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The 2020 PREDICT Dataset Methodology

Authors: Benages E., Hernández L., Mínguez C., Pascual, F., Robledo J.C., Rosell, I., Salamanca J., Solaz M., Cardona M., López-Cobo M, Righi R., Samoili, S., Vazquez-Prada Baillet M.

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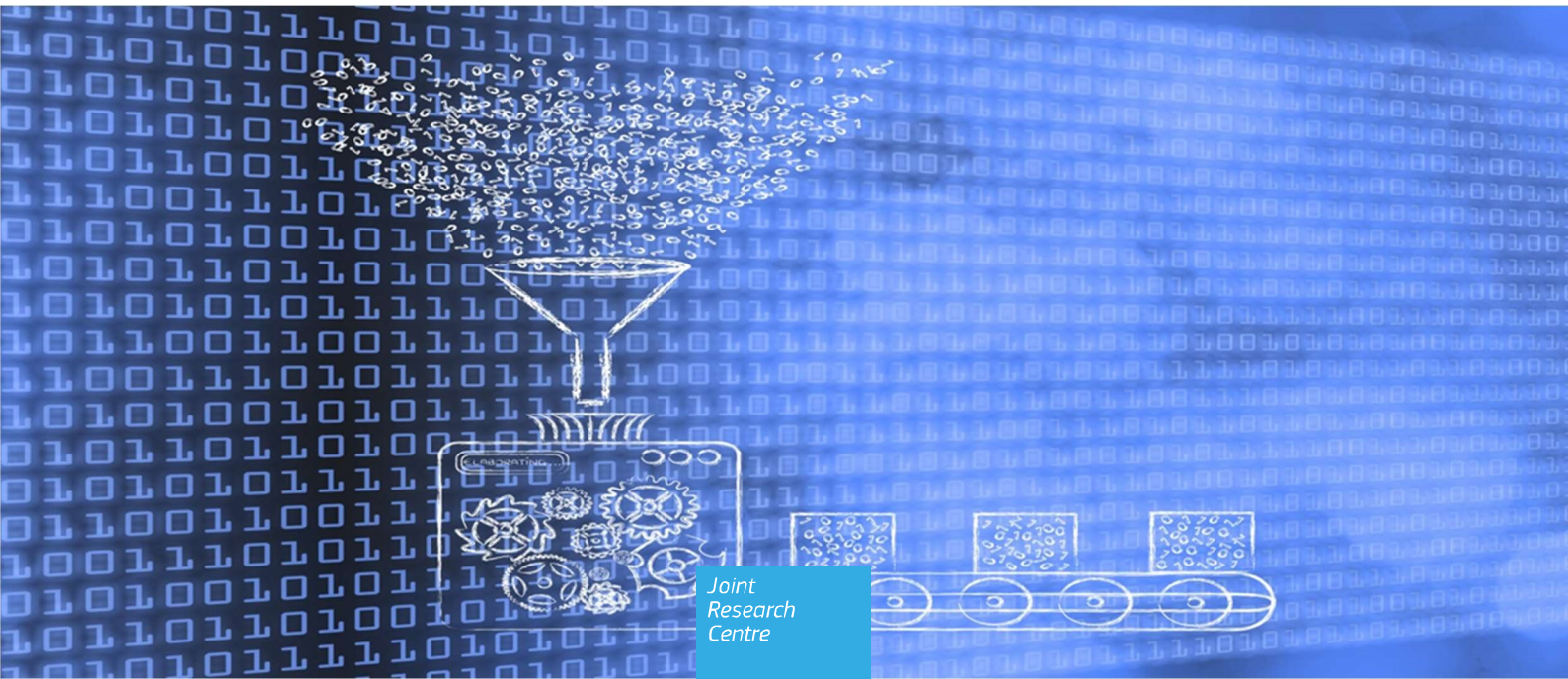

Contact information
Address: Edificio Expo, C/ Inca Garcilaso 3, Sevilla 41092, Spain
Email: JRC-LIST-B6-SECRETARIAT@ec.europa.eu

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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 European UnionEU28 plus Norway, Russia and Switzerland in Europe, Canada, the United States and Brazil in the America, 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 "A Europe fit for the digital age" was identified as one of the six European Commission priorities for the years 2019-2024.

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 2020. 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 2018 and 2019, thus providing comparable time series from 1995 to 2019.

1 Introduction

This methodological report details the work done in the Prospective Insights on R&D in ICT (PREDICT) project in 2020. 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 "A Europe fit for the Digital Age" has been identified as one of the six priorities by the current Commission. 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 2018 and 2019. Therefore, time series comparable across countries are covering the main indicators for the period between 1995 and 2019.

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 updatedIn the last chapter the 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 1995-2017

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 2020 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 aggregates[1], 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 2020 dataset ensures comparability with the industrial classification NACE Rev.2[2] from 1995 onwards[3]. It provides detailed information about: the ICT sector and sub-sectors[4]; 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 2020 core dataset are:

Business R&D Expenditure (BERD);

Gross R&D Expenditure (GERD);

R&D personnel (PERD);

R&D researchers (RERD);

Gross Value Added (GVA);

Gross Output (GO),

Employment (EMP)

Hours worked (HEMP)

Labour productivity per employed person (PRODEMP) and per hour worked (PRODHEMP)

Government budget allocations for R&D (GBARD) for the period 2006-2018

Government budget allocations for ICT R&D (ICT GBARD) for the period 2006-2018

The data for the variables 1 to 9 in the core dataset are 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

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:

[1] The data for the EU aggregates refers for the whole period under study to the composition of EU between 2013 and 2020 (EU28) and the aggregate of the 27 countries of the EU without United Kingdom since 2020 (EU27_2020).

[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 2018 and 2019.

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

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	*TW. ICT trade industries [TW=6+7]*
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, Gross output 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) 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 from 1995 onwards 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 onwards, 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 since 1995, the same strategy adopted for 2008-2017 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)[5] 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). 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.

[5] 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.

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

Individual codes

Benchmark	**Auxiliary sources**			
NACE Rev. 2	**NACE Rev. 2**		**NACE Rev. 1.1**	
NA (from 1995)	SBS (from 2008)	SBS (2005-2007)	NA/EU KLEMS (1995-2007)[1]	EU KLEMS/SBS (1995-2007)[1,2]
A*64	**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

Agreggate codes

NACE Rev. 2	**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	**Auxiliary sources**		
NACE Rev. 2	**NACE Rev. 2**		**NACE Rev.1.1**
R&D Statistics from 2005	SBS (from 2008)	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			
61	61	61	642
62	62	62	72
631	631	63	72
639	639		72
951	951	95	52

Agreggate 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.

PREDICT aims 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).[6] However, both types of estimation methods are closely related to the aims of PREDICT.

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: 2018 and 2019. The PREDICT 2020 database now covers the period 1995-2017, 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 2020 nowcasting follows the methodology applied in the previous editions of PREDICT databases. 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 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 tests the accuracy of the nowcasting approach by comparing information from the nowcasted data included in PREDICT 2019 and the actual data of PREDICT 2020. Section 7 summarises the main issues.

[6] 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.

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 for the EU countries consists of the comprehensive definition for total ICT sector, ICT manufacturing sector and ICT services sector, the Telecommunications sector (IT), the Computer and related activities sector (IC) and ICT Trade Industries (TW), 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, given the fact that the objective is to compare the EU countries with non-EU economies, we also estimate 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, exports, and so on. 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; Bánbura, 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 Kourtellos, 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 2018 and 2019. 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 2020 database includes data that covers the period 1995-2017, which allows us to use time-series methods applied individually to each country. Therefore, our 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.*).

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

The model of equation (2) is estimated for each of the EU countries, including the EU[7], 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. we include the lag of the dependent variable. In all the models finally selected, the first order correlation is rejected. Tables 3-5, 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 2017– and, obviously, for 2018 and 2019. 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*

Variables from Quarterly NA, annualised

Estimated sector	Independent variables: VA, Persons employed and GFCF in intellectual property. Industry disaggregation
ICT Sector (comprehensive and operational)	NACE C (Manufacturing) + J (Information and communication); Intellectual Property (only for BERD) Total economy
ICT manufacturing sector (comprehensive and operational)	NACE C (Manufacturing); Intellectual Property (only for BERD) Total economy
ICT total services sector and ICT services sector	NACE J (Information and communication); Intellectual Property (only for BERD) Total economy
ICT trade industries	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
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.

[7] For PREDICT 2020 we have included in our dataset a new aggregate, EU27_2020, which excludes UK.

[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.

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 1 shows the industry aggregation used for the nowcasting of each ICT sector[11] in the case of all four variables to be nowcasted (value added, employment, hours worked and BERD).

In the case of BERD there are no short-term variables for the period required that proxy R&D intensity. 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 2019. The only available information up to 2019 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 we have tested alternative specifications including up to three dummies covering up to the three sharpest jumps in series. 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 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 January 8, 2020, and data from the OECD and of National Statistical Offices for the non-EU countries on January 16, 2020.

[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 previous PREDICT projects. 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 2018 and 2019, 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.

[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 1 was the most effective.

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 and 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)

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 2017 (2016 for Canada for GVA). 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 dummies[12] that capture the three sharpest jumps in the series, or a step dummy[13] 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:

$$D.Y_{clt} = \alpha + \delta_1 D.GVA_{clt} + \delta_2 D.PersonsEmployed_{clt} + \delta_3 D.IntelectualProperty_{clt} + \\ + \delta_4 Dummy1 + \delta_5 Dummy2 + \delta_6 Dummy3 + \delta_7 Dummy10\_17 + \delta_8 [AR(1) or\ a\ trend] + \varepsilon_{clt} \quad (3)$$

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_17 is a step dummy variable that takes value 1 for years 2010-2017 and 0 for the rest of the years. Intellectual property is only included in the BERD models, and if Dummy10_17 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.

We used a twofold criterion to select the best model estimated for each country/ICT industry/variable. First, we employ a criterion based on the goodness of fit of the model estimated for the years 1995-

[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 2010-2017 and zero otherwise.

2017. For each model we calculate the average root mean squared errors ($RMSE_{9517}$) so that the model specification with lower $RMSE_{9517}$ is preferred. This criterion is combined with a second indicator that evaluates the model's predictive capacity. To implement this latter criterion we use the years 1995-2015 as a training set. We re-estimate each model for the training set and compute the test error defined as the root mean squared error of the predictions for the test set, that is, for years 2016 and 2017 ($RMSE_{1617}$). This second procedure allows us to test the performance of the model to make out-of-sample predictions. Our 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. With this second criterion we choose the model with the lowest prediction error out of the training set.

To combine the two criteria we calculate what we call the total RMSE ($RMSE_{total}$) as follows:

$$RMSE_{total} = RMSE_{9517} + RMSE_{1617} \quad (4)$$

and we choose the model with the lowest $RMSE_{total}$. What are the advantages of combining the two *RMSE*? Essentially, by doing so we can select the model that makes good predictions in the test set combined with the model that also behaves well over the whole period. When only one of the criteria is used, misleading results may arise in some cases. For example, we observed cases 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, because we only test the out-of-sample predictive capacity using only two years, the $RMSE_{1617}$ is prone to be affected by unusual data in the test set.

Tables 8, 9 and 10 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 1995-2015 (in the training set) or in years 2016 -2017. 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 1995-2017, and the $RMSE_{9517,}$ $RMSE_{1517}$.Table 8 shows the information for the model estimated for value added, table 9 for employment, table 10 for hours worked and table 11 for BERD.

Table 8.a. Description of the estimation models for GVA. Total ICT sector (comprehensive definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors C+J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed	3	No	Yes	OLS	0.614	311.111	336.729
BE	Persons employed, GVA	2	No	No	OLS	0.689	272.272	100.079
BG	Persons employed, GVA	1	Yes	No	OLS	0.811	84.612	155.369
CY	Persons employed, GVA	3	No	Yes	OLS	0.860	18.648	37.322
CZ	Persons employed, GVA	2	Yes	No	OLS	0.710	240.440	92.158
DE	Persons employed, GVA	1	Yes	No	OLS	0.520	3,056.271	2,447.404
DK	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.363	270.800	226.367
EE	Persons employed, GVA	0	Yes	No	OLS	0.716	26.763	61.035
EL	Persons employed, GVA	1	No	Yes	OLS	0.561	308.917	23.002
ES	Persons employed, GVA	0	Yes	No	OLS	0.464	920.869	158.398
FI	Persons employed, GVA	3	No	No	OLS	0.759	895.349	617.310
FR	Persons employed, GVA	0	Yes	No	OLS	0.657	1,463.681	2,680.347
HR	GVA	3	No	No	OLS	0.849	44.951	31.223
HU	Persons employed, GVA	0	Yes	No	OLS	0.345	282.646	178.836
IE	*Model not estimated because there is a break in the series of the dependent variable*							
IT	Persons employed, GVA	0	Yes	No	OLS	0.268	2,022.824	264.084
LT	Persons employed, GVA	1	Yes	No	OLS	0.391	42.252	63.980
LU	Persons employed, GVA	0	Yes	No	OLS	0.657	124.403	617.061
LV	Persons employed, GVA	1	Yes	Yes	OLS	0.504	47.999	14.541
MT	Persons employed, GVA	3	No	No	OLS	0.723	29.744	22.917
NL	Persons employed, GVA	3	No	Yes	OLS	0.536	860.641	145.962
PL	Persons employed, GVA	3	No	No	OLS	0.689	371.168	860.580
PT	Persons employed, GVA	0	Yes	No	OLS	0.403	165.475	64.846
RO	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.798	329.044	131.661
SE	Persons employed, GVA	3	No	Yes	OLS	0.879	746.424	376.666
SI	Persons employed, GVA	3	No	No	OLS	0.720	28.320	20.209
SK	Persons employed, GVA	2	Yes	No	OLS	0.714	99.675	155.552
UK	Persons employed, GVA	3	No	No	OLS	0.878	2,635.118	716.031
EU28	**Persons employed, GVA**	**1**	**Yes**	**No**	**OLS**	**0.744**	**9,358.716**	**7,380.548**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.813**	**5,796.085**	**7,970.670**

Table 8.b. Description of the estimation models for GVA. Total ICT sector (operational definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors C+J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	1	Yes	Yes	OLS	0.695	260.769	203.990
BE	Persons employed, GVA	1	Yes	No	OLS	0.565	238.492	81.136
BG	Persons employed, GVA	1	Yes	No	OLS	0.829	78.742	149.507
CY	Persons employed, GVA	3	No	Yes	OLS	0.885	16.680	37.557
CZ	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.832	172.092	185.449
DE	Persons employed, GVA	1	Yes	No	OLS	0.443	3,353.730	1,496.440
DK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.369	252.126	186.305
EE	Persons employed, GVA	0	Yes	Yes	OLS	0.749	24.957	55.567
EL	Persons employed, GVA	1	No	Yes	OLS	0.660	248.335	6.189
ES	Persons employed, GVA	1	Yes	No	OLS	0.427	852.651	8.352
FI	Persons employed, GVA	3	No	No	OLS	0.755	884.813	707.425
FR	Persons employed, GVA	1	Yes	No	OLS	0.700	1,278.711	2,731.686
HR	Persons employed, GVA	3	No	No	OLS	0.847	42.879	46.088
HU	Persons employed, GVA	0	Yes	No	OLS	0.297	289.346	227.102
IE	*Model not estimated because there is a break in the series of the dependent variable*							
IT	Persons employed, GVA	1	Yes	No	OLS	0.405	1,825.137	414.387
LT	Persons employed, GVA	1	Yes	No	OLS	0.378	41.748	65.989
LU	Persons employed, GVA	3	No	No	OLS	0.733	95.754	564.101
LV	Persons employed, GVA	1	Yes	Yes	OLS	0.510	42.511	16.566
MT	Persons employed, GVA	2	Yes	No	OLS	0.668	31.886	20.637
NL	Persons employed, GVA	3	No	Yes	OLS	0.776	404.058	226.775
PL	Persons employed, GVA	1	Yes	No	OLS	0.636	385.344	762.272
PT	Persons employed, GVA	0	Yes	No	OLS	0.495	134.585	91.775
RO	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.846	289.998	142.349
SE	Persons employed, GVA	3	No	Yes	OLS	0.868	740.454	451.426
SI	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.749	23.505	12.046
SK	Persons employed, GVA	2	Yes	No	OLS	0.698	100.427	163.707
UK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.880	2,436.977	1,491.587
EU28	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.731**	**9,018.445**	**5,367.938**
EU27_2020	**Persons employed, GVA**	**0**	**Yes**	**No**	**OLS**	**0.629**	**7,448.135**	**5,259.119**
AU	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.717	1,197.066	101.770
CA	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.949	606.859	623.347
JP	Persons employed, GVA	3	No	Yes	OLS	0.950	6,487.014	3,121.577
KR	Persons employed, GVA	0	Yes	No	OLS	0.965	1,563.899	6,295.987
TW	GVA	0	Yes	No	OLS	0.888	1,460.383	1,468.856
US	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.951	13,038.250	13,695.190

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

Table 8.c. Description of the estimation models for GVA. ICT manufacturing (comprehensive definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector C)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	1	Yes	No	OLS	0.877	111.821	75.248
BE	Persons employed, GVA	2	No	No	OLS	0.535	135.818	69.038
BG	Persons employed, GVA	3	No	Yes	OLS	0.442	8.066	8.779
CY	Persons employed, GVA	3	No	No	OLS	0.805	2.447	11.829
CZ	GVA	2	No	Yes	OLS	0.476	87.828	87.802
DE	Persons employed, GVA	3	No	Yes	OLS	0.677	1,320.090	97.116
DK	Persons employed, GVA	2	No	No	OLS	0.277	87.634	15.861
EE	Persons employed, GVA	2	Yes	No	OLS	0.624	15.632	1.470
EL	Persons employed, GVA	3	No	Yes	OLS	0.398	44.746	33.884
ES	Persons employed, GVA	3	No	Yes	OLS	0.737	88.660	10.298
FI	Persons employed, GVA	3	No	No	OLS	0.737	868.787	809.565
FR	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.421	544.480	626.675
HR	Persons employed, GVA	3	No	No	OLS	0.573	20.700	14.050
HU	Persons employed, GVA	1	Yes	No	OLS	0.156	199.997	166.351
IE	*Model not estimated because there is a break in the series of the dependent variable*							
IT	Persons employed, GVA	1	No	No	OLS	0.394	273.724	86.010
LT	Persons employed, GVA	2	Yes	Yes	OLS	0.236	13.706	12.889
LU	Persons employed, GVA	1	Yes	Yes	OLS	0.625	1.162	1.250
LV	Persons employed, GVA	2	Yes	No	OLS	0.772	7.939	7.971
MT	Persons employed, GVA	3	No	Yes	OLS	0.753	21.203	25.923
NL	Persons employed, GVA	3	No	Yes	OLS	0.437	299.599	466.518
PL	Persons employed, GVA	3	No	No	OLS	0.478	108.629	101.606
PT	Persons employed, GVA	3	No	No	OLS	0.897	24.946	17.326
RO	Persons employed, GVA	3	No	Yes	OLS	0.925	81.304	13.171
SE	Persons employed, GVA	3	No	No	OLS	0.920	589.636	201.083
SI	Persons employed, GVA	1	No	Yes	OLS	0.551	12.489	5.806
SK	Persons employed	2	Yes	No	OLS	0.552	82.181	65.348
UK	Persons employed, GVA	3	No	No	OLS	0.733	633.731	434.776
EU28	**Persons employed, GVA**	**2**	**No**	**No**	**OLS**	**0.682**	**3,576.173**	**2,419.922**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.803**	**2,499.264**	**2,862.775**

Table 8.d. Description of the estimation models for GVA. ICT manufacturing (operational definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector C)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	1	Yes	No	OLS	0.877	111.821	75.248
BE	Persons employed, GVA	2	No	No	OLS	0.536	135.661	69.150
BG	Persons employed, GVA	3	No	Yes	OLS	0.462	7.861	8.336
CY	Persons employed, GVA	3	No	Yes	OLS	0.809	2.365	11.785
CZ	GVA	2	No	Yes	OLS	0.459	88.562	88.569
DE	Persons employed, GVA	3	No	Yes	OLS	0.681	1,304.490	85.989
DK	Persons employed, GVA	2	No	No	OLS	0.277	87.560	15.728
EE	Persons employed, GVA	2	Yes	No	OLS	0.624	15.635	1.466
EL	Persons employed, GVA	3	No	Yes	OLS	0.399	44.694	33.570
ES	Persons employed, GVA	3	No	Yes	OLS	0.737	88.660	10.298
FI	Persons employed, GVA	3	No	No	OLS	0.737	868.827	809.971
FR	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.419	544.440	627.419
HR	Persons employed, GVA	3	No	No	OLS	0.573	20.699	14.051
HU	Persons employed, GVA	1	Yes	No	OLS	0.156	199.994	166.312
IE	*Model not estimated because there is a break in the series of the dependent variable*							
IT	Persons employed, GVA	1	No	No	OLS	0.390	276.128	87.029
LT	Persons employed, GVA	2	Yes	Yes	OLS	0.239	13.570	13.565
LU	Persons employed, GVA	1	Yes	Yes	OLS	0.625	1.162	1.250
LV	Persons employed, GVA	2	Yes	No	OLS	0.772	7.939	7.971
MT	Persons employed, GVA	3	No	Yes	OLS	0.753	21.203	25.923
NL	Persons employed, GVA	3	No	Yes	OLS	0.436	300.594	464.176
PL	Persons employed, GVA	3	No	No	OLS	0.474	109.036	102.676
PT	Persons employed, GVA	3	No	No	OLS	0.897	24.946	17.326
RO	Persons employed, GVA	3	No	Yes	OLS	0.925	81.314	13.172
SE	Persons employed, GVA	3	No	No	OLS	0.920	590.140	201.137
SI	Persons employed, GVA	1	No	Yes	OLS	0.550	12.563	5.757
SK	Persons employed	2	Yes	No	OLS	0.552	82.197	65.253
UK	Persons employed, GVA	3	No	No	OLS	0.732	632.217	435.008
EU28	**Persons employed, GVA**	**2**	**No**	**No**	**OLS**	**0.686**	**3,550.867**	**2,423.027**
EU27_2020	**GVA**	**2**	**No**	**No**	**OLS**	**0.622**	**3,490.567**	**888.396**
AU	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.435	104.005	58.269
CA	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.413	286.907	43.616
JP	Persons employed, GVA	3	No	Yes	OLS	0.882	5,012.007	1,715.821
KR	Persons employed, GVA	0	Yes	No	OLS	0.951	1,425.895	7,440.084
TW	GVA	2	Yes	No	OLS	0.836	1,511.616	1,391.262
US	Persons employed, GVA	3	No	No	OLS	0.919	5,397.746	1,780.497

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

Table 8.e. Description of the estimation models for GVA. ICT total services

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	0	Yes	No	OLS	0.845	121.636	90.415
BE	GVA	2	No	Yes	OLS	0.596	284.159	19.029
BG	Persons employed, GVA	0	Yes	No	OLS	0.961	38.495	28.922
CY	Persons employed, GVA	3	No	Yes	OLS	0.969	9.056	34.177
CZ	Persons employed, GVA	3	No	No	OLS	0.990	36.446	14.498
DE	Persons employed, GVA	0	No	Yes	OLS	0.799	1,724.513	2,528.867
DK	Persons employed, GVA	3	No	Yes	OLS	0.804	133.566	150.234
EE	Persons employed	2	Yes	No	OLS	0.643	23.205	73.505
EL	Persons employed, GVA	3	No	Yes	OLS	0.948	107.058	30.542
ES	Persons employed, GVA	0	No	No	OLS	0.900	392.964	101.399
FI	Persons employed, GVA	1	Yes	No	OLS	0.951	82.398	179.354
FR	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.940	533.854	239.897
HR	Persons employed, GVA	3	No	No	OLS	0.959	18.977	13.230
HU	Persons employed, GVA	1	No	No	OLS	0.833	83.818	31.782
IE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.788	535.893	630.769
IT	Persons employed, GVA	3	No	Yes	OLS	0.929	596.975	485.446
LT	Persons employed, GVA	0	Yes	No	OLS	0.871	18.649	8.545
LU	Persons employed, GVA	0	Yes	No	OLS	0.746	106.949	600.177
LV	Persons employed, GVA	0	Yes	No	OLS	0.923	16.933	20.771
MT	Persons employed, GVA	3	No	No	OLS	0.984	4.474	3.819
NL	Persons employed, GVA	2	No	No	OLS	0.637	694.787	18.667
PL	Persons employed, GVA	2	Yes	Yes	OLS	0.877	233.999	425.988
PT	Persons employed, GVA	3	No	Yes	OLS	0.901	58.791	19.390
RO	Persons employed, GVA	1	Yes	No	OLS	0.991	55.847	319.171
SE	Persons employed, GVA	1	Yes	No	OLS	0.938	368.679	441.897
SI	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.783	22.155	3.921
SK	Persons employed, GVA	0	Yes	No	OLS	0.808	60.128	14.378
UK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.889	2,332.597	2,047.665
EU28	**Persons employed, GVA**	**0**	**Yes**	**Yes**	**OLS**	**0.971**	**2,463.309**	**2,997.237**
EU27_2020	**Persons employed, GVA**	**0**	**Yes**	**Yes**	**OLS**	**0.978**	**1,495.214**	**4,405.791**

Table 8.f. Description of the estimation models for GVA. ICT trade industries

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors G_I)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	1	No	No	OLS	0.622	63.945	11.553
BE	Persons employed, GVA	2	Yes	Yes	OLS	0.664	156.125	60.590
BG	Persons employed, GVA	2	Yes	No	OLS	0.593	9.851	10.201
CY	Persons employed, GVA	2	No	No	OLS	0.339	4.492	0.596
CZ	Persons employed, GVA	1	Yes	No	OLS	0.696	22.095	27.221
DE	Persons employed, GVA	2	Yes	Yes	OLS	0.494	588.933	1,027.354
DK	Persons employed, GVA	3	No	Yes	OLS	0.498	50.699	9.854
EE	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.363	6.738	3.317
EL	Persons employed, GVA	2	Yes	No	OLS	0.878	58.672	54.690
ES	Persons employed, GVA	0	Yes	No	OLS	0.354	170.580	42.060
FI	Persons employed, GVA	1	Yes	Yes	OLS	0.691	40.867	88.231
FR	GVA	2	No	Yes	OLS	0.617	235.821	124.526
HR	Persons employed, GVA	1	Yes	No	OLS	0.549	9.215	8.557
HU	Persons employed, GVA	1	Yes	No	OLS	0.650	23.226	65.287
IE	Persons employed, GVA	3	No	Yes	OLS	0.639	243.705	142.085
IT	Persons employed, GVA	2	Yes	No	OLS	0.535	336.877	291.725
LT	Persons employed, GVA	3	No	Yes	OLS	0.642	5.665	4.566
LU	Persons employed, GVA	2	Yes	Yes	OLS	0.877	30.604	156.368
LV	GVA	0	No	No	OLS	0.459	8.896	5.513
MT	Persons employed, GVA	3	No	Yes	OLS	0.902	1.038	1.046
NL	Persons employed, GVA	3	No	Yes	OLS	0.729	357.046	274.619
PL	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.412	90.203	35.645
PT	GVA	3	No	Yes	OLS	0.824	27.934	34.868
RO	Persons employed, GVA	3	No	Yes	OLS	0.840	28.210	64.745
SE	Persons employed, GVA	2	No	No	OLS	0.751	73.146	38.952
SI	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.476	6.553	7.113
SK	Persons employed, GVA	2	Yes	No	OLS	0.625	16.428	28.019
UK	Persons employed	3	No	Yes	OLS	0.519	1,086.795	936.997
EU28	**Persons employed, GVA**	**2**	**Yes**	**Yes**	**OLS**	**0.359**	**2,060.790**	**505.481**
EU27_2020	**Persons employed, GVA**	**1**	**Yes**	**Yes**	**OLS**	**0.188**	**1,518.263**	**1,778.816**

Table 8.g. Description of the estimation models for GVA. ICT services industries

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	1	Yes	No	OLS	0.946	66.137	83.122
BE	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.855	129.554	60.968
BG	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.976	29.977	11.635
CY	Persons employed, GVA	3	No	Yes	OLS	0.978	7.502	33.065
CZ	Persons employed, GVA	3	No	No	OLS	0.991	31.198	22.156
DE	Persons employed	3	No	Yes	OLS	0.498	2,694.708	1,433.952
DK	Persons employed, GVA	2	Yes	No	OLS	0.899	95.560	164.117
EE	Persons employed, GVA	2	Yes	Yes	OLS	0.980	5.462	3.147
EL	Persons employed, GVA	0	No	No	OLS	0.912	125.126	25.785
ES	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.936	279.127	114.732
FI	Persons employed, GVA	0	Yes	No	OLS	0.953	70.913	89.755
FR	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.964	382.901	280.812
HR	Persons employed, GVA	1	Yes	No	OLS	0.922	25.373	5.901
HU	Persons employed, GVA	2	Yes	No	OLS	0.784	93.580	72.453
IE	Persons employed, GVA	0	Yes	Yes	OLS	0.944	254.131	781.874
IT	Persons employed, GVA	1	Yes	No	OLS	0.972	373.309	110.310
LT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.922	14.023	3.919
LU	Persons employed, GVA	3	No	Yes	OLS	0.888	61.833	481.566
LV	Persons employed, GVA	0	Yes	No	OLS	0.929	14.569	15.816
MT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.972	5.511	0.870
NL	Persons employed, GVA	3	No	No	OLS	0.981	113.214	119.639
PL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.861	236.403	296.417
PT	Persons employed, GVA	0	Yes	No	OLS	0.935	41.634	14.851
RO	Persons employed, GVA	3	No	No	OLS	0.970	98.207	201.309
SE	Persons employed, GVA	1	Yes	No	OLS	0.959	285.608	285.313
SI	Persons employed, GVA	1	Yes	No	OLS	0.769	19.420	3.011
SK	Persons employed, GVA	0	Yes	No	OLS	0.863	48.014	25.071
UK	Persons employed, GVA	0	Yes	No	OLS	0.920	1,867.638	3,795.266
EU28	**Persons employed, GVA**	**Step dummy from 2010**	**No**	**Yes**	**OLS**	**0.976**	**2,112.666**	**1,764.080**
EU27_2020	**Persons employed, GVA**	**0**	**Yes**	**Yes**	**OLS**	**0.965**	**1,811.988**	**2,257.789**
AU	Persons employed, GVA	1	Yes	Yes	OLS	0.874	775.505	644.092
CA	Persons employed, GVA	1	No	No	OLS	0.987	279.262	42.149
JP	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.995	1,290.739	496.296
KR	Persons employed, GVA	0	Yes	Yes	OLS	0.991	267.659	38.238
TW	Persons employed, GVA	3	No	Yes	OLS	0.985	91.020	46.153
US	Persons employed, GVA	2	Yes	Yes	OLS	0.982	6,213.009	3,960.001

Table 8.h. Description of the estimation models for GVA. IT services (Telecommunications)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.622	122.199	30.786
BE	Persons employed, GVA	2	Yes	Yes	OLS	0.697	133.105	125.663
BG	Persons employed, GVA	3	No	Yes	OLS	0.861	56.901	204.088
CY	Persons employed, GVA	3	No	Yes	OLS	0.634	13.889	64.844
CZ	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.829	83.320	53.130
DE	Persons employed, GVA	3	No	No	OLS	0.551	1,861.937	1,270.402
DK	Persons employed, GVA	1	Yes	Yes	OLS	0.483	157.768	136.082
EE	Persons employed, GVA	Step dummy from 2010	Yes	No	OLS	0.711	8.990	26.571
EL	Persons employed, GVA	3	No	No	OLS	0.779	182.900	28.887
ES	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.866	273.921	301.046
FI	Persons employed, GVA	3	No	Yes	OLS	0.914	77.706	72.106
FR	Persons employed, GVA	2	Yes	Yes	OLS	0.694	809.441	450.562
HR	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.819	36.169	16.385
HU	Persons employed, GVA	3	No	Yes	OLS	0.795	73.626	65.499
IE	Persons employed, GVA	3	No	No	OLS	0.463	203.206	134.270
IT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.898	503.420	80.859
LT	Persons employed, GVA	3	No	Yes	OLS	0.887	15.672	7.978
LU	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.492	62.770	55.935
LV	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.869	15.298	4.161
MT	Persons employed, GVA	0	Yes	No	OLS	0.698	6.625	12.073
NL	Persons employed	2	No	No	OLS	0.732	289.657	247.693
PL	Persons employed, GVA	3	No	No	OLS	0.666	258.720	157.942
PT	Persons employed, GVA	3	No	No	OLS	0.832	64.485	165.021
RO	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.697	164.468	87.241
SE	Persons employed, GVA	3	No	Yes	OLS	0.338	214.258	308.539
SI	Persons employed, GVA	3	No	Yes	OLS	0.823	12.981	21.824
SK	Persons employed, GVA	Step dummy from 2010	Yes	No	OLS	0.669	28.834	43.592
UK	Persons employed, GVA	3	No	Yes	OLS	0.829	1,065.768	1,303.015
EU28	**Persons employed, GVA**	**2**	**No**	**Yes**	**OLS**	**0.928**	**2,223.649**	**902.499**
EU27_2020	**Persons employed, GVA**	**Step dummy from 2010**	**No**	**No**	**OLS**	**0.826**	**2,919.108**	**756.960**
AU	Persons employed, GVA	2	No	Yes	OLS	0.899	285.570	49.195
CA	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.960	296.718	178.201
JP	Persons employed, GVA	0	No	No	OLS	0.994	743.796	198.206
KR	Persons employed, GVA	0	No	Yes	OLS	0.983	187.521	278.901
TW	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.943	113.271	95.734
US	GVA	3	No	Yes	OLS	0.870	7,559.259	8,946.225

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 8.i. 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	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	1	Yes	Yes	OLS	0.836	75.909	81.284
BE	Persons employed, GVA	3	No	Yes	OLS	0.806	112.262	53.367
BG	Persons employed, GVA	3	No	Yes	OLS	0.832	40.029	207.637
CY	Persons employed, GVA	0	Yes	Yes	OLS	0.911	14.455	82.997
CZ	Persons employed, GVA	1	Yes	Yes	OLS	0.873	76.323	87.734
DE	Persons employed, GVA	3	No	Yes	OLS	0.777	1,013.084	191.139
DK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.536	182.384	62.554
EE	Persons employed, GVA	0	Yes	Yes	OLS	0.948	8.880	27.855
EL	Persons employed, GVA	2	No	Yes	OLS	0.374	92.788	53.477
ES	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.588	338.766	185.541
FI	Persons employed, GVA	2	Yes	Yes	OLS	0.507	129.335	150.305
FR	Persons employed, GVA	0	Yes	Yes	OLS	0.718	842.092	1,047.656
HR	GVA	2	Yes	Yes	OLS	0.401	19.403	22.043
HU	Persons employed, GVA	0	Yes	Yes	OLS	0.749	45.819	69.253
IE	Persons employed, GVA	3	No	Yes	OLS	0.879	373.336	444.433
IT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.785	421.009	242.540
LT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.778	16.616	7.094
LU	Persons employed, GVA	3	No	No	OLS	0.917	38.782	423.034
LV	GVA	3	No	Yes	OLS	0.751	15.067	18.437
MT	Persons employed, GVA	1	Yes	No	OLS	0.829	10.087	10.454
NL	Persons employed, GVA	1	Yes	Yes	OLS	0.821	275.867	524.224
PL	Persons employed, GVA	2	Yes	Yes	OLS	0.860	149.234	201.274
PT	Persons employed, GVA	0	Yes	Yes	OLS	0.834	32.794	130.708
RO	Persons employed, GVA	3	No	Yes	OLS	0.771	206.802	135.912
SE	Persons employed, GVA	3	No	No	OLS	0.970	240.817	85.369
SI	Persons employed, GVA	0	Yes	Yes	OLS	0.770	10.405	14.025
SK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.801	50.596	55.488
UK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.837	1,724.919	2,467.531
EU28	**Persons employed, GVA**	**Step dummy from 2010**	**No**	**Yes**	**OLS**	**0.911**	**2,562.379**	**2,249.339**
EU27_2020	**Persons employed**	**3**	**No**	**Yes**	**OLS**	**0.741**	**3,290.136**	**3,818.358**
AU	Persons employed, GVA	0	Yes	Yes	OLS	0.769	673.230	707.333
CA	Persons employed, GVA	3	No	No	OLS	0.851	408.378	54.080
JP	Persons employed, GVA	1	Yes	Yes	OLS	0.985	1,133.351	460.091
KR	Persons employed, GVA	0	Yes	Yes	OLS	0.980	197.514	255.968
TW	Persons employed, GVA	0	Yes	Yes	OLS	0.890	91.901	124.787
US	Persons employed, GVA	0	Yes	Yes	OLS	0.943	6,891.555	5,451.664

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 8.j. 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	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	Yes	OLS	0.356	58.665	68.714
BE	Persons employed, GVA	3	Yes	Yes	OLS	0.515	73.335	143.114
BG	Persons employed, GVA	3	No	Yes	OLS	0.803	13.451	29.420
CY	Persons employed, GVA	0	Yes	Yes	OLS	0.715	7.566	34.263
CZ	Persons employed, GVA	3	No	Yes	OLS	0.873	28.768	17.731
DE	Persons employed, GVA	2	Yes	No	OLS	0.690	813.619	1,501.814
DK	Persons employed, GVA	3	No	No	OLS	0.617	81.012	209.593
EE	Persons employed, GVA	1	Yes	No	OLS	0.681	4.842	1.869
EL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.586	151.881	12.800
ES	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.553	253.494	77.887
FI	Persons employed, GVA	1	Yes	No	OLS	0.606	66.052	83.708
FR	Persons employed, GVA	3	No	No	OLS	0.212	409.449	237.752
HR	Persons employed, GVA	2	Yes	Yes	OLS	0.773	18.417	22.928
HU	Persons employed, GVA	2	Yes	No	OLS	0.581	68.616	72.478
IE	Persons employed, GVA	2	No	No	OLS	0.290	178.857	66.775
IT	Persons employed, GVA	3	No	No	OLS	0.770	296.710	163.293
LT	Persons employed, GVA	2	No	No	OLS	0.647	9.886	1.301
LU	Persons employed, GVA	3	No	No	OLS	0.483	27.279	17.993
LV	Persons employed, GVA	1	Yes	No	OLS	0.618	10.182	7.385
MT	GVA	3	No	No	OLS	0.667	3.164	0.186
NL	Persons employed, GVA	3	No	No	OLS	0.598	91.893	86.936
PL	Persons employed, GVA	2	No	Yes	OLS	0.852	140.505	101.653
PT	Persons employed, GVA	0	No	Yes	OLS	0.485	39.458	16.440
RO	Persons employed, GVA	3	No	Yes	OLS	0.636	62.226	118.330
SE	Persons employed, GVA	1	Yes	Yes	OLS	0.926	160.152	340.147
SI	Persons employed, GVA	3	No	No	OLS	0.928	6.951	1.498
SK	Persons employed, GVA	2	No	Yes	OLS	0.728	33.431	30.633
UK	Persons employed, GVA	2	Yes	Yes	OLS	0.877	868.805	275.780
EU28	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.807**	**1,895.283**	**2,022.030**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.720**	**1,437.481**	**897.603**
AU	Persons employed, GVA	1	No	Yes	OLS	0.846	263.026	208.945
CA	Persons employed, GVA	3	No	No	OLS	0.809	271.395	22.906
JP	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.879	1,419.535	84.048
KR	Persons employed, GVA	2	Yes	Yes	OLS	0.974	91.157	90.224
TW	Persons employed, GVA	0	Yes	Yes	OLS	0.904	53.558	45.731
US	Persons employed, GVA	1	Yes	No	OLS	0.844	7,878.173	11,449.680

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 8.k. Description of the estimation models for GVA. Retail sale sector

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors G_I)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	Yes	OLS	0.769	12.705	34.849
BE	Persons employed, GVA	1	Yes	Yes	OLS	0.467	15.306	29.105
BG	Persons employed, GVA	3	No	Yes	OLS	0.598	1.981	6.728
CY	Persons employed, GVA	2	Yes	Yes	OLS	0.407	0.362	0.197
CZ	Persons employed, GVA	0	Yes	Yes	OLS	0.668	14.020	37.854
DE	Persons employed, GVA	2	Yes	No	OLS	0.396	550.968	615.364
DK	Persons employed, GVA	2	Yes	Yes	OLS	0.354	13.320	12.839
EE	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.259	4.093	6.523
EL	Persons employed, GVA	1	Yes	Yes	OLS	0.545	4.958	5.635
ES	Persons employed, GVA	0	Yes	Yes	OLS	0.567	37.353	117.935
FI	Persons employed, GVA	3	No	Yes	OLS	0.260	5.969	6.377
FR	Persons employed, GVA	2	Yes	Yes	OLS	0.534	125.073	74.542
HR	Persons employed, GVA	3	No	Yes	OLS	0.918	0.886	2.188
HU	Persons employed, GVA	0	Yes	Yes	OLS	0.357	5.424	4.809
IE	GVA	2	Yes	Yes	OLS	0.576	37.163	48.888
IT	Persons employed, GVA	3	No	No	OLS	0.496	121.323	74.185
LT	Persons employed, GVA	2	Yes	Yes	OLS	0.774	3.516	12.689
LU	Persons employed, GVA	1	No	Yes	OLS	0.201	10.102	7.929
LV	Persons employed, GVA	3	No	Yes	OLS	0.904	2.567	13.925
MT	Persons employed, GVA	4	No	No	OLS	0.966	1.546	1.014
NL	Persons employed, GVA	2	Yes	No	OLS	0.633	56.595	196.591
PL	Persons employed, GVA	0	Yes	Yes	OLS	0.466	82.633	206.087
PT	Persons employed	1	No	Yes	OLS	0.372	2.655	0.992
RO	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.854	16.599	209.920
SE	Persons employed, GVA	0	Yes	Yes	OLS	0.514	31.751	42.651
SI	Persons employed, GVA	3	No	Yes	OLS	0.777	5.453	7.593
SK	Persons employed, GVA	2	No	No	OLS	0.443	18.190	3.480
UK	Persons employed, GVA	3	No	No	OLS	0.707	512.870	1.068.100
EU28	**Persons employed, GVA**	**2**	**Yes**	**No**	**OLS**	**0.680**	**627.505**	**533.545**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.442**	**683.244**	**915.544**
AU	Persons employed, GVA	2	Yes	No	OLS	0.682	68.353	17.476
CA	Persons employed	0	Yes	Yes	OLS	0.720	41.605	0.281
JP	*Model not estimated because the dependent variable is not available for the Retail sale sector*							
KR	GVA	Step dummy from 2010	No	Yes	OLS	0.711	114.787	164.529
TW	Persons employed, GVA	3	No	No	OLS	0.919	24.733	31.378
US	GVA	Step dummy from 2010	No	Yes	OLS	0.855	2,298.315	3,464.255

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 9.a. Description of the estimation models for Employment. Total ICT sector (comprehensive definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors C+J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	2	Yes	No	OLS	0.670	2.265	1.245
BE	Persons employed, GVA	2	No	Yes	OLS	0.676	2.485	0.495
BG	Persons employed, GVA	1	Yes	Yes	OLS	0.672	1.786	2.647
CY	Persons employed, GVA	2	Yes	No	OLS	0.439	0.185	0.092
CZ	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.595	3.462	2.603
DE	Persons employed, GVA	0	No	No	OLS	0.679	17.561	5.458
DK	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.551	2.191	1.715
EE	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.204	0.939	0.633
EL	Persons employed, GVA	3	No	No	OLS	0.647	1.982	1.101
ES	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.603	8.322	3.837
FI	Persons employed, GVA	2	No	No	OLS	0.675	2.819	0.425
FR	Persons employed, GVA	0	Yes	No	OLS	0.697	11.438	10.236
HR	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.259	2.927	4.353
HU	Persons employed	1	No	No	OLS	0.294	10.119	2.000
IE	Persons employed, GVA	3	No	No	OLS	0.845	2.433	1.209
IT	Persons employed, GVA	3	No	No	OLS	0.628	9.542	7.213
LT	Persons employed, GVA	2	Yes	No	OLS	0.609	1.079	1.492
LU	Persons employed, GVA	1	Yes	Yes	OLS	0.552	0.296	0.019
LV	Persons employed	3	No	Yes	OLS	0.837	0.599	0.286
MT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.763	0.270	0.261
NL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.897	4.426	1.006
PL	Persons employed, GVA	2	Yes	Yes	OLS	0.719	6.158	17.031
PT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.560	1.416	1.781
RO	Persons employed, GVA	2	Yes	No	OLS	0.672	9.741	6.686
SE	Persons employed, GVA	3	No	Yes	OLS	0.889	3.182	0.737
SI	Persons employed, GVA	1	No	No	OLS	0.052	0.622	0.686
SK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.428	2.414	0.261
UK	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.451	19.738	5.808
EU28	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.792**	**49.270**	**42.364**
EU27_2020	**Persons employed, GVA**	**Step dummy from 2010**	**No**	**Yes**	**OLS**	**0.761**	**45.242**	**34.004**

Table 9.b. Description of the estimation models for Employment. Total ICT sector (operational definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors C+J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	2	Yes	No	OLS	0.702	2.016	1.269
BE	Persons employed, GVA	3	No	No	OLS	0.759	1.815	0.190
BG	Persons employed, GVA	1	Yes	Yes	OLS	0.772	1.499	2.154
CY	Persons employed, GVA	2	Yes	No	OLS	0.555	0.148	0.038
CZ	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.600	3.285	3.110
DE	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.746	12.876	12.151
DK	Persons employed, GVA	2	No	No	OLS	0.469	2.011	0.460
EE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.241	0.909	0.583
EL	Persons employed, GVA	2	Yes	No	OLS	0.465	2.277	1.104
ES	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.523	7.865	4.117
FI	Persons employed, GVA	2	No	No	OLS	0.671	2.544	0.486
FR	Persons employed, GVA	0	Yes	No	OLS	0.615	11.786	13.254
HR	Persons employed, GVA	2	Yes	No	OLS	0.897	1.045	5.728
HU	Persons employed	1	No	No	OLS	0.300	10.162	1.958
IE	Persons employed, GVA	2	No	Yes	OLS	0.801	2.888	1.620
IT	Persons employed, GVA	3	No	No	OLS	0.544	10.094	10.188
LT	Persons employed, GVA	3	No	Yes	OLS	0.561	1.096	1.549
LU	Persons employed, GVA	1	Yes	Yes	OLS	0.687	0.200	0.027
LV	Persons employed, GVA	2	Yes	Yes	OLS	0.708	0.802	0.113
MT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.741	0.273	0.221
NL	Persons employed, GVA	2	No	Yes	OLS	0.920	3.110	0.335
PL	Persons employed, GVA	2	Yes	Yes	OLS	0.656	6.721	15.381
PT	Persons employed, GVA	0	Yes	Yes	OLS	0.793	0.887	2.003
RO	Persons employed, GVA	2	Yes	No	OLS	0.634	9.750	6.838
SE	Persons employed, GVA	3	No	Yes	OLS	0.904	2.696	0.725
SI	Persons employed, GVA	3	No	No	OLS	0.150	0.579	0.455
SK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.415	2.141	0.427
UK	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.422	19.012	10.646
EU28	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.743**	**49.833**	**51.728**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.683**	**48.457**	**44.213**
AU	Persons employed, GVA	3	No	Yes	OLS	0.472	14.553	5.376
CA	Persons employed, GVA	0	Yes	Yes	OLS	0.472	7.387	15.861
JP	Persons employed, GVA	3	No	No	OLS	0.991	6.462	0.958
KR	Persons employed, GVA	3	No	No	OLS	0.428	26.435	13.408
TW	Persons employed, GVA	0	Yes	No	OLS	0.487	22.381	22.275
US	Persons employed, GVA	3	No	Yes	OLS	0.988	21.022	8.058

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

Table 9.c. Description of the estimation models for Employment. ICT manufacturing (comprehensive definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector C)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	Yes	OLS	0.934	0.560	0.149
BE	Persons employed, GVA	3	No	Yes	OLS	0.759	0.577	0.313
BG	GVA	2	Yes	Yes	OLS	0.529	0.556	0.466
CY	Persons employed, GVA	3	No	No	OLS	0.951	0.009	0.010
CZ	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.700	1.575	1.180
DE	Persons employed, GVA	3	No	Yes	OLS	0.836	3.844	1.650
DK	Persons employed, GVA	3	No	No	OLS	0.363	0.551	0.171
EE	Persons employed, GVA	3	No	Yes	OLS	0.435	0.322	0.299
EL	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.329	0.542	0.494
ES	Persons employed	3	No	No	OLS	0.788	1.826	0.097
FI	Persons employed, GVA	3	No	Yes	OLS	0.615	1.541	1.024
FR	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.608	2.699	3.841
HR	Persons employed, GVA	3	No	No	OLS	0.983	0.178	0.172
HU	Persons employed, GVA	3	No	No	OLS	0.461	8.340	2.587
IE	Persons employed, GVA	3	No	Yes	OLS	0.746	1.594	0.359
IT	Persons employed, GVA	3	No	No	OLS	0.679	1.937	3.655
LT	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	-0.117	1.084	0.479
LU	Persons employed, GVA	3	No	No	OLS	0.135	0.055	0.016
LV	GVA	Step dummy from 2010	No	No	OLS	0.235	0.132	0.071
MT	Persons employed, GVA	2	Yes	No	OLS	0.212	0.253	0.018
NL	Persons employed, GVA	3	No	Yes	OLS	0.751	0.565	0.042
PL	Persons employed, GVA	0	No	Yes	OLS	0.555	2.596	3.621
PT	Persons employed, GVA	2	No	No	OLS	0.666	0.360	0.110
RO	Persons employed, GVA	3	No	No	OLS	0.862	3.481	1.057
SE	Persons employed, GVA	3	No	Yes	OLS	0.896	1.580	0.106
SI	Persons employed, GVA	3	No	No	OLS	0.713	0.206	0.563
SK	Persons employed, GVA	2	No	No	OLS	0.267	1.184	0.506
UK	Persons employed, GVA	2	No	No	OLS	0.639	3.499	0.358
EU28	**Persons employed, GVA**	**1**	**No**	**No**	**OLS**	**0.556**	**21.737**	**8.947**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.680**	**16.247**	**29.071**

Table 9.d. Description of the estimation models for Employment. ICT manufacturing (operational definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector C)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	Yes	OLS	0.934	0.560	0.149
BE	Persons employed, GVA	3	No	Yes	OLS	0.759	0.577	0.313
BG	GVA	2	Yes	Yes	OLS	0.508	0.558	0.455
CY	Persons employed, GVA	2	Yes	No	OLS	0.964	0.007	0.010
CZ	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.699	1.572	1.184
DE	Persons employed, GVA	3	No	Yes	OLS	0.831	3.841	1.584
DK	Persons employed, GVA	3	No	No	OLS	0.363	0.552	0.173
EE	Persons employed, GVA	3	No	Yes	OLS	0.435	0.322	0.299
EL	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.324	0.544	0.496
ES	Persons employed	3	No	No	OLS	0.788	1.826	0.097
FI	Persons employed, GVA	3	No	Yes	OLS	0.615	1.541	1.025
FR	Persons employed, GVA	Step dummy from 2010	Yes	No	OLS	0.607	2.699	3.843
HR	Persons employed, GVA	3	No	No	OLS	0.983	0.178	0.172
HU	Persons employed, GVA	3	No	No	OLS	0.461	8.340	2.587
IE	Persons employed, GVA	3	No	Yes	OLS	0.747	1.569	0.339
IT	Persons employed, GVA	3	No	Yes	OLS	0.678	1.930	3.602
LT	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	-0.115	1.083	0.480
LU	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.049	0.050	0.018
LV	GVA	Step dummy from 2010	No	No	OLS	0.235	0.132	0.071
MT	Persons employed, GVA	2	Yes	No	OLS	0.212	0.253	0.018
NL	Persons employed, GVA	3	No	Yes	OLS	0.758	0.561	0.055
PL	Persons employed, GVA	0	No	Yes	OLS	0.555	2.604	3.615
PT	Persons employed, GVA	2	No	No	OLS	0.666	0.360	0.110
RO	Persons employed, GVA	3	No	No	OLS	0.862	3.479	1.054
SE	Persons employed, GVA	3	No	Yes	OLS	0.896	1.577	0.112
SI	Persons employed, GVA	3	No	No	OLS	0.713	0.206	0.563
SK	Persons employed, GVA	2	No	No	OLS	0.272	1.177	0.495
UK	Persons employed, GVA	2	No	No	OLS	0.631	3.494	0.324
EU28	**Persons employed, GVA**	**1**	**No**	**No**	**OLS**	**0.554**	**21.682**	**8.955**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.651**	**16.452**	**21.188**
AU	Persons employed, GVA	2	Yes	No	OLS	0.235	3.549	4.835
CA	Persons employed, GVA	3	No	Yes	OLS	0.087	3.907	6.466
JP	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.979	7.501	5.410
KR	Persons employed, GVA	3	No	No	OLS	0.573	13.414	4.689
TW	Persons employed, GVA	0	Yes	No	OLS	0.502	21.087	19.280
US	Persons employed, GVA	1	No	Yes	OLS	0.978	8.622	4.308

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

Table 9.e. Description of the estimation models for Employment. ICT total services

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	GVA	2	Yes	No	OLS	0.533	1.950	1.756
BE	Persons employed, GVA	1	No	Yes	OLS	0.877	1.206	0.744
BG	Persons employed, GVA	1	Yes	Yes	OLS	0.841	1.226	1.834
CY	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.669	0.134	0.034
CZ	Persons employed, GVA	3	No	Yes	OLS	0.861	1.427	0.547
DE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.642	12.490	2.613
DK	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.756	1.299	0.932
EE	Persons employed, GVA	3	No	Yes	OLS	0.618	0.595	0.834
EL	Persons employed, GVA	0	Yes	No	OLS	0.727	1.671	2.274
ES	Persons employed, GVA	1	Yes	Yes	OLS	0.763	5.519	0.812
FI	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.930	0.857	0.555
FR	Persons employed, GVA	3	No	No	OLS	0.959	3.483	7.649
HR	Persons employed	3	No	Yes	OLS	0.886	1.096	1.908
HU	Persons employed	Step dummy from 2010	No	No	OLS	0.751	2.420	1.186
IE	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.906	1.190	1.602
IT	Persons employed, GVA	0	No	No	OLS	0.902	4.852	2.437
LT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.649	1.190	0.405
LU	Persons employed, GVA	3	No	Yes	OLS	0.877	0.151	0.046
LV	Persons employed, GVA	3	No	Yes	OLS	0.947	0.327	0.266
MT	Persons employed, GVA	0	Yes	No	OLS	0.849	0.157	0.327
NL	Persons employed, GVA	2	No	Yes	OLS	0.957	2.570	1.821
PL	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.758	5.053	4.648
PT	Persons employed, GVA	3	No	No	OLS	0.793	0.933	0.379
RO	Persons employed, GVA	0	Yes	No	OLS	0.299	9.494	0.354
SE	Persons employed, GVA	3	No	No	OLS	0.765	3.491	3.634
SI	Persons employed, GVA	3	No	Yes	OLS	0.788	0.206	0.189
SK	Persons employed, GVA	3	No	Yes	OLS	0.792	1.176	0.408
UK	Persons employed, GVA	3	No	Yes	OLS	0.752	11.607	13.034
EU28	**Persons employed, GVA**	**Step dummy from 2010**	**No**	**No**	**OLS**	**0.912**	**24.159**	**3.559**
EU27_2020	**Persons employed, GVA**	**0**	**Yes**	**Yes**	**OLS**	**0.923**	**20.115**	**10.437**

Table 9.f. Description of the estimation models for Employment. ICT trade industries

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors G_I)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	2	No	No	OLS	0.553	0.364	0.071
BE	Persons employed	2	No	Yes	OLS	0.474	0.872	0.248
BG	Persons employed, GVA	3	No	No	OLS	0.660	0.409	0.082
CY	Persons employed, GVA	2	No	Yes	OLS	0.532	0.045	0.005
CZ	Persons employed, GVA	3	No	No	OLS	0.476	0.433	0.431
DE	Persons employed, GVA	2	No	Yes	OLS	0.564	7.861	3.829
DK	Persons employed, GVA	3	No	Yes	OLS	0.685	0.552	0.638
EE	Persons employed, GVA	3	No	Yes	OLS	0.576	0.071	0.007
EL	Persons employed, GVA	3	No	No	OLS	0.837	0.457	0.233
ES	Persons employed, GVA	1	No	Yes	OLS	0.719	1.986	0.635
FI	Persons employed, GVA	3	No	No	OLS	0.763	0.315	0.098
FR	Persons employed, GVA	3	No	Yes	OLS	0.584	2.139	0.372
HR	GVA	1	Yes	No	OLS	0.747	0.131	0.174
HU	Persons employed, GVA	3	No	Yes	OLS	0.406	0.451	0.320
IE	Persons employed, GVA	3	No	No	OLS	0.776	0.506	0.200
IT	Persons employed, GVA	3	No	Yes	OLS	0.744	2.627	3.513
LT	Persons employed, GVA	1	Yes	Yes	OLS	0.481	0.144	0.126
LU	Persons employed, GVA	2	Yes	No	OLS	0.752	0.059	0.069
LV	Persons employed, GVA	3	No	No	OLS	0.756	0.157	0.098
MT	Persons employed, GVA	1	Yes	No	OLS	0.838	0.050	0.150
NL	Persons employed, GVA	3	No	Yes	OLS	0.741	1.471	1.418
PL	Persons employed, GVA	1	Yes	Yes	OLS	0.619	0.584	1.351
PT	Persons employed, GVA	3	No	Yes	OLS	0.779	0.372	0.230
RO	Persons employed, GVA	3	No	No	OLS	0.833	0.647	0.092
SE	Persons employed, GVA	3	No	No	OLS	0.243	0.707	0.285
SI	Persons employed, GVA	3	No	No	OLS	0.679	0.044	0.027
SK	Persons employed, GVA	3	No	No	OLS	0.758	0.667	0.021
UK	Persons employed, GVA	1	Yes	No	OLS	0.496	4.735	7.860
EU28	**Persons employed, GVA**	**2**	**No**	**Yes**	**OLS**	**0.757**	**8.297**	**2.207**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.857**	**6.522**	**2.656**

Table 9.g. Description of the estimation models for Employment. ICT services industries

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.950	0.577	0.051
BE	Persons employed, GVA	2	Yes	Yes	OLS	0.984	0.378	0.437
BG	Persons employed, GVA	1	Yes	Yes	OLS	0.901	0.976	1.507
CY	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.804	0.093	0.031
CZ	Persons employed, GVA	3	No	Yes	OLS	0.883	1.247	0.924
DE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.762	9.916	1.270
DK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.850	0.923	0.568
EE	Persons employed, GVA	3	No	Yes	OLS	0.618	0.592	0.729
EL	Persons employed, GVA	2	Yes	No	OLS	0.865	1.128	1.932
ES	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.797	4.132	1.043
FI	Persons employed, GVA	2	Yes	Yes	OLS	0.962	0.573	0.729
FR	Persons employed, GVA	2	Yes	No	OLS	0.973	2.617	9.724
HR	Persons employed, GVA	0	Yes	No	OLS	0.900	1.034	2.201
HU	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.828	2.066	1.442
IE	Persons employed, GVA	1	Yes	Yes	OLS	0.985	0.512	1.521
IT	GVA	2	No	No	OLS	0.577	8.813	5.113
LT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.691	1.059	0.550
LU	Persons employed, GVA	3	No	Yes	OLS	0.911	0.102	0.007
LV	Persons employed, GVA	3	No	Yes	OLS	0.948	0.323	0.201
MT	Persons employed, GVA	3	No	Yes	OLS	0.968	0.065	0.204
NL	Persons employed, GVA	3	No	Yes	OLS	0.974	1.659	0.656
PL	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.756	5.063	2.835
PT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.888	0.625	0.533
RO	Persons employed, GVA	0	Yes	No	OLS	0.340	8.961	0.366
SE	Persons employed, GVA	3	No	No	OLS	0.793	3.156	3.333
SI	Persons employed, GVA	2	No	Yes	OLS	0.815	0.188	0.168
SK	Persons employed, GVA	2	No	No	OLS	0.902	0.675	0.131
UK	Persons employed, GVA	3	No	Yes	OLS	0.866	8.259	9.165
EU28	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.964**	**14.662**	**11.873**
EU27_2020	**Persons employed**	**Step dummy from 2010**	**No**	**Yes**	**OLS**	**0.941**	**16.552**	**10.769**
AU	Persons employed, GVA	1	Yes	No	OLS	0.469	13.961	10.053
CA	Persons employed, GVA	0	Yes	Yes	OLS	0.551	5.197	10.382
JP	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.997	2.190	3.392
KR	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.791	8.398	2.365
TW	Persons employed, GVA	0	Yes	No	OLS	0.579	2.322	3.942
US	Persons employed, GVA	3	No	Yes	OLS	0.984	17.245	4.978

Table 9.h. Description of the estimation models for Employment. IT services (Telecommunications)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	Yes	OLS	0.603	0.483	0.009
BE	Persons employed, GVA	0	No	Yes	OLS	0.522	0.789	0.547
BG	Persons employed, GVA	3	No	No	OLS	0.561	0.603	0.075
CY	Persons employed, GVA	2	No	Yes	OLS	0.623	0.046	0.015
CZ	GVA	1	No	No	OLS	0.192	1.171	1.112
DE	GVA	3	No	No	OLS	0.614	5.386	1.100
DK	Persons employed, GVA	1	Yes	No	OLS	0.405	0.693	0.113
EE	Persons employed, GVA	3	No	No	OLS	0.352	0.439	0.439
EL	Persons employed, GVA	2	Yes	Yes	OLS	0.790	0.776	1.329
ES	Persons employed, GVA	3	No	Yes	OLS	0.738	1.696	1.625
FI	Persons employed, GVA	3	No	Yes	OLS	0.749	0.455	0.365
FR	Persons employed, GVA	3	No	Yes	OLS	0.418	2.499	1.009
HR	Persons employed, GVA	0	Yes	Yes	OLS	0.839	0.831	0.807
HU	Persons employed, GVA	2	No	Yes	OLS	0.350	1.122	1.320
IE	Persons employed, GVA	2	No	Yes	OLS	0.849	0.727	0.455
IT	Persons employed, GVA	1	Yes	No	OLS	0.691	2.030	3.289
LT	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.244	1.003	0.716
LU	Persons employed, GVA	3	No	Yes	OLS	0.554	0.033	0.049
LV	Persons employed, GVA	3	No	No	OLS	0.875	0.305	0.142
MT	Persons employed, GVA	0	Yes	No	OLS	0.563	0.132	0.336
NL	Persons employed, GVA	3	No	Yes	OLS	0.814	2.050	1.132
PL	Persons employed, GVA	1	Yes	Yes	OLS	0.693	2.741	5.400
PT	Persons employed, GVA	2	Yes	Yes	OLS	0.602	0.435	0.371
RO	Persons employed, GVA	1	Yes	No	OLS	0.671	4.601	1.119
SE	Persons employed, GVA	1	Yes	No	OLS	0.416	0.938	0.102
SI	GVA	1	Yes	Yes	OLS	0.514	0.127	0.146
SK	Persons employed, GVA	3	No	Yes	OLS	0.603	0.437	0.392
UK	Persons employed, GVA	3	No	Yes	OLS	0.600	4.853	5.048
EU28	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.767**	**16.742**	**17.661**
EU27_2020	**Persons employed, GVA**	**Step dummy from 2010**	**No**	**Yes**	**OLS**	**0.769**	**14.854**	**11.815**
AU	Persons employed, GVA	3	No	No	OLS	0.527	6.290	3.392
CA	Persons employed, GVA	3	No	No	OLS	0.398	3.110	1.248
JP	GVA	3	No	No	OLS	0.262	7.448	3.825
KR	Persons employed, GVA	3	No	No	OLS	0.576	8.929	2.129
TW	Persons employed, GVA	0	Yes	No	OLS	0.747	1.695	6.038
US	Persons employed, GVA	2	No	No	OLS	0.794	23.581	1.769

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 9.i. 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	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.895	0.691	0.108
BE	Persons employed, GVA	2	Yes	Yes	OLS	0.857	0.845	0.800
BG	Persons employed, GVA	1	Yes	Yes	OLS	0.952	0.764	1.572
CY	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.663	0.130	0.065
CZ	Persons employed, GVA	3	No	Yes	OLS	0.762	1.670	0.927
DE	Persons employed, GVA	3	No	Yes	OLS	0.730	8.066	2.637
DK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.788	0.911	0.607
EE	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.628	0.464	0.176
EL	Persons employed, GVA	3	No	No	OLS	0.719	1.389	0.682
ES	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.841	3.172	1.215
FI	Persons employed, GVA	1	Yes	Yes	OLS	0.961	0.469	0.569
FR	Persons employed, GVA	0	Yes	Yes	OLS	0.960	2.889	8.679
HR	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.399	1.424	1.705
HU	Persons employed	Step dummy from 2010	No	Yes	OLS	0.740	2.260	2.013
IE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.898	0.900	1.154
IT	Persons employed, GVA	3	No	No	OLS	0.936	2.899	0.612
LT	Persons employed, GVA	2	Yes	No	OLS	0.855	0.645	0.658
LU	Persons employed, GVA	0	Yes	Yes	OLS	0.879	0.118	0.034
LV	Persons employed, GVA	3	No	Yes	OLS	0.818	0.409	0.068
MT	Persons employed, GVA	3	No	No	OLS	0.769	0.123	0.040
NL	Persons employed, GVA	0	Yes	No	OLS	0.854	2.481	0.648
PL	Persons employed, GVA	2	Yes	Yes	OLS	0.691	4.652	5.945
PT	Persons employed, GVA	3	No	Yes	OLS	0.817	0.770	0.899
RO	Persons employed, GVA	2	Yes	No	OLS	0.646	4.384	1.440
SE	Persons employed, GVA	3	No	Yes	OLS	0.821	2.609	3.320
SI	Persons employed, GVA	0	Yes	Yes	OLS	0.653	0.222	0.250
SK	Persons employed, GVA	3	No	Yes	OLS	0.772	0.958	0.520
UK	Persons employed, GVA	1	Yes	No	OLS	0.781	8.825	1.259
EU28	**Persons employed, GVA**	**2**	**Yes**	**No**	**OLS**	**0.799**	**27.345**	**73.435**
EU27_2020	**Persons employed, GVA**	**Step dummy from 2010**	**No**	**Yes**	**OLS**	**0.874**	**19.219**	**13.711**
AU	Persons employed, GVA	3	No	Yes	OLS	0.370	11.384	7.777
CA	Persons employed, GVA	3	No	Yes	OLS	0.459	5.477	6.404
JP	GVA	2	Yes	Yes	OLS	0.294	31.290	18.940
KR	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.634	7.611	7.420
TW	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.565	2.555	2.996
US	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.893	31.223	3.776

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 9.j. 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	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	No	OLS	0.706	0.367	0.102
BE	Persons employed, GVA	3	No	Yes	OLS	0.748	0.248	0.730
BG	Persons employed, GVA	3	No	Yes	OLS	0.908	0.599	1.002
CY	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.798	0.073	0.042
CZ	Persons employed, GVA	3	No	Yes	OLS	0.879	0.593	0.687
DE	Persons employed, GVA	2	Yes	Yes	OLS	0.709	6.963	1.740
DK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.253	1.019	1.212
EE	Persons employed, GVA	3	No	No	OLS	0.657	0.272	0.496
EL	Persons employed, GVA	1	Yes	No	OLS	0.456	1.330	1.865
ES	Persons employed, GVA	3	No	Yes	OLS	0.740	3.639	1.058
FI	Persons employed, GVA	1	Yes	Yes	OLS	0.665	0.410	0.943
FR	Persons employed	2	Yes	Yes	OLS	0.760	2.200	6.228
HR	Persons employed, GVA	2	Yes	No	OLS	0.727	0.879	1.910
HU	Persons employed, GVA	3	No	No	OLS	0.369	1.609	0.666
IE	Persons employed, GVA	3	No	Yes	OLS	0.846	0.445	1.334
IT	Persons employed, GVA	3	No	Yes	OLS	0.633	1.779	1.441
LT	Persons employed, GVA	3	No	Yes	OLS	0.406	0.819	0.811
LU	Persons employed, GVA	3	No	No	OLS	0.587	0.075	0.024
LV	Persons employed, GVA	2	No	Yes	OLS	0.741	0.326	0.246
MT	Persons employed, GVA	2	Yes	Yes	OLS	0.566	0.053	0.154
NL	Persons employed, GVA	3	No	Yes	OLS	0.417	1.229	0.622
PL	Persons employed, GVA	3	No	Yes	OLS	0.566	2.860	3.323
PT	Persons employed, GVA	3	No	Yes	OLS	0.715	0.387	0.563
RO	Persons employed, GVA	1	Yes	No	OLS	0.052	2.919	1.305
SE	Persons employed, GVA	3	No	No	OLS	0.546	0.996	0.360
SI	Persons employed, GVA	2	Yes	Yes	OLS	0.773	0.112	0.175
SK	Persons employed, GVA	0	No	No	OLS	0.075	0.676	0.088
UK	Persons employed	0	Yes	Yes	OLS	0.001	7.766	4.480
EU28	**Persons employed**	**Step dummy from 2010**	**Yes**	**No**	**OLS**	**0.650**	**22.774**	**13.758**
EU27_2020	**Persons employed**	**Step dummy from 2010**	**Yes**	**No**	**OLS**	**0.669**	**20.046**	**11.561**
AU	Persons employed, GVA	2	Yes	No	OLS	0.442	6.975	11.726
CA	GVA	2	Yes	Yes	OLS	0.186	4.097	4.895
JP	GVA	3	No	Yes	OLS	0.566	4.559	2.837
KR	Persons employed	Step dummy from 2010	No	Yes	OLS	0.006	7.804	2.471
TW	Persons employed, GVA	0	Yes	No	OLS	0.635	1.892	5.074
US	Persons employed, GVA	1	Yes	No	OLS	0.808	18.273	17.846

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 9.k. Description of the estimation models for Employment. Retail sale sector

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors G_I)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	Yes	OLS	0.601	0.221	0.256
BE	Persons employed, GVA	3	No	Yes	OLS	0.535	0.147	0.097
BG	Persons employed, GVA	0	Yes	Yes	OLS	0.896	0.100	0.653
CY	Persons employed, GVA	1	Yes	No	OLS	0.672	0.013	0.018
CZ	Persons employed, GVA	0	Yes	Yes	OLS	0.342	0.910	1.055
DE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.711	5.132	1.954
DK	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.566	0.284	0.078
EE	Persons employed, GVA	0	Yes	Yes	OLS	0.600	0.074	0.106
EL	Persons employed, GVA	0	Yes	Yes	OLS	0.559	0.146	0.120
ES	Persons employed, GVA	3	No	Yes	OLS	0.502	0.970	2.967
FI	Persons employed, GVA	2	No	Yes	OLS	0.556	0.112	0.008
FR	Persons employed, GVA	3	No	No	OLS	0.710	3.910	2.878
HR	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.577	0.098	0.031
HU	Persons employed	0	Yes	Yes	OLS	0.731	0.347	0.700
IE	Persons employed, GVA	2	Yes	Yes	OLS	0.398	0.104	0.080
IT	Persons employed, GVA	0	Yes	Yes	OLS	0.633	0.841	2.419
LT	Persons employed	2	Yes	Yes	OLS	0.692	0.206	0.331
LU	Persons employed, GVA	3	No	Yes	OLS	0.421	0.028	0.008
LV	Persons employed, GVA	3	No	Yes	OLS	0.721	0.225	0.075
MT	Persons employed, GVA	2	No	Yes	OLS	0.929	0.018	0.017
NL	Persons employed, GVA	0	Yes	Yes	OLS	0.542	1.270	0.378
PL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.329	3.007	1.096
PT	GVA	1	Yes	Yes	OLS	0.415	0.168	0.224
RO	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.825	0.599	0.678
SE	Persons employed	0	Yes	Yes	OLS	0.685	0.354	0.568
SI	Persons employed, GVA	3	No	No	OLS	0.251	0.106	0.120
SK	Persons employed, GVA	3	No	Yes	OLS	0.648	0.214	0.016
UK	Persons employed, GVA	3	No	Yes	OLS	0.733	6.529	2.915
EU28	**Persons employed, GVA**	**Step dummy from 2010**	**Yes**	**Yes**	**OLS**	**0.590**	**17.329**	**9.278**
EU27_2020	**Persons employed**	**2**	**Yes**	**Yes**	**OLS**	**0.609**	**12.092**	**14.344**
AU	Persons employed, GVA	1	Yes	Yes	OLS	0.184	1.724	1.068
CA	Persons employed, GVA	0	No	Yes	OLS	0.975	0.176	0.131
JP	*Model not estimated because the dependent variable is not available for the Retail sale sector*							
KR	Persons employed, GVA	0	Yes	No	OLS	0.377	2.260	4.558
TW	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.342	0.494	0.956
US	Persons employed	2	Yes	No	OLS	0.805	7.945	10.447

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 10.a. Description of the estimation models for Hours Worked. Total ICT sector (comprehensive definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors C+J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	No	OLS	0.669	4.840	1.111
BE	Persons employed, GVA	3	No	Yes	OLS	0.743	3.590	0.519
BG	Persons employed, GVA	1	Yes	Yes	OLS	0.700	2.880	4.581
CY	Persons employed, GVA	1	Yes	No	OLS	0.499	0.325	0.033
CZ	Persons employed, GVA	1	Yes	No	OLS	0.178	9.141	5.497
DE	Persons employed, GVA	2	No	No	OLS	0.744	24.950	8.394
DK	Persons employed, GVA	3	No	No	OLS	0.701	3.616	1.904
EE	Persons employed, GVA	2	Yes	No	OLS	0.547	3.311	4.995
EL	Persons employed, GVA	2	Yes	No	OLS	0.500	4.719	5.040
ES	Persons employed, GVA	2	Yes	No	OLS	0.441	17.401	5.972
FI	Persons employed, GVA	3	No	No	OLS	0.807	4.112	0.404
FR	Persons employed, GVA	3	No	Yes	OLS	0.518	23.551	16.468
HR	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.623	5.970	12.265
HU	Persons employed	3	No	No	OLS	0.457	15.519	5.598
IE	Persons employed, GVA	3	No	No	OLS	0.829	5.099	1.948
IT	Persons employed, GVA	2	No	No	OLS	0.484	23.220	7.433
LT	Persons employed, GVA	2	Yes	No	OLS	0.444	2.958	2.928
LU	Persons employed, GVA	3	No	Yes	OLS	0.758	0.375	0.187
LV	Persons employed, GVA	3	No	Yes	OLS	0.912	1.080	0.715
MT	Persons employed, GVA	0	Yes	No	OLS	0.466	1.371	3.076
NL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.797	10.056	2.668
PL	Persons employed, GVA	2	Yes	Yes	OLS	0.510	18.346	28.335
PT	GVA	Step dummy from 2010	No	Yes	OLS	0.547	2.760	1.944
RO	Persons employed, GVA	3	No	Yes	OLS	0.807	14.191	11.723
SE	Persons employed, GVA	3	No	Yes	OLS	0.892	5.772	2.888
SI	Persons employed, GVA	3	No	Yes	OLS	0.142	1.113	1.260
SK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.257	4.776	0.829
UK	Persons employed, GVA	3	No	No	OLS	0.341	45.694	27.824
EU28	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.636**	**136.912**	**55.076**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.728**	**94.160**	**27.914**

Table 10.b. Description of the estimation models for Hours Worked. Total ICT sector (operational definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors C+J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	No	OLS	0.691	4.513	0.973
BE	Persons employed, GVA	3	No	No	OLS	0.765	2.921	1.142
BG	Persons employed, GVA	1	Yes	Yes	OLS	0.764	2.592	3.745
CY	Persons employed, GVA	0	Yes	No	OLS	0.410	0.320	0.095
CZ	Persons employed, GVA	1	Yes	No	OLS	0.181	8.730	6.054
DE	Persons employed, GVA	1	Yes	No	OLS	0.643	24.412	12.641
DK	Persons employed, GVA	3	No	No	OLS	0.645	3.287	1.380
EE	Persons employed, GVA	1	Yes	No	OLS	0.472	3.534	4.708
EL	Persons employed, GVA	1	Yes	No	OLS	0.367	4.787	4.530
ES	Persons employed, GVA	1	Yes	No	OLS	0.410	15.586	7.351
FI	Persons employed, GVA	3	No	No	OLS	0.772	3.995	0.374
FR	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.375	24.928	22.199
HR	Persons employed	3	No	No	OLS	0.949	2.073	16.806
HU	Persons employed	3	No	No	OLS	0.488	15.209	5.625
IE	Persons employed, GVA	2	No	Yes	OLS	0.786	5.897	3.098
IT	Persons employed, GVA	2	Yes	No	OLS	0.385	23.621	11.179
LT	Persons employed	3	No	Yes	OLS	0.400	2.935	2.550
LU	Persons employed, GVA	3	No	Yes	OLS	0.819	0.267	0.184
LV	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.155	3.290	1.586
MT	Persons employed, GVA	0	Yes	No	OLS	0.544	1.148	2.892
NL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.856	6.772	3.028
PL	Persons employed, GVA	2	Yes	No	OLS	0.469	18.924	25.288
PT	GVA	Step dummy from 2010	No	Yes	OLS	0.599	2.326	2.223
RO	Persons employed, GVA	3	No	Yes	OLS	0.791	13.963	12.006
SE	Persons employed, GVA	3	No	Yes	OLS	0.887	5.447	2.865
SI	Persons employed, GVA	3	No	Yes	OLS	0.186	1.081	1.185
SK	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.294	4.038	0.742
UK	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.459	40.378	7.854
EU28	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.598**	**131.263**	**70.395**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.687**	**103.019**	**37.191**
AU	Persons employed, GVA	2	Yes	Yes	OLS	0.466	28.281	4.806
CA	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.307	17.454	22.461
JP	Persons employed, GVA	2	No	No	OLS	0.896	52.804	42.841
KR	Persons employed, GVA	2	Yes	No	OLS	0.659	62.513	94.013
TW	Persons employed, GVA	0	Yes	No	OLS	0.397	63.827	84.452
US	Persons employed, GVA	3	Yes	Yes	OLS	0.982	54.473	95.779

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

Table 10.c. Description of the estimation models for Hours Worked. ICT manufacturing (comprehensive definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector C)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	2	No	Yes	OLS	0.894	1.260	0.208
BE	Persons employed	3	No	No	OLS	0.770	0.884	0.225
BG	Persons employed, GVA	2	Yes	Yes	OLS	0.835	0.631	0.773
CY	Persons employed, GVA	3	No	No	OLS	0.978	0.011	0.012
CZ	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.725	2.381	2.007
DE	Persons employed, GVA	2	No	No	OLS	0.866	6.050	4.900
DK	Persons employed, GVA	3	No	Yes	OLS	0.740	0.578	0.321
EE	Persons employed, GVA	3	No	No	OLS	0.705	1.194	0.436
EL	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.384	1.147	1.411
ES	Persons employed, GVA	3	No	Yes	OLS	0.820	2.983	1.300
FI	Persons employed, GVA	3	No	Yes	OLS	0.666	2.417	1.521
FR	Persons employed, GVA	Step dummy from 2010	Yes	No	OLS	0.604	4.125	7.066
HR	GVA	Step dummy from 2010	No	No	OLS	0.932	0.671	0.497
HU	Persons employed, GVA	3	No	No	OLS	0.495	15.580	4.994
IE	Persons employed, GVA	3	No	Yes	OLS	0.697	3.205	0.312
IT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.228	5.132	8.420
LT	Persons employed, GVA	2	No	Yes	OLS	0.764	0.969	0.909
LU	Persons employed, GVA	3	No	No	OLS	0.168	0.093	0.029
LV	GVA	3	No	Yes	OLS	0.600	0.200	0.140
MT	Persons employed, GVA	3	No	Yes	OLS	0.535	0.390	0.355
NL	Persons employed, GVA	1	No	Yes	OLS	0.661	1.125	0.144
PL	Persons employed, GVA	1	Yes	No	OLS	0.406	6.430	7.133
PT	Persons employed, GVA	2	Yes	No	OLS	0.678	0.621	0.222
RO	Persons employed, GVA	3	No	No	OLS	0.848	7.018	2.049
SE	Persons employed, GVA	3	No	No	OLS	0.897	2.404	0.438
SI	Persons employed, GVA	3	No	Yes	OLS	0.780	0.278	0.673
SK	Persons employed, GVA	3	No	No	OLS	0.331	1.990	0.619
UK	Persons employed, GVA	2	No	No	OLS	0.482	8.005	1.520
EU28	**Persons employed, GVA**	**1**	**No**	**No**	**OLS**	**0.525**	**48.229**	**4.858**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.769**	**28.584**	**23.665**

Table 10.d. Description of the estimation models for Hours Worked. ICT manufacturing (operational definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector C)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	2	No	Yes	OLS	0.894	1.260	0.208
BE	Persons employed	3	No	No	OLS	0.770	0.883	0.226
BG	Persons employed, GVA	2	Yes	Yes	OLS	0.823	0.639	0.755
CY	Persons employed, GVA	3	No	No	OLS	0.980	0.009	0.012
CZ	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.724	2.376	2.014
DE	Persons employed, GVA	2	No	No	OLS	0.868	5.910	4.816
DK	Persons employed, GVA	3	No	Yes	OLS	0.740	0.578	0.323
EE	Persons employed, GVA	3	No	No	OLS	0.705	1.194	0.436
EL	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.380	1.151	1.413
ES	Persons employed, GVA	3	No	Yes	OLS	0.820	2.983	1.300
FI	Persons employed, GVA	3	No	Yes	OLS	0.665	2.418	1.524
FR	Persons employed, GVA	Step dummy from 2010	Yes	No	OLS	0.604	4.118	7.062
HR	GVA	Step dummy from 2010	No	No	OLS	0.932	0.671	0.497
HU	Persons employed, GVA	3	No	No	OLS	0.495	15.581	4.993
IE	Persons employed, GVA	3	No	Yes	OLS	0.698	3.164	0.310
IT	Persons employed, GVA	1	Yes	No	OLS	0.507	4.070	7.516
LT	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	-0.157	2.168	0.994
LU	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.069	0.086	0.033
LV	GVA	3	No	Yes	OLS	0.601	0.199	0.140
MT	Persons employed, GVA	2	Yes	No	OLS	0.111	0.540	0.205
NL	Persons employed, GVA	1	No	Yes	OLS	0.664	1.128	0.159
PL	Persons employed, GVA	1	Yes	No	OLS	0.405	6.451	7.119
PT	Persons employed, GVA	2	Yes	No	OLS	0.678	0.621	0.222
RO	Persons employed, GVA	3	No	No	OLS	0.848	7.014	2.042
SE	Persons employed, GVA	3	No	No	OLS	0.897	2.400	0.437
SI	Persons employed, GVA	3	No	Yes	OLS	0.780	0.278	0.673
SK	Persons employed, GVA	3	No	No	OLS	0.337	1.977	0.601
UK	Persons employed, GVA	3	No	No	OLS	0.485	7.900	1.265
EU28	**Persons employed, GVA**	**1**	**No**	**No**	**OLS**	**0.526**	**47.931**	**4.974**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.587**	**40.562**	**4.688**
AU	Persons employed, GVA	2	Yes	No	OLS	0.275	7.214	10.080
CA	Persons employed, GVA	0	No	No	OLS	0.028	7.877	5.278
JP	Persons employed, GVA	2	No	No	OLS	0.901	36.906	15.007
KR	GVA	2	Yes	Yes	OLS	0.412	51.999	30.111
TW	Persons employed, GVA	0	Yes	No	OLS	0.395	61.303	71.840
US	Persons employed, GVA	1	No	No	OLS	0.946	26.386	9.015

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

Table 10.e. Description of the estimation models for Hours Worked. ICT total services

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	2	Yes	No	OLS	0.869	2.287	1.940
BE	Persons employed, GVA	1	No	Yes	OLS	0.892	1.926	0.942
BG	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.516	3.597	1.788
CY	Persons employed, GVA	0	Yes	Yes	OLS	0.492	0.302	0.083
CZ	Persons employed, GVA	0	Yes	Yes	OLS	0.737	4.031	1.917
DE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.498	23.610	2.631
DK	Persons employed, GVA	2	No	Yes	OLS	0.734	2.716	1.739
EE	Persons employed, GVA	1	Yes	No	OLS	0.653	2.216	2.708
EL	Persons employed, GVA	3	No	Yes	OLS	0.781	2.962	7.991
ES	Persons employed, GVA	3	No	No	OLS	0.790	9.022	1.934
FI	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.909	1.793	1.251
FR	Persons employed, GVA	2	Yes	No	OLS	0.834	11.789	11.375
HR	Persons employed, GVA	0	Yes	No	OLS	0.796	4.040	11.206
HU	Persons employed, GVA	3	No	No	OLS	0.663	6.063	4.242
IE	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.897	2.755	2.189
IT	Persons employed, GVA	0	No	No	OLS	0.861	11.839	7.501
LT	Persons employed, GVA	2	Yes	No	OLS	0.728	2.486	2.059
LU	Persons employed, GVA	2	Yes	No	OLS	0.921	0.207	0.135
LV	Persons employed, GVA	3	No	Yes	OLS	0.940	0.866	0.507
MT	Persons employed, GVA	0	Yes	No	OLS	0.373	1.449	3.193
NL	Persons employed, GVA	3	No	Yes	OLS	0.908	6.027	4.368
PL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.663	13.532	1.028
PT	Persons employed, GVA	3	No	No	OLS	0.706	2.213	1.116
RO	Persons employed, GVA	0	Yes	No	OLS	0.215	18.926	1.359
SE	Persons employed, GVA	1	Yes	Yes	OLS	0.615	7.854	4.061
SI	Persons employed, GVA	3	No	No	OLS	0.643	0.505	0.588
SK	Persons employed, GVA	3	No	No	OLS	0.649	2.642	1.154
UK	Persons employed, GVA	1	Yes	Yes	OLS	0.777	24.085	73.614
EU28	**Persons employed, GVA**	**Step dummy from 2010**	**No**	**No**	**OLS**	**0.845**	**64.136**	**76.375**
EU27_2020	**Persons employed, GVA**	**Step dummy from 2010**	**Yes**	**Yes**	**OLS**	**0.860**	**54.259**	**60.855**

Table 10.f. Description of the estimation models for Hours Worked. ICT trade industries

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors G_I)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	Yes	OLS	0.697	0.569	0.106
BE	Persons employed, GVA	3	No	Yes	OLS	0.436	1.511	0.594
BG	Persons employed, GVA	3	No	No	OLS	0.671	0.680	0.147
CY	Persons employed, GVA	2	No	Yes	OLS	0.482	0.088	0.011
CZ	Persons employed, GVA	0	Yes	No	OLS	0.057	1.021	0.609
DE	Persons employed, GVA	2	No	Yes	OLS	0.580	12.503	4.304
DK	Persons employed, GVA	0	No	Yes	OLS	0.003	1.586	0.686
EE	Persons employed, GVA	3	No	Yes	OLS	0.772	0.115	0.045
EL	Persons employed, GVA	2	Yes	No	OLS	0.653	1.483	0.180
ES	Persons employed, GVA	3	No	Yes	OLS	0.800	3.259	2.267
FI	Persons employed, GVA	3	No	Yes	OLS	0.643	0.707	0.216
FR	Persons employed, GVA	2	No	Yes	OLS	0.594	3.766	1.923
HR	Persons employed, GVA	3	No	No	OLS	0.918	0.145	0.160
HU	Persons employed, GVA	3	No	Yes	OLS	0.570	0.733	0.461
IE	Persons employed, GVA	3	No	Yes	OLS	0.737	1.042	0.743
IT	Persons employed, GVA	3	No	Yes	OLS	0.774	4.925	6.574
LT	Persons employed, GVA	1	Yes	Yes	OLS	0.563	0.284	0.314
LU	Persons employed, GVA	3	No	No	OLS	0.584	0.133	0.152
LV	Persons employed, GVA	3	No	No	OLS	0.778	0.326	0.131
MT	Persons employed, GVA	1	Yes	Yes	OLS	0.828	0.101	0.313
NL	Persons employed, GVA	3	No	Yes	OLS	0.610	3.228	0.779
PL	Persons employed, GVA	2	Yes	Yes	OLS	0.415	1.603	2.756
PT	Persons employed, GVA	3	No	Yes	OLS	0.725	0.872	0.496
RO	Persons employed, GVA	3	No	No	OLS	0.837	1.266	0.176
SE	Persons employed, GVA	3	No	No	OLS	0.297	1.397	0.756
SI	Persons employed, GVA	3	No	No	OLS	0.664	0.073	0.068
SK	Persons employed	3	No	No	OLS	0.695	1.432	0.398
UK	Persons employed, GVA	2	Yes	No	OLS	0.627	8.549	17.899
EU28	**Persons employed, GVA**	**2**	**No**	**Yes**	**OLS**	**0.500**	**23.028**	**22.653**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.836**	**12.087**	**7.696**

Table 10.g. Description of the estimation models for Hours Worked. ICT services industries

,,,	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	No	OLS	0.818	2.559	2.344
BE	Persons employed, GVA	3	No	Yes	OLS	0.970	0.878	0.184
BG	Persons employed, GVA	1	Yes	Yes	OLS	0.840	2.099	2.070
CY	Persons employed, GVA	3	No	Yes	OLS	0.593	0.246	0.045
CZ	Persons employed, GVA	0	Yes	Yes	OLS	0.792	3.438	2.622
DE	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.799	14.116	6.956
DK	Persons employed, GVA	2	No	No	OLS	0.815	2.056	1.701
EE	Persons employed, GVA	0	Yes	No	OLS	0.582	2.391	2.749
EL	Persons employed, GVA	2	Yes	No	OLS	0.626	3.628	7.212
ES	Persons employed, GVA	2	Yes	No	OLS	0.678	9.256	2.228
FI	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.936	1.373	1.134
FR	Persons employed, GVA	2	Yes	No	OLS	0.816	11.777	16.744
HR	Persons employed, GVA	0	Yes	No	OLS	0.758	4.456	11.931
HU	Persons employed, GVA	3	No	No	OLS	0.672	6.005	3.970
IE	Persons employed, GVA	1	Yes	No	OLS	0.961	1.803	2.233
IT	Persons employed, GVA	0	No	Yes	OLS	0.926	7.595	3.025
LT	Persons employed, GVA	2	Yes	No	OLS	0.743	2.301	2.379
LU	Persons employed, GVA	3	No	No	OLS	0.930	0.157	0.075
LV	Persons employed, GVA	3	No	Yes	OLS	0.963	0.674	0.505
MT	Persons employed, GVA	0	Yes	No	OLS	0.450	1.210	2.994
NL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.940	4.081	3.164
PL	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.661	13.570	1.949
PT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.723	1.911	0.821
RO	Persons employed, GVA	0	Yes	No	OLS	0.251	17.929	1.518
SE	Persons employed, GVA	3	No	No	OLS	0.662	7.068	3.902
SI	Persons employed, GVA	3	No	No	OLS	0.705	0.457	0.526
SK	Persons employed, GVA	3	No	Yes	OLS	0.830	1.473	0.748
UK	Persons employed, GVA	2	Yes	Yes	OLS	0.849	19.116	44.963
EU28	**Persons employed, GVA**	**0**	**Yes**	**No**	**OLS**	**0.903**	**47.272**	**49.658**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**No**	**OLS**	**0.877**	**47.458**	**9.436**
AU	Persons employed, GVA	3	No	Yes	OLS	0.679	21.111	10.780
CA	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.396	12.577	13.127
JP	Persons employed, GVA	1	Yes	No	OLS	0.907	29.838	22.080
KR	Persons employed, GVA	3	No	No	OLS	0.409	57.882	38.580
TW	Persons employed, GVA	3	No	Yes	OLS	0.801	3.525	11.922
US	Persons employed, GVA	3	Yes	Yes	OLS	0.980	42.797	85.435

Table 10.h. 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	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.254	1.435	0.350
BE	Persons employed, GVA	3	No	Yes	OLS	0.557	1.251	0.516
BG	Persons employed, GVA	2	No	No	OLS	0.361	1.331	0.101
CY	Persons employed, GVA	3	No	Yes	OLS	0.644	0.117	0.057
CZ	Persons employed, GVA	1	Yes	No	OLS	0.448	2.136	2.133
DE	Persons employed, GVA	3	No	No	OLS	0.615	8.479	1.555
DK	Persons employed, GVA	3	No	No	OLS	0.675	1.006	0.419
EE	Persons employed, GVA	0	Yes	No	OLS	0.576	1.784	4.490
EL	Persons employed, GVA	2	Yes	Yes	OLS	0.537	2.714	7.291
ES	Persons employed, GVA	3	No	Yes	OLS	0.636	3.723	3.693
FI	Persons employed, GVA	2	No	Yes	OLS	0.715	0.752	0.675
FR	Persons employed, GVA	3	No	Yes	OLS	0.636	3.021	2.227
HR	Persons employed	3	No	No	OLS	0.963	0.980	6.141
HU	Persons employed, GVA	3	No	Yes	OLS	0.533	2.539	2.339
IE	Persons employed, GVA	0	No	Yes	OLS	0.779	1.668	0.295
IT	Persons employed, GVA	3	No	Yes	OLS	0.803	3.260	1.706
LT	Persons employed	2	Yes	No	OLS	0.542	1.589	3.143
LU	Persons employed, GVA	1	Yes	No	OLS	0.325	0.079	0.096
LV	Persons employed, GVA	2	Yes	No	OLS	0.835	0.615	0.814
MT	Persons employed, GVA	0	Yes	No	OLS	0.537	0.439	1.423
NL	Persons employed, GVA	2	No	Yes	OLS	0.825	2.901	1.688
PL	Persons employed, GVA	2	Yes	Yes	OLS	0.797	4.610	9.885
PT	Persons employed, GVA	1	Yes	Yes	OLS	0.551	0.870	0.922
RO	Persons employed, GVA	1	Yes	No	OLS	0.622	9.683	2.432
SE	Persons employed, GVA	3	No	No	OLS	0.728	1.046	0.829
SI	Persons employed, GVA	0	Yes	Yes	OLS	0.630	0.196	0.381
SK	Persons employed, GVA	2	No	Yes	OLS	0.649	0.730	0.621
UK	Persons employed, GVA	2	No	No	OLS	0.639	9.512	0.086
EU28	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.795**	**18.001**	**13.034**
EU27_2020	**Persons employed, GVA**	**1**	**Yes**	**Yes**	**OLS**	**0.578**	**22.498**	**19.992**
AU	Persons employed, GVA	3	No	No	OLS	0.531	12.004	1.456
CA	Persons employed, GVA	3	No	No	OLS	0.657	4.520	3.272
JP	Persons employed, GVA	1	No	No	OLS	0.738	8.891	2.859
KR	Persons employed, GVA	3	No	No	OLS	0.043	34.785	10.826
TW	Persons employed	3	No	No	OLS	0.829	2.916	13.190
US	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.795	45.528	27.029

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 10.i. 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	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	1	Yes	No	OLS	0.804	2.354	1.937
BE	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.864	1.475	0.783
BG	Persons employed, GVA	1	Yes	Yes	OLS	0.933	1.460	2.184
CY	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.603	0.268	0.111
CZ	Persons employed, GVA	3	No	Yes	OLS	0.752	3.238	2.254
DE	Persons employed, GVA	3	No	Yes	OLS	0.724	12.459	8.438
DK	Persons employed, GVA	3	No	No	OLS	0.730	1.954	1.474
EE	Persons employed, GVA	3	No	No	OLS	0.525	1.563	1.431
EL	Persons employed, GVA	3	No	No	OLS	0.551	2.551	0.373
ES	Persons employed, GVA	0	Yes	Yes	OLS	0.641	8.711	2.142
FI	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.925	1.228	0.385
FR	Persons employed, GVA	0	Yes	Yes	OLS	0.830	10.485	15.250
HR	Persons employed	0	Yes	Yes	OLS	0.867	2.174	6.770
HU	Persons employed, GVA	0	Yes	No	OLS	0.540	6.064	5.857
IE	Persons employed, GVA	3	No	No	OLS	0.900	2.011	2.508
IT	Persons employed, GVA	2	No	Yes	OLS	0.919	6.406	5.068
LT	Persons employed, GVA	2	Yes	No	OLS	0.720	2.244	0.691
LU	Persons employed, GVA	3	No	Yes	OLS	0.933	0.152	0.047
LV	Persons employed, GVA	3	No	Yes	OLS	0.938	0.580	0.390
MT	Persons employed, GVA	0	Yes	No	OLS	0.264	0.946	1.571
NL	Persons employed, GVA	2	No	No	OLS	0.817	4.806	1.159
PL	Persons employed, GVA	0	Yes	Yes	OLS	0.429	13.870	12.498
PT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.651	2.086	1.298
RO	Persons employed, GVA	1	Yes	No	OLS	0.389	11.075	0.808
SE	Persons employed, GVA	3	No	Yes	OLS	0.718	5.913	4.183
SI	Persons employed, GVA	3	No	Yes	OLS	0.600	0.424	0.355
SK	Persons employed, GVA	3	No	Yes	OLS	0.737	1.747	1.394
UK	Persons employed, GVA	2	Yes	Yes	OLS	0.735	23.058	40.236
EU28	**Persons employed, GVA**	**0**	**Yes**	**No**	**OLS**	**0.871**	**43.681**	**52.312**
EU27_2020	**Persons employed, GVA**	**Step dummy from 2010**	**No**	**No**	**OLS**	**0.868**	**39.243**	**19.852**
AU	Persons employed, GVA	1	Yes	Yes	OLS	0.356	23.831	12.959
CA	Persons employed, GVA	3	No	Yes	OLS	0.329	11.896	8.922
JP	Persons employed	1	Yes	Yes	OLS	0.875	31.091	14.209
KR	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.284	43.707	72.780
TW	Persons employed, GVA	2	No	Yes	OLS	0.859	2.906	1.106
US	Persons employed, GVA	Step dummy from 2010	Yes	No	OLS	0.924	61.165	102.408

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 10.j. 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	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	2	No	Yes	OLS	0.608	1.085	0.917
BE	Persons employed, GVA	3	No	Yes	OLS	0.696	0.436	1.299
BG	Persons employed, GVA	2	No	Yes	OLS	0.836	1.416	2.199
CY	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.723	0.167	0.117
CZ	Persons employed, GVA	3	No	Yes	OLS	0.873	1.166	0.470
DE	Persons employed, GVA	2	Yes	Yes	OLS	0.897	5.779	7.089
DK	Persons employed, GVA	2	Yes	No	OLS	0.686	0.814	1.362
EE	Persons employed, GVA	3	No	No	OLS	0.468	1.426	0.975
EL	Persons employed, GVA	2	Yes	No	OLS	0.498	3.074	4.179
ES	Persons employed, GVA	3	No	Yes	OLS	0.798	5.221	1.884
FI	Persons employed, GVA	3	No	Yes	OLS	0.414	0.721	1.767
FR	Persons employed, GVA	2	Yes	No	OLS	0.658	4.200	13.524
HR	GVA	2	Yes	No	OLS	0.248	3.664	6.058
HU	Persons employed, GVA	3	No	No	OLS	0.451	2.499	1.375
IE	Persons employed, GVA	3	No	No	OLS	0.758	0.945	2.655
IT	Persons employed, GVA	3	No	Yes	OLS	0.562	3.545	2.686
LT	GVA	2	No	No	OLS	0.402	1.956	0.854
LU	Persons employed, GVA	3	No	No	OLS	0.730	0.119	0.038
LV	Persons employed, GVA	2	No	Yes	OLS	0.928	0.491	0.613
MT	Persons employed, GVA	3	No	No	OLS	0.714	0.111	0.104
NL	Persons employed, GVA	2	No	Yes	OLS	0.690	1.577	0.225
PL	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.632	5.790	4.518
PT	Persons employed, GVA	3	No	Yes	OLS	0.798	0.631	0.860
RO	Persons employed, GVA	3	No	No	OLS	0.418	4.685	1.635
SE	Persons employed, GVA	3	No	No	OLS	0.618	1.310	1.436
SI	Persons employed, GVA	2	No	Yes	OLS	0.403	0.292	0.191
SK	Persons employed, GVA	3	No	No	OLS	0.567	0.797	0.258
UK	Persons employed, GVA	3	No	No	OLS	0.513	11.254	5.917
EU28	**Persons employed, GVA**	**2**	**No**	**Yes**	**OLS**	**0.588**	**29.928**	**8.236**
EU27_2020	**Persons employed**	**1**	**No**	**Yes**	**OLS**	**0.596**	**27.607**	**4.392**
AU	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.368	15.383	29.481
CA	Persons employed	3	No	No	OLS	0.411	7.347	13.548
JP	Persons employed	0	Yes	No	OLS	0.605	9.422	2.414
KR	GVA	3	Yes	Yes	OLS	0.427	24.393	19.197
TW	Persons employed, GVA	3	No	No	OLS	0.587	3.997	10.291
US	Persons employed, GVA	2	No	No	OLS	0.801	43.868	27.113

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 10.k. Description of the estimation models for Hours Worked. Retail sale sector

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors G_I)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA	3	No	Yes	OLS	0.494	0.513	0.801
BE	Persons employed, GVA	3	No	Yes	OLS	0.546	0.219	0.132
BG	Persons employed, GVA	0	Yes	Yes	OLS	0.889	0.179	1.123
CY	Persons employed, GVA	1	Yes	No	OLS	0.647	0.025	0.035
CZ	Persons employed, GVA	0	Yes	Yes	OLS	0.316	1.916	2.406
DE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.715	6.996	3.223
DK	Persons employed, GVA	Step dummy from 2010	No	No	AR(1)	0.584	0.301	0.125
EE	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.334	0.194	0.192
EL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.495	0.369	0.228
ES	Persons employed	Step dummy from 2010	Yes	Yes	OLS	0.357	2.042	6.059
FI	Persons employed, GVA	3	No	Yes	OLS	0.592	0.168	0.081
FR	Persons employed, GVA	3	No	No	OLS	0.673	6.770	5.535
HR	Persons employed, GVA	3	No	Yes	OLS	0.883	0.147	0.205
HU	Persons employed, GVA	0	Yes	Yes	OLS	0.652	0.670	1.371
IE	Persons employed, GVA	2	Yes	No	OLS	0.396	0.177	0.162
IT	Persons employed, GVA	3	No	Yes	OLS	0.777	1.266	5.677
LT	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.534	0.520	0.736
LU	Persons employed, GVA	2	Yes	Yes	OLS	0.635	0.053	0.080
LV	Persons employed, GVA	3	No	No	OLS	0.726	0.481	0.055
MT	Persons employed, GVA	3	No	No	OLS	0.763	0.075	0.027
NL	Persons employed, GVA	3	No	Yes	OLS	0.716	1.859	3.710
PL	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.293	6.197	0.485
PT	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.250	0.450	0.549
RO	Persons employed, GVA	Step dummy from 2010	Yes	Yes	OLS	0.859	1.035	2.320
SE	Persons employed, GVA	2	Yes	Yes	OLS	0.742	0.672	1.272
SI	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.421	0.146	0.170
SK	Persons employed, GVA	3	No	No	OLS	0.699	0.357	0.071
UK	Persons employed, GVA	3	No	Yes	OLS	0.771	9.862	3.729
EU28	**Persons employed, GVA**	**Step dummy from 2010**	**Yes**	**Yes**	**OLS**	**0.612**	**27.543**	**22.169**
EU27_2020	**Persons employed**	**2**	**Yes**	**Yes**	**OLS**	**0.646**	**18.341**	**19.617**
AU	Persons employed, GVA	1	Yes	Yes	OLS	0.256	2.582	2.422
CA	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.981	0.234	0.192
JP	*Model not estimated because the dependent variable is not available for the Retail sale sector*							
KR	GVA	3	No	Yes	OLS	0.700	4.298	9.750
TW	Persons employed, GVA	Step dummy from 2010	No	Yes	AR(1)	0.415	1.052	1.737
US	Persons employed, GVA	2	Yes	No	OLS	0.842	11.021	20.692

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 11.a. Description of the estimation models for BERD. Total ICT sector (comprehensive definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors C+J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.736	60.382	13.031
BE	Persons employed, GVA	0	Yes	Yes	OLS	0.395	62.792	56.155
BG	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.872	4.475	26.612
CY	Persons employed, GVA	0	Yes	Yes	OLS	0.869	1.041	4.495
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.590	14.834	25.876
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.389	291.801	271.755
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.444	69.871	191.575
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.458	5.037	8.250
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.782	15.448	6.930
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	Yes	OLS	0.703	48.852	47.061
FI	Persons employed; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.929	62.533	111.945
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	OLS	0.492	211.213	65.529
HR	Persons employed, GVA	3	No	No	OLS	0.375	5.028	8.673
HU	Persons employed, GVA	1	Yes	Yes	OLS	0.929	9.020	18.596
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.529	48.082	78.600
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.242	127.590	139.677
LT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.772	3.929	8.384
LU	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.549	4.557	5.782
LV	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	AR(1)	0.290	1.661	2.546
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.599	1.078	1.356
NL	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.569	116.576	111.271
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.934	16.547	138.661
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.708	22.709	26.156
RO	GVA	2	Yes	Yes	OLS	0.761	9.472	42.381
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	No	OLS	0.631	140.548	248.890
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.724	4.392	11.072
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.778	3.356	4.955
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	No	OLS	0.727	242.713	81.726
EU28	**GVA**	**3**	**No**	**No**	**OLS**	**0.696**	**554.720**	**117.349**
EU27_2020	**Persons employed, GVA**	**2**	**No**	**No**	**OLS**	**0.610**	**439.926**	**79.479**

Table 11.b. Description of the estimation models for BERD. Total ICT sector (operational definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors C+J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	1	No	No	OLS	0.641	69.990	8.210
BE	Persons employed, GVA	0	Yes	Yes	OLS	0.379	63.447	53.641
BG	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.883	4.299	26.728
CY	Persons employed, GVA	0	Yes	Yes	OLS	0.869	1.042	4.494
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.601	14.547	27.220
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.390	291.718	273.392
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.417	66.975	146.643
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.483	4.826	7.850
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.732	17.220	10.567
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.696	43.749	50.817
FI	Persons employed; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.929	62.442	123.086
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	OLS	0.522	206.556	61.810
HR	Persons employed, GVA	3	No	Yes	OLS	0.560	4.284	9.829
HU	Persons employed	3	No	Yes	OLS	0.885	11.334	16.423
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.477	37.568	70.167
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.258	123.139	149.684
LT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.785	3.742	8.195
LU	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.554	4.489	5.585
LV	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	AR(1)	0.268	1.651	2.623
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.576	1.091	1.291
NL	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.579	110.399	88.546
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.919	18.361	134.166
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.842	16.376	20.489
RO	Persons employed, GVA	2	Yes	No	OLS	0.744	9.750	42.640
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	No	OLS	0.630	139.421	249.924
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.739	4.265	11.056
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.767	3.473	4.374
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	1	No	Yes	OLS	0.693	245.128	47.762
EU28	**GVA; GFCF Int. Prop. (Total)**	**3**	**No**	**Yes**	**OLS**	**0.649**	**585.130**	**139.575**
EU27_2020	**Persons employed, GVA**	**2**	**No**	**No**	**OLS**	**0.637**	**424.583**	**111.666**
AU	Persons employed, GVA	0	Yes	Yes	OLS	0.340	136.081	202.128
CA	Persons employed, GVA	3	No	No	OLS	0.893	118.880	124.733
JP	Persons employed, GVA	2	No	Yes	OLS	0.691	2,040.924	415.990
KR	GVA	2	Yes	No	OLS	0.665	754.546	767.996
TW	Persons employed, GVA	2	Yes	Yes	OLS	0.868	164.875	192.334
US	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.723	4,194.878	2,040.063

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

Table 11.c. Description of the estimation models for BERD. ICT manufacturing (comprehensive definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector C)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.911	36.264	12.714
BE	Persons employed, GVA	2	No	No	OLS	0.829	30.032	5.618
BG	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.163	1.289	0.888
CY	Persons employed, GVA	3	No	Yes	OLS	0.967	0.004	0.003
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.742	3.367	0.734
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	0	No	Yes	OLS	0.389	276.141	331.472
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.624	13.015	5.375
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.455	1.117	2.075
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	Yes	OLS	0.843	4.308	4.596
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.867	14.832	2.860
FI	GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.899	74.556	120.349
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.661	116.453	125.073
HR	Persons employed, GVA	0	Yes	Yes	OLS	0.325	6.373	13.014
HU	Persons employed, GVA	3	No	No	OLS	0.754	4.324	1.577
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.757	25.461	14.032
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.455	63.380	86.488
LT	Persons employed; GFCF Int. Prop. (Total)	3	No	No	OLS	0.953	0.816	0.680
LU	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.425	0.616	0.054
LV	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.567	0.372	0.660
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.762	0.653	1.518
NL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.967	20.053	22.140
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.850	2.339	7.603
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.870	2.518	2.689
RO	Persons employed, GVA	3	No	No	OLS	0.985	0.470	0.378
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	AR(1)	0.240	282.884	663.428
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.450	2.618	4.070
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	No	OLS	0.557	1.275	0.686
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	No	OLS	0.514	92.464	80.259
EU28	**GVA**	**1**	**Yes**	**Yes**	**OLS**	**0.593**	**458.451**	**491.074**
EU27_2020	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**1**	**Yes**	**Yes**	**OLS**	**0.561**	**419.148**	**654.543**

Table 11.d. Description of the estimation models for BERD. ICT manufacturing (operational definition)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector C)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.911	36.264	12.714
BE	Persons employed, GVA	2	No	No	OLS	0.829	30.031	5.618
BG	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.163	1.289	0.888
CY	Persons employed, GVA	3	No	No	OLS	0.812	0.015	0.001
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.742	3.367	0.734
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	0	No	Yes	OLS	0.389	276.166	332.109
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.623	13.040	5.339
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.455	1.117	2.075
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	Yes	OLS	0.843	4.308	4.596
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.867	14.832	2.860
FI	GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.899	74.556	120.349
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.661	116.453	125.073
HR	Persons employed, GVA	1	Yes	Yes	OLS	0.885	2.595	9.432
HU	Persons employed, GVA	3	No	No	OLS	0.754	4.324	1.577
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.755	25.473	13.993
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.455	63.391	86.561
LT	Persons employed; GFCF Int. Prop. (Total)	3	No	No	OLS	0.953	0.816	0.680
LU	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.583	0.418	0.040
LV	Persons employed; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.565	0.338	0.566
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.762	0.653	1.518
NL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.967	19.968	22.089
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.850	2.339	7.603
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.870	2.518	2.689
RO	Persons employed, GVA	3	No	No	OLS	0.985	0.470	0.378
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	AR(1)	0.239	282.905	663.405
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.450	2.618	4.070
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	No	OLS	0.557	1.275	0.686
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	No	OLS	0.513	92.484	80.662
EU28	**GVA**	**1**	**Yes**	**Yes**	**OLS**	**0.594**	**458.336**	**490.112**
EU27_2020	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**1**	**Yes**	**Yes**	**OLS**	**0.561**	**419.010**	**653.595**
AU	Persons employed, GVA	3	Yes	Yes	OLS	0.221	29.859	84.659
CA	Persons employed, GVA	3	No	No	OLS	0.806	160.525	16.899
JP	Persons employed, GVA	2	No	Yes	OLS	0.740	1,604.716	416.337
KR	Persons employed, GVA	2	Yes	No	OLS	0.758	632.088	599.902
TW	Persons employed, GVA	2	Yes	Yes	OLS	0.860	160.444	197.333
US	Persons employed, GVA	3	No	Yes	OLS	0.781	3,104.780	1,167.433

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

Table 11.e. Description of the estimation models for BERD. ICT total services

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.573	19.738	19.099
BE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.199	47.580	85.205
BG	Persons employed; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.939	2.956	27.516
CY	Persons employed, GVA	0	Yes	Yes	OLS	0.849	1.118	6.681
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.687	11.561	25.513
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	Yes	OLS	0.579	121.655	41.426
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.433	72.289	178.399
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.622	4.298	12.282
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.283	22.717	16.695
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.760	48.595	37.883
FI	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.408	28.679	42.298
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.662	130.319	24.107
HR	Persons employed, GVA	1	Yes	No	OLS	0.317	7.720	1.060
HU	Persons employed, GVA	2	Yes	Yes	OLS	0.885	11.735	19.106
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.427	30.042	26.853
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.343	91.575	31.447
LT	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.702	4.235	10.330
LU	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.406	5.310	6.270
LV	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.636	0.999	2.884
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	OLS	0.199	1.212	1.746
NL	GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.480	75.930	153.114
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.954	13.594	136.647
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	0	No	Yes	OLS	0.532	29.015	7.736
RO	Persons employed, GVA	0	Yes	No	OLS	0.632	11.176	44.348
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.953	53.668	831.166
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.727	3.520	8.211
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.920	1.828	4.665
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	No	OLS	0.740	180.737	203.826
EU28	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**1**	**Yes**	**Yes**	**OLS**	**0.602**	**343.849**	**281.728**
EU27_2020	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**0**	**Yes**	**Yes**	**OLS**	**0.485**	**384.559**	**782.721**

Table 11.f. Description of the estimation models for BERD. ICT trade industries

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors G_I)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.501	2.412	3.614
BE	Persons employed, GVA	3	No	Yes	OLS	0.968	0.789	4.755
BG	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.798	0.252	1.138
CY	GVA	2	Yes	No	OLS	0.913	0.004	0.003
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.457	0.530	0.607
DE	GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.778	0.962	4.145
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	AR(1)	0.711	16.022	8.645
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.925	0.113	0.399
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.667	4.061	4.599
ES	GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.976	4.113	1.577
FI	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.988	0.582	11.190
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.728	15.561	7.727
HR	*Model not estimated because the dependent variable is equal to zero most of the period*							
HU	Persons employed, GVA	3	No	Yes	OLS	0.960	0.333	0.503
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.724	20.415	18.407
IT	GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.950	4.093	6.442
LT	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.827	0.110	0.240
LU	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.985	0.016	0.207
LV	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.910	0.037	0.077
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.942	0.032	0.202
NL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.816	12.924	17.192
PL	GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.654	2.690	4.456
PT	GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.988	2.192	0.919
RO	Persons employed, GVA	0	Yes	No	OLS	0.534	0.273	0.105
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	No	OLS	0.261	3.409	1.636
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	No	OLS	0.836	0.308	0.141
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.917	0.221	1.487
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.936	18.971	48.679
EU28	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**3**	**No**	**No**	**OLS**	**0.869**	**44.636**	**63.484**
EU27_2020	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**Step dummy from 2010**	**No**	**Yes**	**OLS**	**0.502**	**50.543**	**17.376**

Table 11.g. Description of the estimation models for BERD. ICT services industries

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.244	25.270	11.412
BE	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.177	48.254	81.968
BG	Persons employed; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.938	3.012	27.703
CY	Persons employed, GVA	0	Yes	Yes	OLS	0.847	1.124	6.672
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.718	10.864	27.329
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	Yes	OLS	0.579	121.459	40.257
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.466	66.673	156.884
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.779	3.230	11.255
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.509	18.896	33.508
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.727	44.434	31.774
FI	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.395	28.745	37.603
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.713	116.391	13.471
HR	Persons employed, GVA	3	No	No	OLS	0.725	4.887	3.417
HU	Persons employed, GVA	2	Yes	Yes	OLS	0.867	12.418	18.992
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.458	22.692	78.927
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.197	97.698	62.991
LT	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.740	3.521	10.322
LU	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.520	4.724	5.881
LV	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.588	1.035	2.804
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	OLS	0.204	1.165	1.429
NL	GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.474	72.060	128.783
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.940	15.673	137.410
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	0	No	Yes	OLS	0.546	27.962	2.940
RO	Persons employed, GVA	0	Yes	No	OLS	0.632	11.166	44.374
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.952	53.694	825.561
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.739	3.380	7.961
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.907	2.007	4.883
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	OLS	0.679	187.979	182.859
EU28	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**1**	**Yes**	**Yes**	**OLS**	**0.651**	**317.396**	**311.419**
EU27_2020	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**0**	**Yes**	**Yes**	**OLS**	**0.533**	**363.246**	**815.031**
AU	Persons employed, GVA	0	Yes	Yes	OLS	0.252	122.461	166.121
CA	Persons employed, GVA	3	Yes	Yes	OLS	0.742	134.626	391.967
JP	Persons employed, GVA	2	Yes	No	OLS	0.591	553.498	246.941
KR	Persons employed, GVA	2	Yes	Yes	OLS	0.255	108.040	104.186
TW	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.767	14.165	2.581
US	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.654	1,765.795	35.725

Table 11.h. Description of the estimation models for BERD. IT services (Telecommunications)

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.610	3.311	1.125
BE	Persons employed, GVA	3	No	Yes	OLS	0.748	20.737	22.064
BG	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	No	OLS	0.250	1.360	1.274
CY	Persons employed, GVA	1	Yes	Yes	OLS	0.889	0.057	0.225
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.908	0.892	0.958
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.612	106.592	17.393
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.672	13.368	2.968
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.763	1.404	1.772
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	No	OLS	0.316	8.432	19.431
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.635	46.759	19.212
FI	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.407	8.411	2.411
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.809	62.010	26.782
HR	Persons employed, GVA	3	No	No	OLS	0.812	3.975	0.869
HU	Persons employed, GVA	3	No	Yes	OLS	0.979	1.518	1.207
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	No	OLS	0.878	3.529	4.012
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.631	95.850	180.222
LT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.941	1.246	0.282
LU	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.569	1.465	1.572
LV	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.999	0.021	1.476
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	AR(1)	0.457	0.085	0.046
NL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.794	20.439	15.074
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.853	6.068	27.289
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.739	16.966	8.660
RO	Persons employed, GVA	3	No	No	OLS	0.919	0.883	9.069
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.221	2.914	1.138
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.917	0.588	2.900
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.946	0.044	0.017
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	Yes	OLS	0.721	99.009	64.701
EU28	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**3**	**No**	**Yes**	**OLS**	**0.685**	**236.894**	**256.992**
EU27_2020	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**3**	**No**	**No**	**OLS**	**0.642**	**232.720**	**201.939**
AU	Persons employed, GVA	0	No	Yes	OLS	0.166	73.070	17.799
CA	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.195	55.466	32.617
JP	Persons employed, GVA	1	No	No	OLS	0.787	366.307	306.689
KR	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.228	36.971	15.104
TW	Persons employed, GVA	Step dummy from 2010	No	No	OLS	0.647	5.986	0.811
US	Persons employed, GVA	1	Yes	Yes	OLS	0.282	479.118	62.268

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 11.i. 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	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.270	24.554	10.178
BE	Persons employed, GVA	0	Yes	Yes	OLS	0.383	34.856	22.321
BG	Persons employed; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.967	2.043	26.260
CY	Persons employed, GVA	0	Yes	Yes	OLS	0.820	1.214	7.047
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.680	11.430	29.026
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	AR(1)	0.343	97.850	34.803
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.333	68.459	155.345
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.737	2.691	9.214
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	No	OLS	0.692	14.383	14.884
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.742	29.532	16.899
FI	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	Yes	OLS	0.296	28.325	38.957
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	2	No	No	OLS	0.435	91.762	11.023
HR	Persons employed, GVA	3	No	Yes	OLS	0.949	1.441	2.417
HU	Persons employed, GVA	2	Yes	Yes	OLS	0.847	10.248	16.386
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.426	27.042	84.900
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	No	OLS	0.745	70.536	152.255
LT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.949	0.972	9.577
LU	Persons employed, GVA; GFCF Int. Prop. (Total)	1	No	Yes	OLS	0.368	4.842	4.321
LV	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.399	1.029	1.328
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	OLS	0.222	1.137	1.335
NL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.528	54.833	105.500
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.980	8.929	163.684
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.464	12.620	13.251
RO	Persons employed, GVA	0	Yes	No	OLS	0.527	10.984	35.536
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.950	54.606	822.011
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.744	2.823	5.720
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.901	2.081	4.878
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.578	144.712	209.688
EU28	**Persons employed, GVA**	**0**	**Yes**	**Yes**	**OLS**	**0.519**	**296.147**	**127.563**
EU27_2020	**Persons employed**	**Step dummy from 2010**	**No**	**Yes**	**OLS**	**0.490**	**298.595**	**765.559**
AU	Persons employed, GVA	0	Yes	Yes	OLS	0.409	95.827	168.518
CA	Persons employed, GVA	1	Yes	No	OLS	0.852	100.422	151.812
JP	Persons employed, GVA	1	Yes	Yes	OLS	0.191	360.040	252.297
KR	Persons employed, GVA	2	Yes	Yes	OLS	0.465	76.988	96.619
TW	Persons employed, GVA	3	No	Yes	OLS	0.805	9.337	7.497
US	Persons employed, GVA	0	Yes	Yes	OLS	0.480	2,094.932	180.678

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 11.j. 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	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sector J)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.392	1.043	1.806
BE	Persons employed, GVA	3	No	No	OLS	0.782	2.138	4.968
BG	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.974	0.057	0.365
CY	*Model not estimated because the dependent variable is equal to zero the whole period*							
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.838	0.072	0.022
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.604	6.525	0.814
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.824	2.886	10.391
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	No	OLS	0.484	0.149	0.409
EL	Persons employed; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.856	0.542	0.194
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.764	10.556	5.868
FI	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.868	3.393	22.447
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.807	7.185	2.725
HR	Persons employed, GVA	Step dummy from 2010	No	Yes	OLS	0.265	0.013	0.040
HU	Persons employed, GVA	1	Yes	No	OLS	0.537	0.367	0.672
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	0	Yes	No	OLS	0.569	0.734	1.375
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.914	3.640	3.570
LT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.997	0.027	0.954
LU	*Model not estimated because the dependent variable is equal to zero the whole period*							
LV	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.892	0.032	0.011
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.992	0.002	0.009
NL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.535	5.774	1.314
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.669	1.104	3.505
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	0	No	Yes	OLS	0.206	1.560	0.061
RO	Persons employed, GVA	2	No	No	OLS	0.658	0.006	0.002
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.225	14.002	1.835
SI	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.982	0.418	0.745
SK	*Model not estimated because the dependent variable is equal to zero most of the period*							
UK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.897	31.755	233.440
EU28	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**3**	**No**	**No**	**OLS**	**0.765**	**51.678**	**205.656**
EU27_2020	**Persons employed, GVA; GFCF Int. Prop. (Total)**	**2**	**No**	**Yes**	**OLS**	**0.537**	**29.426**	**30.679**
AU	Persons employed, GVA	3	No	Yes	OLS	0.515	11.922	2.438
CA	Persons employed, GVA	2	Yes	No	OLS	0.791	12.149	10.401
JP	Persons employed, GVA	0	No	Yes	OLS	0.192	46.372	29.773
KR	Persons employed, GVA	3	No	Yes	OLS	0.322	8.921	0.371
TW	Persons employed, GVA	3	No	Yes	OLS	0.292	0.966	0.721
US	Persons employed, GVA	2	Yes	Yes	OLS	0.897	679.105	34.004

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 11.k. Description of the estimation models for BERD. Retail sale sector

Country	Predictors				Estimation method	Adjusted R^2 for the model of the whole period	$RMSE_{9517}$ (Estimation for the whole period)	$RMSE_{1617}$ (Out of sample prediction)
	National Accounts variables (NACE sectors G_I)	Dummies for the years 1995-2015	Dummies for the years 2016, 2017	Trend				
AT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.881	22.844	76.127
BE	Persons employed, GVA	3	No	No	OLS	0.879	19.916	51.538
BG	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	Yes	OLS	0.453	0.457	0.252
CY	GVA	3	No	Yes	OLS	0.960	0.006	0.014
CZ	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.825	2.327	5.508
DE	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.951	12.077	72.615
DK	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	Yes	OLS	0.833	15.143	4.451
EE	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	Yes	OLS	0.720	0.297	0.516
EL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.745	5.508	15.592
ES	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.901	10.210	37.900
FI	Persons employed, GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.772	5.281	13.759
FR	Persons employed, GVA; GFCF Int. Prop. (Total)	1	Yes	No	OLS	0.941	74.208	241.535
HR	*Model not estimated because the dependent variable is equal to zero the whole period*							
HU	Persons employed, GVA	3	No	No	OLS	0.895	8.264	18.329
IE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.984	1.798	21.989
IT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.968	12.625	77.877
LT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.878	0.428	0.667
LU	GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.902	0.472	2.956
LV	GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.602	0.086	0.210
MT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.953	0.250	1.467
NL	Persons employed, GVA; GFCF Int. Prop. (Total)	Step dummy from 2010	No	No	AR(1)	0.908	26.614	76.787
PL	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	Yes	OLS	0.955	4.487	4.799
PT	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.817	3.377	5.768
RO	GVA	1	Yes	Yes	OLS	0.907	1.094	5.012
SE	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.984	12.663	137.193
SI	GVA; GFCF Int. Prop. (Total)	2	Yes	No	OLS	0.821	0.841	1.126
SK	Persons employed, GVA; GFCF Int. Prop. (Total)	3	No	No	OLS	0.990	0.150	2.437
UK	GVA; GFCF Int. Prop. (Total)	1	Yes	No	OLS	0.245	87.133	102.483
EU28	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.887**	**307.212**	**889.102**
EU27_2020	**Persons employed, GVA**	**3**	**No**	**Yes**	**OLS**	**0.934**	**213.579**	**756.859**
AU	Persons employed, GVA	0	Yes	Yes	OLS	0.408	3.754	6.596
CA	Persons employed, GVA	0	Yes	No	OLS	0.085	0.103	0.223
JP	*Model not estimated because the dependent variable is not available for the Retail sale sector*							
KR	Persons employed, GVA	3	No	Yes	OLS	0.401	44.736	6.903
TW	Persons employed, GVA	2	Yes	Yes	OLS	0.760	1.919	1.897
US	Persons employed, GVA	3	No	Yes	OLS	0.999	62.186	16.723

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.

Additionally, figures 1 (for value added), 2 (employment), 3 (hours worked) and 4 (BERD) in the Annex depict the results of the model selected for each variable and industry. The figures show the in-sample predictions and provide a detailed summary of the results as they include the original variable in differences, the estimated values for $D.\hat{Y}$, and the 95% confidence intervals. In general the models behave reasonably well in all the countries and industries selected.

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:

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

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

The problem here is which transfer rate to apply to estimate the values for 2018 and 2019. The alternatives possible are: the transfer rate of 2017, 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 we proceeded as follows:

1. For each country, industry and variable (personnel and researchers) the following regression model is estimated using the data for 1995-2017:

$$Transfer\ Rate_{clt}^{Personnel\ or\ Researcher} = \alpha + \delta Trend + \varepsilon_{clt} \quad (7)$$

2. The predicted transfer rates for years 2018 and 2019 are obtained using the estimated parameters of equation (7) if the parameter δ is statistically significant. Otherwise, we use the transfer rate of 2017.

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 2018 and 2019. If the transfer rate does not show a trend (the estimated parameter δ is not statistically significant), we use the estimated transfer rate corresponding to the last available year.

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. We therefore opted to use the transfer rate of the last available year in this sector.

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 2018 and 2019 are obtained using the procedures described above. To this end, we use the estimated parameters and the value of the predictors for 2018 and 2019. These increases are applied to the original values of the variables in 2017 to obtain the nowcasted data.

Once all the variables for all sectors have been nowcasted individually for the EU countries, some decisions must be taken to guarantee the internal coherence of the database. For the comprehensive classification we proceed as follow. The first decision concerns the fact that the total ICT sector has to be equal to the aggregation of the ICT manufacturing, the ICT services sectors and ICT trade industries,

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 approach described up to now, these two conditions are not guaranteed. We took the nowcasted data for the total ICT sector as a benchmark, and proportionally adjusted the nowcasted data of the ICT manufacturing, the ICT services sector and ICT trade industries to this benchmark. Additionally, these adjusted data of the ICT services sector are also used as a benchmark to proportionally adjust the values of the Telecommunications and Computer and related activities sector.

To guarantee the coherence between the comprehensive and operational classification we take the former as reference. Then we calculate the operational ICT manufacturing and services subsectors as follows. First, we calculate the operational total ICT manufacturing by substracting from the comprehensive ICT manufacturing the share of Manufacture of magnetic and optical media sector (NACE Rev. 2 268). Given both the absence of reliable results to estimate such an industry disaggregation and its small weight within the ICT manufacturing (0.14% for the Gross Value Added of EU28 in 2016-2017), we obtain the estimation of the Manufacture of magnetic and optical media sector by applying the last two years' average share (Manufacture of magenetic and optical media / ICT manufacturing) to the nowcasted value for ICT manufacturing. Second, we substract from the total comprehensive ICT services the trade industry. Finally, total operational ICT sector is calculated aggregating the operational ICT manufacturing and ICT services industries.

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 around 0.8 pp between the last PREDICT 2020 database period (2016-2017) and the nowcasted years (2018-2019)[14].

With all these decisions taken into account, table 12 shows the nowcasted values for the European Union. The data for 2007-2017 are those of the PREDICT 2020 database. Data for 2018 and 2019 are the nowcasted values using the adjustments mentioned in the paragraph above.

[14] The difference between ICT GVA in the ICT sector for the years 2016-2017 in the EU and the sum of the individual European countries is 6.0%, whereas this difference is 5.2% for the nowcasted years 2018-2019.

Table 12. Estimated data of the EU28. 2007-2019. Comprehensive classification for the ICT Total and ICT manufacturing sectors

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
a) Gross Value Added (GVA)													
(Millions of current euros)													
ICT Total	574,833.2	568,392.8	531,644.3	545,004.0	559,546.2	570,855.0	578,567.3	596,251.1	634,511.9	649,260.2	684,099.5	710,008.9	730,294.7
ICT manufacturing sector	74,098.3	67,189.0	51,317.0	56,808.1	54,105.5	46,313.3	48,431.5	49,670.0	51,706.4	54,232.4	54,322.0	54,064.9	51,995.4
ICT total services	500,734.9	501,203.8	480,327.3	488,195.9	505,440.7	524,541.8	530,135.8	546,581.0	582,805.5	595,027.8	629,777.6	655,944.0	678,299.4
ICT trade industries	45,588.5	45,930.1	43,691.3	46,418.2	47,441.3	52,040.5	53,846.1	49,114.8	51,091.2	51,041.2	53,966.7	55,559.0	56,932.2
ICT services industries	455,146.4	455,273.7	436,636.1	441,777.7	457,999.4	472,501.2	476,289.7	497,466.2	531,714.4	543,986.7	575,810.8	600,385.0	621,367.2
Telecommunications sector	209,375.4	206,266.3	195,827.6	188,195.7	185,405.3	180,516.3	170,897.3	170,452.7	177,024.5	174,485.2	177,404.2	177,626.1	177,617.4
Computer and related activities sector	245,771.0	249,007.4	240,808.5	253,582.0	272,594.1	291,984.9	305,392.4	327,013.5	354,689.8	369,501.5	398,406.6	422,758.8	443,749.8
Media and content sector	135,978.2	133,284.3	123,690.3	127,927.9	129,010.6	129,111.2	128,817.9	131,659.2	138,237.5	136,939.3	136,407.9	138,396.5	141,681.9
Retail sale sector	11,418.4	11,299.9	12,243.9	12,861.6	13,668.1	15,147.9	15,918.3	18,735.6	23,044.8	22,683.8	23,523.7	23,944.4	24,484.6
b) Employment													
(1000 persons employed)													
ICT Total	5,924.1	6,024.1	5,940.6	5,841.8	5,988.5	6,065.7	6,153.5	6,277.2	6,461.6	6,631.9	6,912.0	7,100.8	7,243.1
ICT manufacturing sector	910.4	866.6	758.1	709.9	707.4	690.3	654.0	634.4	604.3	606.5	623.0	623.8	597.9
ICT total services	5,013.7	5,157.5	5,182.6	5,131.9	5,281.1	5,375.4	5,499.5	5,642.8	5,857.3	6,025.3	6,289.0	6,477.0	6,645.2
ICT trade industries	588.9	616.6	566.6	570.0	580.3	573.3	571.7	565.5	566.7	579.4	577.3	579.8	573.5
ICT services industries	4,424.8	4,540.9	4,616.0	4,561.9	4,700.8	4,802.1	4,927.8	5,077.2	5,290.6	5,445.9	5,711.7	5,897.2	6,071.8
Telecommunications sector	1,235.9	1,198.8	1,172.9	1,103.5	1,084.1	1,077.8	1,061.1	1,052.9	1,064.7	1,044.8	1,034.5	1,040.8	1,052.0
Computer and related activities sector	3,188.9	3,342.1	3,443.1	3,458.4	3,616.7	3,724.3	3,866.7	4,024.4	4,225.9	4,401.1	4,677.2	4,856.3	5,019.8
Media and content sector	1,837.4	1,813.6	1,758.4	1,720.4	1,692.6	1,668.8	1,628.4	1,638.7	1,586.8	1,570.8	1,566.3	1,569.8	1,585.0
Retail sale sector	272.5	288.6	281.3	321.0	363.1	420.9	447.8	481.7	532.4	578.2	637.3	683.6	727.2
c) Hours Worked (HEMP)													
(Millions of hours worked)													
ICT Total	10,435.4	10,641.4	10,472.9	10,316.1	10,619.4	10,671.2	10,807.6	11,017.7	11,292.7	11,651.6	12,055.6	12,395.1	12,637.5
ICT manufacturing sector	1,591.2	1,514.5	1,296.8	1,218.3	1,225.7	1,178.7	1,119.2	1,078.3	1,029.5	1,041.3	1,060.6	1,069.3	1,022.7
ICT total services	8,844.2	9,126.9	9,176.2	9,097.8	9,393.7	9,492.6	9,688.4	9,939.4	10,263.2	10,610.3	10,995.0	11,325.8	11,614.8
ICT trade industries	999.0	1,082.9	1,009.9	1,018.0	1,040.4	1,001.8	1,012.1	997.3	999.5	1,018.3	999.7	992.3	973.1
ICT services industries	7,845.2	8,043.9	8,166.3	8,079.8	8,353.3	8,490.7	8,676.3	8,942.2	9,263.7	9,592.0	9,995.4	10,333.4	10,641.8
Telecommunications sector	2,152.3	2,072.6	2,043.9	1,942.8	1,900.0	1,895.3	1,856.4	1,838.2	1,867.1	1,835.9	1,854.8	1,859.4	1,861.7
Computer and related activities sector	5,692.9	5,971.4	6,122.3	6,137.0	6,453.3	6,595.4	6,820.0	7,103.9	7,396.6	7,756.1	8,140.5	8,474.0	8,780.0
Media and content sector	2,981.9	2,951.4	2,840.6	2,777.2	2,727.4	2,652.6	2,611.3	2,638.6	2,604.2	2,589.4	2,595.8	2,591.0	2,595.5
Retail sale sector	434.7	463.9	450.1	513.2	579.4	663.4	718.4	779.6	850.1	922.3	1,030.7	1,105.8	1,177.1

Table 12 (cont.). Estimated data of the EU28. 2007-2019. Comprehensive classification for the ICT Total and ICT manufacturing sectors

	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
d) Business Ent. Expenditure on R&D (BERD)													
(Millions of current euros)													
ICT Total	26,599.7	26,999.9	25,391.0	26,299.1	27,956.7	28,811.2	28,924.3	29,878.4	31,556.9	32,070.1	33,034.0	33,862.5	34,490.9
ICT manufacturing sector	13,193.5	13,172.8	11,211.5	11,300.0	11,862.7	11,829.8	11,428.2	11,360.0	11,771.7	10,667.9	10,060.0	9,565.9	8,805.6
ICT total services	13,406.2	13,827.2	14,179.6	14,999.1	16,094.0	16,981.4	17,496.2	18,518.4	19,785.2	21,402.3	22,974.0	24,296.6	25,685.3
ICT trade industries	536.9	536.4	616.7	812.5	803.4	909.7	762.5	789.9	1,073.7	1,013.8	940.4	835.0	1,090.2
ICT services industries	12,869.2	13,290.8	13,562.9	14,186.6	15,290.6	16,071.7	16,733.7	17,728.5	18,711.5	20,388.5	22,033.6	23,461.6	24,595.1
Telecommunications sector	4,297.9	4,187.9	4,207.2	4,044.5	3,819.3	3,790.6	3,196.6	3,337.5	3,249.7	3,668.0	3,768.6	3,997.1	4,165.0
Computer and related activities sector	8,571.3	9,102.9	9,355.7	10,142.1	11,471.3	12,281.2	13,537.1	14,391.0	15,461.8	16,720.5	18,265.0	19,464.5	20,430.1
Media and content sector	627.5	527.3	372.2	448.4	394.0	436.3	463.3	622.8	755.2	1,121.1	1,118.3	1,144.6	1,284.6
Retail sale sector	316.5	574.0	1,097.2	1,668.0	1,659.2	2,105.3	3,710.3	4,446.0	2,801.5	4,641.9	4,723.4	5,064.9	5,457.4
e) Business R&D personnel (PERD)													
(Full Time Equivalent)													
ICT Total	236,982	243,583	243,483	255,797	263,809	277,008	283,096	293,888	303,520	315,135	328,747	336,992	343,246
ICT manufacturing sector	97,655	94,871	81,921	78,686	81,293	82,673	80,606	80,221	84,515	82,236	71,714	67,198	60,818
ICT total services	139,327	148,712	161,562	177,111	182,516	194,335	202,490	213,667	219,005	232,899	257,033	269,794	282,428
ICT trade industries	5,701	6,372	5,755	8,712	7,312	8,539	8,274	9,308	10,732	11,204	10,630	9,383	12,146
ICT services industries	133,626	142,340	155,807	168,399	175,204	185,796	194,216	204,359	208,273	221,694	246,404	260,411	270,282
Telecommunications sector	26,272	29,936	37,296	38,682	33,704	33,650	29,510	30,271	27,580	29,445	30,940	32,591	33,641
Computer and related activities sector	107,354	112,404	118,511	129,717	141,500	152,146	164,706	174,088	180,693	192,250	215,463	227,820	236,641
Media and content sector	4,860	4,401	3,694	4,256	4,452	4,875	6,392	6,525	7,873	7,079	6,833	6,993	7,849
Retail sale sector	-	13,335	11,761	8,681	5,806	5,784	18,205	10,023	9,666	24,918	23,141	24,814	26,737
f) Business R&D researchers (RERD)													
(Full Time Equivalent)													
ICT Total	152,170	154,051	152,614	162,615	166,412	177,923	180,507	188,741	194,957	205,683	215,234	220,632	224,727
ICT manufacturing sector	65,825	63,942	54,936	54,956	55,968	58,070	59,878	59,646	61,437	59,722	51,284	48,431	44,208
ICT total services	86,345	90,109	97,678	107,659	110,444	119,853	120,629	129,095	133,520	145,961	163,950	172,201	180,518
ICT trade industries	3,805	3,948	3,990	5,162	4,641	6,177	5,822	6,898	7,648	7,452	7,488	6,666	8,695
ICT services industries	82,540	86,161	93,688	102,497	105,803	113,676	114,807	122,198	125,871	138,509	156,462	165,535	171,823
Telecommunications sector	15,758	15,188	19,479	21,456	19,188	18,780	17,533	18,064	18,610	19,652	21,317	22,461	23,168
Computer and related activities sector	66,782	70,973	74,209	81,041	86,615	94,896	97,274	104,133	107,262	118,857	135,145	143,074	148,655
Media and content sector	2,133	2,007	2,035	2,504	2,511	3,088	3,347	3,655	4,837	4,454	4,170	4,268	4,790
Retail sale sector	-	7,052	6,535	4,865	3,145	2,967	10,512	6,021	5,500	13,544	13,124	14,073	15,163

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 2018 and 2019, 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 ICT Trade industry, 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. Stančik[15] (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 Reports 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 has also worked on the FP7 SPINTAN project, one of whose aims was to create a database of intangible assets for the non-market economy. A key aspect of this project was 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 Eurostat's GBARD –published according to the Nomenclature for the Analysis and Comparison of Scientific Budgets and Programmes (NABS) chapters– could 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 already applied in previous editions of PREDICT (since the 2017 edition) 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.

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

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 38 industries, of which 7 are ICT sectors16 (Table).

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 13) from 2004 to 201817 for all the EU Member States, Iceland, Norway, Switzerland, North Macedonia, Serbia, Turkey, Bosnia and Herzegovina, Russia, the United States, Japan and South Korea. Regarding the EU aggregates, data for the EU28 (which still includes the UK as part of the EU by the last Eurostat update dated 10-10-2019) and EA19 start in 2007. The data for 2007-2018 is dissagregated by NABS chapters, and for the period 2004-2006 it is only available for the total GBARD amount. 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 2000 and the EU15 aggregate starts in 1981). The non-Member State countries covered are Iceland (available for the years 1983-1986, 1991-1992), Norway (1981-2007), Switzerland (1981, 1983, 1986, 1988-1990, 1992, 1994, 1996, 1998, 2000, 2002, 2004, 2006), Russia (1999-2001), the United States (1980-2007) and Japan (1988-2007).

[16] Following the OECD 2007 ICT sector definition: OECD Information Economy–Sector definitions based on the International Standard Industry Classification (ISIC 4) available at 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, 2008 for Turkey, data available only for 2013-2014 for North Macedonia, 2014-2017 for Bosnia and Herzegovina, South Korea for the period 2004-2017, and Switzerland only available for the years 2004, 2006, 2008, 2010, 2012, 2014, 2015 and 2017. 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.

Table 13. NABS 2007 chapters

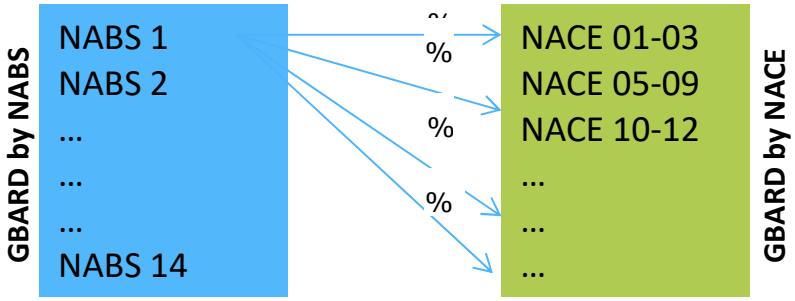
NABS 2007 chapters	
1	Exploration and exploitation of the earth
2	Environment
3	Exploration and exploitation of space
4	Transport, telecommunication and other infrastructures
5	Energy
6	Industrial production and technology
7	Health
8	Agriculture
9	Education
10	Culture, recreation, religion and mass media
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 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. 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 GBARD 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).

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



Regarding the first of these requirements, 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 2008-2018.

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

NABS 2007 → NACE Rev. 2 (2008-2018)

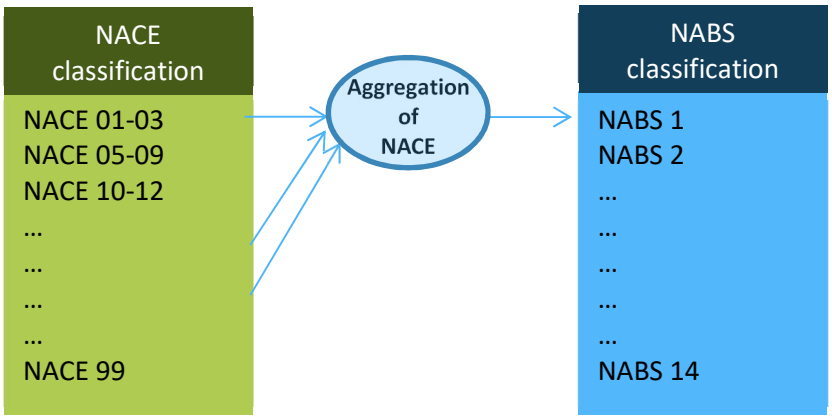
Tables in the appendix show the correspondences used in the new PREDICT methodology. More precisely, the tables show the correspondences of the NABS classification and both the NACE Rev 1.1 and NACE Rev. 2 industry classifications.

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).

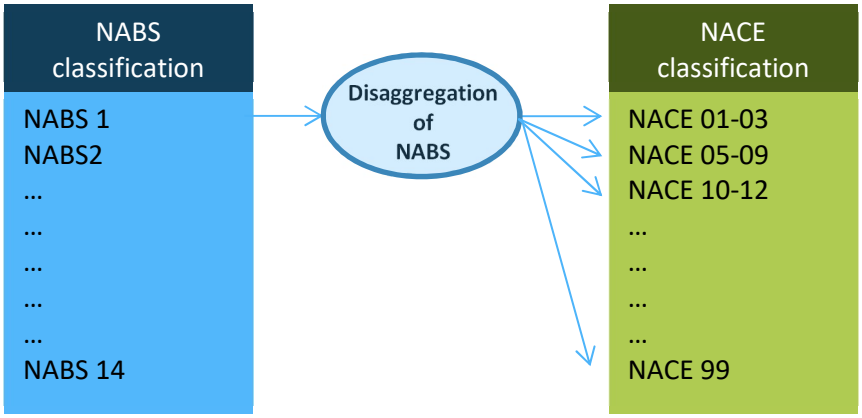
The second requirement is the distribution of the weights of each NABS among the NACE (Rev. 1.1 and Rev. 2) industries, since each NABS chapter is very likely to correspond to more than one NACE industry. Again, following Stančik's (2012) general idea, the proxy selected for estimating the NABS weights 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.

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

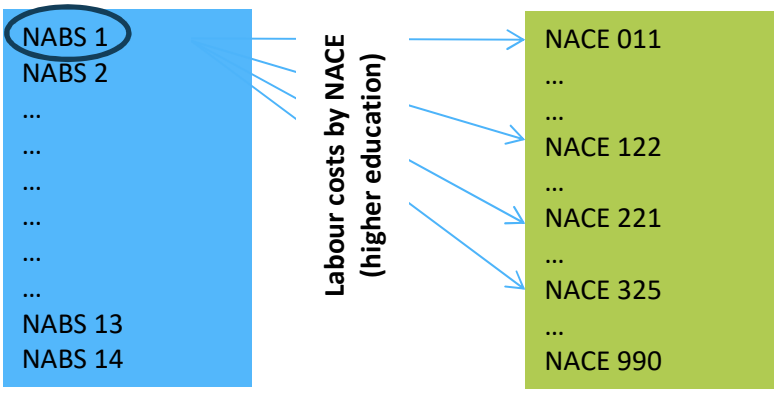


The data needed to calculate the weights are hours worked by employees with higher education by 3-digit NACE Rev. 1.1. and Rev. 2 industries (Labour Force Survey, LFS) and hourly wages of employees with higher education by 3-digit NACE industries (Structure of Earnings Survey, SES). For the period to be estimated (2006-2018), data for wages are only available for the years 2006, 2010 and 2014. Again, we follow Stančik (2012) approach to hold constant the distintct SES values for years between surveys: 2006 SES data are used until 2007, 2010 SES data are used for the years 2008 to 2012, and 2014 SES data are used from 2012 onwards. Tailor-made data for both LFS and SES were received from Eurostat specifically for this project taking into account the confidentiality and reliability restrictions of the data extractions.

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

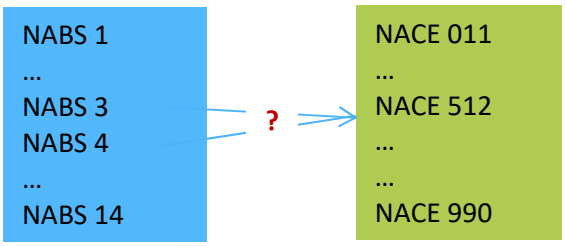


b) Example: NABS 1 – NACE Rev. 2 correspondence and estimation of weights through labour costs

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 (8).

$$\text{GBARD}_k = \sum_{j=1}^{14} \text{GBARD}_j * \left[\text{Labour costs}_{j,k} \Big/ \sum_k \text{Labour costs}_{j,k} \right] \qquad (8)$$

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. 2[18] is used to give a final NACE classification of 38 2-digit NACE Rev. 2 industries, comprising 7 ICT sectors (according to the OECD classification). Table14 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 (2008-2018). 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 38 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 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:

$$\text{ICT share}_k = \frac{\text{Labour costs for employees with higher education } \textbf{in ICT occupations}_k}{\text{Labour costs for employees with higher education}_k} \qquad (9)$$

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

$$\text{ICT GBARD}_k = \text{GBARD}_k * \text{ICT share}_k \quad (10)$$

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

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 each time an additional year is estimated for a new update of the PREDICT database.

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 14. Final NACE classification: 38 NACE Rev. 2 industries, differentiating ICT sectors (in blue)

	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(non-ICT)
12	Manufacture of computer, electronic and optical products (ICT industries)	ICT26
12.1	Manufacture of electronic components and boards	ICT261
12.2	Manufacture of computers and peripheral equipment	ICT262
12.3	Manufacture of communication equipment	ICT263
12.4	Manufacture of consumer electronics	ICT264
12.5	Manufacture of magnetic and optical media	ICT268
13	Manufacture of electrical equipment	27
14	Manufacture of machinery and equipment n.e.c.	28
15	Manufacture of transport equipment	29-30
16	Other manufacturing, and repair and installation of machinery and equipment	31-33
17	Electricity, gas, steam and air-conditioning supply	35
18	Water supply, sewerage, waste management and remediation	36-39
19	Construction	41-43
20	Transportation and storage	49-53
21	Publishing, audio-visual and broadcasting activities (except ICT industries)	58-60(non-ICT)
22	ICT Computer and related activities	ICT5820+62+631+951
23	Telecommunications	ICT61
24	Computer programming, consultancy and related activ.; Information service activ. (exc. ICT)	62-63(non-ICT)
25	Legal and accounting, head offices, management consultancy, architectural and engineering activ; technical testing and analysis	69-71
26	Scientific research and development	72
27	Advertising and market research; other professional, scientific and technical activities; veterinary activities	73-75
28	Administrative and support service activities	77-82
29	Public administration and defence; compulsory social security	84
30	Education	85
31	Human health and social work	86-88
32	Arts, entertainment and recreation	90-93
33	Activities of membership organisations	94
TOT	TOTAL	

ICT sectors shaded in blue. Source: Mas, Benages, Fernández de Guevara and Hernández (2016).

5.2 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 spilt 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.

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List of abbreviations

BERD	Business Expenditure on Research and Development
BRDIS	Business R&D and Innovation Survey
DG CONNECT	Directorate General for Communications Networks, Content and Technology
EU28	Former European Union (aggregate of the 28 countries between 2013 and 2020)
EU27_2020	European Union aggregate with 27 Member States from 2020 (without United Kingdom)
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

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 former EU-28 aggregate in the PREDICT dataset covers the composition of the EU between 2013 and 2020, with 28 Members States (including United Kingdom).

EU27_2020: New code for European aggregate covering the EU with 27 Member States (without United Kingdom) from 2020

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.

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Annex I: The Collection of Data

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

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_e_berdindr2&lang=en

  Downloaded: 29-11-2019

  (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: 29-11-2019

  (Total intramural R&D expenditure (GERD) by sectors of performance)

Structural ANalysis Database (STAN) from OECD

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

  Downloaded: 14-11-2018

  (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: 29-11-2019

  (Research and development Statistics in Denmark)

- http://www.statistikdatabasen.scb.se/pxweb/en/ssd/

  Downloaded: 04-12-2019

  (Research and development in Sweden)

- http://statdat.statistics.sk/

  Downloaded: 15-10-2016

  (Expenditures on research and development in Slovakia)

- https://www.bfs.admin.ch/bfs/fr/home/statistiques/education-science/technologie/systeme-indicateurs/acces-indicateurs/input-s-t/depenses-r-d-entreprises-privees.html

  Downloaded: 04-12-2019

  (R&D in business enterprise sector in Switzerland)

- 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: 04-12-2019

  (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: 04-12-2019

  (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: 04-12-2019

  (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: 04-12-2019

  (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

  (Employment by economic activity and level of education attained (NACE Rev. 1.1))

Exchange rates and PPP from Eurostat

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

  Downloaded: 09-01-2020

  (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: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from annual macro-economic database of the European Commission (AMECO)

- https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm

  Downloaded: 09-01-2020

  (Purchasing power parities)

Remarks

The elaboration of the 2006-2017 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:

a. Using R&D data provided by National Statistical Institutes for Estonia, Denmark, Sweden, Slovakia, Spain and Switzerland.

b. 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].

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 turnover: weight of sector 465 (Wholesale of information and communication equipment) in sector G (Wholesale and retail trade; repair of motor vehicles and motorcycles); distribution of the sector 26 (Manufacture of computer, electronic and optical products) to 3-digits; weight of sector 631 (Data processing, hosting and related activities; web portals) in sector 63 (Information service activities).

e. 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.

[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 NACE Rev. 1.1 and NACE Rev. 2

f. 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.

g. 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, 15% in 2016, 10% in 2017).

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 the BERD dataset in PPS by using purchasing power parities from Eurostat. GERD data expressed in PPS are provided by Eurostat for each country, and EU28 data and EU27_2020 (European Union without United Kingdom) 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:

h. OECD data (NACE Rev. 2) are used for all available years (2000 onwards) and required sectors.

i. 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 make it possible to estimate BERD (NACE Rev. 2) backwards.

j. 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 (EU28) and for European Union without United Kingdom (EU27_2020) 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: 29-11-2019

  (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: 29-11-2019

  (Total intramural R&D expenditure (GERD) by sectors of performance)

Structural ANalysis Database (STAN) from OECD

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

  Downloaded: 14-11-2018

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

Exchange rates and PPP from Eurostat

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

  Downloaded: 09-01-2020

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

  Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from annual macro-economic database of the European Commission (AMECO)

- https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm

  Downloaded: 09-01-2020

  (Purchasing power parities)

Remarks

The elaboration of the 2006-2017 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 the 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: 29-11-2019

  (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: 29-11-2019

  (Total intramural R&D expenditure (GERD) by sectors of performance)

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

- https://www.bfs.admin.ch/bfs/fr/home/statistiques/education-science/technologie/systeme-indicateurs/acces-indicateurs/input-s-t/depenses-r-d-entreprises-privees.html

  Downloaded: 04-12-2019

  (R&D in business enterprise sector in Switzerland)

Structural ANalysis Database (STAN) from OECD

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

  Downloaded: 14-11-2018

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

Exchange rates and PPP from Eurostat

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

  Downloaded: 09-01-2020

  (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: 09-01-2020

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

  Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from annual macro-economic database of the European Commission (AMECO)

- https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm

  Downloaded: 09-01-2020

  (Purchasing power parities)

Remarks

The elaboration of the 2006-2017 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 Federal Statistical Office (BFS) and OECD.

The main sources of Business Expenditure R&D data are Expenditure on R&D of private companies (Federal Statistical Office) and STAN R&D expenditures (OECD).

Data for Switzerland has been modified due to a change in the data published by Eurostat to correct an issue in sector C26 in 2012. Eurostat published in 2012 a value for sector C26 that it is now assigned to sector C261. This variation raised the question as to which should be the correct data for sector C26. The Federal Statistical Office (BFS) of Switzerland was consulted in this regard to compare the data they published with the data from Eurostat. The BFS has confirmed that the sum of its statistics published as "Instruments haute technologies" + "TIC – fabrication" is the sum of NACE industries C26 and C303. Therefore, this value should be assigned completely to sector C26.

On the other hand, considering the limited information available for the services sector, it has been decided to give only data for the total ICT services subsector and not for its components. Total ICT services sector data is obtained from the Statistics on R&D in Switzerland (*Rechercheetdéveloppement (R-D) dans les entreprises*), which has been only produced for years 2008, 2012, 2015 and 2017.

This above mentioned issue is particularly relevant in the case of the Operational definition of the ICT services sector. Given the fact that in the comprehensive classification it is not possible to disentangle ICT trade from the total ICT services sector, we cannot compute operational total ICT services sector. In previous

editions of the PREDICT database this data was estimated with Eurostat data that has been discontinued this year.

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)

- https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8104.02017-18?OpenDocument

  Downloaded: 29-01-2020

  (Business expenditure on R&D)

- https://www.abs.gov.au/ausstats/abs@.nsf/Latestproducts/8104.0Main%20Features22017-18?opendocument&tabname=Summary&prodno=8104.0&issue=2017-18&num=&view=

  Downloaded: 29-01-2020

  (Gross Expenditure on R&D)

Research and Experimental Development, Higher Education Organisations, Australia

- https://www.abs.gov.au/ausstats/abs@.nsf/0/AE02B963FB1D51B2CA2571B60075B1C0?Opendocument

  Downloaded: 29-01-2020

  (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/DetailsPage/8109.02016-17?OpenDocument

  Downloaded: 29-01-2020

  (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=ANBERD2011_REV3

  Downloaded: 14-10-2016

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

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDU

  Downloaded: 09-12-2019

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

- https://stats.oecd.org/Index.aspx?DataSetCode=GERD_SOF

  Downloaded: 09-12-2019

(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: 09-01-2020

  (Exchange rates)

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

  Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 ANSZIC 2006 and NACE Rev. 2[21]. 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 information available for 2012, 2014 and 2016 on BERD and GERD in the official Australian Statistics (ABS), as the frequency of the "Survey of Research and Experimental Development (R&D), Businesses" changed from annual to biennial since the 2011-2012 data release. However, the OECD provides estimates on BERD for this country for the years 2012 and 2014. When available, we rely on the OECD estimates and we use average growth rates and percentage structures from previous and following years to obtain the required sectoral disaggregation.

The official Australian Statistics (ABS) published in 2019 information for year 2017. In consequence, data on BERD for 2016 has been estimated using the average growth rate of published BERD (ABS). On the other hand, GERD for 2016 has been estimated using ABS statistics on Government and private non-profit and Higher

[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).

education R&D expenditure, combined with the estimated figure of BERD for 2016. Data on sectors for 2016 has been estimated using average growth rates from 2015 and 2017, and then these figures have been adjusted to total BERD.

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 1993[22]). 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) incudes *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)

- https://www.ibge.gov.br/en/np-statistics/multi-domain/science-technology-and-innovation/17379-survey-of-innovation.html?=&t=o-que-e

  Downloaded: 28-11-2018

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

- http://data.uis.unesco.org/

  Downloaded: 09-01-2020

[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=&

Annual Survey of Industry from IBGE

- http://www.ibge.gov.br/home/estatistica/economia/industria/pia/empresas/2014/defaultempresa.shtm

  Downloaded: 7-11-2016

Exchange rates and PPP from Eurostat

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

  Downloaded: 09-01-2020

  (Exchange rates)

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

  Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 sectors[23]. However, PINTEC survey is only available for 2000, 2003, 2005, 2008, 2011 and 2014, 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

[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).

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 2017 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

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2710033301

  Downloaded: 15-12-2019

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

  Downloaded: 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

  Downloaded: 13-11-2019

Annual Wholesale Trade Survey from Statistics Canada

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2010007701

  Downloaded: 27-01-2020

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

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDU

  Downloaded: 09-12-2019

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

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

  Downloaded: 09-12-2019

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

- https://stats.oecd.org/Index.aspx?DataSetCode=GERD_SOF

  Downloaded: 09-12-2019

  (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: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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, although sectoral data are only available up to 2016. 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 and relying on national sources when necessary. However, the national R&D survey has suffered a methodological and conceptual revision from 2014 onwards[24] that has caused a break in the series at the sectoral level. According to Statistics Canada, a back-casted dataset for specific variables (including: total in-house R&D expenditures, total outsourced R&D expenditures and total R&D personnel) by industry group will be provided in the future for the period 2008-2013. Until these homogenous back-casted series are published and in order to elaborate this PREDICT dataset, the criterion adopted is to use OECD published data, taking into account that data should be read with caution when comparing 2014 data with historical datasets.

As mentioned previously, additional information is needed 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. 4[25]. Data on BERD for 2017 by sectors (which is not available in the OECD database) has been estimated using data from CANSIM (data directly published is used when there is a clear correspondence between NAICS and ISIC Rev. 4, while in other cases growth rates or structures are applied). Then, data by sectors has been adjusted to total BERD, which is the official figure published by Statistics Canada and the OECD.

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).

[24] According to the correspondence maintained with Statistics Canada, several aspects of the R&D survey were redesigned, including concepts, methodology, the collection method and the data processing system. Prior to 2014, the survey was considered a census of known. Beginning with reference year 2014, the R&D survey is a weighted stratified sample survey, supplemented by administrative tax data.

[25] The correspondence between NAICS and ISIC Rev. 4 is 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 a correspondence table for ICT, MC and RS sectors between NACE Rev. 2 and NAICS (see Annex II).

- 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.

Canada's data 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: 03-01-2020

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: 03-01-2020

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: 03-01-2020

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

- https://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDU
  Downloaded: 09-12-2019
  (R&D expenditures by industry (ISIC Rev. 4))
- https://stats.oecd.org/Index.aspx?DataSetCode=GERD_SOF
  Downloaded: 09-12-2019
  (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: 09-01-2020
  (Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
  Downloaded: 09-01-2020
  (Purchasing power parities)

PPP from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=PPPGDP
  Downloaded: 09-01-2020
  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx
  Downloaded: 09-01-2020
  (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 publishes ISIC Rev. 4 R&D data for China. However, data are only available for the years 2000 and 2008-2017. 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)[26]. 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), while in other cases, the estimation of services sector figures has been based on BERD/GVA ratios corresponding to the most proximate years or the closest sectoral aggregation. 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.

China's 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), Retail sale via mail order houses or via Internet sector (NACE 4791) and Education (NACE 85). 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 2000-2016, 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 2011-12 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

Research and Development Statistics 2017-18 from National Science and Technology Management Information System (NSTMIS), Department of Science and Technology, Government of India

- http://www.nstmis-dst.org/newsite/Publication.aspx

  Downloaded: 15-11-2018

Annual Survey of Industries from MOSPI

- https://data.gov.in/catalog/annual-survey-industries-1

  Downloaded: 17-10-2017

[26] The correspondence between Chinese SIC and ISIC Rev. 3 is available at: http://www.stats.gov.cn/tjsj/tjbz/hyflbz/201710/t20171012_1541679.html. Ivie has also elaborated a correspondence table for ICT sectors (see Annex II)

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

- http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS

  Downloaded: 20-01-2020

Exchange rates and PPP from Eurostat

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

  Downloaded: 09-01-2020

  (Exchange rates)

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

  Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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's dataset has been obtained using approximate correspondences between the classification of activities used in the Research and Development Statistics of India 2011-12 and NACE Rev. 1.1 (Research and Development Statistics 2017-18 does not offer information by industry). 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 using information from previous years, as the most recent national R&D survey in India (2017-18) does not offer information by sector. Therefore, the main source for the sectoral distribution of BERD is the previous R&D survey, which offers information by sector up to 2010. This information has been used to estimate the sectoral distribution for 2011, 2012 and 2013, while there is no such information for India for the period 2014 to 2017.

Thus, India's dataset covers the years between 2002 and 2013 (in addition to total GERD and BERD for 2014-2017), but does not contain information for 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. GERD and BERD figures for 2017 have been estimated using the ratios GERD/GDP and BERD/GERD from previous years, as no other information is available at the moment.

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/en/stat-search/files?page=1&toukei=00200543
  Downloaded: 16-01-2020

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDU
  Downloaded: 09-12-2019
  (R&D expenditures by industry (ISIC Rev. 4))
- http://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDUSTRY
  Downloaded: 16-11-2017
  (R&D expenditures by industry (ISIC Rev. 3.1))
- https://stats.oecd.org/Index.aspx?DataSetCode=GERD_SOF
  Downloaded: 09-12-2019
  (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: 09-01-2020
  (Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en
  Downloaded: 09-01-2020

(Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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's 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=ANBERD2011_REV3

  Downloaded: 14-10-2016

  (STAN R&D expenditures by industry (ISIC Rev. 3))

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDU

  Downloaded: 09-12-2019

  (Business R&D expenditure by industry (ISIC Rev. 4))
- https://stats.oecd.org/Index.aspx?DataSetCode=GERD_SOF

  Downloaded: 09-12-2019

  (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: 09-01-2020

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

  Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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. However, the OECD does not offer information by industry for 2016 and 2017 (last two years included in PREDICT database) and neither does Statistics Korea. Due to this, industry disaggregation for these years has been estimated using average growth rates or data percentage structures from previous years, adjusting them to the total BERD OECD official figure. Thus, results must be taken with caution.

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's 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) for the initial years.

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

- Information provided by Margarita Bobrova (Department for Foreign Statistics and International Projects from Rosstat) in December 2018

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

- https://stats.oecd.org/Index.aspx?DataSetCode=GERD_SOF

  Downloaded: 09-12-2019

  (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: 09-01-2020

  (Exchange rates)

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

  Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 Annex II). In addition, this database does not offer information for the years 2010-2017. 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 was used. Also, information provided directly to the Ivie by Rosstat is used to estimate some ICT subsectors.

As national data follows ISIC Rev. 3.1 up to 2016, 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's 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) in the years 1995-2016. It does not include information also on 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 for the years 1995-2016, also 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.

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: 11-12-2019

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

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

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDU

  Downloaded: 09-12-2019

  (R&D expenditures by industry (ISIC Rev. 4))
- https://stats.oecd.org/Index.aspx?DataSetCode=GERD_SOF

  Downloaded: 09-12-2019

  (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: 09-01-2020

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

  Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 Annex II). 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's 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's 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 European countries methodology section for more details).

Taiwan's 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.) are neither available.

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 Survey (BRDS) from National Science Foundation and United States Census Bureau

- https://www.nsf.gov/statistics/srvybrds/#tabs-1

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

Business R&D and Innovation Survey (BRDIS) 2008-2016 from National Science Foundation and United States Census Bureau

- https://ncses.nsf.gov/pubs/nsf18313

  Downloaded: 24-11-2018

  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) 1953-2007 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=ANBERD2011_REV3

  Downloaded: 14-10-2016

  (STAN R&D expenditures by industry (ISIC Rev. 3))

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=BERD_INDU

  Downloaded: 09-12-2019

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

- https://stats.oecd.org/Index.aspx?DataSetCode=GERD_SOF

  Downloaded: 09-10-2019

  (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: 09-01-2020

  (Exchange rates)

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

  Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 2017, data for this year come directly from Business R&D Survey (BRDS) (elaborated by National Science Foundation and United States Census Bureau).

In order to complete the distribution by industry, information coming from BRDS, its predecessor, the 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. 2[27]. Additional correspondences need to be used in order to take into account the different revisions of the NAICS[28] (1997, 2002, 2007, 2012 and 2017) and also the previous classification, SIC (Standard Industrial Classification) 1987, which was used in the initial years of the database (1995 to 2007).

The 2008 BRDIS data offer a greater industrial disaggregation. For this reason this year's 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/BRDS.

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.

[27] 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)

[28] These correspondences are available at:

http://www.census.gov/eos/www/naics/concordances/concordances.html.

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: 29-11-2019

  (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: 21-11-2018

  (Research and development Statistics in Denmark)

  http://www.statistikdatabasen.scb.se/pxweb/en/ssd/

  Downloaded: 04-12-2019

  (Research and development in Sweden)

- http://statdat.statistics.sk/

  Downloaded: 15-10-2016

  (Expenditures on research and development in Slovakia)

- https://www.bfs.admin.ch/bfs/fr/home/statistiques/education-science/technologie/systeme-indicateurs/acces-indicateurs/input-s-t/depenses-r-d-entreprises-privees.html

  Downloaded: 04-12-2019

(R&D in business enterprise sector in Switzerland)

- 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 2006-2017 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, Spain and Switzerland.

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)[29].

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); distribution of sector 26 (Manufacture of computer, electronic and optical products) to 3-digits; weight of the sector 631 (Data processing, hosting and related activities; web portals) in sector 63 (Information service activities).

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

[29] 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

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).

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 (EU28) and for European Union without United Kingdom /EU27_2020) 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 each country 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 (EU28) and the European Union without United Kingdom (EU27_2020) 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: 29-11-2019

(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 2006-2017 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: 29-11-2019

  (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))

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

- https://www.bfs.admin.ch/bfs/fr/home/statistiques/education-science/technologie/systeme-indicateurs/acces-indicateurs/input-s-t/depenses-r-d-entreprises-privees.html

  Downloaded: 04-12-2019

  (R&D in business enterprise sector in Switzerland)

Remarks

The elaboration of the 2006-2017 R&D Personnel NACE Rev. 2 database (in full-time equivalent) for Switzerland has been based on the information provided by Federal Statistical Office (BFS).

The main source of R&D Personnel data is Statistics on Research and Development Personnel (BFS).

Data for Switzerland has been modified due to a change in the data published by Eurostat to correct an issue in sector C26 in 2012. Eurostat published in 2012 a value for sector C26 that it is now assigned to sector C261. This variation raised the question as to which should be the correct data for sector C26. The Federal Statistical Office (BFS) of Switzerland was consulted in this regard to compare the data they published with the data from Eurostat. The BFS has confirmed that the sum of its statistics published as "Instruments haute technologies" + "TIC – fabrication" is the sum of NACE industries C26 and C303. Therefore, this value should be assigned completely to sector C26.

On the other hand, considering the limited information available for the services sector, it has been decided to give only data for the total ICT services subsector and not for its components. Total ICT services sector data is obtained from the Statistics on R&D in Switzerland (*Rechercheetdéveloppement (R-D) dans les entreprises*), which has been only produced for years 2008, 2012, 2015 and 2017.

This above mentioned issue is particularly relevant in the case of the Operational definition of the ICT services sector. Given the fact that in the comprehensive classification it is not possible to disentangle ICT trade from the total ICT services sector, we cannot compute operational total ICT services sector. In previous editions of the PREDICT database this data was estimated with Eurostat data that has been discontinued this year.

Statistics on R&D in Switzerland (*Rechercheetdéveloppement (R-D) dans les entreprises*) is conducted every four years, with exception of 2017. Only four years are available: 2008, 2012, 2015 and 2017.

Australia

Sources

- http://www.abs.gov.au/ausstats/abs@.nsf/0/17EF02A5029649E2CA257F990030EDFE?Opendocument

  Downloaded: 30-01-2020

  (R&D researchers)

Research and Experimental Development, Higher Education Organisations, Australia

- http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8111.02016?OpenDocument

  Downloaded: 30-01-2020

  (Higher education R&D researchers)

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

- http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8109.02016-17?OpenDocument

  Downloaded: 30-01-2020

  (Government R&D researchers and Private non-profit R&D researchers)

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 09-12-2019

  (R&D personnel (ISIC Rev. 4))

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

  Downloaded: 09-12-2019

  (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 2015. 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 took 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 ANSZIC 2006 and NACE Rev. 2[30]. When necessary, methods such as interpolation have been used in the case of some industries to complete the database.

[30] 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 ANZIC 2006 (see Annex II).

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 1993[31]). 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 data available for 2012, 2014 and 2016 in the case of Australia, as the frequency of the "Survey of Research and Experimental Development (R&D), Businesses" changed from annual to biennial since the 2011-2012 data release. 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 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. The OECD has published data for 2015 for some sectors. If data is available in the OECD, we rely on their figures; but if not, we use data from the Research and Experimental Development survey (published by the Australian Bureau of Statistics, ABS).

In 2019 data for PERD in 2017 was released. Data for 2016 has been estimated using the ABS statistics on Government and private non-profit and higher education Human Resources devoted to R&D. Industry data for 2017 is published in the Research and Experimental Development Survey. This survey is used to estimate data on sectors for 2016. More precisely, the estimation is carried out using the average growth rates from 2015 and 2017 for each industry, and then adjusting these figures to total PERD.

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.

[31] 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=&

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.

Brazil

Sources

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

- https://www.ibge.gov.br/en/np-statistics/multi-domain/science-technology-and-innovation/17379-survey-of-innovation.html?=&t=o-que-e

  Downloaded: 28-11-2018

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

- http://data.uis.unesco.org/

  Downloaded: 09-01-2020

Annual Survey of Industry from IBGE

- http://www.ibge.gov.br/home/estatistica/economia/industria/pia/empresas/2014/defaultempresa.shtm

  Downloaded: 7-11-2016

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, 2011 and 2014). We have used PINTEC data by industry and correspondences between CNAE 2/CNAE 1 and NACE Rev. 2 to distribute R&D personnel among sectors[32]. However, PINTEC survey is only available for 2000, 2003, 2005, 2008, 2011 and 2014, 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

[32] See Annex II and the correspondence between CNAE 2 and ISIC Rev. 4 at: https://www.ibge.gov.br/estatisticas-novoportal/metodos-e-classificacoes/classificacoes-e-listas-estatisticas/9078-classificacao-nacional-de-atividades-economicas.html.

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

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2710033701

  Downloaded: 27-01-2020

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

  Downloaded: 26-10-2016

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 09-12-2019

  (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

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410022001

  Downloaded: 13-11-2019

Labour Productivity Accounts from Statistics Canada

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610048001

  Downloaded: 13-11-2019

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. The OECD has sectoral data for Canada only up to 2016, while Statistics Canada up to 2017. However, it has to be taken into account that the national R&D

survey suffered a methodological and conceptual revision in 2014 that caused a break in the series at the sectoral level. Hence, a comparison between the series for the years prior to and after 2014 has to be taken with caution. Data based on the new methodology is available in Statistics Canada for the period 2014 to 2017. According to the correspondence maintained with this Institute, they will provide a back-casted dataset for specific variables (including: total in-house R&D expenditures, total outsourced R&D expenditures, and total R&D personnel) in the future by industry group for the period 2008-2013. Until this new information is published, the criterion adopted for this PREDICT dataset is to use as a basis data from the OECD for 2014, 2015 and 2016 and from CANSIM to estimate 2017.

Additional information is also necessary 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. 4[33].

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's data 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.

[33] 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).

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: 03-01-2020

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: 03-01-2020

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: 03-01-2020

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 09-12-2019

  (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))
- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_FUNC

  Downloaded: 09-12-2019

  (R&D personnel by sector and function)

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, at present, data is only available for the period 2008-2017 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)[34].

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's R&D personnel dataset only offers information for the period 2005-2017 (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.

India

Sources

Research and Development Statistics 2011-12 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

Research and Development Statistics 2017-18 from National Science and Technology Management Information System (NSTMIS), Department of Science and Technology, Government of India

- http://www.nstmis-dst.org/newsite/Publication.aspx

  Downloaded: 15-11-2018

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

- http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS

  Downloaded: 20-01-2020

Annual Survey of Industries from MOSPI

- https://data.gov.in/catalog/annual-survey-industries-1

[34] The correspondence between Chinese SIC and ISIC Rev. 3 is available at: http://www.stats.gov.cn/tjsj/tjbz/hyflbz/201710/t20171012_1541679.html. Ivie has also elaborated a correspondence table for ICT sectors (see Appendix 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, 2011-2014 and 2016-2017 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, sectoral data only covers the years between 2002 and 2013. 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/en/stat-search/files?page=1&toukei=00200543&result_page=1

  Downloaded: 17-01-2020

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 09-12-2019

  (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 Annex II) have been used. For non-ICT industries, the official correspondence table between JSIC and NACE Rev. 2 has been used[35].

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 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

Survey of Research and Development in Korea from Ministry of Science, ICT and Future Planning

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01&statId=1982011&themaId=#0_3_5_1.4

[35] 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

Ivie has also elaborated a correspondence table for ICT and RS sectors (see Annex II).

Downloaded: 15-01-2020

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 03-02-2020

  (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))

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_FUNC

  Downloaded: 15-01-2020

  (R&D personnel by sector and function)

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 Korea's 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. 2[36]. Data for 2016 and 2017 have been estimated by using the Survey of Research and Development in Korea and by applying average growth rates and percentage structures from previous years, adjusting them to the total PERD OECD figure.

For the remaining years, and 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 for 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 sometimes 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's 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

[36] See Mas, Robledo and Pérez (2012).

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
- Information provided by Margarita Bobrova (Department for Foreign Statistics and International Projects from Rosstat) in December 2018

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_FUNC

  Downloaded: 09-12-2019

  (R&D personnel by sector and function)

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 Annex II) for the majority of the years.

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 (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.

The 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), 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. Also, sector 85 (Education) is not available for the last three years

included in the database and sectors 27-28 (Manufacture of machinery and equipment) and 303 (Manufacture of air and spacecraft and related machinery) are only available since 2012. Sector 58-63 (Information and communication) is only available for the last year of the database.

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: 11-12-2019

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 09-12-2019

  (R&D personnel (ISIC Rev. 4))

- https://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 the 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's 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.) are neither available.

United States

Sources

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_FUNC

  Downloaded: 17-01-2020

  (R&D personnel by sector and function. R&D personnel in Business sector)

Remarks

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, BRDIS and BRDS) 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 provides information by industry on this variable for US. Only total PERD data is available from 2011 to 2016 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: 29-11-2019

  (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: 21-11-2018

  (Research and development Statistics in Denmark)

  http://www.statistikdatabasen.scb.se/pxweb/en/ssd/

  Downloaded: 04-12-2019

  (Research and development in Sweden)

- http://statdat.statistics.sk/

  Downloaded: 15-10-2016

  (Expenditures on research and development in Slovakia)

- https://www.bfs.admin.ch/bfs/fr/home/statistiques/education-science/technologie/systeme-indicateurs/acces-indicateurs/input-s-t/depenses-r-d-entreprises-privees.html

  Downloaded: 04-12-2019

(R&D in business enterprise sector in Switzerland)

- 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.

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: 29-11-2019

  (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.

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: 29-11-2019

  (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))

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

- https://www.bfs.admin.ch/bfs/fr/home/statistiques/education-science/technologie/systeme-indicateurs/acces-indicateurs/input-s-t/depenses-r-d-entreprises-privees.html

  Downloaded: 04-12-2019

  (R&D in business enterprise sector in Switzerland)

Remarks

The methodology is the same as for R&D Personnel.

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: 30-01-2020

  (R&D researchers)

Research and Experimental Development, Higher Education Organisations, Australia

- http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8111.02016?OpenDocument

  Downloaded: 30-01-2020

  (Higher education R&D researchers)

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

- http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8109.02016-17?OpenDocument

  Downloaded: 30-01-2020

  (Government R&D researchers and Private non-profit R&D researchers)

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 09-12-2019

  (R&D researchers (ISIC Rev. 4))

- https://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 it has already published NACE Rev. 2 data (ISIC Rev. 4) for the years 2006 to 2015. 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 took 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 ANSZIC 2006 and NACE Rev. 2[37]. 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, 2014 and 2016 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 three years, the ABS statistics on Government and private non-profit and higher education R&D expenditure have been used in combination with 2013, 2015 and 2017 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. The OECD has published data for 2015 for some sectors. If data is available from the OECD, we rely on their figures; but if not, we use data from the Research and Experimental Development survey 2015-2016 (published by the Australian Bureau of Statistics, ABS).

In 2019 data for PERD in 2017 was released. Data for 2016 has been estimated using the ABS statistics on Government and private non-profit and higher education Human Resources devoted to R&D. Industry data for 2017 is published in the Research and Experimental Development Survey. This survey is used to estimate data on sectors for 2016. More precisely, the estimation is carried out using the average growth rates from 2015 and 2017 for each industry, then these figures have been adjusted to total PERD.

[37] 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).

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) incudes 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)

- https://www.ibge.gov.br/en/np-statistics/multi-domain/science-technology-and-innovation/17379-survey-of-innovation.html?=&t=o-que-e

  Downloaded: 28-11-2018

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

- http://data.uis.unesco.org/

  Downloaded: 09-01-2020

Annual Survey of Industry from IBGE

- http://www.ibge.gov.br/home/estatistica/economia/industria/pia/empresas/2014/defaultempresa.shtm

  Downloaded: 7-11-2016

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 and 2014 (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 sectors[38]. 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

[38] See Annex II and the correspondence between CNAE 2 and ISIC Rev. 4 at: https://www.ibge.gov.br/estatisticas-novoportal/metodos-e-classificacoes/classificacoes-e-listas-estatisticas/9078-classificacao-nacional-de-atividades-economicas.html.

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 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

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2710033701

  Downloaded: 27-01-2020
- http://www.statcan.gc.ca/eng/subjects/science_and_technology/research_and_development#data

  Downloaded: 26-10-2016

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 09-12-2019

  (R&D researchers by industry (ISIC Rev. 4))
- https://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

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410022001

  Downloaded: 13-11-2019

Labour Productivity Accounts from Statistics Canada

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610048001

  Downloaded: 13-11-2019

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.

Sectoral data for Canada in the OECD database are available up to 2015, and up to 2016 in Statistics Canada. However, the national R&D survey suffered a methodological and conceptual revision in 2014 that has caused a break in series at the sectoral level. Hence, the comparison between the figures prior to and after 2014 should be taken with caution. Data based on the new methodology is available in Statistics Canada for the period 2014-2016. According to the correspondence maintained with this Institute, they are going to provide a back-casted dataset for specific variables (including: total in-house R&D expenditures, total outsourced R&D expenditures, and total R&D personnel) by industry group for the period from 2008 to 2013. However, for this PREDICT dataset, the criterion that has been adopted is to use the data published by the OECD when it is available. Therefore, only data for 2017 has been totally estimated taking as a basis data from CANSIM.

Additional information has been used 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. 4[39].

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's 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.

[39] 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).

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: 03-01-2020

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: 03-01-2020

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: 03-01-2020

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 09-12-2019

  (R&D researchers by industry (ISIC Rev. 4))
- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY

  Downloaded: 14-10-2016

  (R&D researchers (ISIC Rev. 3.1))
- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_FUNC

  Downloaded: 09-12-2019

  (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 published for the first time NACE Rev. 2 data for China. However, data are only available for the period 2008-2017 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's 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 2005-2017 in the case of China.

India

Sources

Research and Development Statistics 2011-12 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

Research and Development Statistics 2017-18 from National Science and Technology Management Information System (NSTMIS), Department of Science and Technology, Government of India

- http://www.nstmis-dst.org/newsite/Publication.aspx

  Downloaded: 15-11-2018

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

- http://data.uis.unesco.org/Index.aspx?DataSetCode=SCN_DS

  Downloaded: 20-01-2020

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 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/en/stat-search/files?page=1&toukei=00200543&result_page=1

  Downloaded: 17-01-2020

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 09-12-2019

  (R&D researchers (ISIC Rev. 4))

- https://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. 2[40] 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.

[40] 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

Ivie has also elaborated a correspondence table for ICT and RS sectors (see Annex II).

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

Survey of Research and Development in Korea from Ministry of Science, ICT and Future Planning

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01&statId=1982011&themaId=#0_3_5_1.4

  Downloaded: 15-01-2020

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDU

  Downloaded: 03-02-2020

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

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY

  Downloaded: 14-10-2016

  (R&D researchers by industry (ISIC Rev. 3.1))

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_FUNC

  Downloaded: 15-01-2020

  (R&D personnel by sector and function: researchers)

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's 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 Rev. 4 (NACE Rev. 2)[41]. However, OECD data by industry is not available for 2016 and 2017. In order to obtain an estimation for both years, average growth rates and percentage structures from previous years have been used, adjusting them to the total Researchers OECD official figures.

Also, in the case of some specific 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.

[41] See Mas, Robledo and Pérez (2012).

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
- Information provided by Margarita Bobrova (Department for Foreign Statistics and International Projects from Rosstat) in December 2018

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_FUNC

  Downloaded: 09-12-2019

  (R&D personnel by sector and function: researchers)

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 1995-2017, 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 ratios have been used as well in order to estimate data for some years/industries.

The 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), 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. Sector 85 (Education) is not available for the last two years included in the database and sector 58-63 (Information and communication) is only available for the last year. 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. Sector 631 is only available for 2017.

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: 11-12-2019

Research and Development Statistics from OECD

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY

  Downloaded: 09-12-2019

  (R&D researchers (ISIC Rev. 4))

- https://stats.oecd.org/Index.aspx?DataSetCode=BERD_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 the 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's 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 Survey (BRDS) from National Science Foundation and United States Census Bureau

- https://www.nsf.gov/statistics/srvybrds/#tabs-1
- Information provided by Raymond M. Wolfe (Economist & Senior Analyst of National Science Foundation 's National Center for Science and Engineering Statistics (NCSES))

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

- https://ncses.nsf.gov/pubs/nsf18313

  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

- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_INDUSTRY

  Downloaded: 14-11-2016

  (R&D researchers (ISIC Rev. 3.1))
- https://stats.oecd.org/Index.aspx?DataSetCode=PERS_FUNC

  Downloaded: 17-01-2020

  (R&D personnel by sector of employment and function. 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 Survey (BRDS) and its predecessors, Business R&D and Innovation Survey (BRDIS), conducted since 2008 till 2016, and Survey of Industrial Research and Development (National Science Foundation), conducted prior to 2008. Researchers' figures have been distributed among ICT, RS, MC and selected macro-sectors, using the correspondence tables between

NAICS and NACE Rev. 2[42] (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 BRDS, BRDIS and SIRD are generally comparable and the definitions used in all of them 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 more recent surveys and SIRD, 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 BRDIS and BRDS. 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.

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, changed their policy with respect to the previous years, 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 database. Consequently, the US researchers' dataset is complete in PREDICT 2020 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 United States' 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. Sector NACE 581 (Publishing of books, periodicals and other publishing activities) is also not available for 2016-2017.

[42] 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)

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. Since 2017 PREDICT database estimates ICT GBARD not only by NABS industries. As in previous editions PREDICT's 2020 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, i.e. is 2018. The methodology applied in the PREDICT 2020 database heavily relies in both Stančík (2012)[43] and Mas et al. (2016)[44]. A complete description of the methodology is described in section 5 (Estimation of ICT GBARD).

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 expenditure. 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-97 codes 5a, 5b and 6 or ISCED-2011 codes 5, 6, 7 and 8) in total labour costs. Finally, to compute the part of R&D public funding devoted to ICTs in each NACE industry, it is assumed that the proportion of expenditure in R&D related to 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 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, 2019 and 2020 databases, 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, the weights of each NACE-NABS crossing and the 2015 ICT shares are held constant in 2016, 2017 and 2018.

[43] Stančik, 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

[44] 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

Sources

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

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

  Downloaded: 05-11-2019 (data last updated by Eurostat: 10-10-2019).

  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: 04-12-2019 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. GBARD data for the US by NABS chapters were downloaded from Eurostat's website.

Sources

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

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

  Downloaded: 05-11-2019 (data last updated by Eurostat: 10-10-2019).

  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: 27-12-2019

  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.

$$ICT\_R\&D\_emp\_share_t = \frac{\sum_{k:ICT\ occupations} employees_t * monthly\_wages_t}{\sum_{k:tertiary\ edu} employees_t * monthly\_wages_t}$$

GBARD data for the Japan by NABS chapters were downloaded from Eurostat's website.

Sources

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

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

  Downloaded: 05-11-2019 (data last updated by Eurostat: 10-10-2019).

  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: 03-01-2020

  Data by school career

- http://www.e-stat.go.jp/SG1/estat/GL08020101.do?_toGL08020101_&tstatCode=000001011429&requestSender=dsearch

  Downloaded: 03-01-2020

  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: 16-03-2020

  (GDP and main components (output, expenditure and income) for EU28 and EU27_2020)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a10&lang=en

  Downloaded: 16-03-2020

  (Gross value added and income by A*10 industry breakdowns for EU28 and EU27_2020)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64&lang=en

  Downloaded: 16-03-2020

  (National Accounts aggregates by industry (up to NACE A*64) for EU28 and EU27_2020)

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: 15-10-2019

  (GDP and main components (output, expenditure and income))

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a10&lang=en

  Downloaded: 15-10-2019

  (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: 15-10-2019

  (National Accounts aggregates by industry (up to NACE A*64)

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (GDP and main components - Current prices)

- http://ec.europa.eu/eurostat

Downloaded: 09-06-2016

(National Accounts by 10 branches - aggregates at current prices)

- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 21 branches - aggregates at current prices)

- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 38 branches - aggregates at current prices)

- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 64 branches - aggregates at current prices)

National Accounts (NA) ESA 1995 NACE Rev 1.1 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

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

- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 31 branches - aggregates at current prices)

- http://ec.europa.eu/eurostat

  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: 15-10-2019

ESA 1995 Input-Output tables (information available upon request)

- http://ec.europa.eu/eurostat

  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: 25-11-2019

  (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: 25-11-2019

  (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: 25-11-2019

  (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: 25-11-2019

  (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/database/niots13

  Downloaded: 15-10-2015

  (National Input-Output Tables, Released November 2013)

- http://www.wiod.org/database/seas13

  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: 09-01-2020

  (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: 09-01-2020

  (Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from annual macro-economic database of the European Commission (AMECO)

- https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm

  Downloaded: 09-01-2020

  (Purchasing power parities)

Remarks

The main source of the GVA, GDP and GO NACE Rev. 2 dataset in nominal euros for the European aggregates and Member States is NA from Eurostat (downloaded on 15-10-2019), 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.

After the compliation and processing the data for the database, Eurostat published a major revision of the National Accounts EU aggregates in March 2020. Therefore, we have decided to use the most recent data available (March, 2020) to update our previous series of GVA, GO and implicit deflator using this new information, for EU-28 countries (2013-2018) and the EU-27 (since 2020 without United Kingdom).

In the March 2020 version of Eurostat NA, the information for some of the NACE Rev. 2 manufacturing industries are confidential from 2015 onwards. This is the case of Manufacture of chemicals and chemical products (division 20), Manufacture of basic pharmaceutical products and pharmaceutical preparations (division 21), Manufacture of computer, electronic and optical products (division 26), Manufacture of machinery and equipment n.e.c. (division 28), Manufacture of other transport

equipment (division 30) and Manufacture of furniture and other manufacturing (divisions 31 to 32).

In order to obtain an estimate of those manufacturing sectors for which we have no data, we build the feasible European aggregate that the March 2020 update of NA allows. This feasible aggregate contains data for all Member States, that have complete information for these sectors and for the the complete period, i.e. all countries except Ireland, Malta, Luxembourg and Sweden. We use the annual growth rates of growth of the new European aggregate to extend VA and GO data for EU28 and EU27 up to 2017.

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 before 2000 for Latvia.

This NA disaggregation is not detailed enough to obtain the complete 4-digit datasets from 1995 onwards. 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 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 Annex II) and the methodology described in Mas, Robledo y Pérez (2012)[45]. 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

[45] 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

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.

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 (GVA) or growth rates of a more aggregated sector in the statistic. Croatia, , Luxembourg, Malta, 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 28 countries (2013-2018) for the period 1995-2004 is obtained as the sum of the member countries since official data is not available. Similarly, the European Union 27 countries (since 2020 without United Kingdom) for the period 1995-2013 had been obtained as the sum of the member countries due to a lack of official GO data for all the period. We obtain GVA and GO dataset in PPS using purchasing power parities from Eurostat.

Additionally, we provide price indexes (implicit deflators, reference year 2015=100) 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. 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: 15-10-2019

  (GDP and main components (output, expenditure and income))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a10&lang=en

  Downloaded: 15-10-2019

  (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: 15-10-2019

  (National Accounts aggregates by industry (up to NACE A*64)

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (GDP and main components - Current prices)
- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 10 branches - aggregates at current prices)
- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 21 branches - aggregates at current prices)
- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 38 branches - aggregates at current prices)
- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 64 branches - aggregates at current prices)

National Accounts (NA) ESA 1995 NACE Rev 1.1 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

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

- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 31 branches - aggregates at current prices)

- http://ec.europa.eu/eurostat

  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: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from annual macro-economic database of the European Commission (AMECO)

- https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm

  Downloaded: 09-01-2020

  (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 Annex II) 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, reference year 2015=100) 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.

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: 15-10-2019

  (GDP and main components (output, expenditure and income))
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a10&lang=en

  Downloaded: 15-10-2019

  (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: 15-10-2019

  (National Accounts aggregates by industry (up to NACE A*64)

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (GDP and main components - Current prices)
- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 10 branches - aggregates at current prices)
- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 21 branches - aggregates at current prices)
- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 38 branches - aggregates at current prices)
- http://ec.europa.eu/eurostat

  Downloaded: 09-06-2016

  (National Accounts by 64 branches - aggregates at current prices)

National Accounts (NA) ESA 1995 NACE Rev 1.1 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 6 branches - aggregates at current prices)
- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 31 branches - aggregates at current prices)
- http://ec.europa.eu/eurostat

  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: 15-10-2019

ESA 1995 Input-Output tables (information available upon request)

- http://ec.europa.eu/eurostat

  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: 25-11-2019

  (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: 25-11-2019

  (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: 25-11-2019

  (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: 25-11-2019

  (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=naio_10_cp1610&lang=en Downloaded: 09-01-2020

  (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: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from annual macro-economic database of the European Commission (AMECO)

- https://ec.europa.eu/economy_finance/ameco/user/serie/SelectSerie.cfm

  Downloaded: 09-01-2020

  (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 Annex II) 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. 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.

Australia

Sources

NA from Australian Bureau of Statistics (ABS)

- http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/110953FFA28D4E52CA2572110002FF03?opendocument

  Downloaded: 24-09-2019

Australian Industry from ABS

- http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/48791677FF5B2814CA256A1D0001FECD?opendocument

  Downloaded: 24-09-2019

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

  Downloaded: 05-10-2015

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: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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. 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.

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, reference year 2015=100) 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.

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: 25-09-2019

[46] The correspondence between ANZIC 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).

Quarterly National Accounts from Instituto Brasileiro de Geografia e Estatística (IBGE)

- https://www.ibge.gov.br/estatisticas/economicas/comercio/9300-contas-nacionais-trimestrais.html?=&t=resultados

  Downloaded: 25-09-2019

Annual Survey of Industry from IBGE

- https://www.ibge.gov.br/estatisticas/economicas/industria/9044-pesquisa-industrial-anual-produto.html?=&t=resultados

  Downloaded: 25-09-2019

Annual Survey of Trade from IBGE

- https://www.ibge.gov.br/estatisticas-novoportal/economicas/comercio/9075-pesquisa-anual-de-comercio.html?&t=resultados

  Downloaded: 25-09-2019

Annual Survey of Services from IBGE

- https://www.ibge.gov.br/estatisticas-novoportal/economicas/servicos/9028-pesquisa-anual-de-servicos.html?&t=resultados

  Downloaded: 25-09-2019

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

- http://www.wiod.org/database/niots13

  Downloaded: 15-10-2015

  (National Input-Output Tables, Released November 2013)

- http://www.wiod.org/database/seas13

  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: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

(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 1995-2017 for GVA, but only for the period 2000-2016 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)[47].

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, reference year 2015=100) 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.

[47] 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).

Canada

Sources

NA from Statistics Canada

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610022201
- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610040101

  Downloaded: 13-11-2019

Annual Survey of Manufactures and Logging from Statistics Canada

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610003801
- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610011701

  Downloaded: 13-11-2019

Annual Non-store Retail Survey from Statistics Canada

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2010007501
- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=2010006801

  Downloaded: 13-11-2019

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: 09-01-2020

  (Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 2007-2016. 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. 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.

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, reference year 2015=100) 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.

[48] 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).

China

Sources

NA from National Bureau of Statistics of China

- http://www.stats.gov.cn/english/Statisticaldata/AnnualData/

  Downloaded: 15-01-2020

World Input-Output Database ISIC Rev. 4 (WIOD)

- http://www.wiod.org/database/seas16

  Downloaded: 12-09-2018

  (Socio Economic Accounts, November 2016 Release)

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

- http://www.wiod.org/database/niots13

  Downloaded: 15-10-2015

  (National Input-Output Tables, Released November 2013)

- http://www.wiod.org/database/seas13

  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: 15-10-2020

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: 15-10-2020

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en Downloaded: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

Downloaded: 09-01-2020

(PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 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 whole period 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)[49].

Most sectors 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.

[49] The correspondence between Chinese SIC and ISIC Rev. 4 is available at: http://www.stats.gov.cn/tjsj/tjbz/hyflbz/201710/t20171012_1541679.html

Additionally, we provide price indexes (implicit deflators, reference year 2015=100) 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.

India

Sources

NA from Ministry of Statistics Programme Implementation (MOSPI).

- http://www.mospi.gov.in/download-reports?main_cat=NzI2&cat=All&sub_category=All

  Downloaded: 20-01-2020

  (National Accounts Statistics)

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

- http://www.wiod.org/new_site/database/niots.htm

  Downloaded: 175-10-2015

  (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.mospi.gov.in/asi-summary-results

  Downloaded: 20-01-2020

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: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

(Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 since2006. 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. 2[50]. 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, reference year 2015=100) 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.

[50] 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.

Japan

Sources

NA from Economic and Social Research Institute (ESRI), Cabinet Office

- https://www.esri.cao.go.jp/en/sna/menu.html

  Downloaded: 10-01-2020

JIP Database 2018 from RIETI and Hitotsubashi University

- https://www.rieti.go.jp/en/database/JIP2018/index.html

  Downloaded: 26-09-2019

JIP Database 2015 from REITI 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: 26-09-2019

Survey of selected services industries from METI

- http://www.meti.go.jp/english/statistics/tyo/tokusabizi/index.html

  Downloaded: 26-09-2019

Structural Business Statistics ISIC Rev. 4 from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=SSIS_BSC_ISIC4

  Downloaded: 26-09-2019

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en Downloaded: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

(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 entire period for both variables. These datasets have been distributed among ICT sector, MC sectors and the rest of industries using mainly the latest version of the JIP Database, that is a fully revised version reflecting changes in the 2008 SNA, that contains a number of important changes as compared to the previous JIP database (2015) (distinguishing 100 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, JIP Database (2015) and correspondence tables between JIP codes, Japan Standard Industrial Classification (JSIC), ISIC Rev. 3 (NACE Rev. 1) and ISIC Rev. 4 (NACE Rev. 2)[51].

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, reference year 2015=100) 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

[51] 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)

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: 29-10-2019

NA from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE6A

  Downloaded: 29-10-2019

Structural Business Statistics ISIC Rev. 4 from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=SSIS_BSC_ISIC4

  Downloaded: 29-10-2019

Mining and Manufacturing Survey from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

  Downloaded: 29-10-2019

Service Industry Survey from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

  Downloaded: 29-10-2019

Survey of Business activities from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

  Downloaded: 29-10-2019

Wholesale and Retail trade Survey from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

  Downloaded: 29-10-2019

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: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 GVA dataset for the period 1995-2017 (1995-2016 for GO dataset) 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. 2[52]. 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

[52] 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)

Russia

Sources

National Accounts NACE Rev. 2 from Federal State Statistic Service of Russian Federation (Rosstat)

- https://www.gks.ru/accounts?print=1#

  Downloaded: 20-11-2019

National Accounts NACE Rev. 1.1 from 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: 09-01-2020

  (Exchange rates)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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 2011-2016 in NACE Rev 1.1 and recently since 2014 in NACE Rev.2. Prior to 2011, NA data are still compiled according to the SNA 1993.

NA data by industry published by Rosstat only covers period 2003-2017. 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 Annex II).

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, reference year 2015=100) 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

- https://eng.stat.gov.tw/ct.asp?xItem=37408&CtNode=5347&mp=5

  Downloaded: 13-11-2019

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: 13-11-2019

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

- http://www.wiod.org/database/niots13

  Downloaded: 15-10-2015

  (National Input-Output Tables, Released November 2013)
- http://www.wiod.org/database/seas13

  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 since 1995, 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, reference year 2015=100) 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.

United States

Sources

NA from Bureau of Economic Analysis (BEA)

- ht tp://www.bea.gov/industry/gdpbyind_data.htm

  Downloaded: 18-09-2019

NA ISIC Rev. 4 from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=STANI4

  Downloaded: 03-09-2019

Industry Productivity and Costs from Bureau of Labor Statistics (BLS)

- http://w ww.bls.gov/lpc/

  Downloaded: 03-09-2019

Exchange rates and PPP from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=ert_bil_eur_a&lang=en Downloaded: 09-01-2020

  (Exchange rates)

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=prc_ppp_ind&lang=en Downloaded: 09-01-2020

  (Purchasing power parities)

PPP from OECD

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

  Downloaded: 09-01-2020

  (PPPs: national currency per US dollar)

PPP from International Monetary Fund (IMF)

- https://www.imf.org/external/pubs/ft/weo/2019/02/weodata/index.aspx

  Downloaded: 09-01-2020

  (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. 4[53].

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. In November 2018, the Bureau of Economic Analysis (BEA) released the results of the 2018 comprehensive update of the

[53] 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)

Industry Economic Accounts (IEAs). The last comprehensive update of the IEAs was released in January 2014.

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 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, reference year 2015=100) 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.

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: 16-03-2020

  (Employment by A*10 industry breakdowns for EU28 and EU27_2020)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64_e&lang=en

  Downloaded: 16-03-2020

  (National Accounts employment data by industry (up to NACE A*64) for EU28 and EU27_2020)

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: 15-09-2019

  (Employment by A*10 industry breakdowns)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64_e&lang=en

  Downloaded: 15-09-2019

  (National Accounts employment data by industry (up to NACE A*64))

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 10 branches – employment data)
- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 21 branches - employment data)
- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 38 branches - employment data)
- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 64 branches - employment data)

National Accounts (NA) ESA 1995 NACE Rev. 1.1 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 6 branches - employment data)
- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 31 branches - employment data)
- http://ec.europa.eu/eurostat

  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: 25-11-2019

  (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: 25-11-2019

  (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: 25-11-2019

  (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: 25-11-2019

  (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/database/seas13

  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: 15-10-2019

  (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: 15-10-2019

  (Employment by sex, age groups and detailed economic activity (division level))

- Eurostat special data request

  Downloaded: 30-10-2019

  (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 European aggregates and its Members States is NA from Eurostat (downloaded on 15-10-2019), 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.

Due to the major review of the National Accounts data published by Eurostat in March 2020 that largely affects to the European aggregates, we have decided to use the most recent data available to calculate the series of Employment and hours worked, instead of the data obtained in October 2019, for EU28 countries (2013-2018) and the EU27 (since 2020 without United Kingdom).

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 for Poland, Croatia and European Union, especially before 2000. In the case of hours worked the same countries plus Bulgaria, Belgium, Estonia, Malta and Hungary lack NA data. In

Hungary, the information is only available since 2010 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, from 1995 onwards. 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 whole period 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 Annex II) and the methodology described in Mas, Robledo y Pérez (2012)[54]. 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

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: 15-09-2019

  (Employment by A*10 industry breakdowns)

[54] 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

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64_e&lang=en

  Downloaded: 15-09-2019

  (National Accounts employment data by industry (up to NACE A*64))

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 10 branches – employment data)
- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 21 branches - employment data)
- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 38 branches - employment data)
- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 64 branches - employment data)

National Accounts (NA) ESA 1995 NACE Rev. 1.1 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 6 branches - employment data)
- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 31 branches - employment data)
- http://ec.europa.eu/eurostat

  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: 25-11-2019

  (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: 25-11-2019

(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: 25-11-2019

  (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: 25-11-2019

  (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

Labour Force Statistics (LFS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_egan2&lang=en

  Downloaded: 15-10-2019

  (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: 15-10-2019

  (Employment by sex, age groups and detailed economic activity (division level))

- Eurostat special data request

  Downloaded: 30-10-2019

  (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 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 Annex II) 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

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: 15-09-2019

  (Employment by A*10 industry breakdowns)
- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64_e&lang=en

  Downloaded: 15-09-2019

  (National Accounts employment data by industry (up to NACE A*64))

National Accounts (NA) ESA 1995 NACE Rev. 2 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 10 branches – employment data)
- http://ec.europa.eu/eurostat

Downloaded: 07-06-2016

(National Accounts by 21 branches - employment data)

- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 38 branches - employment data)

- http://ec.europa.eu/eurostat

  Downloaded: 07-06-2016

  (National Accounts by 64 branches - employment data)

National Accounts (NA) ESA 1995 NACE Rev. 1.1 from Eurostat (information available upon request)

- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 6 branches - employment data)

- http://ec.europa.eu/eurostat

  Downloaded: 06-11-2015

  (National Accounts by 31 branches - employment data)

- http://ec.europa.eu/eurostat

  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: 25-11-2019

  (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: 25-11-2019

  (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: 25-11-2019

  (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: 25-11-2019

  (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

Labour Force Statistics (LFS) NACE Rev. 2 from Eurostat

- http://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=lfsa_egan2&lang=en

  Downloaded: 15-10-2019

  (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: 15-10-2019

  (Employment by sex, age groups and detailed economic activity (division level))

- Eurostat special data request

  Downloaded: 30-10-2019

  (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))

Statistik der Unternehmensstruktur from Bundesamt für Statistik (BFS) of Switzerland

- https://www.bfs.admin.ch/bfs/de/home/statistiken/industrie-dienstleistungen/erhebungen/statent.html

  (Downloaded: 17-12-2019)

  (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 the whole 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 Annex II) 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

Sources

NA from Australian Bureau of Statistics (ABS)

- http://www.abs.gov.au/ausstats/abs@.nsf/mf/6291.0.55.003

  Downloaded: 24-09-2019

NA ISIC Rev. 4 from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=STANI4

  Downloaded: 24-09-2019

Australian Industry from ABS

- http://www.abs.gov.au/AUSSTATS/abs@.nsf/allprimarymainfeatures/48791677FF5B2814CA256A1D0001FECD?opendocument

  Downloaded: 24-09-2019

Experimental Estimates for the Manufacturing Industry from ABS

- http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8159.02009-10?OpenDocument

  Downloaded: 26-10-2015

Information and Communication Technology from ABS

- http://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/8126.02006-07?OpenDocument

  Downloaded: 05-10-2015

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)

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) from 1995 onwards, while OECD data is available for the same period 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 Annex II).

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: 25-09-2019

Annual Survey of Industry from IBGE

- https://www.ibge.gov.br/estatisticas/economicas/industria/9044-pesquisa-industrial-anual-produto.html?=&t=resultados

  Downloaded: 25-09-2019

Annual Survey of Trade from IBGE

- https://www.ibge.gov.br/estatisticas-novoportal/economicas/comercio/9075-pesquisa-anual-de-comercio.html?&t=resultados

  Downloaded: 25-09-2019

Annual Survey of Services from IBGE

- https://www.ibge.gov.br/estatisticas-novoportal/economicas/servicos/9028-pesquisa-anual-de-servicos.html?&t=resultados

  Downloaded: 25-09-2019

National Household Sample Survey from IBGE

- https://www.ibge.gov.br/estatisticas/sociais/trabalho/9171-pesquisa-nacional-por-amostra-de-domicilios-continua-mensal.html?=&t=resultados

  Downloaded: 25-09-2019

World Input-Output Database ISIC Rev. 4 (WIOD)

- http://www.wiod.org/database/seas16

  Downloaded: 12-09-2018

(Socio Economic Accounts, November 2016 Release) (Socio Economic Accounts, November 2016 Release)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 since 2000 for employment, but does not publish any data for hours worked. Prior to 2000 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)[55].

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 databases covers period 1995-2014, we estimate forwards to the end of the period 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

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=3610048001

  Downloaded: 13-11-2019

Annual Survey of Manufactures and Logging from Statistics Canada

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610003801
- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1610011701

  Downloaded: 13-11-2019

Labour Force Survey from Statistics Canada

- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410002301
- https://www150.statcan.gc.ca/t1/tbl1/en/tv.action?pid=1410022001

  Downloaded: 13-11-2019

[55] 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).

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.

The last National Accounts data published covers the period 1997-2016. 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. 2[56].

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: 17-12-2019

World Input-Output Database ISIC Rev. 4 (WIOD)

- http://www.wiod.org/database/seas16

  Downloaded: 12-09-2018

  (Socio Economic Accounts, November 2016 Release)

[56] 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).

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

- http://www.wiod.org/database/seas13

  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: 17-12-2019

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: 17-12-2019

Remarks

Employment and hours worked by industry for China is taken from National Bureau of Statistics of China and WIOD databases.

Employment information has been distributed among ICT sectors, RS sector and the rest of industries for the whole period 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 (Chinese SIC), ISIC Rev. 3 and ISIC Rev. 4 (NACE Rev. 2)[57].

To obtain hours worked dataset by industry we use the yearly number of hours worked by employed person derived from the CIP and WIOD databases and final employment dataset. As all the information available on hours worked covers the period 1995-2010, we estimate from then onwards 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

[57] The correspondence between Chinese SIC and ISIC Rev. 4 is available at: http://www.stats.gov.cn/tjsj/tjbz/hyflbz/201710/t20171012_1541679.html. Ivie has also elaborated a correspondence table for ICT sectors (see Annex II)

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

India KLEMS of India's Central Bank

- https://www.rbi.org.in/Scripts/KLEMS.aspx

  Downloaded: 21-01-2020

  (July 2019 Release)

World Input-Output Database ISIC Rev. 4 (WIOD)

- http://www.wiod.org/database/seas16

  Downloaded: 12-09-2018

  (Socio Economic Accounts, November 2016 Release)

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

- http://www.wiod.org/database/seas13

  Downloaded: 15-10-2015

  (Socio Economic Accounts, Released July 2014)

Productivity Database 2019 of Asian Productivity Organization (APO)

- http://www.apo-tokyo.org/wedo/productivity-measurement

  Downloaded: 16-10-2019

Annual Survey of Industries from Ministry of Statistics and Programme Implementation (MOSPI)

- http://www.csoisw.gov.in/CMS/cms/Feedback.aspx

  Downloaded: 20-01-2020

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 India KLEMS and WIOD databases. 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 ones[58].

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

[58] 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.

- https://www.esri.cao.go.jp/en/sna/menu.html

  Downloaded: 10-01-2020

JIP Database 2018 from RIETI and Hitotsubashi University

- https://www.rieti.go.jp/en/database/JIP2018/index.html

  Downloaded: 26-09-2019

JIP Database 2015 from REITI 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: 15-10-2019

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: 26-09-2019

Survey of selected services industries from METI

- http://www.meti.go.jp/english/statistics/tyo/tokusabizi/index.html

  Downloaded: 26-09-2019

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 whole period for both variables. These datasets have been distributed among ICT sectors, MC sectors and the rest of industries using mainly the latest version of the JIP Database, which is a fully revised version that reflects the changes made in the 2008 SNA and contains a number of important

changes as compared to the previous JIP database (2015) (distinguishing 100 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, JIP Database (2015) and correspondence tables between JIP codes, Japan Standard Industrial Classification (JSIC), ISIC Rev. 3 (NACE Rev. 1) and ISIC Rev. 4 (NACE Rev. 2)[59]..

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/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

  Downloaded: 29-10-2019

NA from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=SNA_TABLE7A

  Downloaded: 29-10-2019

Structural Business Statistics ISIC Rev. 4 from OECD

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

  Downloaded: 29-10-2019

Mining and Manufacturing Survey from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

  Downloaded: 29-10-2019

Service Industry Survey from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

[59] 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)

Downloaded: 29-10-2019

Survey of Business activities from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

  Downloaded: 29-10-2019

Wholesale and Retail trade Survey from Statistics Korea

- http://kosis.kr/eng/statisticsList/statisticsListIndex.do?menuId=M_01_01&vwcd=MT_ETITLE&parmTabId=M_01_01

  Downloaded: 29-10-2019

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 since 2004. 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. 2[60].

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

Sources

WORLD KLEMS Dataset ISIC Rev. 3 for Russia (Russia KLEMS)

[60] 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)

- 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: 26-11-2019

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: 27-11-2019

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 from then onwards 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 Annex II).

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 from then onwards using growth rates of employment by industry.

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: 14-11-2019

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: 14-11-2019

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: 14-11-2019

World Input-Output Database ISIC Rev. 4 (WIOD)

- http://www.wiod.org/database/seas16

  Downloaded: 12-09-2018

  (Socio Economic Accounts, November 2016 Release)

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 since 2001, we extrapolate series backwards to 1995 using WIOD databases.

The LFS employment data has been 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 databases and final employment dataset. As hours worked in WIOD database covers period 1995-2014, we estimate from 2014 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: 18-09-2019

NA ISIC Rev. 4 from OECD

- http://stats.oecd.org/Index.aspx?DataSetCode=STANI4

  Downloaded: 18-09-2019

Industry Productivity and Costs from Bureau of Labor Statistics (BLS)

- http://www.bls.gov/lpc/

  Downloaded: 18-09-2019

Annual Survey of Manufactures from United States Census Bureau

- http://www.census.gov/manufacturing/asm/index.html

  Downloaded: 18-09-2019

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. 4[61].

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.

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 series for the whole period.

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).

[61] 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)

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

Table A I (cont.) 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

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 activities	922P	9213P
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

Table A I (cont.) 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

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), 9211-9213, 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

Table A II (cont.) Correspondences between NACE Rev.2 and ANZSIC (Australia)

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)

ICT SECTOR

	NACE Rev. 2	CNAE 2.0
ICT manufacturing industries		
Manufacture of electronic components and boards	261	261
Manufacture of electronic components	2611	261P
Manufacture of loaded electronic boards	2612	261P
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	6202, 6203
Publishing of computer games	5821	6202P, 6203P
Other software publishing	5829	6202P, 6203P
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	6204P
Computer facilities management activities	6203	6204P
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

Table A III (cont.) Correspondences between NACE Rev. 2 and CNAE (Brazil)

RS SECTOR

	NACE Rev. 2	CNAE 2.0
Retail sale via mail order houses or via Internet	4791	4713P

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	6391
Other information service activities n.e.c.	6399	6399

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 IV Correspondences between NACE Rev. 2 and CSIC (China)

ICT SECTOR

	NACE Rev. 2	CSIC 2017
ICT manufacturing industries		
Manufacture of electronic components and boards	261	397, 398
Manufacture of electronic components	2611	397P, 398P
Manufacture of loaded electronic boards	2612	397P, 398P
Manufacture of computers and peripheral equipment	262	391
Manufacture of communication equipment	263	392, 393
Manufacture of consumer electronics	264	395, 396
Manufacture of magnetic and optical media	268	2664
ICT trade industries		
Wholesale of computers, computer peripheral equipment and software	4651	5176
Wholesale of electronic and telecommunications equipment and parts	4652	5177
ICT services industries		
Software publishing	582	8625
Publishing of computer games	5821	8625P
Other software publishing	5829	8625P
Telecommunications	61	63
Wired telecommunications activities	611	6311, 6321
Wireless telecommunications activities	612	6312, 6322
Satellite telecommunications activities	613	633
Other telecommunications activities	619	6319
Computer programming, consultancy and related activities	62	65 (ex. 656, 657)
Computer programming activities	6201	651
Computer consultancy and computer facilities management activities	6202-6203	652-655
Computer consultancy activities	6202	652-655P
Computer facilities management activities	6203	652-655P
Other information technology and computer service activities	6209	659
Data processing, hosting and related activities; web portals	631	64, 656
Data processing, hosting and related activities	6311	64 (ex. 642), 656
Web portals	6312	642
Repair of computers and communication equipment	951	812
Repair of computers and peripheral equipment	9511	8121
Repair of communication equipment	9512	8122-8129

Table A IV (cont.) Correspondences between NACE Rev. 2 and CSIC (China)

RS SECTOR

	NACE Rev. 2	CSIC 2017
Retail sale via mail order houses or via Internet	4791	5292, 5293

MC SECTOR

	NACE Rev. 2	CSIC 2017
MC sector		
Publishing of books, periodicals and other publishing activities		
Book publishing	5811	8621P
Publishing of directories and mailing lists	5812	8621P
Publishing of newspapers, journals and periodicals	5813-5814	8622, 8623
Publishing of newspapers	5813	8622P, 8623P
Publishing of journals and periodicals	5814	8622P, 8623P
Other publishing activities	5819	8626, 8629
Audiovisual and broadcasting activities		
Motion picture, video and television programme production, sound recording and music publishing activities	59	873, 875-877
Motion picture, video and television programme activities	591	873, 875, 876
Motion picture, video and television programme production activities	5911	8730P
Motion picture, video and television programme post-production activities	5912	8730P
Motion picture, video and television programme distribution activities	5913	875
Motion picture projection activities	5914	876
Sound recording and music publishing activities	592	877
Programming and broadcasting activities	60	871, 872, 874
Radio broadcasting	601	871, 874P
Television programming and broadcasting activities	602	872, 874P
Other information service activities		
News agency activities	6391	861
Other information service activities n.e.c.	6399	657

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 V 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

Table A V (cont.) Correspondences between NACE Rev.2 and JSIC (Japan)

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 VI 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

Table A VI (cont.) Correspondences between NACE Rev.2 and KSIC (South Korea)

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 VII Correspondences between NACE Rev.2 and SIC (Taiwan)

a) ICT sector

	NACE Rev.2	SIC (9th version)
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

Table A VII (cont.) Correspondences between NACE Rev.2 and SIC (Taiwan)

b) RS sector

	NACE Rev.2	SIC (9th version)
Retail sale via mail order houses or via Internet	4791	4874

c) MC sector

	NACE Rev.2	SIC (9th version)
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 VIII Correspondences between NACE Rev.2 and NAICS (US and Canada)

a) ICT sector

	NACE Rev.2	NAICS2012
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

Table A VIII (cont.) Correspondences between NACE Rev.2 and NAICS (US and Canada)

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 IX 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

Table A IX (cont.) NABS – NACE Rev. 1.1. correspondence table

NABS 2007		NACE Rev. 1.1	
10	Culture, recreation, religion and mass media	22.1	Publishing
		91.3	Activities of other membership organizations
		92	Recreational, cultural and sporting activities
11	Political and social systems, structures and processes	74.1	Legal, accounting and consultancy
		74.5	Labour recruitment and provision of personnel
		75	Public administration and defence; compulsory social security
		85.32	Social work activities without accommodation
		excluded here: 75.22	
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	Manufacture of weapons and ammunition
		75.22	Defence activities

Note: some NACE sub-categories are referred as *excluded* - it is because they are part of a different NABS chapter.

Source: Stančik (2012) and European Commission (2018).

Table A X 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	

Table A X (cont.) NABS – NACE Rev. 2 correspondence table

NABS 2007		NACE Rev. 2	
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.

Source: Stančik (2012) and European Commission (2018).

Table A XI 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 (2020).
http://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm

Table A XII 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 (2020).
http://ec.europa.eu/eurostat/cache/metadata/en/isoc_skslf_esms.htm

Table A XIII 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 European Commission (2018).

Table A XIV 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	Sewage treatment facilities
		7790	Waste management and remediation services
		7290 (p)	Architectural, engineering and related activities
3	Exploration and exploitation of space	3590	Aerospace product and parts manufacturing
		9570	Administration of economic programs and space research
4	Transport, telecommunication and other infrastructures	0770	Construction
		6070 - 6390	Transportation and warehousing
		6680 – 6690 (p)	Telecommunications
		7290 (p)	Architectural, engineering, and related services
5	Energy	0570 - 0690	Utilities
		7290 (p)	Architectural, engineering, and related services
		excluded here: 0680	
6	Industrial production and technology	1070 - 2390	Nondurable goods manufacturing
		2470 - 2990	Durable goods manufacturing
		3090	Commercial and service industry machinery manufacturing
		3170	Metalworking machinery manufacturing
		3180	Engines, turbines, and power transmission equipment manufacturing
		3190	Machinery manufacturing, n.e.c.
		3290	Not specified machinery manufacturing
		3360	Computer and peripheral equipment manufacturing
		3370	Communications, and audio and video equipment manufacturing
		3380	Navigational, measuring, electromedical, and control instruments manufacturing*
		3390	Electronic component and product manufacturing, n.e.c.
		3470 - 3490	Electrical equipment and appliances manufacturing
		3570 (p)	Motor vehicles and motor vehicle equipment manufacturing
		3580 (p)	Aircraft and parts manufacturing
		3680 (p)	Ship and boat building
		3770 - 3870	Wood products manufacturing
		3970	Sporting and athletic goods, and doll, toy and game manufacturing
		3980	Miscellaneous manufacturing, n.e.c.
		3990	Not specified manufacturing industries
		6490	Software publishers
		6680 – 6690 (p)	Telecommunications
		7290 (p)	Architectural, engineering, and related services
		7380	Computer systems design and related services
		excluded here: 2180, 2970	
7	Health	2190	Pharmaceutical and medicine manufacturing
		3960	Medical equipment and supplies manufacturing
		7970 - 8180	Health services, except hospitals
		8270 - 8290	Health services, except hospitals

Table A XIV (cont.) NABS – CIC correspondence table (US)

NABS 2007		CIC 2010	
Code	**Name**	**Code**	**Name**
8	Agriculture	0170 0290	Agriculture, forestry, fishing, and hunting
		2180	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: Stančik (2012) and European Commission (2018).

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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