Data Article

GLOBALINTO input-output intangibles database: Industry-level data on intangibles for the EU-27 and the UK

Petros Dimas\(^a,\)*, Dimitrios Stamopoulou\(^a\), Aggelos Tsakanikas\(^a\), Michail Vasileiadis\(^b\)

\(^a\) Laboratory of Industrial and Energy Economics, National Technical University of Athens, Greece
\(^b\) Foundation for Economic and Industrial Research, Athens, Greece

**A R T I C L E   I N F O**

Article history:
Received 13 January 2022
Accepted 2 February 2022
Available online 5 February 2022

Keywords:
Intangible assets
Global value chains
Exports
Competitiveness
R&D
Patents
European Union

**A B S T R A C T**

This paper presents the GLOBALINTO Input-Output Intangibles Database, that was constructed in the context of the Horizon2020 project ‘GLOBALINTO: Capturing the value of intangible assets in micro data to promote the EU’s Growth and Competitiveness’. The database is formulated under an input-output framework and treats intangibles as producer services that derive from certain knowledge producing sectors in the economy (namely J62-J63 – Computer programming, consultancy, and related activities; Information service activities, M72 – Scientific research and development, M73 – Advertising and market research, and N – Administrative and support service activities) and embeds them within the context of global value chains (GVCs) as traded knowledge intermediates. Data include intangibles related variables for 56 2-digit NACE Rev. 2/ ISIC Rev. 4 sectors from the EU-27 and the UK and are complemented with export variables and R&D related statistics from Eurostat for the period 2000-2014. An application of the dataset can be found in the research article ‘Intangibles, innovation, and sector specialization in global value chains: A case study on the EU’s and the UK’s manufacturing industries’ [1].

* Corresponding author.

E-mail address: petrdimas@chemeng.ntua.gr (P. Dimas).

Social media: @LIEENTUA (P. Dimas)

https://doi.org/10.1016/j.dib.2022.107932

2352-3409/© 2022 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/4.0/)
Specifications Table

| Subject                                      | Economics                                           |
|----------------------------------------------|-----------------------------------------------------|
| Specific subject area                        | Intangible Assets; Global Value Chains; Economics of Innovation; International Trade; Competitiveness |
| Type of data                                 | Tables                                              |
| How the data were acquired                   | Data regarding GVCs and intermediates are retrieved online from the World Input-Output Database (WIOD) [2] while those related to R&D and patent applications are drawn from Eurostat. |
| Data format                                  | The database is in Excel file format (.xlsx), analysed and organised appropriately per variable of interest, industry, and year in separate files for each country. It is available online (Mendeley Data repository). |
| Description of data collection               | The GLOBALINTO Input-Output Intangibles Database contains novel indicators and measures that derive from two publicly available sources:  
1. Data regarding production linkages and international trade are drawn from the 2016 release of WIOD available at http://www.wiod.org/database/wiots16  
2. Data regarding R&D and patent applications are drawn from Eurostat’s Structural Business Statistics, available online at https://ec.europa.eu/eurostat/web/structural-business-statistics/data/database |
| Data source location                         | The primary data used for the development of this database reflect the sources of WIOD and Eurostat and derive mainly from National Accounts, which are publicly available from the national statistical agencies and institutes of the countries covered in the database, namely: Austria, Belgium, Bulgaria, Croatia, Republic of Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Luxembourg, Malta, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain, Sweden, and the United Kingdom. Additional sources of primary data include OECD and the United Nations National Accounts. |
| Data accessibility                           | Repository Name: Mendeley Data  
Data identification number: 10.17632/g9cdn9rmc2.1  
Direct URL to data: https://data.mendeley.com/datasets/g9cdn9rmc2/1 |
| Related research article                     | A. Tsakanikas, Y. Caloghirou, P. Dimas, D. Stamopoulos, Intangibles, innovation, and sector specialization in global value chains: A case study on the EU’s and the UK’s manufacturing industries, Technol. Forecast. Soc. Change. 177 (2022) 121488.  
https://doi.org/10.1016/j.techfore.2022.121488. |

Value of the Data

- The database is based on a novel approach regarding the conceptualization of intangible assets as producers’ services utilized for production purposes. It thus directly embeds intangibles within the context of global value chains as traded intermediates and provides the proper setting and tools for the mapping and study of critical dimensions of knowledge diffusion across sectors and countries in the global production network.
- The key novelty of the database lies in the origin dimension, as the I-O framework enables us to differentiate between domestically produced intangibles and imported intangibles from different economies and regions.
- The I-O format of the data provides the proper setting for evidence-based industrial and innovation policymaking applications.
• These data can be utilized by academics, researchers, policymakers, and other parties interested in the study of knowledge-based assets, knowledge diffusion, knowledge networks, global value chains, and overall in the disciplines of Economics of Innovation, International Economics, International Trade, Industrial and Innovation Policy, Industrial Economics and Growth and Development Economics.

• The database can be utilized for: 1) descriptive applications at the sector, country, and regional level, 2) comparative analyses between different sectors (or groupings), countries and regions, 3) case studies at the country, region and sector (or groupings) level, 4) cross-sectional and panel econometric applications, 5) growth accounting applications.

• Overall, the database presents a wealth of data that covers an unprecedented range of industries and countries to be utilized in future research applications.

1. Data Description

The GLOBALINTO Input-Output Intangibles Database (abbreviation/short: GIOD) is a novel sector-level database for intangible assets based on production input data from all over the world. The database includes intangibles-related variables and data for 56 sectors for all EU-27 countries plus the United Kingdom, constructed upon available data from the 2016 Release of the WIOD for the period 2000-2014. Data for 56 sectors are classified according to the International Standard Industrial Classification revision 4 (ISIC Rev. 4) that is also consistent with the NACE Rev.2 industry classification and adhere to the 2008 version of the System of National Accounts (SNA). Furthermore, I-O data are complemented with several statistics related to R&D investment from Eurostat Structural Business Statistics and National Accounts.

The variables are organised in a tabulated format and in spreadsheets by type, sector, and year, which are then grouped appropriately in separate files for each individual country. In total, we provide 28 individual files, each dedicated to an EU country with an additional one for the UK. Each individual file contains an introductory sheet with the description of the data and 30 data spreadsheets, which are separated in two sections with 15 dedicated spreadsheets each: the inputs side and the outputs side.

The structure of the inputs side contains spreadsheets dedicated to each year of reference (time frame 2000-2014 i.e., 15 spreadsheets) with two different tables each: i) an adjusted $n^*T_p \times 1^*s$ I-O type table for each EU-27 member and the UK, were $T_p$ represents the 4 intangibles producing sectors of each country $n$ and their corresponding provision of intangible inputs $I_{INTAN,j}$ to each sector $s$ of the country of focus, and ii) a table of additional variables regarding intangibles inputs per sector. The format of the I-O type table is presented in Fig. 1 and the list of detailed variables included in the second table is presented in Table 1.

| Countries/Sectors | Intermediate Consumption of intangibles per sector |
|-------------------|--------------------------------------------------|
|                   | $s_1$  | $s_2$ | $s_3$ | ... | $s_J$ |
| $C_1$             | $I_{1,1}$ | $I_{1,2}$ | $I_{1,3}$ | ... | $I_{1,J}$ |
| $C_2$             | $I_{2,1}$ | $I_{2,2}$ | $I_{2,3}$ | ... | $I_{2,J}$ |
| [...]             | [...] | [...] | [...] | ... | [...] |
| $C_n$             | $I_{n,1}$ | $I_{n,2}$ | $I_{n,3}$ | ... | $I_{n,J}$ |
| $C_{EU}$          | $I_{EU,1}$ | $I_{EU,2}$ | $I_{EU,3}$ | ... | $I_{EU,J}$ |
| $C_{EA}$          | $I_{EA,1}$ | $I_{EA,2}$ | $I_{EA,3}$ | ... | $I_{EA,J}$ |
| $C_{BRICS}$       | $I_{BRICS,1}$ | $I_{BRICS,2}$ | $I_{BRICS,3}$ | ... | $I_{BRICS,J}$ |
| $C_{IMP}$         | $I_{IMP,1}$ | $I_{IMP,2}$ | $I_{IMP,3}$ | ... | $I_{IMP,J}$ |

Fig. 1. Intangible inputs table format per country.
### Table 1
Description of variables included in the GLOBALINTO 1-O Intangibles Database (input-side).

| Variable                                      | Type    | Units          | Dimensions                  |
|-----------------------------------------------|---------|----------------|-----------------------------|
| Imports of intangibles                        | Numeric | mil. $         | $C \times S \times T_p \times Y$ |
| Domestically purchased intangibles            | Numeric | mil. $         | $C \times S \times T_p \times Y$ |
| Share of imported intangibles to global imports of intangibles | Numeric | Dimensionless | $C \times S \times T_p \times Y$ |
| Share of Euro Area imported intangibles to sector's intangible inputs | Numeric | Dimensionless | $C \times S \times T_p \times Y$ |
| Share of EU-28 imported intangibles to sector's intangible inputs | Numeric | Dimensionless | $C \times S \times T_p \times Y$ |
| Share of BRIC economies imported intangibles to sector's intangible inputs | Numeric | Dimensionless | $C \times S \times T_p \times Y$ |
| Share of RoW imported intangibles to sector's intangible inputs | Numeric | Dimensionless | $C \times S \times T_p \times Y$ |
| Share of domestically produced intangibles to domestic production of intangibles globally | Numeric | Dimensionless | $C \times S \times T_p \times Y$ |
| Share of domestic intangibles to total intermediate consumption | Numeric | Dimensionless | $C \times S \times Y$ |
| Share of domestic intangibles to total output | Numeric | Dimensionless | $C \times S \times Y$ |
| Share of imported intangibles to total output | Numeric | Dimensionless | $C \times S \times Y$ |
| Share of R&D expenditure to output            | Numeric | Dimensionless | $C \times S \times Y$ |
| Share of R&D personnel to total employment    | Numeric | mil. $/ \text{thousand employees}$ | $C \times S \times Y$ |

Notes: $Y =$Year (from 2000 to 2014), $T_p =$ Type of intangible flow (J62-J63, M72, M73, and N), $C =$ Country (EU-27 countries plus UK), $S =$ Sector (56 2-digit NACE Rev. 2 sectors), EU-28 refers to EU-27 and the UK.

### Table 2
Description of variables included in the GLOBALINTO 1-O Intangibles Database (outputs-side).

| Variable                                      | Type    | Units          | Dimensions                  |
|-----------------------------------------------|---------|----------------|-----------------------------|
| Exports                                       | Numeric | mil. $         | $C \times S \times U \times D \times Y$ |
| Share of sector exports to global sector exports | Numeric | Dimensionless | $C \times S \times U \times D \times Y$ |
| Share of exports to sector output             | Numeric | Dimensionless | $C \times S \times U \times Y$ |
| Share of exports to sector output, performance relative to global sector | Numeric | Dimensionless | $C \times S \times U \times Y$ |
| Value of sector exports to sectors producing intangibles | Numeric | mil. $         | $C \times S \times D \times Y$ |
| Share of sector exports of intangibles to global sector exports of intangibles | Numeric | Dimensionless | $C \times S \times D \times Y$ |
| Share of exports to sectors producing intangibles to sector output | Numeric | Dimensionless | $C \times S \times Y$ |
| Share of exports to sectors producing intangibles to sector output, performance relative to global sector | Numeric | Dimensionless | $C \times S \times Y$ |
| Sector efficiency (ratio of Value Added to total output per sector) | Numeric | Dimensionless | $C \times S \times Y$ |
| Sector efficiency, performance relative to global sector efficiency | Numeric | Dimensionless | $C \times S \times Y$ |
| Patent applications to the European Patent Office per sector | Numeric | Number in thousands | $C \times S \times Y$ |

Notes: $Y =$Year (from 2000 to 2014), $C =$ Country (EU-27 countries plus UK), $S =$ Sector (56 2-digit NACE Rev. 2 sectors), EU-28 refers to EU-27 and the UK, $U =$ Type of final consumption (Households, Government, Non-profit organizations, and Gross Fixed Capital Formation), $D =$ Destination (INTRA-EU and EXTRA-EU exports).

The structure of the **outputs side** follows a similar format and contains 15 spreadsheets of data dedicated to each year in the 2000–2014 period, with a similar structure with the second table in the inputs side. A detailed list of variables included in each spreadsheet of the outputs side is presented in **Table 2**.
2. Experimental Design, Materials, and Methods

The methodological approach for the construction of the database is based on the relevant literature and consists of three main phases:

1. Extraction of the raw data from WIOD’s intercountry I-O tables with respect to Leontief’s [3] basic principles of I-O analysis and certain extensions presented in Miller and Blair [4].
   i. Identification of relevant data with respect to intangibles-producing and user sectors and countries.
   ii. Refinement of the original WIOD tables into an appropriate format for extraction.
   iii. Extraction of input-output data for each type of intangible.
   iv. Treatment and curation of input-output data and preparation for calculation.

2. Calculation of the respective variables and measures included in the database.
   i. Definition of variables and indicators to be constructed.
   ii. Construction of a preliminary dataframe based on the dimensions from all variables of interest (multi-dimensional block arrays).
   iii. Calculation of variables and measures of interest.
   iv. Placement of calculated variables and measures into the dataframe with proper readjustments when necessary.

3. Consolidation of the calculated variables and measures with additional complementary data from Eurostat Structural Business Statistics and National Accounts and export in final form.
   i. Incorporation of R&D data and patent applications into the existing dataframe.
   ii. Dimension adjustments of the dataframe into table-sized objects.
   iii. Reorganisation of tables based on country, sector, and year.
   iv. Export of the dimension-reduced dataset into the final spreadsheet form.

This procedure adds significant value to the source WIOD, since all the new estimated measures emanate from the relevant literature, and present a new methodological and conceptual approach of measuring intangibles at the national and the sectoral level.

As stated above, each country file in GIOID is divided into two separate sections of data and indicators: data related with sector input (inputs side) and data related with sector output (outputs side). The quantification details for the calculation of the variables of each category are presented below.

2.1. Intangible sector inputs (at current prices)

Drawing elements from the I-O concept of WIOD and the conceptual frameworks developed in the latest edition of the EU-KLEMS [5] and the INTAN-Invest database [6,7], we approximate intangible assets as production inputs that are produced from four two-digit NACE Rev.2 industry sectors (or groups). Specifically, the sectors producing intangibles are:

- J62-J63 sectors: Computer programming, consultancy, and related activities; Information service activities
- M72 sector: Scientific research and development
- M73 sector: Advertising and market research
- N sector: Administrative and support service activities

The intangible inputs are produced from these sectors in 43 countries (all EU members and the UK included) and the rest of the world (RoW) and used by 56 2-digit NACE Rev.2 sectors in each EU country and Great Britain, during the period 2000-2014. Aggregate country-level estimates per category of intangibles are also provided. The database also includes aggregates of intangible inputs imported from BRIC economies (Brazil, Russia, India, and China), the Euro Area and EU-27 together with the UK.
2.2. R&D sector inputs

Using the available Eurostat Structural Business Statistics data, we include in the database two indicators regarding R&D inputs:

- R&D spending to output ratio (current prices): data cover 37 2-digit NACE Rev.2 sectors from all EU members and the UK for the period 2007-2013.
- R&D personnel to total employment ratio: data cover 37 2-digit NACE Rev.2 sectors for the period 2008-2014.

2.3. Sector outputs (at current prices)

The database includes data about the part of production absorbed from exports for 56 2-digit NACE Rev. 2 sectors, in each EU country. Exports are divided into five categories, with respect to use purpose, following the classification in the I-O tables of WIOD:

- Exports used as intermediate inputs
- Exports used for household consumption
- Exports used by non-profit organizations serving households
- Exports used for government consumption
- Exports used for gross fixed capital formation

These exported goods are produced in the EU-27 economies and the UK and exported into 42 countries (all EU members except from the country of origin included) and the rest of the world (RoW), for the period 2000-2014. The database also includes aggregates for sector intra and extra EU exports per use, with emphasis on the exports of intermediate inputs. Especially regarding exports of intermediate inputs, the database includes exports' data to sectors producing intangibles. This fact enables the tracing of value chains of intangibles.

In addition, we provide data regarding sector efficiency, approximated by the ratio of value added to total output (at current prices) and an all sectors (total economy) estimate. We further introduce revealed comparative advantage type [8] indicators to capture competitiveness implications at the sector and country level. In detail, the database includes a specialization indicator about each sector’s efficiency performance relative to the efficiency of the average global sector. On the same notion, we provide an additional indicator regarding the share of each sector’s exports to its total output and a relative indicator which divides this share with the average exports share of the global sector.

2.4. R&D output

Using the available Eurostat Structural Business Statistics data, we include an indicator to approximate the R&D output derived by each sector’s R&D activity:

- Patent applications to the European Patent Office: data cover 19 2-digit NACE Rev.2 sectors from all EU-28 members for the period 2000 – 2013.

A formal application of the database can be found in [1] and the database is publicly available on Mendeley data [9].

CRediT Author Statement

**Petros Dimas**: Conceptualization, Methodology, Formal analysis, Software, Data Curation, Writing – original draft, Writing – review & editing; **Dimitrios Stamopoulos**: Software, Data Curation, Writing – review & editing; **Angelos Tsakanikas**: Writing – Review & Editing, Project Administration, Supervision; **Michail Vasileiadis**: Conceptualization, Methodology.
Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

Acknowledgments

This paper received funding from the H2020-EU.3.6.1.1. GLOBALINTO project (GLOBALINTO: Capturing the value of Intangible Assets in Micro Data to Promote the EU’s Growth and Competitiveness, Contract Number: 822259).

Supplementary Materials

Supplementary material associated with this article can be found in the online version at doi:10.1016/j.dib.2022.107932.

References

[1] A. Tsakanikas, Y. Caloghirou, P. Dimas, D. Stamopoulos, Intangibles, innovation, and sector specialization in global value chains: A case study on the EU’s and the UK’s manufacturing industries, Technol. Forecast. Soc. Change. 177 (2022) 121488, doi:10.1016/j.techfore.2022.121488.
[2] M.P. Timmer, E. Dietzenbacher, B. Los, R. Stehrer, G.J. de Vries, An illustrated user guide to the world input-output database: the case of global automotive production, Rev. Int. Econ. 23 (2015) 575–605, doi:10.1111/roie.12178.
[3] W. Leontief, Input-Output Economics, second ed., Oxford University Press, New York, 1986.
[4] R.E. Miller, P.D. Blair, Input-Output Analysis: Foundations and Extensions, second ed., Cambridge University Press, Cambridge, 2009.
[5] EU KLEMS growth and productivity accounts, 2019 release data repository. https://euklems.eu/. Accessed January 13, 2022.
[6] C. Corrado, C. Hulten, D. Sichel, Measuring capital and technology: an expanded framework, in: C. Corrado, J. Haltiwanger, D. Sichel (Eds.), Measuring Capital in the New Economy, University of Chicago Press, Chicago, 2005, pp. 11–46.
[7] C. Corrado, J. Haskel, C. Jona-Lasinio, M. Iommi, Intangible investment in the EU and US before and since the Great Recession and its contribution to productivity growth, J. Infrastruct. Policy Dev. 2 (2018), doi:10.24294/jipd.v2i1.205.
[8] B. Balassa, trade liberalisation and “revealed” comparative advantage, Manchester Sch 33 (1965) 99–123, doi:10.1111/j.1467-9957.1965.tb00050.x.
[9] P. Dimas, D. Stamopoulos, A. Tsakanikas, M. Vasileiadis, GLOBALINTO input-output intangibles database, Mendeley Data V1 (2021), doi:10.17632/g9cdn9rmc2.1.