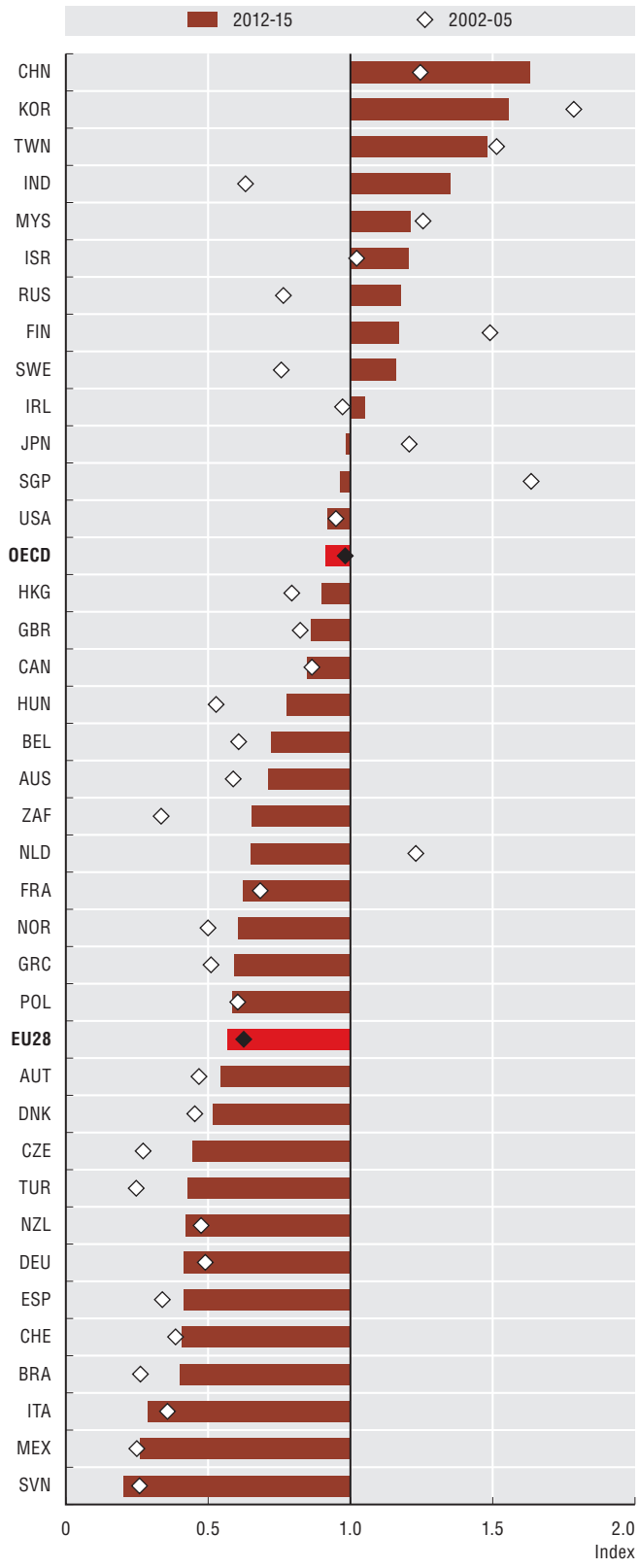
5. Technological advantage

Revealed technology advantage in ICT, 2002-05 and 2012-15

Index based on IP5 patent families



Source: OECD, STI Micro-data Lab: Intellectual Property Database, *http://oe.cd/ipstats* , June 2017. StatLink contains more data. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933619752

Did you know?

Specialisation in ICT patents more than doubled in India during 2002-15 and increased by more than 50% in China.

Innovations in enabling technologies such as information and communication technologies (ICT) and technologies addressing societal needs related to health and the environment have the potential to benefit people worldwide. Information contained in patent documents helps to shed light on the relative specialisation of countries with regard to these technologies.

Between 2002 and 2015, a number of economies, especially China and India, increased their relative specialisation in ICT, as measured by the index of revealed technology advantage (RTA). The average decrease in specialisation of OECD countries (-7% on average) between 2002-05 and 2012-15 conceals a diverse picture. For example, Korea and Finland decreased their specialisation in ICT-patented technologies by more than 20%, while specialisation increased in Israel and Sweden by approximately 20% or more.

While OECD countries, overall, did not increase their specialisation in health or environmental applications, fairly heterogeneous patterns emerge. Health-related technologies saw many OECD countries further increase their RTA over the period considered. Among them, the Netherlands more than doubled its RTA in health technologies and Korea substantially reduced the relative lack of specialisation exhibited the previous decade. Conversely, China despecialised over the same period.

Somewhat similar patterns can be observed in the case of environmental technologies, which saw OECD economies such as Denmark and New Zealand increase their RTA by more than 50%. Conversely, BRIICS countries appear to have despecialised by more than 20%, overall.

Definitions

The revealed technological advantage (RTA) index measures the share of an economy's patents in a specific technology relative to the share of total patents owned. The index is calculated on the basis of patent families within the Five IP Offices (IP5), by location of the inventor(s).

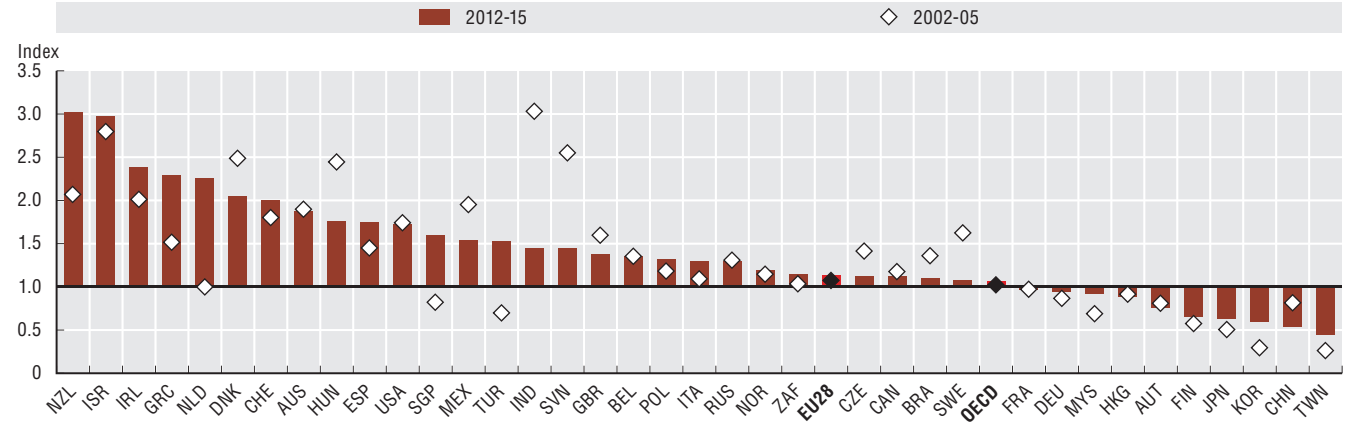
Patents in ICT rely on the International Patent Classification (IPC) codes detailed in Inaba and Squicciarini (2017), and reflect recent developments in ICT, notably in networks, mobile communication, security, data analysis and human interfaces.

Health-related patents are identified using the WIPO IPC-technology concordance (2013), and cover pharmaceutical and medical technology patents.

Environmental technology patents are identified using refined search strategies based on the IPC and the Cooperative Patent Classification (CPC), and draw upon the expertise of patent examiners at the European Patent Office (EPO), as described in Haščič and Migotto (2015).

Revealed technology advantage in health-related technologies, 2002-05 and 2012-15

Index based on IP5 patent families

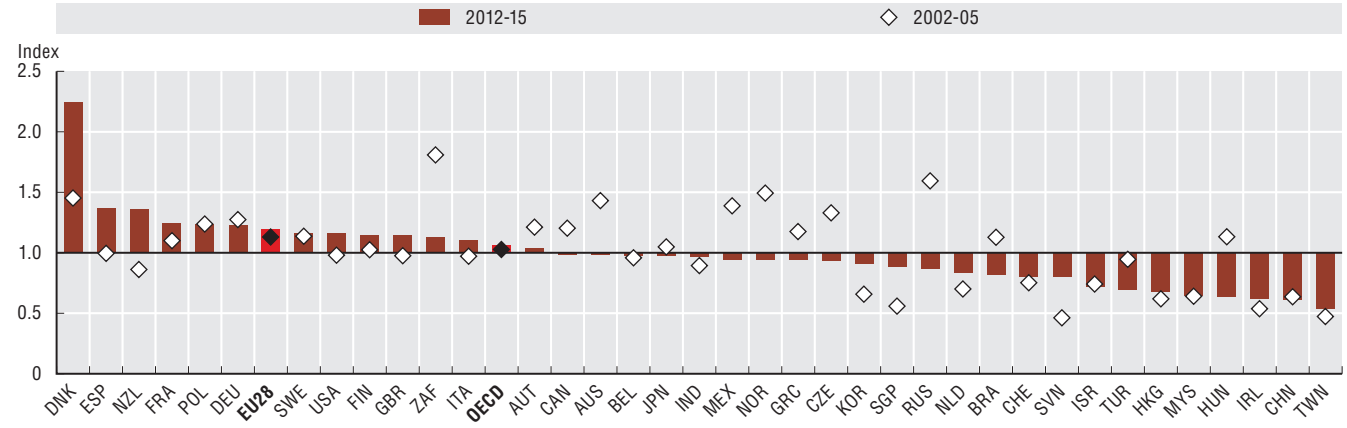


Source: OECD, STI Micro-data Lab: Intellectual Property Database, *http://oe.cd/ipstats* , June 2017. StatLink contains more data. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933619771

Revealed technology advantage in environment-related technologies, 2002-05 and 2012-15

Index based on IP5 patent families



Source: OECD, STI Micro-data Lab: Intellectual Property Database, *http://oe.cd/ipstats* , June 2017. StatLink contains more data. See chapter notes.

StatLink http://dx.doi.org/10.1787/888933619790

Measurability

The RTA index is equal to zero when the economy has no patents in a given field, equals 1 when the economy's share in the technology field is equivalent to its share in all fields (no specialisation), and rises above 1 when specialisation is observed. Given the way the RTA is compiled, economies with relatively low levels of patenting may appear highly specialised in certain technologies, as their activities are more likely to be concentrated in only a few fields.

International Patent Classification codes attributed by patent examiners during the examination process indicate the technological domains to which inventions belong. IPC classifications are revised periodically to account for the emergence of new technologies and the evolution of existing ones. This may lead to the reclassification of patents into different classes.

The use of data from other patent offices may change the patterns observed, as companies within and across technology fields may behave differently and pursue different innovative strategies in different markets.

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 recognizes 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 recognized 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."

5.1. R&D specialisation

Business R&D intensity adjusted for industrial structure, 2015

A country's industrial structure-adjusted indicator of R&D intensity is a weighted average of its sectoral R&D intensities (ratio of R&D to value added), using the OECD industrial structure – sectoral share in OECD value added for 2015 – as adjusted, common weights across all countries. The unadjusted measure of BERD intensity is by definition an average based on each country's actual sector shares.

R&D series are presented as a percentage of value added in industry estimated as the value added in all activities except: Real estate activities (ISIC Rev.4 68); Public administration and defence; Compulsory social security and education (ISIC Rev.4 84-85); Human health and social work activities (ISIC Rev.4 86-88); and Activities of households as employers (ISIC Rev.4 97-98). R&D performed in these sectors across the OECD is reported to be negligible.

Figures are based on estimates of business R&D by industry reported on a main activity basis, in ISIC Rev.4.

For Australia, Austria, Belgium, Canada, France, Greece, Ireland, Korea and Sweden, data refer to 2013.

For Denmark, Finland, Hungary, Italy, the Netherlands, Poland, Portugal, Slovenia, the United Kingdom and the United States, data refer to 2014.

Value added is measured at basic prices except for Japan (purchasers' prices).

Data on value added come from the OECD STructural ANalysis (STAN) Database except for Hungary, Iceland, Ireland, Korea and Turkey (OECD National Accounts Statistics), Canada (national source) and Australia (OECD National Accounts Statistics and estimates based on ABS Australian National Accounts: Input-Output Tables, 2013-14, for manufacturing industries).

Business R&D in manufacturing, by R&D intensity group, 2015

The R&D intensity groups are defined according to the OECD R&D intensity classification at a two-digit level. See Galindo-Rueda and Verger (2016), "OECD Taxonomy of Economic Activities Based on R&D Intensity", OECD Science, Technology and Industry Working Papers, No. 2016/04, OECD Publishing, Paris. DOI: *http://dx.doi.org/10.1787/5jlv73sqqp8r-en*.

High and medium-high R&D intensive manufacturing includes "Chemicals and pharmaceutical products" (ISIC Rev.4 Divisions 20 and 21) and "Computer, electronic and optical products, electrical equipment, machinery, motor vehicles and other transport equipment" (ISIC Rev.4 Divisions 26 to 30).

Figures are based on estimates of business R&D by industry reported on a main activity basis, in ISIC Rev.4.

For Austria, Belgium, France, Greece, Ireland and Sweden, data refer to 2013.

For Canada, Denmark, Finland, Hungary, Israel, Italy, the Netherlands, Poland, Portugal, Slovenia, the United Kingdom and the United States, data refer to 2014.

For Denmark, Israel, Sweden and Switzerland, "Chemicals and chemical products" (ISIC Rev.4 Division 20) are included in "Other manufacturing industries".

R&D in services industries, 2015

Figures are based on estimates of business R&D by industry reported on a main activity basis, in ISIC Rev.4.

These statistics are based on OECD R&D Statistics (*http://oe.cd/rds*) and ANBERD (*http://oe.cd/anberd*) Databases. For more information on these data, including on issues such as breaks in series, please see those sources.

For Australia, Austria, Belgium, Ireland and New Zealand, data refer to 2013.

For Canada, Denmark, Finland, Hungary, Israel, Italy, the Netherlands, Poland, Portugal, Slovenia and the United States, data refer to 2014.

For Chile, data refer to 2007 and 2015.

For France and Sweden, data refer to 2007 and 2013.

For Greece, the 2015 estimate for R&D services industry is based on 2013 data.

For Switzerland, data refer to 2004 and 2015.

For the United Kingdom, data refer to 2007 and 2014.

5.2. E-business uptake

Diffusion of selected ICT tools and activities in enterprises, by technology, 2016

Unless otherwise stated, only enterprises with ten or more employees are considered.

Data for ERP relate to 2015 for all countries except Canada (2013), Iceland (2014) and Sweden (2014).

Data for CRM relate to 2015.

Data for RFID relate to 2014.

Cloud computing: For Canada, data refer to 2012 and to enterprises that have made expenditures on "software as a service" (e.g. cloud computing). For Mexico, data refer to 2012.

"For countries in the European Statistical System, data on e-purchases and e-sales refer to 2015.

For Australia, data refer to the fiscal year 2014/15 ending on 30 June.

For Canada, data refer to 2013 except cloud computing (2012).

For Iceland, data refer to 2014.

For Japan, data refer to 2015 and include businesses with 100 or more employees instead of ten or more.

For Korea, data refer to 2015 except cloud computing (2013).

For Switzerland, data refer 2015 and to businesses with five or more employees instead of ten or more.

Diffusion of selected ICT tools and activities in enterprises, OECD countries, 2010 and 2016

E-purchases and e-sales refer to the purchase and sales of goods or services conducted over computer networks by methods specifically designed for the purpose of receiving or placing orders (i.e. webpages, extranet or electronic data interchange (EDI), but not orders by telephone, fax or manually typed e-mails). Payment and delivery methods are not considered.

Enterprise resource planning (ERP) systems are software-based tools that can integrate the management of internal and external information flows from material and human resources to finance, accounting and customer relations. Here, only sharing of information within the firm is considered. For ERP, data refer to 2015.

Cloud computing refers to ICT services over the Internet to access server, storage, network components and software applications.

Supply chain management (SCM) refers to the use of automated data exchange (ADE) applications. For SCM, data refer to 2015.

Customer/supplier relationship management software (CRM) is a software package used for managing a company's interactions with customers, clients, sales prospects, partners, employees and suppliers. For CRM, data refer to 2015.

Social media refers to applications based on Internet technology or communication platforms for connecting, creating and exchanging content online with customers, suppliers or partners, or within the enterprise. Social media might include social networks (other than paid adverts), blogs, file sharing and wiki-type knowledge-sharing tools.

Radio frequency identification (RFID) is a technology that enables contactless transmission of information via radio waves. RFID can be used for a wide range of purposes, including personal identification or access control, logistics, retail trade and process monitoring in manufacturing. For RFID, data refer to 2014.

Enterprises engaged in sales via e-commerce, by size, 2015

Unless otherwise stated, only enterprises with ten or more employees are considered. Small firms have 10-49 employees and large firms have 250 or more employees.

For Australia, data refer to the fiscal years 2010/11 ending on 30 June and 2014/15.

For Canada, data refer to 2012 and 2013. Large firms have 300 or more employees. Sales online over the Internet may include EDI sales over the Internet as well as website sales, but do not include sales via manually typed e-mail or leads.

For Iceland, data refer to 2013 instead of 2015.

For Japan, data refer to 2010 instead of 2009 and to businesses with 100 or more employees instead of ten or more. Large firms have 300 or more employees.

For Korea, data refer to 2010 instead of 2009.

For Mexico, data refer to 2012 and to businesses receiving orders via the Internet instead of over computer networks.

For New Zealand, data refer to the fiscal years 2010/11 ending on 30 June and 2015/16.

For Switzerland, data refer to 2011.

5.3. E-business across applications and sectors

Enterprises using cloud computing services, by size, 2016

Unless otherwise stated, only enterprises with ten or more persons employed are considered. Size classes are defined as: small (from 10 to 49 persons employed), medium (50 to 249) and large (250 and more).

For Australia, data refer to the fiscal year 2014/2015 ending on 30 June.

For Brazil, data refer to 2015.

For Canada, data refer to 2012 and to enterprises that have made expenditures on "software as a service" (e.g. cloud computing). Medium-sized enterprises have 50-299 employees. Large enterprises have 300 or more employees.

For Iceland, data refer to 2014.

For Italy, there is a break in series between 2014 and 2016.

For Japan, data refer to 2015 instead of 2016 and to businesses with 100 or more employees. Medium-sized enterprises have 100-299 employees. Large enterprises have 300 or more employees.

For Korea, data refer to 2015 instead of 2016.

For Mexico, data refer to 2012.

For Switzerland, data refer to 2015 and to firms with five or more employees.

Uptake of cloud services in industries, OECD, 2016

Data refer to 2016 or most recent year available.

Unless otherwise stated, data refer to enterprises with ten or more persons employed.

The following industries were considered: Manufacturing; Construction; Wholesale trade, except of motor vehicles and motorcycles; Retail trade, except of motor vehicles and motorcycles; Transportation and storage; Accommodation and Food and beverage service activities; Information and communication; Real estate activities; Professional, scientific and technical activities; Administrative and support service activities. For each of those industries, the following indicators are reported: (i) the OECD simple average based on the OECD countries available; and (ii) the countries with respectively the maximal and minimal value.

Diffusion of selected ICT tools and activities in industries, OECD, 2016

Data refer to 2016 or most recent year available.

For each ICT tool or activity, the following industries were considered: Manufacturing; Construction; Wholesale trade, except of motor vehicles and motorcycles; Retail trade, except of motor vehicles and motorcycles; Transportation and storage; Accommodation and Food and beverage service activities; Information and communication; Real estate activities; Professional, scientific and technical activities; Administrative and support service activities. For each ICT tool or activity: (i) an OECD simple average was calculated for each of the industries based on data available for the OECD countries; (ii) the OECD simple average by industry was ranked by decreasing order of the value by industry, and the maximum and minimum value with the respective industries have been reported in the figure. For each ICT tool or activity, the value of the average reported in the figure correspond to the OECD average calculated for all available OECD countries for all industries and may differ slightly from the average value reported in Figure 5.2.2.

E-purchases and e-sales refer to the purchase and sales of goods or services conducted over computer networks by methods specifically designed for the purpose of receiving or placing orders (i.e. web pages, extranet or electronic data interchange [EDI], but not orders by telephone, fax or manually typed e-mails). Payment and delivery methods are not considered.

Enterprise resource planning (ERP) systems are software-based tools that can integrate the management of internal and external information flows from material and human resources to finance, accounting and customer relations. Here, only sharing of information within the firm is considered. For ERP, data refer to 2015.

Supply chain management (SCM) refers to the use of automated data exchange (ADE) applications. For SCM, data refer to 2015.

Customer/supplier relationship management software (CRM) is a software package used for managing a company's interactions with customers, clients, sales prospects, partners, employees and suppliers. For CRM, data refer to 2015.

Social media refers to applications based on Internet technology or communication platforms for connecting, creating and exchanging content online with customers, suppliers or partners, or within the enterprise. Social media might include social networks (other than paid adverts), blogs, file sharing and wiki-type knowledge-sharing tools.

Radio frequency identification (RFID) is a technology that enables contactless transmission of information via radio waves. RFID can be used for a wide range of purposes, including personal identification or access control, logistics, retail trade and process monitoring in manufacturing. For RFID, data refer to 2014.

5.4. Start-up dynamics

Entry and exit rates in ICT and other business sectors, 2013-15

Figures report averages over the three most recent available years, conditional on the availability of data.

The ICT sector includes the ISIC Rev.4 sectors 26, 61 and 62-63: Computer and electronics; Telecommunications and IT and other information services.

Other sectors cover manufacturing and the non-financial business services sector excluding the ICT sector, Coke and refined petroleum products and Real estate activities.

Figures from DynEmp v.3 exclude units in the 0-1 size class.

DynEmp v.2 and v.3 apply a different adjustment to the year of birth when this occurs within the sample period.

Data for some countries are still preliminary.

Owing to methodological differences, figures may deviate from officially published national statistics.

For Italy and the United Kingdom, data refer to 2008-10.

For France and New Zealand, data refer to 2009-11.

For Austria, Denmark, Luxembourg, the Netherlands and Portugal, data refer to 2010-12.

For Belgium and the United States, data refer to 2011-13.

For Norway, data refer to 2010-11 and 2014.

Concerning the United Kingdom, this work contains statistical data from the Office for National Statistics (ONS) which is Crown Copyright. The use of ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

Share of young micro and small existing firms in ICT and other sectors, 2013-15

The graph reports the share of young (less than 6 years old) micro and small (less than 50 employees) incumbent units.

Figures report averages over the three most recent available years, conditional on the availability of data.

The ICT sector includes the ISIC Rev.4 sectors 26, 61 and 62-63: Computer and electronics; Telecommunications and IT and other information services.

Other sectors cover manufacturing and the non-financial business services sector excluding the ICT sector, Coke and refined petroleum products and Real estate activities.

Figures from DynEmp v.3 exclude units in the 0-1 size class.

DynEmp v.2 and v.3 apply a different adjustment to the year of birth when this occurs within the sample period.

Data for some countries are still preliminary.

Owing to methodological differences, figures may deviate from officially published national statistics.

For Italy and the United Kingdom, data refer to 2008-10.

For France and New Zealand, data refer to 2009-11.

For Austria, Denmark, Luxembourg, the Netherlands and Portugal, data refer to 2010-12.

For Belgium and the United States, data refer to 2011-13.

For Norway, data refer to 2010-11 and 2014.

Concerning the United Kingdom, this work contains statistical data from the Office for National Statistics (ONS) which is Crown Copyright. The use of ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

Differences in employment growth between young small and old small firms in ICT and other sectors, 2013-15

The graph shows the difference between the average employment growth rate of small (10-49 employees) young (less than 6 years old) units and the average employment growth rate of small (10-49 employees) old (6+ years old) units.

Micro (less than 10 employees) units are excluded from the computations.

Figures report averages over the three most recent available years, conditional on the availability of data.

The ICT sector includes the ISIC Rev.4 sectors 26, 61 and 62-63: Computer and electronics; Telecommunications and IT and other information services.

Other sectors cover manufacturing and the non-financial business services sector excluding the ICT sector, Coke and refined petroleum products and Real estate activities.

Data for some countries are still preliminary.

Owing to methodological differences, figures may deviate from officially published national statistics.

For Italy and the United Kingdom, data refer to 2008-10.

For France and New Zealand, data refer to 2009-11.

For Austria, Denmark, Luxembourg, the Netherlands and Portugal, data refer to 2010-12.

For Belgium and the United States, data refer to 2011-13.

For Norway, data refer to 2010-11 and 2014.

Concerning the United Kingdom, this work contains statistical data from the Office for National Statistics (ONS) which is Crown Copyright. The use of ONS statistical data in this work does not imply the endorsement of the ONS in relation to the interpretation or analysis of the statistical data. This work uses research datasets which may not exactly reproduce National Statistics aggregates.

5.5. Technological advantage

Revealed technology advantage in ICT, 2002-05 and 2012-15

The revealed technological advantage index is calculated as the share of patents of an economy in a particular technology area relative to the share of total patents belonging to the economy. Data refer to IP5 families, by filing date, according to the inventors' residence using fractional counts. Patents in ICT are identified using the list of IPC codes in Inaba and Squicciarini (2017). Only economies with more than 250 patents families in the periods considered are included. 2014 and 2015 figures are estimated based on available data for those years.

Revealed technology advantage in health-related technologies, 2002-05 and 2012-15

The revealed technological advantage index is calculated as the share of patents of an economy in a particular technology area relative to the share of total patents belonging to the economy. Data refer to IP5 families, by filing date, according to the inventor's residence using fractional counts. Patents are allocated to health-related fields on the basis of the International Patent Classification (IPC) codes, following the concordance provided by WIPO (2013). Only economies with more than 250 patents families in the periods considered are included. 2014 and 2015 figures are estimated based on available data for those years.

Revealed technology advantage in environment-related technologies, 2002-05 and 2012-15

The revealed technological advantage index is calculated as the share of patents of an economy in a particular technology area relative to the share of total patents belonging to the economy. Data refer to IP5 families by filing date according to the inventor's residence using fractional counts. Environment-related patents are defined on the basis of their International Patent Classification (IPC) codes or Cooperative Patent Classification (CPC) codes, as described in Haščič and Migotto (2015). Only economies with more than 250 patents families in the periods considered are included. 2014 and 2015 figures are estimated based on available data for those years.

5.6. Participation in global value chains

Regional origin of the foreign value added embodied in gross exports, 2014

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

5.7. Trade and jobs

Jobs in the business sector sustained by foreign final demand, 2005 and 2014

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

Jobs in information and communication industries sustained by foreign final demand, 2005 and 2014

The information and communication industries correspond to ISIC Rev.3 Divisions 30, 32, 33, 64 and 72.

Share of compensation of employees in the business sector sustained by domestic and foreign final demand, 2014

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

An industry's output can be driven by both domestic and foreign final demand. Using an ICIO/TiVA framework, value added generated to meet foreign demand can be separated from value added generated to meet domestic demand. The same distinction can be made for labour costs. Here, labour costs embodied in domestic demand as a share of value added embodied in domestic demand is compared with labour costs embodied in foreign demand as a share of value added embodied in foreign demand. Note that at the most detailed level of industry, for most countries, labour shares of value added are the same whether the output is destined for domestic or foreign consumption. This is a consequence of assumptions in the construction of ICIO (exceptions are China and Mexico, where processing exporters are distinguished from other firms). The differences in the labour shares for the aggregate business sector mainly reflect the differences in weights of underlying industries meeting domestic demand and foreign demand.

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From:

OECD Science, Technology and Industry Scoreboard 2017

The digital transformation

Access the complete publication at:

https://doi.org/10.1787/9789264268821-en

Please cite this chapter as:

OECD (2017), "Technological advantage", in *OECD Science, Technology and Industry Scoreboard 2017: The digital transformation*, OECD Publishing, Paris.

DOI: https://doi.org/10.1787/sti_scoreboard-2017-32-en

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