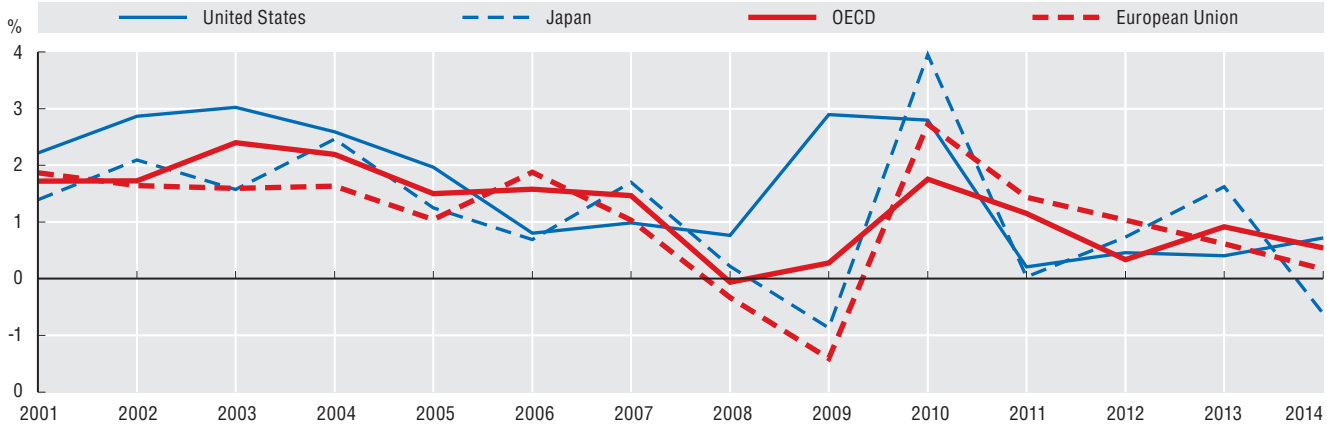
The growth and jobs challenge

Productivity and jobs challenge

The world today continues to feel the effects of the economic downturn seven years after the start of the crisis. In 2010, strong productivity growth signalled the start of a global recovery, however the pace of recovery has been unusually weak and labour productivity growth in the OECD area remains below pre-crisis levels. The failure to achieve a stronger cyclical upswing has had very real costs in terms of foregone employment, stagnant living standards in advanced economies, less vigorous development in some emerging economies, and rising inequality nearly everywhere (OECD, 2015a). The BRIICS (Brazil, the Russian Federation, India, Indonesia, the People's Republic of China and South Africa) economies were affected by the global slowdown to a lesser extent, with productivity growing at over 6% in 2009-14, compared to 1% in the OECD area. In China, GDP per employee grew at around 9% a year, compared to the 11% annual growth enjoyed in 2002-07.

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

Average annual growth rates in percentage points



Source: OECD, *Productivity Database*, *www.oecd.org/std/productivity-stats*, May 2015.

StatLink http://dx.doi.org/10.1787/888933272766

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

Average annual growth rates in percentage points

Source: OECD, *Productivity Database*, *www.oecd.org/std/productivity-stats*, May 2015. See chapter notes.

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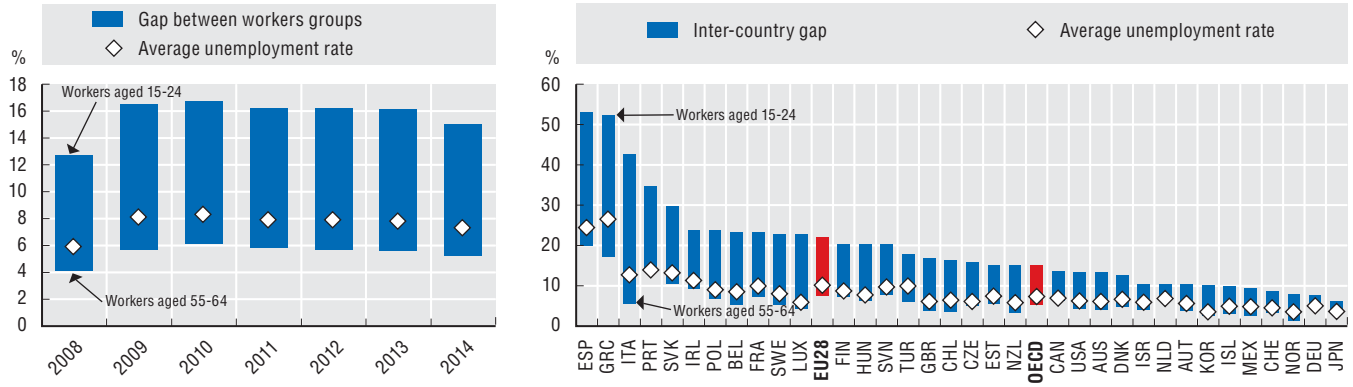
Productivity and jobs challenge

Job recovery is becoming more widespread and gaining momentum with unemployment declining in most countries, including those hardest hit by the crisis (OECD, 2015b). The OECD-wide unemployment rate declined by 1.6 percentage points from a post-war high of 8.5% in October 2009 to 6.9% in April 2015, with the average unemployment rate in the European Union remaining at almost 10%. However, youth employment rates remain of particular concern, especially in Europe, with average unemployment rates for younger workers (15-24 years old) at over 20%, rising to above 40% in Spain, Greece and Italy. Employment growth varied widely for different groups during the recovery, with unemployment rates for women slightly above those for men.

3. Unemployment rates in the OECD, gap between younger and older workers 2008-14 and differences by country in 2014

Percentage points

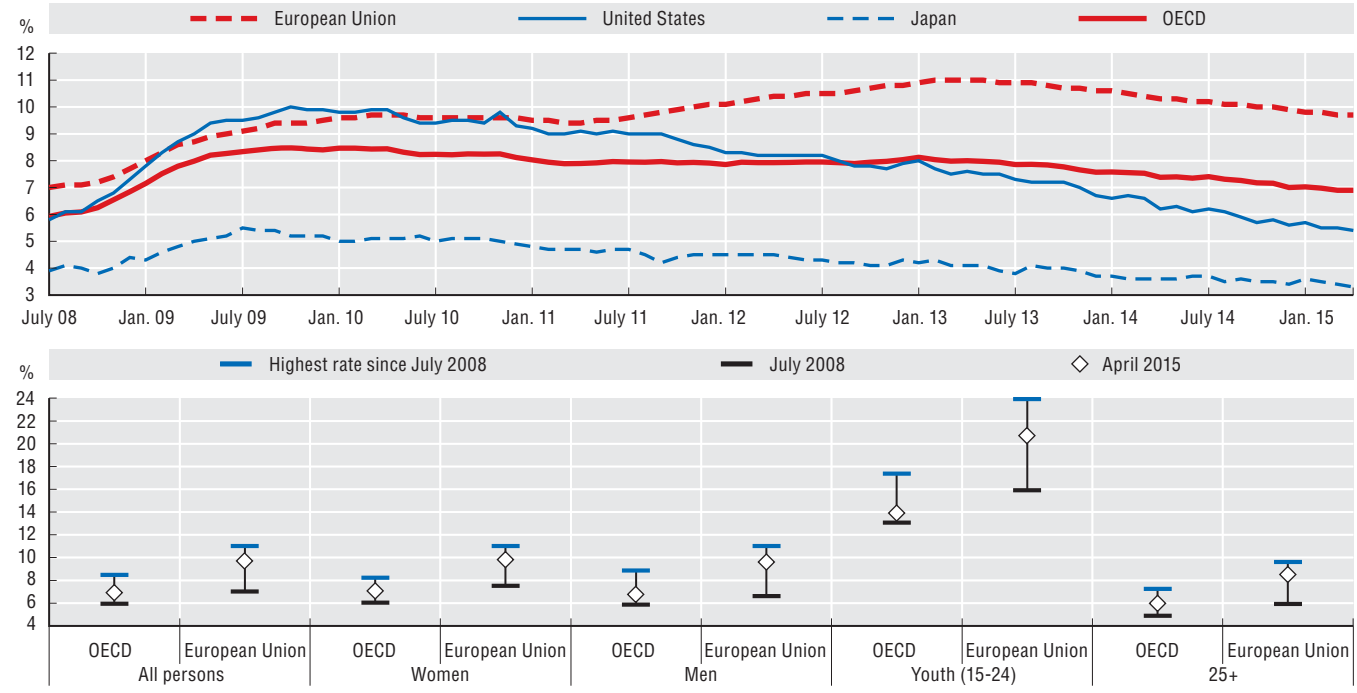


Source: OECD, *Short-Term Labour Market Statistics Database*, May 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933272781

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

Percentage points



Source: OECD, *Short-Term Labour Market Statistics Database*, June 2015.

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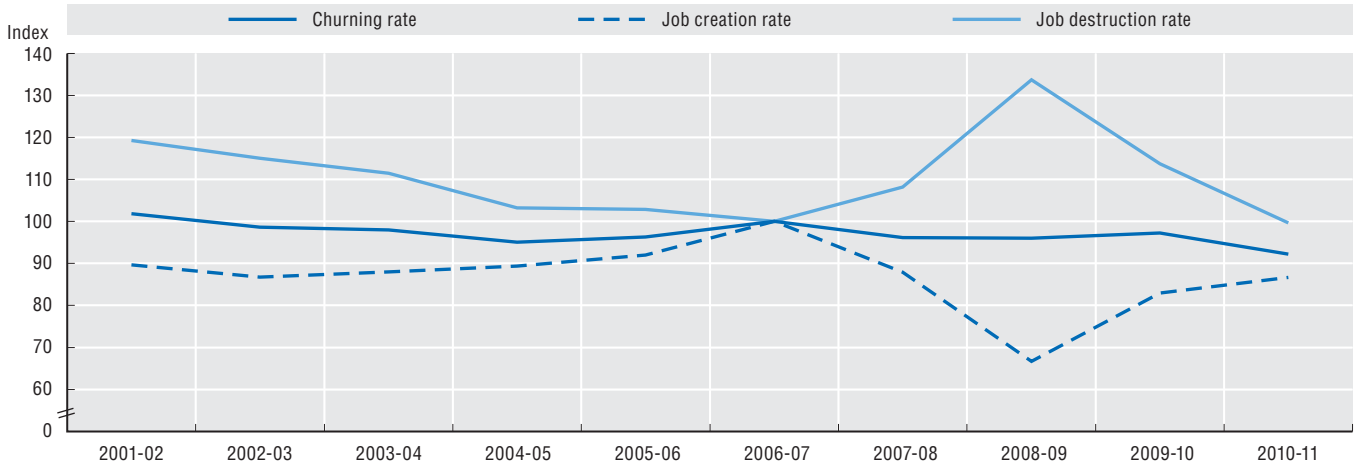
Firm dynamics and jobs

In the first decade of the 21st century, the job reallocation rate, as measured by the churning rate (i.e. the sum of job destruction and job creation rates) remained relatively stable. Prior to the crisis, the gap between job creation and job destruction was comparatively small, reflecting a Schumpeterian process of creative destruction which reallocates employment from firms destroying jobs to firms creating jobs. The 2008 economic crisis had a significant impact on this process, resulting in a sharp increase in gross job destruction and a drop in gross job creation. This gap contracted only partially over the 2009-10 biennium, with creation and destruction rates eventually aligning to pre-crisis levels during the following period.

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

Unweighted average across countries, index 2006-07 = 100



Source: OECD, calculations based on the *DynEmp v.2 Database*, preliminary data, *www.oecd.org/sti/dynemp.htm*, July 2015. See chapter notes.

StatLink *http://dx.doi.org/10.1787/888933272807*

DynEmp and MultiProd: OECD projects on firm-level dynamics and productivity

The DynEmp project is based on a distributed data collection exercise (see Criscuolo et al., 2014b) aimed at creating a harmonised cross-country micro-aggregated database on employment dynamics from confidential micro-level sources. The primary sources of firm and establishment data are national business registers. Analysis of the DynEmp project has shown that young firms are the engines of job creation across all countries considered (see Criscuolo et al., 2014a and 2014c). The new *DynEmp v.2 Database* contains more detailed data on the within-sector contribution of start-ups and young firms to employment growth, taking into account the role played by national policies and framework conditions (see for example Calvino et al., 2015). Work on the differences in employment dynamics and job reallocation across sectors is ongoing.

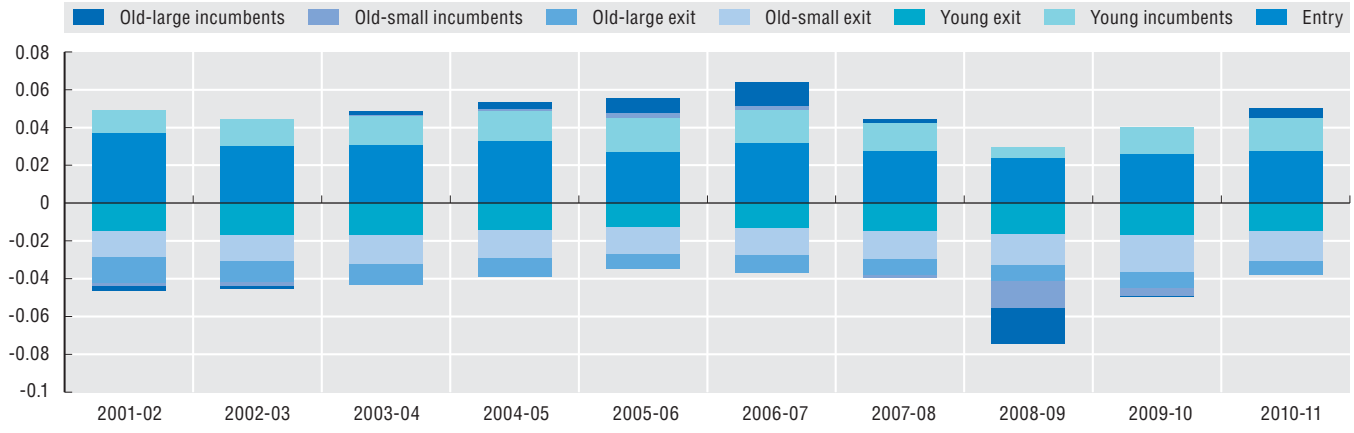
MultiProd is a companion project that uses a similar approach to examine the micro drivers of aggregate productivity. The project is presently building a micro-aggregated dataset using business registers and production surveys, with the aim of documenting the heterogeneity of productivity distribution within and across sectors, as well as its impact on aggregate outcomes. In particular, the project will investigate how policy frameworks affect resource allocation and productivity growth, measure the impact of (mis)allocations on aggregate productivity, and explore the link between productivity heterogeneity and wage inequality.

Firm dynamics and jobs

Between 2001 and 2011, entrants and young firms remained the main contributors to net job creation. During the pre-crisis period, adjustments in the exit margin for all firms across the age and size spectrum accounted for the majority of net job destruction. However, the picture changed dramatically during the crisis period. Both large and small incumbents shed jobs while remaining in business, resulting in a sizeable increase in net job destruction. The sharp decline in the job contribution of incumbents during the 2008-09 crisis, combined with their negative contribution to net job creation, was characteristic of all sectors – manufacturing, construction and services alike. However, the negative peak was especially sharp in the manufacturing sector. Conversely, incumbent firms in the services sector drove improvements in net job creation during 2009-10 and 2010-11.

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

Unweighted average across countries in the non-financial business sector



Source: OECD, calculations based on the *DynEmp v.2 Database*, preliminary data, *www.oecd.org/sti/dynemp.htm*, July 2015. See chapter notes.

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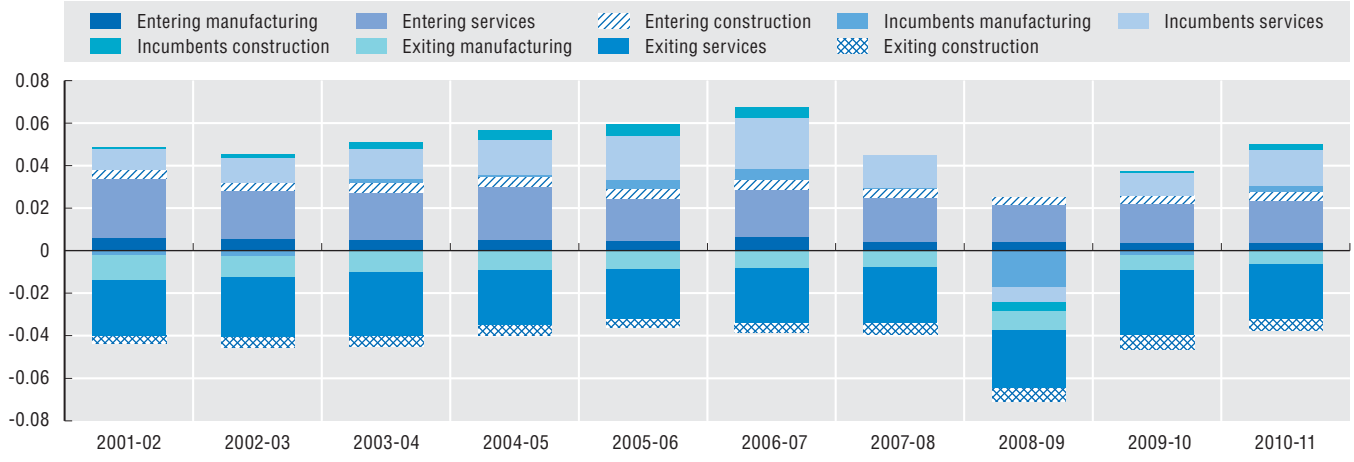
7. Contribution to net job creation rate by group of firms and macro sector, 2001-11

Unweighted average across countries in the non-financial business sector



Source: OECD, calculations based on the *DynEmp v.2 Database*, preliminary data, *www.oecd.org/sti/dynemp.htm*, July 2015. See chapter notes.

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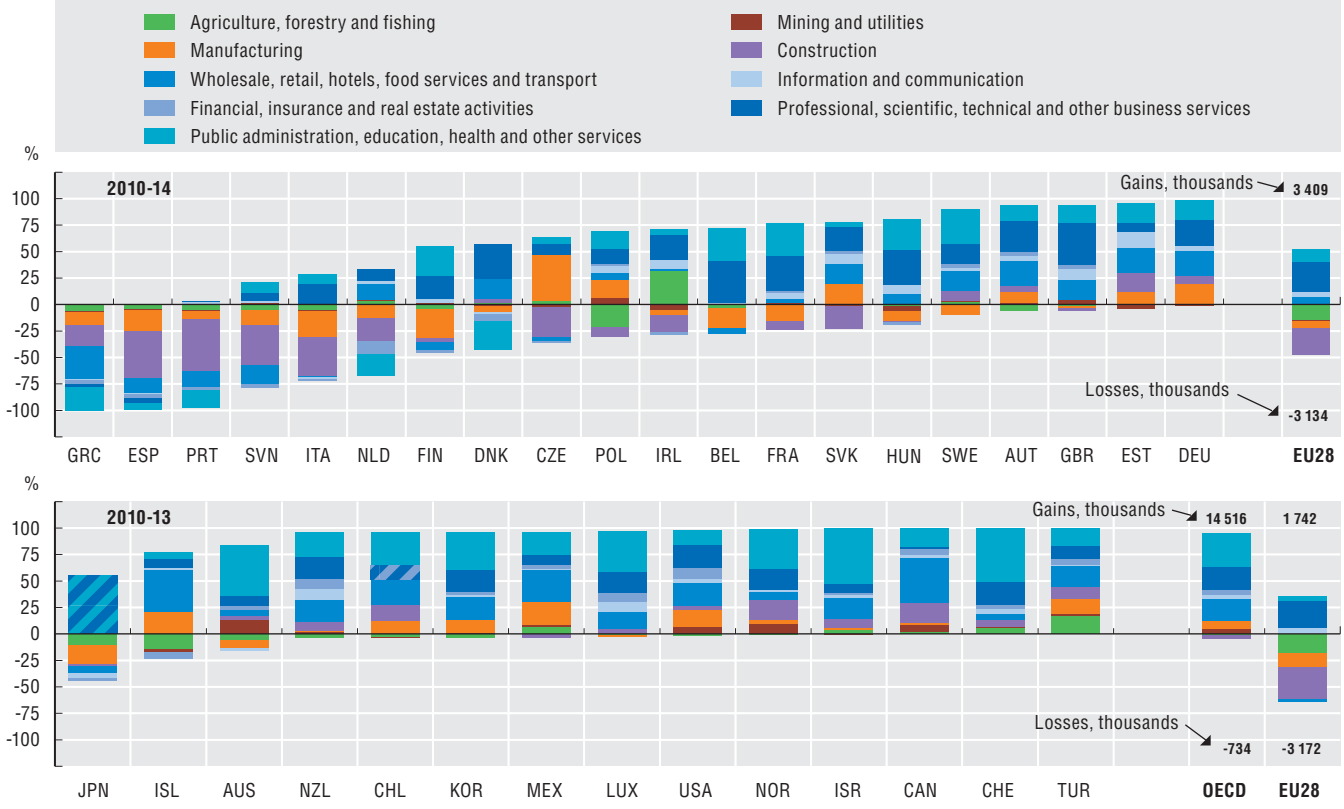
Jobs after the crisis

In the post crisis period between 2010 and 2013, total employment in the OECD area grew by 2.5% (a net gain of about 13.8 million jobs). This increase was driven mainly by non-EU countries with a net gain of over 8 million in NAFTA alone. Most increases occurred in service sectors with over 30% of net gains in OECD jobs coming from *Public administration, education, health and other services*. During the same period about 1.4 million jobs were lost in the European Union. In 2014, however, the European Union as a whole fared better with a net gain of about 275 000 jobs between 2010 and 2014, with a notable rise in *Professional, scientific, technical and other business services*. However, there was significant variation within the overall rise in EU employment, between 2010 and 2014, with Germany and the United Kingdom experiencing net gains of about 1.6 million and 1 million jobs respectively, while Greece, Italy, Portugal and Spain suffered a collective net loss of 3 million jobs, with the construction sector and, to a lesser extent, manufacturing, showing few signs of returning to pre-crisis levels of employment.

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

Relative contribution to change in total employment by major sectors of economic activity



Source: OECD, *Annual National Accounts Database* and national statistical institutes, June 2015. See chapter notes.

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How to read these figures

Changes in employment levels by economic activity can be "normalised" to highlight their relative contributions, in each country, to the total change in employment between 2010-13 and 2010-14. This is achieved for each country by expressing the sectoral changes as a percentage of the sum of the absolute changes. The aggregate activity groups are defined according to ISIC Rev. 4 classes.

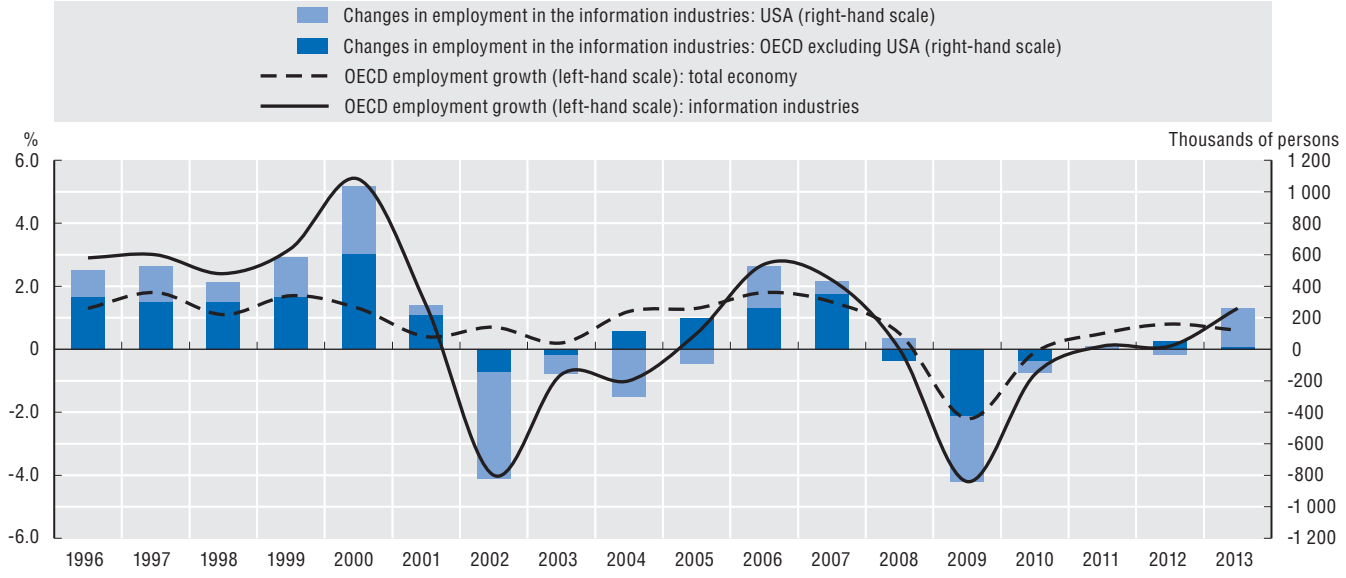
The employment data are drawn mostly from Annual National Accounts sources and are measured in terms of persons except for Canada which provides figures for jobs.

Jobs after the crisis

The information industries are considered by many as an important source of growth in OECD countries despite accounting for less than 4% of total OECD employment. Between 1995 and 2013, OECD employment in information industries grew by about 15% – marginally less than the growth in total employment during the same period. However, employment in the information sector has been susceptible to relatively high volatility over the business cycle since 1995. For example, during the 2008-09 financial crisis, OECD information industry employment fell by 4%, compared to 2% for total employment, shedding over 800 000 jobs. This drop was similar to that which occurred between 2001 and 2002 following the bursting of the dot-com bubble, which peaked in 2000 after relatively strong growth in the preceding years. The United States now accounts for about 30% of OECD employment in the information industries (from a peak of about 34% in 2001), and has been a main driver of observed changes in OECD information sector employment over recent years. Most post-crisis growth in information sector employment can therefore be attributed to the United States.

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

Annual change in percentage and in thousands of persons



Source: OECD calculations based on OECD, *Annual National Accounts Database* and *Structural Analysis (STAN) Database*, *http://oe.cd/stan* and national sources, June 2015. See chapter notes.

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Definition of information industries

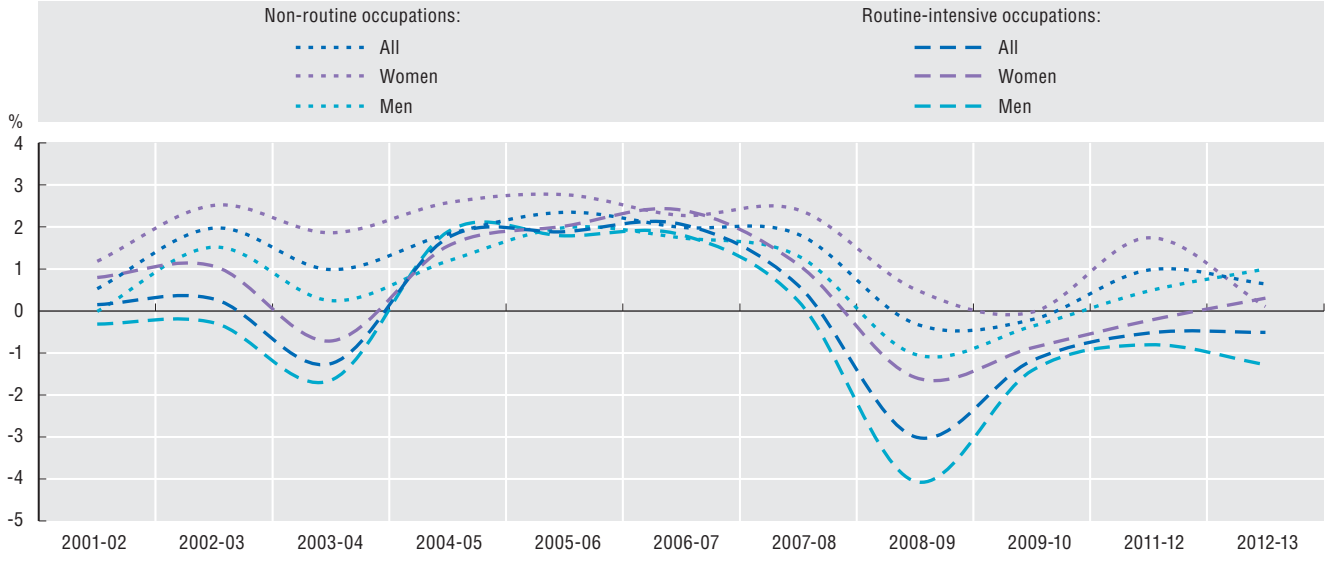
For this analysis, "Information industries" are defined according to ISIC Rev. 4. They cover ISIC Rev. 4 Division 26, *Manufacture of computer, electronic and optical products* and Section J, *Information and communication services*, which consists of *Publishing activities* (Division 58), *Audiovisual and broadcasting activities* (59-60), *Telecommunications* (61), and *IT and other information services* (62-63). This aggregate covers both the ICT sector and the Content and Media sector as defined by the OECD according to ISIC Rev. 4. See OECD (2011).

Jobs hit by the crisis

Occupations provide another way of looking at changes in employment. Job losses affect different types of workers in different ways, depending on their skills and the type of tasks carried out on the job. Experimental OECD work categorising occupations according to their routine intensity – the extent to which the tasks carried out follow precise patterns and may or may not be done differently, by someone else or somewhere else (i.e. automated, outsourced and/or offshored) – suggests that, in Europe, routine intensive occupations are more affected by layoffs during downturns and benefit less from growth spells. However, women in non-routine and routine-intensive occupations tend to suffer proportionally less during crises and to benefit relatively more during expansions. Among the factors that may contribute to explaining these gender-specific patterns are differences in the distribution of employment of men and women in the public and private sectors, industry-and-gender specific dynamics such as the marked decline of construction activities (a male-dominated sector), and the specific type of job accomplished (e.g. personal care).

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

Growth in occupations by routine intensity and gender, selected European economies



Source: OECD, calculations based on *Programme for International Assessment of Adult Competencies (PIAAC) Database* and Eurostat, European Labour Force Surveys (EULFS), June 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933272854

Measuring routine jobs: A new methodology using PIAAC data

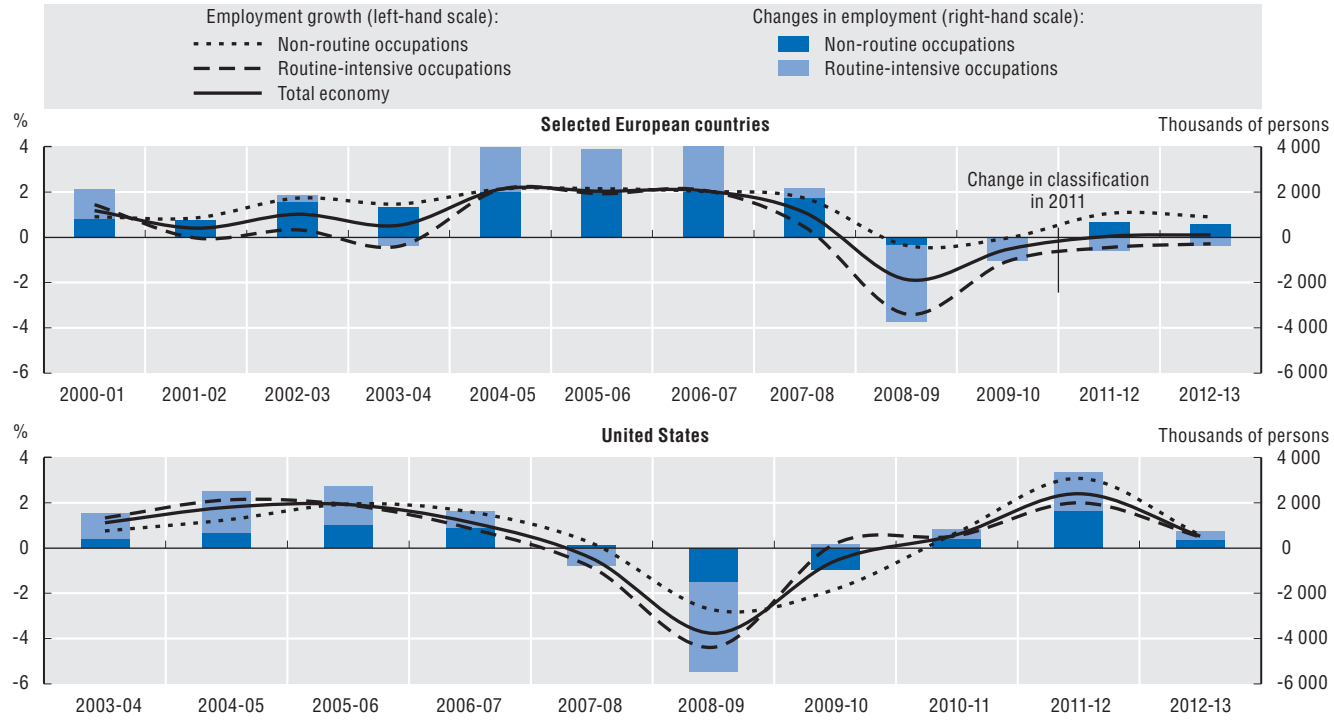
Experimental OECD work categorises occupations according to the routine intensity of the tasks performed on the job and investigates how such routine intensity relates to employment patterns. Routine-intensive occupations are broadly defined as jobs entailing the performance of tasks that are mainly accomplished by following a set of well-defined rules or patterns. Conversely, non-routine tasks entail performing more complex activities, such as creative problem solving and decision making, and involve greater autonomy for workers in carrying out the work. The proposed methodology exploits data from the OECD Programme for the International Assessment of Adult Competencies (PIAAC) survey and assesses the routine content of occupations using information about the possibility of making independent choices, and of altering the sequence and manner in which tasks are performed. This information is combined in an index, which is then used to subdivide occupations into four categories, homogenous with respect to the routine-intensity of the tasks accomplished. These are: low-routine-intensive occupations (e.g. managing directors and chief executives); medium-low-routine-intensive occupations (e.g. administrative and specialised secretaries); medium-high-routine-intensive occupations (e.g. machinery mechanics and repairers); and high-routine-intensive occupations (e.g. assemblers, food preparation assistants). Low and medium-low routine-intensive occupations are here denoted as "non-routine", whereas medium-high and high-routine-intensive occupations are denoted as "routine-intensive". Thanks to the richness of PIAAC, it is possible to redefine the routine intensity of occupations at the country and industry levels, and to examine, for example, gender-related and firm-size-related patterns. In addition, the routine intensity of occupations is being related to skill characteristics such as educational attainment, numeracy and the problem-solving ability of workers. This can help inform policies addressing issues such as the requalification and re-employment of workers (for more details about this new methodology, see Marcolin et al., 2015).

Jobs hit by the crisis

In Europe, the crisis disproportionnally affected the construction sector, where employment levels had increased significantly in previous expansion years thanks to investment in public infrastructure and housing booms. In general, while the United States shows more cyclical responsiveness than the EU, in both areas routine-intensive occupations appear more cyclical than non-routine ones, which are more resilient. In the depths of the crisis (2008-09), job losses in Europe mainly concerned routine-intensive occupations while in the United States they affected both groups. During the upswing of 2011-12 the United States gained jobs in both routine-intensive and non-routine occupations, while gains in Europe were only in non-routine occupations. In the United States these dynamics were driven by a mix of long-term trends, such as the growing role of occupations linked to the information economy or health care services, together with responses to both cyclical and unforeseen shocks (e.g. economic crisis). For instance, routine-intensive workers in health grew by 2 million and non-routine ICT-related occupations grew by 800 000 jobs over the decade.

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

Yearly growth rates, selected European countries and the United States



Note: 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.

Source: OECD, calculations based on *Programme for International Assessment of Adult Competencies (PIAAC) Database*, June 2015; Eurostat, European Labour Force Surveys (EULFS), June 2015 and United States Current Population Survey (CPS), June 2015. See chapter notes.

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How to read this figure

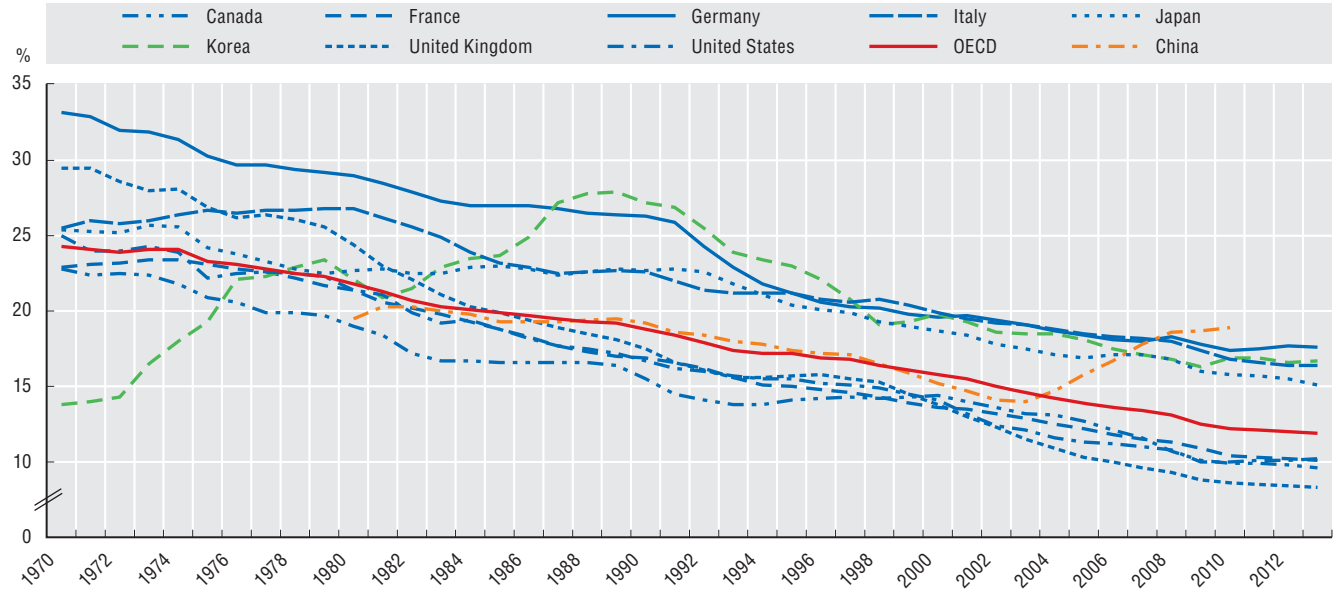
During the peak years of the crises (i.e. 2008-09), more than 3.7 million jobs were lost in Europe and about 5.5 million in the United States (right-hand scale, below the zero axis). In both economies, mostly routine-intensive workers were made redundant (about 3.4 million in Europe and 4 million in the United States). This corresponded to negative growth rates of 3.4% in Europe and 4.4% in the United States (left-hand scale). The crises affected non-routine workers significantly more in the United States than in Europe, with negative growth rates of -0.4% and -2.7%, respectively.

Long-term decline in manufacturing jobs

Since the early 1970s, most OECD countries have experienced a steady and persistent decline in employment in the manufacturing sector. Around 35 years ago, manufacturing typically accounted for about a quarter to a third of employment, whereas today in some OECD countries, such as Canada, France, the United Kingdom and the United States, the share has dwindled to 10% or lower. Broad deindustrialisation across OECD countries has been accompanied by waves of industrialisation in non-OECD countries, particularly in East and Southeast Asia. In Korea, prior to joining the OECD, the manufacturing base increased steadily, reaching a peak in employment in the early 1990s before its slow decline. This was followed by China, which by 2010 had become the world's leading manufacturer. These global shifts in manufacturing employment reflect major changes in production strategies among OECD firms, particularly those of multinational enterprises, with many production stages and tasks becoming distributed across economies as global value chains have become more widespread.

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

Manufacturing as a percentage of total employment, selected economies



Source: OECD, *Annual National Accounts Database*, *Structural Analysis (STAN) Database*, *http://oe.cd/stan*; Eurostat, *National Accounts Database* and national sources, June 2015; *World Input-Output Database (WIOD)*, *www.wiod.org*, July 2014; RIETI, *China Industrial Productivity (CIP) Database 3.0*, *www.rieti.go.jp/en/database/CIP2015/*, July 2015. See chapter notes.

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Definition of R&D intensive industries

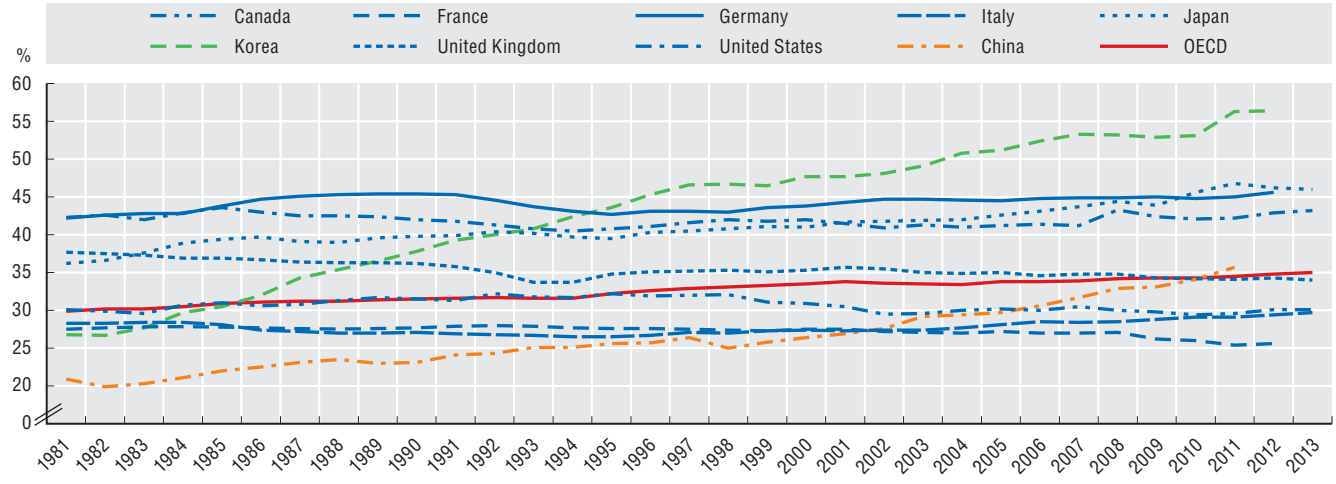
Industry R&D intensity is usually defined as the ratio of industry R&D expenditure to a measure of industry output – usually gross value added or gross output (production). In order to group industries according to R&D intensity, for each industry, the average R&D expenditure to output ratio is calculated over as many (usually OECD) countries as possible for the most recent year(s). The industries are then ranked. Recent work at OECD using the latest ISIC Rev. 4 data identified five high R&D-intensive industries: *Pharmaceuticals* (ISIC Rev. 4 Division 21), *Computer, electronic and optical products* (26) *Air and spacecraft* (303), *Software publishing* (582) and *Scientific R&D services* (72). To take account of the availability of employment data, this analysis employs a broader definition covering High and Medium-high R&D intensive manufacturing activities: *Chemical and pharmaceutical products* (ISIC Rev. 4 Divisions 20 and 21), *Machinery and equipment* (26, 27 and 28) and *Transport equipment* (29 and 30). As the R&D intensity classification is based on averages, in some countries some of the industries listed above may not be R&D intensive. Conversely, firms in some countries may perform high levels of R&D in activities allocated to a low R&D intensity group.

Long-term decline in manufacturing jobs

The loss of manufacturing jobs in the OECD area has affected some industries more than others. Over the past 30 years or so, a steadily increasing share of OECD manufacturing employment has come from R&D-intensive industries, rising from 30% to about 35%. In other words, relatively fewer jobs have been shed in this group of industries (chemicals, machinery and transport equipment) compared to others (e.g. textiles, plastics and basic metals). Relative to other OECD countries, Germany, Japan and Korea have retained high shares of jobs in manufacturing (over 15%), and employment in R&D intensive industries has remained comparatively buoyant, while the United States now accounts for over 40% of total manufacturing employment. Changes in global production patterns have seen manufacturing in China become more orientated around R&D-intensive industries, with the share of employment rising from 20% in the early 1980s to about 35% in recent years. However, a high presence of R&D-intensive industries does not necessarily indicate high levels of R&D expenditure, as much R&D can be embodied in imported intermediate goods.

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

As a percentage of total employment in manufacturing, selected economies



Source: OECD, *Annual National Accounts Database*, *Structural Analysis (STAN) Database*, *http://oe.cd/stan*; Eurostat, *National Accounts Database* and national sources, June 2015; *World Input-Output Database (WIOD)*, *www.wiod.org*, July 2014; RIETI, *China Industrial Productivity (CIP) Database 3.0*, *www.rieti.go.jp/en/database/CIP2015/*, July 2015. See chapter notes.

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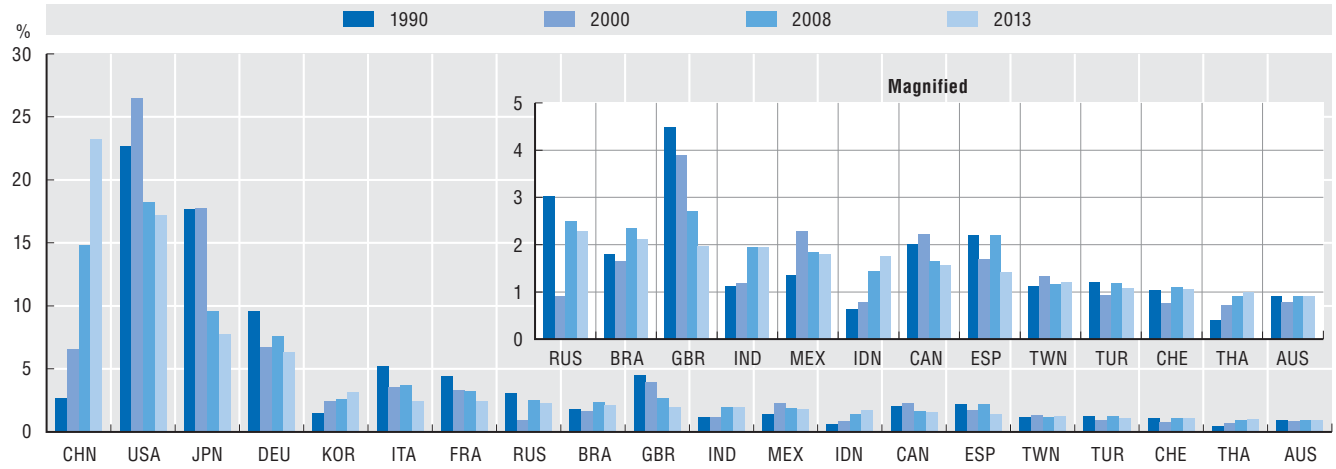
14. Top manufacturers in the last 20 years

Percentage share of total world manufacturing value added



Source: United Nations Statistical Division, *National Accounts Main Aggregates Database*, May 2015. See chapter notes.

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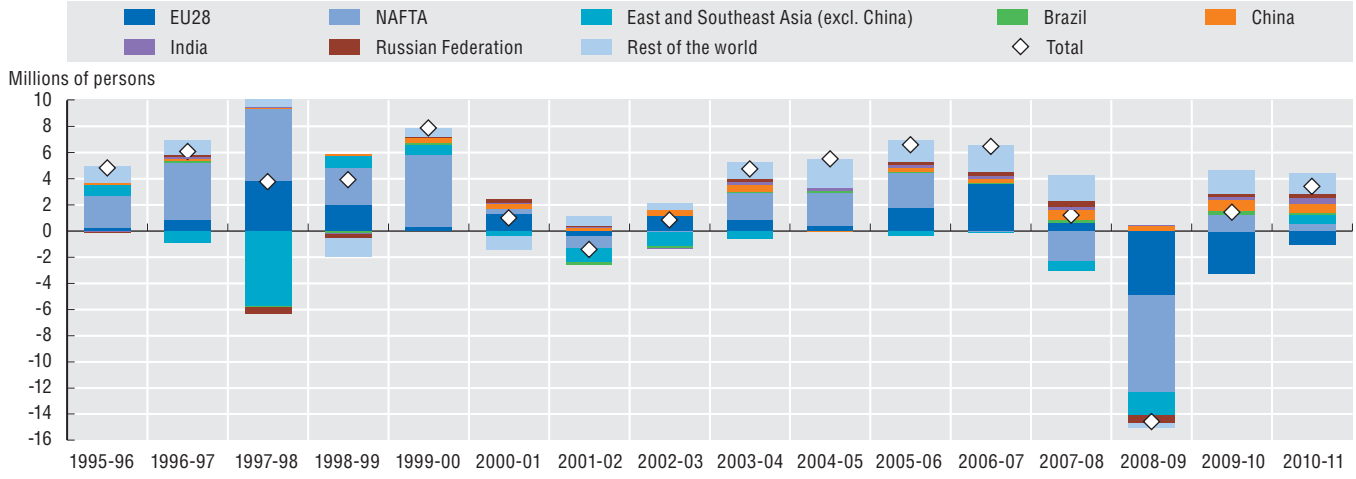
Changing sources of job demand

Growing economic and political integration worldwide has increased the sensitivity of employment in one country or region to changes in demand in other countries or regions. The OECD's Inter-Country Input-Output (ICIO) database enables researchers to derive experimental indicators that reveal how annual changes in OECD employment can be decomposed to account for changes in final demand for goods and services across different countries and regions. For example, an apparent overall increase of about 4 million business sector jobs in the OECD area, between 1997 and 1998, hides an increase of about 10 million jobs to meet demand in the European Union and the United States, which was offset by a loss of about 6 million jobs due to the financial crisis that hit Southeast Asia in 1997. In general, changes in OECD employment are affected by changes in OECD demand. This is illustrated by the significant loss of jobs during the most recent financial crisis, which was attributed to the decrease in demand across OECD countries. The immediate post-crisis period saw modest increases in OECD employment driven by demand from emerging economies, while sluggish demand in the European Union contributed to increased job losses.

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

Millions of persons, annual changes by region of demand



Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*, June 2015; OECD, *Structural Analysis (STAN) Database*, *http://oe.cd/stan* and *Annual National Accounts Database*, June 2015; *World Input-Output Database (WIOD)*, *www.wiod.org*, July 2014. See chapter notes.

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Towards measuring jobs sustained by foreign final demand

The goods and services people buy are composed of inputs imported from various countries around the world. However, the flows of goods and services within these global production chains are not always apparent from conventional international trade statistics, nor from national Input-Output or Supply and Use tables, which reveal flows of intermediate goods and services between industries (or product groups) used *within* a country for production to meet domestic and foreign demand. Building on these data sources, and many others, the OECD's *Inter-Country Input-Output (ICIO) Database* provides estimates of flows of goods and services between 61 economies and 34 economic activities (including 16 manufacturing and 14 service sectors) over seven years between 1995 and 2011.

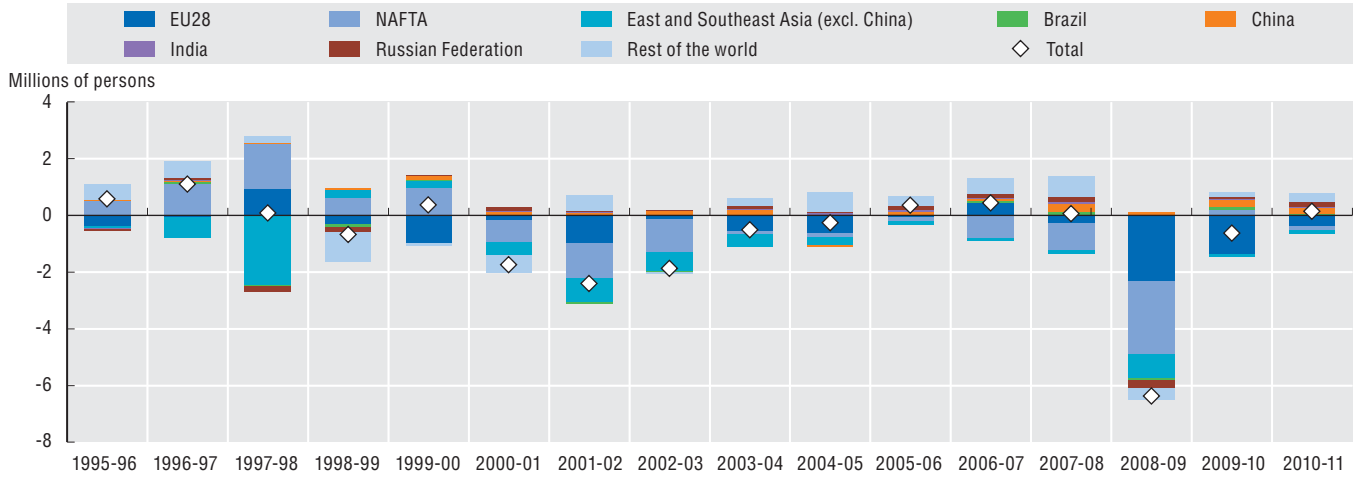
The most visible use of the ICIO is the construction of a suite of Trade in Value Added (TiVA) indicators under the joint OECD-WTO TiVA initiative. In general, these indicators reveal the value added origin (both domestic and foreign) of countries' exports and final demand. These indicators enable estimation of jobs *embodied* in (or sustained by) foreign final demand, in a manner similar to estimates of *Domestic value added embodied in foreign final demand*. However, experimental jobs-related indicators rely on some broad assumptions – in particular, that within each industry labour productivity in exporting firms is the same as firms producing goods and services for domestic use only, and that all firms use the same share of imports for a given output, whether exporters or domestic producers only. However, evidence suggests that exporting firms have higher labour productivity and use more imports in production. More efforts are required to account for firm heterogeneity within the ICIO framework, in order to reduce the potential upward biases resulting from the current assumptions.

Changing sources of job demand

The long-term decline in OECD employment in manufacturing can generally be attributed to the fall in demand in OECD countries for goods manufactured in the OECD area. In other words, as global value chains have propagated, more of the demand for manufactured goods in the OECD has been met by workers in emerging economies. In addition, evolving demand in these economies has had a positive impact for many manufacturing firms in the OECD area in recent years. For example, combined demand in Brazil, China and India apparently contributed to a net increase of over 300 000 manufacturing jobs in the OECD per year in the immediate aftermath of the 2009 crisis. Meanwhile, increasing specialisation in business services in OECD countries, and the accompanying increase in jobs in these sectors, occurred while meeting general global demand – although predominantly from OECD countries. Where there have been job losses in the business service sector, these often occur in services closely linked to manufacturing, such as transport and wholesale. Falling OECD demand for financial services also contributed to the decrease in business sector services during the financial crisis.

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

Millions of persons, annual changes by region of demand

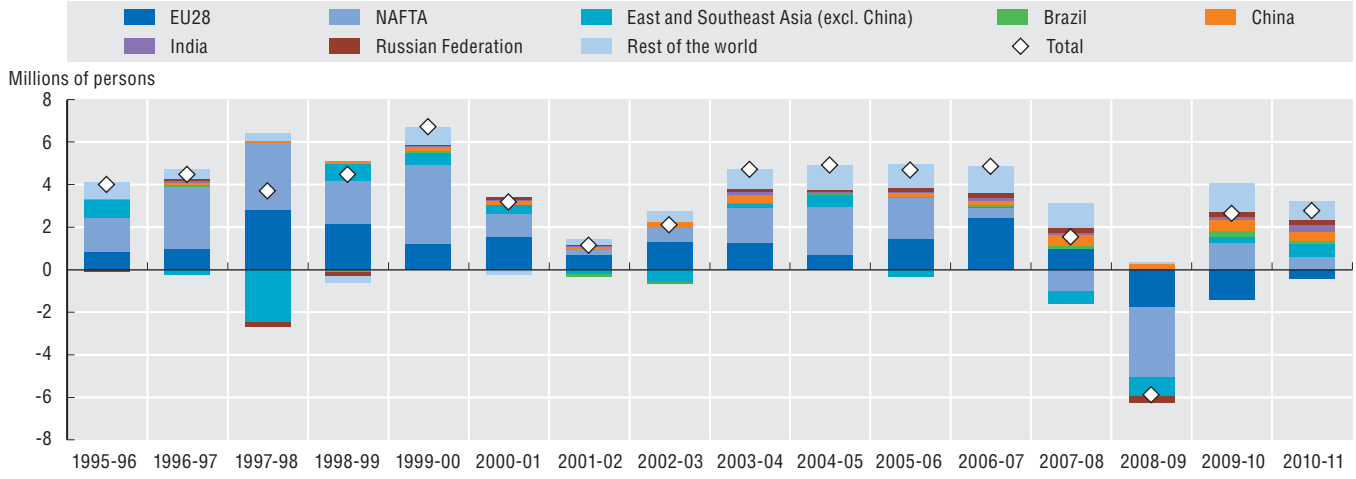


Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*; *Structural Analysis (STAN) Database*, *http://oe.cd/stan* and *Annual National Accounts Database*, June 2015; *World Input-Output Database (WIOD)*, *www.wiod.org*, July 2014. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933272914

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

Millions of persons, annual changes by region of demand



Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*; *Structural Analysis (STAN) Database*, *http://oe.cd/stan* and *Annual National Accounts Database*, June 2015; *World Input-Output Database (WIOD)*, *www.wiod.org*, July 2014. See chapter notes.

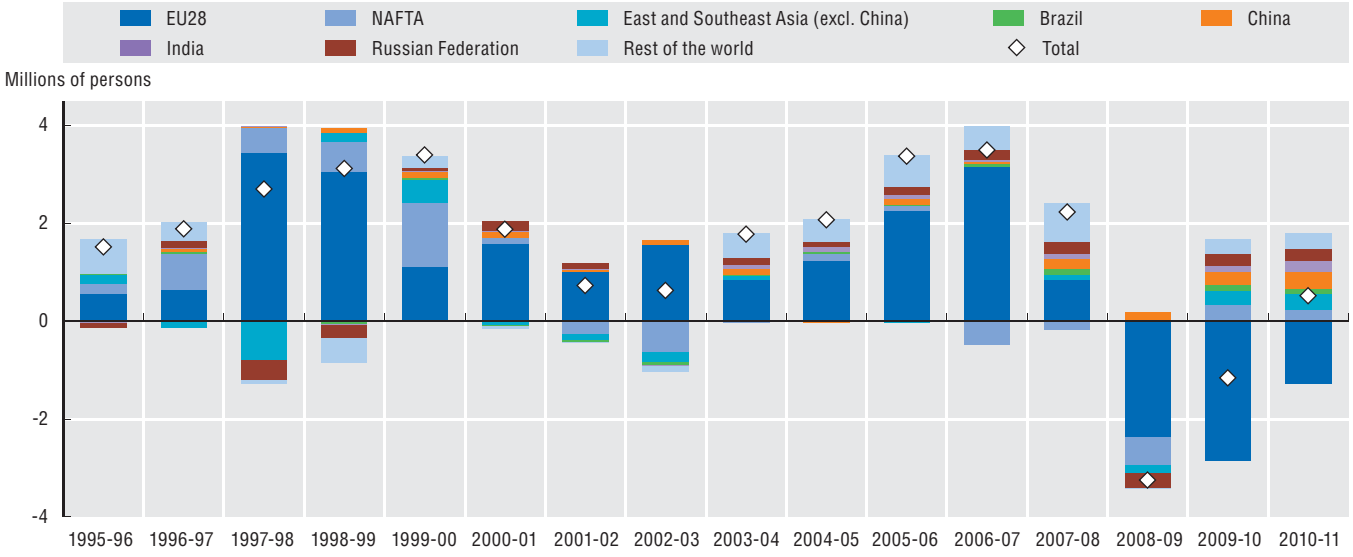
StatLink http://dx.doi.org/10.1787/888933272922

Jobs and skills in global value chains

Between 1995 and 2011, net changes in employment across the European Union were driven mainly by changes in EU final demand, with the impact of shifting demand patterns in NAFTA most noticeable prior to 2001. Subsequently, increasing demand from emerging economies, such as the Russian Federation and East and Southeast Asia and, to a lesser extent, Brazil and India, has made steady positive contributions to employment in the European Union. In general, overall improvements in EU employment following the crisis seem to have stemmed from increasing final demand in emerging economies, with China leading the way. Net EU job losses between 2009 and 2010 would have been significantly higher without demand for EU goods and services from outside the European Union, with a loss of 2.9 million jobs due to continuing falls in EU demand being partly offset by gains of 1.7 million due to demand elsewhere. Between 2010 and 2011, there was a modest net increase in EU employment despite the negative impact of faltering EU demand.

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

Millions of persons, annual changes by region of demand



Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*; *Structural Analysis (STAN) Database*, *http://oe.cd/stan* and *Annual National Accounts Database*, June 2015; *World Input-Output Database (WIOD)*, *www.wiod.org*, July 2014. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933272931

What do we mean by "jobs sustained by foreign final demand"?

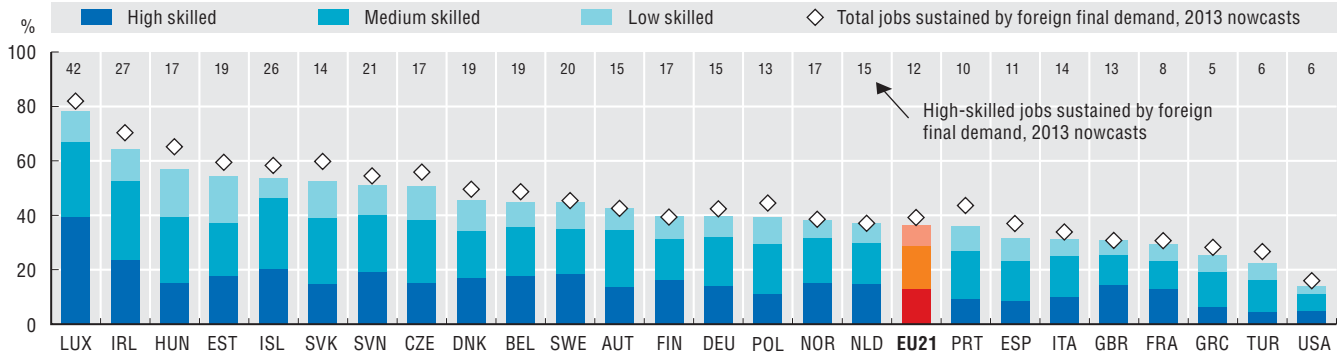
The notion of *jobs sustained by foreign final demand* attempts to capture the average number or share of jobs engaged in producing output that satisfied foreign demand for final goods and services. Accordingly, if foreign demand accounts for a quarter of a firm's output in a given year (whether intermediate or final goods), that firm's workers could be said to have used a quarter of their time to fulfil foreign demand. If half the output from the same firm in the following year, employing the same number of workers, is consumed abroad, then that firm's workers have used half their time to sustain foreign final demand. Thus, estimates of jobs sustained by foreign final demand reflect the fluctuating origins of demand (both domestic and foreign) for goods and services produced domestically i.e. an increase in the number of jobs sustained by foreign final demand does not necessarily translate into an increase in the total number of jobs; if the number of jobs sustained by domestic demand decreases. The use of hours worked or a measure of full-time equivalent employment could provide better metrics for determining the impact of global demand on domestic job markets. However, due to data availability this analysis used estimates of total numbers engaged (usually measured in persons) relative to output, by industry. Finally, biases may occur due to assumptions about homogenous labour productivity within industrial activities in countries and when aggregating country results to regions.

Jobs and skills in global value chains

In 2013, approximately 53 million and 14 million business sector workers across 21 EU countries and the United States, respectively, were engaged in production to satisfy foreign final demand. Preliminary results for 21 European countries suggest that about 36% of these jobs were in high-skilled occupations – a share that varies from about 20% in Turkey to about 50% in Luxembourg. For six other countries these shares are greater than 40% – the United Kingdom (47%), France (44%), Sweden (42%), Finland (41%), Norway (41%) and the Netherlands (40%). In the United States, the skill composition of jobs sustained by foreign final demand is similar to that of the EU aggregate, with 36% coming from high-skilled occupations. Preliminary *nowcasts* suggest that for most European countries and the United States, the share of jobs sustained by final demand increased between 2011 and 2013, as did the proportion of high-skilled workers. Greater integration in global value chains has implications for the demand for skills in countries. This results from differences in skills required in production for domestic consumption or for exports, differences in skill profiles of workers in foreign versus domestic companies, or differences in the structural composition of domestic versus foreign final demand. Regarding the latter, the results suggest that higher shares of low- and high-skilled workers are usually required to meet foreign demand than to meet domestic demand – which relies relatively more on medium-skilled occupations.

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

As a percentage of total business sector employment

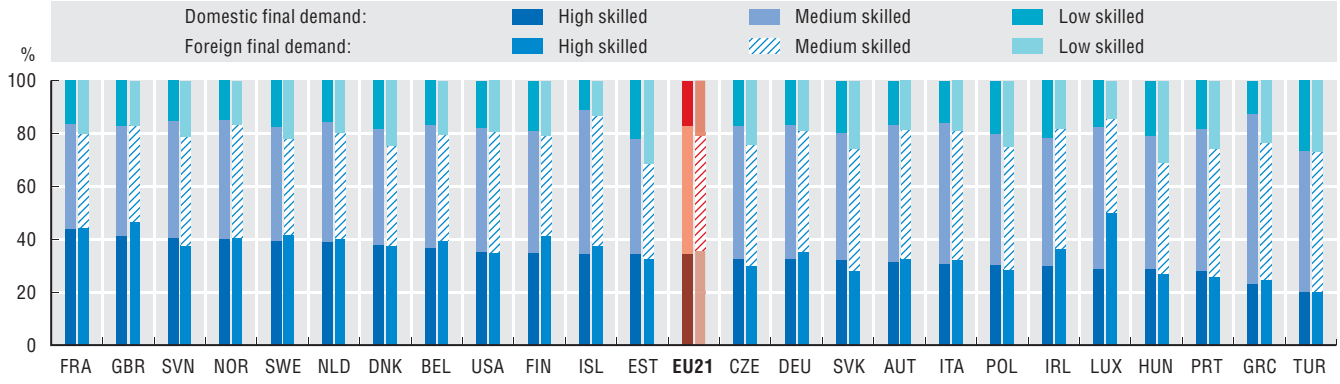


Note: Estimates for jobs sustained by foreign final demand in 2011 are derived directly from OECD's Inter-Country Input-Output (ICIO) table for 2011, while the estimates for 2013 are preliminary projections or *nowcasts*. This experimental indicator decomposes total employment sustained by foreign final demand into three groups of skill intensity 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 and 9).

Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*, *Annual National Accounts Database*, June 2015; Eurostat, European Labour Force Surveys (EULFS), June 2015; United States Current Population Survey (CPS), July 2015; and *World Input-Output Database (WIOD)*, *www.wiod.org*, July 2014.

StatLink http://dx.doi.org/10.1787/888933272947

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



Source: OECD, *Inter-Country Input-Output (ICIO) Database*, *http://oe.cd/icio*, *Annual National Accounts Database*, June 2015; Eurostat, European Labour Force Surveys (EULFS), June 2015; United States Current Population Survey (CPS), July 2015; and *World Input-Output Database (WIOD)*, *www.wiod.org*, July 2014.

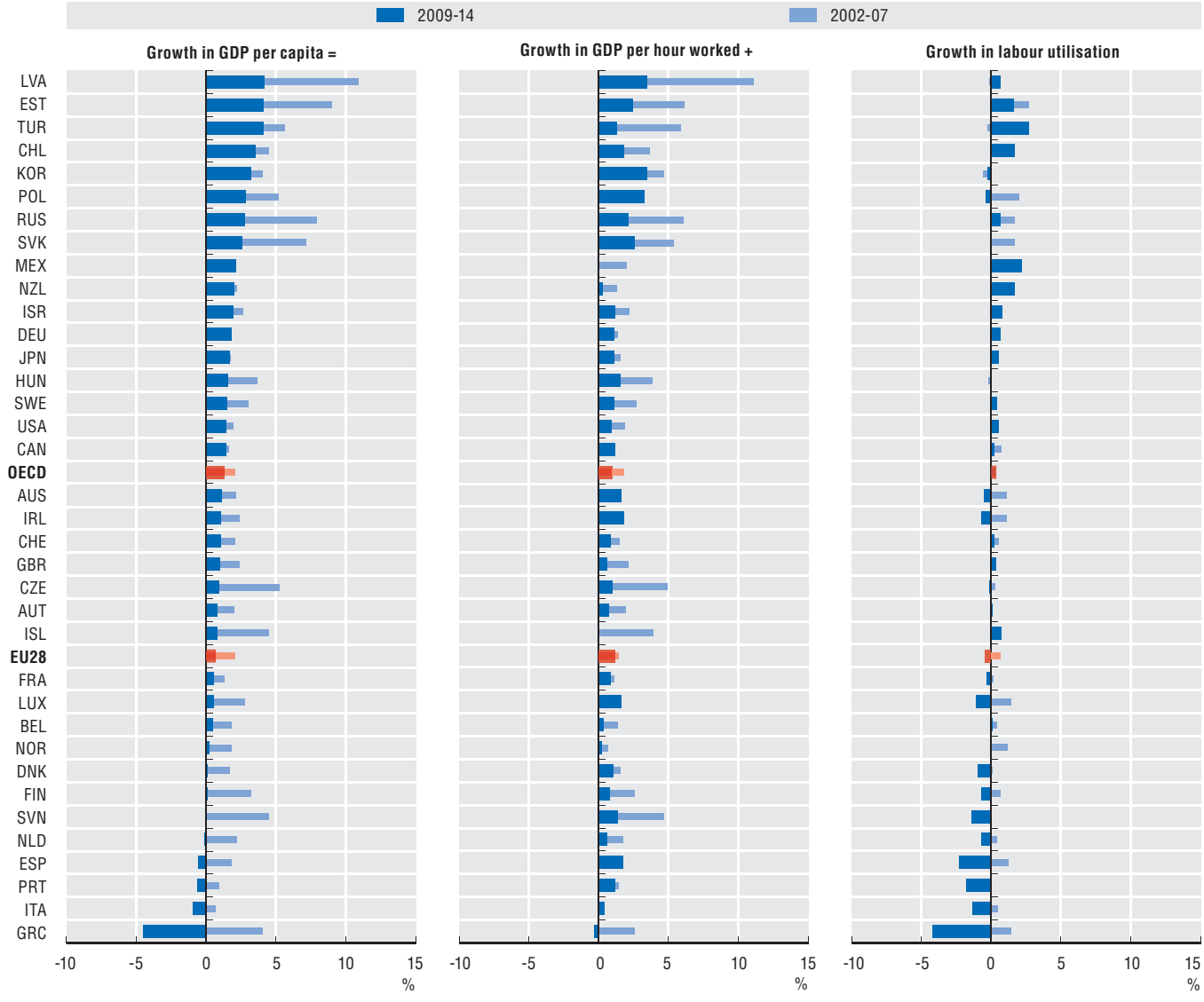
StatLink http://dx.doi.org/10.1787/888933272954

Sources of growth

Gross domestic product (GDP) per capita is a measure traditionally used to gauge a nation's welfare. Changes in this measure can result from shifts in labour productivity (GDP per hour worked) and labour utilisation (hours worked per employee and employment per capita). Differences in GDP per capita growth in OECD countries can be attributed mainly to differences in labour productivity growth, as labour utilisation has generally increased only marginally over the past 15 years. The picture changed slightly following the onset of the financial crisis. In some countries, the decline in GDP per capita resulted not only from slower productivity growth, but also from substantial declines in labour utilisation. These were due mainly to falls in employment and hours worked per person, while labour force participation remained broadly unchanged. In 2010, widespread growth signalled the start of a global recovery. However, the pace of recovery varies across the OECD and obliges countries to find new and sustainable sources of growth.

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

Total economy, annual percentage change



Source: OECD, *Productivity Database*, *www.oecd.org/std/productivity-stats*, May 2015. See chapter notes.

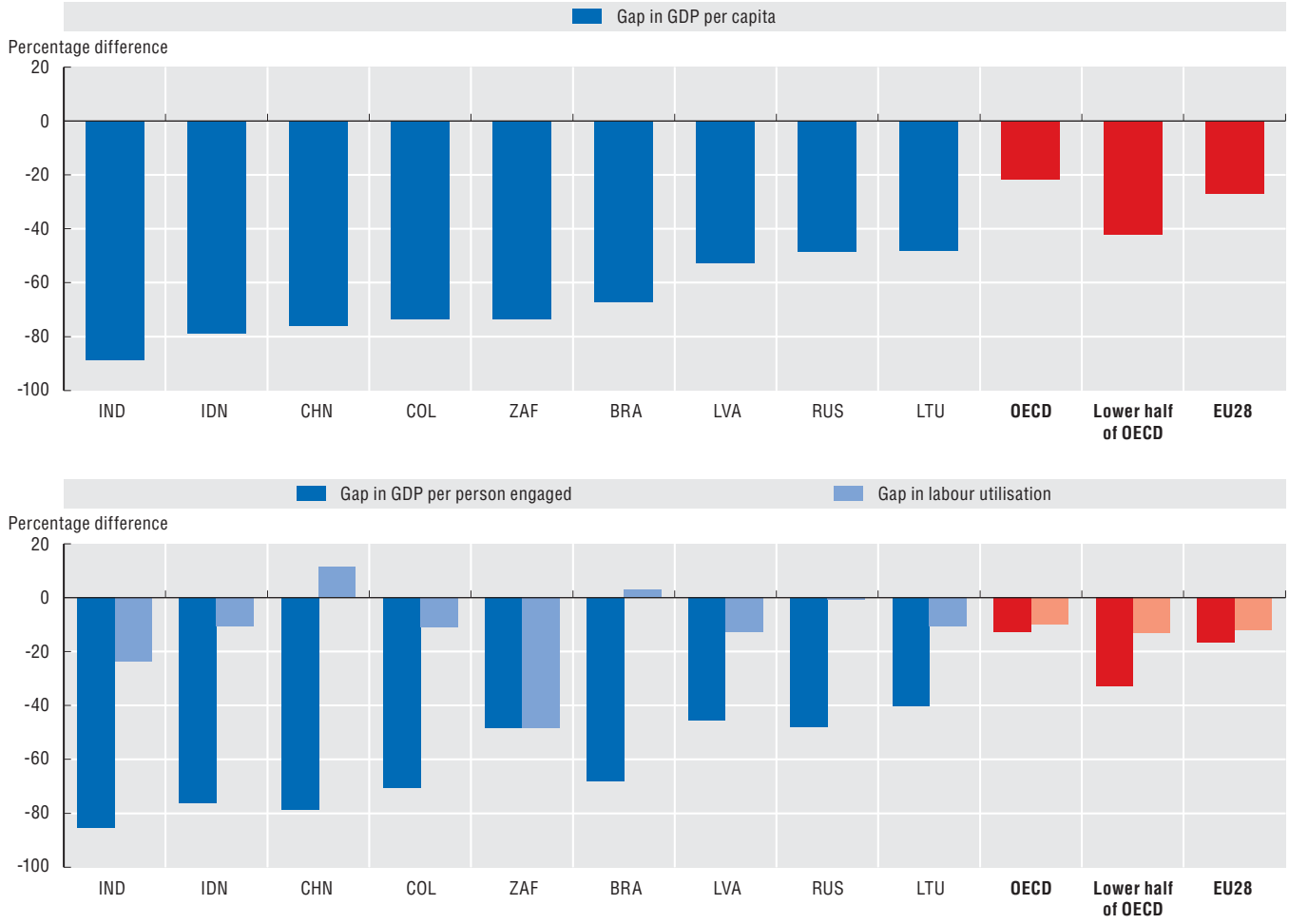
StatLink http://dx.doi.org/10.1787/888933272969

Sources of growth

Decomposition of GDP per capita highlights the importance of labour productivity in explaining the cross-country dispersion in income per capita. Despite rapid convergence among some BRIICS economies, income gaps persist with respect to the top half of OECD countries ranging from 49 and 89 percentage points (or 6 and 47 percentage points with respect to the lower half of the OECD). These gaps are due mainly to large labour productivity shortfalls compared to the United States. Among BRIICs countries, China's GDP per capita soared during the years of the crisis, drawing closer to the upper half of OECD over 2008-14, although it grew at a slower pace than in the preceding five years. The income gap is attributable to lower output per worker, as participation rates are above those in OECD countries. In Brazil, the GDP per capita gap is diminishing gradually but remains significant, due mainly to comparatively weak labour productivity performance (OECD, 2015c).

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

Percentage points differences with respect to the top half of the OECD



Source: OECD, *Productivity Database*, *www.oecd.org/std/productivity-stats*, May 2015. See chapter notes.

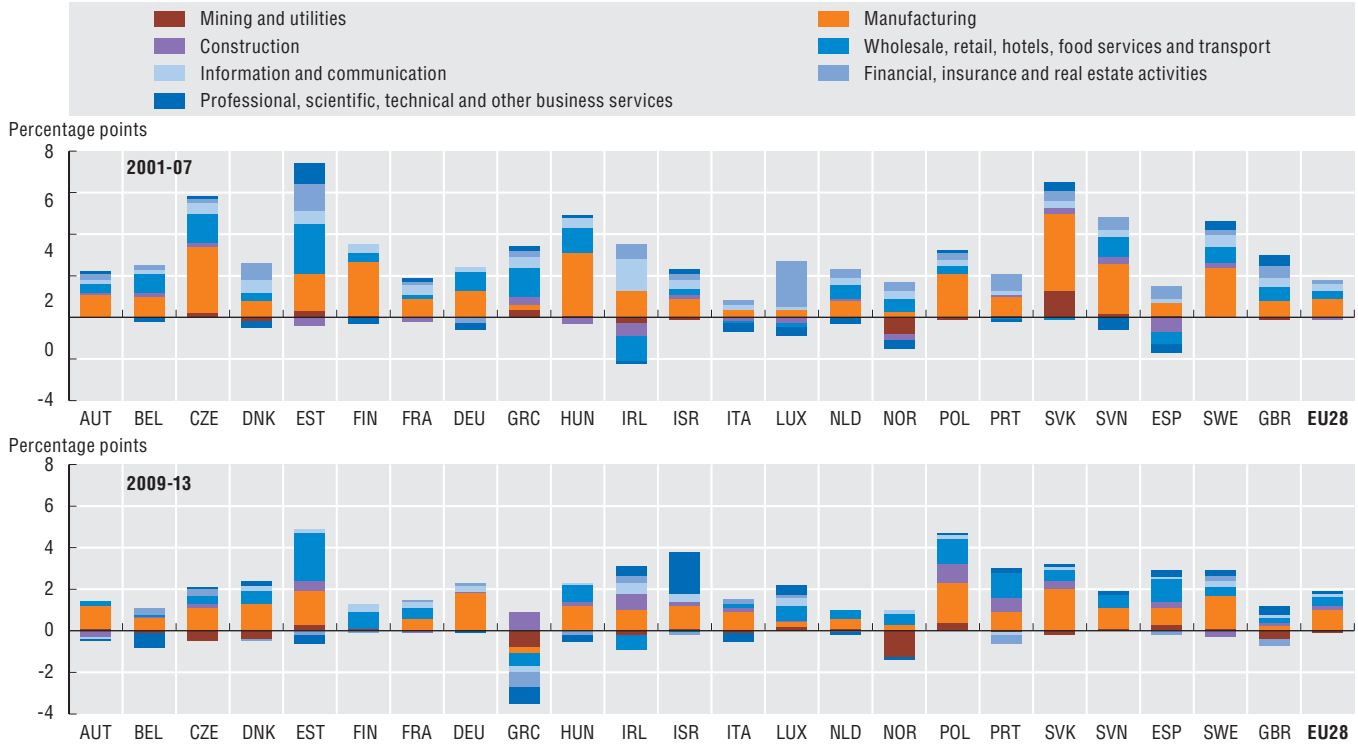
StatLink http://dx.doi.org/10.1787/888933272974

Labour productivity in sectors

Understanding the drivers of productivity growth at the total economy level requires an awareness of the contribution made by each industry. An individual sector's contribution depends not only on its productivity growth, but also on its share in total value added and employment. In the years up to the economic crisis (2001-07), productivity growth was driven almost entirely by increased productivity in manufacturing and by the increasing share of business services in overall activity. Excluding real estate, business-sector services accounted for 35% to 50% of value added across OECD countries. In European countries for which data are available, labour productivity growth decreased following the onset of the financial crisis in 2008, with this decline spread broadly across sectors. After 2008, changes in sector contributions seem to have been driven primarily by changes in sector productivity growth, rather than reallocation across sectors.

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

Contributions to average annual percentage change in non-agriculture business sector



Source: OECD, *Productivity Database*, *www.oecd.org/std/productivity-stats*, May 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933272986

Measuring labour productivity by sector

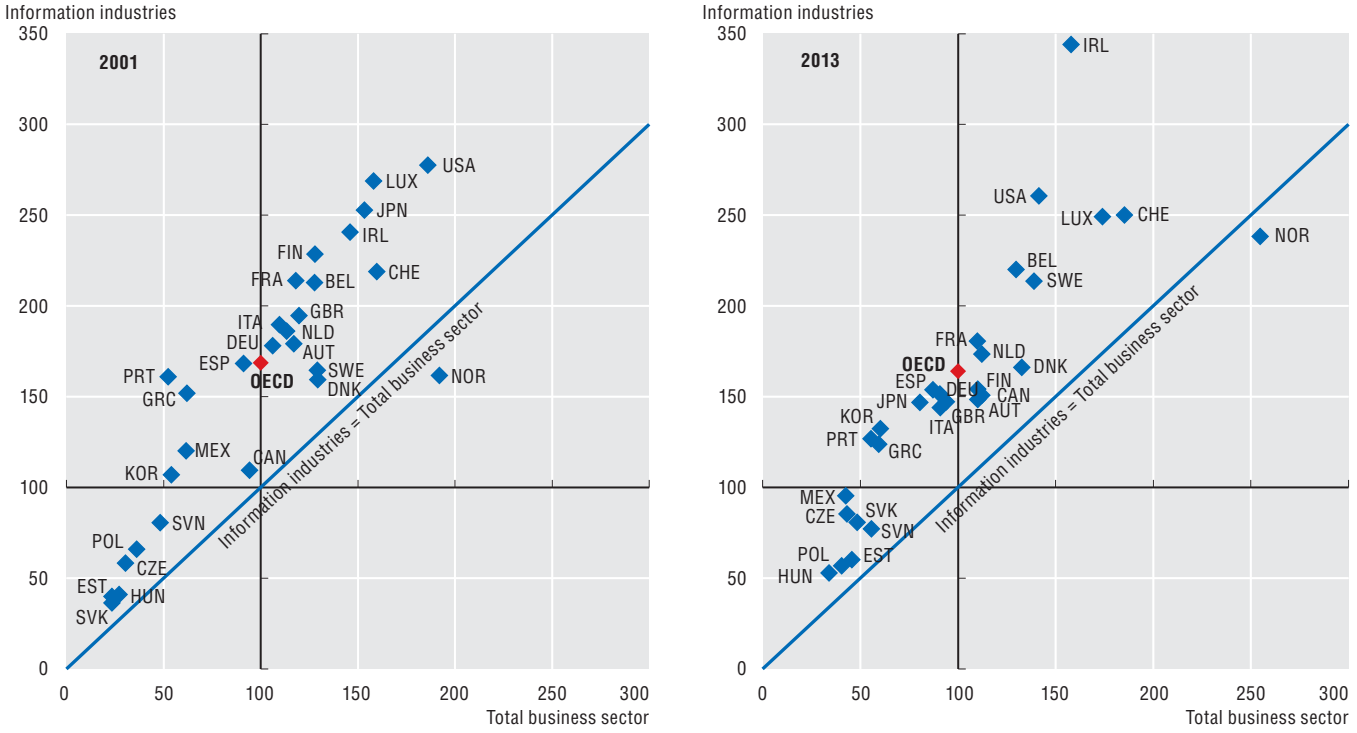
Labour productivity growth is defined as the rate of growth in real value added per hours worked. Differences in labour productivity growth across sectors may relate, for instance, to the intensity with which sectors use capital (including knowledge-based capital and skilled labour) in their production, the scope for product and process innovation, the degree of product standardisation, the scope for economies of scale, and involvement in global value chains. The comparability of productivity growth across industries and countries may be affected by problems in measuring real value added. This is particularly relevant for services, as price effects are difficult to isolate due to changes in the quality or mix of services from pure price changes. Despite the substantial progress made over the past ten years in compiling service producer price indices (SPPIs), the methods used to compute real value added still vary across OECD countries. Estimates of real value added in some industries are based on a sum-of-costs approach, which deflates, using assumptions about labour productivity growth, compensation of employees. For example, most countries assume no change in labour productivity for public administration activities; as such, this sector is not included here. Real estate services are also excluded, as the output of this sector reflects mainly the imputation made for the dwelling services provided and consumed by homeowners. In addition, sectors such as construction and several services are characterised by a high degree of part-time work and self-employment, which can affect the quality of estimates of actual hours worked. See OECD (2015), *OECD Compendium of Productivity Indicators 2015*.

Labour productivity in sectors

Information industries are characterised by higher than average levels of labour productivity across all OECD economies, reflecting their relative intensity in fixed and knowledge-based capital. On average, across the OECD area labour productivity in the information industries is more than 60% higher than in the total business sector, comparable to similar levels in 2001 at the height of the "new economy". This figure is higher than the total business sector average for the majority of OECD countries for which data are available. Ireland displays the highest labour productivity, driven in particular by growth in productivity of ICT services and in part by the presence of several US multinational headquarters in the ICT field, with high value added but few employees. The United States has the highest labour productivity in ICT manufacturing.

24. Labour productivity in information industries, 2001 and 2013

OECD total business sector = 100



Note: "Information industries" cover ISIC Rev. 4 Division 26, Manufacture of computer, electronic and optical products and Section J, Information and communication services, which consists of Publishing activities (Division 58), Audiovisual and broadcasting activities (59-60), Telecommunications (61), and IT and other information services (62-63). This aggregate covers both the ICT sector and the Content and Media sector as defined by the OECD, see OECD (2011).

Source: OECD, *Annual National Accounts Database* and *Structural Analysis (STAN) Database*, ISIC Rev. 4, *http://oe.cd/stan*, June 2015. See chapter notes.

StatLink *http://dx.doi.org/10.1787/888933272994*

How to read this figure

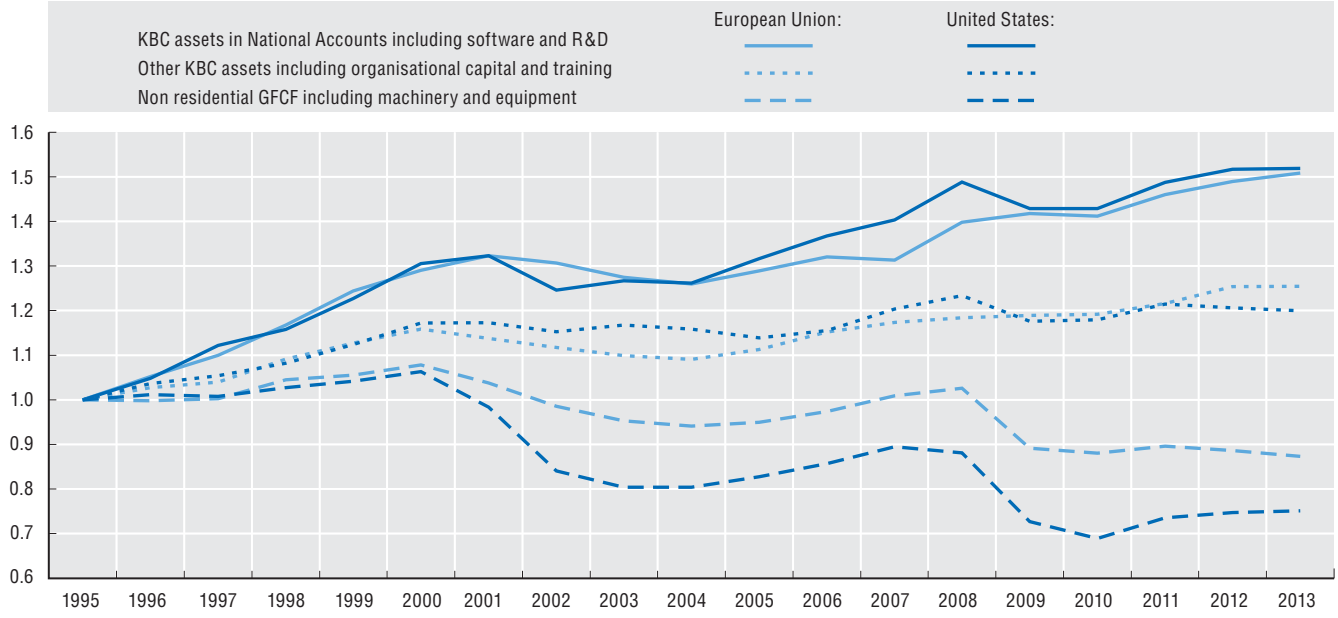
For values along the diagonal the labour productivity of information industries is equal to that of the total business sector. In all countries except for Norway, information industries have higher than average business sector labour productivity (countries are positioned above the diagonal). In 2001, labour productivity in OECD information industries was almost 69 percentage points higher than in the OECD total business sector and 64 percentage points higher than 2013 (red marks). Countries to the left (to the right) of the value 100 for the X axis have lower (higher) business sector productivity than the OECD average. In 2013, information industries in Ireland and the United States had the highest labour productivity.

Knowledge-based capital

Productivity is driven by innovation. This process relies not only on investment in research and development (R&D), but also on complementary assets such as software, design and human capital. In addition, it relies on the organisational capabilities of firms, specifically their ability to co-ordinate and manage production across global value chains, and on firm-specific training that enables workers to cope with change while improving productivity. Over the last two decades, businesses in a range of countries have increased their investment in knowledge-based assets, often at a faster pace than investment in traditional physical capital. While the latter decreased after 2000 – at a more marked pace in the United States than in Europe – business investment in KBC grew faster, or did not decline to the same extent, throughout the period. By 2011, KBC growth paths in both areas had returned to pre-crisis levels. This characteristic of aggregate investment in KBC may depend partly on the nature of the expenditures measured, primarily wages, which tend to be stickier than other forms of business expenditures.

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

Business sector investment by type of asset, as a percentage of gross value added, index 1995 = 1



Source: OECD calculations based on INTAN-Invest data, *www.intan-invest.net* and OECD, *Structural Analysis (STAN) Database*, *http://oe.cd/stan*, June 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273008

What do we mean by "knowledge-based capital"?

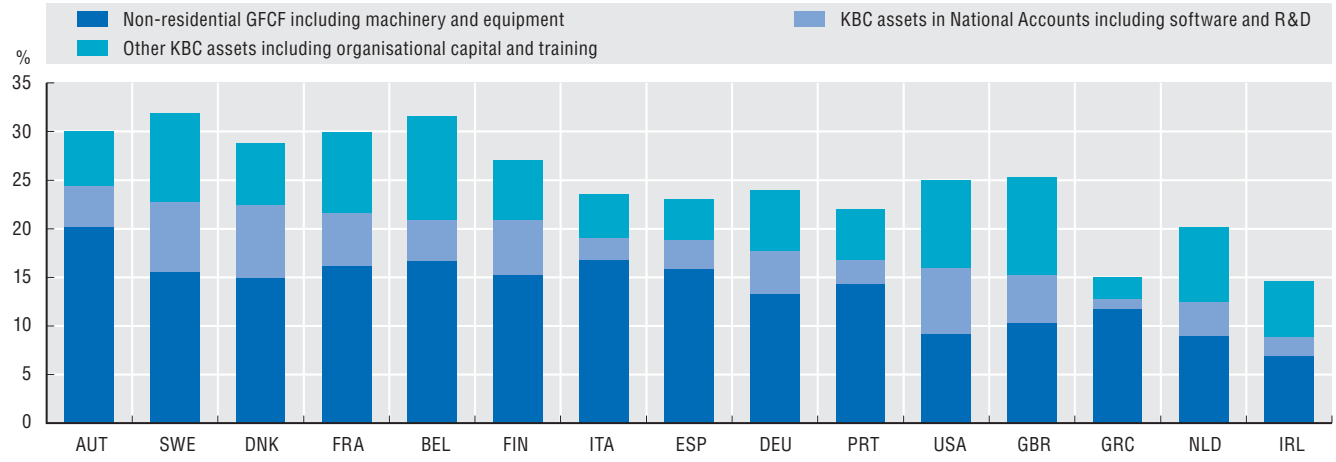
Knowledge-based capital (KBC), sometimes referred to as "intangible assets" or "intellectual capital", constitutes a long-lasting resource for companies and institutions. KBC assets are not physical in nature and their main value stems from their knowledge content and their ability to add value to other assets. The generation and accumulation of KBC result mostly from investment in human capital (i.e. people and their education, abilities, creativity and capacity for innovation). Following a widely used classification proposed by Corrado et al. (2009), investment in KBC can be subdivided into three main groups: computerised information (e.g. software and databases); innovative property (e.g. scientific and non-scientific R&D, copyrights, designs and trademarks); and economic competencies (including brand equity, aspects of advertising and marketing, firm-specific human capital, and organisational know-how and capabilities). Some KBC types have recently been recognised by the international statistical community as capital assets and are now accounted for in the *System of National Accounts* (SNA), underlining their importance. KBC assets consistent with the SNA definition include: software, R&D, entertainment, literary and artistic originals, and mineral exploration. Other KBC assets such as design, new product development in the financial industry, brands, firm-specific training and organisational capital have in recent years been at the centre of methodological work aimed at measuring these assets in an internationally comparable way. While much has been done to underpin these new sources of growth, future measurement work will need to address the pricing of these assets, the rate at which they depreciate, and the extent to which investment in different assets overlap. As firms within and across industries differ in their investment behaviours, additional work will be needed to measure and study investment patterns at the firm and industry levels. Such efforts will help to inform policy design to leverage these sources of growth, their specificities and their complementarities.

Knowledge-based capital

The importance of knowledge-based capital (KBC) for productivity and economic growth has been widely recognised, with firms in many OECD countries investing as much or more in KBC as they do in physical capital (machinery, equipment and buildings). In 2013, in the United States and the United Kingdom, investment in all types of KBC amounted to about 1.5 times investment in fixed assets. In contrast, investment in KBC in countries such as Italy and Spain amounted to less than half of investment in fixed assets. This proportion increased to about 80% in France and Germany and to about 90% or more in Denmark and Sweden. These investment patterns mirror the industrial structure of economies and differences in the knowledge intensity of sectors. Two main trends emerge when comparing 1995 and 2013 industry-specific KBC investment patterns: all sectors saw their median knowledge capital intensity increase, confirming the total business sector trends, and these increases were more heterogeneous, as indicated by the greater differences shown in the sector-specific intensities of top and bottom quartiles. This is partly explained by the crisis that hit sectors to a different extent and in particular sectors such as finance and construction. Organisational competences and design explain the relatively high knowledge intensity in the construction sector.

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

As a percentage of business sectors' gross value added



Source: OECD calculations based on INTAN-Invest data, *www.intan-invest.net* and OECD, *Structural Analysis (STAN) Database*, *http://oe.cd/stan*, June 2015.
See chapter notes.

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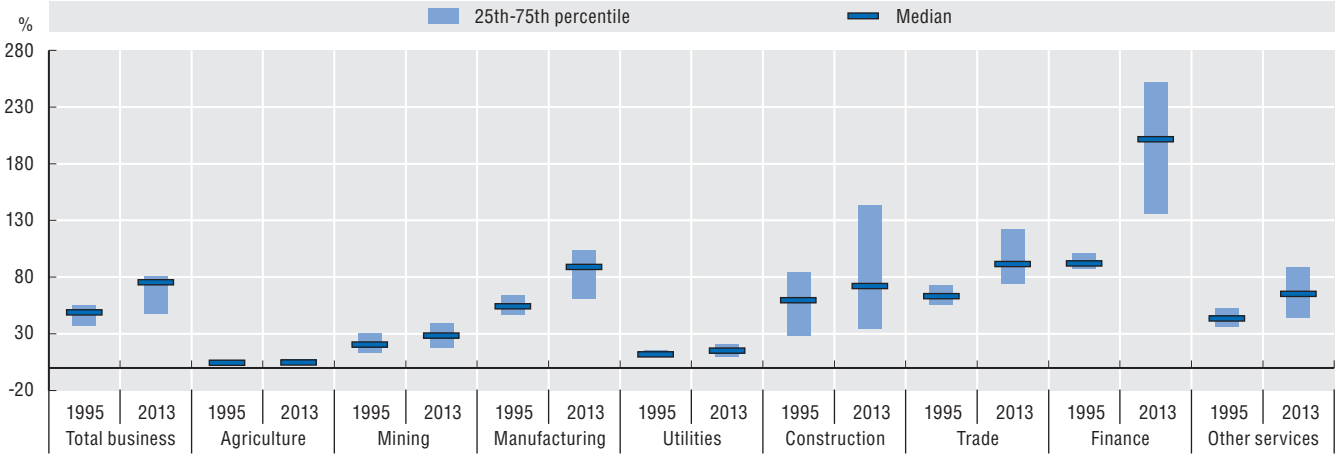
27. Knowledge capital intensity by sector, selected economies, 1995 and 2013

As a percentage of sectors' gross fixed capital formation



Source: OECD calculations based on INTAN-Invest data, *www.intan-invest.net* and OECD, *Structural Analysis (STAN) Database*, *http://oe.cd/stan*, June 2015.
See chapter notes.

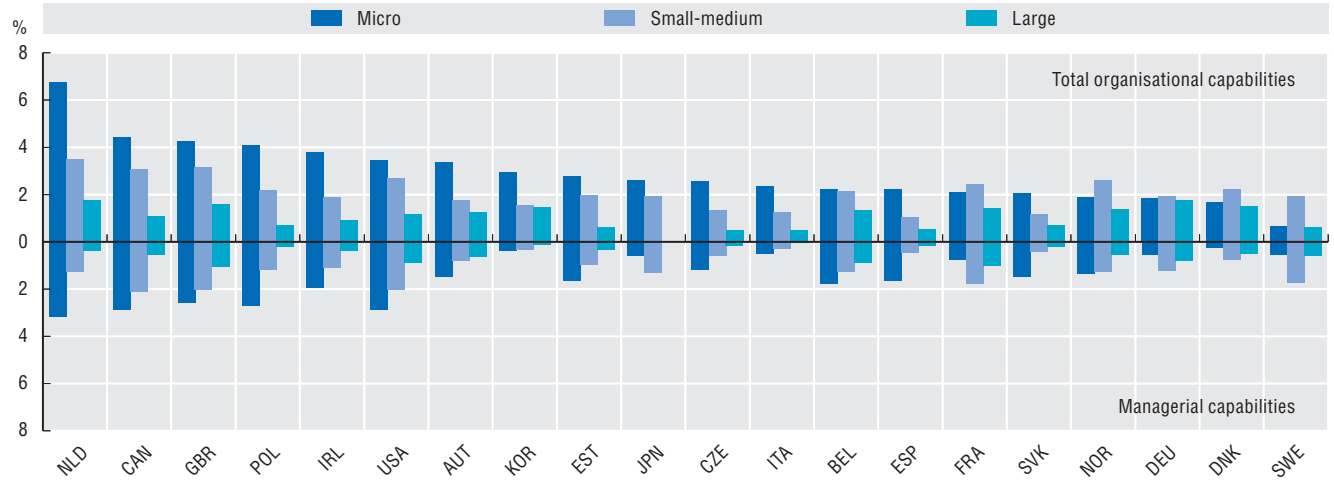
StatLink http://dx.doi.org/10.1787/888933273022

Organisational assets and training

The ways in which companies are organised, the skills of different workers and the tasks and functions they accomplish, and the extent to which knowledge is generated, codified, shared and used, are among the most important drivers of firm's performance and ability to compete and succeed on the market. Indicators based on a new OECD experimental methodology suggest that in most economies, micro and small and medium-sized enterprises (SMEs) invest a larger proportion of their value added in organisational and managerial capabilities than large firms. While seemingly counterintuitive, this result mirrors the fact that a number of organisational and strategic functions need to be accomplished regardless of company size (e.g. planning sales, identifying and comparing possible suppliers), and hence their incidence over total value added is proportionally higher the smaller the firm. In micro firms and SMEs, more than 50% of investment in organisational capabilities corresponds to managers, whereas this share decreases to 45% in large firms, where the importance of organisational profiles other than managers (e.g. production supervisors) is more pronounced.

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

As a percentage of country-wide value added in the size category



Source: OECD calculations based on *Programme for International Assessment of Adult Competencies (PIAAC) Database*; OECD, *Structural Analysis (STAN) Database*, *http://oe.cd/stan*; OECD, *Structural and Demographic Business Statistics (SDBS) Database* and national data sources, June 2015. See chapter notes.

StatLink *http://dx.doi.org/10.1787/888933273038*

What do we mean by "organisational capital"?

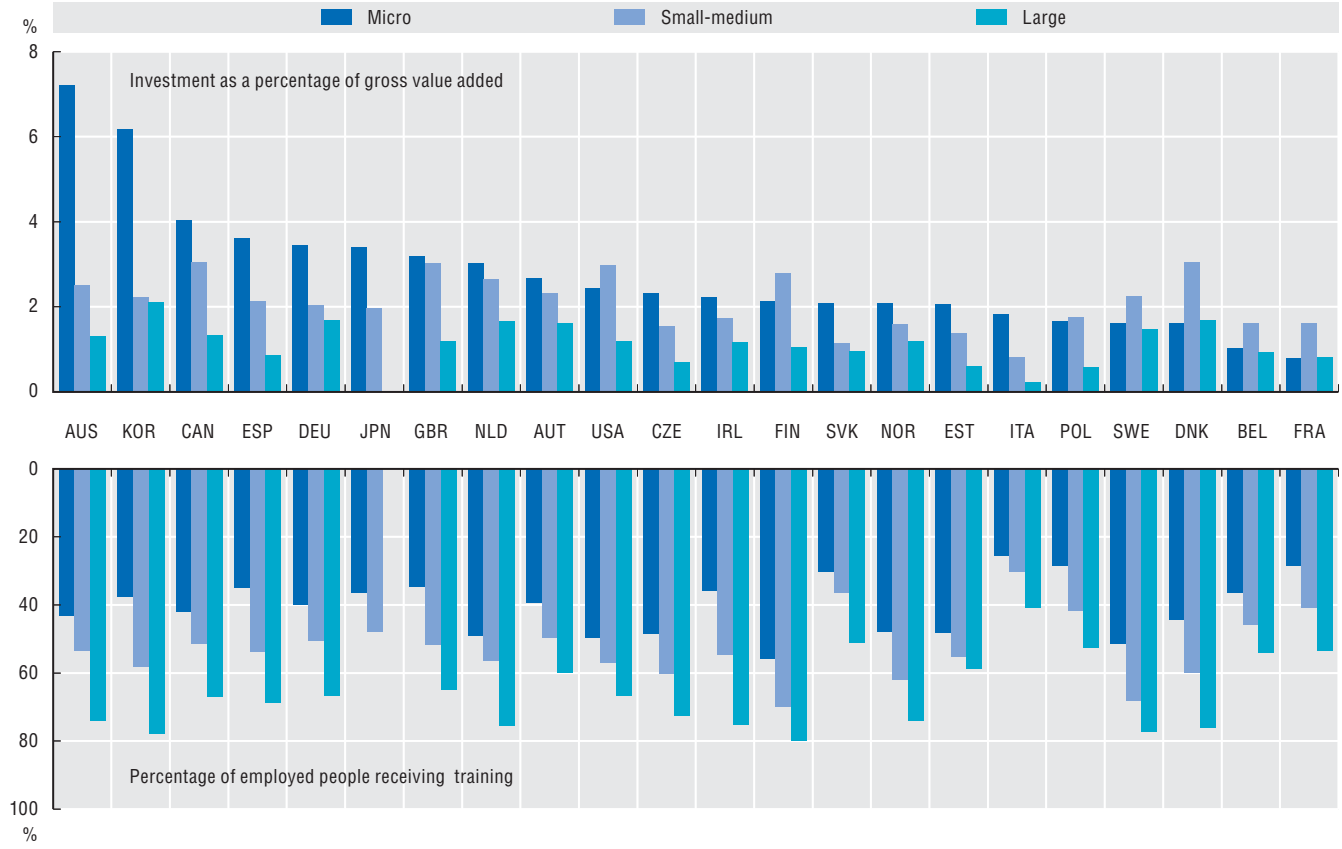
Organisational capital (OC) is firm-specific human capital, i.e. workers such as managers, supervisors and professionals who carry out tasks and activities that affect the medium and long-term functioning and performance of firms. Organisational capital workers perform tasks that involve to varying degrees: developing objectives and strategies; organising, planning and prioritising work; building teams, matching employees to tasks and providing training; supervising and co-ordinating activities; and communicating across and within groups to provide guidance and motivation. Organisational capital-related workers have been identified using information from the Programme for the International Assessment of Adult Competencies (PIAAC) regarding the frequency with which workers in different occupations perform OC-related activities. Occupations contributing to the generation and accumulation of organisational capital are those that perform such OC-related activities to the highest extent, and do so much more than workers in other occupations. Estimates of investment in organisational capital assume that OC workers on average dedicate one day a week of their work to strategic and organisation-related activities intended to shape the long-term functioning of firms. The corresponding proportions of these workers' salaries are accounted for as investment. Crucially, it is the impact of OC activities on the organisation and performance of the firm in future years, as well as in the year in which expenditures are incurred, that makes it a capital asset. The experimental methodology on which estimates rely (see Le Mouel and Squicciarini, 2015) also addresses country specificities in terms of occupational profiles generating organisational capital, and differences emerge with respect to the occupational profiles that most contribute to the generation of organisational capital within and across industries and countries. Firms' organisational capabilities are embodied in managers, albeit not exclusively, as most of the tasks traditionally carried out by managers have been progressively devolved to non-managerial occupations, due to a general move towards the decentralisation of responsibilities and less hierarchical organisational structures.

Organisational assets and training

Training helps to improve and maintain the human capital of firms by endowing workers with the skills and knowledge needed to perform on the job and adapt to change. Training also increases the productivity of workers and thus enhances the performance and productivity of firms. While the percentage of workers receiving on-the-job training is comparatively higher in large firms in all the economies considered, the percentage of value added invested in training is generally higher for micro and small and medium-sized companies than for large enterprises. In small firms, having one of few employees devoting time to training rather than work entails allocating relatively bigger shares of productive resources to it. The cases of France, Sweden and Denmark are notable, where investment in organisational capital and on-the-job training is highest for SMEs. Factors such as the industrial structure and specialisation of economies, the skill endowment of the workforce, and participation in global value chains all contribute to shaping investment patterns in training and organisational capital.

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

Employees and investment in the respective size category



Source: OECD calculations based on *Programme for International Assessment of Adult Competencies (PIAAC) Database*; OECD, *Structural Analysis (STAN) Database*, *http://oe.cd/stan*; OECD, *Structural and Demographic Business Statistics (SDBS) Database* and national data sources, June 2015. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933273041

How to read this figure

The bottom panel of the figure shows that more than 40% of workers in micro firms in Australia underwent on-the-job training in 2012, as compared to more than 50% in small and medium-sized enterprises, and almost 80% in the case of large firms. However, based on estimates that take into account information regarding the length of training, the kind of workers benefitting from it and other factors, the figure in the top panel shows that micro firms invest more than 7% of their value added in training. This share is much larger than for SMEs and large companies, which invest 2% and 1%, respectively, of overall value added generated by companies in the same size class.

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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