EUKLEMS industry accounts with Intangibles

The EUKLEMS & INTANProd productivity database: Methods and data description

(Preliminary)

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1. Introduction

This report provides an overview of the sources and methods adopted to build the EUKLEMS & INTANProd database for productivity analysis. EUKLEMS & INTANProd updates the widely used EUKLEMS productivity database and extends it with new estimates of intangible investment coherent with INTAN-Invest (www.intaninvest.net). The creation of a harmonized and fully integrated productivity database including all the Corrado, Hulten and Sichel list of intangible assets is a significant improvement for developing productivity analysis for policymaking.

The database includes two main sections, the **statistical** and the **analytical** modules containing key variables for studying productivity including output, intermediate inputs, gross value added, employment, compensation of employees, as well as investment in capital stocks across both tangible and intangible assets. The **statistical** module provides standard national accounts variables for productivity analysis while the **analytical** module complements these data with information on investment and capital stocks for intangible assets that are not included in the National Accounts, notably design, brand, organisational capital, training and new financial products and new estimates of productivity levels for the benchmark year 2017[1].

EUKLEMS & INTANProd provides detailed data for 27 EU Member States, the US[2], Japan and the United Kingdom, across 40 industries (although coverage may vary over time and across countries), 23 industry aggregates, over the period 1995-2019.

The EUKLEMS & INTANProd 2021 release offers some advancements compared to EUKLEMS 2019 and INTAN-Invest 2019. In particular:

- Data on intangibles are estimated for 13 manufacturing industries and all intangible estimates are now integrated with the EUKLEMS data in a coherent framework for productivity analysis.
- New measures of organizational capital, brand, design and training include micro level based estimates of the own account component.
- EUKLEMS&INTANProd provides also a larger sectoral disaggregation as all variables are available separately for Professional, scientific, and technical services (section M of

[1] New estimates of productivity levels will be released late Spring 2022.
[2] US data will be released by the end of February 2022.

the NACE rev. 2 classification) and Administrative and support services (section N of the NACE rev. 2 classification) for all those countries for which data are available.

- The EUKLEMS-INTANProd 2021 release also includes industry measures of productivity levels.

The report is organized as follows: section 2 illustrates the main data sources and methods for the statistical module while section 3 provides information about the variables in the analytical module. Section 4 shows some growth accounting results and section 5 focuses on sources and methods for measuring productivity levels.

2. Statistical module: data sources and estimation methods

This section provides an overview of data sources and availabilities for the variables included in the statistical module. The main data sources for the **European** economies (EU27 and UK) are the annual national accounts available from the Eurostat database in the section "Economy and finance" [National accounts (ESA 2010) (na10)]. For Belgium data have been collected with the support of the Federal Planning Bureau, while for Spain, Instituto Valenciano de Investigaciones Económicas (IVIE) directly provided data on gross fixed capital formation and capital stocks. The IVIE contributed to all EUKLEMS releases since the very beginning to supplement the lack of official data for Spain and continue to provide substantial support to keep the EUKLEMS variables up to date.

Data for the **US** have been collected from the Bureau of Economic Analysis (BEA) and the Bureau of Labor Statistics (BLS). Data for **Japan** have been delivered directly by the RIETI institute and Hitotsubashi University.

Output measures

Output data for the **European** countries, and in particular, GDP and its main aggregates (output, expenditure and income) as well detailed breakdowns of main output, income and employment aggregates by industry (as well as a cross-classification of gross fixed capital formation (GFCF) and capital stock by asset and industry) are gathered from the “Annual national accounts

(nama10)". Geographical and industry coverage is almost complete for gross value added (both at current prices and in volume terms), gross output at current prices, employment and compensation of employees. The only exceptions are Luxembourg and Malta which disseminate only limited data at 2-digit level due to confidentiality issues.

Notice, however, that 12 countries out of 27 do not report gross output in volume terms (see Table 1A in the appendix). For countries not reporting gross output in volume terms, gross output deflators have been computed using the following sources of information:

- National Statistical Institutes;
- The OECD STAN database;
- Official Supply and Use Tables (SUT) from the Eurostat website, for estimating gross output in volume terms for time series starting from 2010. Data for the years 2000-2009 have been filled with the deflators provided by the latest release of the World Input-Output Database (WIOD).

Gross output at previous year prices has been calculated following the general method described above, whereas intermediate consumption at previous year prices has been derived as a residual.

For the **US**, value added, output, intermediate consumption and compensation of employees are from the GDP-by-Industry tables[3]. Investment and capital stocks are from BEA's fixed assets accounts[4].Employment data have been provided by the BLS, Industry Productivity Studies[5]. Chained-volume series for aggregate industries and asset classes are obtained using Fisher quantity indexes, consistently with the BEA methodology. Data for Government are all included in the public administration industry (NACE section O).

Labour input

The labour input is composed of two factors: labour quantity and labour quality. The labour quantity is measured by the employment variables included in the national accounts. The labour quality, that captures different composition of the workforce considering workers characteristics

[3] https://apps.bea.gov/iTable/index_industry_gdpIndy.cfm
[4] https://apps.bea.gov/iTable/index_FA.cfm
[5] We would like to thank Matthew Russels and Chris Sparks for providing the data and assistance.

likely affecting their productivity contribution[6], has been computed following the approach adopted by previous EUKLEMS releases.

The calculation of labor quality across countries and industries requires information on employment and wages across countries cross-classified by industry, age, gender and level of education at 2-digits of the NACE Rev 2 classification. But, as this information is not publicly available for the European countries it is necessary to request to the EU a dedicated access to the following datasets: Labour Force Survey (LFS), Structure of Earnings Survey (SES), and European Union Statistics on Income and Living Conditions (EU-SILC). This is what has been done for the EUKLEMS & INTANProd 2021 release to capture changes in the structure of the workforce, in terms of skills and qualifications and other productivity-relevant characteristics. In particular, and consistently with previous EUKLEMS releases, the estimates of the labour input include the shares of employment and labour compensation by type of worker cross-classifying labour inputs by gender, age and educational qualifications levels.

For the **US**, wage and employment shares for total economy have been provided by the BLS, Industry Productivity Studies.[7]

Capital input

The main data source for GFCF and capital stocks in the capital inputs database of the statistical module for the **European** countries is the database "Cross-classification of gross fixed capital formation by industry and by asset (flows) [nama_10_nfa_fl]" from Eurostat.

The availability of data at the level of the EUKLEMS industry and asset disaggregation is quite limited. Only six countries report GFCF in all asset types for 64 industries (A64, which is the level of detail needed to cover all the industries of the EUKLEMS industry classification).[8] Only 15

[6] An hour worked by a young un-skilled persons does not usually have the same economic value that an hour worked by a highly qualified highly experienced person.
[7] Data have been kindly provided by Corby Garner.
[8] The following industries are identified only at the level of 64 industries of the national accounts classifications: Wholesale and retail trade and repair of motor vehicles and motorcycles (G45), Wholesale trade, except of motor vehicles and motorcycles (G46), Retail trade, except of motor vehicles and motorcycles (G47), Land transport and transport via pipelines (H49), Water transport (H50), Air transport (H51), Warehousing and support activities for transportation (H52), and Postal and courier activities (H53).

countries provide some information at the A64 level and only nine provide GFCF for all or almost all asset types (see Table 2A in the appendix).

The coverage at the level of 38 industries (A38, which is the level of detail needed to identify the 13 manufacturing industries and the three information and communication industries) is larger but far from being complete. Twelve countries provide GFCF for all assets and other six deliver GFCF for at least the major categories. As for the asset types, the major data gaps are for ICT goods, as only 13 countries report data on computer hardware and telecommunications equipment (see Table 3A in the appendix).

The coverage of Eurostat databases slightly increases when the Non-Financial Asset (NFA) database is merged with the database "Gross capital formation by industry (up to NACE A*64) [nama_10_a64_p5]". However, the coverage for the asset type of the A64 database is more limited than the NFA database, as only total intellectual property products are reported, with no detail on computer software and R&D.

The coverage of net capital stock in the NFA database is even lower than the coverage of GFCF, although with several exceptions for each asset type. Only 9 countries report total net capital total at the level of A64 classification and only 14 at the level of A38 classification. The coverage of total capital stock by industry is almost complete at the level of A21: at this level of industry breakdown only Bulgaria and Cyprus do not report total capital stock. However, a few countries do not report data for some industries, as it is the case of Ireland for manufacturing (Nace division C) and administrative and support service activities (Nace division N). Ireland does not deliver data for the larger parent industries either (corresponding, respectively, to the divisions B-E and M-N at the level of the A10 classification) (see Tables 4A and 5A in the appendix).

To fill the data gaps for gross fixed capital formation and capital stocks the EUKLEMS & INTANProd release 2021 screened the data availability country by country and cross classified by asset and industry and, where necessary, resorted to national level information to estimates missing values. Germany is a critical example as the official statistics reports data to Eurostat only for 21 industries (corresponding to the A21 classification of national accounts) but disseminates more disaggregated data by industry on the NSI's website (for machinery and equipment, construction,

and other assets, with no further asset detail). Another example is Spain, for which data on GFCF and capital stocks cross-classified by industry and asset are provided by the IVIE.

When no official estimates are available, the approach is to use the method already adopted for the INTAN-Invest database to estimate the industry distribution of GFCF for R&D, computer software and other intellectual property products. The method takes advantage of the availability of total GFCF in Intellectual Property Products by industry for some European countries (with no further detail by asset type) to be complemented by available national accounts estimates of capital stocks for R&D and computer software by industry.

In this case, GFCF can be estimated as follows. Starting from national accounts capital stocks (chained values) for year t and t-1 (K_t and K_{t-1}) and assuming a given value of the depreciation rate (*delta*) it is possible to compute the implied value of chained investment for year t (I_t), as:

$I_t = K_t - K_{t-1} + K_{t-1}$**delta*.

If net capital stocks were estimated with the geometric model and if the actual depreciation rate used to compute capital stocks is known the above calculation would provide the correct value for I_t. In the **EU**, national statistical institutes usually do not use the geometric method (except for R&D), then the result of the calculation above can provide only an approximation of the real value of I_t.

The same method can be applied to the few countries reporting GFCF in total IPP and computer software by industry, but do not report GFCF in R&D. In this case the initial distribution by industry of GFCF in R&D can be estimated based on the expenditures on R&D surveys.

When no other sources are available, GFCF values have been imputed based on EUKLEMS 2019.

As for capital stocks, the approach is to fill any gap based on producing preliminary estimates of capital stocks applying the permanent inventory method to (official or imputed) GFCF data and then re-scaling them to make them consistent with official national accounts available at a more aggregate level (if any).

Valuation method

Figures in volume terms are provided coherently with current practice in European official national accounts where 2015 is the reference year for chain-linked volumes and price indices.

The general data collection and estimation strategy is as follows:

1) Collect official national accounts data at current and previous year prices from Eurostat or national statistical offices at maximum level of industry disaggregation.

2) Calculate the aggregates of interest at current and previous year prices for the total economy and all desired intermediate levels of (dis-)aggregation adding up detailed industry level data (which is possible as current and previous year prices data are additive);

3) Calculate chain-linked volumes and price indices separately at each level of aggregation.

For countries reporting data at more aggregate level or not reporting industry level data at all, data for the required industries breakdown at current and previous year prices are be obtained as follows:

a) For each variable, it has been necessary to estimate current prices data at the industry level consistent with more aggregate data available from official national accounts using country-specific indicators. Possible (non-exhaustive list) data sources for the indicators are the OECD STAN database, previous editions of national accounts and supply and use tables available from national statistical institutes (NSIs), previous releases of the EU KLEMS database, WIOD database, and, for industries mostly composed by market producers, structural business statistics (SBS).

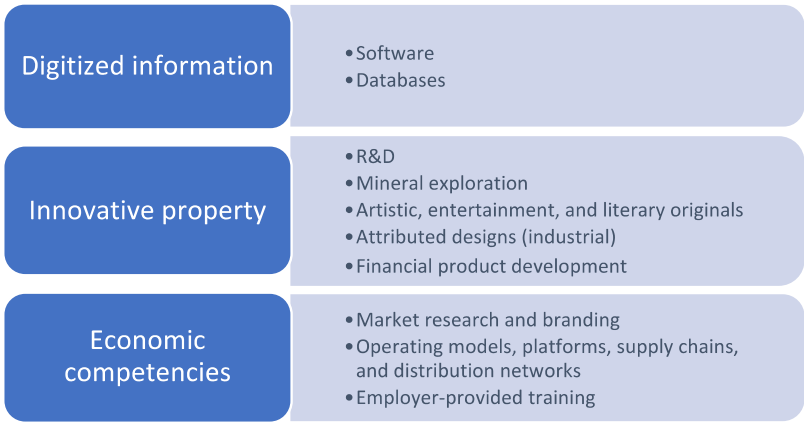
b) For each variable, we calculate deflators at the lowest level of industry aggregation (elementary level) and then we compute initial estimates at previous year prices deflating the current prices estimates. Deflator's calculation relies as much as possible on country and industry-specific price indices. In addition to the data sources mentioned in step one, other sources for deflators are producers price indices (PPIs) and, as a second-best alternative for industries not covered by the PPIs, consumer price indices (CPIs). Whenever possible value added at previous year prices has been calculated using the double-deflation method (i.e. as gross output at previous year prices minus intermediate consumption at previous year prices).

c) As a first step, aggregate preliminary estimates at previous year prices to the higher levels of aggregation have been generated. Then preliminary estimates at previous year prices have been rescaled at 40 industries level to make them consistent with official national accounts available at more aggregate level (if any).

3. Analytical module: data sources and estimation methods

The analytical module includes estimates of GFCF, capital stock and related measures for the whole set of intangible assets originally proposed by Corrado, Hulten and Sichel (2005, 2009), which includes computerized information (software and databases), R&D, design and other nonscience-based new product development costs, brand equity, firm-specific training, and business process reorganization (Table 1).

Table 1. CHS Intangibles



Source: Corrado, Hulten, and Sichel (2005, 2009).

Estimates of intangibles not included in National Accounts, (Design, Financial Product development, Market research and Advertising are estimated following the methodology of INTAN-Invest (www.intaninvest.net).

The main pillar of INTAN-Invest estimation strategy is the adoption of the expenditure-based approach to measure the value of investment in intangible assets (i.e., expenditure data are used to develop direct measures of intangible investment). Moreover, the project generates measures of harmonized intangible investment satisfying (as much as possible) the following criteria: exhaustiveness, reproducibility, comparability across countries and over time, and consistency with official national accounts data. The above characteristics are guaranteed by the adoption of official statistics homogeneous across countries as the main data sources to estimate intangible data in the analytical module.

For all intangible assets not included in National Accounts we generate exhaustive estimates covering both purchased and own account components (i.e. an estimate of the value of intangible assets that economic units produce for their own final use).

The main data sources to measure non National Account intangible investment are as follows (Table 2):

- SUTs for the purchased component of Brand, Design and Organisational capital;
- SES and LFS (tabulated data) for the own-account component of organisational capital;
- SES and LFS (microdata) for the own-account component of brand and design;
- CVTS and LCS for FSHC.

Table 3. Main Data Sources for Non-National Accounts Intangibles

Intangible Asset	Broad Category	Purchased	Own-account	Total
Design	Innovative Property	SUTs	SES, LFS	Purch+O-A
New Financial Products	Innovative Property	na	SES, LFS	O-A
Brand	Economic Competencies	SUTs	SES, LFS	Purch+O-A
Organisational Capital	Economic Competencies	SUTs	SES, LFS	Purch+O-A
Firm-Specific Human Capital	Economic Competencies	na	na	CVTS, LCS

Purchased brand, design and organisational capital for the European economies

The estimates of the purchased component of brand, design and organisational capital for the European countries are obtained directly by industry using expenditure data from the Use Tables[9].

The Use tables compiled according to NACE Rev.2/CPA 2008 report intermediate costs of each industry for the following products: advertising and market research services (CPA M73), architectural and engineering services, technical testing and analysis services (CPA M71) and legal and accounting services, services of head offices and management consulting services (CPA M69 and M70). We use the data on total intermediate costs for these products as a proxy for total expenditure, respectively, in brand, design and organisational capital.

The general approach is similar for the three assets and assumes that the information from the use tables are a good proxy of expenditure in the corresponding asset. We deem that for advertising and market research services (CPA M73) and architectural and engineering services, technical testing and analysis services (CPA M71) the products identified in the use table are good proxies of the corresponding assets and no further adjustments are needed. But this is not the case for legal and accounting services, services of head offices and management consulting services (CPA M69

[9] Use tables consistent with ESA2010 national accounts are available for all EU countries for almost all years from 2010 onwards.

and M70). In this case, we compute the share of turnover of NACE M702 in total turnover of NACE M69_M70 for each country and we apply this share to intermediate consumption in CPA M69_M70. The above correction assumes that, in each country the share of CPA M702 (consulting services) in total intermediate consumption for CPA M69_M70 is the same across all industries. Data on turnover of NACE M702 and M69_70 from SBS are available for all countries for almost all years starting in 2008.

Finally, in each industry a capitalization factor is applied to total expenditure by market producers to obtain the value of total expenditure that we deem should be treated as GFCF and not as intermediate consumption. Capitalization factors are 0.8 for organizational capital, 0.6 for brand and 0.5 for design and are asset specific but not industry specific, with the only exception of a special treatment for subcontracting. It is likely that part of Advertising and Market Research Services (CPA M73) bought by the Advertising and Market Research industry, that part of Design services (CPA M71) bought by the Architectural and engineering industry and that part of Legal, accounting and consulting services (CPA M69 and M70) bought by the Legal, accounting and consulting industry are generated by subcontracting activity. For this reason, we assume that the capitalisation factors for CPA M73 in the Advertising and Market Research industry, for CPA M71 in the Architectural and engineering industry and for CPA M69 and M70 in the Legal, accounting and consulting industry are 50% lower than in the other industries.

For the years earlier than 2010 the World Input-Output Database (WIOD, http://www.wiod.org/home) is an alternative source. The 2016 release, the most recent one, provides national SUTs in current prices, expressed in millions of local currencies for 64 industries, classified according to the International Standard Industrial Classification revision 4 (ISIC Rev. 4) and consistent with the 2008 version of the SNA. The database covers 28 EU countries and 15 other major countries in the world for the period from 2000 to 2014. In particular, the USE table provides intermediate consumption for M69-70, M71 and M73 products.

The largest data gap is for 1995-1999, as for these years there are no use tables available for gathering data on intermediate consumption for M69-70, M71 and M73. For these years we use EUKLEMS 2019 as indicator to back-cast the year 2000 level to 1995.

Own-account brand, design, organisational capital and new financial products for the European countries.

We have estimated the own-account component of organizational capital, brand, design, and new financial products using a cost-based approach consistent with the methods usually adopted by national statistical offices to estimate own account software and databases. The calculation is as follows: first we estimate the labour cost component by multiplying the number of the relevant employees (adjusted for the share of time spent in producing the relevant asset) for their average compensation; then we multiply the labour cost by a blow-up factor to account for other cost components (intermediate consumption and gross operating surplus) to derive an output measure consistent with national accounts.

Estimating the own account component of GFCF requires detailed employment and compensation data by type of occupation and by industry. We use micro-data of the EU Structure of Earnings Survey (SES) for 2010, 2014, and 2018 and the EU Labour Force Survey (LFS) for 2008-2019. SES microdata are not available for Ireland and Austria. The SES provides information on the number of employees by occupation (at the three-digit level of the 2008 International Standard Classification of Occupations, ISCO) and economic activity and their annual earning, while the LFS only provides data on employment with no information on wages. In the LFS, occupations are available at the three-digit level of ISCO for all countries, while SES data for 11 countries are available at two-digit. We have disaggregated two-digit ISCO into three digits for these countries based on the share of each relevant three-digit occupation from the LFS.

For each asset, the calculation for 2010, 2014 and 2018 (the year for which we have the SES) is as follows:

1. Calculate total employment for each relevant occupational group involved in producing the asset (identified at three-digit ISCO)

2. Apply occupation-specific time-use assumptions to each occupation's employment

3. Calculate total wages for each (time-use adjusted) relevant occupation.

4. Calculate the total share of all occupations involved in producing data stores/data intelligence in total wages from the SES

5. Calculate labor cost component consistent with national accounts by applying the share calculated at step 4 to national accounts' compensation of employees.

6. calculate gross output by applying country-specific blow-up factors to the labour cost component derived at step 5. We have used blow-up factors equal to 2 for each country.

We have derived the wage shares of the intervening years (when the SES is not available) by based on information from the LFS. For each country, we have calculated the share of (time-use adjusted) relevant occupations in total employment for 2012-2018 from LFS. We have then used the employment share as an indicator to extrapolate/retropolate the wage shares obtained from the SES.

We have estimated the wage shares by industry at the level of Nace sections excluding Nace sections O (public administration and defence; compulsory social security), which the SES does not cover. When relevant, the shares of each section are used to calculate own-account GFCF in the corresponding more disaggregated industries.

The SES and LFS industry breakdown in the data disseminated by Eurostat is limited to one-digit level of the NACE classification. For more disaggregated industries, we apply the share of each category of occupation calculated for the respective 1-digit industry to all the corresponding disaggregated industries.

Training (EU countries and UK)

Investment in firm specific human capital (training) is obtained as the sum of investment in vocational training and apprenticeships.

The estimates of investment in vocational training are based on data from the EU Continuing Vocational Training Survey (CVTS) integrated with data from the EU Labour Cost Survey (LCS) to derive the EUKLEMS industry breakdown. The CVTS collects information on enterprises' investment in the continuing vocational training of their staff and is available for 2005, 2010, and 2015. Continuing vocational training (CVT) refers to education or training courses that are financed in total or at least partly by the enterprise (directly or indirectly). Estimates of training costs based on the CVTS include both the purchased and the own account component. For instance, both internal and external CVT courses are identified, and courses' costs include the labour costs of internal trainers. In addition, CVTS costs also cover the opportunity cost for employees

attending courses, as they include the labour cost of participants for vocational training courses that take place during paid working time.

The country coverage of the CVTS is almost complete, but the industry detail is very low. Data from Eurostat are available only for five large industries: industry except construction (B-E), construction (F), wholesale and retail trade, transport, accommodation, and food service activities (G-I), information and communication, and financial and insurance activities (J-K), real estate activities, professional, scientific and technical activities, administrative and support service activities, arts, entertainment and recreation, and other service activities (L-N-R-S).

Starting from the estimates for the industries based on CVTS, the EUKLEMS industry breakdown is derived using indicators from the LCS, which reports the share of vocational training in total labour costs with a much higher level of industry detail.

LCS, collected every four years, provides detailed information on the level and structure of labour cost data, hours worked and hours paid in different sectors of economic activity and results are available for the reference years 2000, 2004, 2008, 2012 and 2016.

The CVTS is our preferred source to estimate GFCF in training with respect to the LCS for several reasons. First, the EU LCS underestimates firms' investment in training, as it does not include the labour cost of participants for vocational training courses in vocational training costs (they are included in the compensation of employees' component of total labour costs). Second, the LCS is not the best data source available on vocational training costs. The goal of the LCS is to provide a comprehensive and detailed picture of the level and structure of labour costs. Vocational training costs account for a minor share of total labour costs, and they are not the main focus of the survey. Thus, it is likely that the accuracy of the estimate of training costs in the LCS is much lower than in the CVTS, whose goal is precisely to collect information on enterprises' investment in the continuing training of their staff.

Based on CVTS and LCS we have estimated the cost of CVT courses as percentage of total labour cost. A time series of shares is obtained linearly interpolating tha values estimated for the years covered by the CVTS and LCS. CVT expenditure consistent with national accounts data is then obtained by multiplying the estimated shares and compensation of employees. Finally, the apprenticeships component is based on apprentice costs as a percentage of total labor derived from

the LCS. For training, we assume that all expenditure increase the value of the stock of FSHC and therefore should be considered as GFCF (i.e. we assume a capitalisation factor equal to one).

US estimates of non-national account intangibles

The general methods outlined for the European economies are followed for the United States, but there are some departures and some significant differences in data availability.

For intangible assets included in the national accounts, separate data for artistic, literary, and entertainment originals, including five detailed components, are available, and thus all national accounts IPP components are available. Each IPP component is obtained from the U.S. Bureau of Economic Analysis (BEA) Fixed Asset Accounts (FAs), which covers 63 private industries and provides time series from 1901 on (where relevant). The U.S. industry data follow the North American Industry Classification System (NAICS) and the 63 industries are grouped to the NACE sectors covered in INTAN-Invest (see above for NACE sectors covered).

Non-national accounts (NonNA) components of intangible investment are based on BEA's Annual Input-Output Accounts (IO), which are available at the 71 industry sector level; the 71 industries include the same 63 included in the FAs, plus 5 government sectors. Annual IO data are available from 1997 on and may be linked to earlier versions from 1977 on. Excluding training, discussed below, we are able to rely on only one commodity component in these accounts, miscellaneous professional and technical services (BEA code 5412OP, which covers NAICS 5412-4,6-9). The relevant individual components are first shared out using details from the benchmark IO table, which covers more than 600 industries. These results are then adjusted to a domestic spending indicator based on gross output less net exports; where relevant gross output and services trade components are not available, product line revenue data from Census Bureau surveys are used.

Ocial survey data on private industry spending on employer-provided train- ing is scant for the United States. However, each year *Training Magazine* issues a "Training Industry Report" on U.S. expenditures. The survey includes payroll of employees devoted to training and spending on external products and ser- vices for training; some major industry detail is provided. These data have been benchmarked to a comprehensive survey conducted by the BLS in 1996, which also provided major industry sector detail, and then controlled to the industry distribution of intermediate purchases of education services from BEA's Annual Input-Output Accounts. The

own-account component is also benchmarked to the BLS survey, extended by information in the "Training Industry Report" on hours of training per employee and BEA wage data by industry**.**

4. Growth accounting

The growth accounting calculation follows the EU KLEMS 2019 release methodology, as described in the *Report on methodologies and data construction for the EU KLEMS Release 2019.*[10] We refer to the *Report* for a formal description of the Growth Accounting model.

We calculate contributions to value added growth and contributions to labor productivity growth (measured in terms of value added per hour worked). Value-added growth in volume terms is decomposed into the contribution of capital and labor services and total factor productivity (TFP) growth. This decomposition is then used to calculate TFP growth as a residual. Value added in volume terms per hour worked growth is decomposed into the contribution from capital services per hour worked, the labor composition effect, and TFP growth (calculated as a residual and equivalent to the estimate obtained from the growth accounting decomposition of value added growth).

The measurement of capital services requires a two-stage method. First, it is necessary to estimate the volume and price of the services provided by each type of asset (i.e., its productive capital stock and its user cost); then to construct an aggregate measure of the productive contribution of the different type of assets (i.e., of the aggregate flow of capital services). Consistently with previous EUKLEMS releases, we adopt the standard neoclassical approach that provides a consistent and comprehensive framework for measuring capital services.

The flows of capital services provided by each asset type are not (usually) observable; therefore, they have to be measured by a proxy. The standard practice assumes that the service flows in volume terms are proportional to the capital stock in volume terms. The user cost of capital measures how much it costs using one unit of the services provided by that asset. More precisely, it includes a nominal rate of return, economic depreciation, and capital gains-losses due to asset price changes.

[10] Available at: https://euklems.eu/documentation/

We measure the nominal rate of return as an endogenous (or internal) rate. This option rests on the assumption that the remuneration of capital services exhausts total non-labor income measured from national accounts (gross operating surplus plus an imputation for the component of gross mixed income attributed to capital). If this equality holds, given the estimates of total income and of productive capital stock and of the other components of user-cost for each asset, then rate of return can be computed residually. Finally, the capital gains-losses component is calculated based on the implicit GFCF deflator for each asset.

Once the productive stocks for different types of assets have been estimated, they are aggregated to get a volume index of capital services. The aggregation procedure requires the choice of a specific aggregation formula and a system of weights. We adopt the standard aggregation approach based on the Tornqvist index and weights given by the average shares of each asset in the value of capital compensation. For each asset, capital compensation is calculated as its productive capital stock times the corresponding user cost.

Analogous to capital services, labor services aim to capture changes in the amount and quality of labor input over time. This approach assumes the labor force is divided into different categories based on age, gender, and educational attainment, as described in section 3. It is further assumed that the flow of labor services for each category is proportional to the hours worked, and workers are paid their marginal productivities. On this basis, the flow of labor services is computed aggregating volume indexes of individual categories using a Tornqvist index and weighting them with the average shares of each category with respect to the value of labor compensation.

Implementation issues

To guarantee continuity with EUKLEMS 2019 release, we use official capital stocks data produced by national statistical institutes in the growth accounts based on national accounts as available in the statistical module. However, this creates some internal inconsistencies. Depreciation rates assumed by the NSIs could be different from the depreciation rates we use in our calculations to derive capital services. Therefore, capital stock measures are not entirely consistent with our measures of return rates, user costs, and capital services.

Growth accounting results based on the extended asset boundary in the analytical module differ from those based on the statistical module for two reasons. First, the capitalization of intangible

assets directly impacts capital services and capital compensations, as additional assets are included in the calculation. Second, the capitalization of new intangibles increases the level of value added and changes its growth rate, as expenditure to purchase them is no longer accounted as intermediate consumption.

Capital stocks of new intangible assets have been generated using the so-called geometric method. However, we have also calculated capital stocks for national accounts assets based on the geometric method to be used in the extended growth accounting alternatively to official estimates. Newly calculated capital stocks allow obtaining consistent measures of user costs and capital services based on the same depreciation rates.

In the growth accounts in the statistical module, we calculate, provide and disseminate:

- All variables from the last release of the EU KLEMS database, including capital services for asset groups (tangible and intangible assets; ICT and non-ICT, etc).
- Capital compensation for each asset type (not disseminated in the previous releases of the EU KLEMS database).

In the extended growth accounts in the analytical module, we calculate, provide and disseminate:

- All standard Growth accounting variables including capital services for asset groups (tangible and intangible assets; ICT and non-ICT, etc). When relevant, the variables are adjusted for the extended asset boundary including intangible assets currently not estimated in official national accounts (e.g., value added and capital compensation).
- Adjusted capital compensation for each asset type

Disseminating capital compensation for each asset type will increase the transparency of growth accounting calculation. In addition, it will allow users to calculate capital services volume indices (and the corresponding contributions to value added and labor productivity growth) for any other asset group of interest.

5. PPPs adjusted productivity levels

Measures of PPPS and productivity levels will be released by the end of January 2022. We calculate the basic data and provide productivity comparisons of productivity levels for the benchmark year 2017, which is also the reference year of the most recently released results of the International Comparison Program (ICP). In addition, we will provide labour and multifactor productivity comparisons for other selected years based on the extrapolation approach proposed by Inklaar at al. (2008). [11] The method is basically a constant PPP approach. For instance, to update a volume comparison for a given variable from 2017 to 2010, we will simply apply the relative volume growth rates between the two countries in the period from the 2017 to 2010.

As for productivity growth, industry productivity levels can be defined in terms of value-added or gross output terms. Consistently with growth accounting analysis in the most recent releases of the EU KLEMS database, we will calculate productivity levels in terms of value-added. To calculate relative TFP levels for value added based TFP we need value added PPPs, labour input PPPs and capital input PPPs. We follow the methodology elaborated in Inklaar et al. (2008) subject to data availability.

Value added PPPs

We calculate PPPs for value added based on the output PPPs only (single deflation) and, for a selection of countries, depending on data availability, also double deflated value added PPPs (i.e., value added derived by independent comparisons of gross output and intermediate inputs with their own PPPs).

For aggregate comparisons, expenditure prices are the common basis for measures of GDP PPP (expenditure-side PPPs). For comparisons of industry output, however, the conceptually correct PPP is based on basic output prices by industry (production-side PPPs). However, compiling the theoretically correct production-side PPPs is very data demanding and simply not feasible for many industries.

[11] Inklaar, R., & Timmer, M. P. (2008). GGDC Productivity Level Database: International Comparisons of Output, Inputs and Productivity at the Industry Level. (GGDC Working Papers; Vol. GD-104). Groningen: GGDC. Available at: https://www.rug.nl/research/portal/files/2761940/gd104online.pdf

Based on Timmer et al. (2007)[12], Inklar at al. (2008) we use the following PPPs for industry output:

- Production-side PPPs which have partly been constructed using unit value ratios for agricultural, mining, and manufacturing products and transport and communication services;
- PPPs based on specified expenditure prices from Eurostat and the OECD adjusted to industry level output by using relative transport and distribution margins and differences in relative tax rates for other market industries.
- A special treatment for non-market services (industries L, M, N and P) where the output PPPs is defined as a weighted sum of EUKLEMS inputs and, consequently, comparative productivity levels in these industries are all one.

Timmer et al. (2007) argue that using PPPs from the expenditure or production side to calculate industry output PPPs is an empirical choice and will differ by industry. They provide a framework to assess the strengths and weaknesses of PPPs from the expenditure side in different industries using a supply-use framework. PPPs from the expenditure side only approximate the industry level prices when most of the expenditure is on domestically produced goods as the produced industry output goes mostly to domestic final expenditure and not to intermediate consumption or exports.

Subject to data availability, we will update the assessment by Timmer, Ypma and van Ark (2007) for some selected countries based on most recent supply and use tables to evaluate whether, for each industry, it is preferable to compute the PPPs from the expenditure or from the production side to calculate industry output PPPs.

For agricultural, mining, and manufacturing products and transport and communication services our first choice is to calculate production-side PPPs replicating Timmer et al. (2007) subject to data availability. If for a given industry, data constraints prevent us from calculating production-side PPPs, we will use (adjusted) expenditure side PPPs.

[12] Timmer, M.P., Ypma, G. and van Ark, B. (2007) PPPs for industry output: a new dataset for international comparisons, Working Paper GD-82, Groningen Growth and Development Centre, University of Groningen

For other market industries, we will calculate PPPs based on specified expenditure prices from Eurostat and the OECD, adjusted to industry level output accordingly to the methodology by Timmer et al (2007)

For non-market services (industries L, M, N and P) we replicate the methodology in Inklaar et al (2008)

PPPs for intermediate input

PPPs for intermediate input are needed to calculate double deflated value added PPPs. Following Inklaar at al. (2008), we use output PPPs as a proxy for relative intermediate input prices under the assumption that the basic price of a good is independent of its use. That is, we use the same gross output PPP of an industry to deflate all intermediate delivers from this industry to other industries.

PPPs for labour input

PPPs for labour inputs are derived by dividing a country's wage rate by the corresponding US wage rate. This must be done at a detailed level of aggregation as characteristics of workers vary greatly across countries. By having a detailed breakdown into various labour types, we try to minimise problems of composition in the determination of relative wages. For each group in each industry, wages per hour worked are taken from the EU KLEMS database.

PPPs for capital input

Capital PPPs give the relative price of the use of a unit of capital in two countries from the purchasers' perspective. Inklaar et al. (2008) follow Jorgenson and Nishimizu (1978) and obtain relative prices for capital input under the assumption that the relative efficiency of new capital goods is the same in both countries. Under this assumption, for each asset type, the relative rental price of a unit of capital between two countries depends on the relative investment price and the user cost of capital input. The latter depends on the rate of return to capital, the depreciation rate and the investment price change, and is available from the input calculations to derive capital service in the EU KLEMS database.

Data sources

For agriculture we will rely on the FAOSTAT Database of the FAO. This database contains a very extensive set of quantities and farm-price values of agricultural products.

For manufacturing and mining, the most important data source needed to calculate PPPs is the Prodcom Survey, which reports, for each product in the Prodcom List, the value and the volume of production in the reporting country during the reference period. The survey covers all EU countries and, for 2017, UK as well.

Investigation is currently underway to identify the most appropriate data sources for transport and communication, for which the key challenge is to match value and quantity data from the same source as much as possible to ensure consistency.

For expenditure-side PPPs (including GFCF PPPs needed to calculate PPPs for capital input) we refer to Eurostat and OECD databases on PPPs, possibly requesting to gain access to more detailed, confidential PPP data below the level of the disseminated analytical categories. We refer to Eurostat and OECD databases on PPPs. On the Eurostat website PPPs for all EU countries and UK are published at the level of 61 analytical categories which comprise aggregates of basic headings and include some of the main expenditure aggregates like GDP, actual individual consumption, household final consumption, collective consumption, and gross fixed capital formation. PPPs for US and Japan are available from the OECD website and are published at the level of 50 categories.

The main issue with data sources for calculating relative productivity levels is the availability of the tables of trade and transport margins needed to adjust expenditure PPPs to industry-level output. In the Eurostat database on supply, use, and input-output tables, tables of margins for 2017 are available only for 13 countries.[13] However, the coverage is almost complete for 2015, as only data for Bulgaria, Germany, and Spain are missing. We use margin rates from the 2015 tables when available, assuming that margin rates are not likely to differ widely in a short period of time. For Bulgaria there is only the 2010 table, while for Germany and Spain there are no margins tables available. For these three countries, we will further investigate whether margins tables are available from country-specific sources. If not, we produce our estimates based on the methods proposed in the United Nations *Handbook on Supply, Use and Input-Output Tables with Extensions and Applications* (2018), integrated with some simplifying assumptions.

[13] CZ, DK, EE, FR, IT, CY, LT, LU, HU, NL, AT, PT, UK.

Appendix

Table 1A. Gross output at previous year prices, missing observations from Eurostat database (% total cells to be estimated in each year)

Country	GEO	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019
Belgium	BE	15.5	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	17.2
Bulgaria	BG	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Czechia	CZ	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Denmark	DK	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Germany	DE	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	50.0
Estonia	EE	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Ireland	IE	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Greece	EL	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Spain	ES	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
France	FR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Croatia	HR	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	3.4	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	100.0
Italy	IT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Cyprus	CY	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Latvia	LV	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	1.7	1.7	1.7	53.4
Lithuania	LT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Luxembourg	LU	100.0	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4	22.4
Hungary	HU	100.0	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Malta	MT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Netherlands	NL	100.0	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Austria	AT	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Poland	PL	100.0	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	3.4	50.0
Portugal	PT	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	100.0
Romania	RO	100.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Slovenia	SI	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Slovakia	SK	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Finland	FI	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7	1.7
Sweden	SE	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	8.6	100.0

Source: Authors' own elaboration on Eurostat data.

Table 2A. Availability of GFCF by asset at the A64 industry classification in the nama_10_nfa_fl database

ASSET10	ASSET10(L)	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
N11G	Total fixed assets	1	1	1	1	0	0	0	1	0	0	0	0	1	0	1	1	0	0	1	0	1	1	0	1	1	1
N112G	Other buildings and structures	0	1	1	1	0	0	0	1	0	0	0	1	1	0	1	1	0	0	1	0	1	1	0	1	1	1
N11MG	Machinery and equipment and weapons systems	0	1	1	1	0	0	0	1	0	0	0	0	1	0	1	1	0	0	1	0	1	1	0	1	1	1
N1131G	Transport equipment	0	1	1	1	0	0	0	1	0	0	0	1	1	0	1	1	0	0	1	0	1	1	0	1	1	1
N1132G	ICT equipment	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	1	0	1	1	1
N11321G	Computer hardware	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	1	0	1	1	1
N11322G	Telecommunications equipment	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	1	0	0	1	1
N11OG	Other machinery and equipment and weapons systems	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	0	0	0	1	0	1	1	0	1	1	1
N117G	Intellectual property products	0	0	1	1	0	0	0	1	0	0	0	0	1	0	1	1	0	0	1	0	1	1	0	1	1	1
N1171G	Research and development	0	0	1	0	0	0	0	0	0	0	0	0	1	0	0	1	0	0	1	0	1	0	0	0	0	1
N1173G	Computer software and databases	0	0	1	0	0	0	0	0	0	0	0	0	1	0	1	1	0	0	1	0	1	1	0	1	1	1

Source: Authors' own elaboration on Eurostat data.

Table 3A. Availability of GFCF by asset at the A38 industry classification in the nama_10_nfa_fl database

ASSET10	ASSET10(L)	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
N11G	Total fixed assets	1	1	1	1	0	0	0	1	0	1	1	0	1	0	1	1	0	1	1	0	1	1	0	1	1	1
N112G	Other buildings and structures	1	1	1	1	0	0	0	1	0	1	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1
N11MG	Machinery and equipment and weapons systems	1	1	1	1	0	0	0	1	0	1	1	0	1	0	1	1	0	1	1	0	1	1	0	1	1	1
N1131G	Transport equipment	1	1	1	1	0	0	0	1	0	1	1	1	1	0	1	1	0	1	1	0	1	1	0	1	1	1
N1132G	ICT equipment	1	0	1	0	0	0	0	0	0	1	1	0	1	0	1	0	0	1	1	0	1	1	0	1	1	1
N11321G	Computer hardware	1	0	1	0	0	0	0	0	0	1	1	0	1	0	1	0	0	1	1	0	1	1	0	1	1	1
N11322G	Telecommunications equipment	1	0	1	0	0	0	0	0	0	1	1	0	1	0	1	0	0	1	1	0	1	1	0	1	1	1
N11OG	Other machinery and equipment and weapons systems	1	0	1	0	0	0	0	0	0	1	1	0	1	0	1	0	0	1	1	0	1	1	0	1	1	1
N117G	Intellectual property products	1	0	1	1	0	0	0	1	0	1	1	0	1	0	1	1	0	1	1	0	1	1	0	1	1	1
N1171G	Research and development	0	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0	1	1	0	1	1	0	1	1	1
N1173G	Computer software and databases	1	0	1	0	0	0	0	0	0	1	1	0	1	0	1	1	0	1	1	0	1	1	0	1	1	1

Source: Authors' own elaboration on Eurostat data.

Table 4A. Availability of net capital stock by asset at the A64 industry classification in the nama_10_nfa_st database

ASSET10	ASSET10(L)	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
N11N	Total fixed assets	0	0	1	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	1
N11KN	Total Construction	0	0	1	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	1	1	1
N112N	Other buildings and structures	0	1	1	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	1	1	1
N11MN	Machinery and equipment and weapons systems	0	1	1	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	1	1	1
N1131N	Transport equipment	0	1	1	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	1	0	0	1	1	1
N1132N	ICT equipment	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	1
N11321N	Computer hardware	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	1
N11322N	Telecommunications equipment	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	1
N11ON	Other machinery and equipment and weapons systems	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	1
N117N	Intellectual property products	0	1	1	1	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	1
N1171N	Research and development	0	1	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	1
N1173N	Computer software and databases	0	0	1	0	0	0	0	1	0	0	0	0	1	0	1	0	0	0	1	0	0	0	0	1	1	1

Source: Authors' own elaboration on Eurostat data.

Table 5A. Availability of net capital stock by asset at the A38 industry classification in the nama_10_nfa_st database

ASSET10	ASSET10(L)	BE	BG	CZ	DK	DE	EE	IE	EL	ES	FR	IT	CY	LV	LT	LU	HU	MT	NL	AT	PL	PT	RO	SI	SK	FI	SE
N11N	Total fixed assets	1	0	1	1	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	1	0	0	1	1	1
N11KN	Total Construction	1	0	1	1	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	1	0	0	1	1	1
N112N	Other buildings and structures	1	1	1	1	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	1	0	0	1	1	1
N11MN	Machinery and equipment and weapons systems	1	1	1	1	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	1	0	0	1	1	1
N1131N	Transport equipment	1	1	1	1	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	1	0	0	1	1	1
N1132N	ICT equipment	1	0	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	0	0	0	1	1	1
N11321N	Computer hardware	1	0	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	0	0	0	1	1	1
N11322N	Telecommunications equipment	1	0	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	0	0	0	1	1	1
N11ON	Other machinery and equipment and weapons systems	1	0	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	0	0	0	1	1	1
N117N	Intellectual property products	1	1	1	1	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	1	0	0	1	1	1
N1171N	Research and development	1	1	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	0	0	0	1	1	1
N1173N	Computer software and databases	1	0	1	0	0	0	0	1	0	1	1	0	1	0	1	0	0	1	1	0	0	0	0	1	1	1

Source: Authors' own elaboration on Eurostat data.