than production-based ones, with large variations across countries. The top three countries and regions in total consumption-based as well as production-based emissions in 2011 were China, the United States and the European Union. The EU28 countries have decreased both production and consumption-based emissions since 1995, while there has been a significant (2.5 times) increase in China and a slight increase in consumption-based emissions in the United States. China is now the country with the single highest absolute emissions from a consumption and production perspective. In per capita terms, however, although Chinese per capita emissions have doubled since 1995, US consumption-based emissions remain almost four times higher.

45. Trends in production- and consumption-based CO_2 emissions, 1995-2011

CO_2 emissions from fuel combustion, Gigatonnes (Gt)



Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*, June 2015; and International Energy Agency (2014), *CO_2 Emissions from Fuel Combustion 2014*, *http://oe.cd/io-co2*.

StatLink http://dx.doi.org/10.1787/888933273201

How to estimate imports and exports of CO_2 and embodied energy

The OECD's Inter-country Input-Output (ICIO) tables can be combined with the IEA's emission and energy statistics (CO_2 emissions from fuel-combustion and energy balances) to estimate international transfers of embodied CO_2 emissions as well as embodied energy. Energy technologies analysed here are selected low-carbon renewables (geothermal, solar thermal, solar photovoltaics, tide, wave and ocean technologies, and wind power), as well as total energy used for electricity and heat generation. The results highlight differences among countries in production-based and consumption-based emissions, as well as in the share of low-carbon renewables used for electricity and heat generation from a production and a consumption perspective. The methodology used to estimate the consumption-based indicators is equivalent to the methodology used to estimate the final demand-related TiVA indicators.

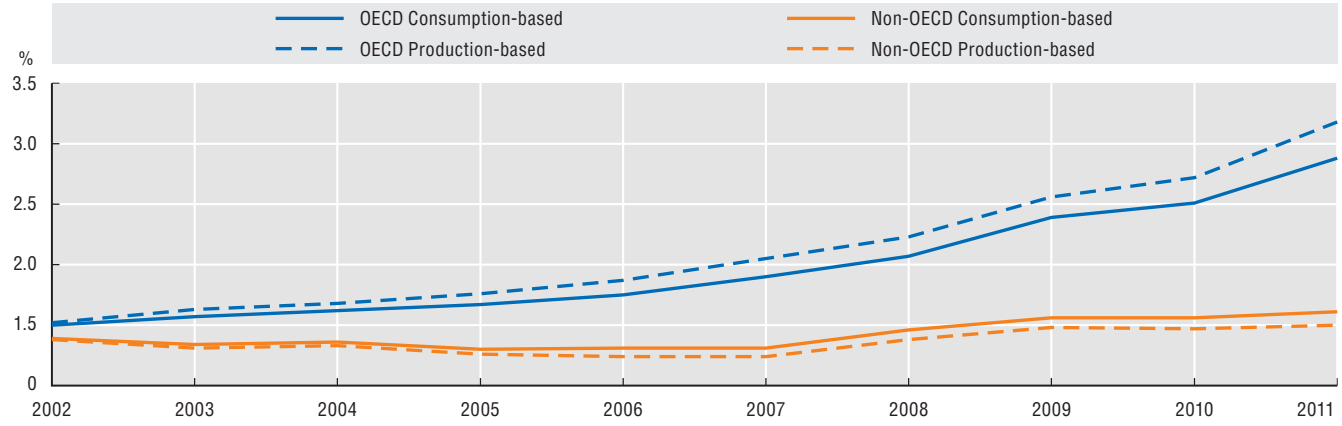
Consumption-based CO_2 emissions of OECD countries were, on average, about 10% to 15% higher over the time period than conventional measures of production-based emissions would suggest. CO_2 emissions embodied in imports can, to a large extent, be traced back to the electricity industry in other countries. Thus, part of the difference between consumption and production-based emissions can be explained by the differences in the CO_2 emission intensity of electricity production. Some countries with large differences between production and consumption-based emissions have relatively low emission intensities of electricity production due to the use of low-carbon renewables. Net exports of embodied renewables used for electricity/heat production are close to zero for many countries, with some exceptions. For example, Indonesia and Iceland, which export energy-intensive manufacturing goods (e.g. aluminium exports of Iceland) and have a high share of geothermal power in electricity production, are among the top net-exporters of embodied selected renewables used for electricity and heat production. The United States, while having the highest absolute electricity and heat production from the selected renewables, also has by far the highest consumption of embodied selected renewables.

Sustainable production chains

All products consumed in daily life require electricity at various stages of the production process. The rise in the use of renewable energy technologies in electricity production over the last decade has contributed to more sustainable production chains. In the OECD area, the percentage of low-carbon renewables in total energy used for electricity and heat production doubled over the decade from 2002-11 to reach 3%, while it remained stable at less than 1.5% in non-OECD economies. Nevertheless, because of the increase of trade with non-OECD economies, the electricity mix embodied in the consumption of OECD countries has included increasingly less renewable energy than the production-based electricity mix. This is one of the underlying reasons for the higher carbon content of consumption compared to production for many OECD countries. OECD economies can be found both among top net-exporters and top net-importers of embodied low-carbon renewables used for electricity generation. This reflects a large cross-country variation in the propensity to use such technologies.

46. Embodied low-carbon renewable energy used for electricity production, 2002-11

As a percentage of total embodied energy used for electricity production

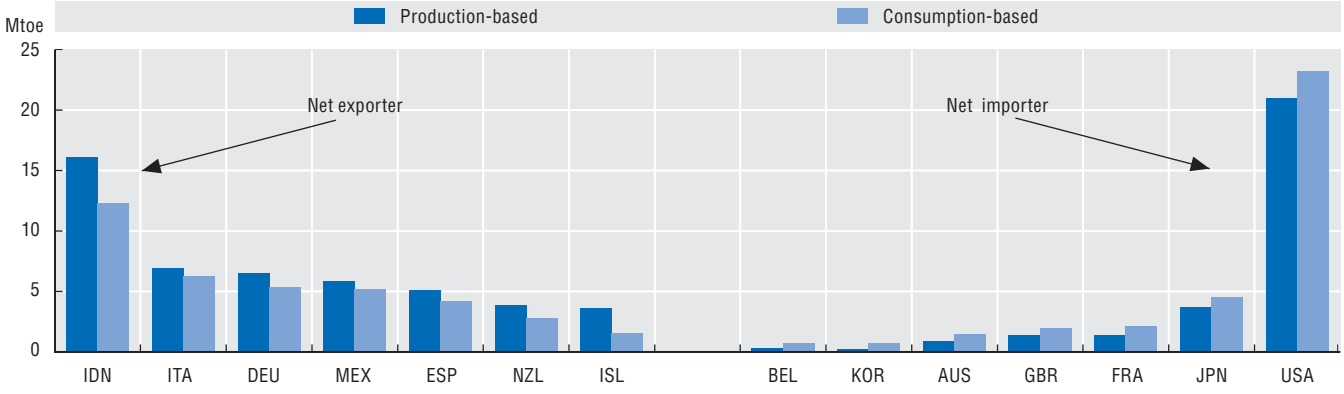


Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*, June 2015; and International Energy Agency (IEA), *World Energy Balances Database*, 2014. StatLink contains more data. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273212

47. Top net exporters and net importers of embodied low-carbon renewables used for electricity production, 2011

Millions of tonnes oil equivalent (Mtoe)



Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*, June 2015; and International Energy Agency (IEA), *World Energy Balances Database*, 2014. StatLink contains more data. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273226

Notes and references

Cyprus

The following note is included at the request of Turkey:

"The information in this document with reference to 'Cyprus' relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognises the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of the United Nations, Turkey shall preserve its position concerning the 'Cyprus issue'."

The following note is included at the request of all of the European Union Member States of the OECD and the European Union:

"The Republic of Cyprus is recognised by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus."

Israel

"The statistical data for Israel are supplied by and under the responsibility of the relevant Israeli authorities or third party. The use of such data by the OECD is without prejudice to the status of the Golan Heights, East Jerusalem and Israeli settlements in the West Bank under the terms of international law."

"It should be noted that statistical data on Israeli patents and trademarks are supplied by the patent and trademark offices of the relevant countries."

1. Labour productivity growth based on hours worked, total economy level, 2001-14

Data for 2014 are provisional.

2. GDP per capita growth and GDP per person employed growth in the BRIICS and the OECD, 2002-07 and 2009-14

Calculations are based on GDP at constant prices, converted to USD using 2005 purchasing power parities.

Employment estimates for Brazil, China, India and Indonesia are based on Gröningen Growth Development Center (GGDC), *Total Economy Database*, January 2013; while series for South Africa are from OECD, Annual National Accounts database.

4. Harmonised unemployment rates in the OECD, European Union, United States and Japan, July 2008-April 2015

The OECD harmonised unemployment rates, compiled for all 34 OECD member countries, are based on the International Labour Office (ILO) guidelines. The unemployed are persons of working age (in the reference period) who are without work, are available for work and have taken specific steps to find work.

Rates are seasonally adjusted.

5. Job creation, job destruction and churning rate, 2001-11

General notes:

The following countries are covered: Austria, Belgium, Brazil, Denmark, Finland, Hungary, Italy, Japan, Luxembourg, the Netherlands, New Zealand, Norway, Portugal, Spain, Sweden and Turkey.

The churning rate is calculated as the sum of the job creation rate and job destruction rate.

Owing to methodological differences, figures may differ from those officially published by national statistical offices.

Mergers and acquisitions are not taken into account in determining firm age, firm entry and firm exit.

Data for Japan are limited to the manufacturing sector only.

Data for the following countries are limited to the period indicated in brackets: Italy (2001-10), Spain (2003-11), Portugal and Turkey (2006-11), and Japan and Norway (2001-09). Data for the Netherlands in 2006 are excluded due to the redesign of the business register.

Additional note:

Gross job creation is defined as the sum of all positive unit-level job variations over the biennium. Gross job destruction is defined as the sum of all negative unit-level job variations over the biennium. For each of the two measures, the rate is calculated as the ratio of the value over the average employment in the biennium. The churning rate is calculated as the sum of job creation rate and job destruction rate.

6. Contribution to net job creation rate by group of firms, 2001-11

See general notes under 5.

Contribution to the net job creation rate is calculated as the ratio of net job creation (the difference between gross job creation and gross job destruction) of the reference group over average total employment in the biennium.

7. Contribution to net job creation rate by group of firms and macro sector, 2001-11

See general notes under 5.

Contribution to the net job creation rate is calculated as the ratio of net job creation (the difference between gross job creation and gross job destruction) of each macro sector over average total employment in the biennium.

8. Where people lost and gained jobs, 2010-14 and 2010-13

Sectoral changes in levels of employment can be "normalised" to highlight their relative contributions, within each country, to the total change in employment between 2010 and 2014. This is achieved, for each country, by expressing the sectoral changes as a percentage of the sum of absolute changes.

Aggregate industrial activities are defined according to ISIC Rev. 4: Agriculture, forestry and fishing (Divisions 01-03); Mining and utilities (05-09 and 35-39); Manufacturing (10-33); Construction (41-43); Wholesale, retail trade, hotels, food services, transportation (45-56); Information and communication (58-63); Finance and insurance (64-68); Professional, scientific and technical and other business services (69-82); and Public administration, education, health and other services (84-99).

The gains and losses, in thousands, represent the sum of those aggregate sectors with positive changes and the sum of those aggregate sectors with negative changes, respectively. A finer activity breakdown (e.g. 2-digit ISIC Rev. 4) would produce different estimates for total gains and losses.

For Japan, Professional, scientific, technical and other business services are combined with Public administration, education, health and other services.

For Chile, Information and communication, Financial, insurance and real estate activities and Professional, scientific, technical and other business services are grouped together.

The employment data are drawn mostly from National Accounts (SNA) sources and are measured in terms of persons, except for Canada, which is measured in terms of jobs.

9. Employment growth in information industries, OECD, 1995-2013

Information industries are defined according to ISIC Rev. 4 Divisions 26 (Computer, electronic and optical products), 58 to 60 (Publishing, audiovisual and broadcasting activities), 61 (Telecommunications) and 62 to 63 (IT and other information services).

OECD consists of OECD countries excluding Chile, Iceland and Turkey.

10. The Great Recession hit routine intensive occupations harder, 2001-13

3-digit occupations are ranked in terms of their routine intensity following an experimental methodology detailed in Marcolin et al. (2015), which exploits information from the OECD, Programme for International Assessment of Adult Competencies (PIAAC) database. Routine-intensive occupations rank above the median in terms of routine intensity of tasks performed on the job; non-routine occupations score below the median.

Employment data are sourced from the European Labour Force Surveys. Armed forces are excluded. Figures are based on data from: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Iceland, Italy, Lithuania, Luxembourg, Latvia, Malta, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom. The change in the ISCO occupational classification used (from ISCO 1988 to ISCO 2008) imposes a break in the series between 2010 and 2011. Data for Italy exclude ISCO 1988 occupation 13 (general managers) due to a country-specific break in the series.

11. Contribution of routine-intensive and non-routine occupations to employment growth, 2000-13

3-digit occupations are ranked in terms of their routine intensity following an experimental methodology detailed in Marcolin et al. (2015), which exploits information from the OECD, Programme for International Assessment of Adult Competencies (PIAAC) database. Routine-intensive occupations rank above the median in terms of routine intensity of tasks performed on the job; non-routine occupations score below the median.

Employment data for Selected European countries are sourced from the European Labour Force Surveys. Armed forces are excluded. Figures are based on data from: Austria, Belgium, Bulgaria, the Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Iceland, Italy, Lithuania, Luxembourg, Latvia, Malta, the Netherlands, Norway, Poland, Portugal, the Slovak Republic, Slovenia, Spain, Sweden and the United Kingdom. The change in the ISCO occupational classification used (from ISCO 1988 to ISCO 2008) imposes a break in the series between 2010 and 2011. Employment data for the United States are sourced from the Current Population Survey. The conversion table for the occupational classification from SOC and Census to ISCO 2008 classifications is described in Eckardt and Squicciarini (2015).

Yearly figures for the United States are calculated as simple averages over monthly data. Figures for Europe are based on annualised quarterly data. 2012 figures for the United States are based on a simple eight-month average (i.e. May to December 2012), to avoid possible biases due to changes in the occupational codes used by the US Census to address confidentiality issues. See Eckardt and Squicciarini (2015) for details.

12. Long-term decline in manufacturing jobs, 1970-2013

G7 consists of Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.

Estimates for Germany prior to 1991 are based on manufacturing employment shares for western Germany.

OECD refers to the unweighted mean of manufacturing shares of employment for 16 countries (i.e. the G7 and Australia, Belgium, Denmark, Finland, Ireland, Korea, the Netherlands, Norway and Sweden).

Manufacturing is defined according to ISIC Rev. 4 Divisions 10 to 33. Estimates for earlier years are based on vintage data for ISIC Rev. 3 Divisions 15 to 37.

13. Long-term trends in R&D-intensive manufacturing employment, 1980-2013

G7 consists of Canada, France, Germany, Italy, Japan, the United Kingdom and the United States.

Estimates for Germany prior to 1991 are based on manufacturing employment shares for western Germany.

OECD here refers to the unweighted mean of R&D intensive shares of employment for the 19 countries (i.e. the G7 and Australia, Austria, Belgium, Denmark, Finland, Ireland, Korea, the Netherlands, Norway, Portugal, Spain and Sweden).

R&D-intensive industries are defined according to ISIC Rev. 4: Chemical and pharmaceutical products (ISIC Rev. 4 Divisions 20 and 21), Machinery and equipment (26, 27 and 28) and Transport equipment (29 and 30). Estimates for earlier years are based on vintage data for equivalent ISIC Rev. 3 Divisions 24 and 29 to 35.

15. Origin of demand for business sector jobs in OECD, 1995-2011

The business services sector corresponds to ISIC Rev. 3 Divisions 10 to 74: Mining (10 to 14), Manufacturing (15 to 37), Utilities (40 to 41), Construction (45) and Business services (50 to 74).

East and Southeast Asia (excluding China) comprises Brunei Darussalam, Cambodia, Indonesia, Hong Kong (China), Japan, Korea, Malaysia, Philippines, Singapore, Chinese Taipei, Thailand and Viet Nam.

16. Origin of demand for manufacturing jobs in OECD, 1995-2011

The manufacturing sector corresponds to ISIC Rev. 3 Divisions 15 to 37.

East and Southeast Asia (excluding China) comprises Brunei Darussalam, Cambodia, Indonesia, Hong Kong (China), Japan, Korea, Malaysia, Philippines, Singapore, Chinese Taipei, Thailand and Viet Nam.

17. Origin of demand for business services jobs in OECD, 1995-2011

The business services sector corresponds to ISIC Rev. 3 Divisions 50 to 74.

East and Southeast Asia (excluding China) comprises Brunei Darussalam, Cambodia, Indonesia, Hong Kong (China), Japan, Korea, Malaysia, Philippines, Singapore, Chinese Taipei, Thailand and Viet Nam.

18. Origin of demand for jobs in Europe, 1995-2011

Europe refers to the 21 OECD members of the European Union (i.e. the EU28 excluding Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta and Romania).

East and Southeast Asia (excluding China) comprises Brunei Darussalam, Cambodia, Indonesia, Hong Kong (China), Japan, Korea, Malaysia, Philippines, Singapore, Chinese Taipei, Thailand and Viet Nam.

19. Jobs sustained by foreign final demand, by skill intensity, 2011 and 2013 estimates

General notes:

The business sector is defined according to ISIC Rev. 3 Divisions 10 to 74: total economy excluding Agriculture, forestry and fishing (Divisions 01 to 05); Public administration (75); Education (80); Health (85) and Other community, social and personal services (90 to 95).

Skill intensity is defined according to major groups of the International Standard Classification of Occupations 2008 (ISCO-08): High-skilled occupations (ISCO-08 major Groups 1 to 3), medium skilled (4 to 7) and low skilled (8 to 9).

EU21 refers to the 21 OECD members of the European Union (i.e. the EU28 excluding Bulgaria, Croatia, Cyprus, Latvia, Lithuania, Malta and Romania).

Additional notes:

While jobs sustained by foreign final demand in 2011 are derived directly from the OECD ICIO table for 2011, the estimates for 2013 are preliminary projections or nowcasts.

Occupational employment data for the United States are sourced from the Current Population Survey. The conversion table for the occupational classification from SOC and Census to ISCO 2008 classifications is described in Eckardt and Squicciarini (2015).

20. Skill content of employment sustained by domestic and foreign final demand, 2011

See general notes under 19.

Additional notes:

Occupational employment data for the United States are sourced from the Current Population Survey. The conversion table for the occupational classification from SOC and Census to ISCO 2008 classifications is described in Eckardt and Squicciarini (2015).

21. Decomposition of growth in GDP per capita, 2002-07 and 2009-14

Calculations are based on GDP at constant prices, converted to USD using 2005 Purchasing Power Parities.

For Australia, estimates refer to fiscal years beginning 1st July.

For New Zealand, underlying GDP series refer to fiscal years beginning 1st April.

22. Gap in GDP per capita, in GDP per person employed and in labour utilisation, non-OECD economies, 2014

Calculations are based on GDP at current prices, converted in USD using 2014 Purchasing Power Parities (PPPs).

Differences are computed *vis-à-vis* the 17 OECD countries with highest GDP per capita in 2014.

Labour productivity is estimated as GDP per person engaged.

Labour utilisation is calculated as the ratio of total employment and population.

Percentage differences in labour productivity and labour utilisation may not add up to the gaps in GDP per capita since the decomposition is multiplicative.

23. Decomposition of labour productivity growth by industry, 2001-07 and 2009-13

Labour productivity growth is defined as the annual change in gross value added (in volume terms) per hour worked.

The aggregate industrial activities are defined according to ISIC Rev. 4: Mining and utilities (Divisions 05-09 and 35-39); Manufacturing (10-33); Construction (41-43); Wholesale, retail, hotels, food services, transportation (45-56); Information and communication (58-63); Finance and insurance (64-68); and Professional, scientific, technical and other business services (69-82).

24. Labour productivity in information industries, 2001 and 2013

Apparent labour productivity is defined as current price value added per person employed.

The business sector is defined according to ISIC Rev. 4 Divisions 05 to 66 and 69 to 82, i.e. total economy excluding Agriculture, forestry and fishing (Divisions 01 to 03); Real estate activities (68); Public administration (84); Education (85); Health (86 to 88) and Other service activities (90 to 98).

Information industries are defined according to ISIC Rev. 4 Divisions 26 (Manufacture of computer, electronic and optical products) and Divisions 58 to 63 (Information and communication service activities).

For Mexico, data refer to 2003.

For Canada, Luxembourg, Portugal, Switzerland, data refer to 2011. For Germany, Mexico, Poland, Spain, Sweden and the United Kingdom, data refer to 2012.

25. Knowledge intensity of business investment, selected EU economies and the United States, 1995-2013

KBC investment data in current prices and local currency up to 2013 are kindly provided by the INTAN-Invest network. Data for non-residential GFCF up to 2010 are also sourced from INTAN-Invest. The time series is extended up to 2013 using the yearly growth rate in non-residential GFCF in the country, as reported in the *Structural Analysis (STAN) Database*. KBC assets consistent with the definition in the *System of National Accounts* (SNA) include: software, R&D, entertainment, literary and artistic originals, and mineral exploration. Other KBC assets include: design, new product developments in the financial industry, brands, firm-specific training and organisational capital.

In this analysis, the European Union covers 14 countries: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

For the European Union, total EU-wide KBC investment and fixed capital investment are divided by EU-wide gross value added before referencing to 1995.

The business sector is defined according to ISIC Rev. 4 Divisions 01 to 82 excluding 68 (real estate) and 90 to 96, i.e. Sections A to N (excluding L) and R to S.

26. Business investment in fixed and knowledge-based capital, selected economies, 2013

See notes under 25.

27. Knowledge capital intensity by sector, selected economies, 1995 and 2013

See notes under 25.

28. Investment in organisational and managerial capabilities by size, 2011-12

General notes:

Shares of value added by firm size are computed on the basis of OECD Entrepreneurship at a Glance data. Investment in training is estimated using PIAAC, the *Structural Analysis (STAN) Database* and other national data sources. Micro firms employ 1-10 workers, small and medium-sized firms employ 11-250 workers, and large firms employ more than 250 workers. Available data for Japan do not allow distinguishing between SMEs and large establishments in terms of value added. For Japan, the small-medium value category includes large companies. The size distribution of value added for Australia, Canada and the United States is estimated on the basis of the cluster analysis detailed in Squicciarini et al. (2015). Figures refer to the market sector and exclude agriculture, constructions and finance, because of data availability issues.

Additional notes:

Investment in managerial capabilities relate to managers (ISCO 2008 occupation Class 1), whereas broader organisational capabilities relate also to non-managerial occupational profiles. See the methodology detailed in Le Mouel and Squicciarini (2015).

29. Investment in firm-specific on-the-job training, by firm size, 2011-12

See general notes under 28.

30. Trends in world foreign direct investment flows, 1995-2013

From 2005 onwards, data refer to the FDI definition of the 6th revision of the Balance of Payments Manual.

The OECD share in World total is based on the average of inward and outward FDI flows.

31. Foreign direct investment inflows, yearly averages, 1995-2001, 2002-07 and 2008-13

Data from 2005 to 2013 refer to the IMF (2009), Balance of Payments and International Investment Position Manual, 6th edition definition of FDI. Data prior to 2005 refer to the IMF (1993), Balance of Payments and International Investment Position Manual, 5th edition definition of FDI.

Other OECD includes: Australia, Canada, Chile, Iceland, Israel, Korea, Mexico, New Zealand, Norway, Switzerland and Turkey.

Other BRIICS includes: Brazil, India, Indonesia, the Russian Federation and South Africa.

South-East Asia includes: Cambodia, Hong Kong (China), Laos, Malaysia, Myanmar, the Philippines, Singapore, Thailand and Viet Nam.

32. Foreign direct investment, outward flows from BRIICS, 2002-07 and 2008-13

For Indonesia, the 2004-07 average is shown.

The IMF (2009), *Balance of Payments and International Investment Position Manual*, 6th edition definition of FDI is used for 2005-13 data, IMF (1993), *Balance of Payments and International Investment Position Manual*, 5th edition definition for 2002-04 data.

33. Exports of intermediate and final goods from R&D-intensive manufacturing industries, 2000-13

R&D intensive manufactures are defined according to ISIC Rev. 4: Pharmaceuticals (Division 21), Computer, electronic and optical products (Division 26) and Air and spacecraft and related machinery (Group 303).

OECD here does not include Luxembourg and the Slovak Republic.

34. Global manufacturing trade networks: Flows of intermediate and final manufactured goods by area, 2013

Trade flows are based on reported import data and exclude intra-regional trade.

ASEAN refers to Brunei Darussalam, Indonesia, Cambodia, Malaysia, Philippines, Singapore, Thailand and Viet Nam (i.e. excluding Laos and Myanmar). East Asia consists of Japan, Korea, China, Hong Kong (China) and Chinese Taipei.

35. Global manufacturing trade networks, major bilateral flows of manufactured intermediate goods, 2000

Intermediate goods are used as inputs into the production of other goods. This analysis only considers intermediates from manufacturing activities (ISIC Rev. 4 Divisions 10 to 32); for example, processed food, textiles, basic chemicals, basic metals, and parts and components of machinery and equipment. Raw materials from agriculture, mining and quarrying activities are not included nor are outputs from electricity, gas and water suppliers.

Calculation of flows is based on import data only. The flows shown represent partner country imports that are higher than USD 15 billion or for which the partner share in a country's total imports is higher than 12%. Significant import flows from China, Germany, Japan and the United States are highlighted. For each country shown, the length of the arc on the circle is proportional to the sum of the export and import flows chosen according to the criteria.

To improve the readability of the diagram, some of the smaller flows were removed, notably those concerning Chile, Costa Rica, Greece, Israel, Luxembourg, Portugal, Romania and Turkey.

36. Global manufacturing trade networks, major bilateral flows of manufactured intermediate goods, 2014

See notes under 35.

38. Business sector services value added in OECD manufacturing exports, by industry, 1995 and 2011

Business sector services are defined according to ISIC Rev. 3 and include: Wholesale and retail trade, hotels and restaurants (Divisions 50 to 55); Transport, storage and communication (60 to 64); Finance and insurance (65 to 67); and Other business services (70 to 74).

39. Global demand for Computer, electronic and optical equipment, percentage shares of total, 1995 and 2011

Other East and Southeast Asia comprises of Brunei Darussalam, Cambodia, Chinese Taipei, Hong Kong (China), Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam.

Computer, electronic and optical equipment is defined according to ISIC Rev. 3 Divisions 30, 32 and 33.

40. Global demand for Motor vehicles, percentage shares of total, 1995 and 2011

Other East and Southeast Asia comprises of Brunei Darussalam, Cambodia, Chinese Taipei, Hong Kong (China), Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam.

Motor vehicles is defined according to ISIC Rev. 3 Division 34.

41. Global demand for Textiles and apparel, percentage shares of total, 1995 and 2011

Other East and Southeast Asia comprises of Brunei Darussalam, Cambodia, Chinese Taipei, Hong Kong (China), Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam.

Textiles and apparel is defined according to ISIC Rev. 3 Divisions 17 to 19.

42. Regional final demand for Computer, electronic and optical equipment, 1995 and 2011

General notes:

East and Southeast Asia comprises Brunei Darussalam, Cambodia, China, Chinese Taipei, Hong Kong (China), Japan, Korea, Indonesia, Malaysia, Philippines, Singapore, Thailand and Viet Nam.

Europe consists of the EU28 member countries as well as Iceland, Norway, Switzerland and the Russian Federation.

EU13 includes Bulgaria, Croatia, Cyprus, the Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, the Slovak Republic and Slovenia.

Additional note:

Computer, electronic and optical equipment is defined according to ISIC Rev. 3 Divisions 30, 32 and 33.

43. Regional final demand for Motor vehicles, 1995 and 2011

See general notes under 42.

Additional note:

Motor vehicles is defined according to ISIC Rev. 3 Division 34.

44. Regional final demand for Textiles and apparel, 1995 and 2011

See general notes under 42.

Additional note:

Textiles and apparel is defined according to ISIC Rev. 3 Divisions 17 to 19.

46. Embodied low-carbon renewable energy used for electricity production, 2002-11

Renewable energy sources are defined as geothermal, solar thermal, solar photovoltaic, tide, wave and ocean technologies, and wind power. This differs from the definition of renewable energy according to IEA, which also includes hydro-electric as well as biofuels and waste.

47. Top net exporters and net importers of embodied low-carbon renewables used for electricity production, 2011

A tonne of oil equivalent (toe) is a unit of energy defined as the amount of energy released by burning one tonne of crude oil. According to the International Energy Agency (IEA), 1 toe = 41.868 gigajoules (GJ).

Renewable energy sources are defined as geothermal, solar thermal, solar photovoltaic, tide, wave and ocean technologies, and wind power. This differs from the definition of renewable energy according to IEA, which also includes hydro-electric as well as biofuels and waste.

48. R&D growth over the business cycle by source of financing, OECD area, 1985-2014

Business and government-financed R&D expenditures are subcomponents of Gross Domestic Expenditure on R&D (GERD) (i.e. intramural R&D expenditures on R&D performed in the national territory). Funding sources are typically identified by the R&D-performing units.

Government budget data tend to be more timely, but may not coincide with R&D performer-reported funding by government, owing to factors such as differences between budgetary plans and actual disbursements.

49. Trends in basic and applied research and experimental development in the OECD area, 1985-2013

Due to the presence of missing breakdowns of GERD by type of R&D (basic, applied and experimental development), as well as breaks in series, long term trends have been estimated by chain-linking year-on-year growth rates. These are calculated each year on a variable pool of countries for which balanced data are available in consecutive years without intervening breaks. The trend series is an index of the volume of expenditures on basic and applied research and experimental development, based on GERD data in USD PPP 2010 constant prices. Some OECD countries are completely missing from the calculations due to no detailed breakdowns by type of R&D being available. Further details on the calculations are available on request.

China's share of GERD by type of R&D has been estimated based on the sum of current and capital expenditures. For the OECD, a GERD-weighted estimate has been computed on the pool of 15 countries for which data by type of R&D were available in 2013. Data used for each country refer to the sum of current and capital expenditures, except for Chile, Norway, Spain and the United States for which only current costs are included in estimates reported to the OECD.

50. Recent trends in R&D performance, OECD and selected economies, 2007-13

For the United States, except for GOVERD, which includes capital expenditure used for R&D, reported figures refer to current expenditures but include a depreciation component, which may differ from the actual level of capital expenditure.

OECD estimates for the EU28 zone may differ slightly from those published by Eurostat. In this publication, national estimates are aggregated using USD Purchasing Power Parity indices (PPPs) instead of EUR exchange rates applied by Eurostat. For example, the EU28 measure of GERD to GDP intensity is an average of EU countries' GERD intensities, weighted by the share of countries' GDP to EU GDP in USD PPPs, as opposed to EUR-based GDP shares.

R&D intensity ratios are normalised using official GDP figures. These are compiled according to the *System of National Accounts* (SNA) 2008 except for China and Japan, where figures are available on the basis of SNA 1993.

51. Trends in government tax incentive and direct support for business R&D, 2000-13

Results are restricted to selected OECD economies for which time-series data on the amount of direct funding and tax support for business R&D are available for a minimum period of six years.

For Canada, France and the United Kingdom, preliminary R&D tax incentive estimates are reported for 2013. The 2012 cost estimate for the United Kingdom is also provisional.

Estimates do not cover sub-national and income-based R&D tax incentives and are limited to the business sector (excluding tax incentive support to individuals). Data refer to estimated initial revenue loss (foregone revenues) unless otherwise specified.

Estimates refer to the cost of incentives for business R&D expenditures, both intramural and extramural, unless otherwise specified. Direct support figures refer only to intramural R&D expenditures.

Country specific notes are available at *www.oecd.org/sti/rd-tax-stats.htm*.

52. Business R&D intensity and government support to business R&D, 2013

For Canada, Chile, France, Norway, Portugal, South Africa, Spain and the United Kingdom, preliminary R&D tax incentive estimates are reported for 2013 (or closest year). Figures are rounded to the second decimal unless rounding would result in a value of zero.

For Belgium, Brazil, Ireland, Israel, South Africa, Spain, Switzerland, the United Kingdom and the United States, figures refer to 2012. For Australia, Iceland, Mexico and the Russian Federation, figures refer to 2011.

Estimates of direct funding for Belgium, Brazil, France, Italy and Portugal are based on imputing the share of direct government-funded BERD in the previous year to the current ratio of BERD to GDP. For Austria, the 2011 share is used for 2013.

In Austria and South Africa, R&D tax incentive support is included in official estimates of direct government funding of business R&D. It is removed from direct funding estimates to avoid double counting. In the case of South Africa, where the overlap of estimates cannot be identified based on available budget data, this transformation was not undertaken.

Estonia, Germany, Luxembourg, Mexico, New Zealand, Sweden and Switzerland did not provide information on expenditure-based R&D tax incentives for 2013. For Israel, the R&D component of incentives cannot be identified separately at present. No data on the cost of expenditure-based R&D tax incentive support are available for Poland.

Estimates do not cover sub-national and income-based R&D tax incentives and are limited to the business sector (excluding tax incentive support to individuals). Data refer to estimated initial revenue loss (foregone revenues) unless otherwise specified.

Estimates refer to the cost of incentives for business expenditures on R&D, both intramural and extramural, unless otherwise specified. Direct support figures refer only to intramural R&D expenditures, except for Brazil.

Country specific notes are available at *www.oecd.org/sti/rd-tax-stats.htm*.

53. R&D in OECD and key partner countries, 2013

Owing to methodological differences, data for some non-OECD economies may not be fully comparable with those for other countries.

R&D expenditures data refer to 2013 except for Australia, Brazil and India (2011).

Researchers data are in full-time unites and refer to 2013 except for Australia (2008), Brazil and India (2010), Canada, Israel and the United States (2012), and Iceland and Mexico (2011).

For Brazil, India and Indonesia, data are provided by the UNESCO Institute for Statistics.

For Indonesia, data refer to 2009.

For Israel, defence R&D is partly excluded from available estimates.

For South Africa, Ireland and Switzerland, data refer to 2012.

For United States, data for researchers have been estimated based on contemporaneous data on business researchers and past data for other sectors.

54. Trends in scientific publication output and excellence, selected countries, 2003-12

Scientific production/Output/Number of documents is the total number of documents published in scholarly journals indexed in Scopus (all document types are included).

Excellence indicates the amount (in %) of an institution's scientific output included in the set of 10% of the most-cited papers in their respective scientific fields. It functions as a measure of high-quality output of research institutions.

55. Institutions with the largest number of top-cited publications, by sector, 2003-12

The indicator is based on the total number of documents by authors in the listed affiliations featuring in the top 10% most-cited documents within each document's relevant domains.

56. Top 4 countries with the largest number of 10% top-cited publications, by field, 2003-12

The indicator is based on the number of documents featuring in the top 10% most-cited documents within each scientific domain. The percentages are based on the ratio between each of the top four largest countries in each field and the sum of top-cited publications for OECD and BRIICS countries.

57. New doctoral degrees awarded to women in OECD countries, by field of education, 2005-12

The figure refers to the following OECD countries on the basis of data availability: Austria, Belgium, Canada, the Czech Republic, Germany, Denmark, Finland, Hungary, Ireland, Iceland, Israel, Italy, Japan, Korea, Mexico, the Netherlands, New Zealand, Norway, Portugal, the Slovak Republic, Spain, Sweden, Switzerland, Turkey, the United Kingdom and the United States.

For Italy, 2008-10 data are OECD estimates.

For Norway, data are based on NIFU's Doctoral Degree Register, which also includes "Licentiate" degrees (equivalent to a doctoral degree).

Data for the following fields of education are not shown in the figure: Agriculture, Education and Services.

58. Female scientific authors in selected fields, by country, 2011

This is an experimental indicator based on a stratified random sample of scientific authors.

Estimates are based on the corresponding authors' self-reported gender in the OECD Pilot Survey of Scientific Authors carried out in January 2015.

Samples are drawn from documents published in 2011 and indexed in the Scopus database. Fields covered include Arts and Humanities, Business, Chemical Engineering, Immunology and Microbiology, Materials Science, Neuroscience and Physics and Astronomy.

Weighted estimates take into account sampling design and non-response patterns by fields, country and journal status.

59. Global scientific collaboration trends, 1996-2013

Calculations based on fractional counts. Institutional collaboration is based on multiple affiliations applying to a given document.

Results for 2000-02 are not displayed because of incomplete indexation in the Scopus database of authors for publications in those years. Figures would accordingly understate the true extent of scientific collaboration in those years.

61. International net flows of scientific authors, selected economies, 1999-2013

This is an experimental indicator.

Estimates are based on differences between implied inflows and outflows of scientific authors for the reference economy, as indicated by a change in the main affiliation of a given author with a Scopus ID over the author's indexed publication span. This figure decomposes net flows recorded over the period on a year-by-year basis for economies exhibiting the largest volumes of gross flows. An inflow is computed for year t and economy c if an author who was previously affiliated to another economy is first identified at t as affiliated to an institution in c. Likewise, an outflow is recorded when an author who was affiliated to c in a previous period is affiliated in a different economy at year t. In the case of multiple publications per author in a given year, the last publication in any given year is used as reference, while others are ignored.

The actual mobility date is undetermined, as more than one year may span between publications. As a result, the timing implied by this figure may be subject to a lag with respect to the point in which mobility flows took place. For more prolific authors, the timing will be more accurate. Estimates for early years in the database are not reported because mobility flows can only be computed once an author has a second publication captured in the database. Likewise, incomplete indexing of all authors over 2000-03 may result in understating total flows and as a consequence, albeit to a lesser extent, estimated net flows.

62. International mobility of scientific authors by field, 1996-2013

For computational reasons, share estimates are based on the comparison between the main (modal) affiliation of a given author with a Scopus ID over the author's indexed publication span. Only authors with two or more publications and in different years are considered. A mobility episode is identified for a given year when an author who was previously affiliated to an institution in a given economy is first observed to have changed affiliation to an institution in another economy. In the case of multiple publications per author in a given year, the last publication in any given year is used as reference, while others are ignored.

The indicator is computed as the share of identified moves out of potential moves, per author. Authors with more publications (higher number of potential moves) have therefore a larger weight in the calculation.

Total numbers of moves are presented based on a fractional measurement of affiliation changes and fields.

Field attribution is based on the classification of the journal in which a document is published. When a document is published in a journal with multiple 4-digit fields, the attribution to a 2-digit field is made on a fractional basis. The field of reference is that of the document in the destination economy, as fields need not remain constant over a given author's publication span.

63. International collaboration in science and innovation, 2003-12

International co-authorship of scientific publications is defined at the institutional level. A scientific document is deemed to involve an international collaboration if there institutions from different countries or economies are present in the list of affiliations reported by single or multiple authors. Estimates are based on whole counts from information contained in the Scopus database.

International co-inventions are measured as the share of patent applications with at least one co-inventor located in a different economy in total patents invented domestically. Data refer to IP5 patent families with members filed at the EPO or the USPTO, by first filing date and according to the inventor's residence using whole counts.

64. Trends in the IP bundle, 1996-2014

The IP bundle in the European market refers to EPO patent applications and OHIM trademark and design applications. The Japanese market refers to patent, trademark and design applications filed at the JPO, and the US market refers to patents and trademarks filed at the USPTO. Designs cannot be registered at USPTO. Before 2001, only USPTO patent grants are considered. Patent families are compiled using information on patent families within the Five IP offices (IP5). Data are presented by filing date. Patent statistics from 2012 are estimates.

65. R&D expenditures and the IP bundle of top R&D companies, 2012

Data relate to companies in the top 2 000 corporate R&D sample, ranked by R&D expenditures.

Data refer to patent applications filed in 2010-12 at the EPO or the USPTO that belong to IP5 families owned by the top R&D companies, using fractional counts.

Data refer to new trademark applications filed at the USPTO and the OHIM in 2010-12, using fractional counts.

66. Top 100 and 250 corporate R&D players by location of headquarters and affiliates, 2012

Data relate to companies in the top 2 000 corporate R&D sample, ranked by R&D expenditures.

67. Top 100 and 250 corporate R&D players by industry, 2012

Data relate to companies in the top 2 000 corporate R&D sample, ranked by R&D expenditures. Industries are defined according to ISIC Rev. 4.

68. Technological specialisation of top R&D investors by headquarters' location, 2010-12

The revealed technological advantage index is calculated as the share of patents owned by a company in a particular technology field relative to the share of total patents belonging to the company. Company data refer to the top 2 000 corporate R&D sample having filed for patents in 2010-12. Patent data refer to IP5 patent families by the first filing date owned by the top R&D companies. Patents are allocated to technology fields on the basis of their International Patent Classification (IPC) codes, following the concordance provided by WIPO (2013).

69. IP filings by foreign affiliates of top R&D corporations, by location of the headquarters, 2010-12

Data refer to patents applications filed at the EPO or the USPTO that belong to IP5 families and to trademark applications at OHIM or USPTO, by filing date, using fractional counts.

Data relate to headquarters' locations featuring at least 100 patent families and 100 trademark applications in 2010-12.

Foreign affiliates correspond to affiliates whose location is different from the location of the registered office of the global ultimate owner (here referred to as headquarters), according to the group structure in 2012.

Economies are ordered according to the share of patent families applied for by foreign affiliates of top R&D corporations.

70. Top players in emerging technologies, 2010-12

Data refer to patent applications filed at the EPO or the USPTO that belong to IP5 families, by filing date and according to the applicant's residence using fractional counts. Patent "bursts" correspond to periods characterised by a sudden and persistent increase in the number of patents filed by Cooperative Patent Classification (CPC) groups. Top patent bursts are identified by comparing the filing patterns of all CPC groups. The intensity of a patent burst refers to the relative strength of the observed increase in filing patterns. Only CPC classes featuring a positive and non-ending burst intensity from 2005 are included.

Descriptions of CPC groups are available at *http://worldwide.espacenet.com/classification?locale=en_EP*.

71. Intensity and development speed in ICT and environment-related technologies, 2000-12

Data refer to patent applications filed at the EPO or the USPTO that belong to IP5 families, by filing date, using fractional counts. ICT-related patents are defined on the basis of their International Patent Classification (IPC) codes. Environment-related patents are defined on the basis of their IPC codes or Cooperative Patent Classification (CPC) codes. Patent "bursts" correspond to periods characterised by a sudden and persistent increase in the number of patents filed in environment-related technologies. Top patent bursts are identified by comparing the filing patterns of all other technologies. The intensity of a patent burst refers to the relative strength of the observed increase in filing patterns. Only patent classes featuring a positive and non-ending burst intensity from 2000 are included.

Descriptions of IPC groups are available at *http://web2.wipo.int/ipcpub*.

Descriptions of CPC groups are available at *http://worldwide.espacenet.com/classification?locale=en_EP*.

72. Top players in selected disruptive technologies, 2005-07 and 2010-12

Data refer to IP5 patent families with members filed at the EPO or the USPTO, by first filing date and according to the applicant's residence using fractional counts. The Intellectual Property Office (IPO) of the United Kingdom has allocated patent documents to technology fields. For further details on IPO's patent landscape reports on *Eight Great Technologies* (October 2014), see *www.gov.uk/government/publications/eight-great-technologies-the-patent-landscapes*.

73. Patents in new generation of ICT-related technologies, 2005-12

Patent data refer to IP5 patent families by first filing date. The Intellectual Property Office (IPO) of the United Kingdom has allocated patent documents to technology fields. For further details on IPO's patent landscape reports on *Eight Great Technologies* (October 2014), see *www.gov.uk/government/publications/eight-great-technologies-the-patent-landscapes*.

74. Top players in IoT, big data and *quantum* computing technologies, 2005-07 and 2010-12

Data refer to IP5 patent families with members filed at the EPO or the USPTO, by first filing date and according to the applicant's residence using fractional counts. The Intellectual Property Office (IPO) of the United Kingdom has allocated patent documents to technology fields. For further details on IPO's patent landscape reports on *Eight Great Technologies* (October 2014), see *www.gov.uk/government/publications/eight-great-technologies-the-patent-landscapes*.

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