

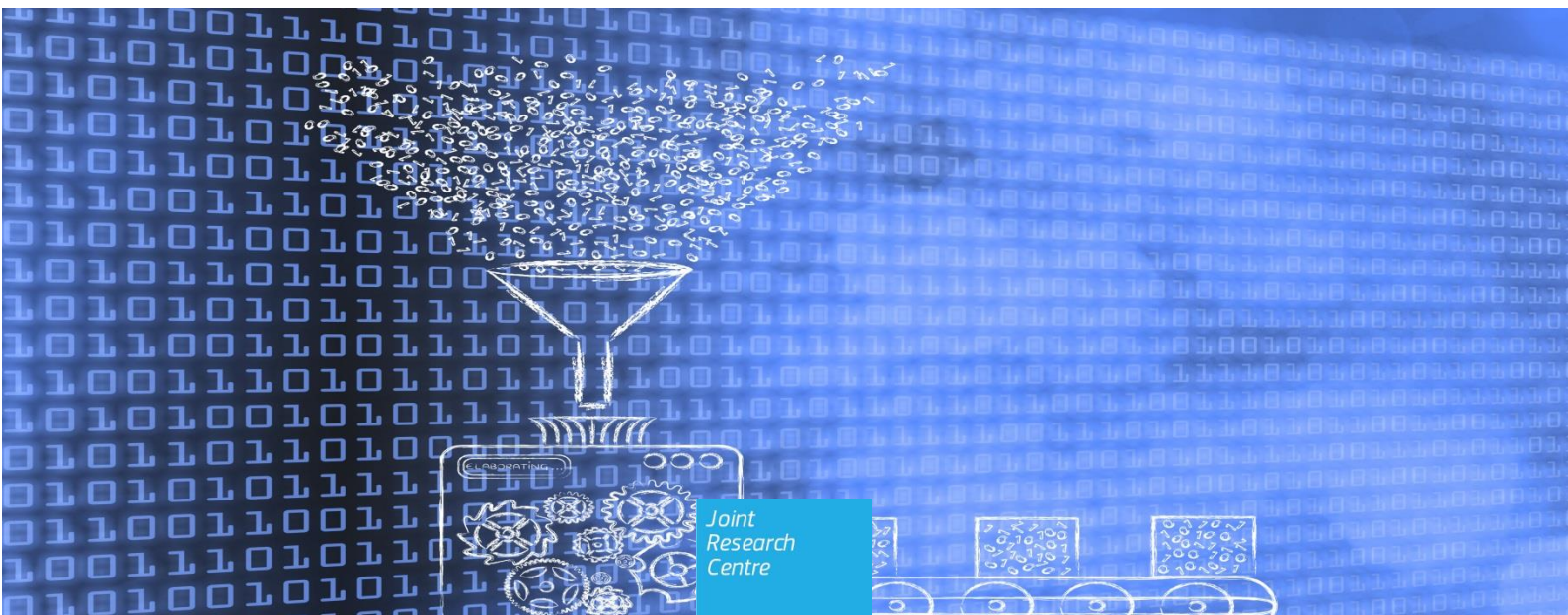


JRC TECHNICAL REPORTS

The 2018 PREDICT Dataset Methodology

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Title: The 2018 PREDICT Key Facts Report. An Analysis of ICT R&D in the EU and Beyond

Abstract

This methodological report details the work done in the Prospective Insights on R&D in ICT (PREDICT) project in 2018. PREDICT provides updated indicators for the Information and Communication Technologies (ICT) sector and for its Research and Development (R&D) in the European Union and in the major ICT leaders worldwide. This project is being carried out jointly by the Joint Research Centre, Directorate B and the Directorate General for Communications Networks, Content and Technology (DG CNECT) of the European Commission. The data and methodologies have been developed in collaboration with the Valencian Institute of Economic Research (IVIE). The PREDICT Dataset has been deepened and expanded along the years in order to include complementary dimensions, such as the Media and Content sector. Since 2017, an updated methodology for estimating Government budget allocations for ICT R&D (ICT GBARD) is applied. Furthermore, for the most important indicators, PREDICT time series have been reconstructed back to 1995, while the main indicators are nowcasted for 2016 and 2017, thus providing comparable time series from 1995 to 2017.

Keywords

R&D, ICT, innovation, statistics, digital economy, ICT industry analysis, ICT R&D and innovation

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Foreword

PREDICT: Prospective Insights on R&D in ICT

PREDICT produces statistics and analyses on ICT industries and their R&D in Europe since 2006. The project covers major competitors worldwide, including 40 advanced and emerging countries – the EU28 plus Norway, Russia and Switzerland in Europe, Canada, the United States and Brazil in the Americas, China, India, Japan, South Korea and Taiwan in Asia, and Australia. It also covers a growing array of indicators related to the ICT content of economic activities.

Rationale

ICTs determine competitive power in the knowledge economy. The ICT sector alone originates almost one fourth of total Business Expenditure in R&D (BERD) for the aggregate of the 40 economies under scrutiny in this project. Besides the impact that ICT uptake has on the organisation of businesses, ICTs also play an important enabling role for innovation in other technological domains. This is reflected at the EU policy level, where the Digital Agenda for Europe was identified in 2010 as one of the seven pillars of the Europe 2020 Strategy for growth. In addition, the achievement of a Digital Single Market (DSM) is one of the 10 political priorities set by the Commission in 2015.

Statistics and indicators

PREDICT provides indicators in a wide variety of topics, including value added, employment, labour productivity and BERD. It distinguishes fine grain economic activities in the ICT and media and content industries (up to 22 individual activities, 14 of which at the class level, i.e. at 4 digits in the ISIC classification) and at a higher level of aggregation for all the other industries in the economy. It also produces data on Government financing of R&D in ICTs, and total R&D expenditure at the country level. Now-casting of more relevant data in these domains is also performed, and time series go back to 1995.

Team

PREDICT is a collaboration between the JRC, Directorate B, and the Directorate General for Communications Networks, Content and Technology (CNECT) of the European Commission.

Since 2013, data collection and analysis has been carried out jointly by the JRC and the Valencian Institute of Economic Research (Instituto Valenciano de Investigaciones Económicas - Ivie).

Abstract

This methodological report details the work done in the *Prospective Insights on R&D in ICT* (PREDICT) project in 2018. PREDICT provides updated indicators for the Information and Communication Technologies (ICT) sector and for its Research and Development (R&D) in the European Union and in the major ICT leaders worldwide. This project is being carried out jointly by the Joint Research Centre, Directorate B and the Directorate General for Communications Networks, Content and Technology (DG CNECT) of the European Commission. The data and methodologies have been developed in collaboration with the Valencian Institute of Economic Research (IVIE).

The PREDICT Dataset has been deepened and expanded along the years in order to include complementary dimensions, such as the Media and Content sector. Since 2017, an updated methodology for estimating Government budget allocations for ICT R&D (ICT GBARD) is applied. Furthermore, for the most important indicators, PREDICT time series have been reconstructed back to 1995, while the main indicators are nowcasted for 2016 and 2017, thus providing comparable time series from 1995 to 2017.

1 Introduction

This methodological report details the work done in the *Prospective Insights on R&D in ICT* (PREDICT) project in 2018. PREDICT provides updated indicators for the Information and Communication Technologies (ICT) sector and for its Research and Development (R&D) in the European Union and in 12 of among the major ICT leaders worldwide. This project is being carried out jointly by the Joint Research Centre, Directorate B and the Directorate General for Communications Networks, Content and Technology (DG CONNECT) of the European Commission. The data and methodologies have been developed in collaboration with the Valencian Institute of Economic Research (IVIE).

Digital technologies are crucial to most capital goods, industrial products, and everyday life. The ICT industries are key enablers of both production and the knowledge systems. EU policies have therefore attributed a strategic role to digital technologies in the promotion of growth, innovation and competitiveness. Achieving the Digital Single Market has been identified as one of the top three priorities for the current Commission in the Digital Agenda for Europe. A competitive ICT industry in Europe, able to attract investments and produce innovation, is therefore of pivotal importance especially in a moment in which the digital transformation is affecting every aspect of economy and society.

PREDICT responds directly to the need for statistical information in order to design and monitor related policies effectively. The PREDICT core dataset has been deepened and expanded in order to include complementary dimensions and to allow for longer comparable time series. Since the 2017 release the PREDICT dataset also covers the Media and Content sector. In addition, it includes estimates of the Government budget allocations for R&D (GBARD) and ICT GBARD estimates based on an updated and improved methodology. Furthermore, for the most important indicators, time series has been reconstructed backwards up to 1995, while figures have been nowcasted for 2016 and 2017. Therefore, time series comparable across countries are covering the main indicators for the period between 1995 and 2017.

In the following chapters, a description of the main characteristics and features of the core dataset and of the complementary sector is provided, together with an overview of the backward reconstruction of the time series. Then, the methodological aspects and econometric models of the nowcasting process are presented. The updated methodology to produce ICT GBARD estimates is detailed too. Finally, the Annexes collect all the relevant methodological notes concerning the process followed to build each indicator for each country in the dataset.

2 The Core PREDICT Dataset 1995-2015

The PREDICT dataset complies with the statistical definitions, classifications and methods to measure and compare the information society across countries established by the *Guide to measuring the Information Society* (Organisation for Economic Co-operation and Development, OECD 2011).

In order to reconstruct the data back to 1995 and include the Media and Content (MC) sector, it was necessary to fill in missing information. Additional technical information about this reconstruction is provided in the next section, however the new PREDICT 2018 data have been produced in the same way as the data from previous PREDICT editions.

With respect the geographical coverage, data is produced for the European Union aggregate (EU¹), the European Member States (MSs), and the major worldwide ICT players: Switzerland, Norway, Australia, Brazil, Canada, China, India, Japan, South Korea, Russia, Taiwan and United States. The PREDICT 2018 dataset ensures comparability with the industrial classification NACE Rev.2² between 1995 and 2015³. It provides detailed information about: the ICT sector and sub-sectors⁴; the Media and content sector (MC); the Retail sale via mail order houses or via Internet sector (RS); and additional economic sectors which allow relevant comparisons.

The economic variables in the PREDICT 2018 core dataset are:

1. Business R&D Expenditure (BERD);
2. Gross R&D Expenditure (GERD);
3. R&D personnel (PERD);
4. R&D researchers (RERD);
5. Gross Value Added (GVA);
6. Gross Output (GO),
7. Employment (EMP)
8. Hours worked (HEMP)
9. Labour productivity per employed person (PRODEMP) and per hour worked (PRODHEMP)
10. Government budget allocations for R&D (GBARD) for the period 2006-2016.
11. Government budget allocations for ICT R&D (ICT GBARD) for the period 2006-2016.

The data is organised in four blocks, according to economic activity: ICT sector (for both comprehensive and operational definitions), MC sector, RS sector and additional economic sectors:

1a. The **comprehensive definition of the ICT sector** (Table 1) is in line with the OECD's definition (2007) and encompasses the following industries of the NACE Rev.2 classification:

- five ICT manufacturing sectors: 261 (i.e. 2611 and 2612), 262, 263, 264 and 268;
- two ICT trade sectors: 4651 and 4652

¹ The data for the EU refers for the whole period under study to the aggregate of the 28 countries of the current configuration of the European Union.

² Available at: <http://ec.europa.eu/eurostat/documents/3859598/5902521/KS-RA-07-015-EN.PDF>

³ Please refer to the following sections for information about the nowcasted dataset covering year 2015 and 2016.

⁴ According to latest OECD definition (2007): <http://www.oecd.org/science/scienceandtechnologypolicy/38217340.pdf>

- five ICT services sectors: 582 (i.e. 5821, 5822, 5823, 5824, 5825, 5826, 5827, 5828, and 5829), 61 (i.e. 611, 612, 613, and 619), 62 (i.e. 6201, 6202, 6203, and 6209), 631 (i.e. 6311 and 6312) and 951 (i.e. 9511 and 9512).

1b. The **operational definition of the ICT sector** (Table 2) provides information to maintain the comparability of countries over longer periods in cases where insufficient information is available to estimate the ICT subsectors of the comprehensive definition. This definition distinguishes between:

- ICT manufacturing, without Manufacture of magnetic and optical media (268);
- ICT services without Trade services (465), encompassing two sub-sectors only: Telecommunication (61), and the aggregate for Computer and related activities (5820, 62, 631, 951).

2. The Media and content sector (Table 3) is defined according to the OECD's definition (2007).

3. The third block encompasses the Retail sale via mail order houses or via Internet sector (4791).

4. The fourth block includes data for selected industries (Table 4) which are meaningful both for comparison with the ICT sector and for comparing EU to the other major economies.

PREDICT 2018 maintains the methodology and procedures developed previously with some minor changes (documented in this report). The correspondence tables between NACE Rev.2 and the national classifications of activities are also the same as in the previous edition (Annex II: Correspondence Tables).

2.1 The Media and Content Sector

This section explains why the MC sector is considered relevant and consequently has been included in since the PREDICT 2017 release. The MC sector is defined as "industries that are engaged in the production, publishing and/or the electronic distribution of content products" (OECD, 2011). This definition relies on international standards, particularly on previous work done by the OECD Working Party on Indicators for the Information Society (OECD, 2007).

Table 3 identifies and details the MC sectors from the technical perspective of the industrial classification. It also highlights how these industries carry out a number of heterogeneous economic activities primarily linked to the creation and dissemination of information and cultural products. These industries engage in video and TV production, programming, distribution, broadcasting, and a wealth of other information services. Another distinctive and common feature of these activities is their level of interconnectedness.

These activities are becoming increasingly intertwined - both with each other, and with the ICT sector which provides most of the means for disseminating MC products. Concurrently, rapid changes have occurred in the way these industries work, in their business models for production and distribution, and in their strategies for interaction with key competitors and for the achievement of their targets. From a policy perspective, these circumstances have given rise to a well-founded and growing interest in collecting and analysing information about these flourishing sectors of the economy and their close relationship to the ICT sectors.

As a consequence, the PREDICT project includes information about the MC sector at 4-digit level since 2017. The approach used to produce MC sector data is entirely consistent with the general statistical procedure employed to produce ICT data for the PREDICT project and reports. Therefore the data for the MC sectors can be integrated within the overall PREDICT framework.

Table 1 The comprehensive definition of the ICT sector (based on NACE Rev.2)

| NACE Rev.2. | Description |
|---|---|
| 261-264, 268, 465, 582, 61, 62, 631, 951 | A. ICT Total [A=B+C] |
| 261-264, 268 | B. ICT manufacturing industries [B=1 to 5] |
| 261 | [1] Manufacture of electronic components and boards |
| 2611 | [1.1] Manufacture of electronic components |
| 2612 | [1.2] Manufacture of loaded electronic boards |
| 262 | [2] Manufacture of computers and peripheral equipment |
| 263 | [3] Manufacture of communication equipment |
| 264 | [4] Manufacture of consumer electronics |
| 268 | [5] Manufacture of magnetic and optical media |
| 465, 582, 61, 62, 631, 951 | SER. ICT total services [SER=TW+C] |
| 465 | <i>TW. ICT trade industries [TW=6+7]</i> |
| 4651 | [6] Wholesale of computers, computer peripheral equipment and software |
| 4652 | [7] Wholesale of electronic and telecommunications equipment and parts |
| 582, 61, 62, 631, 951 | C. ICT services industries [C=8+9] |
| 61 | [8] Telecommunications |
| 611 | [8.1] Wired telecommunications activities |
| 612 | [8.2] Wireless telecommunications activities |
| 613 | [8.3] Satellite telecommunications activities |
| 619 | [8.4] Other telecommunications activities |
| 582, 62, 631, 951 | [9] Computer and related activities [9=10+11+12+13] |
| 582 | [10] Software publishing |
| 5821 | [10.1] Publishing of computer games |
| 5829 | [10.2] Other software publishing |
| 62 | [11] Computer programming, consultancy and related activities |
| 6201 | [11.1] Computer programming activities |
| 6202-6203 | [11.2] Computer consultancy and computer facilities management activities |
| 6202 | [11.2.1] Computer consultancy activities |
| 6203 | [11.2.2] Computer facilities management activities |
| 6209 | [11.3] Other information technology and computer service activities |
| 631 | [12] Data processing, hosting and related activities; web portals |
| 6311 | [12.1] Data processing, hosting and related activities |
| 6312 | [12.2] Web portals |
| 951 | [13] Repair of computers and communication equipment |
| 9511 | [13.1] Repair of computers and peripheral equipment |
| 9512 | [13.2] Repair of communication equipment |

Source: Own elaboration based on OECD (2007).

Table 2 The operational definition of the ICT sector (based on NACE Rev.2)

| NACE Rev.2. | Description |
|---------------------------------------|---|
| 261-264, 582, 61, 62, 631, 951 | A'. ICT Total (operational) [A'=B'+C] |
| 261-264 | B'. ICT manufacturing industries (operational) [B'=1 to 4] |
| 261 | [1] Manufacture of electronic components and boards |
| 262 | [2] Manufacture of computers and peripheral equipment |
| 263 | [3] Manufacture of communication equipment |
| 264 | [4] Manufacture of consumer electronics |
| 582, 61, 62, 631, 951 | C. ICT services industries (operational) [C=8+9] |
| 61 | [8] Telecommunications |
| 582, 62, 631, 951 | [9] Computer and related activities [9=10+11+12+13] |

Source: Own elaboration.

Table 3 MC sector disaggregation (based on NACE Rev.2)

| NACE Rev.2. | Description |
|-------------------------|---|
| 581, 59, 60, 639 | E. MC sector [E=F+G+H] |
| 581 | F. Publishing of books, periodicals and other publishing activities [F=14 to 16] |
| 5811-5812 | [14] Book publishing; Publishing of directories and mailing lists |
| 5811 | [14.1] Book publishing |
| 5812 | [14.2] Publishing of directories and mailing lists |
| 5813-5814 | [15] Publishing of newspapers, journals and periodicals |
| 5813 | [15.1] Publishing of newspapers |
| 5814 | [15.2] Publishing of journals and periodicals |
| 5819 | [16] Other publishing activities |
| 59-60 | G. Audiovisual and broadcasting activities [G=17+18] |
| 59 | [17] Motion picture, video and television programme production, sound recording and music publishing activities |
| 591 | [17.1] Motion picture, video and television programme activities |
| 5911 | [17.1.1] Motion picture, video and television programme production activities |
| 5912 | [17.1.2] Motion picture, video and television programme post-production activities |
| 5913 | [17.1.3] Motion picture, video and television programme distribution activities |
| 5914 | [17.1.4] Motion picture projection activities |
| 592 | [17.2] Sound recording and music publishing activities |
| 60 | [18] Programming and broadcasting activities |
| 601 | [18.1] Radio broadcasting |
| 602 | [18.2] Television programming and broadcasting activities |
| 639 | H. Other information service activities [H=19+20] |
| 6391 | [19] News agency activities |
| 6399 | [20] Other information service activities n.e.c. |

Source: Own elaboration based on OECD (2007).

Table 4 Additional sectors (based on NACE Rev.2)

| NACE Rev.2. | Description |
|--------------------|---|
| 10-33 | Manufacturing |
| 20-21 | Manufacture of chemicals and chemical products; Manufacture of pharmaceuticals, medicinal chemical and botanical products |
| 20 | Manufacture of chemicals and chemical products |
| 21 | Manufacture of pharmaceuticals, medicinal chemical and botanical products |
| 26 | Manufacture of computer, electronic and optical products |
| 27-28 | Manufacture of machinery and equipment |
| 29-30 | Manufacture of transport equipment |
| 29 | Manufacture of motor vehicles, trailers and semi-trailers |
| 30 | Manufacture of other transport equipment |
| 303 | Manufacture of air and spacecraft and related machinery |
| 45-47 | Wholesale and retail trade, repair of motor vehicles and motorcycles |
| 49-99 | Services, except trade |
| 49-53 | Transportation and storage |
| 58-63 | Information and communication |
| 64-66 | Financial and insurance activities |
| 69-82 | Professional, scientific, technical, administration and support service activities |
| 69-75 | Professional, scientific and technical activities |
| 85 | Education |
| 86-88 | Human health and social work activities |

Source: Own elaboration.

3 The Backwards Reconstruction of Time Series

From a technical point of view, producing data to reconstruct the time series backwards employs a two-step strategy:

1. Initially, data from Eurostat National Accounts are used as benchmark for Value Added and Employment, while the Eurostat R&D survey is used for BERD, PERD and RERD. In particular, the industries provided by the National Accounts (NA) aggregates by industry (up to NACE A*64)⁵ are used as benchmarks to disaggregate both Value Added and Employment, and to comply with the OECD (2007) definitions of the ICT and Media and Content sectors.
2. Table 5 shows the available information which is used to estimate both the MC (green cells) and the ICT services sectors (red cells). As reported in the first column of the table, the NA (ESA 2010) covers the period 1995-2015 and the industries available for benchmarking are NACE 58, 59-60, 61, 62-63, 95.
3. Then alternative data sources are employed to disentangle the NACE codes into the industries to fulfil in PREDICT. Specifically, the Structural Business Statistics (SBS) are considered as for the NACE Rev.2 from 2008-2015, while data from EU KLEMS and from the SBS (NACE Rev. 1.1) is used for the period 1995-2007.
4. Table 5 shows the industry classification available in each of the alternative data sources. The procedure at this stage consisted of breaking down NA A*64 aggregates using the alternative data sources available. Since NA data are available for the period 1995-2015, the same strategy adopted for 2008-2015 was followed for the years 1995-2005, only using the above mentioned specific ancillary sources.

Additional sources of official data (e.g., OECD, National Statistical Offices, EU KLEMS) are employed whenever Eurostat A*64 has missing values. These additional sources of data are directly plugged into the database, or used in the imputations of the following step. Standard imputation methods (e.g., the calculation of difference or shares in the available data, data interpolation, etc.) are employed in cases where no alternative sources of information are available. In some cases, "linking coefficients" corresponding to a more aggregated industry are used –as the only way– to maintain the official correspondence between NACE Rev 1.1 and NACE Rev.2.

In general, a distinctive trait of the imputation approach developed for the PREDICT project is that each missing value is considered as a separate case, and no general rules are defined for all the missing values or for groups of missing values. The best imputation strategy is decided for each individual case on the basis of the information available or of the series characteristics (e.g., whether the series are stationary or have a trend, whether or not the percentage structure is stable over time, etc.).

Another key aspect of the procedure relates to how the change from NACE Rev. 1.1 to NACE Rev.2 is dealt with. Since there are no official tables for the correspondence between NACE Rev.2 and NACE Rev. 1.1, Mas et al. (2012)⁶ developed a "transition methodology" in order to produce homogeneous series for the PREDICT variables and industries. According to this approach, for each (sub-) sector, variable and country, a linking coefficient is calculated as the ratio between its values in the NACE Rev.2 and in the NACE Rev. 1.1 of 2008 (the linking year).

⁵ <https://data.europa.eu/euodp/en/data/dataset/CL1mabTDvnuSIpbVXiwV7A>

⁶ Mas, M., J.C. Robledo and J. Pérez (2012). "ICT Sector definition transition from NACE Rev. 1.1 to NACE Rev. 2: A methodological note". JRC Technical Reports, Luxemburg. European Commission, 27 pp.

Then the linking coefficient for 2008 is multiplied to each individual item of data for the previous years to estimate, assuming that the value of the sector under NACE Rev. 1.1 is always a proportion of the value of the sector under NACE Rev.2, and that this proportion remains constant over time.

The methodology is the same for BERD, PERD and RERD. However, these indicators differ as regards the data sources used as benchmarks, the available industry disaggregation, and the alternative information used. This information is reported in Table 5.

Table 5 Data used to estimate the ICT services and the MC sector

a. Macroeconomic variables: value added and employment

| Benchmark NACE Rev. 2 | Auxiliary sources | | | |
|--------------------------|-------------------|-----------------|-------------------------|--------------------------|
| | NACE Rev. 2 | | NACE Rev. 1.1 | |
| NA (1995-2015) | SBS (2008-2015) | SBS (2005-2007) | NA/EU KLEMS (1995-2007) | EU KLEMS/SBS (1995-2007) |
| Codes | Codes | Codes | Codes | Codes |
| 58 | 581 | 58 | 221 | 221 |
| | 582 | | 72 | 7221 |
| 59-60 | 59-60 | 59-60 | 92 | 92 |
| 61 | 61 | 61 | 64 | 642 |
| 62-63 | 62 | 62 | 72 | 721, 7222, 726 |
| | 631 | 63 | 72 | 723, 724 |
| | 639 | | 92 | 92 |
| 95 | 951 | 95 | 72 | 725 |
| | 952 | | 52 | 527 |

Aggregate codes

| | NACE Rev. 2 | | NACE Rev. 1.1 | |
|---------------------------------|--------------------|--------------------|---------------|----|
| Computer and related activities | 582, 61,62,631,951 | 582, 61,62,631,951 | 72 | 72 |

b. R&D variables: BERD, PERD and RERD

Individual codes

| Benchmark NACE Rev. 2 | Auxiliary sources | | |
|--------------------------|-------------------|-----------------|----------------------------|
| | NACE Rev. 2 | | NACE Rev. 1.1 |
| R&D Statistics 2005-2015 | SBS (2008-2015) | SBS (2005-2007) | R&D Statistics (1995-2010) |
| Codes | Codes | Codes | Codes |
| 581 | 581 | 58 | 22 |
| 582 | 582 | | 722 |
| 59 | 59-60 | 59-60 | 75-99 |
| 60 | | | 652 |
| 61 | 61 | 62 | 72 |
| 62 | 62 | 63 | 72 |
| 631 | 631 | 63 | 72 |
| 639 | 639 | | 72 |
| 951 | 951 | 95 | 52 |

Aggregate codes

| | NACE Rev. 2 | NACE Rev. 1.1 |
|--|-------------------|----------------|
| | 5820,62,631,951 | 72 |
| | 85-87 | 80-85 (ex.852) |
| | 582,61,62,631,951 | 72, 642 |

Notes: Cells show the NACE codes available for each corresponding data sources. MC sector industries marked in green and ICT industries in red.

4 Nowcasting Methodology

A common thread running through the PREDICT database is the need for a high level of disaggregation (3- or 4-digit level) in the information in order to achieve the required ICT, MC and RS classifications. Statistics that enable such a high level of detail in the industry breakdown are generally published only after a significant delay. The requirements therefore envisage a 3-year lag, due to the timing of releases by Statistical Offices of both National Accounts and R&D data with the necessary level of industry disaggregation.

The aim is to shorten this delay and make the information available in the ICT sector database, at least for the main aggregates, as policy-makers need insights into the state of the sector today rather than three years ago if they are to have sufficient room for manoeuvre in policy making. The objective, therefore, is to nowcast the present values of the main variables included in the PREDICT database: value added, employment, hours worked, labour productivity, business R&D expenditure (BERD), business R&D personnel (PERD) and business R&D researchers (RERD). These variables are nowcasted for the ICT sector and some of its sub-industries, and also for the MC and RS sectors.

Nowcasting is currently on the research agendas of academics, statistical offices and central banks. According to Eurostat's *Glossary on Rapid Estimates* (Eurostat, 2012), "nowcasting is a rapid evaluation produced during the current reference period T (the present) for a hard economic variable of interest observed for the same reference period T . Nowcasting makes use of the real-time data flow available between T and $T-1$ ". Hence, the term *nowcast* refers to the prediction of the current values of the relevant variables by using other contemporaneous information. Nowcasting differs from forecasting in that the latter "is the process of making statements about events whose actual outcomes (typically) have not yet been observed. A common place example might be an estimation for a statistical variable of interest related to a specific future date" (Eurostat, 2012).⁷ However, both types of estimation methods are closely related to the aims of WP5.

A variety of different methodologies have been developed to reduce the delay with which official statistics become available. What they have in common is the use of contemporaneous, generally higher frequency (quarterly, monthly or daily), information for the variable to be nowcasted. However, they differ in the number of variables used, how this auxiliary information is processed, the way different frequencies are integrated, and the forecasting technique used.

This methodological note describes the approach followed in PREDICT nowcasting, which offers the nowcasted values for the variables described above, for both the European Union countries and the selected non-European countries. The data was obtained for the two subsequent years to those included in the database: 2016 and 2017. The PREDICT 2018 database now covers the period 1995-2015, and therefore, the length of the time series allows individual estimations for each variable by country and by industry. This framework allows the predictors to influence each dependent variable differently in each country. The PREDICT 2018 nowcasting follows the methodology applied in the previous edition of PREDICT database. One of the main issues in the methodology is the fact that in general, given the definition of the ICT industry used in PREDICT, the number of proxies that can be used as predictors is limited. They are basically taken from the

⁷ Other related terms used in the Eurostat Glossary are *ex-ante forecast*, a forecast that only uses the information (i.e. the value of economic variables) available at the time of the actual forecast and not the value of some variables available for the forecasting horizon; *ex-post forecast*, a forecast that uses the information (i.e. the value of economic variables) which extends beyond the time at which the actual forecast is prepared, and *projections*, the process of moving forward in time through the imagining of future events, or by means of estimates based on certain assumptions or past trends.

Quarterly National Accounts (value added and employment). The main challenge was to select the industry disaggregation that best proxied the ICT industries.

This document is structured as follows. Section 2 describes the main goals pursued in this Final Nowcasted Dataset in terms of variables, years, countries and industry coverage. Section 3 briefly summarises the main approaches found in the literature. Section 4 presents the methodology to nowcast PREDICT variables. Section 5 presents the nowcasted data. Section 6 summarises the main issues.

4.1 Nowcasting Main Objectives

The objectives of the nowcasting exercise are outlined below.

Variables: The nowcasting exercise covers the main PREDICT variables: value added, employment, hours worked, labour productivity, BERD and R&D personnel and researchers. Value added and BERD are nowcasted in current euros, and they are then also converted into purchasing power parities (PPPs).

Geographical coverage: The geographical coverage of the nowcasting exercise includes the European Union and its Member States, Australia, Canada, Japan, Korea, Taiwan and the US. It is extremely difficult to estimate the values for the remainder of the PREDICT countries (Brazil, China, India and Russia) given the lack of short-term statistics with a sufficient degree of industry-level disaggregation, and as a result, data for these countries are not nowcasted.

Industry disaggregation: The target industry disaggregation consists of total ICT sector, ICT manufacturing sector and ICT services sector, the Telecommunications sector (IT) and the Computer and related activities sector (IC), in addition to the Media and content (MC) and the Retail sale sector (RS). Given the available information in terms of industry disaggregation and the nature of short-term statistics variables, it would not seem possible to produce reliable results when attempting to take the industry disaggregation any further. Additionally, because the objective is to compare the EU countries with non-EU economies, the chosen reference classification for the analysis is the operational definition of the ICT industries. This definition excludes the ICT trade industries (NACE 465) and Manufacture of magnetic and optical media (NACE 268) and is the one to be used whenever EU and non-EU countries are to be compared.

4.2 Outline of the Main Nowcasting Methodologies

Several methodological approaches for nowcasting data have been developed in the literature. Nowcasting is increasingly used to obtain real-time data for macroeconomic aggregates such as GDP, inflation, or exports. Researchers choose the most appropriate method according to their final objectives, frequency of releases, and information availability.

Nowcasting methodologies are broadly grouped into three categories:

1. *Transfer rates.* This methodology consists of using the relationship between the variable to be nowcasted with another that is known at the time the estimate is made. Nowcasted values are projected using transfer coefficients, which measure the past relationship between the two variables. In general, transfer rates have the advantage of being easy to implement. However, their disadvantage is that they do not capture changes in trends or in the underlying variables. Furthermore, this method does not explicitly use all the additional information available at the time of nowcasting. This method is used, for example, to estimate patent data (Dernis 2007; Eurostat 2010). These authors estimate the European Patent Office (EPO) regional applications under the Patent Cooperation Treaty (PCT) using ratios of the regional EPO PCT applications at the regional phase to EPO designated PCT applications.

2. *Trend analysis*. This method extrapolates the trend in the variable to be nowcasted from its past values. Different procedures can be used to extract the trend component: single equation methods (linear trend with constant, declining or rising growth rates, saturation curves, etc.), or methods of smoothing data (arithmetic moving averages, exponential moving averages, Hodrick-Prescott filter). Additionally, the non-structural Box-Jenkins approach –known as the ARIMA (autoregressive integrated moving averages) models– can also be used for prediction via the Census Bureau X-11 or TRAMO-SEAT programs. In general, all these techniques require longer time series than those included in the PREDICT database.
3. *Econometric methods*. These methods are based on the projection of the variables into a set of explanatory variables. Hence, the information is provided by exogenous variables contemporaneous to the period to be nowcasted. That is, these models incorporate the most up-to-date information from additional variables closely related to that to be nowcasted, very often relying on information with a different frequency, or released in a non-synchronous pattern. The literature provides a wide variety of models (see, for example, the survey by Castle, Hendry, and Kitov, 2013) tailored to the specific purpose of the nowcast and to the variable of interest.

The main methodological problems (Castle, Hendry, and Kitov, 2013; Bábura, Giannone and Reichlin, 2011) that arise in the *Econometric methods* are derived from the fact that not all the disaggregated contemporaneous nowcasted data are known when they are needed (e.g. nowcasted final demand components are not known when the nowcasting quarterly GDP is published; nowcasted data for all the European MS are not available when nowcasting data for EU) –the missing data problem; data on some variables are released after they are required for the nowcasting process –the latency problem; the same set of variables is not always available at the time of nowcasting –the change of database problem; the original information used is frequently revised or updated so that the previous estimates suffer from measurement errors; there are also breakdown problems derived from the change in the long-run means of the nowcasted variables; and frequently there are more variables than observations.

Most of the *Econometric methods* combine data with diverse frequencies. For example, higher frequency statistics, such as monthly industrial production or high-frequency financial data, are used to nowcast quarterly GDP. When *Econometrics methods* are applied, the nowcasting methodology should therefore consider the procedure to exploit this information –mixed frequencies and a large number of variables– in the most efficient way to avoid any loss of information. That is, the first stage consists of converting data with different frequencies into the same frequency. This problem is usually overcome by using one of three approaches: *Mixed-data sampling models* (MIDAS), which link a low-frequency variable with a higher frequency variable by means of a lag polynomial (Ghysels, Sinko and Valkanov, 2007; Andreou, Ghysels and Kourtellis, 2011); the *Factor model*, which uses a factor model to reduce all the monthly or quarterly indicators of all the different variables to a set of common factors (Boivin and Ng, 2005); or *Bridge equations*, which are less restrictive and easier to interpret than the MIDAS and Factor models. The basic idea behind the bridge equations is that the current value of the nowcasted variable depends on its own lagged values and on transformed versions of the observed high-frequency indicators converted to lower frequency (e.g. from monthly to quarterly frequencies).

4.3 Nowcasting Methodology

This section outlines the general framework for nowcasting PREDICT variables. The general methodology is applied only for value added, employment, hours worked and BERD. Labour productivity is calculated as the ratio of value added and hours worked nowcasted values. Business R&D personnel and researchers are calculated with transfer rates using nowcasted BERD data, as described later on.

4.3.1 General Approach: Value Added, Employment, Hours Worked and BERD

Before describing the framework, it is important to note that the nowcasting envisaged here has some specific features that shape the methodology and differentiate it from other approaches in the literature. The main issue is related to the fact that the objective is to release annual data referring to 2016 and 2017. By contrast, nowcasting methodologies are usually designed to update estimates on a monthly or quarterly basis, incorporating new information released in the meantime. These updates are carried out continuously until the official data for the nowcasted variables are published. The particular feature of nowcasting the PREDICT dataset means that monthly or quarterly statistics are not necessary, as the estimate can be based on annual data or annualised quarterly data, thus completing the statistics chosen to perform the estimations. This implies that the usual nowcasting problems derived from different data frequencies are not present here.

The PREDICT 2018 database includes data that covers the period 1995-2015, which allows the use of time-series methods applied individually to each country. Therefore, the general model is based on the definition of the following equation for each industry l and country c to be nowcasted:

$$Y_{clt} = \alpha + \delta_{cl} X_{clt} + \varepsilon_{clt} \quad (1)$$

Where Y_{clt} stands for the variable to be nowcasted (value added, employment or BERD) for country c at time t in industry l ; X_{clt} is a matrix of correlates, predictors or independent variables for a given country and industry, and ε_{clt} is white noise. Value added, employment and BERD show marked trends, as they are not stationary. Hence, the estimation is carried out in first differences (noted by D).

$$D.Y_{clt} = \alpha + \delta_{cl} D.X_{clt} + \varepsilon_{clt} \quad (2)$$

The model of equation (2) is estimated for each of the EU countries, including the EU, which is treated as an additional country, and for the non-EU countries. Although the model is estimated in first differences, first order serial correlation is tested using the Breush-Godfrey test. In the event that first order correlation exists, alternative definitions of the explanatory variables are used, and if necessary, a trend or alternatively, an autoregressive term –AR(1)– are included in the estimation,⁸ i.e. the lag of the dependent variable is included. In all the models finally selected, the first order correlation is rejected. Table 8Table 35, which describe the variables included in the estimation of each model, report the cases in which a trend or an AR(1) term are included.

4.3.2 Independent Variables

For the sake of uniformity, the independent variables must be confined to a common set of indicators for all countries. This set of indicators is based on the availability of information for both the estimation period –1995 to 2015– and,

⁸ In all the estimations in which first order serial correlation is detected, the inclusion of a trend or an AR(1) term solved the issue, removing the need for higher order autoregressive terms.

obviously, for 2016 and 2017. Because the objective of the analysis is to nowcast indicators of the ICT sector, which is quite detailed, the number of possible correlates is quite low, particularly in the case of BERD for which there are almost no variables to proxy the R&D intensity at the detailed industry level. In fact, the predictors are limited to indicators of value added and employment of the nearest industry aggregation to that of the PREDICT database.

Table 6 Explanatory variables for the estimation of VA, employment, hours worked and BERD used according to the estimated sector*

| Estimated sector | Independent variables: VA, Persons employed and GFCF in intellectual property. Industry disaggregation (Variables from Quarterly NA, annualised) |
|--|---|
| ICT Sector | NACE C (Manufacturing) + J (Information and communication); Intellectual Property (only for BERD) Total economy |
| ICT manufacturing sector | NACE C (Manufacturing); Intellectual Property (only for BERD) Total economy |
| ICT services sector | NACE J (Information and communication); Intellectual Property (only for BERD) Total economy |
| Telecommunications sector | NACE J (Information and communication); Intellectual Property (only for BERD) Total economy |
| Computer and related activities sector | NACE J (Information and communication); Intellectual Property (only for BERD) Total economy |
| Media and content sector | NACE J (Information and communication); Intellectual Property (only for BERD) Total economy |
| Retail sale sector | NACE G_I (Wholesale and retail trade, transport, accommodation and food service activities) for the EU countries and G for the Non-EU Countries ; Intellectual Property (only for BERD) Total economy |

* The explanatory variables used for the estimation of each sector are the same for GVA, EMP, HEMP, BERD. Additionally, gross fixed capital formation in intellectual property is added for the estimation of BERD.

Source of NA data: Eurostat for EU countries and OECD and national statistics offices for non-EU countries.

The variables selected as independent variables and the industry disaggregation to proxy PREDICT industry are specified in Table 6.⁹ Two indicators from the Quarterly National Accounts are used as independent variables: value added and persons employed. The quarterly data is annualised by aggregating all four quarters of each year (or the last four available quarters if the whole year is not available). This information captures the differences in the economic cycle of each economy and the possible changes in the means of the variable. Quarterly National Accounts (QNA) offer information disaggregated according to the A*10 industry breakdown,¹⁰ both for value added and persons employed. Depending on the industries to nowcast, different industry aggregations of the two predictors will be used. Table 6 shows the

⁹ The final selection of variables is the result of several tests carried out in the Interim Nowcasted dataset and subsequent tests, and the experience of the Nowcasting exercise in PREDICT 2017. Some additional variables were tested and discarded because they did not improve the results in value added, employment or BERD. Among the variables tested were employees with higher education from the Labour Force Survey, and turnover from Eurostat's Short Term Statistics. Other potential independent variables were also discarded because they did not cover the years 2016 and 2017, which were necessary to carry on the nowcasting exercise (EPO patents, R&D from the EU's Industrial Scoreboard, among others).

¹⁰ A*10 NACE Rev. 2 industry breakdown: A) Agriculture, forestry and fishing; B-E) Industry (except construction); C) Manufacturing; F) Construction; G-I) Wholesale and retail trade, transport, accommodation and food service activities; J) Information and communication; K) Financial and insurance activities; L) Real estate activities; M_N) Professional, scientific and technical activities; administrative and support service activities; O-Q) Public administration, defence, education, human health and social work activities; R-U) Arts, entertainment and recreation; other service activities; activities of household and extra-territorial organisations and bodies.

industry aggregation used for the nowcasting of each ICT sector¹¹ in the case of all three variables to be nowcasted (VA, Employment and BERD).

In the case of BERD there are no short-term variables for the period required that proxy R&D. In fact, there is no specific information on R&D with monthly/quarterly frequency that can be used as a basis for the nowcasting procedure. For example, the EPO patents information and R&D expenditures from Eurostat's R&D does not go up to 2017. The only available information up to 2017 is the Gross Fixed Capital Formation in intellectual property published in the National Account Statistics for the aggregated economy (not available by industries). This variable is included as an additional independent variable in the BERD estimations, as well as value added and persons employed.

The basic specification therefore includes value added and persons employed, and gross fixed capital formation in intellectual property in the case of BERD. Additionally, as mentioned earlier, the dependent variable in the estimation is the first difference of the PREDICT variables (value added, employment, hours worked and BERD). Given the fact that the series in first differences are sometimes quite erratic, particularly in the case of BERD, alternative specifications including up to three dummies covering up to the three sharpest jumps in series have been tested. Alternatively, in some cases (countries/ICT sector or subsector) the profile of the series suggested that the variable behaved differently before and after 2010. Therefore, an additional specification was considered, including a step dummy variable for these years. The following subsections offer more details on the selection of the best model for each variable and on the definition of the dummy variables.

Table 7 Data sources for the independent variables, by country

| Country | Source of data |
|----------------------|---|
| EU and Member States | Eurostat: Quarterly National Accounts (VA, persons employed and GFCF in intellectual property) |
| Australia | Australian Bureau of Statistics: Quarterly National Accounts (VA, persons employed) |
| Canada | Statistics Canada: Canadian socioeconomic database from Statistics Canada – CANSIM (employees). OECD: Quarterly National Accounts and own elaboration (VA) |
| Japan | Cabinet Office: Quarterly National Accounts (VA). Japan Industrial Productivity (JIP) from Research Institute of Economy, Trade and Industry (RIETI) and Hitotsubashi University and Labour Force Survey from e-STAT portal in Japan (persons employed) |
| Korea | Korean Statistical Information Service: Quarterly National Accounts (VA and persons employed) |
| Taiwan | National Statistics of the Republic of China: Quarterly National Accounts (VA and persons employed) |
| US | Bureau of Economic Analysis (BEA): Quarterly National Accounts (VA). Bureau of Labor Statistics (BLS): Current Employment Statistics (employees) |

Table 7 shows the data sources used for each country. Data for the EU countries come from the same source, Eurostat (Quarterly National Accounts). Additional data sources were used for the remaining countries, essentially National Accounts from their National Statistical Offices or from the OECD. The indicators for these additional countries were chosen to match as closely as possible (in terms of industry disaggregation and definition of the variable) those selected for the EU countries. Eurostat data was downloaded on December 27, 2017, and data from the OECD and of National Statistical Offices for the non-EU countries on December 21, 2017.

¹¹ In the Interim Nowcasted dataset alternative industry disaggregations of the independent variables were tested. In general, the correspondence of the ICT industry with the industry disaggregation available in the Quarterly National Accounts shown in Table 6 was the most effective.

4.3.3 Selection of Models

The nowcasting strategy consists of estimating a linear regression for each country, variable and ICT sector or subsector for the period 1995 (or first year available) to 2015 (2014 for Canada). The dependent variable is the first difference of value added, employment, hours worked or BERD, and the predictors are the first differences of value added, employment, and also gross fixed capital formation in intellectual property in the case of BERD. Additionally, several specifications are tested, including up to three impulse dummies¹² that capture the three sharpest jumps in the series, or a step dummy¹³ to capture differences in the profile of the dependent variable before and after 2010. Lastly, a trend or an AR(1) additional term is included if first order correlation in the residuals is observed. Therefore, a range of models is estimated for each country/variable/industry. First, three different alternatives are defined: models with only value added as the predictor, with only persons employed, and with the two variables. For each of the alternatives, several models are estimated including a step dummy, or, alternatively, one, two or three dummy variables for the first, second and third sharpest jumps (impulse dummies) in the dependent variable. Eventually a trend or an AR(1) term is included if autocorrelation is detected. In the case of BERD, intellectual property is included in addition to the other variables described. More specifically, of all the possible models estimated, the one that includes the highest number of predictors is the following:

$$D.Y_{ct} = \alpha + \delta_1 D.GVA_{ct} + \delta_2 D.PersonsEmployed_{ct} + \delta_3 D.Intellectual\ Property_{ct} + \delta_4 Dummy1 + \delta_5 Dummy2 + \delta_6 Dummy3 + \delta_7 Dummy10_15 + \delta_8 [AR(1) \text{ or a trend}] + \varepsilon_{ct} \quad (3)$$

Where *Dummy1*, *Dummy2* and *Dummy3* stand for the impulse dummy variables that take the value 1 for the year in which the highest, the second or the third variation in the dependent variable occurs. These dummy variables are not systematically related to specific years, as they vary across countries and industries within each independent variable. *Dummy10_15* is a step dummy variable that takes value 1 for years 2010-2015 and 0 for the rest of the years. Intellectual property is only included in the BERD models, and if *Dummy10_15* is included, the variables *Dummy1*, *Dummy2*, and *Dummy3* are not considered. Finally, for each ICT subsector, different industry aggregations from the QNA are used, as described in Table 6.

The best estimation model for each country/ICT industry/variable is based on a twofold criterion. The first criterion is based on the goodness of fit of the model estimated for the years 1995-2015. The average root mean squared errors (RMSE₉₅₁₅) is calculated so that the model specification with lower RMSE₉₅₁₅ is preferred. This criterion is combined with a second indicator that evaluates the model's predictive capacity. For this latter criterion the years 1995-2013 are used as a training set. For the training set each model is re-estimated and the test error defined as the root mean squared error of the predictions is computed for the test set, that is, for years 2014 and 2015 (RMSE₁₄₁₅). This second procedure allows testing the performance of the model to make out-of-sample predictions. The model may perfectly fit the data used for the estimations, but may fail to make out-of-sample predictions; this is known as the overfitting problem. Based on the second criterion the model with the lowest prediction error out of the training set was chosen.

To combine the two criteria total RMSE (RMSE_{total}) is calculated as follows:

¹² An impulse dummy is a variable that takes the value one for the year in which the dependent variable shows a sharp jump, and zero otherwise.

¹³ The step dummy is defined as a variable that takes the value one for the years 2010-2015 and zero otherwise.

$$RMSE_{total} = RMSE_{9515} + RMSE_{1415} \quad (4)$$

And the model with the lowest $RMSE_{total}$ chosen. The advantages of combining the two RMSE is to select a model that makes good predictions in the test set and also behaves well over the whole period. When only one of the criteria is used, misleading results may arise in some cases. For example, cases were observed in which the best model selected according only to the out-of-sample prediction capacity performed poorly when it was estimated for the whole period (adjusted R-squared below 0.1). Additionally, when testing the out-of-sample predictive capacity using only two years, the $RMSE_{1415}$ is prone to be affected by unusual data in the test set.

Table 8 Table 28 show the description of the best models selected according to the criteria based on the minimum $RMSE_{total}$. Each table shows, for each country, the variables finally considered in the estimations (including the industry disaggregation used for value added and persons employed). The table also specifies whether dummies were included in the period 1995-2013 (in the training set) or in years 2014 -2015. It also reports the estimation method (plain OLS or OLS including a trend or an AR(1) term to overcome the serial correlation problems), the adjusted R-squared of the model estimated for 1995-2015, and the $RMSE_{9515}$, $RMSE_{1415}$. Table 8 to Table 14 show the information for the model estimated for value added, Table 15 to Table 21 for employment, Table 22 to Table 28 for hours worked and Table 29 to Table 35 for BERD. In general the models behave reasonably well in all the countries and industries selected.¹⁴

¹⁴ Additionally, figures for value added, employment, hours worked, and BERD depicting the results of the model selected for each variable and industry can be provided upon request. The figures show the in-sample predictions and provide a detailed summary of the results.

Table 8 Description of the estimation models for GVA. Total ICT Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | National Accounts variables (NACE sectors C+J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 1 | Yes | No | OLS | 0.671 | 264.726 | 127.003 |
| BE | Persons employed, GVA | 2 | No | No | OLS | 0.630 | 219.447 | 131.448 |
| BG | Persons employed, GVA | 3 | No | Yes | OLS | 0.802 | 82.731 | 50.460 |
| CY | Persons employed, GVA | 1 | Yes | No | OLS | 0.620 | 17.546 | 12.138 |
| CZ | Persons employed, GVA | 3 | No | No | OLS | 0.728 | 226.318 | 190.857 |
| DE | Persons employed, GVA | 1 | No | No | OLS | 0.476 | 3,365.419 | 1,197.988 |
| DK | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.259 | 262.128 | 181.436 |
| EE | Persons employed, GVA | 2 | No | Yes | OLS | 0.829 | 17.031 | 16.419 |
| EL | Persons employed, GVA | 3 | No | Yes | OLS | 0.651 | 264.596 | 41.519 |
| ES | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.874 | 417.217 | 41.500 |
| FI | Persons employed, GVA | 0 | No | Yes | OLS | 0.662 | 1,073.076 | 480.572 |
| FR | Persons employed, GVA | 3 | No | No | OLS | 0.728 | 1,193.662 | 270.983 |
| HR | Persons employed, GVA | 1 | No | No | OLS | 0.780 | 54.951 | 20.795 |
| HU | GVA | 0 | No | Yes | OLS | 0.440 | 262.680 | 53.306 |
| IE | <i>Model not estimated because there is a break in the series of the dependent variable</i> | | | | | | | |
| IT | Persons employed, GVA | 3 | No | No | OLS | 0.654 | 1,491.303 | 414.854 |
| LT | Persons employed, GVA | 1 | Yes | No | OLS | 0.322 | 42.313 | 32.538 |
| LU | Persons employed, GVA | 0 | Yes | No | OLS | 0.332 | 98.918 | 205.656 |
| LV | Persons employed, GVA | 3 | No | No | OLS | 0.728 | 31.952 | 67.214 |
| MT | Persons employed, GVA | 3 | No | No | OLS | 0.929 | 14.296 | 11.381 |
| NL | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.744 | 429.465 | 83.079 |
| PL | Persons employed, GVA | 3 | No | Yes | OLS | 0.655 | 405.008 | 37.036 |
| PT | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.757 | 94.135 | 57.269 |
| RO | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.657 | 511.260 | 459.091 |
| SE | Persons employed, GVA | 3 | No | Yes | OLS | 0.886 | 693.551 | 636.370 |
| SI | Persons employed, GVA | 3 | No | No | OLS | 0.767 | 23.137 | 6.979 |
| SK | Persons employed, GVA | 3 | No | Yes | OLS | 0.855 | 73.400 | 119.509 |
| UK | Persons employed, GVA | 0 | Yes | No | OLS | 0.848 | 2,546.010 | 1,042.493 |
| EU28 | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.796 | 7,860.087 | 4,781.749 |
| AU | Persons employed, GVA | 3 | No | Yes | OLS | 0.833 | 967.549 | 303.438 |
| CA | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.875 | 1,001.528 | 539.194 |
| JP | Persons employed, GVA | 3 | No | Yes | OLS | 0.948 | 6,840.025 | 2,238.585 |
| KR | Persons employed, GVA | 0 | Yes | No | OLS | 0.976 | 1,288.599 | 144.151 |
| TW | GVA | 1 | Yes | No | OLS | 0.889 | 1,481.606 | 1,547.628 |
| US | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.972 | 9,635.331 | 5,931.908 |

Note: NACE sectors C26+J for CA, JP and US for the predictor of Persons employed.

Table 9 Description of the estimation models for GVA. ICT Manufacturing

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | National Accounts variables (NACE sector C) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 3 | No | No | OLS | 0.900 | 104.239 | 50.797 |
| BE | Persons employed, GVA | 3 | No | Yes | OLS | 0.654 | 121.839 | 77.566 |
| BG | Persons employed, GVA | 2 | Yes | No | OLS | 0.418 | 7.784 | 10.217 |
| CY | Persons employed, GVA | 1 | Yes | No | OLS | 0.674 | 2.006 | 6.765 |
| CZ | Persons employed, GVA | 0 | No | Yes | OLS | 0.635 | 75.639 | 35.852 |
| DE | Persons employed, GVA | 0 | No | No | OLS | 0.427 | 1,866.709 | 485.108 |
| DK | Persons employed, GVA | 2 | No | Yes | OLS | 0.258 | 93.579 | 53.392 |
| EE | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.549 | 18.010 | 24.016 |
| EL | Persons employed, GVA | 3 | No | No | OLS | 0.426 | 45.259 | 3.056 |
| ES | Persons employed, GVA | 3 | No | No | OLS | 0.714 | 101.239 | 42.460 |
| FI | Persons employed, GVA | 3 | No | Yes | OLS | 0.850 | 679.494 | 563.297 |
| FR | Persons employed, GVA | 3 | No | No | OLS | 0.651 | 420.650 | 291.309 |
| HR | Persons employed, GVA | 3 | No | No | OLS | 0.653 | 19.731 | 9.256 |
| HU | Persons employed, GVA | 3 | No | No | OLS | 0.564 | 147.721 | 131.871 |
| IE | <i>Model not estimated because there is a break in the series of the dependent variable</i> | | | | | | | |
| IT | Persons employed, GVA | 3 | No | Yes | OLS | 0.411 | 281.799 | 130.582 |
| LT | Persons employed, GVA | 3 | No | No | OLS | 0.476 | 11.445 | 6.128 |
| LU | Persons employed, GVA | 3 | No | Yes | OLS | 0.831 | 0.786 | 0.763 |
| LV | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.831 | 7.069 | 41.223 |
| MT | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.543 | 28.422 | 8.018 |
| NL | Persons employed, GVA | 2 | No | No | OLS | 0.505 | 273.254 | 44.845 |
| PL | Persons employed, GVA | 1 | No | No | OLS | 0.536 | 129.308 | 10.042 |
| PT | Persons employed, GVA | 2 | No | Yes | OLS | 0.914 | 23.712 | 12.469 |
| RO | Persons employed, GVA | 3 | No | Yes | OLS | 0.861 | 94.346 | 49.267 |
| SE | Persons employed, GVA | 3 | No | Yes | OLS | 0.922 | 594.447 | 2,891.299 |
| SI | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.173 | 18.059 | 20.314 |
| SK | Persons employed, GVA | Step dummy from 2010 | No | No | AR(1) | 0.614 | 80.606 | 53.892 |
| UK | Persons employed, GVA | 3 | No | No | OLS | 0.737 | 650.013 | 803.803 |
| EU28 | Persons employed, GVA | 3 | No | Yes | OLS | 0.780 | 3,149.565 | 3,267.626 |
| AU | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.523 | 99.438 | 142.915 |
| CA | Persons employed, GVA | 3 | No | Yes | OLS | 0.207 | 350.033 | 3.246 |
| JP | Persons employed, GVA | 3 | No | No | OLS | 0.877 | 5,352.344 | 1,926.420 |
| KR | Persons employed, GVA | 1 | Yes | No | OLS | 0.953 | 1,185.028 | 1,112.643 |
| TW | Persons employed, GVA | 0 | Yes | No | OLS | 0.816 | 1,518.409 | 1,621.463 |
| US | Persons employed, GVA | 3 | No | No | OLS | 0.951 | 4,455.958 | 1,433.225 |

Note: NACE sector C26 for CA, JP and US for the predictor of Persons employed.

Table 10 Description of the estimation models for GVA. ICT Services

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 0 | Yes | No | OLS | 0.949 | 61.282 | 73.216 |
| BE | Persons employed, GVA | 1 | Yes | No | OLS | 0.892 | 112.397 | 65.447 |
| BG | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.968 | 34.019 | 20.479 |
| CY | Persons employed, GVA | 3 | No | Yes | OLS | 0.931 | 7.255 | 1.330 |
| CZ | Persons employed, GVA | 0 | Yes | No | OLS | 0.990 | 34.458 | 8.151 |
| DE | Persons employed, GVA | 0 | No | No | OLS | 0.895 | 1,257.970 | 329.851 |
| DK | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.874 | 102.040 | 25.612 |
| EE | Persons employed, GVA | 2 | Yes | No | OLS | 0.963 | 5.223 | 1.586 |
| EL | Persons employed, GVA | 3 | No | No | OLS | 0.925 | 122.174 | 36.905 |
| ES | Persons employed, GVA | 0 | No | No | OLS | 0.932 | 298.989 | 270.226 |
| FI | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.957 | 71.808 | 69.318 |
| FR | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.946 | 461.757 | 157.573 |
| HR | Persons employed, GVA | 1 | No | No | OLS | 0.940 | 23.594 | 6.921 |
| HU | Persons employed, GVA | 2 | No | Yes | OLS | 0.765 | 99.761 | 114.474 |
| IE | Persons employed, GVA | 3 | No | No | OLS | 0.907 | 227.007 | 66.359 |
| IT | Persons employed, GVA | 2 | No | No | OLS | 0.980 | 339.263 | 129.120 |
| LT | GVA | 3 | No | Yes | OLS | 0.902 | 15.490 | 0.771 |
| LU | Persons employed, GVA | 0 | Yes | No | OLS | 0.893 | 39.510 | 25.400 |
| LV | Persons employed, GVA | 0 | No | Yes | OLS | 0.934 | 14.003 | 12.025 |
| MT | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.981 | 4.142 | 14.062 |
| NL | Persons employed, GVA | 0 | No | No | OLS | 0.981 | 108.759 | 101.530 |
| PL | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.814 | 293.806 | 9.033 |
| PT | Persons employed, GVA | 2 | No | No | OLS | 0.960 | 33.122 | 11.370 |
| RO | Persons employed, GVA | 3 | No | No | OLS | 0.990 | 74.525 | 110.050 |
| SE | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.996 | 89.436 | 138.927 |
| SI | Persons employed, GVA | 0 | No | No | OLS | 0.769 | 19.438 | 0.801 |
| SK | Persons employed, GVA | 2 | No | Yes | OLS | 0.855 | 46.727 | 65.993 |
| UK | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.972 | 981.718 | 304.583 |
| EU28 | Persons employed, GVA | 2 | Yes | No | OLS | 0.968 | 2,465.107 | 2,375.795 |
| AU | Persons employed, GVA | 3 | No | Yes | OLS | 0.932 | 597.089 | 562.078 |
| CA | Persons employed, GVA | 2 | No | Yes | OLS | 0.644 | 1,526.043 | 864.174 |
| JP | Persons employed, GVA | 2 | No | Yes | OLS | 0.994 | 1,428.175 | 101.671 |
| KR | Persons employed, GVA | 3 | No | No | OLS | 0.999 | 99.691 | 72.596 |
| TW | Persons employed, GVA | 3 | No | No | OLS | 0.995 | 54.393 | 53.956 |
| US | Persons employed, GVA | 3 | No | No | OLS | 0.983 | 5,751.469 | 2,210.174 |

Table 11 Description of the estimation models for GVA. IT Services (Telecommunications)

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 0 | No | No | OLS | 0.578 | 129.734 | 44.480 |
| BE | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.721 | 129.723 | 149.105 |
| BG | Persons employed, GVA | 3 | No | No | OLS | 0.957 | 33.008 | 10.056 |
| CY | Persons employed, GVA | 3 | No | No | OLS | 0.752 | 12.001 | 17.014 |
| CZ | Persons employed, GVA | 0 | No | Yes | OLS | 0.889 | 70.558 | 29.385 |
| DE | Persons employed, GVA | 0 | No | No | OLS | 0.556 | 1,940.075 | 479.290 |
| DK | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.351 | 166.252 | 49.508 |
| EE | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.848 | 6.552 | 3.898 |
| EL | Persons employed, GVA | 2 | No | No | OLS | 0.756 | 201.593 | 74.396 |
| ES | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.889 | 283.590 | 453.157 |
| FI | Persons employed, GVA | 3 | No | Yes | OLS | 0.916 | 80.423 | 45.513 |
| FR | Persons employed, GVA | 3 | No | Yes | OLS | 0.800 | 675.868 | 1,040.800 |
| HR | Persons employed, GVA | 2 | No | Yes | OLS | 0.817 | 38.433 | 7.828 |
| HU | Persons employed, GVA | 3 | No | No | OLS | 0.805 | 75.198 | 70.108 |
| IE | Persons employed, GVA | 3 | No | Yes | OLS | 0.781 | 136.419 | 265.522 |
| IT | Persons employed, GVA | 3 | No | Yes | OLS | 0.935 | 435.285 | 280.501 |
| LT | Persons employed, GVA | 2 | No | Yes | OLS | 0.867 | 17.689 | 23.507 |
| LU | Persons employed, GVA | 3 | No | Yes | OLS | 0.826 | 35.532 | 73.480 |
| LV | Persons employed, GVA | 3 | No | Yes | OLS | 0.917 | 12.574 | 13.005 |
| MT | Persons employed, GVA | 0 | Yes | No | OLS | 0.645 | 6.368 | 20.498 |
| NL | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.800 | 262.163 | 135.699 |
| PL | Persons employed, GVA | 0 | Yes | No | OLS | 0.559 | 302.188 | 127.339 |
| PT | Persons employed, GVA | 1 | No | No | OLS | 0.874 | 57.437 | 60.044 |
| RO | Persons employed, GVA | 1 | No | No | OLS | 0.829 | 132.521 | 182.674 |
| SE | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.453 | 191.244 | 562.572 |
| SI | Persons employed, GVA | 1 | No | Yes | OLS | 0.639 | 18.317 | 21.821 |
| SK | Persons employed, GVA | Step dummy from 2010 | Yes | No | OLS | 0.677 | 30.581 | 49.018 |
| UK | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.880 | 855.686 | 420.368 |
| EU28 | GVA | 3 | No | No | OLS | 0.768 | 4,162.198 | 5,037.503 |
| AU | Persons employed, GVA | 3 | No | Yes | OLS | 0.888 | 317.244 | 234.120 |
| CA | Persons employed, GVA | 2 | No | Yes | OLS | 0.832 | 649.957 | 667.776 |
| JP | Persons employed, GVA | 1 | No | Yes | OLS | 0.995 | 703.886 | 1,029.093 |
| KR | Persons employed | 1 | No | No | OLS | 0.492 | 1,130.907 | 458.477 |
| TW | Persons employed, GVA | 0 | Yes | No | OLS | 0.985 | 61.710 | 60.043 |
| US | Persons employed, GVA | 0 | Yes | No | OLS | 1.000 | 0.000 | 1,690.185 |

Note: NACE sector J61 for CA, JP and US for the predictor Persons employed. NACE sector J61 for JP, KR and US for the predictor GVA.

Table 12 Description of the estimation models for GVA. IC Services (Computer and related activities)

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.833 | 71.640 | 25.417 |
| BE | Persons employed, GVA | 3 | No | Yes | OLS | 0.791 | 115.067 | 96.496 |
| BG | Persons employed, GVA | Step dummy from 2010 | No | No | AR(1) | 0.694 | 29.922 | 61.187 |
| CY | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.558 | 13.537 | 20.350 |
| CZ | Persons employed, GVA | 3 | No | Yes | OLS | 0.856 | 80.127 | 36.335 |
| DE | Persons employed, GVA | 3 | No | No | OLS | 0.691 | 1,211.215 | 544.904 |
| DK | Persons employed, GVA | 3 | No | Yes | OLS | 0.558 | 183.870 | 47.150 |
| EE | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.912 | 7.231 | 2.928 |
| EL | Persons employed, GVA | 1 | No | No | OLS | 0.409 | 93.460 | 99.863 |
| ES | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.456 | 354.916 | 114.812 |
| FI | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.474 | 149.812 | 178.542 |
| FR | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.700 | 766.547 | 795.231 |
| HR | GVA | 2 | Yes | Yes | OLS | 0.604 | 14.030 | 11.544 |
| HU | Persons employed, GVA | 3 | No | No | OLS | 0.629 | 43.620 | 16.345 |
| IE | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.781 | 345.214 | 416.282 |
| IT | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.781 | 438.525 | 240.359 |
| LT | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.641 | 17.680 | 24.984 |
| LU | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.813 | 37.467 | 169.429 |
| LV | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.752 | 14.511 | 15.220 |
| MT | Persons employed, GVA | 2 | Yes | No | OLS | 0.855 | 8.773 | 24.808 |
| NL | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.768 | 271.546 | 214.106 |
| PL | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.895 | 121.511 | 185.988 |
| PT | Persons employed, GVA | 3 | No | No | OLS | 0.371 | 32.639 | 40.344 |
| RO | Persons employed, GVA | 1 | Yes | No | OLS | 0.791 | 267.153 | 188.633 |
| SE | Persons employed, GVA | 3 | No | Yes | OLS | 0.974 | 229.276 | 449.517 |
| SI | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.800 | 9.053 | 21.057 |
| SK | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.788 | 47.632 | 105.803 |
| UK | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.909 | 1,102.963 | 632.819 |
| EU28 | Persons employed, GVA | 3 | No | No | OLS | 0.703 | 4,307.520 | 2,674.146 |
| AU | Persons employed, GVA | 3 | No | Yes | OLS | 0.849 | 561.599 | 327.958 |
| CA | Persons employed, GVA | 2 | No | No | OLS | 0.509 | 775.682 | 42.282 |
| JP | Persons employed, GVA | 1 | No | No | OLS | 0.978 | 1,396.690 | 578.511 |
| KR | Persons employed, GVA | 0 | Yes | No | OLS | 0.988 | 171.497 | 39.824 |
| TW | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.875 | 92.823 | 13.747 |
| US | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.961 | 4,911.624 | 1,254.769 |

Note: Difference of the NACE sectors J- J61 for CA, JP and US for the predictor Persons employed. Difference of the NACE sectors J- J61 for JP, KR and US for the predictor GVA.

Table 13 Description of the estimation models for GVA. Media and Content Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 3 | No | No | OLS | 0.422 | 56.497 | 49.374 |
| BE | Persons employed, GVA | 3 | No | No | OLS | 0.523 | 72.545 | 84.844 |
| BG | Persons employed, GVA | 2 | Yes | No | OLS | 0.760 | 12.280 | 38.595 |
| CY | Persons employed, GVA | 2 | No | Yes | OLS | 0.583 | 5.935 | 2.381 |
| CZ | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.867 | 30.662 | 4.654 |
| DE | Persons employed, GVA | 3 | No | Yes | OLS | 0.678 | 792.585 | 280.928 |
| DK | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.374 | 86.692 | 23.193 |
| EE | Persons employed, GVA | 1 | Yes | No | OLS | 0.606 | 5.164 | 2.586 |
| EL | Persons employed, GVA | 3 | No | No | OLS | 0.793 | 112.628 | 19.096 |
| ES | Persons employed, GVA | 3 | No | No | OLS | 0.584 | 254.699 | 206.042 |
| FI | Persons employed, GVA | 3 | No | Yes | OLS | 0.784 | 48.968 | 13.472 |
| FR | Persons employed, GVA | 2 | No | No | OLS | 0.235 | 431.643 | 209.074 |
| HR | Persons employed, GVA | 2 | No | Yes | OLS | 0.836 | 16.588 | 12.442 |
| HU | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.645 | 62.624 | 66.634 |
| IE | Persons employed, GVA | 2 | No | No | OLS | 0.181 | 198.078 | 104.267 |
| IT | Persons employed, GVA | 2 | No | Yes | OLS | 0.795 | 302.777 | 205.142 |
| LT | Persons employed, GVA | 3 | No | No | OLS | 0.700 | 9.273 | 4.408 |
| LU | Persons employed, GVA | 1 | No | Yes | OLS | 0.274 | 33.444 | 21.024 |
| LV | Persons employed, GVA | 2 | No | Yes | OLS | 0.711 | 9.097 | 5.040 |
| MT | GVA | 3 | No | Yes | OLS | 0.699 | 3.725 | 14.642 |
| NL | Persons employed, GVA | 2 | No | No | OLS | 0.588 | 96.578 | 99.098 |
| PL | Persons employed, GVA | 0 | No | No | OLS | 0.739 | 239.542 | 231.747 |
| PT | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.516 | 39.710 | 19.859 |
| RO | Persons employed, GVA | 0 | Yes | No | OLS | 0.569 | 53.639 | 154.852 |
| SE | GVA | Step dummy from 2010 | No | Yes | OLS | 0.966 | 103.655 | 100.627 |
| SI | Persons employed, GVA | 3 | No | Yes | OLS | 0.927 | 7.215 | 2.603 |
| SK | Persons employed, GVA | 1 | No | Yes | OLS | 0.706 | 30.500 | 62.378 |
| UK | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.785 | 1,107.362 | 266.747 |
| EU28 | Persons employed, GVA | 3 | No | No | OLS | 0.738 | 2,316.488 | 1,303.202 |
| AU | Persons employed, GVA | 0 | No | No | OLS | 0.830 | 272.612 | 36.623 |
| CA | Persons employed, GVA | 3 | No | No | OLS | 0.589 | 413.211 | 151.596 |
| JP | Persons employed, GVA | 0 | No | No | OLS | 0.823 | 1,620.858 | 704.975 |
| KR | Persons employed, GVA | 3 | No | Yes | OLS | 0.986 | 72.134 | 25.712 |
| TW | Persons employed, GVA | 3 | No | No | OLS | 0.939 | 47.464 | 22.428 |
| US | GVA | 3 | No | Yes | OLS | 0.945 | 4,482.492 | 8,069.944 |

Note: Difference of the NACE sectors J- J61 for CA, JP and US for the predictor Persons employed. Difference of the NACE sectors J- J61 for JP, KR and US for the predictor GVA.

Table 14 Description of the estimation models for GVA. Retail Sale Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | National Accounts variables (NACE sectors G, H, I) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed | 2 | No | Yes | OLS | 0.171 | 18.109 | 32.449 |
| BE | GVA | 3 | No | Yes | OLS | 0.635 | 11.742 | 3.145 |
| BG | Persons employed, GVA | 2 | Yes | No | OLS | 0.166 | 1.782 | 2.587 |
| CY | Persons employed, GVA | 3 | No | No | OLS | 0.618 | 0.298 | 0.451 |
| CZ | GVA | 1 | Yes | Yes | OLS | 0.705 | 10.025 | 20.243 |
| DE | Persons employed, GVA | 3 | No | Yes | OLS | 0.629 | 433.429 | 969.833 |
| DK | Persons employed, GVA | 3 | No | Yes | OLS | 0.682 | 9.318 | 14.447 |
| EE | Persons employed, GVA | 3 | No | No | OLS | 0.686 | 2.106 | 3.739 |
| EL | Persons employed, GVA | 1 | Yes | No | OLS | 0.646 | 5.122 | 13.494 |
| ES | Persons employed, GVA | 3 | No | Yes | OLS | 0.291 | 32.372 | 67.052 |
| FI | Persons employed, GVA | 1 | Yes | No | OLS | 0.274 | 6.000 | 11.241 |
| FR | Persons employed, GVA | 3 | No | Yes | OLS | 0.731 | 99.522 | 233.033 |
| HR | Persons employed, GVA | 2 | No | Yes | OLS | 0.968 | 0.559 | 0.994 |
| HU | Persons employed, GVA | 3 | No | Yes | OLS | 0.584 | 3.875 | 7.863 |
| IE | Persons employed, GVA | 3 | No | No | OLS | 0.688 | 32.227 | 41.226 |
| IT | Persons employed, GVA | Step dummy from 2010 | No | No | AR(1) | 0.482 | 126.198 | 13.712 |
| LT | Persons employed, GVA | 3 | No | No | OLS | 0.878 | 2.072 | 6.491 |
| LU | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.152 | 10.655 | 4.530 |
| LV | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.872 | 2.574 | 2.359 |
| MT | Persons employed, GVA | 4 | No | No | OLS | 0.967 | 1.625 | 0.697 |
| NL | Persons employed, GVA | 3 | No | No | OLS | 0.547 | 57.980 | 114.753 |
| PL | Persons employed, GVA | 0 | No | No | OLS | 0.293 | 100.392 | 59.458 |
| PT | Persons employed, GVA | 3 | No | Yes | OLS | 0.414 | 2.624 | 1.376 |
| RO | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.674 | 10.725 | 42.757 |
| SE | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.363 | 32.324 | 34.158 |
| SI | Persons employed, GVA | 3 | No | Yes | OLS | 0.798 | 5.493 | 5.155 |
| SK | Persons employed, GVA | 2 | No | No | OLS | 0.417 | 21.117 | 5.718 |
| UK | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.382 | 638.402 | 290.538 |
| EU28 | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.668 | 633.556 | 2,753.634 |
| AU | GVA | 0 | Yes | Yes | OLS | 0.943 | 30.573 | 97.487 |
| CA | GVA | Step dummy from 2010 | No | Yes | OLS | 0.381 | 38.961 | 45.638 |
| JP | <i>Model not estimated because the dependent variable is not available for the Retail sale sector</i> | | | | | | | |
| KR | Persons employed, GVA | 0 | Yes | No | OLS | 0.738 | 115.023 | 256.708 |
| TW | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.861 | 30.339 | 49.891 |
| US | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.958 | 1,287.472 | 5,912.011 |

Note: NACE sectors G47 for JP and G4791 for CA and US for the predictor Persons employed. NACE sector G47 for JP and US for the predictor GVA.

Table 15 Description of the estimation models for Employment. Total ICT Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|--|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sectors C+J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 3 | No | Yes | OLS | 0.759 | 1.843 | 1.383 |
| BE | Persons employed, GVA | 3 | No | No | OLS | 0.752 | 1.899 | 1.130 |
| BG | Persons employed, GVA | 3 | No | Yes | OLS | 0.857 | 1.176 | 2.282 |
| CY | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.597 | 0.125 | 0.032 |
| CZ | Persons employed, GVA | 3 | No | No | OLS | 0.416 | 4.042 | 0.622 |
| DE | Persons employed, GVA | 2 | No | No | OLS | 0.758 | 13.075 | 2.483 |
| DK | Persons employed, GVA | 1 | No | Yes | OLS | 0.442 | 2.158 | 0.069 |
| EE | Persons employed, GVA | 0 | Yes | No | OLS | 0.426 | 1.696 | 1.417 |
| EL | Persons employed, GVA | 3 | No | Yes | OLS | 0.807 | 1.512 | 3.990 |
| ES | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.379 | 8.959 | 12.055 |
| FI | Persons employed, GVA | 3 | No | No | OLS | 0.750 | 2.327 | 0.535 |
| FR | Persons employed, GVA | 3 | No | No | OLS | 0.674 | 10.852 | 8.720 |
| HR | Persons employed, GVA | 3 | No | Yes | OLS | 0.830 | 0.784 | 1.524 |
| HU | Persons employed | 1 | No | Yes | OLS | 0.346 | 10.165 | 3.731 |
| IE | Persons employed, GVA | 2 | No | Yes | OLS | 0.758 | 3.682 | 0.244 |
| IT | Persons employed, GVA | 2 | No | No | OLS | 0.478 | 10.917 | 7.531 |
| LT | Persons employed, GVA | 3 | No | No | OLS | 0.669 | 0.977 | 1.908 |
| LU | Persons employed, GVA | 1 | No | Yes | OLS | 0.674 | 0.199 | 0.095 |
| LV | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.655 | 0.892 | 1.886 |
| MT | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.701 | 0.224 | 0.097 |
| NL | Persons employed, GVA | 3 | No | Yes | OLS | 0.891 | 3.783 | 0.219 |
| PL | Persons employed | 2 | Yes | Yes | OLS | 0.528 | 8.318 | 2.424 |
| PT | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.644 | 0.886 | 0.887 |
| RO | Persons employed, GVA | 3 | No | Yes | OLS | 0.860 | 5.342 | 12.437 |
| SE | Persons employed, GVA | 3 | No | Yes | OLS | 0.906 | 2.800 | 1.187 |
| SI | Persons employed, GVA | 3 | No | No | OLS | 0.151 | 0.588 | 0.323 |
| SK | Persons employed, GVA | 3 | No | No | OLS | 0.493 | 2.048 | 0.565 |
| UK | Persons employed, GVA | 1 | Yes | No | OLS | 0.403 | 21.214 | 14.913 |
| EU28 | Persons employed, GVA | 3 | No | No | OLS | 0.860 | 40.355 | 10.376 |
| AU | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.327 | 9.011 | 9.772 |
| CA | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.556 | 6.513 | 7.353 |
| JP | Persons employed, GVA | 0 | No | No | OLS | 0.881 | 24.993 | 19.346 |
| KR | Persons employed, GVA | 0 | Yes | No | OLS | 0.407 | 25.411 | 59.750 |
| TW | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.568 | 21.148 | 1.017 |
| US | Persons employed, GVA | 2 | No | No | OLS | 0.981 | 27.045 | 4.527 |

Note: NACE sectors C26+J for CA, JP and US for the predictor of Persons employed.

Table 16 Description of the estimation models for Employment. ICT Manufacturing

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector C) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 3 | No | Yes | OLS | 0.929 | 0.600 | 0.167 |
| BE | Persons employed, GVA | 3 | No | No | OLS | 0.739 | 0.621 | 0.314 |
| BG | Persons employed, GVA | 1 | No | No | OLS | 0.337 | 0.648 | 0.140 |
| CY | Persons employed, GVA | 3 | No | No | OLS | 0.996 | 0.002 | 0.001 |
| CZ | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.717 | 1.594 | 0.438 |
| DE | Persons employed, GVA | 3 | No | No | OLS | 0.838 | 3.935 | 0.678 |
| DK | Persons employed, GVA | 3 | No | Yes | OLS | 0.426 | 0.550 | 0.190 |
| EE | Persons employed, GVA | 3 | No | Yes | OLS | 0.693 | 0.586 | 0.342 |
| EL | Persons employed, GVA | Step dummy from 2010 | No | Yes | AR(1) | 0.324 | 0.547 | 0.128 |
| ES | Persons employed, GVA | 3 | No | No | OLS | 0.808 | 1.720 | 0.780 |
| FI | Persons employed, GVA | 3 | No | No | OLS | 0.516 | 1.776 | 0.689 |
| FR | Persons employed, GVA | 2 | No | No | OLS | 0.762 | 1.856 | 0.387 |
| HR | Persons employed | 2 | Yes | No | OLS | 0.979 | 0.212 | 0.066 |
| HU | Persons employed, GVA | 3 | No | Yes | OLS | 0.598 | 7.564 | 4.723 |
| IE | Persons employed, GVA | 2 | No | No | OLS | 0.646 | 2.023 | 0.564 |
| IT | Persons employed, GVA | 1 | Yes | No | OLS | 0.530 | 2.021 | 2.145 |
| LT | Persons employed, GVA | 2 | No | No | OLS | 0.815 | 0.453 | 0.277 |
| LU | Persons employed, GVA | 0 | No | No | OLS | 0.126 | 0.051 | 0.013 |
| LV | GVA | 3 | No | Yes | OLS | 0.865 | 0.161 | 0.093 |
| MT | Persons employed, GVA | 3 | No | No | OLS | 0.482 | 0.186 | 0.048 |
| NL | Persons employed, GVA | 2 | No | No | OLS | 0.685 | 0.713 | 0.196 |
| PL | Persons employed, GVA | 3 | No | No | OLS | 0.689 | 2.228 | 2.827 |
| PT | Persons employed | 3 | No | Yes | OLS | 0.716 | 0.333 | 0.044 |
| RO | Persons employed, GVA | 1 | No | Yes | OLS | 0.617 | 5.164 | 4.871 |
| SE | Persons employed, GVA | 3 | No | Yes | OLS | 0.895 | 1.657 | 9.386 |
| SI | Persons employed, GVA | 2 | No | No | OLS | 0.654 | 0.211 | 0.081 |
| SK | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.564 | 0.951 | 0.175 |
| UK | Persons employed, GVA | 3 | No | No | OLS | 0.624 | 3.914 | 4.145 |
| EU28 | Persons employed | 3 | No | No | OLS | 0.851 | 14.788 | 12.652 |
| AU | Persons employed, GVA | 3 | No | No | OLS | 0.569 | 1.542 | 0.335 |
| CA | GVA | Step dummy from 2010 | Yes | Yes | OLS | 0.279 | 3.630 | 2.734 |
| JP | Persons employed, GVA | 2 | No | No | OLS | 0.964 | 9.878 | 1.466 |
| KR | Persons employed, GVA | 0 | Yes | No | OLS | 0.520 | 11.881 | 24.501 |
| TW | Persons employed, GVA | 1 | No | Yes | OLS | 0.758 | 15.125 | 8.856 |
| US | Persons employed, GVA | 0 | No | No | OLS | 0.976 | 9.482 | 5.894 |

Note: NACE sector C26 for CA, JP and US for the predictor of Persons employed.

Table 17 Description of the estimation models for Employment. ICT Services

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.946 | 0.612 | 0.362 |
| BE | Persons employed, GVA | 2 | No | Yes | OLS | 0.975 | 0.479 | 0.065 |
| BG | Persons employed, GVA | 3 | No | Yes | OLS | 0.933 | 0.802 | 1.361 |
| CY | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.746 | 0.091 | 0.200 |
| CZ | Persons employed, GVA | 1 | No | Yes | OLS | 0.863 | 1.359 | 0.264 |
| DE | Persons employed, GVA | 3 | No | Yes | OLS | 0.857 | 7.601 | 7.941 |
| DK | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.831 | 1.023 | 0.588 |
| EE | Persons employed, GVA | 0 | Yes | No | OLS | 0.687 | 0.938 | 1.347 |
| EL | Persons employed, GVA | 3 | No | No | OLS | 0.954 | 0.725 | 3.659 |
| ES | Persons employed, GVA | 0 | Yes | No | OLS | 0.850 | 3.587 | 7.239 |
| FI | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.968 | 0.535 | 0.099 |
| FR | Persons employed, GVA | 3 | No | No | OLS | 0.980 | 2.301 | 2.256 |
| HR | Persons employed, GVA | 3 | No | No | OLS | 0.921 | 0.609 | 0.577 |
| HU | Persons employed | 1 | Yes | No | OLS | 0.815 | 2.144 | 2.516 |
| IE | Persons employed, GVA | 2 | No | Yes | OLS | 0.989 | 0.565 | 0.666 |
| IT | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.981 | 1.919 | 0.880 |
| LT | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.693 | 1.083 | 1.120 |
| LU | Persons employed, GVA | 2 | No | Yes | OLS | 0.900 | 0.105 | 0.042 |
| LV | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.917 | 0.405 | 1.369 |
| MT | Persons employed, GVA | 2 | Yes | No | OLS | 0.940 | 0.064 | 0.031 |
| NL | Persons employed, GVA | 3 | No | No | OLS | 0.975 | 1.704 | 0.559 |
| PL | Persons employed, GVA | 3 | No | No | OLS | 0.981 | 1.593 | 1.029 |
| PT | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.881 | 0.530 | 0.496 |
| RO | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.942 | 2.471 | 6.123 |
| SE | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.956 | 1.531 | 1.836 |
| SI | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.750 | 0.225 | 0.197 |
| SK | Persons employed, GVA | 3 | No | No | OLS | 0.884 | 0.742 | 0.377 |
| UK | Persons employed, GVA | 0 | Yes | No | OLS | 0.835 | 9.896 | 14.313 |
| EU28 | Persons employed, GVA | 3 | No | No | OLS | 0.954 | 17.221 | 7.872 |
| AU | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.670 | 6.030 | 7.968 |
| CA | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.573 | 5.605 | 5.785 |
| JP | Persons employed, GVA | 2 | Yes | No | OLS | 0.830 | 17.087 | 40.550 |
| KR | Persons employed, GVA | 0 | Yes | No | OLS | 0.837 | 8.307 | 9.704 |
| TW | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.642 | 2.049 | 2.711 |
| US | Persons employed, GVA | 2 | No | No | OLS | 0.976 | 22.412 | 3.048 |

Table 18 Description of the estimation models for Employment. IT Services (Telecommunications)

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 2 | No | Yes | OLS | 0.551 | 0.539 | 0.290 |
| BE | Persons employed, GVA | 1 | No | No | OLS | 0.551 | 0.799 | 0.758 |
| BG | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.589 | 0.613 | 1.030 |
| CY | Persons employed | 2 | Yes | No | OLS | 0.678 | 0.044 | 0.132 |
| CZ | Persons employed, GVA | 3 | No | No | OLS | 0.633 | 0.793 | 0.166 |
| DE | Persons employed, GVA | 2 | No | Yes | OLS | 0.734 | 4.505 | 2.927 |
| DK | Persons employed, GVA | 3 | No | Yes | OLS | 0.756 | 0.466 | 0.369 |
| EE | Persons employed, GVA | 1 | Yes | No | OLS | 0.583 | 0.704 | 1.115 |
| EL | Persons employed, GVA | 3 | No | Yes | OLS | 0.785 | 0.803 | 0.329 |
| ES | Persons employed, GVA | 1 | No | Yes | OLS | 0.558 | 2.282 | 0.237 |
| FI | Persons employed, GVA | 2 | No | No | OLS | 0.716 | 0.508 | 0.336 |
| FR | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.453 | 2.549 | 3.884 |
| HR | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.805 | 0.721 | 0.861 |
| HU | Persons employed, GVA | 3 | No | Yes | OLS | 0.473 | 1.038 | 0.610 |
| IE | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.837 | 0.744 | 0.407 |
| IT | Persons employed, GVA | 3 | No | No | OLS | 0.666 | 2.009 | 1.156 |
| LT | Persons employed, GVA | 3 | No | No | OLS | 0.627 | 0.644 | 1.035 |
| LU | Persons employed, GVA | 3 | No | Yes | OLS | 0.412 | 0.038 | 0.024 |
| LV | Persons employed, GVA | 1 | No | No | OLS | 0.749 | 0.471 | 0.573 |
| MT | Persons employed, GVA | 2 | Yes | No | OLS | 0.311 | 0.095 | 0.174 |
| NL | Persons employed, GVA | 3 | No | No | OLS | 0.846 | 1.957 | 0.834 |
| PL | Persons employed | 2 | Yes | Yes | OLS | 0.791 | 2.291 | 2.474 |
| PT | Persons employed, GVA | 3 | No | No | OLS | 0.654 | 0.408 | 0.843 |
| RO | Persons employed, GVA | 1 | Yes | No | OLS | 0.902 | 2.262 | 0.579 |
| SE | Persons employed, GVA | 0 | Yes | No | OLS | 0.437 | 0.961 | 0.931 |
| SI | Persons employed | 3 | No | Yes | OLS | 0.759 | 0.086 | 0.045 |
| SK | Persons employed, GVA | 3 | No | Yes | OLS | 0.605 | 0.443 | 0.242 |
| UK | Persons employed, GVA | 3 | No | No | OLS | 0.623 | 4.889 | 5.921 |
| EU28 | Persons employed, GVA | 3 | No | Yes | OLS | 0.790 | 11.536 | 7.794 |
| AU | Persons employed, GVA | 3 | No | Yes | OLS | 0.669 | 2.640 | 1.374 |
| CA | GVA | 3 | No | No | OLS | 0.678 | 3.211 | 2.399 |
| JP | GVA | 3 | No | Yes | OLS | 0.389 | 8.907 | 4.267 |
| KR | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.716 | 8.131 | 9.884 |
| TW | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.171 | 1.494 | 2.033 |
| US | Persons employed, GVA | 3 | No | No | OLS | 0.881 | 18.877 | 10.253 |

Note: NACE sector J61 for CA, JP and US for the predictor Persons employed. NACE sector J61 for JP, KR and US for the predictor GVA.

Table 19 Description of the estimation models for Employment. IC Services (Computer and related activities)

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.886 | 0.730 | 0.728 |
| BE | Persons employed, GVA | 0 | No | No | OLS | 0.862 | 0.832 | 0.839 |
| BG | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.988 | 0.383 | 1.613 |
| CY | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.690 | 0.105 | 0.323 |
| CZ | Persons employed, GVA | 3 | No | Yes | OLS | 0.752 | 1.751 | 0.245 |
| DE | Persons employed, GVA | 3 | No | No | OLS | 0.683 | 8.606 | 3.257 |
| DK | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.633 | 1.251 | 0.739 |
| EE | Persons employed, GVA | 0 | Yes | No | OLS | 0.252 | 1.043 | 1.354 |
| EL | Persons employed | 3 | No | No | OLS | 0.688 | 1.697 | 3.897 |
| ES | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.889 | 2.546 | 8.204 |
| FI | Persons employed, GVA | 0 | No | No | OLS | 0.951 | 0.522 | 0.269 |
| FR | Persons employed, GVA | 2 | No | No | OLS | 0.957 | 3.013 | 2.257 |
| HR | Persons employed, GVA | 2 | Yes | No | OLS | 0.812 | 0.667 | 2.026 |
| HU | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.850 | 1.679 | 2.874 |
| IE | Persons employed, GVA | 1 | No | No | OLS | 0.920 | 1.137 | 0.999 |
| IT | Persons employed, GVA | 3 | No | No | OLS | 0.935 | 3.073 | 2.104 |
| LT | Persons employed, GVA | 2 | Yes | No | OLS | 0.886 | 0.602 | 2.752 |
| LU | Persons employed, GVA | 0 | No | Yes | OLS | 0.875 | 0.113 | 0.018 |
| LV | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.819 | 0.415 | 2.016 |
| MT | Persons employed, GVA | 0 | Yes | No | OLS | 0.795 | 0.119 | 0.137 |
| NL | Persons employed, GVA | 2 | No | No | OLS | 0.884 | 2.242 | 0.935 |
| PL | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.946 | 1.955 | 1.810 |
| PT | Persons employed, GVA | 3 | No | No | OLS | 0.495 | 0.930 | 0.406 |
| RO | Persons employed, GVA | 3 | No | No | OLS | 0.900 | 2.664 | 6.264 |
| SE | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.932 | 1.677 | 1.511 |
| SI | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.602 | 0.231 | 0.142 |
| SK | Persons employed, GVA | 3 | No | No | OLS | 0.852 | 0.780 | 0.587 |
| UK | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.719 | 10.553 | 11.790 |
| EU28 | Persons employed, GVA | 2 | Yes | No | OLS | 0.885 | 22.502 | 21.858 |
| AU | Persons employed, GVA | 0 | Yes | No | OLS | 0.398 | 6.838 | 8.359 |
| CA | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.494 | 5.924 | 9.182 |
| JP | Persons employed, GVA | 2 | Yes | No | OLS | 0.842 | 15.114 | 33.876 |
| KR | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.506 | 8.875 | 1.020 |
| TW | Persons employed, GVA | 0 | No | Yes | OLS | 0.622 | 2.422 | 1.434 |
| US | Persons employed, GVA | 3 | No | Yes | OLS | 0.934 | 25.534 | 13.493 |

Note: Difference of the NACE sectors J- J61 for CA, JP and US for the predictor Persons employed. Difference of the NACE sectors J- J61 for JP, KR and US for the predictor GVA.

Table 20 Description of the estimation models for Employment. Media and Content Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | GVA | 3 | No | Yes | OLS | 0.652 | 0.416 | 0.237 |
| BE | Persons employed, GVA | 3 | No | No | OLS | 0.712 | 0.213 | 0.069 |
| BG | Persons employed, GVA | 3 | No | No | OLS | 0.905 | 0.637 | 0.442 |
| CY | GVA | Step dummy from 2010 | No | No | OLS | 0.292 | 0.159 | 0.134 |
| CZ | Persons employed, GVA | 3 | No | Yes | OLS | 0.885 | 0.601 | 0.072 |
| DE | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.747 | 6.673 | 10.341 |
| DK | Persons employed, GVA | 3 | No | Yes | OLS | 0.746 | 0.624 | 0.663 |
| EE | Persons employed, GVA | 3 | No | No | OLS | 0.519 | 0.840 | 1.337 |
| EL | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.763 | 0.958 | 3.077 |
| ES | Persons employed, GVA | 3 | No | Yes | OLS | 0.766 | 3.725 | 5.264 |
| FI | Persons employed, GVA | 3 | No | Yes | OLS | 0.650 | 0.380 | 0.196 |
| FR | Persons employed | 2 | No | Yes | OLS | 0.814 | 1.824 | 1.355 |
| HR | Persons employed, GVA | 2 | Yes | No | OLS | 0.927 | 0.487 | 1.498 |
| HU | Persons employed, GVA | 3 | No | No | OLS | 0.445 | 1.584 | 2.663 |
| IE | Persons employed, GVA | 1 | Yes | No | OLS | 0.762 | 0.516 | 0.497 |
| IT | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.501 | 2.166 | 1.430 |
| LT | Persons employed, GVA | 3 | No | Yes | OLS | 0.442 | 0.824 | 0.864 |
| LU | Persons employed, GVA | 3 | No | No | OLS | 0.556 | 0.079 | 0.063 |
| LV | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.668 | 0.391 | 0.205 |
| MT | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.413 | 0.052 | 0.080 |
| NL | Persons employed, GVA | 3 | No | No | OLS | 0.546 | 1.198 | 0.578 |
| PL | Persons employed, GVA | 0 | Yes | No | OLS | 0.503 | 3.474 | 3.443 |
| PT | Persons employed, GVA | 3 | No | Yes | OLS | 0.769 | 0.366 | 0.426 |
| RO | Persons employed, GVA | 3 | No | No | OLS | 0.706 | 1.572 | 4.616 |
| SE | Persons employed, GVA | 3 | No | No | OLS | 0.585 | 0.999 | 0.369 |
| SI | Persons employed, GVA | 0 | No | No | OLS | 0.213 | 0.212 | 0.075 |
| SK | Persons employed | 3 | No | No | OLS | 0.607 | 0.461 | 0.508 |
| UK | Persons employed, GVA | 3 | No | Yes | OLS | 0.357 | 6.960 | 7.507 |
| EU28 | Persons employed, GVA | 3 | No | No | OLS | 0.713 | 17.297 | 4.901 |
| AU | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.277 | 5.047 | 1.703 |
| CA | Persons employed, GVA | 3 | No | No | OLS | 0.185 | 4.477 | 5.293 |
| JP | Persons employed, GVA | 0 | No | Yes | OLS | 0.351 | 9.786 | 7.217 |
| KR | Persons employed, GVA | 0 | Yes | No | OLS | 0.340 | 7.304 | 9.548 |
| TW | Persons employed, GVA | 3 | No | Yes | OLS | 0.722 | 1.499 | 1.537 |
| US | Persons employed, GVA | 1 | Yes | No | OLS | 0.877 | 15.252 | 27.374 |

Note: Difference of the NACE sectors J- J61 for CA, JP and US for the predictor Persons employed. Difference of the NACE sectors J- J61 for JP, KR and US for the predictor GVA.

Table 21 Description of the estimation models for Employment. Retail Sale Sector

| Country | National Accounts variables (NACE sectors G, H, I) | Predictors | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 4 | Yes | No | OLS | 0.798 | 0.155 | 0.374 |
| BE | Persons employed, GVA | 4 | Yes | No | OLS | 0.616 | 0.137 | 0.119 |
| BG | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.768 | 0.081 | 0.158 |
| CY | Persons employed, GVA | 4 | No | Yes | OLS | 0.897 | 0.007 | 0.040 |
| CZ | Persons employed, GVA | 4 | Yes | No | OLS | 0.870 | 0.312 | 0.165 |
| DE | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.653 | 5.396 | 3.847 |
| DK | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.655 | 0.249 | 0.581 |
| EE | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.331 | 0.085 | 0.083 |
| EL | Persons employed, GVA | 4 | Yes | No | OLS | 0.943 | 0.058 | 0.440 |
| ES | Persons employed, GVA | Step dummy from 2010 | No | No | AR(1) | 0.384 | 0.789 | 0.484 |
| FI | Persons employed, GVA | 4 | No | Yes | OLS | 0.656 | 0.104 | 0.077 |
| FR | Persons employed, GVA | 4 | Yes | No | OLS | 0.769 | 3.693 | 13.385 |
| HR | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.343 | 0.119 | 0.176 |
| HU | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.709 | 0.329 | 0.708 |
| IE | Persons employed, GVA | 3 | No | Yes | OLS | 0.525 | 0.095 | 0.004 |
| IT | Persons employed, GVA | 4 | No | Yes | OLS | 0.192 | 0.852 | 0.895 |
| LT | Persons employed, GVA | 4 | No | Yes | OLS | 0.855 | 0.122 | 0.367 |
| LU | Persons employed, GVA | 4 | No | Yes | OLS | 0.598 | 0.023 | 0.014 |
| LV | Persons employed, GVA | 4 | No | Yes | OLS | 0.852 | 0.173 | 0.190 |
| MT | Persons employed, GVA | 1 | No | Yes | OLS | 0.596 | 0.045 | 0.051 |
| NL | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.556 | 1.167 | 2.075 |
| PL | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.927 | 1.028 | 6.182 |
| PT | Persons employed, GVA | 4 | No | Yes | OLS | 0.594 | 0.130 | 0.315 |
| RO | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.778 | 0.594 | 1.203 |
| SE | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.847 | 0.198 | 1.019 |
| SI | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.474 | 0.088 | 0.125 |
| SK | Persons employed, GVA | 2 | No | Yes | OLS | 0.485 | 0.271 | 0.209 |
| UK | Persons employed, GVA | 4 | No | Yes | OLS | 0.842 | 5.260 | 5.909 |
| EU28 | Persons employed, GVA | 4 | No | Yes | OLS | 0.498 | 18.110 | 14.149 |
| AU | GVA | 2 | Yes | Yes | OLS | 0.569 | 1.180 | 0.618 |
| CA | Persons employed | Step dummy from 2010 | No | No | OLS | 0.984 | 0.152 | 0.131 |
| JP | <i>Model not estimated because the dependent variable is not available for the Retail sale sector</i> | | | | | | | |
| KR | Persons employed | 3 | No | Yes | OLS | 0.760 | 1.623 | 4.764 |
| TW | Persons employed, GVA | Step dummy from 2010 | No | No | AR(1) | 0.361 | 0.651 | 0.168 |
| US | Persons employed, GVA | 2 | Yes | No | OLS | 0.807 | 8.091 | 14.376 |

Note: NACE sectors G47 for JP and G4791 for CA and US for the predictor Persons employed. NACE sector G47 for JP and US for the predictor GVA.

Table 22 Description of the estimation models for Hours Worked. Total ICT Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|--|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sectors C+J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 2 | Yes | No | OLS | 0.698 | 4.634 | 7.432 |
| BE | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.670 | 3.568 | 4.009 |
| BG | Persons employed, GVA | 3 | No | Yes | OLS | 0.866 | 1.929 | 3.728 |
| CY | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.477 | 0.266 | 0.278 |
| CZ | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.530 | 6.620 | 5.540 |
| DE | GVA | 1 | No | Yes | OLS | 0.307 | 35.044 | 3.082 |
| DK | Persons employed, GVA | 3 | No | Yes | OLS | 0.734 | 2.979 | 1.001 |
| EE | Persons employed, GVA | 0 | Yes | No | OLS | 0.568 | 3.292 | 3.724 |
| EL | Persons employed, GVA | 3 | No | Yes | OLS | 0.901 | 2.064 | 9.680 |
| ES | Persons employed, GVA | 0 | Yes | No | OLS | 0.432 | 15.449 | 28.919 |
| FI | Persons employed, GVA | 3 | No | No | OLS | 0.765 | 4.262 | 1.223 |
| FR | Persons employed, GVA | 2 | No | No | OLS | 0.500 | 22.338 | 13.672 |
| HR | Persons employed | 3 | No | No | OLS | 0.850 | 1.499 | 2.129 |
| HU | Persons employed | 2 | No | Yes | OLS | 0.568 | 14.499 | 6.968 |
| IE | Persons employed, GVA | 3 | No | No | OLS | 0.754 | 7.762 | 1.474 |
| IT | Persons employed, GVA | 3 | No | No | OLS | 0.526 | 21.289 | 18.928 |
| LT | Persons employed | 2 | Yes | No | OLS | 0.407 | 2.957 | 2.546 |
| LU | Persons employed, GVA | 1 | No | Yes | OLS | 0.745 | 0.315 | 0.082 |
| LV | Persons employed, GVA | 3 | No | Yes | OLS | 0.877 | 1.328 | 2.257 |
| MT | Persons employed, GVA | 1 | Yes | No | OLS | 0.750 | 0.685 | 1.522 |
| NL | Persons employed, GVA | 1 | No | Yes | OLS | 0.863 | 6.812 | 3.357 |
| PL | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.326 | 21.655 | 4.491 |
| PT | GVA | 2 | Yes | Yes | OLS | 0.534 | 2.082 | 3.351 |
| RO | Persons employed, GVA | 3 | No | Yes | OLS | 0.654 | 16.317 | 25.606 |
| SE | Persons employed, GVA | 3 | No | Yes | OLS | 0.885 | 5.710 | 6.029 |
| SI | Persons employed, GVA | 3 | No | No | OLS | 0.151 | 1.102 | 0.962 |
| SK | Persons employed, GVA | 3 | No | No | OLS | 0.513 | 3.490 | 2.449 |
| UK | Persons employed | 2 | Yes | Yes | OLS | 0.437 | 43.068 | 59.445 |
| EU28 | Persons employed, GVA | 3 | No | No | OLS | 0.717 | 102.599 | 20.745 |
| AU | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.356 | 18.111 | 14.214 |
| CA | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.398 | 17.576 | 17.185 |
| JP | Persons employed | 3 | No | No | OLS | 0.805 | 72.803 | 26.373 |
| KR | Persons employed, GVA | 3 | No | No | OLS | 0.731 | 79.222 | 285.722 |
| TW | Persons employed, GVA | 3 | No | No | OLS | 0.709 | 58.455 | 35.640 |
| US | Persons employed, GVA | 0 | No | Yes | OLS | 0.963 | 80.756 | 2.600 |

Note: NACE sectors C26+J for CA, JP and US for the predictor of Persons employed.

Table 23 Description of the estimation models for Hours Worked. ICT Manufacturing

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | National Accounts variables (NACE sector C) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 2 | No | Yes | OLS | 0.888 | 1.345 | 0.213 |
| BE | Persons employed, GVA | 3 | No | No | OLS | 0.753 | 0.947 | 0.440 |
| BG | Persons employed, GVA | 3 | No | No | OLS | 0.838 | 0.621 | 0.132 |
| CY | Persons employed | 3 | No | No | OLS | 0.984 | 0.008 | 0.005 |
| CZ | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.748 | 2.375 | 0.757 |
| DE | Persons employed, GVA | 3 | No | Yes | OLS | 0.907 | 5.070 | 0.705 |
| DK | Persons employed, GVA | 3 | No | Yes | OLS | 0.742 | 0.605 | 0.220 |
| EE | Persons employed, GVA | 3 | No | Yes | OLS | 0.731 | 1.222 | 1.282 |
| EL | Persons employed, GVA | Step dummy from 2010 | No | Yes | AR(1) | 0.398 | 1.109 | 0.138 |
| ES | Persons employed, GVA | 3 | No | No | OLS | 0.779 | 3.235 | 1.517 |
| FI | Persons employed, GVA | 3 | No | Yes | OLS | 0.661 | 2.515 | 1.797 |
| FR | Persons employed, GVA | 2 | No | No | OLS | 0.654 | 3.480 | 0.953 |
| HR | Persons employed | Step dummy from 2010 | No | No | OLS | 0.958 | 0.585 | 0.374 |
| HU | Persons employed, GVA | 3 | No | Yes | OLS | 0.628 | 14.036 | 6.767 |
| IE | Persons employed, GVA | 2 | No | No | OLS | 0.630 | 4.149 | 1.726 |
| IT | Persons employed, GVA | 0 | Yes | No | OLS | 0.269 | 4.153 | 4.652 |
| LT | Persons employed, GVA | 3 | No | No | OLS | 0.821 | 0.871 | 0.775 |
| LU | Persons employed | 3 | No | No | OLS | 0.235 | 0.082 | 0.007 |
| LV | Persons employed, GVA | 3 | No | No | OLS | 0.902 | 0.297 | 0.291 |
| MT | Persons employed, GVA | 3 | No | No | OLS | 0.792 | 0.240 | 0.132 |
| NL | Persons employed | 3 | No | No | OLS | 0.708 | 1.115 | 0.250 |
| PL | Persons employed, GVA | 3 | No | No | OLS | 0.635 | 5.005 | 6.519 |
| PT | Persons employed, GVA | 3 | No | Yes | OLS | 0.757 | 0.539 | 0.040 |
| RO | Persons employed, GVA | 1 | No | Yes | OLS | 0.604 | 10.138 | 11.023 |
| SE | Persons employed, GVA | 3 | No | Yes | OLS | 0.917 | 2.253 | 12.371 |
| SI | Persons employed, GVA | 3 | No | No | OLS | 0.831 | 0.234 | 0.111 |
| SK | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.450 | 1.885 | 0.325 |
| UK | Persons employed, GVA | 3 | No | No | OLS | 0.465 | 9.107 | 9.485 |
| EU28 | Persons employed, GVA | 3 | No | Yes | OLS | 0.864 | 27.581 | 30.842 |
| AU | GVA | 3 | No | No | OLS | 0.493 | 3.832 | 0.766 |
| CA | GVA | Step dummy from 2010 | Yes | Yes | OLS | 0.364 | 6.278 | 5.629 |
| JP | Persons employed, GVA | 2 | No | No | OLS | 0.921 | 34.441 | 16.100 |
| KR | Persons employed, GVA | 3 | No | No | OLS | 0.685 | 37.326 | 107.897 |
| TW | Persons employed, GVA | 3 | No | Yes | OLS | 0.841 | 42.297 | 37.332 |
| US | Persons employed, GVA | 0 | No | Yes | OLS | 0.935 | 30.418 | 13.510 |

Note: NACE sector C26 for CA, JP and US for the predictor of Persons employed.

Table 24 Description of the estimation models for Hours Worked. ICT Services

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 1 | Yes | No | OLS | 0.847 | 2.442 | 5.022 |
| BE | Persons employed, GVA | 3 | No | Yes | OLS | 0.964 | 0.988 | 0.377 |
| BG | Persons employed, GVA | 0 | Yes | No | OLS | 0.401 | 4.058 | 0.336 |
| CY | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.232 | 0.290 | 0.204 |
| CZ | Persons employed, GVA | 2 | No | Yes | OLS | 0.820 | 3.152 | 3.507 |
| DE | Persons employed, GVA | 2 | No | Yes | OLS | 0.731 | 16.821 | 18.964 |
| DK | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.794 | 2.274 | 2.684 |
| EE | Persons employed, GVA | 0 | Yes | No | OLS | 0.753 | 1.864 | 3.926 |
| EL | Persons employed, GVA | 3 | No | Yes | OLS | 0.823 | 2.665 | 8.149 |
| ES | Persons employed, GVA | 0 | Yes | No | OLS | 0.811 | 7.302 | 17.798 |
| FI | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.938 | 1.405 | 2.315 |
| FR | Persons employed, GVA | 0 | No | Yes | OLS | 0.809 | 12.150 | 9.464 |
| HR | Persons employed | 3 | No | No | OLS | 0.812 | 1.949 | 3.196 |
| HU | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.627 | 6.550 | 4.443 |
| IE | Persons employed, GVA | 2 | No | No | OLS | 0.971 | 1.977 | 3.130 |
| IT | Persons employed, GVA | 2 | No | No | OLS | 0.934 | 7.512 | 1.910 |
| LT | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.646 | 2.741 | 0.198 |
| LU | Persons employed, GVA | 1 | No | Yes | OLS | 0.929 | 0.156 | 0.019 |
| LV | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.956 | 0.735 | 1.671 |
| MT | Persons employed, GVA | 3 | No | Yes | OLS | 0.907 | 0.388 | 1.528 |
| NL | Persons employed, GVA | 2 | No | Yes | OLS | 0.959 | 3.458 | 1.903 |
| PL | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.985 | 3.149 | 3.321 |
| PT | Persons employed, GVA | 3 | No | No | OLS | 0.651 | 1.911 | 2.116 |
| RO | Persons employed | 2 | Yes | Yes | OLS | 0.891 | 6.467 | 11.972 |
| SE | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.859 | 4.679 | 14.825 |
| SI | Persons employed, GVA | 1 | Yes | No | OLS | 0.709 | 0.473 | 0.610 |
| SK | Persons employed, GVA | 3 | No | No | OLS | 0.819 | 1.554 | 2.136 |
| UK | Persons employed, GVA | 0 | Yes | No | OLS | 0.772 | 24.918 | 29.115 |
| EU28 | Persons employed, GVA | 3 | No | No | OLS | 0.904 | 42.699 | 22.469 |
| AU | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.734 | 10.967 | 10.497 |
| CA | Persons employed, GVA | 4 | No | No | OLS | 0.373 | 15.911 | 16.516 |
| JP | Persons employed, GVA | 3 | No | No | OLS | 0.788 | 42.493 | 53.700 |
| KR | Persons employed | 0 | Yes | Yes | OLS | 0.729 | 51.465 | 200.706 |
| TW | Persons employed, GVA | 2 | No | No | OLS | 0.540 | 4.844 | 1.089 |
| US | Persons employed, GVA | 2 | No | Yes | OLS | 0.966 | 58.882 | 26.905 |

Table 25 Description of the estimation models for Hours Worked. IT Services (Telecommunications)

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 3 | No | No | OLS | 0.393 | 1.351 | 0.499 |
| BE | Persons employed, GVA | 1 | No | No | OLS | 0.577 | 1.272 | 1.402 |
| BG | Persons employed, GVA | 3 | No | Yes | OLS | 0.358 | 1.399 | 1.964 |
| CY | Persons employed, GVA | 3 | No | Yes | OLS | 0.614 | 0.140 | 0.200 |
| CZ | Persons employed, GVA | 3 | No | No | OLS | 0.629 | 1.751 | 0.195 |
| DE | Persons employed | 3 | No | Yes | OLS | 0.691 | 7.833 | 5.967 |
| DK | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.629 | 1.128 | 0.166 |
| EE | Persons employed, GVA | 2 | Yes | No | OLS | 0.652 | 1.380 | 1.185 |
| EL | Persons employed, GVA | 3 | No | Yes | OLS | 0.704 | 1.883 | 1.310 |
| ES | Persons employed, GVA | 1 | No | Yes | OLS | 0.484 | 4.551 | 3.061 |
| FI | Persons employed, GVA | 2 | No | No | OLS | 0.696 | 0.814 | 0.449 |
| FR | Persons employed, GVA | 3 | No | No | OLS | 0.607 | 3.208 | 6.366 |
| HR | Persons employed | 3 | No | No | OLS | 0.963 | 0.670 | 3.479 |
| HU | Persons employed, GVA | 3 | No | Yes | OLS | 0.534 | 2.648 | 1.093 |
| IE | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.865 | 1.392 | 0.374 |
| IT | Persons employed, GVA | 1 | Yes | No | OLS | 0.565 | 4.947 | 6.484 |
| LT | Persons employed | 3 | No | No | OLS | 0.540 | 1.477 | 2.478 |
| LU | Persons employed, GVA | 3 | No | Yes | OLS | 0.475 | 0.068 | 0.026 |
| LV | Persons employed, GVA | 2 | Yes | No | OLS | 0.887 | 0.541 | 1.273 |
| MT | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.466 | 0.304 | 0.164 |
| NL | Persons employed, GVA | 1 | No | No | OLS | 0.836 | 2.939 | 1.650 |
| PL | Persons employed, GVA | 3 | No | Yes | OLS | 0.879 | 3.875 | 3.320 |
| PT | Persons employed, GVA | 3 | No | No | OLS | 0.710 | 0.701 | 1.888 |
| RO | Persons employed, GVA | 1 | Yes | No | OLS | 0.904 | 4.474 | 3.079 |
| SE | Persons employed, GVA | 2 | No | No | OLS | 0.617 | 1.290 | 0.571 |
| SI | Persons employed, GVA | 3 | No | No | OLS | 0.571 | 0.191 | 0.045 |
| SK | Persons employed, GVA | 2 | No | Yes | OLS | 0.654 | 0.746 | 0.234 |
| UK | Persons employed, GVA | 1 | No | No | OLS | 0.205 | 14.445 | 4.383 |
| EU28 | Persons employed, GVA | 0 | Yes | No | OLS | 0.867 | 16.062 | 36.942 |
| AU | Persons employed, GVA | 1 | No | No | OLS | 0.553 | 6.050 | 1.762 |
| CA | Persons employed, GVA | 3 | No | No | OLS | 0.434 | 6.507 | 4.028 |
| JP | Persons employed, GVA | 0 | Year | Yes | OLS | 0.628 | 12.284 | 13.607 |
| KR | Persons employed, GVA | 3 | No | Yes | OLS | 0.471 | 31.347 | 60.963 |
| TW | Persons employed, GVA | 3 | No | No | OLS | 0.435 | 2.820 | 2.931 |
| US | Persons employed, GVA | 2 | No | No | OLS | 0.874 | 36.849 | 24.981 |

Note: NACE sector J61 for CA, JP and US for the predictor Persons employed. NACE sector J61 for JP, KR and US for the predictor GVA.

Table 26 Description of the estimation models for Hours Worked. IC Services (Computer and related activities)

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 0 | Yes | No | OLS | 0.837 | 2.223 | 5.792 |
| BE | Persons employed, GVA | 0 | No | Yes | OLS | 0.813 | 1.744 | 1.874 |
| BG | GVA | 3 | No | Yes | OLS | 0.975 | 0.906 | 3.366 |
| CY | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.552 | 0.217 | 0.519 |
| CZ | Persons employed, GVA | 3 | No | No | OLS | 0.761 | 3.213 | 3.060 |
| DE | Persons employed, GVA | 3 | No | Yes | OLS | 0.741 | 12.246 | 6.090 |
| DK | Persons employed, GVA | 3 | No | No | OLS | 0.734 | 2.026 | 1.098 |
| EE | Persons employed, GVA | 0 | Yes | No | OLS | 0.298 | 2.082 | 2.737 |
| EL | Persons employed, GVA | 3 | No | No | OLS | 0.683 | 2.561 | 6.732 |
| ES | Persons employed, GVA | 0 | Yes | No | OLS | 0.805 | 6.446 | 16.695 |
| FI | Persons employed, GVA | 0 | No | Yes | OLS | 0.923 | 1.287 | 1.849 |
| FR | Persons employed, GVA | 0 | No | Yes | OLS | 0.840 | 10.338 | 3.380 |
| HR | Persons employed | 0 | Yes | Yes | OLS | 0.945 | 0.991 | 7.894 |
| HU | Persons employed | 0 | Yes | No | OLS | 0.436 | 6.773 | 7.482 |
| IE | Persons employed, GVA | 2 | No | No | OLS | 0.895 | 2.835 | 2.242 |
| IT | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.926 | 6.504 | 3.999 |
| LT | Persons employed, GVA | 1 | Yes | No | OLS | 0.728 | 2.310 | 3.772 |
| LU | Persons employed, GVA | 0 | No | Yes | OLS | 0.909 | 0.173 | 0.026 |
| LV | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.940 | 0.571 | 3.032 |
| MT | GVA | 1 | Yes | Yes | OLS | 0.795 | 0.451 | 1.558 |
| NL | Persons employed, GVA | 0 | No | No | OLS | 0.806 | 5.042 | 0.532 |
| PL | Persons employed | 0 | Yes | Yes | OLS | 0.732 | 10.054 | 2.448 |
| PT | Persons employed, GVA | 3 | No | No | OLS | 0.379 | 2.232 | 1.221 |
| RO | Persons employed, GVA | 3 | No | No | OLS | 0.897 | 5.146 | 12.922 |
| SE | Persons employed, GVA | 3 | No | Yes | OLS | 0.845 | 4.500 | 13.699 |
| SI | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.538 | 0.479 | 0.527 |
| SK | Persons employed, GVA | 3 | No | Yes | OLS | 0.719 | 1.830 | 2.058 |
| UK | Persons employed, GVA | 0 | Yes | No | OLS | 0.737 | 23.743 | 34.160 |
| EU28 | Persons employed, GVA | 2 | Yes | No | OLS | 0.811 | 46.156 | 54.800 |
| AU | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.557 | 12.219 | 13.479 |
| CA | Persons employed, GVA | 3 | No | Yes | OLS | 0.415 | 13.144 | 15.393 |
| JP | Persons employed, GVA | 3 | No | No | OLS | 0.811 | 34.464 | 38.388 |
| KR | Persons employed | 0 | Yes | No | OLS | 0.740 | 33.963 | 142.461 |
| TW | Persons employed, GVA | 0 | No | Yes | OLS | 0.621 | 4.945 | 3.496 |
| US | Persons employed, GVA | 1 | No | No | OLS | 0.941 | 55.818 | 12.489 |

Note: Difference of the NACE sectors J- J61 for CA, JP and US for the predictor Persons employed. Difference of the NACE sectors J- J61 for JP, KR and US for the predictor GVA.

Table 27 Description of the estimation models for Hours Worked. Media and Content Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 2 | No | No | OLS | 0.637 | 1.088 | 0.408 |
| BE | Persons employed, GVA | 3 | No | Yes | OLS | 0.468 | 0.421 | 0.020 |
| BG | Persons employed, GVA | 2 | No | No | OLS | 0.865 | 1.349 | 0.924 |
| CY | GVA | Step dummy from 2010 | No | Yes | OLS | 0.414 | 0.262 | 0.097 |
| CZ | Persons employed, GVA | 3 | No | Yes | OLS | 0.869 | 1.240 | 0.461 |
| DE | Persons employed, GVA | 2 | No | Yes | OLS | 0.913 | 5.895 | 5.174 |
| DK | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.438 | 1.072 | 0.063 |
| EE | Persons employed, GVA | 2 | No | Yes | OLS | 0.349 | 1.796 | 1.526 |
| EL | Persons employed, GVA | 3 | No | No | OLS | 0.680 | 2.721 | 6.978 |
| ES | Persons employed, GVA | 3 | No | Yes | OLS | 0.776 | 5.778 | 6.049 |
| FI | Persons employed, GVA | 2 | No | Yes | OLS | 0.523 | 0.526 | 0.209 |
| FR | Persons employed, GVA | 3 | No | No | OLS | 0.826 | 2.906 | 0.089 |
| HR | Persons employed | 1 | Yes | No | OLS | 0.665 | 2.649 | 5.013 |
| HU | Persons employed, GVA | 1 | No | No | OLS | 0.270 | 2.994 | 2.116 |
| IE | Persons employed, GVA | 3 | No | No | OLS | 0.798 | 0.844 | 0.644 |
| IT | Persons employed, GVA | 3 | No | Yes | OLS | 0.585 | 3.561 | 4.239 |
| LT | GVA | 2 | No | No | OLS | 0.414 | 2.036 | 0.235 |
| LU | Persons employed, GVA | 3 | No | Yes | OLS | 0.799 | 0.106 | 0.029 |
| LV | Persons employed, GVA | 0 | No | No | OLS | 0.152 | 1.773 | 0.269 |
| MT | Persons employed, GVA | 3 | No | Yes | OLS | 0.775 | 0.123 | 0.534 |
| NL | Persons employed, GVA | 3 | No | No | OLS | 0.723 | 1.549 | 0.989 |
| PL | Persons employed, GVA | 0 | Yes | No | OLS | 0.794 | 4.991 | 6.820 |
| PT | Persons employed, GVA | 2 | No | Yes | OLS | 0.796 | 0.664 | 0.959 |
| RO | Persons employed, GVA | 3 | No | No | OLS | 0.587 | 3.635 | 8.525 |
| SE | Persons employed, GVA | 2 | Yes | No | OLS | 0.604 | 1.285 | 1.532 |
| SI | Persons employed, GVA | 3 | No | Yes | OLS | 0.655 | 0.227 | 0.033 |
| SK | GVA | 3 | No | Yes | OLS | 0.579 | 0.824 | 1.082 |
| UK | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.366 | 14.778 | 8.441 |
| EU28 | Persons employed, GVA | 3 | No | No | OLS | 0.544 | 35.826 | 28.193 |
| AU | Persons employed, GVA | 1 | No | Yes | OLS | 0.369 | 10.474 | 1.596 |
| CA | Persons employed, GVA | 3 | No | No | OLS | 0.193 | 8.600 | 12.761 |
| JP | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.379 | 20.588 | 4.201 |
| KR | GVA | 1 | No | Yes | OLS | 0.119 | 32.246 | 31.178 |
| TW | Persons employed, GVA | 3 | No | No | OLS | 0.591 | 3.522 | 3.709 |
| US | Persons employed, GVA | 0 | No | No | OLS | 0.688 | 59.120 | 24.040 |

Note: Difference of the NACE sectors J- J61 for CA, JP and US for the predictor Persons employed. Difference of the NACE sectors J- J61 for JP, KR and US for the predictor GVA.

Table 28 Description of the estimation models for Hours Worked. Retail Sale Sector

| Country | National Accounts variables (NACE sectors G, H, I) | Predictors | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.642 | 0.403 | 0.952 |
| BE | Persons employed, GVA | 1 | No | Yes | OLS | 0.238 | 0.292 | 0.258 |
| BG | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.749 | 0.147 | 0.270 |
| CY | Persons employed, GVA | 3 | No | Yes | OLS | 0.848 | 0.016 | 0.073 |
| CZ | Persons employed, GVA | 2 | No | No | OLS | 0.785 | 0.830 | 0.538 |
| DE | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.639 | 7.405 | 5.331 |
| DK | Persons employed, GVA | 3 | No | Yes | OLS | 0.692 | 0.261 | 0.692 |
| EE | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.290 | 0.180 | 0.259 |
| EL | Persons employed, GVA | 3 | No | Yes | OLS | 0.912 | 0.158 | 0.813 |
| ES | Persons employed, GVA | Step dummy from 2010 | No | No | AR(1) | 0.221 | 1.529 | 1.108 |
| FI | Persons employed, GVA | 2 | No | Yes | OLS | 0.504 | 0.193 | 0.109 |
| FR | Persons employed, GVA | 1 | Yes | No | OLS | 0.699 | 6.794 | 21.664 |
| HR | GVA | 3 | No | No | OLS | 0.405 | 0.270 | 0.405 |
| HU | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.708 | 0.557 | 1.553 |
| IE | Persons employed, GVA | 3 | No | Yes | OLS | 0.513 | 0.162 | 0.018 |
| IT | Persons employed, GVA | 3 | No | Yes | OLS | 0.518 | 1.281 | 1.247 |
| LT | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.787 | 0.284 | 0.949 |
| LU | Persons employed, GVA | Step dummy from 2010 | No | Yes | AR(1) | 0.372 | 0.068 | 0.012 |
| LV | Persons employed, GVA | 3 | No | No | OLS | 0.717 | 0.521 | 0.623 |
| MT | Persons employed, GVA | 3 | No | Yes | OLS | 0.831 | 0.068 | 0.091 |
| NL | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.607 | 1.908 | 3.132 |
| PL | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.833 | 3.205 | 13.230 |
| PT | Persons employed | 0 | Yes | Yes | OLS | 0.152 | 0.416 | 0.842 |
| RO | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.860 | 0.936 | 1.776 |
| SE | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.838 | 0.437 | 2.345 |
| SI | Persons employed, GVA | 2 | Yes | No | OLS | 0.223 | 0.170 | 0.190 |
| SK | Persons employed, GVA | 2 | No | Yes | OLS | 0.514 | 0.475 | 0.430 |
| UK | Persons employed, GVA | 3 | No | Yes | OLS | 0.754 | 10.587 | 1.311 |
| EU28 | Persons employed, GVA | 3 | No | Yes | OLS | 0.573 | 26.322 | 8.105 |
| AU | GVA | 2 | Yes | Yes | OLS | 0.541 | 1.866 | 1.324 |
| CA | Persons employed | Step dummy from 2010 | No | No | OLS | 0.983 | 0.236 | 0.235 |
| JP | <i>Model not estimated because the dependent variable is not available for the Retail sale sector</i> | | | | | | | |
| KR | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.631 | 5.355 | 10.019 |
| TW | Persons employed, GVA | Step dummy from 2010 | No | No | AR(1) | 0.410 | 1.374 | 0.361 |
| US | Persons employed, GVA | 0 | Yes | No | OLS | 0.738 | 12.622 | 1.437 |

Note: NACE sectors G47 for JP and G4791 for CA and US for the predictor Persons employed. NACE sector G47 for JP and US for the predictor GVA.

Table 29 Description of the estimation models for BERD. Total ICT Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|--|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | National Accounts variables (NACE sectors C+J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA; GFCF Int. Prop. (Total) | 2 | No | Yes | OLS | 0.693 | 68.338 | 11.072 |
| BE | GVA | 3 | No | No | OLS | 0.732 | 37.611 | 2.490 |
| BG | Persons employed, GVA; GFCF Int. Prop. (Total) | 0 | Yes | Yes | OLS | 0.677 | 3.377 | 14.281 |
| CY | Persons employed, GVA | 0 | Yes | No | OLS | 0.261 | 0.901 | 1.795 |
| CZ | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.528 | 13.493 | 32.695 |
| DE | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.377 | 300.845 | 39.335 |
| DK | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.177 | 67.745 | 62.295 |
| EE | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.682 | 3.948 | 6.068 |
| EL | Persons employed, GVA; GFCF Int. Prop. (Total) | 2 | No | Yes | OLS | 0.701 | 17.947 | 7.115 |
| ES | GVA; GFCF Int. Prop. (Total) | 2 | Yes | No | OLS | 0.695 | 45.702 | 55.635 |
| FI | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.955 | 51.300 | 180.985 |
| FR | Persons employed, GVA; GFCF Int. Prop. (Total) | 1 | Yes | Yes | OLS | 0.407 | 222.984 | 148.377 |
| HR | Persons employed, GVA | 3 | No | No | OLS | 0.396 | 4.598 | 4.086 |
| HU | Persons employed, GVA | 3 | No | Yes | OLS | 0.945 | 8.091 | 73.107 |
| IE | Persons employed, GVA | 3 | No | No | OLS | 0.501 | 35.288 | 71.968 |
| IT | Persons employed, GVA; GFCF Int. Prop. (Total) | 2 | Yes | No | OLS | 0.443 | 109.316 | 174.172 |
| LT | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.732 | 3.765 | 3.024 |
| LU | Persons employed, GVA; GFCF Int. Prop. (Total) | 1 | Yes | No | OLS | 0.413 | 5.183 | 5.576 |
| LV | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.790 | 0.693 | 0.590 |
| MT | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.764 | 0.813 | 0.613 |
| NL | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.899 | 56.987 | 16.612 |
| PL | GVA; GFCF Int. Prop. (Total) | 1 | Yes | Yes | OLS | 0.897 | 10.649 | 24.364 |
| PT | Persons employed, GVA; GFCF Int. Prop. (Total) | Step dummy from 2010 | No | Yes | OLS | 0.707 | 22.725 | 57.205 |
| RO | Persons employed, GVA | 1 | Yes | Yes | OLS | 0.495 | 9.862 | 8.210 |
| SE | Persons employed, GVA; GFCF Int. Prop. (Total) | 2 | Yes | No | OLS | 0.687 | 126.955 | 154.357 |
| SI | Persons employed, GVA; GFCF Int. Prop. (Total) | 1 | Yes | No | OLS | 0.540 | 4.413 | 6.503 |
| SK | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.902 | 2.279 | 4.272 |
| UK | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.694 | 246.135 | 167.634 |
| EU28 | GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.659 | 604.055 | 259.037 |
| AU | Persons employed, GVA | 3 | No | Yes | OLS | 0.417 | 119.085 | 151.042 |
| CA | Persons employed, GVA | 2 | No | Yes | OLS | 0.796 | 172.578 | 90.736 |
| JP | Persons employed, GVA | 3 | No | No | OLS | 0.698 | 2,139.228 | 1,057.974 |
| KR | GVA | 2 | Yes | No | OLS | 0.817 | 544.088 | 1,160.596 |
| TW | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.914 | 128.259 | 333.034 |
| US | Persons employed, GVA | 3 | No | No | OLS | 0.848 | 3,269.678 | 2,461.596 |

Note: NACE sectors C26+J for CA, JP and US for the predictor of Persons employed.

Table 30 Description of the estimation models for BERD. ICT Manufacturing

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | National Accounts variables (NACE sector C) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| EU28 | Persons employed, GVA; GFCF Int. Prop. (Total) | Step dummy from 2010 | No | Yes | OLS | 0.781 | 326.758 | 100.734 |
| AU | Persons employed, GVA | 2 | Yes | No | OLS | 0.579 | 21.055 | 51.362 |
| CA | GVA | 0 | Yes | Yes | OLS | 0.278 | 353.634 | 186.487 |
| JP | Persons employed, GVA | 2 | No | Yes | OLS | 0.740 | 1,683.190 | 440.981 |
| KR | GVA | 2 | Yes | Yes | OLS | 0.847 | 443.854 | 1,053.576 |
| TW | Persons employed, GVA | 2 | Yes | Yes | OLS | 0.899 | 130.266 | 329.778 |
| US | Persons employed, GVA | 0 | Yes | No | OLS | 0.564 | 4,590.368 | 611.139 |

Note: NACE sector C26 for CA, JP and US for the predictor of Persons employed.

Table 31 Description of the estimation models for BERD. ICT Services

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| EU28 | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.635 | 293.362 | 148.991 |
| AU | Persons employed, GVA | 3 | No | Yes | OLS | 0.295 | 111.412 | 149.113 |
| CA | Persons employed, GVA | Step dummy from 2010 | No | Yes | OLS | 0.378 | 130.072 | 79.386 |
| JP | GVA | 2 | Yes | No | OLS | 0.830 | 377.735 | 948.388 |
| KR | Persons employed, GVA | 0 | Yes | No | OLS | 0.107 | 120.500 | 44.146 |
| TW | Persons employed, GVA | 0 | Yes | No | OLS | 0.733 | 15.576 | 4.057 |
| US | GVA | 2 | Yes | Yes | OLS | 0.610 | 1,935.871 | 1,175.972 |

Table 32 Description of the estimation models for BERD. IT Services (Telecommunications)

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|------------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| EU28 | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.765 | 212.262 | 97.237 |
| AU | Persons employed, GVA | 1 | No | No | OLS | 0.308 | 66.415 | 20.644 |
| CA | Persons employed, GVA | 2 | No | Yes | OLS | 0.373 | 51.234 | 26.108 |
| JP | Persons employed, GVA | 3 | No | Yes | OLS | 0.828 | 342.220 | 405.552 |
| KR | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.277 | 38.688 | 24.217 |
| TW | Persons employed, GVA | 2 | No | No | OLS | 0.775 | 5.009 | 7.561 |
| US | Persons employed, GVA | 3 | No | No | OLS | 0.659 | 341.271 | 291.218 |

Note: NACE sector J61 for CA, JP and US for the predictor Persons employed. NACE sector J61 for JP, KR and US for the predictor GVA.

Table 33 Description of the estimation models for BERD. IC Services (Computer and related activities)

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| EU28 | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.782 | 174.768 | 132.233 |
| AU | Persons employed, GVA | 1 | Yes | No | OLS | 0.689 | 63.169 | 74.819 |
| CA | Persons employed, GVA | 0 | No | No | OLS | 0.159 | 113.262 | 26.925 |
| JP | Persons employed, GVA | 3 | No | Yes | OLS | 0.434 | 306.294 | 530.110 |
| KR | GVA | 3 | No | Yes | OLS | 0.642 | 75.774 | 58.849 |
| TW | Persons employed, GVA | 3 | No | No | OLS | 0.798 | 9.708 | 6.000 |
| US | Persons employed, GVA | 0 | Yes | No | OLS | 0.436 | 2,271.379 | 871.743 |

Note: Difference of the NACE sectors J- J61 for CA, JP and US for the predictor Persons employed. Difference of the NACE sectors J- J61 for JP, KR and US for the predictor GVA.

Table 34 Description of the estimation models for BERD. Media and Content Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|--------------------|-------------------|---|--|---|
| | National Accounts variables (NACE sector J) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.630 | 0.715 | 0.868 |
| BE | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.704 | 2.256 | 8.710 |
| BG | Persons employed, GVA; GFCF Int. Prop. (Total) | 2 | Yes | No | OLS | 0.984 | 0.046 | 0.771 |
| CY | <i>Model not estimated because the dependent variable is equal to zero the whole period</i> | | | | | | | |
| CZ | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.834 | 0.077 | 0.081 |
| DE | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.771 | 4.483 | 1.175 |
| DK | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.877 | 1.828 | 3.072 |
| EE | Persons employed, GVA; GFCF Int. Prop. (Total) | 0 | No | Yes: trend, trend2 | OLS | 0.204 | 0.132 | 0.305 |
| EL | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.835 | 0.621 | 0.224 |
| ES | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.778 | 10.769 | 2.918 |
| FI | Persons employed, GVA; GFCF Int. Prop. (Total) | Step dummy from 2010 | No | No | OLS | 0.278 | 5.095 | 2.509 |
| FR | Persons employed, GVA; GFCF Int. Prop. (Total) | 2 | No | No | OLS | 0.770 | 8.233 | 0.835 |
| HR | <i>Model not estimated because the dependent variable is equal to zero the whole period</i> | | | | | | | |
| HU | Persons employed | 2 | Yes | Yes | OLS | 0.631 | 0.296 | 0.270 |
| IE | Persons employed, GVA | 3 | No | No | OLS | 0.692 | 0.429 | 0.910 |
| IT | Persons employed, GVA; GFCF Int. Prop. (Total) | 2 | No | No | OLS | 0.890 | 4.289 | 2.717 |
| LT | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.997 | 0.015 | 0.673 |
| LU | <i>Model not estimated because the dependent variable is equal to zero the whole period</i> | | | | | | | |
| LV | GVA; GFCF Int. Prop. (Total) | 2 | Yes | No | OLS | 0.939 | 0.025 | 0.113 |
| MT | Persons employed, GVA; GFCF Int. Prop. (Total) | 0 | Yes | No | OLS | 0.649 | 0.015 | 0.018 |
| NL | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.561 | 5.896 | 2.634 |
| PL | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.729 | 1.133 | 1.731 |
| PT | Persons employed, GVA; GFCF Int. Prop. (Total) | 2 | No | No | OLS | 0.455 | 1.353 | 2.923 |
| RO | Persons employed, GVA | 2 | No | No | OLS | 0.642 | 0.006 | 0.005 |
| SE | Persons employed, GVA; GFCF Int. Prop. (Total) | 0 | No | Yes: trend, trend2 | OLS | 0.218 | 14.090 | 16.887 |
| SI | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.989 | 0.341 | 0.254 |
| SK | <i>Model not estimated because the dependent variable is equal to zero the whole period</i> | | | | | | | |
| UK | Persons employed, GVA; GFCF Int. Prop. (Total) | 0 | No | Yes: trend, trend2 | OLS | 0.684 | 29.883 | 35.689 |
| EU28 | Persons employed, GVA; GFCF Int. Prop. (Total) | Step dummy from 2010 | No | Yes | OLS | 0.604 | 51.908 | 87.969 |
| AU | Persons employed, GVA | 2 | Yes | No | OLS | 0.620 | 12.411 | 16.191 |
| CA | Persons employed | 2 | No | No | OLS | 0.788 | 10.875 | 5.071 |
| JP | Persons employed, GVA | 3 | No | Yes | OLS | 0.594 | 33.597 | 50.428 |
| KR | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.154 | 9.253 | 9.340 |
| TW | Persons employed, GVA | 1 | Yes | No | OLS | 0.314 | 0.937 | 1.531 |
| US | Persons employed, GVA | 0 | Yes | Yes | OLS | 0.907 | 584.577 | 1,512.794 |

Note: Difference of the NACE sectors J- J61 for CA, JP and US for the predictor Persons employed. Difference of the NACE sectors J- J61 for JP, KR and US for the predictor GVA.

Table 35 Description of the estimation models for BERD. Retail Sale Sector

| Country | Predictors | | | | Estimation method | Adjusted R ² for the model of the whole period | RMSE ₉₅₁₅ (Estimation for the whole period) | RMSE ₁₄₁₅ (Out of sample prediction) |
|-------------|---|---------------------------------|----------------------------------|-----------|-------------------|---|--|---|
| | National Accounts variables (NACE sector G, H, I) | Dummies for the years 1995-2013 | Dummies for the years 2014, 2015 | Trend | | | | |
| AT | Persons employed; GFCF Int. Prop. (Total) | 2 | Yes | No | OLS | 0.966 | 11.573 | 92.068 |
| BE | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.806 | 24.033 | 44.291 |
| BG | GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.995 | 0.040 | 0.873 |
| CY | GVA | 4 | Yes | No | OLS | 0.975 | 0.005 | 0.036 |
| CZ | Persons employed; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.837 | 2.262 | 5.905 |
| DE | GVA; GFCF Int. Prop. (Total) | 0 | Yes | No | OLS | 0.847 | 14.328 | 34.909 |
| DK | GVA; GFCF Int. Prop. (Total) | 4 | Yes | No | OLS | 0.977 | 5.279 | 66.286 |
| EE | GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.944 | 0.120 | 0.902 |
| EL | Persons employed; GFCF Int. Prop. (Total) | 1 | Yes | No | OLS | 0.985 | 1.005 | 11.003 |
| ES | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.961 | 4.967 | 28.432 |
| FI | GVA; GFCF Int. Prop. (Total) | 2 | Yes | No | OLS | 0.771 | 4.426 | 12.332 |
| FR | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.959 | 59.070 | 381.910 |
| HR | <i>Model not estimated because the dependent variable is equal to zero the whole period</i> | | | | | | | |
| HU | GVA | 4 | Yes | No | OLS | 0.986 | 3.157 | 40.136 |
| IE | Persons employed, GVA | 3 | No | No | OLS | 0.771 | 4.248 | 3.247 |
| IT | GVA; GFCF Int. Prop. (Total) | 4 | Yes | No | OLS | 0.950 | 12.416 | 81.806 |
| LT | Persons employed, GVA; GFCF Int. Prop. (Total) | 3 | No | No | OLS | 0.964 | 0.253 | 2.616 |
| LU | GVA; GFCF Int. Prop. (Total) | 4 | Yes | No | OLS | 0.951 | 0.144 | 0.265 |
| LV | GVA; GFCF Int. Prop. (Total) | 4 | Yes | No | OLS | 0.272 | 0.072 | 0.069 |
| MT | GVA; GFCF Int. Prop. (Total) | 3 | No | Yes | OLS | 0.999 | 0.035 | 1.843 |
| NL | Persons employed, GVA; GFCF Int. Prop. (Total) | 1 | Yes | No | OLS | 0.898 | 17.558 | 49.055 |
| PL | GVA; GFCF Int. Prop. (Total) | 4 | Yes | No | OLS | 0.986 | 2.625 | 24.882 |
| PT | GVA; GFCF Int. Prop. (Total) | 4 | Yes | No | OLS | 0.952 | 1.673 | 13.437 |
| RO | Persons employed | 0 | Yes | Yes | OLS | 0.964 | 0.610 | 6.182 |
| SE | GVA; GFCF Int. Prop. (Total) | 4 | Yes | No | OLS | 0.944 | 21.018 | 80.210 |
| SI | GVA; GFCF Int. Prop. (Total) | 2 | Yes | No | OLS | 0.957 | 0.429 | 3.149 |
| SK | GVA; GFCF Int. Prop. (Total) | 2 | Yes | Yes | OLS | 0.985 | 0.085 | 0.610 |
| UK | Persons employed; GFCF Int. Prop. (Total) | 4 | No | No | OLS | 0.546 | 63.597 | 125.783 |
| EU28 | Persons employed, GVA; GFCF Int. Prop. (Total) | 2 | Yes | No | OLS | 0.983 | 110.748 | 1,563.904 |
| AU | GVA | 2 | Yes | No | OLS | 0.947 | 0.922 | 1.152 |
| CA | Persons employed, GVA | Step dummy from 2010 | No | No | OLS | 0.016 | 0.061 | 0.024 |
| JP | <i>Model not estimated because the dependent variable is not available for the Retail sale sector</i> | | | | | | | |
| KR | GVA | 1 | Yes | Yes | OLS | 0.693 | 41.143 | 101.215 |
| TW | Persons employed, GVA | 2 | Yes | No | OLS | 0.923 | 1.186 | 5.373 |
| US | Persons employed, GVA | 0 | Yes | No | OLS | 0.341 | 107.265 | 87.811 |

Note: NACE sectors G47 for JP and G4791 for CA and US for the predictor Persons employed. NACE sector G47 for JP and US for the predictor GVA.

4.3.4 Transfer Rates: Personnel and Researchers

The estimation of R&D personnel and researchers is based on the definition of transfer rates. Two transfer rates are defined for each year, country and industry:

$$\text{Transfer Rate}^{\text{Personnel}} = \frac{\text{R \& D Personnel}}{\text{BERD}} \quad (5)$$

$$\text{Transfer Rate}^{\text{Researchers}} = \frac{\text{Re searchers}}{\text{BERD}} \quad (6)$$

The problem here is which transfer rate to apply to estimate the values for 2016 and 2017. The alternatives possible are: the transfer rate of 2015, or an average of the most recent years. Using an average of the previous years is a good alternative if the transfer rate is stable in time (stationary). However, it may be misleading if this rate shows a marked trend. To overcome this issue following procedure is applied:

1. For each country, industry and variable (personnel and researchers) the following regression model is estimated using the data for 1995-2015:

$$\text{Transfer Rate}_{ct}^{\text{Personnel or Researcher}} = \alpha + \delta \text{Trend} + \varepsilon_{ct} \quad (7)$$

2. The predicted transfer rates for years 2016 and 2017 are obtained using the estimated parameters of equation (7).
3. The predicted transfer rates are used to obtain the values of personnel and researchers using the nowcasted BERD data.

The advantage of this procedure is that it takes into account the previous evolution of the variables to estimate the transfer rates used for years 2016 and 2017. If the transfer rate does not show a trend (the estimated parameter δ is not statistically significant), the estimated transfer rate corresponding to the last available year is used.

The only exception to this procedure is in the Retail sale sector. The transfer rates are quite volatile, and the estimated transfer rates from a trend regression frequently yield negative values. Therefore the transfer rate of the last available year in this sector was used.

4.4 Nowcasted Data

Although the models for ICT sector value added, employment, hours worked and BERD are estimated in first differences, the files delivered consist of the absolute values of the variables. To recover the levels of the original variables, the estimated increases (first differences) for 2016 and 2017 are obtained using the procedures described above. To this end, the estimated parameters and the value of the predictors for 2016 and 2017 are used. These increases are applied to the original values of the variables in 2015 to obtain the nowcasted data.

Once all the variables for all sectors have been nowcasted individually, some decisions must be taken to guarantee the internal coherence of the database. The first decision concerns the fact that the total ICT sector has to be equal to the aggregation of the ICT manufacturing and ICT services sectors, and, in the same vein, the total ICT services sector has to be equal to the aggregation of the Telecommunications sector and Computer and related activities. With the current methodology these two conditions are not guaranteed. The nowcasted data for the ICT sector serve as a benchmark, and proportionally adjust the nowcasted data of both the ICT manufacturing and the ICT services sector to this benchmark. Additionally, these adjusted data of the ICT services sector were also used as a benchmark to proportionally adjust the values of the Telecommunications and Computer and related activities sector.

An additional issue that is worth mentioning is the treatment of the European Union as an additional country. This means that the aggregation of EU countries in each industry does not coincide with the estimated data. For example, in the case of the ICT sector value added, the difference between the EU value and the aggregation of countries is below 1%.

4.5 Main Issues

The availability of nowcasted data is an asset as it will provide timely information on the evolution of the ICT, MC and RS sectors. This will help to monitor their development and facilitate policy decisions. To nowcast data many decisions have to be taken, such as selecting the nowcasting technique and the most suitable data.

The objective of the nowcasting exercise is to obtain an estimation of the PREDICT variables for the years 2016 and 2017, i.e. the two years subsequent to the current PREDICT database. The variables to be nowcasted are value added, employment, hours worked, labour productivity, BERD and business R&D personnel and researchers. In terms of industry disaggregation, the objective is to nowcast the total ICT sector, the ICT manufacturing sector, ICT services, including the Telecommunications and IC sector, the Media and content industry and the Retail sale sector. The aim is to produce estimates for the EU, its Member States, Australia, Canada, Japan, Korea, Taiwan and the US.

The development of the methodology needs to bear in mind that the final methodology must 1) be understandable and replicable by third parties (e.g., new contractors), 2) rely on official data as much as possible; and 3) employ a consistent framework for value added, employment, hours worked and BERD.

The two previous paragraphs restrict the possible methodological alternatives because only a small number of possible explanatory variables are available, and because the time span of the data is short. Additionally, as the PREDICT Nowcasting project aims to produce yearly data, the typical issues in the literature do not arise for heterogeneous data frequencies. That is, the annual data can be estimated from annual or annualised quarterly predictors.

The Final Nowcasted Dataset is the result of the nowcasting exercise carried out within the PREDICT project. The approach followed was based on the estimation of regression models for each EU Member State, for the EU and for some additional countries. The estimations rely only on three predictors: GVA, persons employed and gross fixed capital in intellectual property obtained from the Quarterly National Accounts. Several models were estimated for each PREDICT variable, and tests were conducted to determine which one has higher explanatory power, and which has the best out-of-sample prediction capacity (minimal overfitting). Overall, the models fit reasonably well with the data, although there is variability across ICT sectors and variables.

5 Estimation of ICT GBARD

The Digital Single Market aims to increase Member States' annual public spending on ICT research and development. However, monitoring the evolution of public funding of ICT R&D is not straightforward as there are no readily available statistics. Generally, analysis of the evolution of R&D is based on surveys of different agents (firms, universities, and so on) requesting information on their Gross Domestic Expenditure on R&D (GERD). The interest of the PREDICT project is to know which part of this activity is funded by the public sector (government-financed GERD). Although R&D surveys can be used to compute effective expenditure on R&D, they are not useful for computing the part of government-financed GERD related to R&D.

An alternative to survey data is to identify the part of the public budget allocated to ICT R&D. Stančik¹⁵ (2012) developed a methodology to disentangle which part of the Government Budget Appropriations or Outlays on R&D (GBARD) finances ICT R&D expenditure (ICT GBARD). Ivie has used this methodology to estimate ICT GBARD in the context of the PREDICT project (PREDICT Report 2013, 2014, 2015 and 2016). Implementing this methodology has given Ivie practical insights to propose technical improvements to the methods described in the documents cited above.

Additionally, Ivie is also working on the FP7 SPINTAN project, one of whose aims is to create a database of intangible assets for the non-market economy. A key aspect of this project is to estimate the subsidies that governments grant to R&D. To this end, Mas, Benages, Fernández de Guevara and Hernández (2016) have developed a methodology to disentangle which part of the Eurostat GBARD –published according to the Nomenclature for the Analysis and Comparison of Scientific Budgets and Programmes (NABS) chapters– can be attributed to different NACE industries. This methodology closely follows Stančik (2012).

The objective of this Final Methodological Report is to describe the main milestones in estimating GBARD (and ICT GBARD) both by NACE industries and by NABS chapters according to Mas et al.'s (2016) methodology. The procedure developed guarantees that the estimation of the ICT GBARD by NACE industries and by NABS chapters are mutually consistent. The document also details some improvements to the methodology applied in PREDICT 2017 regarding the approaches developed by Mas et al. (2016) and Stančik (2012): revision of the NACE-NABS correspondence, estimation of missing NABS chapters in the official Eurostat statistics for some countries, and a change in the smoothing technique used. Finally, the data produced with this new methodology is compared with the previous PREDICT estimations, and the effect of each change in the methodology is assessed.

This document is organized as follows. Section 2 describes the methodological proposal to estimate GBARD (and ICT GBARD) in terms of NACE industries. Section 3 compares the data obtained in PREDICT 2017 with data from PREDICT 2016, i.e., a comparison of the new methodology and the previous one based on Stančik (2012). Finally, section 4 summarizes the main issues dealt with in this Final Methodological Report.

5.1 Estimation of GBARD and ICT GBARD in terms of NACE Sectors

The estimations of GBARD and ICT GBARD by NACE industries are based on Mas et al.'s (2016) methodology. This methodology draws heavily from Stančik (2012) and can be considered an extension of his procedures. This methodological approach also goes some steps further on Mas et al. (2016), including some additional extensions to the methodology. The industry disaggregation follows a homogeneous classification (NACE Rev.2) for the EU Member States, detailed at 37 industries, of which 7 are ICT sectors¹⁶ (Table 37).

¹⁵ <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=5119>

¹⁶ Following the OECD 2007 ICT sector definition: OECD Information Economy–Sector definitions based on the International Standard Industry Classification (ISIC 4) available at

The starting point: GBARD data

The starting point for the methodology is the GBARD data published by NABS chapters (Eurostat). GBARD, as mentioned, is a measure of government expenditure on R&D based on budgetary information following the guidelines of the Frascati Manual (OECD 2015). All the budget items involving R&D are first identified, and their R&D content in terms of funding is then estimated. "Government" should cover central (or federal) and provincial (or state) government, when its contribution is significant (public enterprises excluded). It covers government-financed R&D undertaken in government establishments but also in other national sectors and abroad (including international organizations). It is based on the funder rather than the performer. These estimates are less accurate than performance-based data but, as they are derived from the budgets, they can be linked to policies through classification by "objectives" or "goals".

GBARD data are available on the Eurostat website for the most recent classification by NABS 2007 socio-economic objectives (see Table 36) from 2004 to 2015¹⁷ for all the EU Member States, Iceland, Norway, Switzerland, Serbia, Turkey, Russia, the United States, Japan and Korea. Regarding the EU aggregates, data for the EU28, EU15 and EA19 start in 2007. This is the classification Stančik (2012) used in the baseline methodology.

Data is also available on the Eurostat website for the previous GBARD classification (NABS 1992 socio-economic objectives) from 1980 to 2007 (the EU27 aggregate starts in 1999). The non-Member State countries covered are Iceland (available for the years 1983-1986, 1991-2007), Norway (1981-2007), Switzerland (1981, 1983, 1986, 1988-1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006), Russia (1999-2007), the United States (1980-2007), Japan (1988-2007) and South Korea (2004-2007).

Table 36 NABS 2007 chapters

NABS 2007 chapters

| | |
|----|--|
| 1 | Exploration and exploitation of the earth |
| 2 | Environment |
| 3 | Exploration and exploitation of space |
| 4 | Transport, telecommunication and other infrastructures |
| 5 | Energy |
| 6 | Industrial production and technology |
| 7 | Health |
| 8 | Agriculture |
| 9 | Education |
| 10 | Culture, recreation, religion and mass media |
| 11 | Political and social systems, structures and processes |
| 12 | General advancement of knowledge: R&D financed from General University Funds (GUF) |
| 13 | General advancement of knowledge: R&D financed from other sources than GUF |
| 14 | Defence |

As will be described later on in this document, the methodology relies on a correspondence of each NABS chapter with the equivalent NACE industry. However, for some countries Eurostat data have missing NABS chapters. These missing NABS chapters

<http://www.oecd.org/science/scienceandtechnologypolicy/38217340.pdf>), Annex 1, p. 15. More details on methodology are provided in Mas, Robledo and Pérez (2012): *ICT sector definition transition from NACE Rev. 1.1 to NACE Rev. 2: A methodological note*, available at <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=5919>.

¹⁷ Data for Italy start in 2005, 2008 for Croatia, 2005 for Hungary, 2013 for Serbia, Korea only until 2011, and Switzerland only available for the years 2004, 2006, 2008, 2010 and 2012. Some countries, like the Czech Republic, Denmark, the Netherlands, Austria, Portugal, Romania, Finland, Sweden, Norway, Turkey and the United States, have already published preliminary data for 2015.

are included in the total GBARD offered by Eurostat (NABS 99). Additionally, the aggregation of NABS chapters does not always coincide with the total GBARD. Because the methodology developed needs to disentangle each NABS' GBARD into its corresponding NACE industry, we must impute the missing NABS chapters. These missing NABS chapters were therefore estimated based on the percentage structure of other years available for the same country, or, if other years are not available for the same country, we used the structure of the most similar country (according to the percentage distribution of the NABS chapters) in the European Union. Additionally, we performed an additional adjustment for countries with differences between their NABS99 (total GBARD) and the sum of NABS chapters so that the structure of GBAORD by NABS chapters was applied to the total (NABS99). Finally, we adjusted all the countries-years in which some of the corrections described were implemented. The RAS method used guarantees that country aggregations coincide with Eurostat's total GBARD by country, and the aggregation of NABS by countries coincides with EU GBARD by NABS.

Disentangling GBARD by industries

In order to break down NABS GBARD by NACE industries, two elements are required: 1) a correspondence between NABS chapters and NACE industries, and 2) weights to distribute the GBARD of each NABS chapter among the different NACE industries, since each NABS chapter will generally be distributed among more than one industry (see Figure 1).

Regarding the first of these requirement, Stančik (2012) already contains a correspondence to assign NACE industries into NABS chapters. This correspondence was used in the estimations of the ICT GBARD by NABS chapters in the previous editions of the PREDICT database and in Mas et al. (2016). The Stančik (2012) NABS-NACE correspondence is used as a starting point, although it has been revised. The revision was based on Eurostat (1994 and 2008), which offers valuable information on which types of activities (industries) should be included in each NABS. In addition, the NACE classification change in 2008 must be taken into account. Hence, two NACE-NABS correspondences are needed, one for NACE Rev. 1.1 for the period 2004-2007 and another one for NACE Rev. 2 for the period 2008-2013.

- NABS 2007 → NACE Rev. 1.1 → NACE Rev. 2 (2004-2007)
- NABS 2007 → NACE Rev. 2 (2008-2014)

Tables in the appendix show the correspondences used in the new PREDICT methodology. More precisely, the tables show the correspondences of the NABS classification and both the NACE Rev 1.1 and NACE Rev. 2 industry classifications.

It is worth mentioning that the NABS-NACE correspondence is used in our methodology in the opposite direction to that in Stančik (2012). Our aim is not to aggregate different NACE industries into NABS chapters, but to break down NABS chapters among industries (see Figure 2).

Figure 1 Requirements of the methodology to break down GBARD by industry: equivalence between GBARD and industries (NACE) including weights

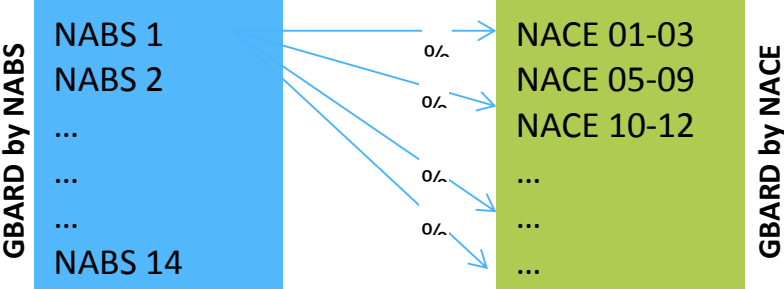
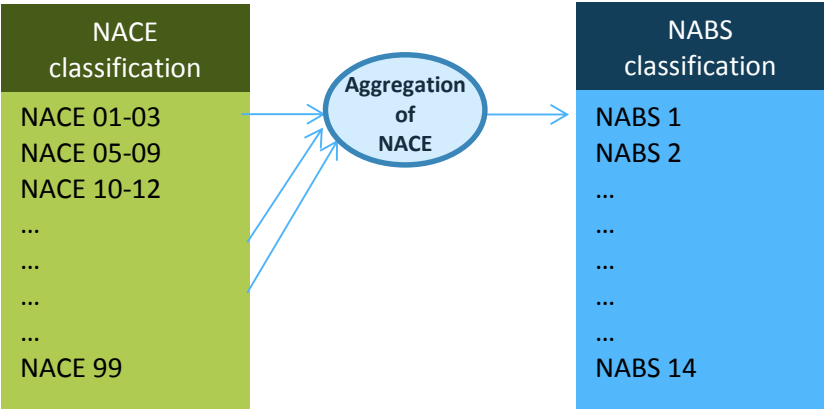
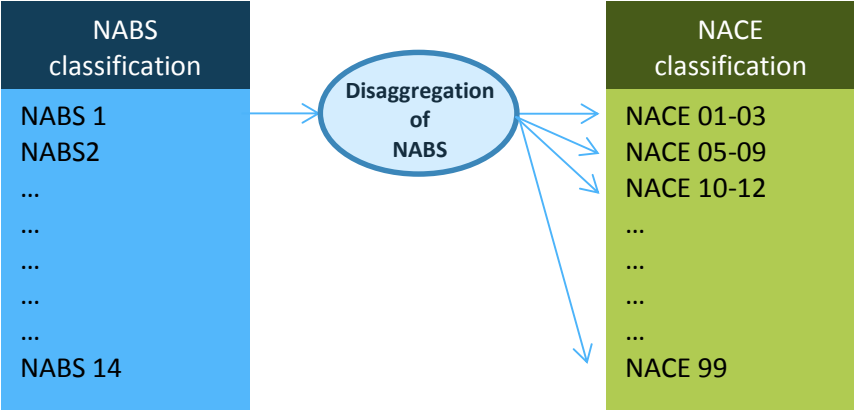


Figure 2 Differences between Stančik (2012) NACE-NABS equivalence and the one needed for the industry disaggregation of GBARD

a) Stančik (2012) NACE-NABS correspondence



b) What is needed here: a NABS-NACE correspondence



The second requirement is the distribution of the weights of each NABS among the NACE (Rev. 1.1 and Rev. 2) industries, since each NABS chapter is very likely to correspond to more than one NACE industry. Again, following Stančik’s (2012) general idea, the proxy selected for estimating the NABS weights are labour costs (average salary per hour worked multiplied by hours worked) of employees with higher education (ISCED 5a, 5b and 6) per NACE sector over total labour costs of employees with ISCED 5-6 in all NACE sectors. This choice of the proxy variable assumes that the distribution of GBARD expenditure by industry is similar to the distribution of the labour costs of the most qualified employees, those more likely to be using ICTs. Total labour costs are used instead of total employment because the former includes salaries, which may reflect differences in productivity. Both in Stančik (2012) and in Mas et al. (2016) ISCED codes 4 to 6 are considered. Here the definition of higher education has been limited to ISCED codes 5a, 5b and 6.

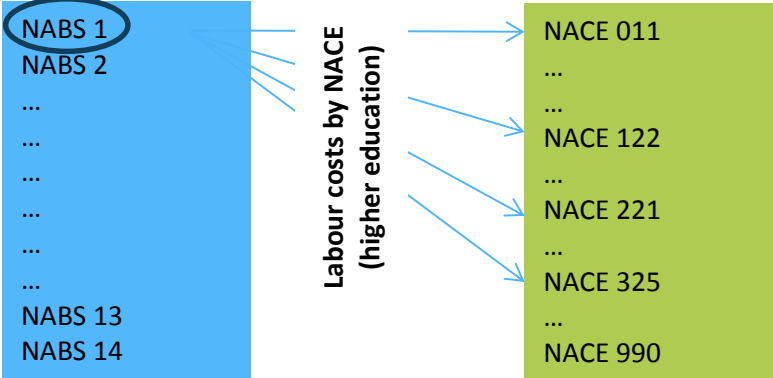
The data needed to calculate the weights are hours worked by employees with higher education by 3-digit NACE Rev. 1.1. and Rev. 2 industries (Labour Force Survey, LFS) and hourly wages of employees with higher education by 3-digit NACE industries (Structure of Earnings Survey, SES). For the period to be estimated (2006-2015), data for wages are only available for the years 2006, 2010, and since very recently, 2014. Again, we follow Stančik (2012): 2006 SES data are interpolated until 2007 and 2010 SES data are used for the years 2008 to 2014. Finally, 2014 SES data are extrapolated from 2014 onwards. Tailor-made data for both LFS and SES were received from Eurostat (avoiding confidentiality restrictions) specifically for this project.

Figure 3 illustrates, for NABS 1, the procedure to break down GBARD NABS chapters by industry using NACE-NABS correspondences and the labour costs as weights. According

to the equivalence, NABS 1 must be broken down into four different NACE Rev. 2 industries (011, 122, 221, 325), shown in Figure 3a. To do this, the weights are calculated from the percentage distribution of total labour costs in these four industries (Figure 3b). These labour cost weights are the ones that will be applied to NABS 1 GBARD to obtain an estimate of GBARD in terms of NACE.

Figure 3 Example of NABS 1- NACE correspondences and estimation of weights through labour costs

a) NABS 1- NACE Rev. 2 correspondence

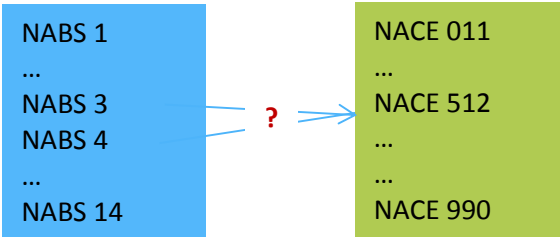


b) Example: NABS 1 – NACE Rev. 2 correspondence and estimation of weights through labour costs

| NABS codes | NACE codes | Labour costs | Weights |
|------------|---------------------------------------|--------------|-------------|
| NABS 1 | NACE 011 | 100 | 15% |
| | NACE 122 | 200 | 31% |
| | NACE 221 | 250 | 38% |
| | NACE 325 | 100 | 15% |
| | Total NACEs assigned to NABS 1 | 650 | 100% |

The method described above is followed as a general rule for each NABS chapter to obtain estimates of GBARD by NACE industries. However, there are some cases in which the procedure is not so straightforward, particularly when several NACE industries are assigned to more than one NABS chapter. In these cases, a previous step is needed. For example, NACE Rev. 2 code 512 (Freight air transport and space transport) is assigned to NABS 3 (Exploration and exploitation of space) and NABS 4 (Transport, telecommunication and other infrastructures), but we do not have information about how much of the labour costs of employees with higher education in industry 512 should be assigned to each NABS 3 and 4 (Figure 4). Since there are more NACE industries involved in NABS 3 or 4, labour costs of NACE 512 cannot be used twice to calculate the weights of all, otherwise they would be counted twice. It is therefore necessary to use an assumption to split NACE 512 labour costs among the NABS affected (NABS 3 and 4 in the example). More precisely, we proceed using the GBARD weight in the NABS involved to assign the labour costs of each NACE industry to the corresponding NABS chapters for each country and year. This procedure to assign NACE industries in several NABS chapters deviates from the baseline methodology proposed in Stančik (2012), which does not explicitly explain how to distribute NACE industries among several NABS chapters.

Figure 4 Example of distribution of NACE Rev. 2 512 code (Freight air transport and space transport) into NABS 3 (Exploration and exploitation of space) and NABS 4 (Transport, telecommunication and other infrastructures)



| NACE codes | Labour costs | NABS codes | GBARD | Weights | Labour costs by NABS |
|------------|--------------|------------|-------|---------|----------------------|
| NACE 512 | 1000 | NABS 3 | 100 | 80% | 800 |
| | | NABS 4 | 25 | 20% | 200 |

All the procedures described above rely on the calculation of the appropriate weights to disentangle GBARD (NABS) by industries. To do this, we need a proper assignment of the labour costs of employees with higher education at 3-digit NACE Rev. 1.1. and Rev. 2 industries to each NABS. Then, the weight of these labour costs are calculated by NACE within the same NABS. This weight will be used to estimate GBARD figures by industries for each country and year according to equation [1].

$$GBARD_k = \sum_{j=1}^{14} GBARD_j * \left[\frac{\text{Labour costs}_{j,k}}{\sum_k \text{Labour costs}_{j,k}} \right] \quad [1]$$

where j =NABS chapter, k = NACE industry and labour costs are hours worked multiplied by hourly wages for employees with higher education.

Given that LFS and SES data are classified following NACE Rev. 1.1 for the period 2004-2007 and NACE Rev. 2 for the period 2008 onwards, the application of the methodology results in GBARD data by two different NACE classifications. In order to have the data harmonized throughout the whole period covered in the database, the correspondence between NACE Rev. 1.1 and Rev. 2¹⁸ is used to give a final NACE classification of 37 2-digit NACE Rev. 2 industries, comprising 7 ICT sectors (according to the OECD classification). Table 37 shows the final classification of industries. Despite using the official correspondence, there is a break in the series in 2008. Therefore, GBARD data by NACE is smoothed. We follow Mas et al. (2016) and smooth the results by estimating a linear regression for the whole period with a trend and a step dummy for the period affected by the new NACE Rev. 2 (2006-2013). The data in the NACE Rev. 2 is maintained, whereas the previous years are smoothed to avoid the break in series.

From GBARD by industries to ICT GBARD

Once GBARD is distributed in the 37 NACE Rev. 2 industries, the next step is to split the GBARD within each industry, year and country into ICT and non-ICT assets. As in Stančik (2012) we assume that the part of total GBARD devoted to ICT assets is proportional to

¹⁸ http://ec.europa.eu/eurostat/ramon/relation/index.cfm?TargetUrl=LST_REL&StrLanguageCode=EN&IntCurrentPage=8.

the share of labour costs for employees with higher education in ICT occupations to total labour costs. More precisely, the ICT share of industry k is defined as:

$$\text{ICT share}_k = \frac{\text{Labour costs for employees with higher education in ICT occupations}_k}{\text{Labour costs for employees with higher education}_k} \quad [3]$$

and ICT GBARD is defined as the product of total GBARD in industry k times its ICT share.

$$\text{ICT GBARD}_k = \text{GBARD}_k * \text{ICT share}_k \quad [4]$$

In contrast to Stančik (2012) and Mas et al. (2016) we follow the new Eurostat taxonomy of ICT specialists for our definition of the ICT occupations.¹⁹ Tables A X and A XI in Annex II show the ISCO-88 and ISCO-08 codes included in the definition of ICT occupations.

Note that the weights to disentangle GBARD by industries are based on a share of labour costs of employees with higher education over total labour costs. Here, the share is expressed as the percentage of labour costs of people with higher education working in ICT occupations over total labour costs of employees with higher education. An additional consideration is needed to specify that, according to our methodology, the estimations of ICT GBARD result in the same values for the aggregate of industries and for NABS chapters.

The ICT share necessary to calculate the ICT GBARD requires very detailed information on average salaries (LFS) and hours worked (SES) by industries, education attainment and occupations. The time profile in some industries and countries is quite volatile due to lack of data resulting from small sample sizes in some of the industry*occupation*educational attainment. Therefore, a smoothing procedure is required. Stančik (2012) based smoothing on the regression of the labour shares on time (years). The consequent linear prediction provides the trend values. This procedure implies that the resulting ICT GBARD for country j in year t will be updated every time a new year is introduced in the dataset. To avoid this drawback, in the new PREDICT methodology the smoothing procedure is changed to double exponential smoothing, which does not require an annual update of all the data.

GBARD and ICT GBARD for the US and Japan

The methodology can also be applied to the US, given the availability of information and the correspondences between the US industry classification by NABS chapters and ICT occupations. Table A XII shows the definition of occupations used in the US and table A XIII, the revised correspondences of the US industry CIC classification (industry classification used in the American Current Population Survey, CPS) and NABS chapters. The correspondence between the CIC and the NACE Rev. 2 classification is also used.

Regarding Japan, there is not enough information available to disaggregate ICT GBARD, neither by NABS nor by NACE. Wages are available for the total economy at a detailed level of occupation (129 occupation classification) from the Basic Survey on Wage Structure, but they are neither crossed by industry nor by level of education and it is not possible to ask for a tailor-made request or obtain the microdata for Japan. Therefore, no information will be provided by NACE industries for Japan, and the methodology remains unchanged from the previous PREDICT databases.

¹⁹ http://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm

Table 37 Final NACE classification: 37 2-digit NACE Rev. 2 industries, differentiating ICT sectors

| Industry description | NACE Rev. 2 code |
|--|-------------------------|
| 1 Agriculture, forestry and fishing | 01-03 |
| 2 Mining and quarrying | 05-09 |
| 3 Manufacture of food products, beverages and tobacco products | 10-12 |
| 4 Manufacture of textiles, apparel, leather and related products | 13-15 |
| 5 Manufacture of wood and paper products, and printing | 16-18 |
| 6 Manufacture of coke, and refined petroleum products | 19 |
| 7 Manufacture of chemicals and chemical products | 20 |
| 8 Manufacture of pharmaceuticals, medicinal chemical and botanical products | 21 |
| 9 Manufacture of rubber and plastics products, and other non-metallic mineral products | 22-23 |
| 10 Manufacture of basic metals and fabricated metal products, except mach. & eq. | 24-25 |
| 11 Manufacture of computer, electronic and optical products (except ICT industries) | 26(nonICT) |
| 12 Manufacture of electronic components and boards | ICT261 |
| 13 Manufacture of computers and peripheral equipment | ICT262 |
| 14 Manufacture of communication equipment | ICT263 |
| 15 Manufacture of consumer electronics | ICT264 |
| 16 Manufacture of magnetic and optical media | ICT268 |
| 17 Manufacture of electrical equipment | 27 |
| 18 Manufacture of machinery and equipment n.e.c. | 28 |
| 19 Manufacture of transport equipment | 29-30 |
| 20 Other manufacturing, and repair and installation of machinery and equipment | 31-33 |
| 21 Electricity, gas, steam and air-conditioning supply | 35 |
| 22 Water supply, sewerage, waste management and remediation | 36-39 |
| 23 Construction | 41-43 |
| 24 Transportation and storage | 49-53 |
| 25 Publishing, audiovisual and broadcasting activities (except ICT industries) | 58-60(nonICT) |
| 26 ICT Computer and related activities | ICT5820+62+631+951 |
| 27 Telecommunications | ICT61 |
| 28 Computer programming, consultancy and related activ.; Information service activ. (exc. ICT) | 62-63(nonICT) |
| 29 Legal and accounting, head offices, management consultancy, architectural and engineering | 69-71 |
| 30 Scientific research and development | 72 |
| 31 Advertising and market research; other professional, scientific and technical activities; | 73-75 |
| 32 Administrative and support service activities | 77-82 |
| 33 Public administration and defence; compulsory social security | 84 |
| 34 Education | 85 |
| 35 Human health and social work | 86-88 |
| 36 Arts, entertainment and recreation | 90-93 |
| 37 Activities of membership organisations | 94 |

ICT sectors shaded in blue. Source: Mas, Benages and Fernández de Guevara (2015).

5.2 Comparison of the New and the Previous Methodologies

The new methodological approach described in this document and implemented in the PREDICT 2017 database implies a break in the data with respect to previous editions of PREDICT. The new approach simultaneously incorporates innovations in various aspects: 1) the incorporation of new data produced by Eurostat such as the SES 2014; 2) changes in the overall method (from GBARD by NABS to GBARD by NACEs and then the estimation of ICT GBARD in each NACE industry); 3) estimating missing NABS chapters; 4) changes in classifications (ICT occupations and education levels); 5) a new NABS-NACE correspondence; and 6) the smoothing procedure. This section briefly assesses the impact each change has on the ICT GBARD figures. We implement step by step each of the methodological milestones to evaluate which proportion of the total variation of ICT GBARD they drive.

We performed various exercises to isolate the effects of each of the changes in ICT GBARD methodology on PREDICT 2017 ICT GBARD figures. We take two benchmark estimations to compare the data. The first benchmark is the data published in PREDICT 2016 following Stančik's (2012) methodology, methodology, shown in Table 38a. The second benchmark is the final estimation delivered in PREDICT 2017, included in Table 38e. Table 38b to d incorporate some of the milestones of the methodology sequentially so that the effects of the methodological improvements can be traced. All the tables include the ICT GBARD data for the EU and its Member States in the period 2006-2015. All the comparisons refer to 2014, the most recent year for which it is possible to compare PREDICT 2016. In this year, ICT GBARD calculated with the new methodology for PREDICT 2017 was 6,231.0 million current euros in the EU, 2% lower than the value with Stančik's (2012) methodology for the same year.

To evaluate the effect of the changes applied in PREDICT 2017 we re-estimated the ICT GBARD, changing, step by step, the improvements applied in PREDICT 2017. Table 38b shows the ICT GBARD estimations when no changes in the methodology are applied, with the exception of using the new data available in the 2017 edition (essentially SES 2014), the new education levels considered (ISCED 5-6 instead of ISCED 4-6) and with the new occupations taxonomy that follows Eurostat's new classification of ICT specialists. This estimation corresponds to the data we would have obtained in PREDICT 2017 if Stančik (2012) methodology had been maintained, and therefore no change in the method had been implemented (apart from the change in education levels, in ICT occupations and the new data available). The ICT GBARD for the EU following this alternative would have been 6,006.6 million current euros in 2014. This implies that, without any further change apart from those already mentioned, the EU's ICT GBARD in 2014 would have been 5% lower in PREDICT 2017 than in PREDICT 2016.

Table 38c reproduces the estimations of Table 38b but using both the new NABS-NACE taxonomy and the estimation of Eurostat's missing NABS chapters. That is, it follows Stančik's (2012) methodology and incorporates the new information available in PREDICT 2017, the new education and occupations classification, the revised NABS-NACE correspondence, and the estimation of the missing NABS chapters. ICT GBARD in the EU in this case would have been 6,171.6 million current euros in 2014, i.e. 3% lower than the estimation published in PREDICT 2016.

In Table 38d the Stančik (2012) method is left behind and the new approach is adopted. As we have already described, this method involves disaggregating GBARD by NABS into its NACE equivalents (based on the NABS-NACE correspondence) and decomposing the part of each NACE industry devoted to ICT assets in a second stage. The main difference with the final data published in PREDICT 2017 is that the linear smoothing of the ICT shares is applied instead of the double exponential smoothing finally adopted. The introduction of the new approach results in a value of 6,312.8 million euros. Therefore, the new method implies an increase of the total ICT GBARD of 2% on Table 38c –which also included the new data, new correspondences and classifications and the estimation

of the missing NABS chapters– and only 0.5% lower than the values presented in PREDICT 2016, both calculated with Stančik’s (2012) procedure.

The last innovation in estimating the ICT GBARD in PREDICT 2017 is the change in the smoothing procedure of the ICT shares. As mentioned above, instead of Stančik’s (2012) linear smoothing we use a double exponential smoothing. A comparison of Table 38 and 38e allows us to assess the effect of this latter change in the methodology. With the new smoothing ICT GBARD falls from 6,312.8 million euros (Table 38d) to 6,231.0 million euros in 2014, which is the data published in PREDICT 2017.

Overall, the new methodology yields a reduction in the ICT GBARD for the year 2014 of 1.8% with respect to PREDICT 2016 (Table 39). This reduction is the combined effect of the negative and positive contribution of some of the improvements in the methodology. The methodological improvements consist of new data available for preparing PREDICT 2017, the new taxonomies of education levels and occupations, and the new smoothing procedure, which negatively contribute to the ICT GBARD, whereas the new NABS-NACE taxonomy and the new approach for measuring GBARD by industries contribute positively.

Table 38 Sensitivity of the ICT GBARD estimation to methodological issues**a) PREDICT 2016 data. Stančík (2012)**

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 |
|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| AT | 163.1 | 164.1 | 176.8 | 181.2 | 181.3 | 182.9 | 175.2 | 175.4 | 178.7 |
| BE | 176.9 | 191.2 | 234.1 | 244.2 | 263.0 | 269.1 | 275.2 | 288.4 | 292.1 |
| BG | 0.0 | 3.9 | 4.5 | 3.6 | 4.8 | 5.2 | 6.4 | 5.8 | 6.7 |
| CY | 1.8 | 2.4 | 2.4 | 2.5 | 2.1 | 1.8 | 1.3 | 1.3 | 1.4 |
| CZ | 54.6 | 64.0 | 73.1 | 80.7 | 86.6 | 108.5 | 111.0 | 107.0 | 96.6 |
| DE | 1,058.1 | 1,087.4 | 1,108.0 | 1,201.8 | 1,275.7 | 1,297.1 | 1,215.0 | 1,287.0 | 1,285.5 |
| DK | 84.3 | 105.1 | 139.5 | 162.2 | 185.5 | 203.9 | 217.7 | 220.5 | 221.6 |
| EE | 1.0 | 1.5 | 2.5 | 2.8 | 3.6 | 4.9 | 5.2 | 6.1 | 6.8 |
| ES | 402.7 | 570.1 | 645.7 | 706.3 | 688.0 | 612.4 | 611.1 | 539.6 | 531.8 |
| FI | 140.2 | 144.0 | 154.9 | 177.1 | 199.6 | 202.4 | 214.3 | 224.9 | 222.0 |
| FR | 761.3 | 742.1 | 664.6 | 701.5 | 647.3 | 616.0 | 536.4 | 535.8 | 514.6 |
| GR | 40.2 | 40.1 | 51.6 | 43.3 | 35.1 | 31.3 | 35.5 | 39.8 | 38.3 |
| HR | 0.0 | 0.0 | 20.5 | 20.7 | 22.3 | 23.6 | 22.7 | 13.4 | 7.5 |
| HU | 23.2 | 20.0 | 23.9 | 27.6 | 21.1 | 15.1 | 22.9 | 48.8 | 32.3 |
| IE | 45.7 | 61.6 | 65.1 | 70.4 | 72.2 | 69.7 | 67.1 | 64.6 | 64.3 |
| IT | 594.0 | 606.0 | 588.6 | 619.6 | 559.2 | 538.6 | 542.5 | 476.1 | 436.1 |
| LT | 1.5 | 3.2 | 4.3 | 4.9 | 5.0 | 6.2 | 6.9 | 7.9 | 8.7 |
| LU | 5.8 | 8.2 | 10.7 | 12.3 | 15.9 | 18.3 | 19.5 | 23.4 | 24.6 |
| LV | 2.7 | 3.2 | 3.1 | 1.7 | 1.2 | 1.2 | 1.6 | 2.0 | 2.2 |
| MT | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 |
| NL | 349.6 | 347.6 | 347.0 | 365.1 | 355.4 | 358.9 | 326.9 | 328.8 | 359.4 |
| PL | 46.0 | 55.7 | 64.6 | 0.0 | 0.0 | 0.0 | 54.9 | 56.0 | 47.5 |
| PT | 53.8 | 48.4 | 29.8 | 34.0 | 30.6 | 27.2 | 27.8 | 28.4 | 28.1 |
| RO | 17.3 | 25.4 | 33.2 | 21.6 | 19.1 | 20.3 | 16.0 | 17.6 | 16.7 |
| SE | 289.6 | 321.1 | 354.0 | 364.4 | 435.8 | 474.8 | 550.9 | 598.3 | 615.9 |
| SI | 11.6 | 12.4 | 14.3 | 21.4 | 19.2 | 20.9 | 19.2 | 17.7 | 18.0 |
| SK | 10.2 | 8.1 | 10.9 | 11.2 | 9.8 | 10.2 | 14.5 | 12.7 | 14.8 |
| UK | 755.9 | 798.9 | 693.7 | 655.1 | 685.6 | 686.3 | 754.1 | 854.0 | 950.2 |
| EU28 | 5,274.4 | 5,540.2 | 5,781.2 | 6,034.8 | 6,143.0 | 6,264.1 | 6,118.6 | 6,307.2 | 6,345.6 |

Table 38 (cont.): Sensitivity of the ICT GBARD estimation to methodological issues**b) Stančík's (2012) methodology, new ICT occupations and educational level and new data available for the PREDICT 2017 estimations**

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| AT | 161.4 | 160.2 | 170.6 | 173.0 | 171.0 | 170.0 | 160.0 | 157.1 | 152.2 | 145.6 |
| BE | 172.6 | 186.6 | 226.1 | 234.2 | 250.5 | 254.4 | 257.6 | 270.4 | 297.9 | 276.0 |
| BG | 0.0 | 4.2 | 4.7 | 4.0 | 4.9 | 5.3 | 6.4 | 5.6 | 6.2 | 7.3 |
| CY | 1.9 | 2.5 | 2.4 | 2.5 | 2.0 | 1.7 | 1.2 | 1.2 | 1.4 | 1.5 |
| CZ | 54.6 | 63.8 | 72.6 | 79.9 | 85.2 | 106.3 | 108.6 | 106.3 | 98.3 | 94.0 |
| DE | 1,076.2 | 1,109.0 | 1,128.6 | 1,222.1 | 1,295.1 | 1,316.3 | 1,233.6 | 1,294.2 | 1,271.3 | 1,288.3 |
| DK | 86.7 | 105.6 | 138.0 | 157.5 | 178.5 | 192.6 | 203.8 | 205.8 | 206.6 | 205.7 |
| EE | 1.2 | 1.6 | 2.6 | 2.9 | 3.8 | 5.1 | 5.3 | 6.3 | 5.4 | 5.0 |
| ES | 421.5 | 578.6 | 639.8 | 678.1 | 645.8 | 559.1 | 537.5 | 457.9 | 468.0 | 436.6 |
| FI | 130.1 | 134.1 | 144.6 | 165.4 | 186.9 | 190.2 | 202.0 | 211.3 | 219.2 | 227.4 |
| FR | 664.2 | 642.7 | 560.7 | 581.3 | 523.5 | 480.1 | 405.4 | 402.1 | 380.8 | 403.2 |
| GR | 37.7 | 37.1 | 53.2 | 43.1 | 34.2 | 30.2 | 33.4 | 37.0 | 32.1 | 31.2 |
| HR | 0.0 | 0.0 | 18.8 | 18.9 | 20.2 | 21.3 | 20.5 | 11.9 | 6.6 | 1.3 |
| HU | 23.0 | 19.9 | 23.7 | 27.1 | 20.6 | 14.7 | 21.9 | 46.7 | 17.2 | 22.7 |
| IE | 47.2 | 72.8 | 84.8 | 100.8 | 112.8 | 117.5 | 119.6 | 125.0 | 134.1 | 146.8 |
| IT | 572.8 | 595.0 | 579.3 | 602.2 | 541.9 | 517.3 | 516.5 | 449.9 | 441.2 | 428.0 |
| LT | 1.6 | 3.5 | 4.4 | 4.9 | 4.9 | 6.0 | 6.5 | 7.1 | 7.5 | 7.6 |
| LU | 5.4 | 7.8 | 10.3 | 12.0 | 15.7 | 18.2 | 21.5 | 26.6 | 28.0 | 0.0 |
| LV | 2.6 | 3.1 | 3.1 | 1.6 | 1.2 | 1.2 | 1.6 | 2.0 | 2.3 | 2.3 |
| MT | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.3 |
| NL | 368.1 | 369.8 | 372.2 | 395.3 | 389.3 | 398.7 | 364.5 | 365.5 | 372.7 | 398.4 |
| PL | 46.1 | 55.7 | 64.4 | 0.0 | 0.0 | 0.0 | 53.6 | 54.9 | 59.5 | 43.8 |
| PT | 55.9 | 51.4 | 36.2 | 40.7 | 35.8 | 32.1 | 31.4 | 32.5 | 32.9 | 37.4 |
| RO | 17.4 | 25.7 | 33.5 | 21.8 | 19.3 | 20.6 | 16.3 | 19.4 | 18.8 | 23.3 |
| SE | 296.0 | 318.6 | 341.0 | 341.5 | 398.0 | 422.8 | 479.5 | 506.4 | 507.4 | 509.9 |
| SI | 11.5 | 12.6 | 14.6 | 21.5 | 19.6 | 21.2 | 19.5 | 17.8 | 16.4 | 15.1 |
| SK | 10.4 | 8.3 | 10.9 | 11.0 | 9.4 | 9.7 | 13.7 | 11.7 | 12.7 | 12.3 |
| UK | 779.1 | 811.6 | 695.0 | 646.7 | 666.6 | 656.1 | 710.7 | 791.7 | 865.7 | 975.6 |
| EU28 | 5,137.8 | 5,431.0 | 5,636.1 | 5,845.0 | 5,920.0 | 5,992.8 | 5,814.9 | 5,956.6 | 6,006.6 | 6,095.6 |

Table 38 (cont.): Sensitivity of the ICT GBARD estimation to methodological issues**c) Stančík's (2012) methodology, new ICT occupations and educational level, new data available for the PREDICT 2017 estimations and revised NABS-NACE correspondence**

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| AT | 159.2 | 157.8 | 167.3 | 170.3 | 167.8 | 166.9 | 156.8 | 153.4 | 147.6 | 140.9 |
| BE | 160.4 | 169.5 | 207.1 | 211.9 | 229.1 | 235.6 | 241.8 | 255.2 | 282.6 | 264.5 |
| BG | 3.5 | 4.1 | 4.9 | 4.1 | 4.9 | 5.3 | 6.3 | 5.7 | 6.2 | 7.2 |
| CY | 2.0 | 2.6 | 2.5 | 2.5 | 2.0 | 1.7 | 1.2 | 1.2 | 1.4 | 1.5 |
| CZ | 53.4 | 63.7 | 71.7 | 77.4 | 84.4 | 103.6 | 105.5 | 102.2 | 94.1 | 90.1 |
| DE | 1,098.1 | 1,116.4 | 1,138.1 | 1,229.1 | 1,287.5 | 1,311.4 | 1,226.3 | 1,279.7 | 1,248.4 | 1,250.8 |
| DK | 86.7 | 104.0 | 132.0 | 149.6 | 166.1 | 177.7 | 186.3 | 188.4 | 189.7 | 189.0 |
| EE | 1.1 | 1.6 | 2.6 | 2.9 | 3.9 | 5.2 | 6.3 | 7.3 | 5.8 | 5.6 |
| ES | 531.7 | 582.6 | 623.7 | 661.8 | 654.0 | 588.9 | 555.6 | 484.1 | 492.6 | 460.9 |
| FI | 130.5 | 134.4 | 144.4 | 163.8 | 184.2 | 188.7 | 198.9 | 207.4 | 214.7 | 222.3 |
| FR | 789.7 | 749.4 | 667.7 | 738.0 | 655.7 | 684.7 | 520.9 | 500.4 | 467.7 | 465.3 |
| GR | 38.1 | 36.4 | 50.7 | 42.2 | 34.1 | 31.2 | 34.6 | 37.9 | 33.8 | 32.7 |
| HR | 0.0 | 0.0 | 18.7 | 18.8 | 20.1 | 21.2 | 20.6 | 11.9 | 6.5 | 1.1 |
| HU | 23.1 | 18.8 | 22.3 | 25.1 | 19.7 | 14.3 | 21.0 | 42.7 | 16.6 | 21.4 |
| IE | 46.7 | 70.4 | 81.4 | 95.8 | 104.7 | 108.6 | 111.2 | 114.2 | 123.1 | 133.6 |
| IT | 747.4 | 687.5 | 638.9 | 638.6 | 571.6 | 511.8 | 471.9 | 423.1 | 409.4 | 392.8 |
| LT | 1.6 | 3.6 | 4.4 | 4.9 | 4.8 | 5.9 | 6.5 | 7.0 | 7.4 | 7.5 |
| LU | 5.8 | 8.0 | 10.1 | 11.3 | 14.6 | 16.6 | 19.2 | 23.0 | 23.7 | 0.0 |
| LV | 2.4 | 2.8 | 2.8 | 1.5 | 1.1 | 1.1 | 1.5 | 1.9 | 2.1 | 2.2 |
| MT | 0.0 | 0.1 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 | 0.0 | 0.0 | 0.0 |
| NL | 364.3 | 365.6 | 369.5 | 395.2 | 384.9 | 396.8 | 359.4 | 365.8 | 372.5 | 394.3 |
| PL | 44.1 | 53.0 | 61.0 | 0.0 | 0.0 | 0.0 | 48.9 | 53.0 | 58.7 | 43.4 |
| PT | 51.6 | 46.9 | 32.8 | 37.4 | 33.1 | 29.6 | 28.9 | 30.0 | 30.2 | 34.5 |
| RO | 16.5 | 27.4 | 32.8 | 21.2 | 17.3 | 18.8 | 14.6 | 19.0 | 18.4 | 23.3 |
| SE | 297.0 | 311.1 | 333.6 | 340.7 | 399.2 | 425.0 | 486.6 | 519.1 | 520.1 | 520.8 |
| SI | 11.7 | 11.9 | 13.7 | 20.2 | 18.5 | 20.3 | 18.6 | 17.0 | 15.6 | 14.3 |
| SK | 9.8 | 7.7 | 10.0 | 10.1 | 8.3 | 8.0 | 11.7 | 9.7 | 10.3 | 9.9 |
| UK | 782.7 | 816.8 | 705.2 | 658.0 | 680.5 | 698.2 | 766.0 | 852.9 | 908.6 | 1,025.7 |
| EU28 | 5,320.0 | 5,509.3 | 5,695.2 | 5,957.5 | 6,035.3 | 6,180.2 | 5,943.3 | 6,110.3 | 6,171.6 | 6,256.8 |

Table 38 (cont.): Sensitivity of the ICT GBARD estimation to methodological issues**d) New methodology except for smoothing of ICT shares (linear smoothing)**

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| AT | 151.4 | 151.2 | 160.7 | 169.6 | 166.7 | 164.3 | 159.8 | 164.1 | 161.2 | 152.5 |
| BE | 149.1 | 158.0 | 192.4 | 207.4 | 223.3 | 223.2 | 240.3 | 243.9 | 268.8 | 250.3 |
| BG | 3.2 | 3.7 | 4.3 | 3.1 | 3.6 | 4.1 | 4.6 | 4.4 | 4.3 | 5.7 |
| CY | 1.1 | 2.4 | 3.7 | 5.7 | 7.2 | 8.9 | 8.9 | 8.8 | 10.2 | 10.9 |
| CZ | 55.0 | 64.9 | 72.4 | 78.0 | 86.2 | 102.7 | 94.5 | 103.7 | 90.8 | 85.7 |
| DE | 1,049.3 | 1,095.0 | 1,146.0 | 1,263.7 | 1,344.1 | 1,410.0 | 1,395.0 | 1,431.1 | 1,399.8 | 1,427.5 |
| DK | 83.2 | 98.0 | 121.3 | 134.2 | 149.3 | 157.2 | 163.6 | 168.1 | 167.9 | 166.5 |
| EE | 1.1 | 1.6 | 2.7 | 2.8 | 3.7 | 5.1 | 6.0 | 7.5 | 6.5 | 6.5 |
| ES | 539.5 | 559.3 | 582.9 | 626.7 | 591.3 | 510.3 | 447.0 | 404.7 | 414.0 | 371.4 |
| FI | 121.3 | 128.3 | 140.3 | 161.7 | 180.8 | 183.1 | 208.3 | 212.3 | 221.3 | 231.1 |
| FR | 733.2 | 728.0 | 727.4 | 839.4 | 788.5 | 864.0 | 738.0 | 707.1 | 697.4 | 701.9 |
| GR | 34.1 | 33.4 | 52.4 | 45.0 | 36.7 | 33.8 | 38.0 | 45.1 | 39.5 | 39.5 |
| HR | 0.0 | 0.0 | 7.7 | 8.1 | 9.2 | 10.3 | 9.7 | 8.5 | 8.9 | 12.4 |
| HU | 20.6 | 17.8 | 23.4 | 26.8 | 24.1 | 21.7 | 29.6 | 55.5 | 25.7 | 30.3 |
| IE | 44.1 | 65.7 | 75.8 | 89.9 | 96.8 | 100.7 | 108.2 | 109.5 | 118.0 | 127.7 |
| IT | 548.5 | 552.8 | 541.2 | 563.9 | 532.9 | 528.3 | 526.8 | 494.7 | 482.9 | 484.8 |
| LT | 2.0 | 3.7 | 4.0 | 4.0 | 3.3 | 3.7 | 3.9 | 4.0 | 4.2 | 4.4 |
| LU | 5.6 | 7.5 | 9.3 | 10.1 | 13.2 | 13.4 | 15.6 | 18.9 | 19.3 | 0.0 |
| LV | 2.3 | 2.9 | 3.1 | 1.9 | 1.5 | 1.5 | 1.5 | 1.6 | 2.1 | 2.2 |
| MT | 0.0 | 0.0 | 0.1 | 0.1 | 0.0 | 0.1 | 0.1 | 0.0 | 0.0 | 0.1 |
| NL | 347.0 | 361.0 | 378.5 | 420.0 | 426.1 | 446.9 | 423.4 | 441.3 | 450.5 | 482.3 |
| PL | 37.7 | 47.2 | 56.3 | 0.0 | 0.0 | 0.0 | 51.0 | 54.0 | 58.2 | 42.6 |
| PT | 39.0 | 39.4 | 34.0 | 45.4 | 47.9 | 46.7 | 49.1 | 52.6 | 60.3 | 66.3 |
| RO | 14.2 | 22.7 | 27.9 | 18.1 | 15.0 | 16.0 | 12.9 | 16.2 | 15.6 | 21.7 |
| SE | 301.3 | 309.0 | 322.2 | 325.0 | 373.5 | 391.1 | 437.2 | 464.1 | 465.0 | 464.2 |
| SI | 11.7 | 11.2 | 11.9 | 15.9 | 14.2 | 14.9 | 13.2 | 11.2 | 9.9 | 9.3 |
| SK | 9.8 | 7.8 | 10.3 | 11.7 | 11.1 | 11.5 | 11.3 | 8.9 | 9.1 | 9.6 |
| UK | 797.5 | 822.1 | 701.9 | 638.9 | 655.9 | 656.0 | 701.1 | 761.0 | 822.1 | 928.2 |
| EU28 | 5,051.8 | 5,304.8 | 5,578.5 | 5,907.0 | 6,021.1 | 6,202.9 | 6,083.4 | 6,240.0 | 6,312.8 | 6,424.4 |

Table 38 (cont.): Sensitivity of the ICT GBARD estimation to methodological issues**e) PREDICT 2017 data. New methodology including the double exponential smoothing of the ICT shares**

| | 2006 | 2007 | 2008 | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 |
|-------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|----------------|
| AT | 127.7 | 138.5 | 157.8 | 175.9 | 184.6 | 194.1 | 201.1 | 215.9 | 226.7 | 231.2 |
| BE | 154.8 | 157.0 | 192.4 | 201.2 | 219.8 | 222.9 | 240.2 | 238.3 | 266.2 | 243.9 |
| BG | 4.3 | 4.8 | 5.4 | 4.7 | 4.9 | 5.4 | 6.4 | 6.4 | 6.5 | 7.9 |
| CY | 5.4 | 8.2 | 8.4 | 9.5 | 10.2 | 11.7 | 11.8 | 12.1 | 14.8 | 15.5 |
| CZ | 58.2 | 68.0 | 74.3 | 79.0 | 85.8 | 104.4 | 99.6 | 107.7 | 92.0 | 87.9 |
| DE | 1,093.8 | 1,149.9 | 1,186.2 | 1,249.9 | 1,391.3 | 1,417.1 | 1,396.8 | 1,450.8 | 1,455.6 | 1,498.4 |
| DK | 89.0 | 104.5 | 128.4 | 139.9 | 154.8 | 159.7 | 162.8 | 160.8 | 155.7 | 152.8 |
| EE | 2.7 | 3.2 | 4.5 | 4.4 | 5.0 | 7.0 | 9.2 | 10.8 | 9.5 | 8.9 |
| ES | 512.5 | 550.5 | 578.3 | 616.7 | 598.5 | 536.9 | 479.0 | 436.7 | 460.9 | 419.3 |
| FI | 146.9 | 135.1 | 135.1 | 143.2 | 160.0 | 169.8 | 211.5 | 212.8 | 227.1 | 234.4 |
| FR | 803.9 | 785.6 | 755.5 | 844.0 | 783.7 | 847.4 | 698.1 | 674.4 | 665.0 | 689.0 |
| GR | 37.3 | 36.4 | 61.6 | 50.9 | 42.2 | 38.9 | 45.3 | 54.9 | 49.6 | 49.2 |
| HR | 0.0 | 0.0 | 22.2 | 21.9 | 24.1 | 25.9 | 25.2 | 21.8 | 22.3 | 29.9 |
| HU | 22.5 | 19.4 | 19.5 | 26.1 | 22.7 | 14.1 | 19.3 | 48.9 | 24.0 | 34.3 |
| IE | 47.9 | 49.6 | 47.9 | 70.9 | 87.3 | 90.5 | 111.5 | 119.9 | 109.9 | 114.1 |
| IT | 615.7 | 629.9 | 622.8 | 641.1 | 604.8 | 595.1 | 594.9 | 562.4 | 552.6 | 550.1 |
| LT | 2.7 | 4.5 | 4.6 | 4.5 | 3.7 | 4.2 | 4.4 | 4.7 | 5.0 | 5.2 |
| LU | 6.6 | 9.2 | 11.1 | 11.7 | 15.8 | 16.9 | 20.7 | 25.1 | 26.0 | 0.0 |
| LV | 5.0 | 6.0 | 6.3 | 3.7 | 2.9 | 3.4 | 3.1 | 3.1 | 4.4 | 4.6 |
| MT | 0.0 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 | 0.1 |
| NL | 379.1 | 380.9 | 387.4 | 415.7 | 412.2 | 422.3 | 392.6 | 405.1 | 410.7 | 434.9 |
| PL | 47.3 | 58.5 | 67.2 | 0.0 | 0.0 | 0.0 | 54.8 | 59.2 | 67.7 | 55.5 |
| PT | 50.3 | 52.5 | 43.7 | 57.5 | 56.7 | 49.9 | 47.9 | 52.3 | 69.6 | 83.2 |
| RO | 17.5 | 28.5 | 35.1 | 22.5 | 18.4 | 19.1 | 14.8 | 19.4 | 19.1 | 25.9 |
| SE | 300.6 | 311.2 | 324.5 | 324.4 | 371.8 | 390.7 | 442.0 | 470.0 | 466.4 | 458.4 |
| SI | 13.4 | 12.9 | 13.4 | 17.7 | 15.6 | 16.4 | 14.2 | 11.9 | 10.7 | 10.1 |
| SK | 10.0 | 8.3 | 12.2 | 12.4 | 11.2 | 12.7 | 13.5 | 10.2 | 10.0 | 10.1 |
| UK | 824.2 | 821.5 | 697.0 | 632.3 | 634.1 | 648.6 | 709.0 | 769.0 | 819.9 | 915.4 |
| EU28 | 5,151.0 | 5,354.9 | 5,594.9 | 5,825.3 | 5,910.8 | 6,124.7 | 6,015.4 | 6,162.0 | 6,231.0 | 6,312.5 |

Table 39 Summary of the impacts of elements of the new methodology on ICT GBARD. European Union, 2014

| | Percentage variation | | |
|---|--------------------------|-------------------|-------------------|
| | Million of current euros | % of PREDICT 2016 | % of PREDICT 2017 |
| Table 38a (Predict 2016): Stančik's (2012) methodology | 6,345.6 | 0.0 | 1.8 |
| Table 38b: Stančik's (2012) methodology with the new data available in 2017, and the new taxonomies of education levels and ICT occupations | 6,006.6 | -5.3 | -3.6 |
| Table 38c: Stančik's (2012) methodology with the new data available in 2017, new taxonomies of education levels and ICT occupations, and including the new NABS-NACE correspondence | 6,171.6 | -2.7 | -1.0 |
| Table 38d: New methodology except for the linear smoothing | 6,312.8 | -0.5 | 1.3 |
| Table 38e: Predict 2017 methodology | 6,231.0 | -1.8 | 0.0 |

5.3 Main Methodological Issues

This document presents the methodology followed for the first time in PREDICT 2017 to estimate the R&D public sector transfers by NACE industries and the part that corresponds to ICT assets. The methodology is based on GBARD data, which account for the sums governments commit to fund other industries' R&D. The methodology closely follows Stančík (2012), which was the method used in past editions of PREDICT.

The new methodology relies on 1) the disaggregation of Eurostat's GBARD published by NABS chapters into NACE industries using a correspondence between the NACE and NABS classifications, and 2) the appropriate weights to split different GBARD by NABS into the corresponding NACE industries. Stančík's (2012) NABS-NACE correspondence is revised, and a new correspondence is proposed. In relation to the weights, we assume that the distribution of government R&D expenditures by industries is similar to the distribution of labour costs of the most qualified employees. Therefore, the data used are for hours worked (LFS) and average salaries (SES) for employees by educational levels.

After breaking down GBARD by NACE industries, the public funding of R&D devoted to ICT assets is calculated assuming that the percentage of ICT R&D assets in each industry is proportional to the share of labour costs of employees with higher education working in ICT occupations over total labour costs of employees with higher education.

Some additional improvements to Stančík (2012) have already been implemented: 1) Eurostat's missing NABS chapters in some countries/years were estimated; 2) Eurostat's new taxonomy on ICT specialists was used to define the ICT occupations; 3) the ISCED codes for higher educated employees were revised; and 4) the smoothing procedure was changed from linear smoothing to double exponential smoothing.

Overall, the new methodology results in a reduction of 1.8% in the ICT GBARD for the year 2014 with respect to PREDICT 2016. This reduction is the combined effect of the negative and positive contribution of some of the methodological improvements in the methodology.

Annex I: The Collection of Data

Variables of R&D, BERD, and Gross R&D expenditure

The European Union and the Member States

Sources

Statistics on Research and Development (SRD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_berdindr2&lang=en
Downloaded: 15-11-2017
(R&D expenditure at national and regional level. Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 2))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_berdind&lang=en
Downloaded: 18-09-2015
(R&D expenditure at national and regional level. Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 1.1))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_gerdtot&lang=en
Downloaded: 15-11-2017
(Total intramural R&D expenditure (GERD) by sectors of performance)

STructuralANalysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV4
Downloaded: 15-11-2017
(STAN R&D expenditures by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD2011_REV3
Downloaded: 18-09-2015
(STAN R&D expenditures by industry (ISIC Rev. 3.1))

Statistics on Research and Development (SRD) from National Statistical Institutes

- http://pub.stat.ee/px-web.2001/I_Databas/Economy/28SCIENCE_TECHNOLOGY_INNOVATION/28SCIENCE_TECHNOLOGY_INNOVATION.asp
Downloaded: 15-10-2016
(R&D in business enterprise sector in Estonia)
- <http://www.statbank.dk/statbank5a/default.asp?w=1280>
Downloaded: 15-10-2016
(Research and development Statistics in Denmark)
- <http://www.scb.se/en/Finding-statistics/Statistics-by-subject-area/Education-and-research/Research/Research-and-development-in-the-business-enterprise-sector/>
Downloaded: 27-09-2017
(Research and development in Sweden)
- <http://statdat.statistics.sk/>
Downloaded: 15-10-2016
(Expenditures on research and development in Slovakia)
- <http://www.ine.es/jaxi/menu.do?type=pcaxis&path=%2Ft14%2Fp057&file=inebase&L=0>
Downloaded: 15-10-2016
(Estadística de I+D. Sector Empresas. Resultados en I+D por rama de actividad)

Structural Business Statistics (SBS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_sca_r2&lang=en
Downloaded: 21-09-2017
(Annual enterprise statistics for special aggregates of activities)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_ind_r2&lang=en

Downloaded: 21-09-2017

(Annual detailed enterprise statistics for industry (B-E))

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_dt_r2&lang=en
Downloaded: 21-09-2017
(Annual detailed enterprise statistics for trade (G))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se_r2&lang=en
Downloaded: 21-09-2017
(Annual detailed enterprise statistics for services (H-N and S95))

Labour Force Survey (LFS) from Eurostat

- Specific request to 3-digits by highest level of education attained
Downloaded: 14-07-2017
(Employment by economic activity and level of education attained (NACE Rev. 2))
- Specific request to 3-digits by highest level of education attained
Downloaded: 1-06-2016
(Employment by economic activity and level of education attained (NACE Rev. 1.1))

Purchasing power parities (PPP) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

Remarks

The elaboration of the 2006-2015 BERD (and GERD) NACE Rev. 2 ICT and RS sectors database (in nominal euros and euros PPS) for the EU countries has been based on the information provided by Eurostat and OECD.

The main sources of Business Expenditure R&D data continue to be the Statistics on Research and Development (Eurostat) and STAN R&D expenditures (OECD). To distribute BERD data among ICT (and non-ICT) sectors, the methodology follows the latest OECD definition (table 1) using data provided by country and industry from Eurostat and OECD.

The majority of the gaps in BERD sectors have been filled following these steps:

- Using R&D data provided by National Statistical Institutes for Estonia, Denmark, Sweden, Slovakia and Spain.
- Using data provided by industry (NACE 1.1.) from Eurostat and the correspondence table between NACE Rev. 2 and NACE Rev. 1.1. This methodology is described in Mas, Robledo and Pérez (2012)²⁰.
- When a country has data for some years in Statistics on R&D, we keep either the trend of expenditure or the subsector weight over the years.
- Using the percentage structure of turnover: weight of sector 465 (Wholesale of information and communication equipment) in sector G (Wholesale and retail trade; repair of motor vehicles and motorcycles; for Finland, Germany, Greece, Ireland, Luxembourg, Netherlands and Sweden); distribution of the sector 26 (Manufacture of computer, electronic and optical products) to 3-digits (for Finland, Greece, Latvia, Luxembourg and Sweden); weight of sector 631 (Data processing, hosting and related activities; web portals) in sector 63 (Information service activities; for Belgium, Finland, Greece, Ireland, Lithuania, Luxembourg, Netherlands, Romania and Sweden).

²⁰ ICT Sector Definition Transition from NACE Rev. 1.1 to NACE Rev. 2: A Methodological Note. JRC Technical Reports (2012). <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=5919>. See in Annex II the correspondence tables for ICT sectors between from NACE Rev. 1.1 and NACE Rev. 2

- Using the United States' R&D/Employment ratio: the relation between this ratio of each NACE subsectors 611, 612, 613 and 619 with regard to sector 61 (Telecommunications) is applied to obtain the R&D/Employment ratio of European countries on these subsectors. The statistics of employment from the SBS (Eurostat) and this estimated R&D/Employment ratio are used to calculate the R&D data on subsectors for European countries. The percentage structure of this data is applied to the 61 sector data for each European country.
- Using the United States' BERD/Employment ratio: the relation between this ratio of sector 4791 (Retail sale via mail order houses or via Internet) with regard to sector G (45-47, Wholesale and retail trade, repair of motor vehicles and motorcycles) is applied to obtain the BERD/Employment ratio of European countries on sector 4791. The statistics of employment (see sources on employment section) and this estimated BERD/Employment ratio are used to calculate the BERD data on sector 4791 for European countries.
- Using the average weight of R&D expenditure in countries with sector 951 data (Repair of computers and communication equipment) in sector S-U (Other service activities; sample 17 countries; weight: 9,5% in 2011 and 9% in 2012, 2013 and 2014, 14% in 2015).

Greece and Luxembourg lack official data, therefore, we recommend taking the results with caution. The missing data has been estimated using some alternative methods such as NACE Rev. 1.1 data and the correspondence table between NACE Rev. 2 and NACE Rev. 1.1 or the percentage structure of turnover.

Data by industry for European Union is obtained as the sum of the member countries since official data is not available.

We obtain BERD dataset in PPS by using purchasing power parities from Eurostat. GERD data expressed in PPS are provided by Eurostat for each country, and EU data is calculated as the sum of the Member countries.

In order to offer a database as complete as possible, BERD NACE Rev. 2 database (in nominal euros and euros PPS) for the EU countries has been completed back to the year 2000 and, when it has been possible, even to 1995. This elaboration is based on the information provided by Research and Development (Statistics) and STAN R&D expenditures (OECD).

To complete the database, the following procedure was followed:

- OECD data (NACE Rev. 2) are used for all available years (2000 onwards) and required sectors.
- When option h) is not available for all or some of the sectors to be reported, information from BERD NACE Rev. 1.1 is used (Eurostat). Based on a common year between the information from BERD NACE Rev. 2 and BERD NACE Rev. 1.1, a relationship is established between these which makes it possible to estimate BERD (NACE Rev. 2) backwards.
- In the case of Denmark, France and the United Kingdom, countries that do not have information under option h) or option i) by sectors (see Data Quality Report), the link is established between the percentage structure of the NA Gross Fixed Capital Formation in R&D and the BERD NACE Rev. 2 of the R&D Survey. In this way, the percentage structure of BERD NACE Rev. 2 is estimated for those early years and is applied to total BERD for the entire period. Total BERD has been obtained applied option h) or i).

As has been done in all deliveries of the database, data by industry for European Union is obtained as the sum of the member countries since official data is not available.

Norway

Sources

Statistics on Research and Development (SRD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_berdindr2&lang=en
Downloaded: 23-11-2016
(R&D expenditure at national and regional level. Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 2))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_berdind&lang=en
Downloaded: 18-09-2015
(R&D expenditure at national and regional level. Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 1.1))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_gerdtot&lang=en
Downloaded: 7-12-2016
(Total intramural R&D expenditure (GERD) by sectors of performance)

STructuralANalysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV4
Downloaded: 28-11-2016
(STAN R&D expenditures by industry (ISIC Rev. 4))

Purchasing power parities (PPP) from Eurostat

1. http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 19-10-2016
(Purchasing power parities (PPP))

Remarks

The elaboration of the 2006-2014 BERD (and GERD) NACE Rev. 2 ICT and RS sector database (in nominal euros and euros PPS) for Norway has been based on the information provided by Eurostat.

The main source of Business Expenditure R&D data is Statistics on Research and Development (Eurostat). BERD data has been distributed among ICT, RS and additional sectors using data provided by industry from Eurostat. The majority of BERD sector gaps have been filled using data provided by industry (NACE Rev. 1.1.) from Eurostat and the correspondence table between NACE Rev. 2 and NACE Rev. 1.1. When data exists for some years in Statistics on R&D, we keep either the trend of expenditure or the subsector weight over the years to complete gaps.

We obtain BERD dataset in PPS using purchasing power parities coming from Eurostat. GERD data expressed in PPS are provided by Eurostat.

Norway data has been completed back to the year 2001. To achieve this, BERD NACE Rev. 1.1 has been used following the methodology described in point i).

Switzerland

Sources

Statistics on Research and Development (SRD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_berdindr2&lang=en
Downloaded: 23-11-2016
(R&D expenditure at national and regional level. Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 2))

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_berdind&lang=en
Downloaded: 18-09-2015
(R&D expenditure at national and regional level. Business enterprise R&D expenditure (BERD) by economic activity (NACE Rev. 1.1))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_e_gerdtot&lang=en
Downloaded: 7-12-2016
(Total intramural R&D expenditure (GERD) by sectors of performance)

STructuralANalysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV4
Downloaded: 28-11-2016
(STAN R&D expenditures by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD2011_REV3
Downloaded: 18-09-2015
(STAN R&D expenditures by industry (ISIC Rev. 3.1))

Purchasing power parities (PPP) from Eurostat

2. http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 19-10-2016
(Purchasing power parities (PPP))

Remarks

The elaboration of the 2006-2014 BERD (and GERD) NACE Rev. 2 ICT and RS sectors database (in nominal euros and euros PPS) for Switzerland has been based on the information provided by Eurostat and OECD.

The main sources of Business Expenditure R&D data are Statistics on Research and Development (Eurostat) and STAN R&D expenditures (OECD). BERD data has been distributed among the selected sectors using data provided by country and industry from Eurostat and OECD.

Statistics on R&D in Switzerland (*Rechercheetdéveloppement (R-D) dans les entreprises*) are conducted every four years. Only two years are available: 2008 and 2012. The majority of the gaps in BERD sectors have been filled using data provided by industry (NACE Rev. 1.1.) from Eurostat and the correspondence table between NACE Rev. 2 and NACE Rev. 1.1.

We obtain BERD dataset in PPS using purchasing power parities coming from Eurostat. GERD data expressed in PPS are provided by Eurostat.

Australia

Sources

Research and Experimental Development, Businesses from Australian Bureau of Statistics (ABS)

- <http://www.abs.gov.au/ausstats/abs@.nsf/0/17EF02A5029649E2CA257F990030EDFE?OpenDocument>
Downloaded: 25-10-2017
(Gross Expenditure on R&D and Business expenditure on R&D)

Research and Experimental Development, Higher Education Organisations, Australia

- <http://www.abs.gov.au/ausstats/abs@.nsf/PrimaryMainFeatures/8111.0?OpenDocument>
Downloaded: 25-10-2017
(Higher education expenditure on R&D)

Research and Experimental Development, Government and Private Non-Profit Organisations, Australia

- <http://www.abs.gov.au/ausstats/abs@.nsf/PrimaryMainFeatures/8109.0?OpenDocument>
Downloaded: 25-10-2017
(Government expenditure on R&D and Private non-profit expenditure on R&D)

STructural ANalysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV4
Downloaded: 25-10-2017
(STAN R&D expenditures by industry (ISIC Rev. 4))

STructural ANalysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD2011_REV3
Downloaded: 14-10-2016
(STAN R&D expenditures by industry (ISIC Rev. 3.1))

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS
Downloaded: 27-10-2017
(Gross Expenditure on R&D)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGBP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of the BERD database for Australia has been mainly based on the information provided by OECD, as it has already published NACE Rev. 2 data (ISIC Rev. 4).

For industries not disaggregated in the OECD database, the information provided by Australian Bureau of Statistics (ABS) in the publication "Research and Experimental Development, Businesses" has been used, with the correspondence tables between ANZIC 2006 and NACE Rev. 2²¹. In the case of some industries, also the information from STAN ISIC Rev. 3 database has been used in order to estimate the period between 1995 and 2004.

There is no available information on 2012 and 2014 BERD and GERD for Australia, as the frequency of the "Survey of Research and Experimental Development (R&D), Businesses" has changed from annual to biennial, and 2012 is the first year without data. This is the reason why, in the case of 2012 and 2014, the ABS statistics on Government and private non-profit and higher education R&D expenditure have been used as a basis to estimate BERD and GERD evolution, combined with the information of 2013 and 2015. This national information has been completed with the OECD databases on R&D variables. In order to obtain the required sectoral disaggregation, structures and average growth rates from previous and next years have been used. The 2015 figures are not available either in the OECD database. However, the Australian Bureau of Statistics has already published

²¹ <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1292.0.55.0052008?OpenDocument>. Also, the Ivie has elaborated correspondence tables for ICT sectors between NACE Rev. 2 and ANZIC 2006 (see Annex II).

this information. Thus, data for 2015 come directly from the national statistical source "Research and Experimental Development, Businesses".

For the period 1995-2004, the available information is more limited, as national R&D surveys only offer information by industries at two-digit level (following ANZSIC 1993²²). Because of that, some industries have been estimated applying the growth rates of a more aggregated sector in the statistic. In addition, total BERD does not include NACE Rev. 2 sector 01-03 (Agriculture, forestry and fishing) for the period 1995-2004, as this sector was not included in Australian R&D Surveys for those years, nor does OECD publish this sector's figures previous to 2005.

ICT sector NACE 261 (Manufacture of electronic components and boards) includes ICT sector NACE 264 (Manufacture of consumer electronics) and 268 (Manufacture of magnetic and optical media) in Australia, as there is not enough information to separate these sectors. ICT subsector 612 (Wireless telecommunications activities) includes ICT subsector NACE 613 (Satellite telecommunications activities), as these two industries are defined as a single industry in ANSZIC. In addition, NACE 4791 (Retail sale via mail order houses or via Internet) includes *Other retail sale not in stores, stalls or markets* (NACE class 4799), as there is not enough information to separate these activities.

ICT and MC sector database does not include information at 4-digit NACE level in the case of Australia, except for sector 61 (Telecommunications), 59 (Motion picture, video and television programme production, sound recording and music publishing activities) and 581 (Publishing of books, periodicals and other publishing activities), but only for some of the most recent years.

We obtain BERD in euros and PPS using exchange rates and purchasing power parities coming from OECD and Eurostat.

Brazil

Sources

PINTEC, Survey of Technological Innovation from Instituto Brasileiro de Geografia e Estatística (IBGE)

- <http://www.ibge.gov.br/home/estatistica/economia/industria/pintec/2011/default.shtm>
Downloaded: 14-10-2016

Science, Technology and Innovation Data from UNESCO Institute for Statistics (UIS)

- <http://data.uis.unesco.org/Index.aspx?queryid=115>
Downloaded: 03-11-2017

Annual Survey of Industry from IBGE

- <http://www.ibge.gov.br/home/estatistica/economia/industria/pia/empresas/2014/defaulttempresa.shtm>
- Downloaded: 17-10-2016

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)

²² The correspondence between ANZSIC 2006 and ANZSIC 1993 is available at: [http://www.abs.gov.au/ausstats/abs@.nsf/second+level+view?ReadForm&prodno=1292.0&viewtitle=Australian%20and%20New%20Zealand%20Standard%20Industrial%20Classification%20\(ANZSIC\)~2006%20\(Revision%202.0\)~Latest~26/06/2013&&tabname=Related%20Products&prodno=1292.0&issue=2006%20\(Revision%202.0\)&num=&view=&](http://www.abs.gov.au/ausstats/abs@.nsf/second+level+view?ReadForm&prodno=1292.0&viewtitle=Australian%20and%20New%20Zealand%20Standard%20Industrial%20Classification%20(ANZSIC)~2006%20(Revision%202.0)~Latest~26/06/2013&&tabname=Related%20Products&prodno=1292.0&issue=2006%20(Revision%202.0)&num=&view=&)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of the BERD database for Brazil has been based on the information provided by IBGE in the Survey of Technological Innovation (PINTEC). We have used PINTEC data by industry and correspondences between CNAE 2/CNAE 1 and NACE Rev. 2 to distribute R&D expenditure among ICT, RS and selected non-ICT sectors²³. However, PINTEC survey is only available for 2000, 2003, 2005, 2008 and 2011, as it is only conducted every two/three years.

Gross value of industrial production from Industrial Survey (IBGE) has been also used, in order to distribute the R&D expenditures between ICT Sector NACE 263 (Manufacture of communication equipment), 264 (Manufacture of consumer electronics) and 268 (Manufacture of magnetic and optical media). It has also been used to estimate NACE 303 (Manufacture of air and spacecraft and related machinery).

ICT sector NACE 62 (Computer programming, consultancy and related activities) includes ICT sector NACE 582 (Software publishing). In addition, for Brazil there is no information for the MC sector (NACE 581, 59, 60 and 639), the ICT trade sector (NACE 465) and for one ICT services sector: 951 (Repair of computers and communication equipment). Also, there is no available information on BERD at 4-digits NACE and ICT services sector's data is only available for 2008 onwards. PINTEC 2000 and 2003 do not include information on services sectors.

Moreover, Brazil's dataset does not contain information for RS sector (NACE 4791) and macro-sectors NACE 45 (Wholesale and retail trade and repair of motor vehicles and motorcycles), 85 (Education) and the aggregations 49-99 (Services, except trade), 45-47 (Wholesale and retail trade, repair of motor vehicles and motorcycles), 49-53 (Transportation and storage), 58-63 (Information and communication), 64-66 (Financial and insurance activities), 69-82 (Professional, scientific, technical, administration and support service activities), 69-75 (Professional, scientific and technical activities) and 86-88 (Human health and social work activities).

Data for GERD come from UNESCO-UIS database, although information for 2015 is not yet available.

We obtain BERD in euros and PPS using exchange rates and purchasing power parities coming from OECD and Eurostat.

Canada

Sources

Science and Technology Indicators from Statistics Canada

- http://www.statcan.gc.ca/eng/subjects/science_and_technology/research_and_development#data

²³ The correspondence between CNAE 2 and ISIC Rev. 4 is available at: <http://www.ibge.gov.br/home/estatistica/economia/classificacoes/cnae2.0/defaulttab.shtm>. Ivie has also elaborated a correspondence table for ICT, MC and RS sectors between NACE Rev. 2 and CNAE 2 (see Annex II).

Downloaded: 01-12-2017 and 26-10-2016

NA from Statistics Canada

- <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=3840038&tabMode=dataTable&srchLan=-1&p1=-1&p2=9>
- <http://www5.statcan.gc.ca/cansim/a33?RT=TABLE&themeID=2745&spMode=tables&lang=eng>

Downloaded: 08-11-2017

Annual Wholesale Trade Survey from Statistics Canada

- <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0810014&paSer=&pattern=&stByVal=1&p1=1&p2=38&tabMode=dataTable&csid=>

Downloaded: 26-07-2017

Annual Non-Store Retail Survey

- <http://www5.statcan.gc.ca/subject-sujet/subtheme-soustheme.action?pid=60000&id=60001&lang=eng&more=0>

Downloaded: 03-03-2016

STructural ANalysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV4

Downloaded: 30-11-2017

(R&D expenditures by industry (ISIC Rev. 4))

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDUSTRY

Downloaded: 30-11-2017

(R&D expenditures by industry (ISIC Rev. 3.1 and ISIC Rev. 4))

- http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS

Downloaded: 01-12-2017

(Gross expenditure on R&D)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en

Downloaded: 16-11-2017

(Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en

Downloaded: 16-11-2017

(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>

Downloaded: 16-11-2017

(PPPs: national currency per US dollar)

Remarks

The elaboration of the database for Canada has been based on the information provided by OECD as it publishes ISIC Rev. 4 data for this country. The R&D expenditures have been distributed among ICT, MC, RS and the other selected sectors, using the correspondence tables between ISIC Rev. 4 and NACE Rev. 2. OECD does not offer 2015 information for Canada and the national R&D survey has suffered a methodological and conceptual revision from 2014 onwards. Due to this, taking OECD as reference, the information on BERD for 2015 has been estimated based on the last publication from the national survey following the old methodology (which offers forecast data for 2015 and

preview data for 2016). However, information for the following year will probably need to be updated in order to adjust the database to the new methodology.

In addition to 2015, for other years it has been necessary to use additional information to estimate specific sectors. In these cases, information provided by Statistics Canada in its key socioeconomic database CANSIM, Science and Technology Indicators has been used. R&D expenditures have been distributed among sectors using the correspondence tables between NAICS and ISIC Rev. 4²⁴.

In the case of some sectors, additional sources and variables need to be used:

- Total Operating Revenue from Annual Retail Non-Store Survey (Statistics Canada) has been used to estimate sector NACE 4791 (Retail sale via mail order houses or via Internet).
- Gross Domestic Product from National Accounts (Statistics Canada) has been used, especially in the initial years of the database, to estimate ICT sectors NACE 61 (Telecommunications) and NACE 631 (Data processing, hosting and related activities; web portals), and the NACE sections M-N (Professional, scientific, technical, administration and support service activities) and M (Professional and scientific activities).
- BERD/employment ratios have been used to estimate the disaggregation of NACE sector 61, applying the ratios' structures of the US, as in the case of the European countries (see section 1.1.1).

Canada dataset does not contain information for one ICT services sector (951, Repair of computers and communication equipment). Also, ICT sectors at 4-digits are not available, as no information is published at that level of detail. The same happens in the case of MC sector, in which only sectors at two/three digits are available.

We obtain BERD in euros and PPS using exchange rates and purchasing power parities from OECD and Eurostat.

China

Sources

China Statistical Yearbook on Science and Technology from National Bureau of Statistics of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 10-11-2017

The Second R&D Resources Inventory Survey Compilation 2009 from National Bureau of Statistics of China

- Information provided by Gao Changlin, Li Xiuquan and Xuan Zhaohui, from Chinese Academy of Science and Technology for Development (CASTED)

China National Expenditures on Science and Technology Statistics from National Bureau of Statistics of China

- <http://data.stats.gov.cn/english/>
Downloaded: 10-11-2017

Statistics on Education, Science and Technology in High-tech Industry by Industrial Sector from China Statistical Yearbook, compiled by National Bureau of Statistics of China

²⁴ The correspondence between NAICS and ISIC Rev. 4 is available at: <http://www.statcan.gc.ca/concepts/concordances-classifications-eng.htm>. Ivie has also elaborated a correspondence table for ICT, MC and RS sectors between NACE Rev. 2 and NAICS (see Annex II).

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 10-11-2017

Structural Analysis Database (STAN) from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=STANI4>
Downloaded: 10-11-2017
(STAN R&D expenditures by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD2011_REV3
Downloaded: 14-10-2016
(STAN R&D expenditures by industry (ISIC Rev. 3.1.))

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS
Downloaded: 10-11-2017
(Gross expenditure on R&D)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGBP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of BERD and GERD database for China has been based on the information provided by OECD as it has already published ISIC Rev. 4 data. However, data are only available for the years 2000 and 2008-2015. In addition, the disaggregation of services sectors is only available for one year: 2009.

Taking all these restrictions into account, when possible the R&D expenditures have been distributed among ICT, MC, and the other selected sectors, using the correspondence tables between ISIC Rev. 4 and NACE Rev. 2.

In some years it has been necessary to use additional information to estimate specific sectors, especially in the case of services. In these cases, information provided by the National Bureau of Statistics of China in The Second R&D Resources Inventory Survey Compilation, China Statistical Yearbook, China Statistical Yearbook on Science and Technology and National Expenditures on Science and Technology Statistics has been used. However, the correspondence between NACE Rev. 2 and China classification of activities is approximate, as it is based on the correspondences between Chinese industry classification and ISIC Rev. 3 (NACE Rev. 1.1)²⁵. Information of Korea's BERD structure has also been used to split some services industries (NACE sectors 58, Publishing activities, 59-60, Motion picture, video, television programme production; programming and broadcasting activities, and 63, Information service activities). Therefore, we recommend taking the results with caution. When necessary, R&D expenditure has also been distributed among sectors, using structures from next/previous years.

²⁵ The correspondence between Chinese SIC and ISIC Rev. 3 is available at: http://www.stats.gov.cn/tjbz/t20040210_402369833.htm

China dataset does not contain information for ICT trade sector, ICT sectors 268 (Manufacture of magnetic and optical media) and 951 (Repair of computers and communication equipment) and Retail sale via mail order houses or via Internet sector (NACE 4791). Also, the disaggregation at 3-4-digits of ICT sectors 261, 582, 61, 62 and 631 is not available, as there is no information with such industry detail. The same happens with MC sectors at 3-4 digits. Data are only available for the period 2000-2015, but for some ICT and the MC sectors the initial year is 2006.

We obtain BERD in euros and PPS using exchange rates and purchasing power parities coming from OECD and Eurostat.

India

Sources

Research and Development Statistics from National Science and Technology Management Information System (NSTMIS), Department of Science and Technology, Government of India

- <http://www.nstmis-dst.org/Publication.aspx>
Downloaded: 20-10-2015

Annual Survey of Industries from MOSPI

- <https://data.gov.in/catalog/annual-survey-industries-1>
Downloaded: 17-10-2017

Science, Technology and Innovation Data from UNESCO Institute for Statistics (UIS)

- http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS
Downloaded: 03-11-2017

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of BERD and GERD database for India has been estimated using the information provided by the National Science and Technology Management Information System (NSTMIS) in the Research and Development Statistics and the R&D UIS database.

India dataset has been obtained using approximate correspondences between the classification of activities used in the Research and Development Statistics of India and NACE Rev. 1.1. Therefore, results for India must be taken with caution.

In order to distribute R&D expenditure between some manufacturing subsectors we have used the output structure from the Annual Survey of Industries (ASI).

Due to the scarce available information for services sectors, some assumptions need to be done in order to obtain an estimate of BERD figures. Because of that, in order to estimate ICT and MC services, and also some additional macro-sectors, the structure

from the most similar country in the sample according to BERD by industry (United Kingdom) has been used. In these cases, BERD intensities from this country have been re-adjusted to total BERD intensity of India and then applied to India's GVA data.

In addition, the sectoral distribution of 2011, 2012 and 2013 has been estimated by using information on previous years' structures, as the last national R&D survey in the case of India offers information by sector to 2010.

India dataset covers the years between 2002 and 2013 (also 2014 and 2015 for total GERD and BERD) and does not contain information for the ICT trade industries (NACE Rev. 2 465) and NACE sector 4791 (Retail sale via mail order houses or via Internet). Also, the disaggregation of ICT and MC subsectors at 3 or 4-digits is not available for this country.

We obtain BERD in euros and PPS using exchange rates and purchasing power parities coming from OECD and Eurostat.

Japan

Sources

Annual Survey of Research and Development from Japan's Ministry of Internal Affairs and Communication (MIC)

- <https://www.e-stat.go.jp/SG1/estat/GL02100104.do?gaid=GL02100102&toacd=00200543>
Downloaded: 16-11-2017

STructural ANalysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV4
Downloaded: 16-11-2017
(STAN R&D expenditures by industry (ISIC Rev. 4))

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDUSTRY
Downloaded: 16-11-2017
(R&D expenditures by industry (ISIC Rev. 3.1 and ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS
Downloaded: 16-11-2017
(Gross expenditure on R&D)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of BERD and GERD database for Japan has been based on the information provided by OECD as it has already published ISIC Rev. 4 data.

In some years it has been necessary to use additional information to estimate specific ICT subsectors, such as 261 (Manufacture of electronic components and boards), 264 (Manufacture of consumer electronics), 268 (Manufacture of magnetic and optical media) and 631 (Data processing, hosting and related activities; web portals). In order to estimate these ICT sectors, data from Japan's Annual Survey of Research and Development has been used, as this survey presents a higher sectoral disaggregation. The structure from this survey is applied to OECD aggregated data. The same procedure has been used to estimate some MC sectors, such as 59 (Motion picture, video and television programme production, sound recording and music publishing activities) and 60 (Programming and broadcasting activities).

In order to fill the blanks of the industries not included separately in Japan's Annual Survey of Research and Development, the percentage structure from the previous/next years has been applied.

Japan dataset does not contain information for sectors NACE 4791 (Retail sale via mail order houses or via Internet), 85 (Education), 86-88 (Human health and social work activities) and one ICT industry: 951 (Repair of computers and communication equipment). In addition, ICT sector 62 (Computer programming, consultancy and related activities) includes ICT sector 582 (Software publishing) and it is not possible to estimate the disaggregation of some ICT and MC sectors in 3-4-digits NACE, as there is not enough available information to do that.

We obtain BERD in euros and PPS using exchange rates and purchasing power parities from OECD and Eurostat.

Korea

Sources

Survey of Business activities from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsList_01List.jsp?vwcd=MT_ETITLE&parentId=K
Downloaded: 17-02-2014

STructural ANalysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV4
Downloaded: 14-11-2017
(STAN R&D expenditures by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD2011_REV3
Downloaded: 14-10-2016
(STAN R&D expenditures by industry (ISIC Rev. 3))

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDUSTRY_ISIC4
Downloaded: 14-11-2017
(Business R&D expenditure by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS
Downloaded: 14-11-2017
(Gross expenditure on R&D)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGBP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of the BERD and GERD database for Korea has been based on the information provided by OECD as it has already published ISIC Rev. 4 data (NACE Rev. 2). Also, information on R&D costs from Survey of Business activities from Statistics Korea was used when necessary. However, for the majority of 3-4 digits sectors (ICT and MC) there is no available information before 2004. Because of that, from this year backwards BERD figures have been estimated applying average growth rates of the following years or/and average percentage structures.

In addition, in order to obtain an estimation of RS sector (NACE 4791, Retail sale via mail order houses or via Internet), US BERD/employment ratios have been used to adjust data coming from OECD database. Thus, the results must be taken with caution.

Korea dataset does not contain information for the ICT trade sector (NACE 465) and the disaggregation at 3-4 digits of the ICT sectors 261, 582, 61, 62 and 951 and the MC sectors 581, 59, 60 and 639 is not available. In addition, there is no information for the NACE Rev. 2 sectors 69-82 (Professional, scientific, technical, administration and support service activities), 69-75 (Professional, scientific and technical activities), 85 (Education) and 86-88 (Human health and social work activities).

We obtain BERD in euros and PPS using exchange rates and purchasing power parities coming from OECD and Eurostat.

Russia

Sources

Russian Science and Technology at a Glance from Russian Centre for Science Research and Statistics (CSRS)

- <http://www.csrs.ru/english/statis/default.htm>
Downloaded: 10-07-2013

Russian Statistics of Science and Education: Costs and Sources of Financing Scientific Research and Development, from Russian Centre for Science Research and Statistics (CSRS)

- http://csrs.ru/archive/stat_2016_finance/
Downloaded: 28-11-2017

R&D data from Rosstat (Russian Federal State Statistics Service)

- Information provided by Galina Lyubova (Department of Foreign Statistics and International Cooperation from Rosstat)
- Online database:
http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/science_and_innovations/science/#
Downloaded: 09-12-2016
- Information provided by Valeriya Kosolapova (Department of Foreign Statistics and International Cooperation from Rosstat) in October 2017

SDBS Structural Business Statistics (ISIC Rev. 3) from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=SSIS_BSC#
Downloaded: 01-12-2016

(Turnover by industry (ISIC Rev. 3))

Structural Analysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD2011_REV3
Downloaded: 14-10-2016
(STAN R&D expenditures by industry (ISIC Rev. 3))

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS
Downloaded: 17-11-2017
(Total intramural R&D expenditure (GERD) by sectors of performance and source of funds)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGBP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of the BERD and GERD database for Russia has been based on the information by industry provided by ANBERD database (elaborated by the OECD). However, in the case of Russia this database still follows the industry classification ISIC Rev. 3.1. Thus, R&D expenditures have been distributed among ICT, MC, RS and the additional selected sectors, using approximate correspondences between ISIC Rev. 4 and ISIC Rev. 3.1 (see Appendix 1). In addition, this database does not offer information for the years 2010-2015. In order to complete these years and to estimate some sectors, information provided by the publication *Russian Science and Technology at a Glance* (CSRS) and by Rosstat in its online database. Also, information provided directly to the Ivie by Rosstat is used to estimate some ICT subsectors.

As national data also follows ISIC Rev. 3.1, these figures have been re-adjusted to OECD total or more aggregated business R&D figures. In addition, some assumptions need to be done in order to estimate some ICT and MC sectors. In these cases, different methods have been applied: estimates based on maintaining the sectoral structures from next/previous years, estimates based on average growth rates, etc. Also, additional information coming from OECD SDBS Structural Business Statistics has been used to split some problematic industries (especially in the case of MC subsectors). In these cases, turnover structure is used to split R&D expenditure figures.

Russia dataset does not contain information for sectors NACE 69-82 (Professional, scientific, technical, administration and support service activities) and 69-75 (Professional, scientific and technical activities) and ICT sectors 2611 (Manufacture of electronic components), 2612 (Manufacture of loaded electronic boards), 268 (Manufacture of magnetic and optical media), 4652 (Wholesale of electronic and telecommunications equipment and parts), 611 (Wired telecommunications activities), 612 (Wireless telecommunications activities), 613 (Satellite telecommunications activities), 619 (Other telecommunications activities) and 951 (Repair of computers and communication equipment) and its disaggregation at 4-digits NACE. In addition, sector 62 (Computer programming, consultancy and related activities) includes ICT sectors 582 (Software publishing) and 631 (Data processing, hosting and related activities; web

portals), which disaggregation at 4 digits are neither available nor MC subsectors at 3-4 digits.

Sector NACE 4791 (Retail sale via mail order houses or via Internet) is also not available in the case of Russia, as well as sector 64-66 (Financial and insurance activities) for 2015.

We obtain BERD in euros and PPS using exchange rates and purchasing power parities coming from OECD and Eurostat.

Taiwan

Sources

National Science and Technology Survey from Taiwan's Ministry of Science and Technology

- <https://ap0512.most.gov.tw/WAS2/English/AsTechnologyEStatisticsList.aspx>
Downloaded: 29-11-2017

Census Statistics from National Statistics of Taiwan

- <http://eng.stat.gov.tw/lp.asp?ctNode=1624&CtUnit=774&BaseDSD=7&mp=5>
Downloaded: 16-11-2016

Labour Force Statistics (Manpower Survey) from National Statistics, Directorate General of Budget, Accounting and Statistics (DGBAS) of Executive Yuan, Taiwan

- <http://statdb.dgbas.gov.tw/pxweb/dialog/statfile1L.asp>
Downloaded: 18-07-2017

Labour Force Statistics (Manpower Survey): Employed persons, by mid-category of industries and class of workers

1. Information provided by Teresa Chang (Directorate General of Budget, Accounting and Statistics (DGBAS) of Executive Yuan, Taiwan)

STructural ANalysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV4
Downloaded: 29-11-2017
(STAN R&D expenditures by industry (ISIC Rev. 4))

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDUSTRY_ISIC4
Downloaded: 29-11-2017
(R&D expenditures by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS
Downloaded: 29-11-2017
(Gross expenditure on R&D)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGBP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of BERD and GERD database for Taiwan has been based on the information by industry provided by OECD as it has already published ISIC Rev. 4 data. The R&D expenditures have been distributed among ICT, MC, RS and non-ICT selected sectors, using the correspondence table between ISIC Rev. 4 and NACE Rev. 2 (see Appendix 1). Also, information from the National Science and Technology Survey from Taiwan's Ministry of Science and Technology has been used to complete some industries not covered by the OECD dataset.

However, the information available in these two datasets does not cover the years 1995, 1996 and 1997. Thus, the figures corresponding to these years in PREDICT dataset have been estimated using average growth rates of the following years and/or sectoral structures from the next years.

In the case of RS sector (NACE 4791, Retail sale via mail order houses or via Internet), US BERD/employment ratios have been used to adjust Taiwan data, as in the case of the European countries (see section 1.1.1 for more details).

Taiwan dataset does not contain information for sector NACE 303 (Manufacture of air and spacecraft and related machinery) and NACE section P (Education) is only available since 2009. It also does not contain data for ICT subsectors 2611 (Manufacture of electronic components), 2612 (Manufacture of loaded electronic boards), 4651 (Wholesale of computers, computer peripheral equipment and software), 4652 (Wholesale of electronic and telecommunications equipment and parts), 5821 (Publishing of computer games), 5829 (Other software publishing), 611 (Wired telecommunications activities), 612 (Wireless telecommunications activities), 613 (Satellite telecommunications activities), 619 (Other telecommunications activities), 6201 (Computer programming activities), 6202 (Computer consultancy activities), 6203 (Computer facilities management activities), 6209 (Other information technology and computer service activities), 6311 (Data processing, hosting and related activities), 6312 (Web portals), 9511 (Repair of computers and peripheral equipment) and 9512 (Repair of communication equipment). The MC sub-sectors 5811 (Book publishing), 5812 (Publishing of directories and mailing lists), 5813 (Publishing of newspapers), 5814 (Publishing of journals and periodicals), 5819 (Other publishing activities), 591 (Motion picture, video and television programme activities) and its subsectors, 592 (Sound recording and music publishing activities), 601 (Radio broadcasting), 602 (Television programming and broadcasting activities), 6391 (News agency activities) and 6399 (Other information service activities n.e.c.).

We obtain BERD in euros and PPS using exchange rates and purchasing power parities coming from OECD and Eurostat.

United States

Sources

Business R&D and Innovation Survey (BRDIS) from National Science Foundation and United States Census Bureau

- <https://www.nsf.gov/statistics/srvyindustry/#tabs-2>
Downloaded: 24-11-2016
- Information provided by Raymond M. Wolfe (Economist & Senior Analyst of National Science Foundation 's National Center for Science and Engineering Statistics (NCSES))

Science and Engineering Indicators from National Science Foundation and United States Census Bureau

- <https://www.nsf.gov/statistics/2016/nsb20161/#/>
Downloaded: 24-11-2016

Survey of Industrial Research and Development (SIRD) from National Science Foundation

- <http://www.nsf.gov/statistics/industry/>
Downloaded: 22-11-2016

STructural Analysis Database (STAN) from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD_REV4
Downloaded: 24-10-2017
(STAN R&D expenditures by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=ANBERD2011_REV3
Downloaded: 14-10-2016
(STAN R&D expenditures by industry (ISIC Rev. 3))

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=GERD_FUNDS
Downloaded: 08-11-2017
(Gross expenditure on R&D)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of the BERD database for the United States has been based mainly on the information provided by OECD in the STAN database. As this source does not include information for US in 2015, data for this year come directly from Business R&D and Innovation Survey (BRDIS) (National Science Foundation and United States Census Bureau).

In order to complete the distribution by industry, information coming from Business R&D and Innovation Survey (BRDIS) and from the publication Science and Engineering Indicators (National Science Foundation and United States Census Bureau) has also been used, especially for the ICT subsectors, the RS sector and the MC sector/subsectors. The R&D expenditures have been distributed among ICT, RS, MC and selected macro-sectors, using the correspondence tables between NAICS and NACE Rev. 2²⁶. Additional correspondences need to be used in order to take into account the different revisions of the NAICS²⁷ (1997, 2002, 2007 and 2012) and also the previous classification, SIC (Standard Industrial Classification) 1987, which was used in the initial years of the database (1995 to 2007).

²⁶ The correspondences between different versions of US NAICS and ISIC Rev. 4 are available at <http://www.census.gov/eos/www/naics/concordances/concordances.html>. Ivie has also elaborated a correspondence table for ICT, MC and RS sectors (see Annex II)

²⁷ These correspondences are available at: <http://www.census.gov/eos/www/naics/concordances/concordances.html>.

2008 onwards BRDIS data offer a greater industrial disaggregation. For this reason these years' structure has been used to distribute R&D expenditures in other years, especially among certain ICT and MC subsectors. For the initial years (1995-1999), when no information about a particular sector/subsector is available, the growth rates of the closer "parent" aggregated sector has been applied. Then, these figures are re-adjusted to sum up official aggregates coming from STAN database or BRDIS.

United States dataset does not contain information for ICT trade industries (NACE 465, 4651 and 4652) and one ICT services sector: 951 (Repair of computers and communication equipment). It also does not offer the disaggregation at 4-digits of ICT and MC sectors, as there is no available information with such detail. This information (4-digits) is only available for NACE sector 61 (Telecommunications) since 2000.

Sector 85 (Education) is also not available (except for 2008).

Time series are expected to be comparable between 2007 and 2008 although some of them may have suffered a break, due to the transition from SIRD to the new BRDIS. The same problem could appear in 1999, as it was the transition year from SIC to NAICS.

We obtain BERD in euros and PPS using exchange rates and purchasing power parities coming from OECD and Eurostat.

R&D Personnel

European Union and its Member States

Sources

Statistics on Research and Development (SRD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempoccr2&lang=en
Downloaded: 15-11-2017
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 2))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempocc&lang=en
Downloaded: 18-09-2015
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 1.1))

Labour Force Survey (LFS) from Eurostat

- Specific request to 3-digits by highest level of education attained
Downloaded: 14-07-2017
(Employment by economic activity and level of education attained (NACE Rev. 2))
- Specific request to 3-digits by highest level of education attained
Downloaded: 1-06-2016
(Employment by economic activity and level of education attained (NACE Rev. 1.1))

Statistics on Research and Development (SRD) from National Statistical Institutes

- http://pub.stat.ee/px-web.2001/I_Databas/Economy/28SCIENCE_TECHNOLOGY_INNOVATION/28SCIENCE_TECHNOLOGY_INNOVATION.asp
Downloaded: 15-10-2016
(R&D in business enterprise sector in Estonia)
- <http://www.statbank.dk/statbank5a/default.asp?w=1280>
Downloaded: 15-10-2016
(Research and development Statistics in Denmark)
- <http://www.scb.se/en/Finding-statistics/Statistics-by-subject-area/Education-and-research/Research/Research-and-development-in-the-business-enterprise-sector/>
Downloaded: 10-10-2017
(Research and development in Sweden)
- <http://statdat.statistics.sk/>
Downloaded: 15-10-2016
(Expenditures on research and development in Slovakia)
- <http://www.ine.es/jaxi/menu.do?type=pcaxis&path=%2Ft14%2Fp057&file=inebase&L=0>
Downloaded: 15-10-2016
(Estadística de I+D. Sector Empresas. Resultados en I+D por rama de actividad)

Remarks

The elaboration of the 2006-2015 R&D Personnel NACE Rev. 2 ICT and RS sector database (in full-time equivalent) for the EU countries has been based on the information provided by Eurostat.

The main source of R&D Personnel data is Statistics on Research and Development (Eurostat). To distribute this data among ICT sectors, the methodology follows the latest OECD definition (table 1), RS and other selected sectors using data provided by country and industry from Eurostat.

The majority of the gaps in the sectors have been completed following these steps:

- a. Using R&D data provided by National Statistical Institutes for Estonia, Denmark, Sweden, Slovakia and Spain.
- b. Using data provided by industry (NACE Rev. 1.1.) from Eurostat and the correspondence table between NACE Rev. 2 and NACE Rev. 1.1 (Mas, Robledo and Pérez 2012)²⁸.
- c. When a country has data for some years in Statistics on R&D, we keep either the trend of expenditure or the subsector weight over the years.
- d. Using the percentage structure of Highly Qualified Employment (Labour Force Statistics from Eurostat): weight of the sector 465 (Wholesale of information and communication equipment) in sector G (Wholesale and retail trade; repair of motor vehicles and motorcycles; for Finland, Germany, Greece, Ireland, Luxembourg, Netherlands and Sweden); distribution of sector 26 (Manufacture of computer, electronic and optical products) to 3-digits (for Finland, Greece, Latvia, Luxembourg and Sweden); weight of the sector 631 (Data processing, hosting and related activities; web portals) in sector 63 (Information service activities; for Belgium, Finland, France, Greece, Ireland, Luxembourg, Romania and Sweden).
- e. Using the percentage structure of Highly Qualified Employment (Labour Force Statistics from Eurostat): the weight of the subsectors 611, 612, 613 and 619 in sector 61 (Telecommunications) is applied to R&D data on sector 61 for each European countries.
- f. Using the United States' RERD/BERD ratio: the relation between this ratio for sector 4791 (Retail sale via mail order houses or via Internet) with regard to sector G (45-47, Wholesale and retail trade, repair of motor vehicles and motorcycles) is applied to obtain the RERD/BERD ratio of European countries on sector 4791. The BERD data of European countries and this estimated RERD/BERD ratio are used to calculate RERD data on sector 4791.

To estimate PERD data, the PERD/RERD ratio for each one European countries on sector G* [G (45-47, Wholesale and retail trade, repair of motor vehicles and motorcycles) - 465 (Wholesale of information and communication equipment)] is used. The PERD data is obtained by applying this ratio to RERD data.
- g. Using the average weight of R&D personnel and researchers in countries with data of the ratio of sector 951/sector S-U (Repair of computers and communication equipment/Other service activities; sample 17 countries; weight: 14% in 2009, 17% in 2010, 14% in 2011 and 16% in 2012).

²⁸ ICT Sector Definition Transition from NACE Rev. 1.1 to NACE Rev. 2: A Methodological Note. JRC Technical Reports (2012). <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=5919>. See in Annex II the correspondence tables for ICT sectors between from NACE Rev. 1.1 and NACE Rev. 2

Greece and Luxembourg lack official data, therefore, we recommend taking the results with caution. The missing data has been estimated using some alternative methods such as NACE Rev. 1.1 data and the correspondence table between NACE Rev. 2 and NACE Rev. 1.1 or percentage structure of Highly Qualified employment.

Data by industry for European Union is obtained as the sum of the member countries since official data is not available.

In the same way as the BERD, in this deliverable the R&D Personnel NACE Rev. 2 database (in full-time equivalent) for the EU countries is extended back to the year 2000 and even, where possible, until 1995.

For this purpose, the information provided by Eurostat about PERD NACE Rev. 1.1 has been used. As in the case of the BERD, the starting point is a common year between the data under the NACE Rev. 2 and NACE Rev. 1.1 classification, establishing a relationship between them. This relationship allows the PERD NACE Rev. 2 data to be estimated for the first years of the series.

In the case of Denmark, France and the United Kingdom, in those common years a relationship is established between the percentage structures of PERD NACE Rev. 2 and BERD NACE Rev. 2. In this way, the percentage structure of PERD NACE Rev. 2 is estimated for those early years and is applied to total PERD for the entire period. Total PERD has been obtained applied methods such as NACE Rev. 1.1 data and the correspondence table between NACE Rev. 2 and NACE Rev. 1.1

As in other years, the European Union is the result of adding the member states.

Norway

Sources

Statistics on Research and Development (SRD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempoccr2&lang=en
Downloaded: 1-12-2016
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 2))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempocc&lang=en
Downloaded: 18-09-2015
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 1.1))

Remarks

The elaboration of the 2006-2014 R&D Personnel NACE Rev. 2 database (in full-time equivalent) for Norway has been based on the information provided by Eurostat.

The main source of R&D Personnel data is Statistics on Research and Development (Eurostat). This data has been distributed among the selected sectors (ICT, RS and additional sectors), using data provided by country and industry from Eurostat.

The majority of the gaps in the sectors have been filled with data provided by industry (NACE 1.1.) from Eurostat and the correspondence table between NACE Rev. 2 and NACE Rev. 1.1. When data exists for some years in Statistics on R&D, we keep either the trend of expenditure or the subsector weight over the years to complete gaps.

Norway data has been completed back to the year 2001. The procedure used is the same as that used for EU countries.

Switzerland

Sources

Statistics on Research and Development (SRD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempoccr2&lang=en
Downloaded: 1-12-2016
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 2))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempocc&lang=en
Downloaded: 18-09-2015
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 1.1))

Remarks

The elaboration of the 2006-2014 R&D Personnel NACE Rev. 2 database (in full-time equivalent) for Switzerland has been based on the information provided by Eurostat.

The main source of R&D Personnel data is Statistics on Research and Development (Eurostat). This data has been distributed among ICT (and non-ICT) sectors, according to the latest OECD definition (table 1) using data provided by country and industry from Eurostat. The same has been done to obtain RS sector.

Statistics on R&D in Switzerland (*Rechercheetdéveloppement (R-D) dans les entreprises*) is conducted every four years. Only two years are available: 2008 and 2012. The majority of the gaps in PERD sectors have been filled using data provided by industry (NACE 1.1.) from Eurostat and the correspondence table between NACE Rev. 2 and NACE Rev. 1.1.

Australia

Sources

Research and Experimental Development, Businesses from Australian Bureau of Statistics (ABS)

- <http://www.abs.gov.au/ausstats/abs@.nsf/0/17EF02A5029649E2CA257F990030EDFE?OpenDocument>
Downloaded: 25-10-2017 (R&D personnel)

Research and Experimental Development, Higher Education Organisations, Australia

- <http://www.abs.gov.au/ausstats/abs@.nsf/PrimaryMainFeatures/8111.0?OpenDocument>
Downloaded: 25-10-2017
(Higher education R&D personnel)

Research and Experimental Development, Government and Private Non-Profit Organisations, Australia

- <http://www.abs.gov.au/ausstats/abs@.nsf/PrimaryMainFeatures/8109.0?OpenDocument>
Downloaded: 25-10-2017
(Government R&D personnel and Private non-profit R&D personnel)

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 25-10-2017
(R&D personnel (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 25-10-2017
(R&D personnel (ISIC Rev. 3.1))

Remarks

The elaboration of the database for Australia has been based on the information provided by OECD, as it has already published NACE Rev. 2 data (ISIC Rev. 4) for the years 2006 to 2013. For the previous years included in PREDICT database, OECD data following ISIC

Rev. 3.1 and data coming from national sources (Australian Bureau of Statistics) have been taken as a basis for the estimation.

For industries not disaggregated in the ISIC Rev. 4 OECD database, the information provided by Australian Bureau of Statistics has been used, distributing R&D personnel among sectors using the correspondence tables between ANZSIC 2006 and NACE Rev. 2²⁹. When necessary, methods such as interpolation have been used in the case of some industries to complete the database.

The previous years have been completed with information coming from OECD ISIC Rev. 3.1 R&D database and the "Survey of Research and Experimental Development (R&D), Businesses" published by ABS. In this case, the available information is more limited, as national R&D surveys only offer information by industries at two-digit level (following ANZSIC 1993³⁰). Because of that, some industries have been estimated applying the growth rates of a more aggregated sector in the statistic. In other cases, averages of BERD/PERD ratios have been used to estimate R&D personnel, as the availability of information in terms of BERD is more comprehensive. In addition, total PERD does not include NACE Rev. 2 sector 01-03 (Agriculture, forestry and fishing) for the period 1995-2004, as this sector was not included in Australian R&D Surveys those years and OECD does not publish this sector's figures previous to 2005.

There is no available data for 2012 and 2014 in the case of Australia, as the frequency of the "Survey of Research and Experimental Development (R&D), Businesses" has changed from annual to biennial, and 2012 is the first year without information. This is the reason why, in the case of these two years, the ABS statistics on Government and private non-profit and higher education R&D expenditure have been used in combination with 2013 and 2015 official R&D personnel figures to estimate business R&D personnel evolution. This information has been completed with the one offered by OECD databases on R&D variables. In order to obtain the required sectoral disaggregation, structures and average growth rates from previous years have been used. Also, 2015 figures are not available in the OECD databases, but the Australian Bureau of Statistics has already published this information. Thus, 2015 data come directly from the Research and Experimental Development survey 2015-2016 (published by ABS).

ICT sector NACE 261 (Manufacture of electronic components and boards) includes ICT sector NACE 264 (Manufacture of consumer electronics) and 268 (Manufacture of magnetic and optical media) in Australia, as there is not enough information to separate these sectors. ICT subsector 612 (Wireless telecommunications activities) includes ICT subsector NACE 613 (Satellite telecommunications activities), as these two industries are defined as a single industry in ANZSIC. In addition, NACE 4791 (Retail sale via mail order houses or via Internet) includes Other retail sale not in stores, stalls or markets (NACE class 4799), as there is not enough information to separate these activities.

ICT and MC sector database does not include information at 4-digits NACE level in the case of Australia, except for sector 61 (Telecommunications), 59 (Motion picture, video and television programme production, sound recording and music publishing activities) and 581 (Publishing of books, periodicals and other publishing activities), but only for some of the most recent years.

²⁹ <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1292.0.55.0052008?OpenDocument>. Also, the Ivie has elaborated correspondence tables for ICT and RS sectors between NACE Rev. 2 and ANZSIC 2006 (see Annex II).

³⁰ The correspondence between ANZSIC 2006 and ANZSIC 1993 is available at: [http://www.abs.gov.au/ausstats/abs@.nsf/second+level+view?ReadForm&prodno=1292.0&viewtitle=Australian%20and%20New%20Zealand%20Standard%20Industrial%20Classification%20\(ANZSIC\)~2006%20\(R%20revision%202.0\)~Latest~26/06/2013&&tabname=Related%20Products&prodno=1292.0&issue=2006%20\(R%20revision%202.0\)&num=&view=&](http://www.abs.gov.au/ausstats/abs@.nsf/second+level+view?ReadForm&prodno=1292.0&viewtitle=Australian%20and%20New%20Zealand%20Standard%20Industrial%20Classification%20(ANZSIC)~2006%20(R%20revision%202.0)~Latest~26/06/2013&&tabname=Related%20Products&prodno=1292.0&issue=2006%20(R%20revision%202.0)&num=&view=&)

Brazil

Sources

PINTEC, Survey of Technological Innovation from Instituto Brasileiro de Geografia e Estatística (IBGE)

- <http://www.ibge.gov.br/home/estatistica/economia/industria/pintec/2011/default.shtm>
Downloaded: 14-10-2016

Science, Technology and Innovation Data from UNESCO Institute for Statistics (UIS)

- <http://data.uis.unesco.org/Index.aspx?queryid=115>
Downloaded: 02-11-2017

Annual Survey of Industry from IBGE

- <http://www.ibge.gov.br/home/estatistica/economia/industria/pia/empresas/2014/defaulttempresa.shtm>
Downloaded: 17-10-2016

Remarks

The elaboration of the R&D personnel database for Brazil has been based on the information provided by IBGE, in the Survey of Technological Innovation (PINTEC 2000, 2003, 2005, 2008 and 2011). We have used PINTEC data by industry and correspondences between CNAE 2/CNAE 1 and NACE Rev. 2 to distribute R&D personnel among sectors³¹. However, PINTEC survey is only available for 2000, 2003, 2005, 2008 and 2011, as it is only conducted every two/three years.

The distribution of Wages from Industrial Survey (IBGE) has been also used to assign the R&D personnel between ICT Sector NACE 263 (Manufacture of communication equipment), 264 (Manufacture of consumer electronics) and 268 (Manufacture of magnetic and optical media). It has also been used to estimate NACE 303 (Manufacture of air and spacecraft and related machinery).

ICT sector NACE 62 (computer programming, consultancy and related activities) includes ICT sector NACE 582 (Software publishing). In addition, for Brazil there is no information for the MC sector (NACE 581, 59, 60 and 639), the ICT trade sector (NACE 465) and one ICT services sector: Repair of computers and communication equipment (NACE 951). Neither for ICT subsectors (3-4-digits level). Total ICT services sector is only available for 2008 onwards. PINTEC 2000 and 2003 do not include information on services sectors.

Moreover, Brazil's dataset does not contain information for RS sector (NACE 4791) and macro-sectors 85 (Education), 49-99 (Services, except trade), 45-47 (Wholesale and retail trade, repair of motor vehicles and motorcycles), 49-53 (Transportation and storage), 58-63 (Information and communication), 64-66 (Financial and insurance activities), 69-82 (Professional, scientific, technical, administration and support service activities), 69-75 (Professional, scientific and technical activities) and 86-88 (Human health and social work activities).

Canada

Sources

Science and Technology Indicators from Statistics Canada

- http://www.statcan.gc.ca/eng/subjects/science_and_technology/research_and_development#data
Downloaded: 01-12-2017 and 26-10-2016

³¹ See Annex II and the correspondence between CNAE 2 and ISIC Rev. 4 at: <http://www.ibge.gov.br/home/estatistica/economia/classificacoes/cnae2.0/defaulttab.shtm>.

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 30-11-2017
(R&D personnel by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D personnel (ISIC Rev. 3.1))

Survey of Employment, Payrolls and Hours from Statistics Canada

- <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=2810047&paSer=&patter n=&stByVal=1&p1=1&p2=35&tabMode=dataTable&csid=>
Downloaded: 03-03-2016

Labour Productivity Accounts from Statistics Canada

- <http://www5.statcan.gc.ca/subject-sujet/subtheme-soustheme.action?pid=3764&id=3355&lang=eng&more=0>
Downloaded: 03-03-2016

Remarks

The elaboration of the database for Canada has been based on the information provided by Statistics Canada in its key socioeconomic database CANSIM, Science and Technology Indicators, and by OECD, as it also offers NACE Rev. 2 (ISIC Rev. 4) data. However, OECD and Statistics Canada do not offer information for 2015. Thus, there is no data available for this year in the Canada dataset. Additionally, the estimation of 2014 has to be taken with caution, as in that year the national R&D survey suffered a methodological and conceptual revision.

The R&D personnel have been distributed among sectors using the correspondence tables between ISIC Rev. 4/NAICS and NACE Rev. 2, as in the case of BERD. In order to estimate the figures for some sectors, additional sources and variables need to be used. For instance, total Employment from Survey of Employment, Payrolls and Hours and Labour Productivity Accounts (Statistics Canada) has been used to estimate RS sector (NACE 4791), the NACE section M (Professional and Scientific activities) and some ICT and MC industries (NACE 581, 582, 59, 60, 61 and 639) .

PERD ratios over BERD/PERD from US have also been used to split ICT sector 61 (Telecommunications) into its subsectors at 3 digits (NACE 611, 612, 613 and 619).

Canada dataset does not contain information for one ICT services sector (951, Repair of computers and communication equipment) and for ICT subsectors at 4-digits, as there is no statistical source with this level of detail. The same happens in the case of the MC sector, with data on sectors only available at 2/3 digits.

China

Sources

China Statistical Yearbook on Science and Technology from National Bureau of Statistics of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 10-11-2017

The Second R&D Resources Inventory Survey Compilation 2009 from National Bureau of Statistics of China

- Information provided by Gao Changlin, Li Xiuquan and Xuan Zhaohui, from Chinese Academy of Science and Technology for Development (CASTED)

China National Expenditures on Science and Technology Statistics from National Bureau of Statistics of China

- <http://data.stats.gov.cn/english/>
Downloaded: 10-11-2017

Statistics on Education, Science and Technology in High-tech Industry by Industrial Sector from China Statistical Yearbook, compiled by National Bureau of Statistics of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 10-11-2017

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 10-11-2017
(R&D personnel by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D personnel by industry (ISIC Rev. 3.1))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_OCCUP
Downloaded: 10-11-2017
(R&D personnel)

Remarks

The elaboration of the R&D personnel database for China has been based on the information provided by the OECD, as in 2015 it has published for the first time NACE Rev. 2 data for China. However, data are only available for the period 2008-2015 and the disaggregation of services sectors is only available for one year: 2009.

This information has been complemented with data provided by the National Bureau of Statistics of China in The Second R&D Resources Inventory Survey Compilation and the China Statistical Yearbook on Science and Technology. However, the correspondence between NACE Rev. 2 and China classification of activities is approximate, as it is based on the correspondences between Chinese industry classification and ISIC Rev. 3 (NACE Rev. 1.1)³².

When necessary, structures from next/previous years and average growth rates from next/previous selected periods have been used to estimate figures for some industries or years. In the case of some industries, BERD/PERD ratios of a higher aggregated sector have been used to estimate R&D personnel figures. Therefore, we recommend taking the results with caution, especially the more disaggregated data and the services sectors' figures.

China R&D personnel dataset only offers information for the period 2005-2015 (only figures for ICT manufacturing and NACE sector 21 are available since 2001) and it does not contain information for ICT trade sector, ICT sectors 268 (Manufacture of magnetic and optical media) and 951 (Repair of computers and communication equipment), RS sector (NACE 4791) and NACE sectors 45-47 (Wholesale and retail trade, repair of motor vehicles and motorcycles) and 85 (Education). ICT and MC subsectors at 3-4 digits are neither available.

³² The correspondence between Chinese SIC and ISIC Rev. 3 is available at:
http://www.stats.gov.cn/tjbz/t20040210_402369833.htm

India

Sources

Research and Development Statistics from National Science and Technology Management Information System (NSTMIS), Department of Science and Technology, Government of India

- <http://www.nstmis-dst.org/Publication.aspx>
Downloaded: 20-10-2015

Science, Technology and Innovation Data from UNESCO Institute for Statistics (UIS)

- http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS
Downloaded: 03-11-2017

Annual Survey of Industries from MOSPI

- <https://data.gov.in/catalog/annual-survey-industries-1>
Downloaded: 17-10-2017

Remarks

Official data for R&D personnel by industry are not available. Only the total amount of R&D personnel is available in national sources, but not for all the years. Thus, data for 1995, 1997, 1999, 2001-2004, 2006-2009 and 2011-2014 are estimations made by interpolating official BERD/R&D Personnel ratios referred to in the closest available years.

To estimate R&D personnel by industry, additional assumptions are required. PERD/BERD ratios by industry from the most similar country in the sample according to BERD structure (United Kingdom) have been selected. These ratios have been adjusted so that they replicate India's total PERD/BERD ratio, which is readily available. However, we recommend taking the results with caution.

In the case of some macro-sectors, India's BERD structure has been applied to estimate PERD figures for these industries.

India's R&D personnel dataset does not contain information for ICT trade sector, RS sector and the disaggregated ICT and MC subsectors at 3-4 digits. In addition data only cover the years between 2002 and 2012. In the case of ICT and MC services data are available from 2005.

Japan

Sources

Annual Survey of Research and Development from Japan's Ministry of Internal Affairs and Communication (MIC)

- <https://www.e-stat.go.jp/SG1/estat/GL02100104.do?gaid=GL02100102&toacd=00200543>
Downloaded: 16-11-2017

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 16-11-2017
(R&D personnel (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D personnel (ISIC Rev. 3.1))

Remarks

The elaboration of the R&D personnel database for Japan has been based on the information provided by OECD, as it has published PERD figures for Japan following ISIC Rev. 4 (NACE Rev. 2) from 2005 onwards. In addition, OECD also publishes these figures following ISIC Rev. 3.1 since 1995, which are sometimes used to complete the updated NACE Rev. 2 series.

This information has been combined with data coming from the Annual Survey of Research and Development from Japan's Ministry of Internal Affairs and Communication (MIC), especially when a high sectoral disaggregation is required, as this national source offers a higher level of industry detail. In order to do that, the correspondence tables between JSIC and NACE Rev. 2 elaborated by Ivie for ICT and RS industries (see Appendix 1) have been used. For non-ICT industries, the official correspondence table between JSIC and NACE Rev. 2 has been used³³.

Although the Annual Survey of Research and Development from Japan offers a great industry disaggregation for recent years (from 2007 onwards), that allows to complete the information for almost all the sectors requested, it doesn't have the same detail for the other years. For these, when necessary, the structure of the most recent years has been applied to estimate some problematic industries.

Japan dataset does not contain information for RS sector (NACE 4791), one ICT services sector: 951 (Repair of computers and communication equipment), and the macro-sectors 85 (Education) and 86-88 (Human health and social work activities) and.

In addition, ICT sector 62 (Computer programming, consultancy and related activities) includes ICT sector 582 (Software publishing). The disaggregation at 3-4-digits NACE of ICT and MC sectors is not available.

Korea

Sources

Survey of Business activities from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsList_01List.jsp?vwcd=MT_ETITLE&parentId=K
Downloaded: 17-02-2014

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 14-11-2017
(R&D personnel by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D personnel by industry (ISIC Rev. 3.1))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_OCCUP
Downloaded: 14-11-2017
(R&D personnel by sector of employment and occupation)

Remarks

The elaboration of the PERD database for Korea has been based on the information provided by the Research and Development Statistics from OECD. In 2015 OECD has published data on R&D personnel following NACE Rev. 2 (ISIC Rev. 4) for the first time. Therefore, this information has been taken as the main basis for the construction of

³³ The correspondences between JIP codes, JSIC, ISIC Rev. 3 and ISIC Rev. 4 are available at:
http://www.rieti.go.jp/en/database/d05_data/03-6.pdf
http://www.euklems.net/data/nace2/JPN_sources_12i.pdf
<http://www.stat.go.jp/english/index/seido/sangyo/index07.htm>

Korea dataset, although it only covers the years 2005-2015. The remaining years included in PREDICT database have been estimated using the ISIC Rev. 3 PERD database from the OECD (ANBERD), which covers the period 1996-2014, and the correspondences between ISIC Rev. 3 and ISIC Rev. 4/NACE Rev. 2³⁴.

In the case of some sectors, average growth rates from the following years or average structures from other years have been used in order to obtain an estimation, especially some ICT and MC subsectors. BERD/PERD ratios have been applied as well in some cases. In addition, as the information on R&D researchers is more comprehensive, PERD/RERD ratios have been used to estimate some industries.

In order to estimate RS sector, PERD ratios over BERD/RERD from US have also been used, as there is no available information on this sector for Korea. Therefore, these figures should be taken with caution.

Korea dataset does not contain information for the ICT trade sector (NACE 465) and ICT/MC subsectors at 3-4-digits level of NACE Rev. 2.

Russia

Sources

Russian Science and Technology at a Glance from Russian Centre for Science Research and Statistics (CSRS)

- <http://www.csrs.ru/english/statis/default.htm>
- <http://www.st-gaterus.eu/en/672.php>

Downloaded: 10-07-2013

R&D data from Rosstat (Russian Federal State Statistics Service)

- Information provided by Galina Lyubova (Department of Foreign Statistics and International Cooperation from Rosstat)
- Information provided by Valeriya Kosolapova (Department of Foreign Statistics and International Cooperation from Rosstat) in October 2017

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_OCCUP
Downloaded: 29-11-2017
(R&D personnel by sector of employment and occupation)

Remarks

The elaboration of the ICT sector database for Russia has been based on the information by industry provided by the publication *Russian Science and Technology at a Glance* (CSRS) and by Rosstat, as OECD ANBERD database does not publish information on business R&D personnel by industry for Russia.

However, and taking into account that BERD figures are based on OECD data, it has been decided to maintain the total R&D personnel figures from ANBERD database and distribute them among ICT, RS and the additional selected sectors, using national sources and approximate correspondences between ISIC Rev. 4 and the classification of industries of Russian statistics, which have a direct correspondence with ISIC Rev. 3.1 (see Appendix 1).

In addition, some assumptions need to be done to estimate business R&D personnel by industry, as the available information by industry refers to total R&D personnel

³⁴ See Mas, Robledo and Pérez (2012).

(business, government, higher education plus private non-profit sectors). For this reason, national data have been re-adjusted to OECD total business R&D figures.

Russian dataset does not contain information by industry for the years 1995-2003 and sectors NACE 4791 (RS sector, Retail sale via mail order houses or via Internet), 45-47 (Wholesale and retail trade, repair of motor vehicles and motorcycles), 49-53 (Transportation and storage), 58-63 (Information and communication), 64-66 (Financial and insurance activities), 69-82 (Professional, scientific, technical, administration and support service activities), 69-75 (Professional, scientific and technical activities) are not available. Sectors 27-28 (Manufacture of machinery and equipment) and 303 (Manufacture of air and spacecraft and related machinery) are available only since 2012.

MC sectors are not available. Regarding ICT industries, sectors 268 (Manufacture of magnetic and optical media), 4652 (Wholesale of electronic and telecommunications equipment and parts), 951 (Repair of computers and communication equipment) and the disaggregation between 582 (Software publishing), 62 (Computer programming, consultancy and related activities) and 631 (Data processing, hosting and related activities; web portals) are also not available.

Also, the disaggregation at 4-digits of ICT sector NACE 261 (Manufacture of electronic components and boards) and at 3 digits of ICT sector NACE 61 (Telecommunications) is not available.

Taiwan

Sources

National Science and Technology Survey from Taiwan's Ministry of Science and Technology

- <https://ap0512.most.gov.tw/WAS2/English/AsTechnologyEStatisticsList.aspx>
Downloaded: 29-11-2017

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 29-11-2017
(R&D personnel (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D personnel (ISIC Rev. 3.1))

Remarks

The elaboration of the database for Taiwan has been based on the information by industry provided by OECD and Taiwan's National Science Council in the National Science and Technology Survey. These two sources have been complementary to elaborate Taiwan's R&D Personnel dataset.

However, the information available in these two datasets does not cover the years 1995, 1996 and 1997. Thus, the figures corresponding to these years in PREDICT dataset have been estimated using average growth rates of the following years and/or sectoral structures from the next years. In addition, blanks appear in some ICT and MC subsectors from 2005 backwards. In these cases, average growth rates and/or sectoral structures of the following years and BERD/PERD ratios have been also applied.

In order to estimate RS sector, additional assumptions need to be done. In this case PERD ratios over BERD and RERD from the US have been applied to Taiwan's data to obtain an estimation of the RS sector. Therefore, we recommend taking the results with caution.

Taiwan dataset does not contain information for sector 303 (Manufacture of air and spacecraft and related machinery) and NACE section P (Education) is only available for the period 2009-2014. Neither does it contain data for ICT subsectors 2611 (Manufacture of electronic components), 2612 (Manufacture of loaded electronic boards), 4651 (Wholesale of computers, computer peripheral equipment and software), 4652 (Wholesale of electronic and telecommunications equipment and parts), 5821 (Publishing of computer games), 5829 (Other software publishing), 611 (Wired telecommunications activities), 612 (Wireless telecommunications activities), 613 (Satellite telecommunications activities), 619 (Other telecommunications activities), 6201 (Computer programming activities), 6202 (Computer consultancy activities), 6203 (Computer facilities management activities), 6209 (Other information technology and computer service activities), 6311 (Data processing, hosting and related activities), 6312 (Web portals), 9511 (Repair of computers and peripheral equipment) and 9512 (Repair of communication equipment). The MC sub-sectors 5811 (Book publishing), 5812 (Publishing of directories and mailing lists), 5813 (Publishing of newspapers), 5814 (Publishing of journals and periodicals), 5819 (Other publishing activities), 591 (Motion picture, video and television programme activities) and its subsectors, 592 (Sound recording and music publishing activities), 601 (Radio broadcasting), 602 (Television programming and broadcasting activities), 6391 (News agency activities) and 6399 (Other information service activities n.e.c.).

United States

In the case of United States, there are no available sectoral data for this variable, as the main national sources for R&D variables (SIRD and BRDIS) do not offer information on R&D personnel. US R&D Surveys include only information on "R&D scientists and engineers", which definition is more similar to R&D researchers. Neither OECD nor Eurostat R&D Statistics provide information by industry on this variable for US. Only total PERD data is available from 2011 to 2014 in the ANBERD database (OECD), which are the unique figures included in the PREDICT database regarding this variable. However, it is possible that these aggregated figures are not fully comparable to those corresponding to other countries.

R&D Researchers

European Union and its Member States

Sources

Statistics on Research and Development (SRD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempoccr2&lang=en
Downloaded: 15-11-2017
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 2))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempocc&lang=en
Downloaded: 18-09-2015
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 1.1))

Labour Force Survey (LFS) from Eurostat

- Specific request to 3-digits by highest level of education attained
Downloaded: 14-07-2017
(Employment by economic activity and level of education attained (NACE Rev. 2))
- Specific request to 3-digits by highest level of education attained
Downloaded: 1-06-2016
(Employment by economic activity and level of education attained (NACE Rev. 1.1))

Statistics on Research and Development (SRD) from National Statistical Institutes

- http://pub.stat.ee/px-web.2001/I_Databas/Economy/28SCIENCE_TECHNOLOGY_INNOVATION/28SCIENCE_TECHNOLOGY_INNOVATION.asp
Downloaded: 15-10-2016
(R&D in business enterprise sector in Estonia)
- <http://www.statbank.dk/statbank5a/default.asp?w=1280>
Downloaded: 15-10-2016
(Research and development Statistics in Denmark)
- <http://www.scb.se/en/Finding-statistics/Statistics-by-subject-area/Education-and-research/Research/Research-and-development-in-the-business-enterprise-sector/>
Downloaded: 27-10-2017
(Research and development in Sweden)
- <http://statdat.statistics.sk/>
Downloaded: 15-10-2016
(Expenditures on research and development in Slovakia)
- <http://www.ine.es/jaxi/menu.do?type=pcaxis&path=%2Ft14%2Fp057&file=inebase&L=0>
Downloaded: 15-10-2016
(Estadística de I+D. Sector Empresas. Resultados en I+D por rama de actividad)

Remarks

The methodology is the same as for R&D Personnel (view remarks in section 1.2.1).

Norway

Sources

Statistics on Research and Development (SRD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempoccr2&lang=en
Downloaded: 1-12-2016
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 2))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempocc&lang=en
Downloaded: 18-09-2015
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 1.1))

Remarks

The methodology is the same as for R&D Personnel (view remarks in section 1.2.2).

Switzerland

Sources

Statistics on Research and Development (SRD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempoccr2&lang=en
Downloaded: 1-12-2016
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 2))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=rd_p_bempocc&lang=en
Downloaded: 18-09-2015
(R&D personnel at national and regional level. Total R&D personnel and researchers in business sector by economic activity and sex (NACE Rev. 1.1))

Remarks

The methodology is the same as for R&D Personnel (view remarks in section 1.2.3).

Australia

Sources

Research and Experimental Development, Businesses from Australian Bureau of Statistics (ABS)

- <http://www.abs.gov.au/ausstats/abs@.nsf/0/17EF02A5029649E2CA257F990030EDFE?OpenDocument>
Downloaded: 25-10-2017
(R&D researchers)

Research and Experimental Development, Higher Education Organisations, Australia

- <http://www.abs.gov.au/ausstats/abs@.nsf/PrimaryMainFeatures/8111.0?OpenDocument>
Downloaded: 25-10-2017
(Higher education R&D researchers)

Research and Experimental Development, Government and Private Non-Profit Organisations, Australia

- <http://www.abs.gov.au/ausstats/abs@.nsf/PrimaryMainFeatures/8109.0?OpenDocument>
Downloaded: 25-10-2017
(Government R&D researchers and Private non-profit R&D researchers)

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 25-10-2017
(R&D researchers (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 25-10-2017
(R&D researchers (ISIC Rev. 3.1))

Remarks

The elaboration of the database for Australia has been based on the information provided by OECD, as in 2015 it has already published NACE Rev. 2 data (ISIC Rev. 4) for the years 2006 to 2013. The source for 2015 is the national business R&D survey published by ABS, as it is already available. For the previous years included in PREDICT database, OECD data following ISIC Rev. 3.1 and data from national sources (Australian Bureau of Statistics) have been taken as a basis for the estimation.

For industries not disaggregated in the OECD database, the information provided by Australian Bureau of Statistics (ABS) in the publication Research and Experimental Development, Businesses has been used, applying the correspondence tables between ANZSIC 2006 and NACE Rev. 2³⁵. Methods such as interpolation have also been used in the case of some industries to complete the database. However, the industry disaggregation in the case of Researchers is not enough to cover all the individual industries in the database, so additional assumptions must be done. In these cases, R&D personnel's structure has been applied to Researchers in order to achieve the industry disaggregation that is needed (see Remarks from R&D Personnel section for more details).

Data for the period 1995-2005 (not available in the last update of the OECD database) have been estimated with information from OECD ISIC Rev. 3.1 R&D database and the "Survey of Research and Experimental Development (R&D), Businesses" published by ABS. In this case, the available information is more limited, as national R&D surveys only offer information by industries at two-digit level (and following ANZSIC 1993). Because of that, some industries have been estimated applying the growth rates of a more aggregated sector in the statistic. In other cases, BERD/RERD ratios or RERD/PERD ratios have been used to estimate the amount of R&D researchers, as the availability of information in terms of BERD and PERD is more comprehensive. In addition, total RERD does not include NACE Rev. 2 sector 01-03 (Agriculture, forestry and fishing) for the period 1995-2004, as this sector was not included in Australian R&D Surveys those years and OECD does not publish this sector's figures previous to 2005.

In addition, there is no available data for 2012 and 2014 on business researchers, as the frequency of the "Survey of Research and Experimental Development (R&D), Businesses" has changed from annual to biennial, and this year is the first one without survey. This is

³⁵ <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1292.0.55.0052008?OpenDocument>. Also, the Ivie has elaborated correspondence tables for ICT sectors between NACE Rev. 2 and ANZSIC 2006 (see Annex II).

the reason why, in the case of 2012 and 2014, data from 2013 and 2015 and from the ABS statistics on Government and private non-profit and higher education R&D human resources of 2012 and 2014 have been used as a basis to estimate business R&D researchers' figures. In order to obtain the required sectoral disaggregation, structures and average growth rates from previous/next years have been used.

ICT sector NACE 261 (Manufacture of electronic components and boards) includes ICT sector NACE 264 (Manufacture of consumer electronics) and 268 (Manufacture of magnetic and optical media) for Australia, as there is not enough information to separate these sectors. ICT subsector 612 (Wireless telecommunications activities) includes ICT subsector NACE 613 (Satellite telecommunications activities), as these two industries are defined as a single industry in ANSZIC. In addition, NACE 4791 (Retail sale via mail order houses or via Internet) includes Other retail sale not in stores, stalls or markets (NACE class 4799), as there is not enough information to separate these activities.

ICT and MC sector database does not include information at 4-digits NACE level in the case of Australia, except for sector 61 (Telecommunications), but only for the period 2000-2015.

Brazil

Sources

PINTEC, Survey of Technological Innovation from Instituto Brasileiro de Geografia e Estatística (IBGE)

- <http://www.ibge.gov.br/home/estatistica/economia/industria/pintec/2011/default.shtm>
Downloaded: 14-10-2016

Science, Technology and Innovation Data from UNESCO Institute for Statistics (UIS)

- <http://data.uis.unesco.org/Index.aspx?queryid=115>
Downloaded: 03-11-2017

Annual Survey of Industry from IBGE

- <http://www.ibge.gov.br/home/estatistica/economia/industria/pia/empresas/2014/defaulttempresa.shtm>
Downloaded: 17-10-2016

Remarks

The elaboration of the R&D researchers' database for Brazil has been based on the information provided by IBGE, in the Survey of Technological Innovation (PINTEC). However, data on researchers are only available in PINTEC 2011 (this variable was not included in the previous editions of this survey).

We have used PINTEC data by industry and correspondences between CNAE 2 and NACE Rev. 2 to distribute researchers among ICT, MC, RS and the additional sectors³⁶. The distribution of Wages from Industrial Survey (IBGE) has been also used to assign the R&D researchers between ICT Sector NACE 263 (Manufacture of communication equipment), 264 (Manufacture of consumer electronics) and 268 (Manufacture of magnetic and optical media). It has also been used to estimate NACE 303 (Manufacture of air and spacecraft and related machinery).

In the case of Brazil, ICT sector NACE 62 (computer programming, consultancy and related activities) includes ICT sector NACE 582 (Software publishing). In addition, there is no information for the MC sector (NACE 581, 59, 60 and 639), the ICT trade sector (NACE 465) and one ICT services sector: Repair of computers and communication

³⁶ See Annex II and the correspondence between CNAE 2 and ISIC Rev. 4 at: <http://www.ibge.gov.br/home/estatistica/economia/classificacoes/cnae2.0/defaulttab.shtm>.

equipment (NACE 951). Neither for ICT subsectors (3-4-digits level). Moreover, Brazil's dataset does not contain information for macro-sectors, 85 (Education) and the aggregations 49-99 (Services, except trade), 45-47 (Wholesale and retail trade, repair of motor vehicles and motorcycles), 49-53 (Transportation and storage), 58-63 (Information and communication), 64-66 (Financial and insurance activities), 69-82 (Professional, scientific, technical, administration and support service activities), 69-75 (Professional, scientific and technical activities) and 86-88 (Human health and social work activities).

Canada

Sources

Science and Technology Indicators from Statistics Canada

- http://www.statcan.gc.ca/eng/subjects/science_and_technology/research_and_development#data
Downloaded: 01-12-2017 and 26-10-2016

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 30-11-2017
(R&D researchers by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D researchers by industry (ISIC Rev. 3.1))

Survey of Employment, Payrolls and Hours from Statistics Canada

- <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=2810047&paSer=&pattern=&stByVal=1&p1=1&p2=35&tabMode=dataTable&csid=>
Downloaded: 03-03-2016

Labour Productivity Accounts from Statistics Canada

- <http://www5.statcan.gc.ca/subject-sujet/subtheme-soustheme.action?pid=3764&id=3355&lang=eng&more=0>
Downloaded: 03-03-2016

Remarks

The elaboration of the database for Canada has been based mainly on the information provided by OECD since it has already published information on researchers following NACE Rev. 2 for Canada. This information has been complemented by the one provided by Statistics Canada in its key socioeconomic database CANSIM, Science and Technology Indicators. However, OECD and Statistics Canada do not offer information for 2015. Thus, there are no data for this year in the Canada dataset. Additionally, the estimation of 2014 has to be taken with caution, as the national R&D survey suffered a methodological and conceptual revision that year.

The R&D researchers have been distributed among sectors using the correspondence tables between ISIC Rev. 4/NAICS and NACE Rev. 2, as in the case of BERD and PERD. In order to estimate the figures for some sectors, additional sources and variables need to be used. For instance, total Employment from Survey of Employment, Payrolls and Hours and Labour Productivity Accounts (Statistics Canada) has been used to estimate RS sector (NACE 4791), the NACE section M (Professional and Scientific activities) and some ICT and MC industries (NACE 581, 582, 59, 60, 61 and 639) .

Methods such as interpolation have been used in the case of some industries to complete the database. However, the available industry disaggregation in the case of Researchers is not enough to cover all the individual industries in the database. To estimate these

problematic sectors, total R&D personnel's structure has been applied to Researchers in some cases in order to achieve the industry disaggregation that is needed (see Remarks from R&D Personnel section).

Canada dataset does not contain information for one ICT services sector (951, Repair of computers and communication equipment) and for ICT and MC subsectors at 4-digits, as there is no statistical source with this level of detail.

China

Sources

China Statistical Yearbook on Science and Technology from National Bureau of Statistics of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 10-11-2017

The Second R&D Resources Inventory Survey Compilation 2009 from National Bureau of Statistics of China

- Information provided by Gao Changlin, Li Xiuquan and Xuan Zhaohui, from Chinese Academy of Science and Technology for Development (CASTED)

China National Expenditures on Science and Technology Statistics from National Bureau of Statistics of China

- <http://data.stats.gov.cn/english/>
Downloaded: 10-11-2017

Statistics on Education, Science and Technology in High-tech Industry by Industrial Sector from China Statistical Yearbook, compiled by National Bureau of Statistics of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 10-11-2017

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 10-11-2017
(R&D researchers by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D researchers (ISIC Rev. 3.1))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_OCCUP
Downloaded: 10-11-2017
(R&D researchers)

Remarks

The elaboration of the researchers' database for China has been based on the information provided by the OECD, as in 2015 it has published for the first time NACE Rev. 2 data for China. However, data are only available for the period 2008-2015 and the disaggregation of services sectors is only available for one year: 2009.

This information has been complemented when necessary with the data provided by the National Bureau of Statistics of China in The Second R&D Resources Inventory Survey Compilation, China Statistical Yearbook on Science and Technology and China Statistical Yearbook (Education, Science and Technology section). However, the correspondence between NACE Rev. 2 and China classification of activities is approximate, as it is based on the correspondences between Chinese industry classification and ISIC Rev. 3 (NACE Rev. 1.1), as in the case of total R&D personnel. Therefore, we recommend taking the

results with caution. RERD/PERD ratios have also been used to estimate data for some ICT, MC and services sectors.

Generally, data by industries from National Bureau of Statistics of China (China Statistical Yearbook and China Statistical Yearbook on Science and Technology) have been used to disaggregate Researchers' total figures coming from OECD. When necessary, structures from next/previous years or total R&D personnel's structures have been used.

China dataset does not contain information for ICT trade sector and ICT sectors 268 (Manufacture of magnetic and optical media) and 951 (Repair of computers and communication equipment). Also, data for RS sector (NACE 4791), NACE sectors 45-47 (Wholesale and retail trade, repair of motor vehicles and motorcycles) and 85 (Education) are not available, as well as the 3-4 digits ICT and MC sectors. RERD figures are only available for the period 2005-2015 in the case of China.

India

Sources

Research and Development Statistics from National Science and Technology Management Information System (NSTMIS), Department of Science and Technology, Government of India

- <http://www.nstmis-dst.org/Publication.aspx>
Downloaded: 20-10-2015

Science, Technology and Innovation Data from UNESCO Institute for Statistics (UIS)

- http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS
Downloaded: 03-11-2017

Annual Survey of Industries from MOSPI

- <https://data.gov.in/catalog/annual-survey-industries-1>
Downloaded: 17-10-2017

Remarks

Official data for R&D researchers by industry are not available. Only the total amount of researchers is available in the national source, but not for all the years. In the case of the non-available years, data are estimated by interpolating Researchers/R&D Personnel ratios referred to in the closest available years.

To estimate R&D researchers by industry, additional assumptions are required. RERD/PERD ratios by industry from the most similar country in the sample according to BERD structure (United Kingdom) have been selected. These ratios have been adjusted so that they replicate India's total RERD/PERD ratio, which is readily available. However, we recommend taking the results with caution.

India's R&D researchers' dataset does not contain information for ICT trade sector (NACE 465) and RS sector (NACE 4791). The disaggregation of neither ICT nor MC sectors 261, 582, 61, 62, 631, 95, 581, 59-60 and 639 is available, as in the case of India there is no statistical R&D source that offers such industry detail. Data by industry are only available for the years 2002-2013.

Japan

Sources

Annual Survey of Research and Development from Japan's Ministry of Internal Affairs and Communication (MIC)

- <https://www.e-stat.go.jp/SG1/estat/GL02100104.do?gaid=GL02100102&toacd=00200543>
Downloaded: 16-11-2017

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 16-11-2017
(R&D researchers (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D researchers (ISIC Rev. 3.1))

Remarks

The elaboration of the Researchers' data for Japan has been based on the information provided by OECD, as it publishes researchers' figures for Japan following ISIC Rev. 4 (NACE Rev. 2) from 2005 onwards. In addition, OECD also publishes these figures following ISIC Rev. 3.1 since 1995.

This information has been combined with data from the Annual Survey of Research and Development (Japan's Ministry of Internal Affairs and Communication, MIC), especially when a high sectoral disaggregation is required, as this national source offers a higher level of industry detail, especially since 2007. Using this information, researchers have been distributed among ICT, RS, MC and the other selected sectors using the correspondence tables between JSIC and NACE Rev. 2³⁷ when the OECD database has a gap. In some cases, Research and Development Statistics from OECD by industry following ISIC Rev. 3 have been also used to estimate the incomplete series, especially in the case of the initial years of the database.

Although the Annual Survey of Research and Development from Japan offers a great industry disaggregation for recent years (from 2007 onwards), that allows to complete the information for almost all the sectors requested, it doesn't have the same detail for the other years. For these, when necessary, the structure of the most recent years has been applied to estimate some problematic industries.

Japan's dataset does not contain information for sectors NACE 85 (Education) and 86-88 (Human health and social work activities), the RS sector (NACE 4791, Retail sale via mail order houses or via Internet) and one ICT services sector: 951 (Repair of computers and communication equipment). In addition, ICT sector 62 (Computer programming, consultancy and related activities) includes ICT sector 582 (Software publishing) and the disaggregation of ICT and MC subsectors at 3-4-digits is not available, as there is no information at that level of detail.

South Korea

Sources

Survey of Business activities from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsList_01List.jsp?vwcd=MT_ETITLE&parentId=K

³⁷ The correspondences between JIP codes, JSIC, ISIC Rev. 3 and ISIC Rev. 4 are available at:
http://www.rieti.go.jp/en/database/d05_data/03-6.pdf
http://www.euklems.net/data/nace2/JPN_sources_12i.pdf
<http://www.stat.go.jp/english/index/seido/sangyo/index07.html>
Ivie has also elaborated a correspondence table for ICT and RS sectors (see Annex II).

Downloaded: 17-02-2014

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 14-11-2017
(R&D researchers by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D researchers by industry (ISIC Rev. 3.1))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_OCCUP
Downloaded: 14-11-2017
(R&D personnel by sector of employment and occupation)

Remarks

The elaboration of the Researchers' database for Korea has been based on the information provided by Research and Development Statistics from OECD. In 2015 OECD has published data on R&D researchers following ISIC Rev. 4 (NACE Rev. 2) for the first time. Therefore, this information has been taken as the main basis for the construction of Korea dataset, although some missing data have been estimated using OECD databases with the classification ISIC Rev. 3.1/NACE Rev. 1.1 and the correspondence between this classification and ISIC Re. 4 (NACE Rev. 2)³⁸.

In the case of some sectors, average growth rates from the following years or average structures from other years have been used in order to obtain RERD figures, especially some ICT and MC subsectors. BERD/RERD ratios have been applied as well in some cases.

In the case of the RS sector, the estimation relies on the calculation of Researchers/BERD ratios in the US and its adjustment to the R&D researchers' figures and structure of Korea.

Korea's dataset does not contain information for the ICT trade sector (NACE 465) and the disaggregation at 3-4-digits NACE of ICT and MC sectors is not available. Also, some additional service sectors are not available from 1995 to 1999.

Russia

Sources

Russian Science and Technology at a Glance from Russian Centre for Science Research and Statistics (CSRS)

- <http://www.csrs.ru/english/statis/default.htm>
- <http://www.st-gaterus.eu/en/672.php>
Downloaded: 10-07-2013

R&D data from Rosstat (Russian Federal State Statistics Service)

- Information provided by Galina Lyubova (Department of Foreign Statistics and International Cooperation from Rosstat)
- Information provided by Valeriya Kosolapova (Department of Foreign Statistics and International Cooperation from Rosstat) in October 2017

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_OCCUP
Downloaded: 29-11-2017
(R&D personnel by sector of employment and occupation)

³⁸ See Mas, Robledo and Pérez (2012).

Remarks

The elaboration of the researchers' database for Russia has been based on the information by industry provided by the publication *Russian Science and Technology at a Glance* (CSRS) and by Rosstat, as OECD ANBERD database does not publish information on researchers by industry for Russia.

However, and taking into account that BERD figures are based on OECD data, it has been decided to maintain the total researchers figures from ANBERD database and to use national information to estimate the disaggregation by industries of these figures. In addition, total researchers' figures from ANBERD cover the period 1995-2015, whereas national data are only available for the most recent years.

Researchers have been distributed among PREDICT selected sectors, using approximate correspondences between ISIC Rev. 4 and ISIC Rev. 3.1 (see Appendix 1), which have a direct correspondence with the classification of industries of Russian R&D statistics. In addition, some assumptions need to be done to estimate business R&D researchers by industry, as the available information by industry refers to total researchers, including researchers that do not work in the business sector. For this reason, national data have been re-adjusted to OECD total business R&D figures. In addition, RERD/PERD ration have been used as well in order to estimate data for some years/industries.

Russian dataset does not contain information by industry for the years 1995-2003 and sectors NACE 4791 (RS sector, Retail sale via mail order houses or via Internet, 45-47 (Wholesale and retail trade, repair of motor vehicles and motorcycles), 49-53 (Transportation and storage), 58-63 (Information and communication), 64-66 (Financial and insurance activities), 69-82 (Professional, scientific, technical, administration and support service activities), 69-75 (Professional, scientific and technical activities) are not available. Sectors 27-28 (Manufacture of machinery and equipment) and 303 (Manufacture of air and spacecraft and related machinery) are available only since 2012.

MC sectors are not available and regarding ICT industries, sectors 268 (Manufacture of magnetic and optical media), 4652 (Wholesale of electronic and telecommunications equipment and parts), 951 (Repair of computers and communication equipment) and the disaggregation between 582 (Software publishing), 62 (Computer programming, consultancy and related activities) and 631 (Data processing, hosting and related activities; web portals) are also not available.

Also, the disaggregation at 4-digits of ICT sector NACE 261 (Manufacture of electronic components and boards) and at 3 digits of ICT sector NACE 61 (Telecommunications) is not available.

Taiwan

Sources

National Science and Technology Survey from Taiwan's Ministry of Science and Technology

- <https://ap0512.most.gov.tw/WAS2/English/AsTechnologyEStatisticsList.aspx>

Downloaded: 29-11-2017

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY_ISIC4
Downloaded: 29-11-2017
(R&D researchers (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-10-2016
(R&D researchers (ISIC Rev. 3.1))

Remarks

The elaboration of the researchers' database for Taiwan has been based on the information by industry provided by OECD and by Taiwan's Ministry of Science and Technology in the National Science and Technology Survey. These two sources have been complementary to elaborate Taiwan's R&D researchers' dataset.

However, the information available in these two datasets does not cover the years 1995, 1996 and 1997. Thus, the number of researchers corresponding to these years in PREDICT dataset have been estimated using average growth rates of the following years and/or sectoral structures from the next years. In addition, blanks appear in some ICT and MC subsectors from 2005 backwards. In these cases, average growth rates and sectoral structures of the following years and BERD/RERD or RERD/PERD ratios have been also applied.

In order to estimate RS sector, additional assumptions need to be done. In this case BERD/Researchers ratios from the US have been re-adjusted and applied to Taiwan's data to obtain an estimation of the RS sector. Therefore, we recommend taking the results with caution.

Taiwan dataset does not contain information for sector 303 (Manufacture of air and spacecraft and related machinery) and NACE section P (Education) in the initial years of the period (1995-2008). Neither does it contain data for ICT subsectors 2611 (Manufacture of electronic components), 2612 (Manufacture of loaded electronic boards), 4651 (Wholesale of computers, computer peripheral equipment and software), 4652 (Wholesale of electronic and telecommunications equipment and parts), 5821 (Publishing of computer games), 5829 (Other software publishing), 611 (Wired telecommunications activities), 612 (Wireless telecommunications activities), 613 (Satellite telecommunications activities), 619 (Other telecommunications activities), 6201 (Computer programming activities), 6202 (Computer consultancy activities), 6203 (Computer facilities management activities), 6209 (Other information technology and computer service activities), 6311 (Data processing, hosting and related activities), 6312 (Web portals), 9511 (Repair of computers and peripheral equipment) and 9512 (Repair of communication equipment), nor for MC sub-sectors 5811 (Book publishing), 5812 (Publishing of directories and mailing lists), 5813 (Publishing of newspapers), 5814 (Publishing of journals and periodicals), 5819 (Other publishing activities), 591 (Motion picture, video and television programme activities) and its subsectors, 592 (Sound recording and music publishing activities), 601 (Radio broadcasting), 602 (Television programming and broadcasting activities), 6391 (News agency activities) and 6399 (Other information service activities n.e.c.).

United States

Sources

Business R&D and Innovation Survey (BRDIS) from National Science Foundation and United States Census Bureau

- <https://www.nsf.gov/statistics/srvyindustry/#tabs-2>
Downloaded: 24-10-2017

- Information provided by Raymond M. Wolfe (Economist & Senior Analyst of National Science Foundation 's National Center for Science and Engineering Statistics (NCSES))

Science and Engineering Indicators from National Science Foundation and United States Census Bureau

- <https://www.nsf.gov/statistics/2016/nsb20161/#/>
Downloaded: 24-11-2016

Survey of Industrial Research and Development (SIRD) from National Science Foundation

- <http://www.nsf.gov/statistics/industry/>
Downloaded: 22-11-2016

Research and Development Statistics from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY
Downloaded: 14-11-2016
(R&D researchers (ISIC Rev. 3.1))
- http://stats.oecd.org/Index.aspx?DataSetCode=PERS_OCCUP
Downloaded: 24-11-2017
(R&D personnel by sector of employment and occupation. Researchers in Business sector)

Remarks

The elaboration of the researchers' database for the United States has been based on the information provided by the National Science Foundation and the United States Census Bureau in its Business R&D and Innovation Survey (BRDIS) (National Science Foundation and United States Census Bureau), conducted since 2008 and its predecessor, Survey of Industrial Research and Development (National Science Foundation). Researchers' figures have been distributed among ICT, RS, MC and selected macro-sectors, using the correspondence tables between NAICS and NACE Rev. 2³⁹ (and taking into account the different revisions of the NAICS (1997, 2002, 2007 and 2012) and also the previous classification, SIC (Standard Industrial Classification) 1987, that was used in the initial years of the database, from 1995 to 1998).

However, although statistics from BRDIS and SIRD are generally comparable and the definitions used in both are very similar, this is not the case of R&D employment figures. For them, a discontinuity (a drop in the amount of R&D researchers) appears between the two surveys, although there is not a definite evidence of the potential reason. According to the National Science Foundation, the discontinuity has much more to do with the way companies responded to the SIRD (survey conducted up to 2007), than with changes in the way the data are collected in the new and current survey (BRDIS). Given the drop in the number of FTE scientists and engineers between the last (2007) cycle of SIRD and the first (2008) cycle of BRDIS, it is suspected that SIRD respondents, although instructed to do otherwise, reported headcounts for this item. NSF and Census are working with this issue and do not have a definite answer yet.

When necessary, different methods such as interpolation have been used in the case of some industries to complete the database. In order to split some sector into its subsectors, other assumptions need to be done, as the use of previous/next years' structure, the use of BERD/Researchers ratio of a higher sectoral aggregated, the use of BERD structure, etc. Also information coming from OECD Research and Development Statistics has been used to fill some blanks in the database, although this database is still classified following ISIC Rev. 3.

³⁹ The correspondences between different versions of US NAICS and ISIC Rev. 4 are available at <http://www.census.gov/eos/www/naics/concordances/concordances.html>. Ivie has also elaborated a correspondence table for ICT, MC and RS sectors (see Annex II)

For the initial years (1995-1998), as the survey results offer less industry detail, the growth rates of a higher sectoral aggregated is sometimes applied to estimate some non-available industries. This estimate is then re-adjusted to the official totals.

In 2015 both, OECD and Eurostat, have changed their policy with respect to the previous years, now publishing in their R&D databases for the first time the researchers' figures from SIRD and BRDIS without any adjustment to correct this break in the series. Hence, it was decided to follow its criteria also in the elaboration of PREDICT 2017 database. Consequently, US researchers' dataset is complete in PREDICT 2017 database, but it must be taken into account that there is a series break in 2008.

Sector NACE 85 (Education) is not available in the US dataset. Also, ICT trade sector (NACE 4651-4652), Repair of computers and communication equipment (NACE 951) and the disaggregation into its 3-4-digits subsectors of the ICT and MC industries (except in the case of Telecommunications, NACE 61) are not available.

Public Funding of ICT R&D

European Union and its Member States

Methodology

Since data on Public Funding of ICT R&D in the European Union and its Member States is not readily available from Eurostat or OECD databases, it is estimated by applying a methodology developed within the PREDICT Project. PREDICT 2018 database estimates ICT GBARD not only by NABS industries, but also by NACE industries, as in PREDICT 2017. PREDICT's 2018 GBARD data is broken down into a high level of industry disaggregation that consists of 37 industries, of which 7 are ICT industries (following OECD's ICT sector definition) for the period 2006 to the most recent year with information available, that is 2016. The methodology applied in the PREDICT 2018 database heavily relies in both Stančík (2012)⁴⁰ and Mas et al. (2016)⁴¹. A complete description of the methodology is described in the Final Methodological Report.

The analysis of public R&D expenditures on ICT is based on GBARD data (Government budget allocations for R&D). GBARD data is reported for 14 different NABS-2007 chapters and is available for every EU Member State in Eurostat databases. Therefore, the available information does not allow us to measure neither the public funding of R&D by industries nor the part devoted to ICT assets. The new methodology aims to estimate these two issues in three stages. First, we propose a correspondence between the NACE classification (Rev 1.1 and Rev 2) and the NABS-2007 chapters at three-digit level. Once the correspondence is defined, the second step consists of constructing weights to assign official GBARD by NABS to each NACE industry. The weights are based on the assumption that R&D intensity in each industry is related to the share of labour costs of employees with higher education (ISCED codes 5a, 5b and 6) in total labour costs. Finally, to compute the part of R&D expenditure devoted to ICT assets in each NACE industry, it is assumed that the proportion of R&D investment in ICT assets is equal to the share of labour costs of employees with higher education performing ICT occupations (based on ISCO-08 and ISCO-88 codes) over total labour costs. To calculate the shares, tailor-made information is used on the hours worked by employees by 3-digit industries and by

⁴⁰ Stančík, J. (2012). "A Methodology for Estimating Public ICT R&D Expenditures in the EU". JRC Science and Policy Report No.25433. Institute for Prospective Technological Studies, Seville. Available at: <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=5119>

⁴¹ Mas, M., Benages, E., Fernández de Guevara, J. and L. Hernández (2016): *A proposal for disentangling funded R&D (GBARD) by industry*. SPINTAN Working Paper No. 23, available at: http://www.spintan.net/wp-content/uploads/public/WP_23_Mas_FernandezdeGuevara_Benages_Hernandez.pdf

occupational attainment from Eurostat's Labour Force Survey and on average earnings of employees with higher education and occupations from the Structure of Earnings Survey. However, in the PREDICT 2018 database, due to a new dissemination policy from Eurostat, the LFS data received were more restricted due to confidentiality constraints. Using these new data would imply a significant break in the series. To avoid this, it was decided to maintain both the weights of each NACE-NABS crossing and the ICT shares from 2015 in 2016.

Sources

Government budget allocations for R&D (GBARD) from Eurostat

[Http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gba_nabsfin07&lang=en](http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gba_nabsfin07&lang=en)

Downloaded: 25-10-2017 (data last updated by Eurostat: 04-10-2017).

Science and technology – Research and development data - Total GBARD by NABS 2007 socio-economic objectives

Tailor-made extractions from the Labour Force Survey (LFS) microdata from Eurostat

- Received: 12-09-2016
Hours worked by NACE sub-sector and ICT versus non-ICT occupations by country, for higher educated employees

Tailor-made extractions from the Structure of Earnings Survey (SES) microdata from Eurostat

- Received: 07-09-2017 for the years 2006, 2010 and 2014.

Mean hourly wages by NACE sub-sector and ICT versus non-ICT occupations by country, for higher educated employees; and mean hourly wages for ICT versus non-ICT occupations by country for higher educated employees

United States

Public Funding of ICT R&D by NABS chapters in the United States is estimated by applying a procedure similar to that of the European Union. The main difference is that the procedure has to be slightly modified due to the need of using correspondences between the industry and occupation classifications used in the US and those of the EU. Namely, the US Census Industrial Classification (CIC) is used. ICT occupations are identified on the Mid-Pacific Information and Communication Technologies Center (MPICT) definition following the Standard Occupation Classification (SOC). All US employment data (hours worked, mean hourly wages) comes from the Current Population Survey. The CIC-NABS correspondence table is defined in table A9 and the ICT occupations following the SOC classification are defined in tables A12 and A13.

Sources

Government budget allocations for R&D (GBARD) from Eurostat

2. http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gba_nabsfin07&lang=en

Downloaded: 25-10-2017 (data last updated by Eurostat: 04-10-2017).

Science and technology – Research and development data - Total GBARD by NABS 2007 socio-economic objectives

Current Population Survey (CPS) from the Bureau of Labor Statistics (BLS) and the US Census Bureau

- <http://dataferrett.census.gov/>
Downloaded: 09-11-2017
Mean hourly wages and hours worked by CIC industrial classification and SOC occupational classification, for higher educated workers

Japan

In order to estimate Public Funding of ICT R&D in Japan, the methodology developed for the EU and for the US is taken as reference, but the availability of data does not allow calculating ICT GBARD with the level of disaggregation required. It is not possible to calculate the disaggregation by industries or by NABS chapters. Therefore, the methodology followed is not as homogeneous with the one followed for the EU countries and the US and it does not allow to estimate ICT GBARD by NABS chapters.

Japanese data comes from the Basic Survey on Wage Structure. The survey aims at obtaining a clear picture of the wage structure of employees in major industries i.e., wage distribution by type of employment, type of work, occupation, sex, age, school career, length of service and occupational career, etc. The survey is conducted every year and investigates the salary referred to June. The average salary for June (instead of the average of hourly wages) is totalized, and working hours are totalled collectively. However, data on earnings by occupation and school career is not available, as well as data on earnings by industries and occupation.

Available data to calculate the ICT R&D employment shares relies on average monthly wages and number of employees by occupation (with a 129 occupation disaggregation) and average monthly wages by school career (tertiary education: graduates of higher professional schools or junior colleges and graduates of universities). The ICT occupations chosen from the 129 occupation classification are: system engineer, programmer and computer operator.

The ICT R&D employment shares are applied to Eurostat's data of GBARD for Japan.

$$ICT_R\&D_emp_share_t = \frac{\sum_{k:ICT\ occupations} employees_t * monthly_wages_t}{\sum_{k:tertiary\ edu} employees_t * monthly_wages_t}$$

Sources

Government budget allocations for R&D (GBARD) from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=gba_nabsfin07&lang=en
Downloaded: 25-10-2017 (data last updated by Eurostat: 04-10-2017).
Science and technology – Research and development data - Total GBARD by NABS 2007 socio-economic objectives

Basic Survey on Wage Structure from the Ministry of Health, Labour and Welfare (Japan)

- <http://www.mhlw.go.jp/english/database/db-l/ordinary.html>
Downloaded: 08-11-2017
Data by school career
- <http://www.e-stat.go.jp/SG1/estat/GL08020101.do? toGL08020101 &tstatCode=000001011429&requestSender=dsearch>
Downloaded: 08-11-2017
Data by detailed occupation

Macroeconomic Variables

Gross Value Added, Gross Domestic Product and Gross Output

European Union and its Member States

Sources

National Accounts (NA) ESA 2010 NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_gdp&lang=en
Downloaded: 16-11-2017
(GDP and main components (output, expenditure and income))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a10&lang=en
Downloaded: 16-11-2017
(Gross value added and income by A*10 industry breakdowns)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64&lang=en
Downloaded: 16-11-2017
(National Accounts aggregates by industry (up to NACE A*64))

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat

- http://epp.eurostat.ec.europa.eu/portal/page/portal/national_accounts/data/database
Downloaded: 07-06-2016
(National Accounts by 10 branches – employment data)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace21_e&lang=en
Downloaded: 07-06-2016
(National Accounts by 21 branches - employment data)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace31_e&lang=en
Downloaded: 07-06-2016
(National Accounts by 38 branches - employment data)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace64_e&lang=en
Downloaded: 07-06-2016
(National Accounts by 64 branches - employment data)

National Accounts (NA) ESA 1995 NACE Rev 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace06_c&lang=en
Downloaded: 06-11-2015
(National Accounts by 6 branches - aggregates at current prices)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace31_c&lang=en
Downloaded: 06-11-2015
(National Accounts by 31 branches - aggregates at current prices)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace38_c&lang=en
Downloaded: 06-11-2015
(National Accounts by 60 branches - aggregates at current prices)

ESA 2010 Input-Output tables

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=naio_10_cp1610&lang=en
Downloaded: 16-11-2017

ESA 1995 Input-Output tables

- <http://ec.europa.eu/eurostat/web/esa-supply-use-input-tables/data/workbooks>
Downloaded: 06-11-2015

Structural Business Statistics (SBS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_sca_r2&lang=en
Downloaded: 16-11-2017
(Annual enterprise statistics for special aggregates of activities)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_ind_r2&lang=en
Downloaded: 16-11-2017

(Annual detailed enterprise statistics for industry (B-E))

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_dt_r2&lang=en
Downloaded: 16-11-2017
(Annual detailed enterprise statistics for trade (G))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se_r2&lang=en
Downloaded: 16-11-2017
(Annual detailed enterprise statistics for services (H-N and S95))

Structural Business Statistics (SBS) NACE Rev 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dade&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on manufacturing subsections DA-DE and total manufacturing)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dfdn&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on manufacturing subsections DF-DN and total manufacturing)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_3b_tr&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on trade)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on services (H-K))

Structural Analysis Database (STAN) ISIC Rev. 3.1 from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS>
Downloaded: 11-11-2015

EU KLEMS Growth and Productivity Accounts ISIC Rev. 3

- <http://www.euklems.net/index.html>
Downloaded: 11-11-2014
(March 2008 Release)
(November 2009 Release, updated March 2011)

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/niots.htm
Downloaded: 15-10-2015
(National Input-Output Tables, Released November 2013)
- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=naio_10_cp1610&lang=en
Downloaded: 16-11-2017
(Conversion factors for euro fixed series into euro/ECU)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

Remarks

The main source of the GVA, GDP and GO NACE Rev. 2 dataset in nominal euros for the EU countries is NA from Eurostat, compiled according to the new European System of

National and Regional Accounts (ESA 2010). The ESA 2010 is based on the concepts of the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009), which provides guidelines on national accounting for all countries throughout the world. Nevertheless, it incorporates certain differences, particularly in its presentation, which is more in line with its specific use within the Union.

According to the OECD definitions, the ICT and MC sectors are defined on the basis of the NACE Rev. 2 nomenclature up to 4-digit level. Something similar occurs with Retail sale via order houses or via Internet (RS sector), excluded from the OECD definition.

The sectorial breakdown in both Eurostat and National Statistical Office (NSO) are limited to 2-digit or division level (A*10, A*21, A*38, A*64 classifications) and is not available for the first years of the period 1995-2015 for Poland, Latvia, Bulgaria and European Union, especially before 2000.

This NA disaggregation is not detailed enough to obtain the complete 4-digit datasets for the period 1995-2015. In the case of ICT sectors, direct NA information is only provided by Eurostat for sector NACE 61 (telecommunications) for all the European countries, with the exception of Malta for the entire period and Bulgaria, Latvia, Poland and EU for the first years of the period. In the case of MC sectors, only sector NACE 59-60 (audiovisual and broadcasting activities) is available in NA, with the same country exceptions as in ICT sectors.

Therefore, many additional sources of data are needed. These sources will be used to split national accounts official data up to the 4-digit level required. Hence, data included in the dataset will be coherent with the NA official statistics. The alternative data sources will be used according to a hierarchy that prioritise Eurostat, other official statistical offices and the OECD over other data.

The GVA NA data has been distributed among ICT sectors, according to the comprehensive and operational ICT sector definition, MC sectors, Retail sale via order houses or via Internet, the selected economic activities (additional sectors) and the rest of industries using GVA or production data (when the first is not available) from NSO of individual countries, previous NA ESA 1995, input-output tables, SBS statistics, EU KLEMS database, WIOD database and correspondence tables between NACE Rev 1.1 and NACE Rev. 2 (see Appendix 1) and the methodology described in Mas, Robledo y Pérez (2012)⁴². The GO final dataset applies the same procedure and sources.

In the case of Ireland, the reallocation of a limited number of large firms into this country supposed a significantly higher revision of Irish GDP (officially released on 12 July 2016) by the Central Statistics Office (CSO) from 2015 onwards. The new data was available (annual and quarterly main aggregate data) in the Eurostat database since 21 July 2016. Related to this revision NACE Rev. 2 sections CF (division 21), CI (division 26), CK (division 28) and CM (divisions 31 to 33) were suppressed since 2015 in the official statistics for confidentiality reasons. As a consequence of this, it has been impossible to obtain the ICT manufacturing sector (NACE Rev.2 groups 261 to 264 and 268) for Ireland since 2015 for GVA, as it is a part of the confidential division 26. In the case of Gross Output, no data is available for Ireland in the last update of National Accounts published by Eurostat.

The majority of GO and GVA sector gaps in each Member State, especially before 2000, have been filled using percentage structure corresponding to the previous/following years, other variables (turnover), European averages and ratio GVA/GO, Turnover/GO

⁴² ICT Sector Definition Transition from NACE Rev. 1.1 to NACE Rev. 2: A Methodological Note. JRC Technical Reports (2012). <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=5919>. See in Annex II the correspondence table between NACE Rev. 1.1 and NACE Rev. 2

(GVA) or growth rates of a more aggregated sector in the statistic. Croatia, Greece, Luxembourg, Malta, Bulgaria, Poland and Latvia lack official information for some industries, therefore, we recommend taking the results with caution.

In the case of GO, data by industry for European Union for the period 1995-2003 is obtained as the sum of the member countries since official data is not available.

We obtain GVA and GO dataset in PPS using purchasing power parities from Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. For countries with no available data for any of them the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

Norway

Sources

National Accounts (NA) ESA 2010 NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_gdp&lang=en
Downloaded: 16-11-2017
(GDP and main components (output, expenditure and income))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a10&lang=en
Downloaded: 16-11-2017
(Gross value added and income by A*10 industry breakdowns)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64&lang=en
Downloaded: 16-11-2017
(National Accounts aggregates by industry (up to NACE A*64))

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_gdp_c&lang=en
Downloaded: 09-06-2016
(GDP and main components - Current prices)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace10_c&lang=en
Downloaded: 09-06-2016
(National Accounts by 10 branches - aggregates at current prices)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace21_c&lang=en
Downloaded: 09-06-2016
(National Accounts by 21 branches - aggregates at current prices)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace38_c&lang=en
Downloaded: 09-06-2016
(National Accounts by 38 branches - aggregates at current prices)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace64_c&lang=en
Downloaded: 09-06-2016
(National Accounts by 64 branches - aggregates at current prices)

National Accounts (NA) ESA 1995 NACE Rev 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace06_c&lang=en
Downloaded: 06-11-2015

(National Accounts by 6 branches - aggregates at current prices)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace31_c&lang=en
Downloaded: 06-11-2015
(National Accounts by 31 branches - aggregates at current prices)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace38_c&lang=en
Downloaded: 06-11-2015
(National Accounts by 60 branches - aggregates at current prices)

Structural Business Statistics (SBS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_sca_r2&lang=en
Downloaded: 16-11-2017
(Annual enterprise statistics for special aggregates of activities)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_ind_r2&lang=en
Downloaded: 16-11-2017
(Annual detailed enterprise statistics for industry (B-E))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_dt_r2&lang=en
Downloaded: 16-11-2017
(Annual detailed enterprise statistics for trade (G))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se_r2&lang=en
Downloaded: 16-11-2017
(Annual detailed enterprise statistics for services (H-N and S95))

Structural Business Statistics (SBS) NACE Rev 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dade&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on manufacturing subsections DA-DE and total manufacturing)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dfdn&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on manufacturing subsections DF-DN and total manufacturing)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_3b_tr&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on trade)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on services (H-K))

Structural ANalysis Database (STAN) ISIC Rev. 3.1 from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS>
Downloaded: 11-11-2015

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

Remarks

The main source of the GVA, GDP and GO NACE Rev. 2 dataset in nominal euros for Norway is NA from Eurostat and Statistics Norway, compiled according to ESA 2010, based on the concepts of the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD,

United Nations and World Bank, 2009), which provides guidelines on national accounting for all countries throughout the world.

According to the OECD definitions, ICT and MC sectors are defined on the basis of the NACE Rev. 2 nomenclature up to 4-digit level. Something similar occurs with RS sector, excluded from the OECD definition. In the case of GVA, the sectorial breakdown in both Eurostat and Statistics Norway are limited to 2-digit or division level (A*10, A*21, A*38, A*64 classifications).

This disaggregation is not detailed enough to obtain the complete 4-digit datasets for the period 1995-2015. In the case of ICT sectors, direct NA information is only provided by Eurostat for sector NACE 61 (telecommunications). In the case of MC sectors, only sector NACE 59-60 (audiovisual and broadcasting activities) is available in NA.

Therefore, many additional sources of data are needed to estimate each variable. These sources will be used to split national accounts official data up to the 4-digit level required. Hence, data included in the dataset will be coherent with the NA official statistics. The alternative data sources will be used according to a hierarchy that prioritise Eurostat, NSO and the OECD over other data.

The NA data has been distributed among ICT sectors according to the comprehensive and operational ICT sector definition, MC sectors, Retail sale via order houses or via Internet, the selected economic activities (additional sectors) and the rest of industries using Statistics Norway NA, previous NA ESA 1995, SBS statistics and correspondence tables between NACE Rev 1.1 and NACE Rev. 2 (see Appendix 1) and the methodology described in Mas, Robledo y Pérez (2012).

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

We obtain GVA and GO datasets in PPS using purchasing power parities from Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

Switzerland

Sources

National Accounts (NA) ESA 2010 NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_gdp&lang=en
Downloaded: 16-11-2017
(GDP and main components (output, expenditure and income))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a10&lang=en
Downloaded: 16-11-2017
(Gross value added and income by A*10 industry breakdowns)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64&lang=en
Downloaded: 16-11-2017
(National Accounts aggregates by industry (up to NACE A*64))

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_gdp_c&lang=en
Downloaded: 09-06-2016
(GDP and main components - Current prices)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace10_c&lang=en
Downloaded: 09-06-2016
(National Accounts by 10 branches - aggregates at current prices)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace21_c&lang=en
Downloaded: 09-06-2016
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- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace38_c&lang=en
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- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace64_c&lang=en
Downloaded: 09-06-2016
(National Accounts by 64 branches - aggregates at current prices)

National Accounts (NA) ESA 1995 NACE Rev 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace06_c&lang=en
Downloaded: 06-11-2015
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- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace31_c&lang=en
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- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace38_c&lang=en
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(National Accounts by 60 branches - aggregates at current prices)

Structural Business Statistics (SBS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_sca_r2&lang=en
Downloaded: 21-09-2017
(Annual enterprise statistics for special aggregates of activities)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_ind_r2&lang=en
Downloaded: 22-09-2017
(Annual detailed enterprise statistics for industry (B-E))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_dt_r2&lang=en
Downloaded: 22-09-2017
(Annual detailed enterprise statistics for trade (G))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se_r2&lang=en
Downloaded: 22-09-2017
(Annual detailed enterprise statistics for services (H-N and S95))

Structural Business Statistics (SBS) NACE Rev 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dade&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on manufacturing subsections DA-DE and total manufacturing)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dfdn&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on manufacturing subsections DF-DN and total manufacturing)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_3b_tr&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on trade)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on services (H-K))

Structural Analysis Database (STAN) ISIC Rev. 3.1 from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS>
Downloaded: 11-11-2015

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

Remarks

The main source of the GVA (and GDP) and GO NACE Rev. 2 dataset in nominal euros for Switzerland is NA from Eurostat and Bundesamt für Statistik (BFS), compiled according to ESA 2010, based on the concepts of the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009), which provides guidelines on national accounting for all countries throughout the world.

According to the OECD definitions, the ICT and MC sectors are defined on the basis of the NACE Rev. 2 nomenclature up to 4-digit level. Something similar occurs with RS sector, excluded from the OECD definition. In the case of GVA, the sectorial breakdown in both Eurostat and NSO are limited to 2-digit or division level (A*10, A*21, A*38, A*64 classifications).

This disaggregation is not detailed enough to obtain the complete 4-digit datasets for the period 1995-2015. In the case of ICT sectors, direct NA information is only provided for sector NACE 61 (telecommunications) and sector NACE 59-60 (audiovisual and broadcasting activities) in the case of MC sectors. Therefore, many additional sources of data are needed to estimate 4-digit dataset. These sources will be used to split national accounts official data up to the 4-digit level required. Hence, data included in the dataset will be coherent with the NA official statistics. The alternative data sources will be used according to a hierarchy that prioritise Eurostat, BFS and the OECD over other data.

The NA data has been distributed among ICT sectors, according to the comprehensive and operational ICT sector definition, MC sectors, Retail sale via order houses or via Internet, the selected economic activities (additional sectors) and the rest of industries using previous ESA 1995, SBS statistics and correspondence tables between NACE Rev 1.1 and NACE Rev. 2 (see Appendix 1) and the methodology described in Mas, Robledo y Pérez (2012).

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

We obtain GVA and GO datasets in PPS using purchasing power parities coming from Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total

manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

Australia

Sources

NA from Australian Bureau of Statistics (ABS)

- <http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/110953FFA28D4E52CA2572110002FF03?opendocument>
Downloaded: 14-07-2017

Australian Industry from ABS

- <http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/48791677FF5B2814CA256A1D0001FECD?opendocument>
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Experimental Estimates for the Manufacturing Industry from ABS

- <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8159.02009-10?OpenDocument>
Downloaded: 26-10-2016

Information and Communication Technology from ABS

- <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8126.02006-07?OpenDocument>
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Information Media and Telecommunications Services

- <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8681.0>
Downloaded: 20-10-2015

Retail and Wholesale Industries

- <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8622.0>
Downloaded: 20-10-2015

EU KLEMS Growth and Productivity Accounts ISIC Rev. 3

- <http://www.euklems.net/index.html>
Downloaded: 11-11-2014
(March 2008 Release)
(November 2009 Release, updated March 2011)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The main source of the GVA (including GDP) and GO NACE Rev. 2 datasets (in national currency) for Australia is ABS. As from December 2009, national accounts estimates are compiled according to the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009).

GVA NA information from ABS is available at ANZSIC division level (the broadest level) for all the period 1995-2015, but only since 2006 in the case of GO. The final GO dataset has been complete using EU KLEMS database. These datasets have been distributed among ICT sector, MC sector, RS sector and the rest of industries using data from Input-Output tables, Australian Industry Statistics, Experimental Estimates for the Manufacturing Industry, Information and Communication Technology Statistics, Information Media and Telecommunications Services Statistics, Retail and Wholesale Industries Statistics, provided by ABS, EU KLEMS database and correspondence tables between ANZSIC 2006 and NACE Rev. 2⁴³.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

In Australia datasets, Manufacturing (divisions 10-33) excludes part of Repair and installation of machinery and equipment (division 33); Group 261 (manufacture of electronic components and boards) includes Manufacture of consumer electronics (group 264) and Manufacture of magnetic and optical media (group 268); Services, except trade (divisions 49-99) include part of Repair and installation of machinery and equipment (division 33); Repair of computers and communication equipment (group 951) include part of Repair and installation of machinery and equipment (division 33), Retail sale via mail order houses or via Internet (RS sector, class 4791), includes Other retail sale not in stores, stalls or markets (class 4799), Group 639 (Other information service activities) include Library and archives activities (class 9101).

We obtain NACE Rev. 2 datasets for GO and GVA in euros and PPS using exchange rates and purchasing power parities respectively from OECD and Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

⁴³ The correspondence between ANZSIC 2006 and ISIC Rev. 4 is available at: <http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1292.0.55.0052008?OpenDocument>. Ivie has also elaborated correspondence tables (see Annex II).

Brazil

Sources

Annual National Accounts from Instituto Brasileiro de Geografia e Estatística (IBGE)

- <https://www.ibge.gov.br/estatisticas-novoportal/economicas/contas-nacionais/9052-sistema-de-contas-nacionais-brasil.html?&t=resultados>
Downloaded: 31-07-2017

Quarterly National Accounts from Instituto Brasileiro de Geografia e Estatística (IBGE)

- <https://www.ibge.gov.br/estatisticas-novoportal/economicas/contas-nacionais/9300-contas-nacionais-trimestrais.html?&t=resultados>
Downloaded: 31-07-2017

Annual Survey of Industry from IBGE

- <https://www.ibge.gov.br/estatisticas-novoportal/economicas/industria/2016-np-pesquisa-industrial-anual/9042-pesquisa-industrial-anual.html?&t=resultados>
Downloaded: 11-10-2017

Annual Survey of Trade from IBGE

- <https://www.ibge.gov.br/estatisticas-novoportal/economicas/comercio/9075-pesquisa-anual-de-comercio.html?&t=resultados>
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Annual Survey of Services from IBGE

- <https://www.ibge.gov.br/estatisticas-novoportal/economicas/servicos/9028-pesquisa-anual-de-servicos.html?&t=resultados>
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World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/niots.htm
Downloaded: 15-10-2015
(National Input-Output Tables, Released November 2013)
- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of the NACE Rev. 2 database for GVA and GO has been based on the NA (annual and quarterly) information published by IBGE in national currency. As from March 2015, national accounts estimates are compiled according to the 2008 SNA

('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009).

The SNA 2008 National Accounts (CNAE 2.0) data is available for the period 1995-2015 for GVA, but only for the period 2000-2014 for GO. To complete NA GO data since 1995 we use WIOD database. Finally, the complete datasets (GO and GVA) have been distributed among ICT sectors, MC sector and the rest of industries using the surveys (Industrial, Trade and Services) provided by IBGE (in CNAE 1.0 and CNAE 2.0), WIOD database and correspondence tables between CNAE 1.0, CNAE 2.0, ISIC Rev. 3.1 (NACE Rev. 1.1) and ISIC Rev. 4 (NACE Rev. 2)⁴⁴.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

Brazil dataset does not include Retail sale via mail order houses or via Internet sector.

We obtain NACE Rev. 2 GVA and GO in euros and PPS using exchange rates and purchasing power parities respectively from OECD and Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

Canada

Sources

NA from Statistics Canada

- <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=3840038&tabMode=dataTable&srchLan=-1&p1=-1&p2=9>
- <http://www5.statcan.gc.ca/cansim/a33?RT=TABLE&themeID=2745&spMode=tables&lang=eng>
Downloaded: 08-11-2017

Annual Survey of Manufactures and Logging from Statistics Canada

- <http://www5.statcan.gc.ca/cansim/a05?lang=eng&id=3010006>
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Annual Wholesale Trade Survey from Statistics Canada

- <http://www5.statcan.gc.ca/cansim/a26?lang=eng&retrLang=eng&id=0810014&paSer=&pattern=&stByVal=1&p1=1&p2=38&tabMode=dataTable&csid=>
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World Input-Output Database ISIC Rev. 3 (WIOD)

⁴⁴ The correspondences between CNAE 1.0, CNAE 2.0, ISIC Rev. 3.1 and ISIC Rev. 4 are available at: <https://www.ibge.gov.br/estatisticas-novoportal/metodos-e-classificacoes/classificacoes-e-listas-estatisticas/9078-classificacao-nacional-de-atividades-economicas.html>. Ivie has also elaborated correspondence tables (see Annex II).

- http://www.wiod.org/new_site/database/niots.htm
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(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
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(Purchasing power parities)

PPP from OECD

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Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The main source of the GVA (including GDP) and GO data in national currency for Canada is National Accounts from Statistics Canada (CANSIM database). As from 2012, NA are compiled according to the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009).

The last National Accounts data published covers the period 2007-2014. The rest of the period, 1995-2006, has been covered with previous versions of NA and WIOD database, distributed among ICT sectors, MC sector, RS sector and the rest of industries using data from previous versions of NA, Annual Survey of Manufacturing and Logging, Annual Wholesale Trade Survey provided by Statistics Canada, WIOD database and correspondence tables between NAICS and NACE Rev. 2⁴⁵.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

In Canada datasets, Manufacturing (divisions 10-33) excludes part of Repair and installation of machinery and equipment (division 33), Manufacture of magnetic and optical media (group 268) includes Reproduction of recorded media (group 182), Services, except trade (divisions 49-99) includes part of Repair and installation of machinery and equipment (division 33), Repair of computers and communication equipment (group 951) include part of Repair and installation of machinery and equipment (division 33) and part of Repair of personal and household goods (group 952).

We obtain NACE Rev. 2 GVA and GO datasets in euros and PPS using exchange rates and purchasing power parities respectively from OECD and Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total

⁴⁵ The correspondence between different versions of Canadian NAICS and ISIC Rev. 4 is available at: <http://www.statcan.gc.ca/concepts/concordances-classifications-eng.htm>. Ivie has also elaborated a correspondence table for ICT sectors (see Annex II).

manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

China

Sources

NA from National Bureau of Statistics of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 19-10-2017

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/niots.htm
Downloaded: 15-10-2015
(National Input-Output Tables, Released November 2013)
- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

China Industrial Productivity (CIP) Database 3.0 from Research Institute of Economy, Trade and Industry (RIETI) and Hitotsubashi University

- <http://www.rieti.go.jp/en/database/CIP2015/>
Downloaded: 17-11-2016

Main industrial economic indicators from National Bureau of Statistics of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 19-10-2017

Statistics on Production and Management in High-tech Industry by Industrial Sector from Ministry of Science and Technology of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 19-10-2017

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PPP_GDP
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The main source of the GVA, GDP and GO series since 1995 (in national currency) for China is National Bureau of Statistics of China. The last China's System of National Accounts (CSNA) estimates (2016) are according to the latest recommendations of SNA

2008 ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009).

This information has been distributed among ICT sectors, RS sector and the rest of industries for the period 1995-2015 using the and WIOD ISIC Rev. 3 Database, Main industrial economic indicators provided by National Bureau of Statistics of China, Statistics on Production and Management in High-tech Industry by Industrial Sector from Ministry of Science and Technology of China, CIP database provided by REITI and correspondence tables between Industrial Classification for National Economic Activities (CSIC), ISIC Rev. 3 and ISIC Rev. 4 (NACE Rev. 2)⁴⁶.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

China's datasets do not include ICT trade, MC and RS sectors. Manufacture of chemicals and chemical products (division 20) includes Manufacture of magnetic and optical media (group 268), Wholesale and retail trade, repair of motor vehicles and motorcycles (divisions 45-47) include Repair of personal and household goods (group 952), Services, except trade (divisions 49-99) include Remediation activities and other waste management services (division 39) and Development of building projects (group 411) and exclude Repair of personal and household goods (group 952), Transportation and storage (divisions 49-53) include Travel agency and tour operator activities (group 791), Professional, scientific, technical, administration and support service activities (divisions 69-82) excludes Travel agency and tour operator activities (group 791) and Veterinary activities (division 75), Divisions 69-75 excludes Veterinary activities (division 75), Divisions 86-88 includes Veterinary activities (division 75).

We obtain NACE Rev. 2 datasets for GO and GVA in euros and PPS using exchange rates and purchasing power parities respectively coming from OECD and Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

India

Sources

NA from Ministry of Statistics Programme Implementation (MOSPI).

- http://www.mospi.gov.in/sites/default/files/press_releases_statements/STATEMENT_11_curr_2017-18.xls
Downloaded: 18-10-2017
(Gross Domestic Product)
- <http://www.mospi.gov.in/publication/national-accounts-statistics-2017-1>
Downloaded: 18-10-2017
(National Accounts Statistics)

⁴⁶ The correspondence between Chinese SIC and ISIC Rev. 4 is available at: http://www.stats.gov.cn/tjsj/tjbz/hyflbz/201710/t20171012_1541679.html

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/niots.htm
Downloaded: 17-10-2015
(National Input-Output Tables, Released November 2013)
- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

Annual Survey of Industries from MOSPI

- <http://www.csoisw.gov.in/CMS/cms/Feedback.aspx>
Downloaded: 17-10-2017

Value added & employment generation in the ICT sector in India from MOSPI

- http://mospi.nic.in/mospi_new/upload/val_add ICT 21june11.pdf
Downloaded: 10-11-2016

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The main source of the GVA and GO data (in national currency) for India is NA from MOSPI. As from January 2015, NA estimates are compiled according to the latest recommendations of SNA 2008 ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009).

This new information only covers period 2006-2015. Prior to 2006 WIOD database has been used to extrapolate the series backwards to 1995. This information has been distributed among ICT sectors, MC sectors and the rest of selected industries using Annual Survey of Industry, Value added & employment generation in the ICT sector in India provided by MOSPI. This last source gives the 2008 National Industry Classification (NIC) codes for ICT sectors following the 2007 definition of OECD, which coincide exactly with those of NACE Rev. 2⁴⁷. India GVA dataset does not include ICT trade and RS sector.

We obtain NACE Rev. 2 datasets for GVA and GO in euros and PPS using exchange rates and purchasing power parities respectively coming from OECD and Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade

⁴⁷ The structure of NIC 2008 is identical to the structure of ISIC Rev. 4 up to 4-digit level (class). NIC 2008 is available at: <http://mospi.nic.in/classification/national-industrial-classification>.

sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

Japan

Sources

NA from Economic and Social Research Institute (ESRI), Cabinet Office

- http://www.esri.cao.go.jp/en/sna/data/kakuhou/files/2015/29annual_report_e.html
Downloaded: 15-07-2016

Japan Industrial Productivity (JIP) from Research Institute of Economy, Trade and Industry (RIETI) and Hitotsubashi University

- <http://www.rieti.go.jp/en/database/JIP2015/index.html>
Downloaded: 8-12-2015

Annual manufacturing census from Economic and Industrial Policy Bureau, Ministry of Economy, Trade and Industry (METI)

- <http://www.meti.go.jp/english/statistics/tyo/kougyo/index.html>
Downloaded: 14-07-2016

Survey of selected services industries from METI

- <http://www.meti.go.jp/english/statistics/tyo/tokusabizi/index.html>
Downloaded: 14-10-2015

Structural Business Statistics ISIC Rev. 4 from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=SSIS_BSC_ISIC4
Downloaded: 15-07-2016

EU KLEMS Growth and Productivity Accounts ISIC Rev. 3

- <http://www.euklems.net/index.html>
Downloaded: 11-11-2014
(March 2008 Release)
(November 2009 Release, updated March 2011)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGBP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The main source of the GO and GVA in national currency for Japan is NA from Economic and Social Research Institute (ESRI), Cabinet Office (Government of Japan). As from December 2016, NA estimates are compiled according to the latest recommendations of SNA 2008 ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009).

The NA database covers the period 1995-2015 for both variables. These datasets have been distributed among ICT sector, MC sectors and the rest of industries using mainly the JIP Database, that forms part of the World Input-Output Database (WIOD) project and uses its own industry classification (distinguishing 108 industries, covering the whole of the Japanese economy), and other sources such as Annual manufacturing census and Survey on Selected Service Industries provided by METI, Structural Business Statistics (OECD), EU KLEMS database and correspondence tables between JIP codes, Japan Standard Industrial Classification (JSIC), ISIC Rev. 3 (NACE Rev. 1) and ISIC Rev. 4 (NACE Rev. 2)⁴⁸.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

Japan's datasets do not include RS sector, ICT sector NACE 951 (Repair of computers and communication equipment), and NACE 62 (Computer programming, consultancy and related activities) includes ICT sector NACE 582 (Software publishing).

We obtain NACE Rev. 2 datasets for GO and GVA in euros and PPS using exchange rates and purchasing power parities respectively coming from OECD and Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

Korea

Sources

NA from Bank of Korea

- http://ecos.bok.or.kr/flex/EasySearch_e.jsp
Downloaded: 10-07-2017

NA from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE6A
Downloaded: 28-07-2017

⁴⁸ The correspondences between JIP codes, JSIC, ISIC Rev. 3 and ISIC Rev. 4 are available at: http://www.rieti.go.jp/en/database/d05_data/03-6.pdf
http://www.euklems.net/data/nace2/JPN_sources_12i.pdf
http://www.soumu.go.jp/english/dgpp_ss/seido/sangyo/index.htm
Ivie has also elaborated correspondence tables (see Annex II)

Structural Business Statistics ISIC Rev. 4 from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=SSIS_BSC_ISIC4
Downloaded: 10-07-2017

Mining and Manufacturing Survey from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsList_01List.jsp?vwcd=MT_ETITLE&parentId=G#jsClick
Downloaded: 27-07-2016

Service Industry Survey from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsList_01List.jsp?vwcd=MT_ETITLE&parentId=G#jsClick
Downloaded: 27-07-2016

Survey of Business activities from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsList_01List.jsp?vwcd=MT_ETITLE&parentId=G#jsClick
Downloaded: 27-07-2016

Wholesale and Retail trade Survey from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsList_01List.jsp?vwcd=MT_ETITLE&parentId=G#jsClick
Downloaded: 27-07-2016

EU KLEMS Growth and Productivity Accounts ISIC Rev. 3

- <http://www.euklems.net/index.html>
Downloaded: 11-11-2014
(March 2008 Release)
(November 2009 Release, updated March 2011)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGBP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The main source of the GVA and GO data (in national currency) for Korea is NA from Bank of Korea and NA from OECD. The NA data published by Bank of Korea from spring 2014 onwards is in accordance with the SNA 2008 recommendations ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009).

Additional information was needed to obtain both datasets for the period 1995-2015 distinguishing ICT sectors, MC sector, RS sector and the rest of industries: Surveys (Mining and Manufacturing, Business activities, Wholesale and Retail trade and Service Industry), provided by Statistics Korea, NA from OECD, EU KLEMS database and

correspondence tables between KSIC and NACE Rev. 2⁴⁹. The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

Transportation and storage (divisions 19-53) excludes postal and courier activities (division 53), because this sector is included in NACE 61 sector (Telecommunications).

We obtain NACE Rev. 2 datasets (GVA and GO) in euros and PPS using exchange rates and purchasing power parities respectively from OECD and Eurostat

Russia

National Accounts NACE Rev. 1.1 from Federal State Statistic Service of Russian Federation (Rosstat)

- http://www.gks.ru/free_doc/new_site/vvp/vvp-god/tab1.htm
- http://www.gks.ru/free_doc/new_site/vvp/vvp-god/tab10.htm
- http://www.gks.ru/free_doc/new_site/vvp/vvp-god/tab10a.htm
- http://www.gks.ru/free_doc/new_site/vvp/tab37.xls
Downloaded: 23-10-2017

Structural Business Statistics ISIC Rev. 3 from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=SSIS_BSC
Downloaded: 23-10-2017

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/niots.htm
Downloaded: 15-10-2015
(National Input-Output Tables, Released November 2013)
- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The main source of the GVA (and GO) by industry (in national currency) for Russia is National Accounts from the Federal State Statistic Service of Russian Federation (Rosstat). The NA estimates published from October 2016 onwards are in accordance with the SNA 2008 recommendations ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009), but only for the period 2011-2015. Prior to 2011, NA data are still compiled according to the SNA 1993.

⁴⁹ The correspondences between KSIC and ISIC Rev. 4 are available at: https://kssc.kostat.go.kr:8443/ksscNew_web/index.jsp#. Ivie has also elaborated correspondence tables (see Annex II)

NA data by industry published by only covers period 2003-2015. WIOD database has been used to extrapolate the series (GVA and GO by industry) backward to 1995. These datasets has been distributed among ICT sectors, MC sectors, RS sector and the rest of activities using Structural Business Statistics ISIC Rev. 3 (OECD) and the correspondence table between NACE Rev. 1.1 and NACE Rev. 2 (see Appendix 1).

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

Russia datasets do not include ICT trade sector, Manufacture of chemicals and chemical products (division 20) includes Manufacture of magnetic and optical media (group 268), Manufacture of electronic components and boards (group 261) includes Manufacture of communication equipment (group 263), Computer programming, consultancy and related activities (division 62) includes Software Publishing (group 582), Services, except trade (divisions 49-99) includes Development of building projects (group 411), Transportation and storage (divisions 49-53) includes Travel agency and tour operator activities (group 791), Professional, scientific, technical, administration and support service activities (divisions 69-82) exclude Travel agency and tour operator activities (group 791) and Class 5911 include Motion picture, video and television programme post-production activities (class 5912) and Motion picture, video and television programme distribution activities (class 5913).

We obtain NACE Rev. 2 datasets for GO and GVA in euros and PPS using exchange rates and purchasing power parities respectively from OECD and Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. Theses deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

Taiwan

Sources

NA from National Statistics of Taiwan

- <http://ebas1.ebas.gov.tw/pxweb/Dialog/statfile1L.asp>
Downloaded: 18-07-2017

Input-Output tables from National Statistics of Taiwan

- <http://eng.stat.gov.tw/lp.asp?ctNode=1650&CtUnit=799&BaseDSD=7&MP=5>
Downloaded: 16-11-2016

Census Statistics from National Statistics of Taiwan

- <http://eng.stat.gov.tw/lp.asp?ctNode=1624&CtUnit=774&BaseDSD=7&mp=5>
Downloaded: 16-11-2016

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/niots.htm
Downloaded: 15-10-2015
(National Input-Output Tables, Released November 2013)

- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of the NACE Rev. 2 databases for GO and GVA (including GDP) for Taiwan has been based on NA information by industry provided by National Statistics of Taiwan (Directorate of Budget, Accounting and Statistics (DGBAS) of Executive Yuan). The NA data published by DGBAS from November 2014 onwards are based on the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009).

The National Accounts data are available for the period 1995-2015, and has been distributed among ICT sectors, MC sectors, RS sector and the rest of activities using Input-Output tables, Census Statistics provided by National Statistics of Taiwan, WIOD database and correspondence tables between Standard Industrial Classification (SIC) of Taiwan and ISIC Rev. 4 (NACE Rev. 2) and between NACE Rev. 1.1 and NACE Rev. 2.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

Taiwan datasets (GO and GVA) do not include ICT trade sector, Services, except trade (divisions 49-99) include Development of building projects (group 411), Repair of computers and communication equipment (group 951) includes Repair of consumer electronics (class 9521). In addition, NACE 4791 (Retail sale via mail order houses or via Internet) includes Other retail sale not in stores, stalls or markets (NACE class 4799), as there is not enough information to separate these activities.

We obtain NACE Rev. 2 datasets in euros and PPS using exchange rates and purchasing power parities respectively coming from IMF and Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector. In case no information is available for any of them, the "harmonized procedure" described in Schreyer and Dupont (2006) has been applied.

United States

Sources

NA from Bureau of Economic Analysis (BEA)

- http://www.bea.gov/industry/gdpbyind_data.htm
Downloaded: 05-07-2017

NA ISIC Rev. 4 from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=STANI4>
Downloaded: 05-07-2017

Industry Productivity and Costs from Bureau of Labor Statistics (BLS)

- <http://www.bls.gov/lpc/>
Downloaded: 05-07-2017

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en
Downloaded: 16-11-2017
(Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
Downloaded: 16-11-2017
(Purchasing power parities)

PPP from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP>
Downloaded: 16-11-2017
(PPPs: national currency per US dollar)

Remarks

The elaboration of the NACE Rev. 2 database for GO and GVA distributed among ICT, MC, RS and the rest of activities for United States have been based on NAICS NA (Gross Domestic Product by Industry) provided by BEA, compiled according to the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009), NA ISIC Rev. 4 provided by OECD and correspondence tables between NAICS and ISIC Rev. 4⁵⁰.

BEA has adopted the 2008 SNA in the 2013 Comprehensive Revision of the National Income and Product Accounts. The NA data published from September 2013 onwards has been based on 2008 SNA.

United States datasets (GO and GVA) does not contain information for the ICT trade sector, Manufacturing (divisions 10-33) excludes part of Repair and installation of machinery and equipment (division 33), Manufacture of magnetic and optical media (group 268) includes Reproduction of recorded media (group 182), Services, except trade (divisions 49-99) includes part of Repair and installation of machinery and equipment (division 33), and Repair of computers and communication equipment (group 951) includes part of Repair and installation of machinery and equipment (division 33) and part of Repair of personal and household goods (group 952), Satellite telecommunications activities (group 613) include Other telecommunications activities (group 619) and Computer facilities management activities (class 6203) include Other

⁵⁰ The correspondences between different versions of US NAICS and ISIC Rev. 4 are available at <http://www.census.gov/eos/www/naics/concordances/concordances.html>. Ivie has also elaborated correspondence tables (see Annex II)

information technology and computer service activities (class 6209). Publishing of directories and mailing lists (class 5812) include Other publishing activities (class 5819).

We obtain NACE Rev. 2 datasets in euros and PPS using exchange rates and purchasing power parities respectively coming from OECD and Eurostat.

Additionally, we provide price indexes (implicit deflators) for GDP and GVA industries using the same sources listed above. These deflators are derived as a ratio of current price to volume series and give indication of underlying price changes. The ten deflators obtained are: GDP deflator for total economy and nine for the following NACE Rev. 2 industries: division 26 for each ICT manufacturing sector, Section C for total manufacturing and each Non-ICT manufacturing sector, division 46 for each ICT trade sector, division 47 for RS sector, Section G for total trade sector and each Non-ICT trade/RS sector, division 61 for telecommunications sector, section J (except 61) deflator for each ICT services sector (except telecommunications) and MC sector, section J for total information and communications sector, Sections H-U for total services (except trade) each Non-ICT services sector.

Employment and Hours Worked

European Union and its Member States

Sources

National Accounts (NA) ESA 2010 NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a10_e&lang=en
Downloaded: 16-11-2017
(Employment by A*10 industry breakdowns)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64_e&lang=en
Downloaded: 16-11-2017
(National Accounts employment data by industry (up to NACE A*64))

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat

- http://epp.eurostat.ec.europa.eu/portal/page/portal/national_accounts/data/database
Downloaded: 07-06-2016
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- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace21_e&lang=en
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- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace31_e&lang=en
Downloaded: 07-06-2016
(National Accounts by 38 branches - employment data)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace64_e&lang=en
Downloaded: 07-06-2016
(National Accounts by 64 branches - employment data)

National Accounts (NA) ESA 1995 NACE Rev. 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace06_e&lang=en
Downloaded: 06-11-2015
(National Accounts by 6 branches - employment data)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace31_e&lang=en
Downloaded: 06-11-2015
(National Accounts by 31 branches - employment data)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace60_e&lang=en
Downloaded: 06-11-2015
(National Accounts by 60 branches - employment data)

Structural Business Statistics (SBS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_sca_r2&lang=en
Downloaded: 16-11-2017
(Annual enterprise statistics for special aggregates of activities)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_ind_r2&lang=en
Downloaded: 16-11-2017
(Annual detailed enterprise statistics for industry (B-E))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_dt_r2&lang=en
Downloaded: 16-11-2017
(Annual detailed enterprise statistics for trade (G))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se_r2&lang=en
Downloaded: 16-11-2017
(Annual detailed enterprise statistics for services (H-N and S95))

Structural Business Statistics (SBS) NACE Rev 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dade&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on manufacturing subsections DA-DE and total manufacturing)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dfdn&lang=en
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- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_3b_tr&lang=en
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Structural ANalysis Database (STAN) ISIC Rev. 3.1 from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS>
Downloaded: 11-11-2015

EU KLEMS Growth and Productivity Accounts ISIC Rev. 3

- <http://www.euklems.net/index.html>
Downloaded: 11-11-2014
(March 2008 Release)
(November 2009 Release, updated March 2011)

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

Labour Force Statistics (LFS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_egan2&lang=en
Downloaded: 20-09-2017
(Employment by sex, age groups and economic activity (section level))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_egan22d&lang=en
Downloaded: 20-09-2017
(Employment by sex, age groups and detailed economic activity (division level))
- Eurostat special data request
Downloaded: 03-08-2017

(Employment by economic activity (section, division and group))
(Hours worked by economic activity (section, division and group))

Labour Force Statistics (LFS) NACE Rev. 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsq_egana&lang=en
Downloaded: 30-11-2015
(Employment by sex, age groups and economic activity (section level))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsq_egana2d&lang=en
Downloaded: 30-11-2015
(Employment by sex, age groups and detailed economic activity (division level))
- Eurostat special data request
Downloaded: 26-07-2016
(Employment by economic activity (section, division and group))
(Hours worked by economic activity (section, division and group))

Remarks

The main source of the employment (in persons) and hours worked NACE Rev. 2 datasets for the EU and its Members States is NA from Eurostat, compiled according to the new European System of National and Regional Accounts (ESA 2010). The ESA 2010 is based on the concepts of the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009), which provides guidelines on national accounting for all countries throughout the world. It nevertheless incorporates certain differences, particularly in its presentation, which is more in line with its specific use within the Union.

According to the OECD definitions, the ICT and MC sectors are defined on the basis of the NACE Rev. 2 nomenclature up to 4-digit level. Something similar occurs with Retail sale via order houses or via Internet (RS sector), excluded from the OECD definition.

The employment sectorial breakdown in both Eurostat and National Statistical Office (NSO) are limited to 2-digit or division level (A*10, A*21, A*38, A*64 classifications) and is not available for the complete period 1995-2015 for Poland, Ireland, Latvia, Bulgaria, Croatia and European Union, especially before 2000. In the case of hours worked the same countries plus Belgium, Estonia, Malta and Hungary lack NA data. In Hungary, the information is only available for the period 2010-2015 at A*64 classification and A*10 for the rest of the period.

This NA disaggregation is not detailed enough to obtain the complete 4-digit datasets, where possible, for the period 1995-2015. In the case of ICT sectors, direct NA information is only provided by Eurostat for sector NACE 61 (telecommunications) for all the European countries, with the exception of the countries listed above. In the case of MC sectors, only sector NACE 59-60 (audiovisual and broadcasting activities) is available in NA, with the same country exceptions as in ICT sectors.

Therefore, many additional sources of data are needed to obtain a complete database. These sources will be used to split national accounts official data up to the 4-digit level required, where possible, and extrapolate country series backwards 1995. Hence, data included in the dataset will be coherent with the NA official statistics. The alternative data sources will be used according to a hierarchy that prioritise Eurostat, other official statistical offices and the OECD over other data.

The NA Employment data for the period 1995-2015 has been distributed among ICT sectors, according to the comprehensive and operational ICT sector definition, MC sectors, Retail sale via order houses or via Internet, the selected economic activities (additional sectors) and the rest of industries using employment or jobs (employed or employee) from NSO of individual countries, previous NA ESA 1995, SBS and LFS, EU KLEMS database, WIOD database, correspondence tables between NACE Rev 1.1 and

NACE Rev. 2 (see Appendix 1) and the methodology described in Mas, Robledo y Pérez (2012)⁵¹. SBS only provides number of employed person data for France since 2010. The hours worked final dataset applies the same procedure and sources used in employment. SBS only offers number of hours worked by employees for manufacturing sectors.

The majority of sector gaps in each Member State, especially before 2000, have been filled using percentage structures corresponding to the previous/following years, European averages, ratio hours worked/employment or growth rates of a more aggregated sector in the statistic. The European countries listed above lack official information for some industries, therefore, we recommend taking the results with caution.

Norway

Sources

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National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat

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(National Accounts by 60 branches - employment data)

Structural Business Statistics (SBS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_sca_r2&lang=en
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⁵¹ ICT Sector Definition Transition from NACE Rev. 1.1 to NACE Rev. 2: A Methodological Note. JRC Technical Reports (2012). <http://ipts.jrc.ec.europa.eu/publications/pub.cfm?id=5919>. See in Annex II the correspondence table between NACE Rev. 1.1 and NACE Rev. 2

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(Annual detailed enterprise statistics for services (H-N and S95))

Structural Business Statistics (SBS) NACE Rev 1.1 from Eurostat

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(Annual detailed enterprise statistics on services (H-K))

Structural ANalysis Database (STAN) ISIC Rev. 3.1 from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=STAN08BIS>
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Labour Force Statistics (LFS) NACE Rev. 2 from Eurostat

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Downloaded: 20-09-2017
(Employment by sex, age groups and economic activity (section level))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_egan22d&lang=en
Downloaded: 20-09-2017
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- Eurostat special data request
Downloaded: 03-08-2017
(Employment by economic activity (section, division and group))
(Hours worked by economic activity (section, division and group))

Labour Force Statistics (LFS) NACE Rev. 1.1 from Eurostat

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Downloaded: 30-11-2015
(Employment by sex, age groups and detailed economic activity (division level))
- Eurostat special data request
Downloaded: 26-07-2016
(Employment by economic activity (section, division and group))
(Hours worked by economic activity (section, division and group))

Remarks

The main source of the employment (in persons) and hours worked NACE Rev. 2 datasets for Norway is NA from Eurostat and Statistics Norway, compiled according to the new European System of National and Regional Accounts (ESA 2010). The ESA 2010 is based on the concepts of the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009), which provides guidelines on national accounting for all countries throughout the world. It nevertheless incorporates certain differences, particularly in its presentation, which is more in line with its specific use within the Union.

According to the OECD definitions, the ICT and MC sectors are defined on the basis of the NACE Rev. 2 nomenclature up to 4-digit level. Something similar occurs with Retail sale via order houses or via Internet (RS sector), excluded from the OECD definition. The sectorial breakdown in both Eurostat and Statistics Norway are limited to 2-digit or division level (A*10, A*21, A*38, A*64 classifications).

This disaggregation is not detailed enough to obtain the complete 4-digit datasets. In the case of ICT sectors, direct NA Employment information is only provided for sector NACE 61 (telecommunications). In the case of MC sectors, only sector NACE 59-60 (audiovisual and broadcasting activities) is available in NA

Therefore, many additional sources of data are needed to estimate each variable. These sources will be used to split national accounts official data up to the 4-digit level required. Hence, data included in the dataset will be coherent with the NA official statistics. The alternative data sources will be used according to a hierarchy that prioritise Eurostat, NSO, other official statistical offices and the OECD over other data.

The NA Employment data has been distributed among ICT, according to the comprehensive and operational ICT sector definition, MC sector, Retail sale via order houses or via Internet, the selected economic activities (additional sectors) and the rest of industries using employment or jobs (employed or employee) from previous NA (ESA 1995), SBS, correspondence tables between NACE Rev 1.1 and NACE Rev. 2 (see Appendix 1) and the methodology described in Mas, Robledo y Pérez (2012). In order to obtain the dataset for hours worked we have followed the procedures and sources used in employment.

The majority of sector gaps in the employment and hours worked datasets have been filled using percentage structure corresponding to the previous/following years, ratio hours worked/employment or growth rates of a more aggregated sector in the statistic.

Switzerland

Sources

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National Accounts (NA) ESA 1995 NACE Rev. 1.1 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace06_e&lang=en
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- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace31_e&lang=en
Downloaded: 06-11-2015
(National Accounts by 31 branches - employment data)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_nace60_e&lang=en
Downloaded: 06-11-2015
(National Accounts by 60 branches - employment data)

Structural Business Statistics (SBS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_sca_r2&lang=en
Downloaded: 21-09-2017
(Annual enterprise statistics for special aggregates of activities)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_ind_r2&lang=en
Downloaded: 22-09-2017
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- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_dt_r2&lang=en
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(Annual detailed enterprise statistics for trade (G))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se_r2&lang=en
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Structural Business Statistics (SBS) NACE Rev 1.1 from Eurostat

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(Annual detailed enterprise statistics on manufacturing subsections DA-DE and total manufacturing)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_2a_dfdn&lang=en
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(Annual detailed enterprise statistics on trade)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=sbs_na_1a_se&lang=en
Downloaded: 11-11-2015
(Annual detailed enterprise statistics on services (H-K))

Structural Analysis Database (STAN) ISIC Rev. 3.1 from OECD

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Labour Force Statistics (LFS) NACE Rev. 2 from Eurostat

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(Employment by sex, age groups and economic activity (section level))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_egana22d&lang=en
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(Employment by sex, age groups and detailed economic activity (division level))
- Eurostat special data request
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(Employment by economic activity (section, division and group))
(Hours worked by economic activity (section, division and group))

Labour Force Statistics (LFS) NACE Rev. 1.1 from Eurostat

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Statistik der Unternehmensstruktur from Bundesamt für Statistik (BFS) of Switzerland

- <https://www.bfs.admin.ch/bfs/de/home/statistiken/industrie-dienstleistungen/erhebungen/statent.html>
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(Employment by economic activity NOGA 2008)

Remarks

The main source of the employment (in persons) and hours worked NACE Rev. 2 datasets for Switzerland is NA from Eurostat and Bundesamt für Statistik (BFS) of Switzerland, compiled according to the new European System of National and Regional Accounts (ESA 2010). The ESA 2010 is based on the concepts of the 2008 SNA ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009), which provides guidelines on national accounting for all countries throughout the world. It nevertheless incorporates certain differences, particularly in its presentation, which is more in line with its specific use within the Union.

According to the OECD definitions, the ICT and MC sector are defined on the basis of the NACE Rev. 2 nomenclature up to 4-digit level. Something similar occurs with Retail sale via order houses or via Internet (RS sector), excluded from the OECD definition. In the case of ESA 2010 the sectorial breakdown for employment and hours worked are limited to A*10/A*21 classifications and period 2000-2015.

The ESA 2010 information is not detailed enough to obtain the complete 4-digit datasets and to cover complete period 1995-2015. Many additional sources of data are needed to estimate complete disaggregation and time period. These sources will be used to split national accounts official data up to the 4-digit level required, where possible, and extrapolate the series backwards to 1995. Hence, data included in the dataset will be coherent with the NA official statistics. The alternative data sources will be used according to a hierarchy that prioritise Eurostat, NSO, other official statistical offices and the OECD over other data.

The NA Employment data has been distributed among ICT sectors, according to the comprehensive and operational ICT sector definition, MC sectors, Retail sale via order houses or via Internet, the selected economic activities (additional sectors) and the rest of industries using employment or jobs (employed or employee) from previous ESA 1995 NA (NACE Rev. 2 and NACE Rev. 1.1), SBS from Eurostat and BFS, LFS, correspondence tables between NACE Rev 1.1 and NACE Rev. 2 (see Appendix 1) and the methodology described in Mas, Robledo y Pérez (2012). In order to obtain the dataset for hours worked we have followed the procedures and sources used in employment.

The majority of sector gaps in employment and hours worked datasets have been filled using percentage structure corresponding to the previous/following years, ratio hours worked/employment and growth rates or hours worked/employment ratio of a more aggregated sector in the statistic.

Australia

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Downloaded: 20-10-2015

Retail and Wholesale Industries

- <http://www.abs.gov.au/ausstats/abs@.nsf/mf/8622.0>
Downloaded: 20-10-2015

EU KLEMS Growth and Productivity Accounts ISIC Rev. 3

- <http://www.euklems.net/index.html>
Downloaded: 11-11-2014
(March 2008 Release)
(November 2009 Release, updated March 2011)

Remarks

Employment (persons employed) and hours worked data for Australia are taken from ABS and OECD.

Employment data from ABS is available at ANZSIC division level (the broadest level) for all the period 1995-2015, while OECD data is available for the period 2011-2013 on a more disaggregated level (A*64 classification of ISIC Rev. 4). These data have been distributed among ICT, MC, RS, the selected economic activities (additional sectors) and the rest of industries using data from Australian Industry Statistics, Experimental Estimates for the Manufacturing Industry, Information and Communication Technology Statistics, Information Media and Telecommunications Services Statistics, Retail and Wholesale Industries Statistics, provided by ABS, EU KLEMS database and correspondence tables between ANZSIC 2006 and NACE Rev. 2 (see appendix 1).

The availability of information for hours worked is similar to the employment data, as well as the procedures and sources used to obtain final dataset. In this case original data from ABS is expressed in weekly number of hours actually worked in all jobs. Assuming 52 working weeks in a year, we arrive at total number of hours worked.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years and growth rates or hours worked/employment ratio of a more aggregated sector in the statistic.

In Australia datasets (employment and hours worked), Manufacturing (divisions 10-33) excludes part of Repair and installation of machinery and equipment (division 33); Manufacture of electronic components and boards (group 261) includes Manufacture of consumer electronics (group 264) and Manufacture of magnetic and optical media (group 268); Services, except trade (divisions 49-99) include part of Repair and installation of machinery and equipment (division 33); Repair of computers and communication equipment (group 951) include part of Repair and installation of machinery and equipment (division 33), and Retail sale via mail order houses or via Internet (RS sector, class 4791), includes Other retail sale not in stores, stalls or markets (class 4799).

Brazil

Sources

Annual National Accounts from Instituto Brasileiro de Geografia e Estatística (IBGE)

- <https://www.ibge.gov.br/estatisticas-novoportal/economicas/contas-nacionais/9052-sistema-de-contas-nacionais-brasil.html?&t=resultados>
Downloaded: 31-07-2017

Annual Survey of Industry from IBGE

- <https://www.ibge.gov.br/estatisticas-novoportal/economicas/industria/2016-np-pesquisa-industrial-anual/9042-pesquisa-industrial-anual.html?&t=resultados>
Downloaded: 11-10-2017

Annual Survey of Trade from IBGE

- <https://www.ibge.gov.br/estatisticas-novoportal/economicas/comercio/9075-pesquisa-anual-de-comercio.html?&t=resultados>
Downloaded: 11-10-2017

Annual Survey of Services from IBGE

- <https://www.ibge.gov.br/estatisticas-novoportal/economicas/servicos/9028-pesquisa-anual-de-servicos.html?&t=resultados>
Downloaded: 11-10-2017

National Household Sample Survey from IBGE

- <https://www.ibge.gov.br/estatisticas-novoportal/sociais/trabalho/9127-pesquisa-nacional-por-amostra-de-domicilios.html?edicao=9409>
Downloaded: 01-08-2017

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

Remarks

The elaboration of the NACE Rev. 2 employment (persons employed) and hours worked database for Brazil has been based on the information published by IBGE and WIOD database.

The SNA 2008 National Accounts (CNAE 2.0) data is available for the period 2000-2015 for employment, but does not publish any data for hours worked. Prior to 2006 WIOD database has been used to extrapolate the employment series backwards to 1995. Finally, the complete datasets for employment have been distributed among ICT sectors, MC sector and the rest of industries using the surveys (Industrial, Trade and Services) provided by IBGE (in CNAE 1.0 and CNAE 2.0), WIOD database and correspondence tables between CNAE 1.0, CNAE 2.0, ISIC Rev. 3.1 (NACE Rev. 1.1) and ISIC Rev. 4 (NACE Rev. 2)⁵².

To obtain hours worked dataset by industry we use the yearly number of hours worked by employed person derived from the WIOD database and final employment dataset. As hours worked in WIOD database covers period 1995-2009, we estimate forwards to 2015 using growth rates of employment by industry.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years and growth rates or hours worked/employment ratio of a more aggregated sector in the statistic.

Brazil's Employment dataset does not include Retail sale via mail order houses or via Internet sector.

Canada

Sources

NA from Statistics Canada

- <http://www5.statcan.gc.ca/cansim/a33?RT=TABLE&themeID=311&spMode=tables&lang=eng>
Downloaded: 27-07-2017

⁵² The correspondences between CNAE 1.0, CNAE 2.0, ISIC Rev. 3.1 and ISIC Rev. 4 are available at: <https://www.ibge.gov.br/estatisticas-novoportal/metodos-e-classificacoes/classificacoes-e-listas-estatisticas/9078-classificacao-nacional-de-atividades-economicas.html>. Ivie has also elaborated correspondence tables (see Annex II).

Annual Survey of Manufactures and Logging from Statistics Canada

- <http://www5.statcan.gc.ca/COR-COR/COR-COR/objList?lang=eng&srcObjType=SDDS&srcObjId=2103&tgtObjType=ARRAY>
Downloaded: 27-07-2017

Labour Force Survey from Statistics Canada

- <http://www5.statcan.gc.ca/cansim/pick-choisir?lang=eng&p2=33&id=2820008>
Downloaded: 27-07-2017

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

Remarks

The main source of the employment (jobs) and hours worked for Canada is National Accounts from Statistics Canada (CANSIM database).

The last National Accounts data published covers the period 1997-2015. Prior to 1997 WIOD database has been used to extrapolate the series by industry backwards to 1995. Finally, the complete datasets for employment have been distributed among ICT, MC, RS sector and the rest of industries using data from Annual Survey of Manufacturing and Logging, Annual Wholesale Trade Survey provided by Statistics Canada, WIOD database and correspondence tables between NAICS and NACE Rev. 2⁵³.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years and growth rates or hours worked/employment ratio of a more aggregated sector in the statistic.

In Canada datasets for employment and hours worked, Manufacturing (divisions 10-33) excludes part of Repair and installation of machinery and equipment (division 33), Manufacture of magnetic and optical media (group 268) includes Reproduction of recorded media (group 182), Services, except trade (divisions 49-99) includes part of Repair and installation of machinery and equipment (division 33), Repair of computers and communication equipment (group 951) include part of Repair and installation of machinery and equipment (division 33) and part of Repair of personal and household goods (group 952).

China

Sources

Main Labour Statistics from National Bureau of Statistics of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 20-10-2017

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

China Industrial Productivity (CIP) Database 3.0 from Research Institute of Economy, Trade and Industry (RIETI) and Hitotsubashi University

⁵³ The correspondence between different versions of Canadian NAICS and ISIC Rev. 4 is available at: <http://www.statcan.gc.ca/concepts/concordances-classifications-eng.htm>. Ivie has also elaborated a correspondence table for ICT sectors (see Annex II).

- <http://www.rieti.go.jp/en/database/CIP2015/>
Downloaded: 17-11-2016

Main industrial economic indicators from National Bureau of Statistics of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 20-10-2017

Statistics on Production and Management in High-tech Industry by Industrial Sector from Ministry of Science and Technology of China

- <http://www.stats.gov.cn/english/Statisticaldata/AnnualData/>
Downloaded: 20-10-2017

Remarks

Employment and hours worked by industry for China is taken from National Bureau of Statistics of China and WIOD ISIC Rev. 3 Database.

Employment information has been distributed among ICT sectors, RS sector and the rest of industries for the period 1995-2015 using the Main industrial economic indicators provided by National Bureau of Statistics of China, Statistics on Production and Management in High-tech Industry by Industrial Sector from Ministry of Science and Technology of China, CIP database provided by REITI and correspondence tables between National Economic Industrial Classification (GB/T 4754-2002), ISIC Rev. 3 and ISIC Rev. 4 (NACE Rev. 2)⁵⁴.

To obtain hours worked dataset by industry we use the yearly number of hours worked by employed person derived from the WIOD database and final employment dataset. As hours worked in WIOD database covers period 1995-2009, we estimate forwards to 2014 using growth rates of employment by industry.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years or growth rates of a more aggregated sector in the statistic.

China's datasets do not include ICT trade, MC and RS sectors. Manufacture of chemicals and chemical products (division 20) includes Manufacture of magnetic and optical media (group 268), Wholesale and retail trade, repair of motor vehicles and motorcycles (divisions 45-47) include Repair of personal and household goods (group 952), Services, except trade (divisions 49-99) include Remediation activities and other waste management services (division 39) and Development of building projects (group 411) and exclude Repair of personal and household goods (group 952), Transportation and storage (divisions 49-53) include Travel agency and tour operator activities (group 791), Professional, scientific, technical, administration and support service activities (divisions 69-82) excludes Travel agency and tour operator activities (group 791) and Veterinary activities (division 75), Divisions 69-75 excludes Veterinary activities (division 75), Divisions 86-88 includes Veterinary activities (division 75).

India

Sources

Productivity Database 2017 of Asian Productivity Organization (APO)

- <http://www.apo-tokyo.org/wedo/measurement>
Downloaded: 06-11-2017

World Input-Output Database ISIC Rev. 3 (WIOD)

⁵⁴ The correspondence between Chinese SIC and ISIC Rev. 4 is available at: http://www.stats.gov.cn/tjsj/tjbz/hyflbz/201710/t20171012_1541679.html

- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 16-10-2015
(Socio Economic Accounts, Released July 2014)

Annual Survey of Industries from Ministry of Statistics and Programme Implementation (MOSPI)

- <http://www.csoisw.gov.in/CMS/cms/Feedback.aspx>
Downloaded: 17-10-2017

Employment and Unemployment Situation in India: 2007-08, Report No. 531, 64th Round (July 2007 - June 2008) from National Sample Survey Office (NSS), MOSPI

- http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=31
Downloaded: 16-10-2015

Key Indicators of Employment and Unemployment in India, July 2009-June 2010, KI (66/10), 66th Round (July 2009 - June 2010) from National Sample Survey Office (NSS), MOSPI

- http://mospi.nic.in/Mospi_New/site/inner.aspx?status=3&menu_id=31
Downloaded: 16-10-2015

Value added & employment generation in the ICT sector in India from MOSPI

- http://mospi.nic.in/mospi_new/upload/val_add ICT 21june11.pdf
Downloaded: 16-10-2015

Remarks

The main source of employment and hours worked data for India is WIOD ISIC Rev. 3 Database. This information has been distributed among ICT, MC, the selected economic activities (additional sectors) and the rest of industries using employment data from APO productivity database, Annual Survey of Industry, Key Indicators of Employment and Unemployment, Employment and Unemployment Situation, Value added & employment generation in the ICT sector in India provided by MOSPI. This last source gives the 2008 National Industry Classification (NIC) codes for ICT sectors following the 2007 definition of OECD, which coincide exactly with NACE Rev. 2 ones⁵⁵.

India's employment dataset does not include RS and ICT trade sectors. MC sector only includes Publishing of books, periodicals and other publishing activities (group 581). Wholesale and retail trade, Repair of motor vehicles and motorcycles (divisions 45-47 NACE Rev. 2) includes Repair of personal and household goods (group 952); Wholesale and retail trade and repair of motor vehicles and motorcycles (division 45) includes Retail sale of automotive fuel in specialized stores (group 473); Services, except trade (divisions 49-99) includes Development of building projects (group 411) and exclude Repair of personal and household goods (group 952); Transportation and storage (divisions 49-53) include Travel agency and tour operator activities (group 791); Professional, scientific, technical, administration and support service activities (divisions 69-82) exclude Travel agency and tour operator activities (group 791) and Veterinary activities (division 75); and Human health and social work activities (divisions 86-88) includes Veterinary activities (division 75).

Japan

Sources

NA from Economic and Social Research Institute (ESRI), Cabinet Office

⁵⁵ The structure of NIC 2008 is identical to the structure of ISIC Rev. 4 up to 4-digit level (class). NIC 2008 is available at: <http://mospi.nic.in/classification/national-industrial-classification>.

- http://www.esri.cao.go.jp/en/sna/data/kakuhou/files/2015/29annual_report_e.html
Downloaded: 15-07-2016

Japan Industrial Productivity (JIP) from Research Institute of Economy, Trade and Industry (RIETI) and Hitotsubashi University

- <http://www.rieti.go.jp/en/database/JIP2015/index.html>
Downloaded: 8-12-2015

EU KLEMS Growth and Productivity Accounts ISIC Rev. 4

- <http://www.euklems.net/index.html>
Downloaded: 14-10-2015
(ISIC Rev. 4, Rolling updates)

Labour Force Statistics from Statistics Japan

- <http://www.stat.go.jp/english/data/roudou/index.htm>
Downloaded: 27-10-2017

Annual manufacturing census from Economic and Industrial Policy Bureau, Ministry of Economy, Trade and Industry (METI)

- <http://www.meti.go.jp/english/statistics/tyo/kougyo/index.html>
Downloaded: 14-07-2016

Survey of selected services industries from METI

- <http://www.meti.go.jp/english/statistics/tyo/tokusabizi/index.html>
Downloaded: 14-10-2015

Structural Business Statistics ISIC Rev. 4 from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=SSIS_BSC_ISIC4
Downloaded: 14-10-2015

Remarks

The main source of the employment and hours worked for Japan is NA from the Economic and Social Research Institute (ESRI), Cabinet Office (Government of Japan). As from December 2016, NA estimates are compiled according to the latest recommendations of SNA 2008 ('System of National Accounts 2008', Commission of the European Communities-Eurostat, International Monetary Fund, OECD, United Nations and World Bank, 2009).

The NA database covers the period 1995-2015 for both variables. These datasets have been distributed among ICT sectors, MC sectors and the rest of industries using mainly the JIP Database, that is part of the World Input-Output Database (WIOD) project and uses its own industry classification (distinguishing 108 industries, covering the whole of the Japanese economy), and other sources such as Annual manufacturing census and Survey on Selected Service Industries provided by METI, Structural Business Statistics (OECD), EU KLEMS database and correspondence tables between JIP codes, Japan Standard Industrial Classification (JSIC), ISIC Rev. 3 (NACE Rev. 1) and ISIC Rev. 4 (NACE Rev. 2)⁵⁶. LFS has been used to extrapolate the JIP employment series forwards to 2015.

⁵⁶ The correspondences between JIP codes, JSIC, ISIC Rev. 3 and ISIC Rev. 4 are available at:
http://www.rieti.go.jp/en/database/d05_data/03-6.pdf
http://www.euklems.net/data/nace2/JPN_sources_12i.pdf
http://www.soumu.go.jp/english/dgpp_ss/seido/sangyo/index.htm
 Ivie has also elaborated correspondence tables (see Annex II)

The majority of sector gaps in both variables have been filled using percentage structure corresponding to the previous/following years and growth rates or hours worked/employment ratio of a more aggregated sector in the statistic.

Japan's datasets do not include RS sector, ICT sector NACE 951 (Repair of computers and communication equipment), and NACE 62 (Computer programming, consultancy and related activities) includes ICT sector NACE 582 (Software publishing).

Korea

Sources

- Economically Active Population Survey from Statistics Korea
 - http://kosis.kr/eng/statisticsList/statisticsList_01List.jsp?vwcd=MT_ETITLE&parmTabId=M_01_01#SubCont
Downloaded: 10-07-2017
- NA from OECD
- http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE7A
Downloaded: 10-07-2017
- Structural Business Statistics ISIC Rev. 4 from OECD
- http://stats.oecd.org/Index.aspx?DataSetCode=SSIS_BSC_ISIC4
Downloaded: 10-07-2017
- Mining and Manufacturing Survey from Statistics Korea
- <http://kostat.go.kr/portal/english/surveyOutlines/6/2/index.static>
Downloaded: 27-07-2016
- Service Industry Survey from Statistics Korea
- <http://kostat.go.kr/portal/english/surveyOutlines/5/5/index.static>
Downloaded: 27-07-2016
- Survey of Business activities from Statistics Korea
- <http://kostat.go.kr/portal/english/surveyOutlines/6/5/index.static>
Downloaded: 27-07-2016
- Wholesale and Retail trade Survey from Statistics Korea
- <http://kostat.go.kr/portal/english/surveyOutlines/5/2/index.static>
Downloaded: 27-07-2016
- EU KLEMS Growth and Productivity Accounts ISIC Rev. 3
- <http://www.euklems.net/index.html>
Downloaded: 11-11-2014
(March 2008 Release)
(November 2009 Release, updated March 2011)

Remarks

Employment and hours worked data by industry for Korea are taken from Economically Active Population Survey from Statistics Korea and NA from OECD.

These sources cover the period 2004-2015. Prior to 2004 EU KLEMS database has been used to extrapolate the series by industry backwards to 1995. Finally, the complete datasets that distinguishes among ICT, MC, RS sectors and the rest of industries for employment have been obtained using additional information: Surveys (Mining and

Manufacturing, Business activities, Wholesale and Retail trade and Service Industry), provided by Statistics Korea, NA from OECD, EU KLEMS database and correspondence tables between KSIC and NACE Rev. 2⁵⁷.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years, growth rates or hours worked/employment ratio of a more aggregated sector in the statistic.

Transportation and storage (divisions 19-53) excludes postal and courier activities (division 53), because this sector is included in NACE 61 sector (Telecommunications).

Russia

WORLD KLEMS Dataset ISIC Rev. 3 for Russia (Russia KLEMS)

- <http://www.worldklems.net/data.htm>
Downloaded: 25-10-2017
(March 2017 Release)
 - Labour Force Statistics (LFS) NACE Rev. 1.1 from Rosstat
- http://www.gks.ru/wps/wcm/connect/rosstat_main/rosstat/ru/statistics/publications/catalog/doc_1140097038766
Downloaded: 25-10-2017

Employed in the ICT sector (NACE Rev. 1.1)

- Information provided in December 2016 by Galina Lyubova (Department of Foreign Statistics and International Cooperation from Rosstat)
- Information provided in October 2017 by Valeriya Kosolapova (Department of Foreign Statistics and International Cooperation from Rosstat)
 - Structural Business Statistics ISIC Rev. 3 from OECD
- http://stats.oecd.org/Index.aspx?DataSetCode=SSIS_BSC
Downloaded: 13-10-2015

Remarks

The main source of the employment and hours worked is World KLEMS dataset for Russia. This is the second release of the World KLEMS dataset for Russia (Russia KLEMS), which has been developed by Groningen Growth and Development Centre (University of Groningen) in collaboration with the Laboratory for Research in Inflation and Growth (National Research University Higher School of Economics, Moscow). As this dataset covers period 1995-2014, we estimate forward to 2015 using growth rates of employment from LFS of Rosstat. This initial employment data has been distributed among ICT, MC, RS and the rest of industries using LFS data provided directly by Rosstat, 4-digits Structural Business Statistics ISIC Rev. 3 (OECD), and the correspondence table between NACE Rev. 1.1 and NACE Rev. 2 (see Appendix 1).

In order to obtain hours worked dataset by industry we use the yearly number of hours worked by employed person derived from the World KLEMS database and final employment dataset. As hours worked in World KLEMS database covers period 1995-2014, we estimate 2015 using growth rates of employment by industry.

⁵⁷ The correspondences between KSIC and ISIC Rev. 4 are available at: https://kssc.kostat.go.kr:8443/ksscNew_web/index.jsp#. Ivie has also elaborated correspondence tables (see Annex II)

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years, growth rates or hours worked/employment ratio of a more aggregated sector in the statistic.

Russia's employment and hours worked datasets do not include ICT trade sector; Manufacture of chemicals and chemical products (division 20) includes Manufacture of magnetic and optical media (group 268); Computer programming, consultancy and related activities (division 62) includes Software Publishing (group 582); Services, except trade (divisions 49-99) includes Development of building projects (group 411); Transportation and storage (divisions 49-53) includes Travel agency and tour operator activities (group 791); Professional, scientific, technical, administration and support service activities (divisions 69-82) exclude Travel agency and tour operator activities (group 791); and Retail sale via mail order houses or via Internet (class 4791) excludes Retail trade via internet.

Taiwan

Sources

Labour Force Statistics (Manpower Survey) from National Statistics, Directorate General of Budget, Accounting and Statistics (DGBAS) of Executive Yuan, Taiwan

- <http://statdb.dgbas.gov.tw/pxweb/dialog/statfile1L.asp>
Downloaded: 18-07-2017

Earnings and productivity, Average Monthly Working Hours of Employees on Payrolls from National Statistics, Directorate General of Budget, Accounting and Statistics (DGBAS) of Executive Yuan, Taiwan

- <http://statdb.dgbas.gov.tw/pxweb/dialog/statfile1L.asp>
Downloaded: 18-07-2017

Labour Force Statistics (Manpower Survey): Employed persons, by mid-category of industries and class of workers

- Information provided by Teresa Chang (Directorate General of Budget, Accounting and Statistics (DGBAS) of Executive Yuan, Taiwan)

Census Statistics from National Statistics of Taiwan

- <http://eng.stat.gov.tw/lp.asp?ctNode=1624&CtUnit=774&BaseDSD=7&mp=5>
Downloaded: 16-11-2016

World Input-Output Database ISIC Rev. 3 (WIOD)

- http://www.wiod.org/new_site/database/seas.htm
Downloaded: 15-10-2015
(Socio Economic Accounts, Released July 2014)

Remarks

The elaboration of the NACE Rev. 2 employment for Taiwan has been based on the LFS information by industry provided by National Statistics of Taiwan (Directorate of Budget, Accounting and Statistics (DGBAS) of Executive Yuan). As employment data by industry from DGBAS covers period 2001-2015, we extrapolate series backwards to 1995 using WIOD database.

The LFS employment data has been distributed among distributed among ICT, MC, RS and the rest of industries using data from Census Statistics provided by National Statistics of Taiwan and correspondence tables between Standard Industrial Classification (SIC) of Taiwan and ISIC Rev. 4 (NACE Rev. 2).

In order to obtain hours worked dataset by industry we use the yearly number of hours worked by employed person derived from the WIOD database and final employment dataset. As hours worked in WIOD database covers period 1995-2009, we estimate from 2009 onwards using average working hours of employees by industry provided by DGBAS.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years, growth rates or hours worked/employment ratio of a more aggregated sector in the statistic.

Taiwan's datasets for employment and hours worked do not include ICT trade sector; Services, except trade (divisions 49-99) include Development of building projects (group 411); Repair of computers and communication equipment (group 951) includes Repair of consumer electronics (class 9521); and RS sector (Class 4791) includes Other retail sale not in stores, stalls or markets (class 4799).

United States

Sources

NA from Bureau of Economic Analysis (BEA)

- <https://www.bea.gov/iTable/iTable.cfm?reqid=19&step=2#reqid=19&step=2&isuri=1&1921=survey>
Downloaded: 11-07-2017

NA ISIC Rev. 4 from OECD

- <http://stats.oecd.org/Index.aspx?DataSetCode=STANI4>
Downloaded: 05-07-2017

Industry Productivity and Costs from Bureau of Labor Statistics (BLS)

- <http://www.bls.gov/lpc/>
Downloaded: 05-07-2017

Annual Survey of Manufactures from United States Census Bureau

- <http://www.census.gov/manufacturing/asm/index.html>
Downloaded: 05-07-2017

Remarks

The elaboration of the NACE Rev. 2 employment and hours worked database distributed among ICT, MC, RS sector, the selected economic activities (additional sectors) and the rest of industries for United States have been based on NA data from BEA and other sources such as NA ISIC Rev. 4 from OECD, Bureau of Labor Statistics and United States Census Bureau, and correspondence tables between NAICS and ISIC Rev. 4⁵⁸.

Following the OECD (and EU KLEMS) methodology, we obtain final employment data for US combining the three categories publishes by BEA: Full-time and part-time employees (FTPT), Full-time equivalent employees (FTE) and Persons engaged in production (PEP). Total employment (number engaged) is defined as FTPT+(PEP- FTE).

However, the information available in NA (Industry Economic Accounts) of the BEA does not cover the years 1995 to 1997 for both variables. Thus, the figures corresponding to these years have been extrapolated using EU KLEMS database.

⁵⁸ The correspondences between different versions of US NAICS and ISIC Rev. 4 are available at <http://www.census.gov/eos/www/naics/concordances/concordances.html>. Ivie has also elaborated correspondence tables (see Appendix 1)

In the case of hours worked, BEA publishes sectorial hours worked by employees, instead of hours worked by total employed persons, while OECD only offers annual hours worked by employed persons for the total economy (not by industry). We assume that the average number of hours worked by employee is equal to the average number of hours worked by self-employed persons. Combining all the available information we estimate complete series for the period 1995-2015.

The majority of sector gaps have been filled using percentage structure corresponding to the previous/following years, growth rates or hours worked/employment ratio of a more aggregated sector in the statistic

Manufacturing (divisions 10-33) excludes part of Repair and installation of machinery and equipment (division 33); Manufacture of magnetic and optical media (group 268) includes Reproduction of recorded media (group 182); Services, except trade (divisions 49-99) includes part of Repair and installation of machinery and equipment (division 33); and Repair of computers and communication equipment (group 951) includes part of Repair and installation of machinery and equipment (division 33) and part of Repair of personal and household goods (group 952).

Labour Productivity

Sources:

See sources in GVA and employment

Remarks:

Labour productivity datasets are provided in nominal euros per person and per hour worked and in euros PPS per person and per hour worked. See comments in related sections on gross value added and employment.

Annex II: Correspondence Tables

Table A I Approximate correspondence between NACE Rev.2 (ISIC Rev. 4) and NACE Rev 1.1 (ISIC Rev. 3.1) for ICT, MC and RS sectors and additional sectors

| a) Comprehensive definition of ICT sector (based on the 2007 OECD ICT sector definition) | | | | |
|---|------------------------------|--|----------------------|----------------------|
| NACE Rev.2 | ISIC Rev. 4 | Description | NACE Rev. 1.1 | ISIC Rev. 3.1 |
| 261-264, 268 | 261-264, 268 | ICT manufacturing industries | 2465, 30, 32 | 2429, 30, 32 |
| 261 | 261 | Manufacture of electronic components and boards | 321 | 321 |
| 2611 | 2610P | Manufacture of electronic components | 321P | 321P |
| 2612 | 2610P | Manufacture of loaded electronic boards | 321P | 321P |
| 262 | 262 | Manufacture of computers and peripheral equipment | 30 | 30 |
| 263 | 263 | Manufacture of communication equipment | 322 | 322 |
| 264 | 264 | Manufacture of consumer electronics | 323 | 323 |
| 268 | 268 | Manufacture of magnetic and optical media | 2465 | 2429 |
| 465 | 4651, 4652 | ICT trade industries | 5184, 5186 | 5151, 5152 |
| 4651 | 4651 | Wholesale of computers, computer peripheral equipment and software | 5184 | 5151 |
| 4652 | 4652 | Wholesale of electronic and telecommunications equipment and parts | 5186 | 5152 |
| 582, 61, 62, 631, 951 | 582, 61, 62, 631, 951 | ICT services industries | 642, 72 | 642, 72 |
| 582 | 582 | Software publishing | 7221 | 7221 |
| 5821 | 5820P | Publishing of computer games | 7221P | 7221P |
| 5829 | 5820P | Other software publishing | 7221P | 7221P |
| 61 | 61 | Telecommunications | 642 | 642 |
| 611 | 611 | Wired telecommunications activities | 642P | 642P |
| 612 | 612 | Wireless telecommunications activities | 642P | 642P |
| 613 | 613 | Satellite telecommunications activities | 642P | 642P |
| 619 | 619 | Other telecommunications activities | 642P | 642P |
| 62 | 62 | Computer programming, consultancy and related activities | 721, 7222, 726 | 721, 7229, 729 |
| 6201 | 6201 | Computer programming activities | 7222P | 7229P |
| 6202 | 6202P | Computer consultancy activities | 721, 7222P | 721, 7229P |
| 6203 | 6202P | Computer facilities management activities | 7222P | 7229P |
| 6209 | 6209 | Other information technology and computer service activities | 7222P, 726 | 7229P, 729 |
| 631 | 631 | Data processing, hosting and related activities; web portals | 723, 724 | 723, 724 |
| 6311 | 6311 | Data processing, hosting and related activities | 723, 724P | 723, 724P |
| 6312 | 6312 | Web portals | 724P | 724P |
| 951 | 951 | Repair of computers and communication equipment | 725 | 725 |
| 9511 | 9511 | Repair of computers and peripheral equipment | 725P | 725P |
| 9512 | 9512 | Repair of communication equipment | 725P | 725P |

b) Operational definition of ICT sector

| NACE Rev.2 | ISIC Rev. 4 | Description | NACE Rev. 1.1 | ISIC Rev. 3.1 |
|------------------------------|------------------------------|---|----------------|----------------|
| 261-264 | 261-264 | ICT manufacturing industries | 30, 32 | 30, 32 |
| 261 | 261 | Manufacture of electronic components and boards | 321 | 321 |
| 262 | 262 | Manufacture of computers and peripheral equipment | 30 | 30 |
| 263 | 263 | Manufacture of communication equipment | 322 | 322 |
| 264 | 264 | Manufacture of consumer electronics | 323 | 323 |
| 582, 61, 62, 631, 951 | 582, 61, 62, 631, 951 | ICT services industries | 642, 72 | 642, 72 |
| 61 | 61 | Telecommunications | 642 | 642 |
| 582, 62, 631, 951 | 582, 62, 631, 951 | Computer and related activities | 72 | 72 |

c) Media and content (MC sector) (based on the 2007 OECD definition)

| NACE Rev.2 | ISIC Rev. 4 | Description | NACE Rev. 1.1 | ISIC Rev. 3.1 |
|-------------------------|-------------------------|--|---------------------------|----------------------------|
| 581, 59, 60, 639 | 581, 59, 60, 639 | MC sector | 221, 921, 922, 924 | 221, 9211-9213, 922 |
| 581 | 581 | Publishing of books, periodicals and other publishing activities | 221 (ex. 2214) | 221 (ex. 2213) |
| 5811-5812 | 5811-5812 | Book publishing; Publishing of directories and mailing lists | 2211 | 2211 |
| 5811 | 5811 | Book publishing | 2211P | 2211P |
| 5812 | 5812 | Publishing of directories and mailing lists | 2211P | 2211P |
| 5813-5814 | 5813 | Publishing of newspapers, journals and periodicals | 2212, 2213 | 2212 |
| 5813 | 5813P | Publishing of newspapers | 2212 | 2212P |
| 5814 | 5813P | Publishing of journals and periodicals | 2213 | 2212P |
| 5819 | 5819 | Other publishing activities | 2215 | 2219 |
| 59-60 | 59-60 | Audiovisual and broadcasting activities | 2214, 921, 922 | 2213, 9211-9213 |
| 59 | 59 | Motion picture, video and television programme production, sound recording and music publishing activities | 2214, 921 | 2213, 9211-9213 |
| 591 | 591 | Motion picture, video and television programme activities | 921 | 9211-9212 |
| 5911 | 5911 | Motion picture, video and television programme production activities | 9211P | 9211P |
| 5912 | 5912 | Motion picture, video and television programme post-production activities | 9211P | 9211P |
| 5913 | 5913 | Motion picture, video and television programme distribution activities | 9212 | 9211P |
| 5914 | 5914 | Motion picture projection activities | 9213 | 9212 |
| 592 | 592 | Sound recording and music publishing activities | 2214 | 2213 |
| 60 | 60 | Programming and broadcasting activities | 922 | 9213 |
| 601 | 601 | Radio broadcasting | 922P | 9213P |
| 602 | 602 | Television programming and broadcasting | 922P | 9213P |

activities

| 639 | 639 | Other information service activities | 924 | 922 |
|------------|------------|---|------------|------------|
| 6391 | 6391 | News agency activities | 924P | 922P |
| 6399 | 6399 | Other information service activities n.e.c. | 924P | 922P |

d) Retail sale via mail order houses or via Internet (RS sector)

| NACE Rev.2 | ISIC Rev. 4 | Description | NACE Rev. 1.1 | ISIC Rev. 3.1 |
|-------------------|--------------------|---|----------------------|----------------------|
| 4791 | 4791 | Retail sale via mail order houses or via Internet | 5261 | 5251 |

e) Additional sectors

| NACE Rev.2 | ISIC Rev. 4 | Description | NACE Rev. 1.1 | ISIC Rev. 3.1 |
|-------------------|--------------------|---|---------------------------------------|----------------------------------|
| 10-33 | 10-33 | Manufacturing | 15-21, 22 (ex. 221), 23-36 | 15-21, 22 (ex. 221), 23-36 |
| 20-21 | 20-21 | Manufacture of chemicals and chemical products; Manufacture of pharmaceuticals, medicinal chemical and botanical products | 24 (ex. 2465) | 24 (ex. 2429) |
| 20 | 20 | Manufacture of chemicals and chemical products | 24 (ex. 244, 2465) | 24 (ex. 2423, 2429) |
| 21 | 21 | Manufacture of pharmaceuticals, medicinal chemical and botanical products | 244 | 2423 |
| 26 | 26 | Manufacture of computer, electronic and optical products | 30, 32, 33 | 30, 32, 33 |
| 27-28 | 27-28 | Manufacture of machinery and equipment | 29, 31 | 29, 31 |
| 29-30 | 29-30 | Manufacture of transport equipment | 34-35 | 34-35 |
| 29 | 29 | Manufacture of motor vehicles, trailers and semi-trailers | 34 | 34 |
| 30 | 30 | Manufacture of other transport equipment | 35 | 35 |
| 303 | 303 | Manufacture of air and spacecraft and related machinery | 353 | 353 |
| 45-47 | 45-47 | Wholesale and retail trade, repair of motor vehicles and motorcycles | 50-52 (ex. 527) | 50-52 (ex. 526) |
| 49-99 | 49-99 | Services, except trade | 221, 527, 60-99 (ex. 7011, 90) | 221, 526, 60-99 (ex. 7010P, 90) |
| 49-53 | 49-53 | Transportation and storage | 60-63 (ex. 633), 641 | 60-63 (ex. 6304), 641 |
| 58-63 | 58-63 | Information and communication | 221, 642, 72 (ex. 725), 921, 922, 924 | 221, 642, 72 (ex. 725), 921, 922 |
| 64-66 | 64-66 | Financial and insurance activities | 65-67 | 65-67 |
| 69-82 | 69-82 | Professional, scientific, technical, administration and support service activities | 633, 71, 73, 74, 852 | 6304, 71, 73, 74, 852 |
| 69-75 | 69-75 | Professional, scientific and technical activities | 73, 741-744, 7481, 7487, 852 | 73, 741-742, 7494, 7499P, 852 |
| 85 | 85 | Education | 80 | 80 |
| 86-88 | 86-88 | Human health and social work activities | 85 (ex. 852) | 85 (ex. 852) |

Note: The P indicates that the NACE (ISIC) codes are linked with more than one NACE Rev.2 (ISIC Rev. 4) code.

Source: Own elaboration

Table A II Correspondences between NACE Rev.2 and ANZSIC (Australia)

a) ICT sector

| | NACE Rev.2 | ANZSIC 2006 |
|--|-------------------|--------------------|
| ICT manufacturing industries | | |
| Manufacture of electronic components and boards | 261 | 2429P |
| Manufacture of electronic components and boards | 2611 | 2429P |
| Manufacture of electronic components | 2619 | 2429P |
| Manufacture of computers and peripheral equipment | 262 | 2421 |
| Manufacture of communication equipment | 263 | 2422 |
| Manufacture of consumer electronics | 264 | 2429P |
| Manufacture of magnetic and optical media | 268 | 2429P |
| ICT trade industries | | |
| Wholesale of computers, computer peripheral equipment and software | 4651 | 3492 |
| Wholesale of electronic and telecommunications equipment and parts | 4652 | 3493 |
| ICT services industries | | |
| Software publishing | 582 | 542 |
| Publishing of computer games | 5821 | 542P |
| Other software publishing | 5829 | 542P |
| Telecommunications | 61 | 58, 591P |
| Wired telecommunications activities | 611 | 5801, 591P |
| Wireless telecommunications activities | 612 | 5802P, 591P |
| Satellite telecommunications activities | 613 | 5802P, 591P |
| Other telecommunications activities | 619 | 5809, 591P |
| Computer programming, consultancy and related activities | 62 | 70 |
| Computer programming activities | 6201 | 70P |
| Computer consultancy and computer facilities management activities | 6202-6203 | 70P |
| Computer consultancy activities | 6202 | 70P |
| Computer facilities management activities | 6203 | 70P |
| Other information technology and computer service activities | 6209 | 70P |
| Data processing, hosting and related activities; web portals | 631 | 591P, 592 |
| Data processing, hosting and related activities | 6311 | 592 |
| Web portals | 6312 | 591P |
| Repair of computers and communication equipment | 951 | 9422 |
| Repair of computers and peripheral equipment | 9511 | 9422P |
| Repair of communication equipment | 9512 | 9422P |

b) RS sector

| | NACE Rev.2 | ANZSIC 2006 |
|---|------------|-------------|
| Retail sale via mail order houses or via Internet | 4791 | 431P |

c) MC sector

| | NACE Rev.2 | ANZSIC 2006 |
|--|------------|-------------|
| Publishing of books, periodicals and other publishing activities | | |
| Book publishing | 5811 | 5413 |
| Publishing of directories and mailing lists | 5812 | 5414 |
| Publishing of newspapers, journals and periodicals | 5813-5814 | 5411-5412 |
| Publishing of newspapers | 5813 | 5411 |
| Publishing of journals and periodicals | 5814 | 5412 |
| Other publishing activities | 5819 | 5419 |
| Audiovisual and broadcasting activities | | |
| Motion picture, video and television programme production, sound recording and music publishing activities | 59 | 55 |
| Motion picture, video and television programme activities | 591 | 551 |
| Motion picture, video and television programme production activities | 5911 | 5511 |
| Motion picture, video and television programme post-production activities | 5912 | 5514, 5512P |
| Motion picture, video and television programme distribution activities | 5913 | 5512P |
| Motion picture projection activities | 5914 | 5513 |
| Sound recording and music publishing activities | 592 | 552 |
| Programming and broadcasting activities | 60 | 56,57 |
| Radio broadcasting | 601 | 561, 57P |
| Television programming and broadcasting activities | 602 | 562, 57P |
| Other information service activities | | |
| News agency activities | 6391 | 602P |
| Other information service activities n.e.c. | 6399 | 602P |

Note: The P indicates that the ANZSIC codes are linked with more than one NACE Rev.2 (ISIC Rev. 4) code.

Source: Own elaboration

Table A III Correspondences between NACE Rev.2 and CNAE (Brazil)

| | NACE Rev.2 | CNAE 2.0 |
|--|-------------------|------------------|
| a) ICT sector | | |
| ICT manufacturing industries | | |
| Manufacture of electronic components and boards | 261 | 261 |
| Manufacture of electronic components and boards | 2611 | |
| Manufacture of electronic components | 2619 | |
| Manufacture of computers and peripheral equipment | 262 | 262 |
| Manufacture of communication equipment | 263 | 263 |
| Manufacture of consumer electronics | 264 | 264 |
| Manufacture of magnetic and optical media | 268 | 268 |
| ICT trade industries | | |
| Wholesale of computers, computer peripheral equipment and software | 4651 | 4651 |
| Wholesale of electronic and telecommunications equipment and parts | 4652 | 4652 |
| ICT services industries | | |
| Software publishing | 582 | 6203, 6203 |
| Publishing of computer games | 5821 | - |
| Other software publishing | 5829 | - |
| Telecommunications | 61 | 61 |
| Wired telecommunications activities | 611 | 6110, 6141 |
| Wireless telecommunications activities | 612 | 6120, 6142 |
| Satellite telecommunications activities | 613 | 6130, 6143 |
| Other telecommunications activities | 619 | 6190 |
| Computer programming, consultancy and related activities | 62 | 6201, 6204, 6209 |
| Computer programming activities | 6201 | 6201 |
| Computer consultancy and computer facilities management activities | 6202-6203 | 6204 |
| Computer consultancy activities | 6202 | - |
| Computer facilities management activities | 6203 | - |
| Other information technology and computer service activities | 6209 | 6209 |
| Data processing, hosting and related activities; web portals | 631 | 631 |
| Data processing, hosting and related activities | 6311 | 6311 |
| Web portals | 6312 | 6319 |
| Repair of computers and communication equipment | 951 | 951 |
| Repair of computers and peripheral equipment | 9511 | 9511 |
| Repair of communication equipment | 9512 | 9512 |

b) RS sector

| | NACE Rev.2 | CNAE 2.0 |
|---|-------------------|-----------------|
| Retail sale via mail order houses or via Internet | 4791 | 4713P |

c) MC sector

| | NACE Rev.2 | CNAE 2.0 |
|--|-------------------|---------------------------|
| MC sector | | |
| Publishing of books, periodicals and other publishing activities | | |
| Book publishing | 5811 | 5811, 5821 |
| Publishing of directories and mailing lists | 5812 | 5819, 5829 |
| Publishing of newspapers, journals and periodicals | 5813-5814 | 5812, 5813, 5822, 5823 |
| Publishing of newspapers | 5813 | 5812, 5822 |
| Publishing of journals and periodicals | 5814 | 5813, 5823 |
| Other publishing activities | 5819 | 5819, 5829 |
| Audiovisual and broadcasting activities | | |
| Motion picture, video and television programme production, sound recording and music publishing activities | 59 | 59 |
| Motion picture, video and television programme activities | 591 | 591 |
| Motion picture, video and television programme production activities | 5911 | 5911 |
| Motion picture, video and television programme post-production activities | 5912 | 5912 |
| Motion picture, video and television programme distribution activities | 5913 | 5913 |
| Motion picture projection activities | 5914 | 5914 |
| Sound recording and music publishing activities | 592 | 5920 |
| Programming and broadcasting activities | 60 | 60 |
| Radio broadcasting | 601 | 601 |
| Television programming and broadcasting activities | 602 | 602 |
| Other information service activities | | |
| News agency activities | 6391 | |
| Other information service activities n.e.c. | 6399 | |

Note: The P indicates that the CNAE codes are linked with more than one NACE Rev.2 (ISIC Rev. 4) code.

Source: Own elaboration

Table A IV Correspondences between NACE Rev.2 and JSIC (Japan)**a) ICT sector**

| | NACE Rev.2 | JSIC Rev. 13 |
|--|-------------------|-------------------------|
| ICT manufacturing industries | | |
| Manufacture of electronic components and boards | 261 | 28 (ex. 283) |
| Manufacture of electronic components and boards | 2611 | 28 (ex. 2814, 283, 284) |
| Manufacture of electronic components | 2612 | 2814, 284 |
| Manufacture of computers and peripheral equipment | 262 | 303 |
| Manufacture of communication equipment | 263 | 301 (ex. 3014, 3015) |
| Manufacture of consumer electronics | 264 | 3014, 302 (ex. 3022) |
| Manufacture of magnetic and optical media | 268 | 2832 |
| ICT trade industries | | |
| Wholesale of computers, computer peripheral equipment and software | 4651 | 5432P |
| Wholesale of electronic and telecommunications equipment and parts | 4652 | 5432P |
| ICT services industries | | |
| Software publishing | 582 | 3913, 3914 |
| Publishing of computer games | 5821 | 3913P |
| Other software publishing | 5829 | 3913P, 3914 |
| Telecommunications | 61 | 37 |
| Wired telecommunications activities | 611 | 371 |
| Wireless telecommunications activities | 612 | 372P |
| Satellite telecommunications activities | 613 | 372P |
| Other telecommunications activities | 619 | 373 |
| Computer programming, consultancy and related activities | 62 | 3911, 3912 |
| Computer programming activities | 6201 | 3911P, 3912 |
| Computer consultancy and computer facilities management activities | 6202-6203 | 3911P |
| Computer consultancy activities | 6202 | 3911P |
| Computer facilities management activities | 6203 | 3911P |
| Other information technology and computer service activities | 6209 | 3911P |
| Data processing, hosting and related activities; web portals | 631 | 3921, 40 (ex. 4013) |
| Data processing, hosting and related activities | 6311 | 3921, 4012 |
| Web portals | 6312 | 4011 |
| Repair of computers and communication equipment | 951 | 9021P |
| Repair of computers and peripheral equipment | 9511 | 9021P |
| Repair of communication equipment | 9512 | 9021P |

b) RS sector

| | NACE Rev.2 | JSIC Rev. 13 |
|---|-------------------|---------------------|
| Retail sale via mail order houses or via Internet | 4791 | 611P, 619P |

c) MC sector

| | NACE Rev.2 | JSIC Rev. 13 |
|--|-------------------|--------------------------|
| MC sector | | |
| Publishing of books, periodicals and other publishing activities | | |
| Book publishing | 5811 | 414P |
| Publishing of directories and mailing lists | 5812 | 414P |
| Publishing of newspapers, journals and periodicals | 5813-5814 | 414P, 415 |
| Publishing of newspapers | 5813 | 414P |
| Publishing of journals and periodicals | 5814 | 414P |
| Other publishing activities | 5819 | 415 |
| Audiovisual and broadcasting activities | | |
| Motion picture, video and television programme production, sound recording and music publishing activities | 59 | 42 |
| Motion picture, video and television programme activities | 591 | 411, 4169P |
| Motion picture, video and television programme production activities | 5911 | 4111, 4112 |
| Motion picture, video and television programme post-production activities | 5912 | 4113, 4169P |
| Motion picture, video and television programme distribution activities | 5913 | 4114 |
| Motion picture projection activities | 5914 | 4114 |
| Sound recording and music publishing activities | 592 | 412, 4169P |
| Programming and broadcasting activities | 60 | 381, 382 |
| Radio broadcasting | 601 | 3822 |
| Television programming and broadcasting activities | 602 | 381, 3821, 3823, 3829 |
| Other information service activities | | |
| News agency activities | 6391 | 4161 |
| Other information service activities n.e.c. | 6399 | 3922, 3929, 4013 |

Note: The P indicates that the JSIC codes are linked with more than one NACE Rev.2 (ISIC Rev. 4) code.

Source: Own elaboration

Table A V Correspondences between NACE Rev.2 and KSIC (South Korea)**a) ICT sector**

| | NACE Rev.2 | KSIC Rev. 9 |
|--|-------------------|---------------------|
| ICT manufacturing industries | | |
| Manufacture of electronic components and boards | 261 | 261, 262 |
| Manufacture of electronic components and boards | 2611 | 261, 262 (ex. 2622) |
| Manufacture of electronic components | 2612 | 2622 |
| Manufacture of computers and peripheral equipment | 262 | 263 |
| Manufacture of communication equipment | 263 | 264 |
| Manufacture of consumer electronics | 264 | 265 |
| Manufacture of magnetic and optical media | 268 | 266 |
| ICT trade industries | | |
| Wholesale of computers, computer peripheral equipment and software | 4651 | 4651 |
| Wholesale of electronic and telecommunications equipment and parts | 4652 | 4652 |
| ICT services industries | | |
| Software publishing | 582 | 582 |
| Publishing of computer games | 5821 | 5821 |
| Other software publishing | 5829 | 5822 |
| Telecommunications | 61 | 612 |
| Wired telecommunications activities | 611 | 6121 |
| Wireless telecommunications activities | 612 | 6122 |
| Satellite telecommunications activities | 613 | 6123 |
| Other telecommunications activities | 619 | 6129 |
| Computer programming, consultancy and related activities | 62 | 62 |
| Computer programming activities | 6201 | 6201 |
| Computer consultancy and computer facilities management activities | 6202-6203 | 6202 |
| Computer consultancy activities | 6202 | 62021 |
| Computer facilities management activities | 6203 | 62022 |
| Other information technology and computer service activities | 6209 | 6209 |
| Data processing, hosting and related activities; web portals | 631 | 631 |
| Data processing, hosting and related activities | 6311 | 6312 |
| Web portals | 6312 | 6311 |
| Repair of computers and communication equipment | 951 | 95121, 95122 |
| Repair of computers and peripheral equipment | 9511 | 95121 |
| Repair of communication equipment | 9512 | 95122 |

b) RS sector

| | NACE Rev.2 | KSIC Rev. 9 |
|---|-------------------|--------------------|
| Retail sale via mail order houses or via Internet | 4791 | 4791 |

c) MC sector

| | NACE Rev.2 | KSIC Rev. 9 |
|--|-------------------|--------------------|
| MC sector | | |
| Publishing of books, periodicals and other publishing activities | | |
| Book publishing | 5811 | 58111, 58112 |
| Publishing of directories and mailing lists | 5812 | 58119 |
| Publishing of newspapers, journals and periodicals | 5813-5814 | 5812 |
| Publishing of newspapers | 5813 | 58121 |
| Publishing of journals and periodicals | 5814 | 58122-58123 |
| Other publishing activities | 5819 | 5819 |
| Audiovisual and broadcasting activities | | |
| Motion picture, video and television programme production, sound recording and music publishing activities | 59 | 59 |
| Motion picture, video and television programme activities | 591 | 591 |
| Motion picture, video and television programme production activities | 5911 | 5911 |
| Motion picture, video and television programme post-production activities | 5912 | 5912 |
| Motion picture, video and television programme distribution activities | 5913 | 5913 |
| Motion picture projection activities | 5914 | 5914 |
| Sound recording and music publishing activities | 592 | 592 |
| Programming and broadcasting activities | 60 | 60 |
| Radio broadcasting | 601 | 601 |
| Television programming and broadcasting activities | 602 | 602 |
| Other information service activities | | |
| News agency activities | 6391 | 6391 |
| Other information service activities n.e.c. | 6399 | 6399 |

Note: The P indicates that the KSIC codes are linked with more than one NACE Rev.2 (ISIC Rev. 4) code.

Source: Own elaboration

Table A VI Correspondences between NACE Rev.2 and SIC (Taiwan)

| | NACE Rev.2 | SIC version) | (9th |
|--|------------|----------------------|------|
| a) ICT sector | | | |
| ICT manufacturing industries | | | |
| Manufacture of electronic components and boards | 261 | 26 | |
| Manufacture of electronic components and boards | 2611 | 2691, 2699P | |
| Manufacture of electronic components | 2612 | 26 (ex. 2691, 2699P) | |
| Manufacture of computers and peripheral equipment | 262 | 271 | |
| Manufacture of communication equipment | 263 | 272 | |
| Manufacture of consumer electronics | 264 | 273 | |
| Manufacture of magnetic and optical media | 268 | 274 | |
| ICT trade industries | | | |
| Wholesale of computers, computer peripheral equipment and software | 4651 | 4641P | |
| Wholesale of electronic and telecommunications equipment and parts | 4652 | 4641P | |
| ICT services industries | | | |
| Software publishing | 582 | 582 | |
| Publishing of computer games | 5821 | - | |
| Other software publishing | 5829 | - | |
| Telecommunications | 61 | 61 | |
| Wired telecommunications activities | 611 | - | |
| Wireless telecommunications activities | 612 | - | |
| Satellite telecommunications activities | 613 | - | |
| Other telecommunications activities | 619 | - | |
| Computer programming, consultancy and related activities | 62 | 62 | |
| Computer programming activities | 6201 | 6201 | |
| Computer consultancy and computer facilities management activities | 6202-6203 | 6202 | |
| Computer consultancy activities | 6202 | - | |
| Computer facilities management activities | 6203 | - | |
| Other information technology and computer service activities | 6209 | 6209 | |
| Data processing, hosting and related activities; web portals | 631 | 631 | |
| Data processing, hosting and related activities | 6311 | 6312 | |
| Web portals | 6312 | 6311 | |
| Repair of computers and communication equipment | 951 | 952 | |
| Repair of computers and peripheral equipment | 9511 | 9521 | |
| Repair of communication equipment | 9512 | 9522 | |

b) RS sector

| | NACE Rev.2 | SIC version) (9th) |
|---|------------|--------------------|
| Retail sale via mail order houses or via Internet | 4791 | 4874 |

c) MC sector

| | NACE Rev.2 | SIC version) (9th) |
|--|--------------|--------------------|
| MC sector | | |
| Publishing of books, periodicals and other publishing activities | 581 | 581 |
| Book publishing | 5811 | 5813 |
| Publishing of directories and mailing lists | 5812 | 5819P |
| Publishing of newspapers, journals and periodicals | 5813-5814 | 5811, 5812 |
| Publishing of newspapers | 5813 | 5811 |
| Publishing of journals and periodicals | 5814 | 5812 |
| Other publishing activities | 5819 | 5819P |
| Audiovisual and broadcasting activities | 59-60 | 59-60 |
| Motion picture, video and television programme production, sound recording and music publishing activities | 59 | 59 |
| Motion picture, video and television programme activities | 591 | 591 |
| Motion picture, video and television programme production activities | 5911 | 5911 |
| Motion picture, video and television programme post-production activities | 5912 | 5912 |
| Motion picture, video and television programme distribution activities | 5913 | 5913 |
| Motion picture projection activities | 5914 | 5914 |
| Sound recording and music publishing activities | 592 | 592 |
| Programming and broadcasting activities | 60 | 60 |
| Radio broadcasting | 601 | 601 |
| Television programming and broadcasting activities | 602 | 602 |
| Other information service activities | 639 | 639 |
| News agency activities | 6391 | 6391 |
| Other information service activities n.e.c. | 6399 | 6399 |

Note: The P indicates that the SIC codes are linked with more than one NACE Rev.2 (ISIC Rev. 4) code.

Source: Own elaboration

Table A VII Correspondences between NACE Rev.2 and NAICS (US and Canada)

a) ICT sector

| | NACE Rev.2 | NAICS2007 |
|--|-------------------|-------------------------------|
| ICT manufacturing industries | | |
| Manufacture of electronic components and boards | 261 | 3344 |
| Manufacture of electronic components and boards | 2611 | 334412- 334417; 334419 |
| Manufacture of electronic components | 2619 | 334418 |
| Manufacture of computers and peripheral equipment | 262 | 3341 |
| Manufacture of communication equipment | 263 | 3342 |
| Manufacture of consumer electronics | 264 | 3343 |
| Manufacture of magnetic and optical media | 268 | 3346 |
| ICT trade industries | | |
| Wholesale of computers, computer peripheral equipment and software | 4651 | 42343 (41731 in Canada) |
| Wholesale of electronic and telecommunications equipment and parts | 4652 | 4236P (41732 in Canada) |
| ICT services industries | | |
| Software publishing | 582 | 5112 |
| Publishing of computer games | 5821 | 5112P |
| Other software publishing | 5829 | 5112P |
| Telecommunications | 61 | 517 |
| Wired telecommunications activities | 611 | 5171 |
| Wireless telecommunications activities | 612 | 5172 |
| Satellite telecommunications activities | 613 | 5174 |
| Other telecommunications activities | 619 | 5179 |
| Computer programming, consultancy and related activities | 62 | 5415 |
| Computer programming activities | 6201 | 541511 |
| Computer consultancy and computer facilities management activities | 6202-6203 | 541512, 541513 |
| Computer consultancy activities | 6202 | 541512 |
| Computer facilities management activities | 6203 | 541513 |
| Other information technology and computer service activities | 6209 | 541519 |
| Data processing, hosting and related activities; web portals | 631 | 5182 |
| Data processing, hosting and related activities | 6311 | 5182P |
| Web portals | 6312 | 5182P |
| Repair of computers and communication equipment | 951 | 811212, 811213 |
| Repair of computers and peripheral equipment | 9511 | 811212 |
| Repair of communication equipment | 9512 | 811213 |

b) RS sector

| | NACE Rev.2 | NAICS2007 |
|---|-------------------|------------------|
| Retail sale via mail order houses or via Internet | 4791 | 4541 |

c) MC sector

| | NACE Rev.2 | NAICS2007 |
|--|-------------------|------------------|
| MC sector | | |
| Publishing of books, periodicals and other publishing activities | | |
| Book publishing | 5811 | 51113 |
| Publishing of directories and mailing lists | 5812 | 51114 |
| Publishing of newspapers, journals and periodicals | 5813-5814 | 51111, 51112 |
| Publishing of newspapers | 5813 | 51111 |
| Publishing of journals and periodicals | 5814 | 51112 |
| Other publishing activities | 5819 | 51119 |
| Audiovisual and broadcasting activities | | |
| Motion picture, video and television programme production, sound recording and music publishing activities | 59 | 512 |
| Motion picture, video and television programme activities | 591 | 5121 |
| Motion picture, video and television programme production activities | 5911 | 51211 |
| Motion picture, video and television programme post-production activities | 5912 | 51219 |
| Motion picture, video and television programme distribution activities | 5913 | 51212 |
| Motion picture projection activities | 5914 | 51213 |
| Sound recording and music publishing activities | 592 | 5122 |
| Programming and broadcasting activities | 60 | 515 |
| Radio broadcasting | 601 | 51511 |
| Television programming and broadcasting activities | 602 | 51512, 5152 |
| Other information service activities | | |
| News agency activities | 6391 | 51911 |
| Other information service activities n.e.c. | 6399 | 51919 |

Note: The P indicates that the NAICS codes are linked with more than one NACE Rev.2 (ISIC Rev. 4) code.

Source: Own elaboration

Table A VIII NABS - NACE Rev. 1.1. correspondence table

| NABS 2007 | | NACE Rev. 1.1 | |
|-----------|--|--|--|
| Code | Name | Code | Name |
| 1 | Exploration and exploitation of the Earth | 10 | Mining of coal and lignite; extraction of peat |
| | | 11 | Extraction of crude petroleum and natural gas |
| | | 12 | Mining of uranium and thorium ores |
| | | 13 | Mining of metal ores |
| | | 14 | Other mining and quarrying |
| | | 74.3 (p) | Technical testing and analysis |
| 2 | Environment | 23.3 | Processing of nuclear fuel |
| | | 37 | Recycling |
| | | 90 | Sewage and refuse disposal, sanitation and similar activities |
| | | 74.3 (p) | Technical testing and analysis |
| 3 | Exploration and exploitation of space | 62.3 | Space transport |
| | | 64.2 (p) | Telecommunications |
| | | 74.3 (p) | Technical testing and analysis |
| 4 | Transport, telecommunication and other infrastructures | 41 | Collection, purification and distribution of water |
| | | 45 | Construction |
| | | 60 | Land transport; transport via pipelines |
| | | 61 | Water transport |
| | | 62 | Air transport |
| | | 63 | Supporting and auxiliary transport activities; activities of travel agencies |
| | | 64 | Post and telecommunications |
| | | 74.2 | Architectural and engineering activities and related technical consultancy |
| | | 64.1 | Post and courier analysis |
| | | 64.2 (p) | Telecommunications |
| 5 | Energy | 40 | Electricity, gas, steam and hot water supply |
| | | 74.3 (p) | Technical testing and analysis |
| 6 | Industrial production and technology | 15-37 | Manufacturing |
| | | 64.2 (p) | Telecommunications |
| | | 72 | Computer and related activities |
| | | 74.3 (p) | Technical testing and analysis |
| | | excluded here: 22.1, 23.3, 24.15, 24.2, 29.3, 29.6, 37 | |
| 7 | Health | 85.1 | Human health activities |
| | | 85.31 | Social work activities with accommodation |
| 8 | Agriculture | 1 | Agriculture, hunting and related service activities |
| | | 2 | Forestry, logging and related service activities |
| | | 5 | Fishing, fish farming and related service activities |
| | | 24.15 | Manufacture of fertilisers and nitrogen compounds |
| | | 24.2 | Manufacture of pesticides and other agrochemical products |
| | | 29.3 | Manufacture of agricultural and forestry machinery |
| | | 85.2 | Veterinary activities |
| | | 74.3 (p) | Technical testing and analysis |
| 9 | Education | 80 | Education |
| 10 | Culture, recreation, religion and mass | 22.1 | Publishing |
| | | 91.3 | Activities of other membership organizations |

| | | | |
|----|---|---|---|
| | media | 92 | Recreational, cultural and sporting activities |
| 11 | Political and social systems, structures and processes | 74.1 74.5 75 85.32 excluded here: 75.22 | Legal, accounting and consultancy Labour recruitment and provision of personnel Public administration and defence; compulsory social security Social work activities without accommodation |
| 12 | General advancement of knowledge (General University Funds - GUF) | 73 (p) | Research and development |
| 13 | General advancement of knowledge (other sources than GUF) | 73 (p) | Research and development |
| 14 | Defence | 29.6 75.22 | Manufacture of weapons and ammunition Defence activities |

Note: some NACE sub-categories are referred as *excluded* - it is because they are part of a different NABS chapter.

Table A IX NABS - NACE Rev. 2 correspondence table

| NABS 2007 | | NACE Rev. 2 | |
|-----------|--|--|---|
| Code | Name | Code | Name |
| 1 | Exploration and exploitation of the Earth | 5 | Mining of coal and lignite |
| | | 6 | Extraction of crude petroleum and natural gas |
| | | 7 | Mining of metal ores |
| | | 8 | Other mining and quarrying |
| | | 9 | Mining support service activities |
| | | 71 (p) (excl: 71.11) | Engineering activities; technical testing and analysis |
| 2 | Environment | 37 | Sewerage |
| | | 38 | Waste collection, treatment and disposal activities; materials recovery |
| | | 39 | Remediation activities and other waste management services |
| | | 71 (p) (excl: 71.11) | Engineering activities; technical testing and analysis |
| 3 | Exploration and exploitation of space | 51.22 | Space transport |
| | | 61 (p) | Telecommunications |
| | | 71 (p) (excl: 71.11) | Engineering activities; technical testing and analysis |
| 4 | Transport, telecommunication and other infrastructures | 36 | Water collection, treatment and supply |
| | | 37 | Sewerage |
| | | 41 | Construction of buildings |
| | | 42 | Civil engineering |
| | | 43 | Specialised construction activities |
| | | 49 | Land transport and transport via pipelines |
| | | 50 | Water transport |
| | | 51 (exc: 51.22) | Air transport |
| | | 52 | Warehousing and support activities for transportation |
| | | 53 | Postal and courier activities |
| | | 61 (p) | Telecommunications |
| | | 71.11 | Architectural activities |
| | | 71 (p) (excl: 71.11) | Engineering activities; technical testing and analysis |
| 5 | Energy | 35 | Electricity, gas, steam and air conditioning supply |
| | | 71 (p) (excl: 71.11) | Engineering activities; technical testing and analysis |
| 6 | Industrial production and technology | 10 - 33 | (all) Manufacturing |
| | | 582 | Software publishing |
| | | 62 | Computer programming, consultancy and related activities |
| | | 63 | Information service activities |
| | | 61 (p) | Telecommunications |
| | | 71 (p) (excl: 71.11) | Engineering activities; technical testing and analysis |
| | | excluded here: 20.15, 20.2, 25.4, 28.3, 30.4 | |
| 7 | Health | 86 | Human health activities |

| | | | |
|----|---|----------------------|--|
| | | 87 | Residential care activities |
| 8 | Agriculture | 1 | Crop and animal production, hunting and related service activities |
| | | 2 | Forestry and logging |
| | | 3 | Fishing and aquaculture |
| | | 20.15 | Manufacture of fertilisers and nitrogen compounds |
| | | 20.2 | Manufacture of pesticides and other agrochemical products |
| | | 28.3 | Manufacture of agricultural and forestry machinery |
| | | 75 | Veterinary activities |
| | | 71 (p) (excl: 71.11) | Engineering activities; technical testing and analysis |
| 9 | Education | 85 | Education |
| 10 | Culture, recreation, religion and mass media | 581 | Publishing of books |
| | | 59 | Motion picture, video and television programme production, sound recording and music publishing activities |
| | | 60 | Programming and broadcasting activities |
| | | 90 | Creative, arts and entertainment activities |
| | | 91 | Libraries, archives, museums and other cultural activities |
| | | 93 | Sports activities and amusement and recreation activities |
| | | 94.9 | Activities of other membership organisations |
| 11 | Political and social systems, structures and processes | 69 | Legal and accounting activities |
| | | 70 | Activities of head offices; management consultancy activities |
| | | 78 | Employment activities |
| | | 84 | Public administration and defence; compulsory social security |
| | | 88 | Social work activities without accommodation |
| | | excluded here: 84.22 | |
| 12 | General advancement of knowledge (General University Funds – GUF) | 72 (p) | Scientific research and development |
| 13 | General advancement of knowledge (other sources than GUF) | 72 (p) | Scientific research and development |
| 14 | Defence | 25.4 | Manufacture of weapons and ammunition |
| | | 30.4 | Manufacture of military fighting vehicles |
| | | 84.22 | Defence activities |

Note: some NACE sub-categories are referred as *excluded* - it is because they are part of a different NABS chapter.

Table A X ICT occupations in ISCO-88 classification**ISCO-88**

| | |
|------|--|
| 1236 | Computing services managers |
| 213 | Computing professionals |
| 2144 | Electronics and telecommunications engineers |
| 2359 | Information technology trainers |
| 3114 | Electronics and telecommunications engineering technicians |
| 312 | Computer associate professionals |
| 313 | Optical and electronic equipment operators |
| 7242 | Electronics fitters |
| 7243 | Electronics mechanics and servicers |
| 8283 | Electronic-equipment assemblers |

Source: Eurostat (2016).
http://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm

Table A XI ICT occupations in ISCO-08 classification**ISCO-08**

| | |
|------|---|
| 133 | Information and communications technology services managers |
| 2152 | Electronic engineers |
| 2153 | Telecommunication engineers |
| 2166 | Graphic and multimedia designers |
| 2356 | Information technology trainers |
| 2434 | ICT sales professionals |
| 251 | Software and multimedia developers and analysts |
| 252 | Database specialists and systems administrators |
| 35 | Information and communications technicians |
| 7421 | Electronics mechanics and servicers |
| 7422 | ICT installers and servicers |

Source: Eurostat (2016).
http://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm

Table A XII ICT occupations in COC and SOC classifications (US)

| 2010 COC | 2010 SOC | |
|--|-----------------|---|
| 110 | 11-3021 | Computer and Information Systems Managers |
| 1000 1010 1020 1040 1050 1060 1100 1110 | 15-1100 | Computer Occupations |
| 1400 | 17-2061 | Computer Hardware Engineers |
| 1550 | 17-3023 | Electronics Engineering Technicians |
| 5010 5020 5030 | 43-2000 | Communications Equipment Operators |
| 5800 | 43-9011 | Computer Operators |
| 5830 | 43-9031 | Desktop Publishers |
| 7020 | 49-2020 | Radio and Telecommunications Equipment Installers and Repairers |
| 7420 | 49-9052 | Telecommunications Line Installers and Repairers |

Source: Stančik (2012) and own elaboration.

Table A XIII NABS - CIC correspondence table (US)

| NABS 2007 | | CIC 2010 | |
|-----------|--|---|--|
| Code | Name | Code | Name |
| 1 | Exploration and exploitation of the Earth | 0370-0490 | Mining, quarrying, and oil and gas extraction |
| 2 | Environment | 0680 7790 7290 (p) | Sewage treatment facilities Waste management and remediation services Architectural, engineering and related activities |
| 3 | Exploration and exploitation of space | 3590 9570 | Aerospace product and parts manufacturing Administration of economic programs and space research |
| 4 | Transport, telecommunication and other infrastructures | 0770 6070 - 6390 6680 - 6690 (p) 7290 (p) | Construction Transportation and warehousing Telecommunications Architectural, engineering, and related services |
| 5 | Energy | 0570 - 0690 7290 (p) | Utilities Architectural, engineering, and related services excluded here: 0680 |
| 6 | Industrial production and technology | 1070 - 2390 2470 - 2990 3090 3170 3180 3190 3290 3360 3370 3380 3390 3470 - 3490 3570 (p) 3580 (p) 3680 (p) 3770 - 3870 3970 3980 3990 6490 6680 - 6690 (p) 7290 (p) 7380 | Nondurable goods manufacturing Durable goods manufacturing Commercial and service industry machinery manufacturing Metalworking machinery manufacturing Engines, turbines, and power transmission equipment manufacturing Machinery manufacturing, n.e.c. Not specified machinery manufacturing Computer and peripheral equipment manufacturing Communications, and audio and video equipment manufacturing Navigational, measuring, electromedical, and control instruments manufacturing* Electronic component and product manufacturing, n.e.c. Electrical equipment and appliances manufacturing Motor vehicles and motor vehicle equipment manufacturing Aircraft and parts manufacturing Ship and boat building Wood products manufacturing Sporting and athletic goods, and doll, toy and game manufacturing Miscellaneous manufacturing, n.e.c. Not specified manufacturing industries Software publishers Telecommunications Architectural, engineering, and related services Computer systems design and related services excluded here: 2180, 2970 |
| 7 | Health | 2190 3960 7970 - 8180 8270 - 8290 | Pharmaceutical and medicine manufacturing Medical equipment and supplies manufacturing Health services, except hospitals Health services, except hospitals |
| 8 | Agriculture | 0170 0290 2180 | Agriculture, forestry, fishing, and hunting Agricultural chemical manufacturing |

| | | | |
|----|---|---------------------------|---|
| | | 3070 | Agricultural implement manufacturing |
| | | 7480 | Veterinary services |
| 9 | Education | 7860 - 7890 | Educational services |
| 10 | Culture, recreation, religion and mass media | 6470 - 6480 | Publishing, except Internet |
| | | 6570 - 6590 | Motion picture and sound recording industries |
| | | 6770 - 6780 | Other information services |
| | | 8560 - 8590 | Arts, entertainment, and recreation |
| | | 9160 - 9190 | Membership associations and organizations |
| | | 9290 | Private households |
| 11 | Political and social systems, structures and processes | 7270 | Legal services |
| | | 7280 | Accounting, tax preparation, bookkeeping, and payroll services |
| | | 7570 | Management of companies and enterprises |
| | | 7390 | Management, scientific, and technical consulting services |
| | | 7580 | Employment services |
| | | 8370 - 8470 | Social assistance |
| | | 9370 - 9590 | Public administration |
| | | excluded here: 9570, 9590 | |
| 12 | General advancement of knowledge (General University Funds - GUF) | 7460 (p) | Scientific research and development services |
| 13 | General advancement of knowledge (other sources than GUF) | 7460 (p) | Scientific research and development services |
| 14 | Defence | 2970 | Ordnance |
| | | 3380 (p) | Navigational, measuring, electromedical, and control instruments manufacturing* |
| | | 3570 (p) | Motor vehicles and motor vehicle equipment manufacturing* |
| | | 3580 (p) | Aircraft and parts manufacturing* |
| | | 3680 (p) | Ship and boat building* |
| | | 9590 | National security and international affairs |

Source: Stančík (2012) and own elaboration.

Note: some NACE sub-categories are referred to as *excluded*; this is because they are part of a different NABS chapter.

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List of Definitions

BERD: Intramural expenditures on R&D performed within business enterprise sector during a specific period, whatever the source of funds (Frascati Manual).

BERD intensity: BERD/GDP.

Business R&D personnel: All persons employed directly in R&D by business enterprise sector, as well as those providing direct services such as R&D managers, administrators and clerical staff. Those providing indirect services, such as canteen and security staff, should be excluded (Frascati Manual).

Business R&D researchers: Business enterprise sector's professionals engaged in the conception or creation of new knowledge, products, processes, methods and systems and also in the management of the projects concerned (Frascati Manual).

Full-time equivalent (FTE): A full-time equivalent corresponds to one year's work by one person. Consequently, someone who normally spends 40% of his or her time on R&D and the rest on other activities (e.g. teaching, university administration or counselling) should be counted as only 0.4 FTE.

Employment: Number of persons employed. In the SNA this is defined as all persons, both employees and self-employed, engaged in some productive activity that falls within the production boundary of the SNA and that is undertaken by a resident institutional unit.

EU28: The EU aggregate in the PREDICT dataset always refers to the aggregate of the 28 countries of the current configuration regardless of the legal status of all 28 countries as Member state of the EU in the respective year. This is to allow for a comparison to the same aggregate.

GBARD: Government budget allocations for R&D are a way of measuring government support for research and development activities. GBARD include all appropriations (government spending) given to R&D in central (or federal) government budgets. Provincial (or State) government posts are only included if the contribution is significant. Local government funds are excluded.

GDP: Measures the total final market value of all goods and services produced within a country during a given period. GDP is the most frequently used indicator of economic activity and is most often measured on an annual or quarterly basis to gauge the growth of a country's economy between one period and another.

GERD: Gross domestic expenditure on research and development (GERD) is total intramural expenditure on research and development performed on the national territory during a given period.

GDP deflator: Implicit price deflator for GDP is calculated as GDP at current prices divided by GDP at "constant prices" (chained volume estimates or fixed-base volume estimates, depending on countries).

ICT BERD intensity: ICT BERD/ICT VA.

ICT GBARD: Government budget allocations for ICT R&D public funding of ICT assets in all industries of the economy. ICT GBARD is allocated to all sectors in the economy, not only the ICT sector.

ICT manufacturing industries: Manufacture of electronic components and boards (NACE 261), Manufacture of computers and peripheral equipment (NACE 262), Manufacture of communication equipment (NACE 263), Manufacture of consumer electronics (NACE 264), Manufacture of magnetic and optical media (NACE 268).

ICT sector comprehensive definition: this definition is available mainly for EU Member States since 2008. It corresponds to the definition given by the OECD (2007). This definition includes ICT manufacturing industries, ICT trade industries and ICT

services industries. Data in accordance with this classification are not available for some non-EU countries.

ICT sector employment: all employed people in the ICT sector definition given by the OECD in 2007.

ICT sector operational definition: this definition allows for an international comparison with non-EU countries over a longer period of time, as some of these countries do not have the necessary disaggregated information to estimate all the ICT sub-sectors included in the comprehensive definition. This definition takes into account the standard distinction between manufacturing and services, but does not include the following sectors: Manufacture of magnetic and optical media (268) and ICT trade industries (465). In addition, ICT services industries are only available for two sub-sectors: Telecommunication (61) and the aggregate Computer and related activities (582, 62, 631, 951).

ICT services industries: Software publishing (NACE 5820), Telecommunications (NACE 61), Computer programming, consultancy and related activities (NACE 62), Data processing, hosting and related activities; web portals (NACE 631), Repair of computers and communications equipment (951).

ICT trade industries: Wholesale of computers, computer peripheral equipment and software (NACE 4651), Wholesale of electronic and telecommunications equipment and parts (NACE 4652).

ICT total services: ICT trade industries and ICT services industries.

MC sector: includes Publishing of books, periodicals and other publishing activities (581), Audiovisual and broadcasting activities (59-60) and Other information service activities (639), OECD (2007).

RS sector: includes data for Retail sale via mail order houses or via Internet (NACE Rev. 2 Code 4791).

Productivity per person employed: Is defined as value added per person employed. It measures how efficiently labour input is combined with other factors of production and how it is used in the production process. Labour input is defined as total persons engaged in production. Labour productivity only partially reflects the productivity of labour in terms of the personal capacities of workers or the intensity of their effort, as it depends on the use of other production factors, e.g. physical capital.

Productivity per hour worked: It is a measure of labour productivity and is defined as value added per hour worked. It measures how efficiently labour input is combined with other factors of production and how it is used in the production process. Labour input is defined as total hours worked of all persons engaged in production. Labour productivity only partially reflects the productivity of labour in terms of the personal capacities of workers or the intensity of their effort.

Purchasing Power Standard (PPS): National currencies are converted into Purchasing Power Standards (PPS), an accounting unit based on current euros, to net for the effect of differences in price levels across countries and of movements in exchange rates. Using PPS it is possible to produce meaningful indicators (based on either price or volume) required for cross-country comparisons.

Value added: In the SNA it is defined as the value of output less the value of intermediate consumption; it is a measure of the contribution to GDP made by an individual producer, industry or sector.

List of Abbreviations used

| | |
|-------------|---|
| BERD: | Business Expenditure on Research and Development |
| BRDIS: | Business R&D and Innovation Survey |
| DG CONNECT: | Directorate General for Communications Networks, Content and Technology |
| EU: | European Union (aggregate of the 28 countries of its current configuration) |
| EUR: | Euros |
| Eurostat: | Statistical Office of the European Communities |
| FTE: | Full-time equivalent |
| GBARD: | Government budget allocations for Research and Development |
| GDP: | Gross domestic product |
| GERD: | Gross domestic Expenditure on Research and Development |
| ICT: | Information and Communication Technologies |
| ISIC: | International Standard Industry Classification |
| Ivie: | Valencian Institute of Economic Research |
| MC: | Media and Content sector |
| MS: | Member State |
| NA | National Accounts |
| NABS | Nomenclature for the Analysis and Comparison of Scientific Budgets and Programmes |
| NACE: | Statistical classification of economic activities in the European Community |
| OECD: | Organisation for Economic Co-operation and Development |
| PERD: | Research and Development personnel |
| PPS: | Purchase Power Standard |
| PREDICT: | Prospective Insights on R&D in ICT |
| R&D: | Research and Development |
| RERD: | Research and Development researchers |
| RS: | Retail sale via mail order houses or via Internet |
| SIRD: | Survey of Industrial Research and Development |
| SNA: | System of National Accounts |
| US: | United States |
| VA: | Value added |

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