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The OECD STAN Database for industrial analysis: Sources and methods

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The OECD STAN Database for Industrial Analysis

Sources and methods

Peter Horvát and Colin Webb

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This paper summarises and describes the variables, industries, methods and sources used in the construction of the STructural ANalysis (STAN) industry database. The STAN database serves as a tool for analysing industrial performance at a relatively detailed level of industrial activity. It includes annual measures of output, value added and its components, as well as labour input, investment and capital stock from 1970 onwards. This allows for a wide range of comparative cross-country analyses focusing on, for example, productivity growth, competitiveness and economic structural change. A standard industry list allows for comparisons across countries and provides sufficient detail to focus on, for example, high R&D-intensive activities, high digital-intensive activities or detailed ICT industries. The industry list is compatible with those used in related OECD industry databases.

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Introduction

The STAN database for STructural ANalysis (STAN) provides analysts and researchers with a comprehensive tool for analysing industrial performance at a relatively detailed level of activity. It includes annual measures of output, value added and its components; labour input, investment and capital stock for total assets including ICT assets, from 1970 onwards, allowing users to construct a wide range of analyses focusing on, for example, productivity growth, competitiveness and general structural change. A standard industry list allows comparisons across countries and provides sufficient detail to enable users to focus on, for example, high R&D intensive activities, high digital intensive activities or detailed ICT industries. The industry list is compatible with those used in related OECD databases.

STAN is based primarily on member countries' annual National Accounts by activity tables and uses data from other sources, such as national industrial surveys/censuses, to estimate missing detail or, previous vintages or different versions of either National Accounts or STAN or other harmonised datasets to extend series back to 1970s. Many of the data points in STAN are estimated; they do not represent official member country submissions. Estimates are distinguished from official data through the use of flags or metadata. The purpose of estimation in STAN is twofold: to provide the longest time series possible based on available data, overcoming breaks in series across different vintages of official statistics, mostly due to changes in methodology; and to provide consistent estimates for detailed industries not available in official National Accounts. The current version of STAN is based on the International Standard Industrial Classification of all Economic Activities, Revision 4 (ISIC Rev. 4) and the System of National Accounts 2008 (SNA08) or European System of Accounts 2010 (ESA10) for European countries. Earlier versions of STAN were based on ISIC Rev. 3 and ISIC Rev. 4 combined with SNA93/ESA95.

STAN is updated on a 'rolling basis' - new tables are made available as soon as they are ready via OECD's online statistics dissemination tool OECD.STAT (for direct access go to http://oe.cd/stan). From OECD.STAT main page (http://stats.oecd.org), STAN is grouped under "*Industry and Services*" together with related data sets such as R&D expenditure (ANBERD), Bilateral Trade by Industry and End-Use (BTDIxE) and harmonised national Input-Output Tables (IOTs). STAN is maintained by the Directorate for Science, Technology and Innovation under the auspices of OECD's Committee on Industry, Innovation and Entrepreneurship (CIIE). The database is published on the responsibility of the Secretary-General of the OECD.

This paper is organised as follows. In the first section, the motivation behind the creation and evolution of the STAN database over time is described. Section two presents the primary and secondary sources used to generate the STAN database and how it links with other OECD databases. Sections three and four describe the industry breakdown and the definitions of variables. The estimation methodology used to populate the STAN database is explained in section five, while section six presents examples of metadata. In the last section, recommended uses, some possible limitations and planned future extensions of the database are outlined.

1. The origins and evolution of the STAN database

The STAN industry database was conceived in the early 1990s as one of a suite of four databases designed with the aim of measuring and analysing international technology diffusion and its impact on productivity (Papaconstantinou, Sakurai and Wyckoff, 1996, and Sakurai, Ioannidis and Papaconstantinou, 1996). The other three databases were i) industry R&D expenditures (ANBERD) used as a proxy to estimate "technology intensity", ii) harmonised national Input-Output tables (for 10 countries) to track inter-industry flows of embodied R&D, and iii) estimates of exports and imports of goods by industry (BTD) to help track inter-country flows of embodied R&D. Since its first publication, the STAN database has evolved significantly. Not only has it followed changes in international standards (e.g. SNA) and activity classifications but its country, industry and variable coverage has increased significantly. The first version of STAN was based on ISIC rev. 2 and the 1968 System of National Accounts (SNA68) and only covered manufacturing activities, seven measures of industrial activity and 12 countries. In the beginning, the database represented an annual snapshot of industrial statistics and to improve timeliness, nowcasting methods were developed based on quarterly data. The latest version of STAN is based on the 2008 System of National Accounts (SNA08) and ISIC Rev. 4 classification. The STAN database is published on a rolling basis for all OECD countries, nearly all ISIC Rev.4 2-digit Divisions of economic activity (and additional detail) and covers 46 measures. The following section and Table 1.1present a brief, non-exhaustive, overview of the different versions and changes over time.

Table 1.1. Overview of STAN evolution

Version/coverage	Countries	Industries	Variables	SNA	Year	Key changes
1.1.STAN ISIC Rev.2 SNA93	22	49 **ISIC Rev. 2** Manufacturing only	8	1968/ 1993	1970- 1998	Introduction of basic prices; capitalisation of software
1.2 STAN ISIC Rev.3 SNA93	34	107 **ISIC Rev. 3**	30	**1993**	1970- 2009	Industry coverage extended to all activities; rolling updates; and chain-linked volumes
1.3 STAN ISIC Rev.4 SNA93	15	121 **ISIC Rev. 4**	32	1993	1970- 2011	Industry classification change
1.4 STAN ISIC Rev.4 SNA08	38	138 ISIC Rev. 4	36	**2008**	1970- 2016	Capitalisation of R&D
1.5 STAN ISIC Rev.4 SNA08 (2015 benchmark)	27*	153 ISIC Rev. 4	46 (+ ICT assets)	2008	1970- 2018	Benchmark revisions

Note: *at the time of publication of this paper

1.1. STAN ISIC Rev. 2 SNA93

Implementation of the recommendations of the 1993 System of National Accounts (SNA93, or ESA95 in Europe) led to two main changes in the time-series presented in STAN database. Firstly, SNA93 introduced the recommendation that gross output and value added by industry should be provided at **basic prices**. Previously, countries used the concept of producer's prices, or factor costs, recommended under SNA68 (also, SNA93 recommended the use of purchaser's prices for Input-Output Tables). Secondly, SNA93 recommended that intangible assets such as software and mineral exploration should be capitalised. The change of treatment of software purchases had a significant effect on

STAN estimates. With software now considered as an investment rather than current costs, estimates of *Gross Fixed Capital Formation* (GFCF) were much higher than before, particularly in heavy ICT using sectors. Removal of software from *Intermediate consumption* led to an increase in *Gross value added*. However, the range of the revisions were significantly different across countries and investigations revealed that differences in estimation procedures contributed significantly to the differences in software capitalisation rates (see Ahmad, 2003). Harmonised methods for estimating software were devised for implementation by countries from the mid-2000's (see next version of STAN, 1.2 below).The last update of this ISIC Rev.2 version of STAN was published in 1998.

1.2. STAN ISIC Rev. 3 SNA93

During the transition of the STAN database to ISIC Rev. 3, the STAN database changed its coverage to incorporate all economic activities for the first time, most notably services.

More and more countries adjusted their national accounts to SNA93 and thus the definitions of variables changed:

- **Use of chained volumes** - Previously, most countries calculated output (and investment) volumes by using fixed base Laspeyres aggregation (hence the term "GDP at constant prices"). The majority of countries now provide annually re-weighted chained volumes**.**
- Capital Stock estimates - Asset type breakdowns were expanded in many countries (e.g. to separate **ICT** and **software goods**) which affected the estimation of capital stocks by industry. Also, many countries refined their methodologies (for example, introducing new estimates of retirement patterns or average service lives).
- **Use of quality-adjusted or "hedonic" deflators** (see Triplett, 2006) - the increasing use of such deflators for ICT products significantly altered the profile of output deflators in ICT industries compared with using prices of ICT products based on traditional deflating methods.
- **Financial intermediation services indirectly measured** (FISIM - formerly known as "Imputed bank service charges") were allocated to *Intermediate consumption* by activity. Previously, FISIM was deducted from Gross value added at the total economy level to arrive at total Gross Domestic product (GDP).
- **Output of services** - There was a general effort in many countries to improve direct measurement of the output of services. For example, the practice of estimating real output for services using input measures (such as employment), particularly for the public sector, greatly limited the validity of productivity indicators for the industries concerned.

This version of STAN was updated, and published, between 1999 and 2011. The final edition presented time series up to 2009.

1.3. STAN ISIC rev. 4 SNA93

In line with preparation for the implementation of SNA08 many countries (mainly in Europe) adopted ISIC Rev.4 (NACE Rev. 2) to classify their economic activities. Although there are many similarities in the industry descriptions of ISIC Rev.4 and ISIC Rev. 3 (the standard for SNA93), there are quite a number of significant differences in the detailed

activities included (for an illustration see Annex 2). Therefore, even without changes in definitions of variables, differences were apparent between the two versions of national accounts based data sets such as STAN. Only a handful of countries produced SNA93 series with ISIC Rev.4 / NACE Rev.2 and this version of STAN was relatively short-lived: only updated between 2012 and 2014.

1.4. STAN ISIC rev. 4 SNA08

From 2009, OECD Member Countries revised their National Accounts to conform to recommendations outlined in SNA08 or, in Europe, ESA10 (EU, 2013). By the end of 2014, most OECD countries had implemented the new standards. Australia was the first in 2009, followed by Canada in 2012, and Israel, Mexico and the United States, in 2013. During 2014, implementation was completed by EU countries and Iceland and Switzerland (in line with EU legislation on the implementation of the ESA 2010) as well as by Korea, Norway and New Zealand. Chile, Japan and Turkey published SNA08 statistics in the following two years.

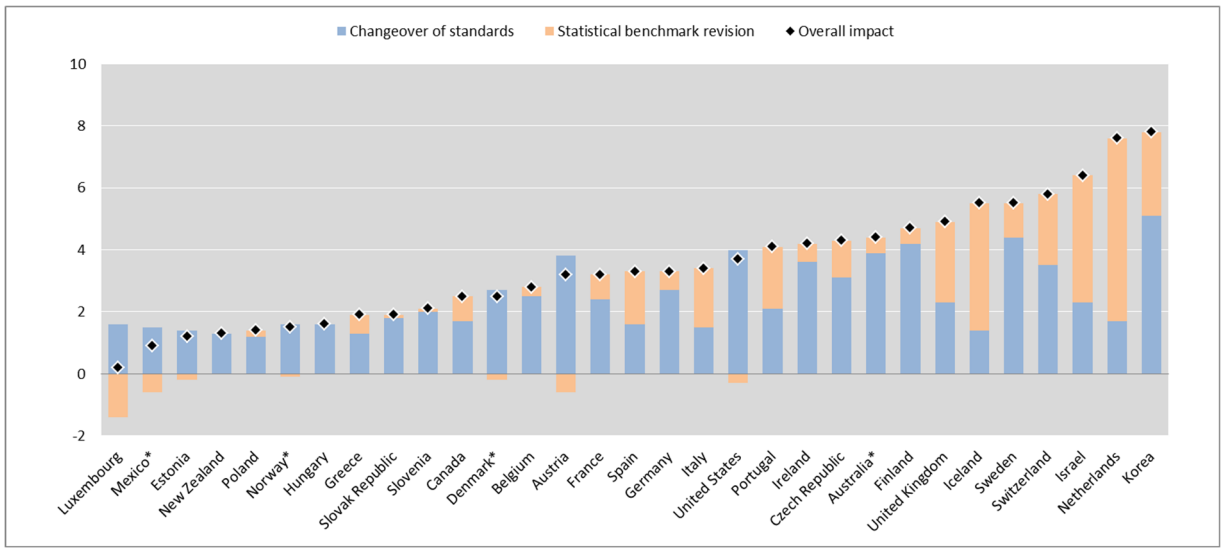
The changes in the international standards (SNA93 to SNA08), that had the most impact on headline indicators such as GDP, concerned the "capitalisation" of expenditures on Research and Development (R&D) and, to a much lesser extent, military weapons systems:

- **Research and development**- purchases of R&D are now recorded as investments whereas previously they were treated as intermediate consumption (c.f. change in treatment of software under SNA93). This change increases value added and GFCF. However, a considerable part of R&D is not purchased but conducted within an enterprise. This increases output with the own-account production of R&D-assets, thus also increasing value added and GFCF.
- **Military weapons systems** – military vehicles, warships, submarines, tanks, aircrafts and missile carriers are also reclassified as fixed assets. Most single-use weapons are classified as military inventories until they are used. They enter intermediate consumption, except some particular types of ballistic missiles with high destructive capabilities that may meet the criteria to be classified as fixed assets. This revision influences mostly Value Added and Fixed capital formation of the "Public Administration" (ISIC rev. 4 Division 84) activity.

Figure 1.1 shows, by country, the overall impact on total GDP of the changeover to SNA08 and the concurrent statistical benchmark revisions to National Accounts. The revision had a significant impact on the overall level of income. The unweighted average of the impact on all available OECD member countries was a 3.4% increase in the level of GDP. See Van de Ven (2015) for a discussion on the macroeconomic impact of the change from SNA93 to SNA08 and, Annex 4 for an example of the impact from an industry perspective.

Figure 1.1. The overall impact of the benchmark revision on GDP levels for the year 2010*

Percentage increase in GDP due to changeover to SNA 2008 standards and to statistical benchmark revisions



*Australia: 2007 data; Denmark: 2008 data; Mexico: 2008 data; Norway: 2011 data.
Source: van de Ven, P.(2015)

This version of STAN was updated, and published, between 2015 and 2019. The final edition presented time series up to 2016.

1.5. STAN ISIC rev. 4 SNA08 with 2015 benchmark revisions

The latest version of STAN incorporates the most recent statistical benchmark revisions to National Accounts (notably, by European Union member countries). The most apparent difference to the previous STAN is the change in reference year for volume and price series to 2015 (previously, 2010). This change should not have any effect on the growth rate of volume series because all series presented in STAN are now based on chain-linked methodology. But there are differences between the two latest versions of STAN mainly due to the benchmark revisions (improvements in methodology, new sources of data or reallocation of firms to new industries based on more recent information which can affect the industry composition) and, mostly for the last three years, the revision of preliminary data. This version of STAN has been updated since 2019.

2. Data sources and links with other OECD databases

2.1. Principal data sources

In general, STAN attempts to combine the comparability of National Accounts time series with the detail of annual industrial surveys or national Supply and Use Tables (SUTs)/ Input- Output Tables (IOTs) to provide a comprehensive data set for analytical use.

2.1.1. Annual National Accounts

Annual National Accounts provide balanced accounts to describe a nation's economy (usually according to international standards such as SNA08). The contents of most tables are not directly measured but are compiled from a wide range of data sources with adjustments and estimations made by national experts. For activity data, much use is made of the information from annual industrial surveys and/or censuses and short-term indicators of industrial activity (see below) as well as labour force surveys, business registers, income surveys, SUTs and benchmark IOTs. National Accounts are considered to be more internationally comparable than industrial survey data.

STAN is based primarily on Annual National Accounts by activity tables (OECD, 2020a). Member countries officially submit SNA08 statistics for inclusion in OECD's Annual National Accounts database (ANA) via a joint OECD/Eurostat questionnaire. Eurostat collects and processes the statistics for EU countries, and a selection of other European countries[2], before passing them on to OECD. Eurostat publishes National Accounts at the relatively aggregate "A64" level of the industry classification NACE Rev.2[3] (which is fully compatible with ISIC Rev.4 at the full 2-digit level of activity, "A88"). While provision of SNA statistics at A64 is mandatory for EU member states, they are encouraged to provide full 2-digit industry statistics on a voluntary basis. Member economies not covered by Eurostat receive the request directly from OECD's Statistics and Data Directorate asking for full 2-digit ISIC Rev.4 detail (the "A88 list") for as many variables as possible. This information is particularly important for countries that publish data using national or regional industry classifications[4] to maximise harmonisation with sector definitions in ISIC Rev.4.

If national statistical offices publish SNA08 data at a more detailed level of activity than submitted officially to OECD or Eurostat (e.g. below 2-digit ISIC Rev.4) then the national source information is incorporated into the STAN database.

[2] Albania, Bosnia and Herzegovina, Iceland, Liechtenstein, Montenegro, Norway, North Macedonia, Serbia, Switzerland and Turkey.

[3] See https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=nama_10_a64&lang=en.

[4] For example, NAICS in Canada, Mexico and the United States, ANZSIC in Australia and New Zealand, JSIC in Japan and KSIC in Korea.

2.1.2. Annual Survey Data

Most countries carry out Annual Industrial (or Business) Surveys, many supplementing them with less frequent censuses. In the past, these have been mainly concentrated on the Mining, Manufacturing and Construction sectors. Currently, almost all OECD countries now have well established comprehensive surveys covering service sectors. The OECD collects such data via a joint OECD/Eurostat questionnaire and publishes them as Structural Business Statistics-SSIS (OECD, 2020b). It contains industry data at the most detailed level (4-digit) of ISIC, for a wide range of variables. In most OECD countries, agricultural activities and/or public enterprises and services are not included in the survey, but might be included in separate surveys. SSIS can be very useful for the analysis and indicator development at a very detailed level of ISIC classification within countries. However, because of differing survey practices across countries (see Box 2.1) it has often been perceived to have limited international comparability. STAN uses data present in SSIS, or detailed enterprise statistics from Eurostat's Structural Business Statistics (SBS) database, to make estimates for detailed sectors not available in National Accounts. Volume and price data are generally not available from annual industrial surveys.

Another limitation is comparability over time. Due to changes in industry classifications, most countries have comparable datasets starting from the mid-2000s. Few, if any, attempts are made to convert previous survey results based on old national or international classifications to the latest ISIC Rev. 4, so long time-series are not generally available.

2.1.3. Supply and Use tables and Input- Output tables

The majority of OECD countries compile Supply and Use tables (SUTs[5]). SUTs are used as a key harmonising framework using balancing techniques to ensure coherence across different methodological approaches to the calculation of GDP (e.g. production account versus expenditure account). The SUTs provide an additional dimension to industry analysis. Input Output analysis and industrial analysis based on SUTs helps to shed light not only on productivity and industrial structure but also diverse aspects of globalisation; for example, measurement of Trade in Value Added (TiVA: http://oe.cd/tiva) and other trade-related applications such as Trade in Embodied CO_2 (TECO2: http://oe.cd/io-co2) and Trade in Employment (TiM: http://oe.cd/io-emp). With much improved dissemination of SUTs or Input-Output tables (IOTs) by national statistical offices, the importance of this source has become more significant in the latest version of STAN. The potential use of SUTs in STAN is twofold:

1. Detail industry estimation: often SUTs provide more detailed industry information than National Accounts although, not necessarily consistent over time.
2. Variable estimation: SUTs in previous year or constant prices are sometimes the only source of price information. For example, some countries do not provide *Output* (*Production*) by industry in National Accounts. If SUTs are not adjusted to the latest benchmark revisions, it is possible to use *Output* over *Gross Value Added* ratios from SUTs applied to *Gross Value Added* from National Accounts to obtain National Accounts aligned estimates of *Output* It is preferable to use SUTs in the form of ratios rather than directly, due to issues outlined in Box 2.1.

[5] Since 2017, OECD has made official requests for SUTs using standard format (89 ISIC Rev. 4 industries and corresponding CPA products) as a supplement to the official SNA08 questionnaire. See https://www.oecd.org/sdd/na/supply-and-use-tables-database.htm

Box 2.1. Differences between National Accounts, Industrial Surveys and SUTs

Coverage - industrial surveys typically cover enterprises (European union member countries) and/or establishments (mostly non-EU countries) above a certain size limit. The threshold is usually defined as a certain number of employees or with a turnover above a certain level. Thresholds vary across countries. Some countries perform further adjustments, for example, (i) for years when full censuses are not performed, survey results may be adjusted upwards based on the last census (ii) the surveys may be supplemented with information from business registers or other sources to cover small firms. Establishments with no employees are generally not covered. Also, manufacturing surveys based on establishments often do not include other establishments in the same enterprise such as head offices, R&D and transport divisions and other services which may be part of separate surveys. Where an establishment/enterprise performs activities that cover more than one industry, it is allocated to industry according to its primary activity (typically determined by *Gross Value Added* contribution or *Number of Employees*). In **National Accounts**, attempts are made to get a more complete picture of industrial activity consistent with other SNA 2008 accounts (e.g. expenditure GDP) through the use of data coming from a variety of alternative sources. For example, National Accounts includes adjustments for the non-observed economy such as underground production and the informal sector - mainly unincorporated household enterprises (see OECD et al., 2002).

Variable definition- in view of the above, *Employment* figures for a particular industry are typically lower in SSIS than in National Accounts where labour force surveys may be used to determine employment for total and broad activities. *Gross Value Added* from manufacturing surveys, on the other hand, can be greater than that on a National Accounts basis since at an establishment level only materials and energy may be recorded as *Intermediate consumption* - it is difficult to determine the costs of services such as finance, transport, IT and communications, usually only known at the enterprise level. In addition, the valuation of *Gross Value Added* measured in surveys may differ from that shown in National Accounts. In National Accounts, *Gross Value Added* is recorded *at basic prices* while for industry surveys in many countries (especially in European SBS) *Gross Value Added* is expressed *at factor costs* (the difference being "other taxes, less subsidies, on production", such as payroll taxes), If surveys have good coverage, *Output (Production)* can match that given in national accounts quite closely.

Relevance- the compilation of SUTs is a complex process and it is common for SUTs or Input- Output tables (IOTs) to be published for a limited number of years, the periodicity of publication might be longer than annual and, the latest tables can lag behind National accounts by more than two years. After publication, historical series of Industrial Surveys and SUTs are often not revised to comply with the latest standards that may limit the comparability over time. National Accounts, on the other hand, are revised annually and in many countries (mostly European) even twice a year. Also, major benchmark revisions are carried out by OECD countries every five years or so. With the change of methodology or classification, national offices tend to revise historical series of National Accounts.

2.2. Old SNA93/ISIC Rev.3/4 databases as sources

When making estimates in STAN, useful sources of data are the last published ISIC Rev. 4 (SNA93) versions of STAN and OECD Annual National Accounts (ANA). Since the introduction of SNA08, some countries (particularly in Europe) have only provided revised National Accounts back to the mid-1990s. The old SNA93/ISIC Rev.3/4 databases can be used to estimate historical data, particularly for aggregate sectors. In addition, detailed 3-digit or 4-digit ISIC Rev.4 survey data (in SSIS) are usually available from 2008 while data in SNA93/ISIC Rev.3/4 is available from mid-1990s for nearly all countries. In many cases, data from the 2005 (ISIC rev.3) version of STAN are used to estimate more detail after first converting them to ISIC Rev. 4 using the approximate correspondence shown in Annex 2.

2.3. Databases linked to STAN - the STAN family

2.3.1. Bilateral trade by industry

The *Bilateral Trade Database by Industry and End-Use* – BTDIxE (http://oe.cd/btd) includes detailed trade flows by manufacturing industry between OECD declaring countries and a selection of partner countries and geographical regions. Data are derived from the UNSD Comtrade database by means of a standard conversion key. The latest version covers the period 1990-2018 and uses an ISIC Rev.4 industry list consistent with STAN covering about 72 detailed and aggregate goods-producing activities (mainly manufactures).

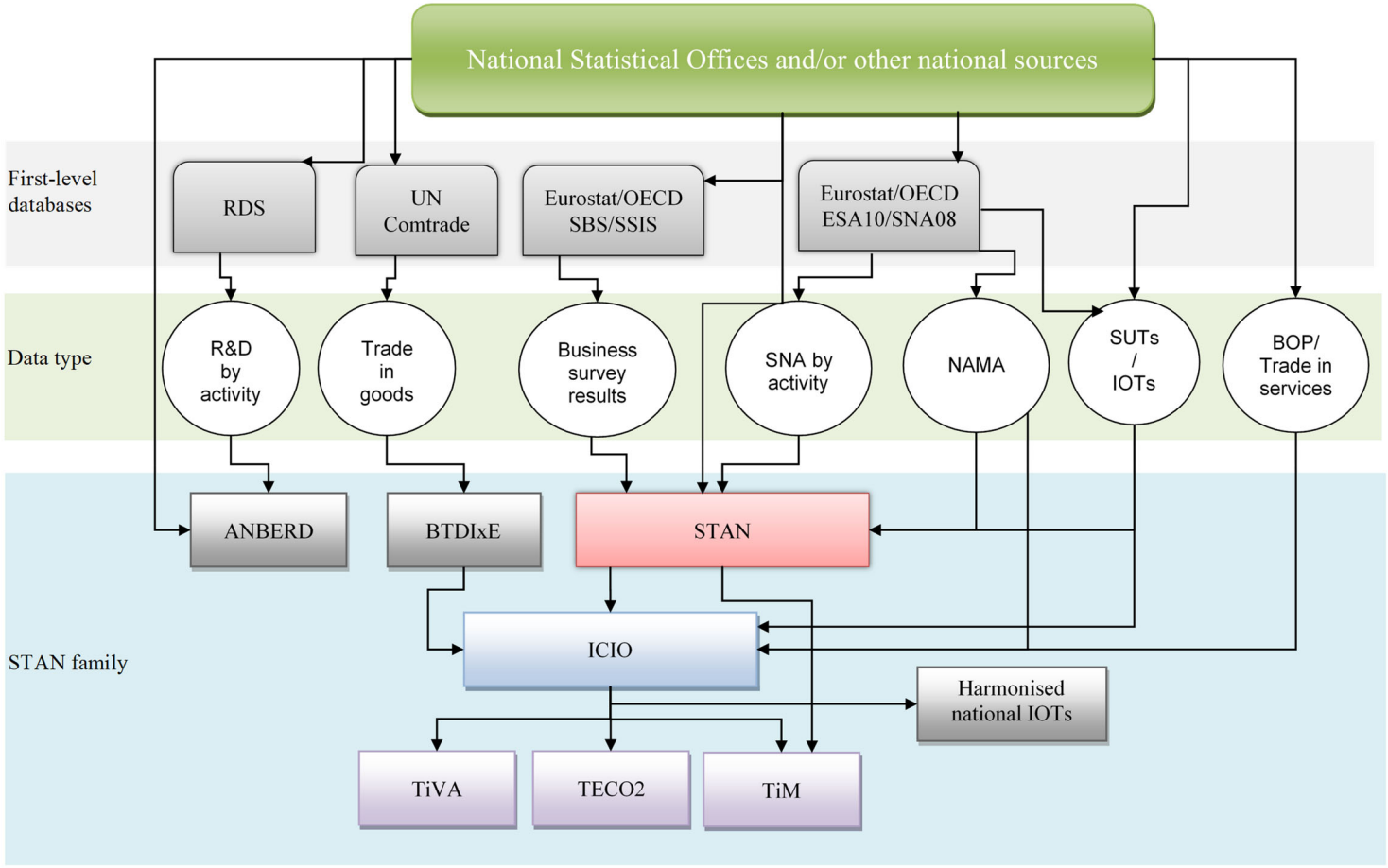
2.3.2. Input-Output and the Inter Country Input-Output databases

OECD's Inter-Country Input-Output (ICIO) tables (http://oe.cd/icio) decompose the global flows of intermediate and final goods and services between countries and industries. OECD's "harmonised" national Input-Output tables (http://oe.cd/i-o) show the inter-industrial transaction flows of goods and services (domestically produced and imported) between the sales and purchases (final and intermediate) of industry outputs. The 2020 edition of OECD Input-Output and ICIO tables consists of matrices in current prices, for all OECD countries and 29 non-member OECD countries covering the years 1995 to 2018. The tables are based on an ISIC Rev. 4 industry list and SNA08. The STAN database provides inputs such as *Output* (*Production*) and *Gross Value Added* by industry for the construction of ICIO tables (and hence harmonised national IOTs) and, *Employment* by industry for the Trade in eMployment (TiM) database. For an illustration of the relationships between databases see Figure 2.1.

2.3.3. R&D expenditure by industry

The Analytical Business Enterprise Research and Development- ANBERD database (http://oe.cd/anberd) is a database estimated with the objective of creating a consistent data set of R&D expenditures, which attempts to overcome problems of international comparability and time discontinuity associated with the official business enterprise R&D data provided to the OECD by its Member countries. ANBERD contains R&D expenditures from 1987 for all OECD countries and six non-member countries using an ISIC Rev.4 industry list consistent with STAN.

Figure 2.1. STAN family databases



Note: RDS, refers to Research and Development Statistics; SNA: System of National Accounts; NAMA: National Accounts Main Aggregates; and, BOP: Balance of Payments statistics

2.4. Apparent inconsistencies across OECD industrial data sets

The notes above describe other data sets that contain the same variables as STAN according to industrial activity. When comparing different published OECD data sets, users may find significant differences in data that they may expect to be similar. The reasons for these "apparent inconsistencies" include:

- **Sources and methods**. For the reasons outlined in Box 2.1, industrial survey data (such as *Gross Value Added* and *Employment*), even at aggregate levels of activity can differ significantly from National Accounts data.
- **Timeliness**. Data in STAN may differ from those published in OECD's *National Accounts* of OECD countries (ANA) because of the timing of updates. Activity tables in ANA are just part of a whole range of accounts and updates may occur at different times than STAN, which attempts to follow the rhythm of countries' releases of National Accounts activity-based tables (some countries release them in Spring while others towards the end of the year). It is worth noting that official revisions of National Accounts can extend back many years.
- **Context**. Data at the aggregate level in STAN (e.g. for *Gross Value Added*, *Employment* and *Investment*) may not match the latest aggregate data published by Member countries. Many countries publish aggregate data some months ahead of more detailed activity data. The emphasis of STAN is to make use of the latest consistent National Accounts by activity tables rather than the latest aggregate figures.

3. STAN industry list

An important feature of STAN is the use of a standard industry list for all countries to facilitate international comparisons (See Box 3.1). The list is based on International Standard Industrial Classification of All Economic Activities Revision 4, ISIC Rev.4 (UNSD, 2008) and is designed for easy comparison with previous industry lists. For the latter reason, it also includes some non-standard aggregates for referencing and use of vintage industry data reported with earlier versions of ISIC, the previous ISIC Rev.3 version of STAN and aggregation of manufactures in the old ISIC Rev.2 version of STAN (for examples see Table 3.1). The list is compatible with the Statistical Classification of Economic Activities in the European Community, NACE Rev.2 - 2008 (EC, 2008).

Table 3.1. Non-standard ISIC rev. 4 aggregates used in STAN and their rough equivalents in previous versions of ISIC

Description	ISIC rev. 4	ISIC rev. 3	ISIC rev. 2
Chemical, rubber, plastics, fuel products and other non-metallic mineral products	Divisions 19-23	Divisions 23-25	Division 35
.Chemical and pharmaceutical products	Divisions 20-21	Division 24	Major Groups 351-352
Electrical, electronic and optical equipment	Divisions 26-27	Divisions 30-33	Major Group 383
Total services	Divisions 45-99	Divisions 50-99	Divisions 61-96
Business sector services	Divisions 45-82	Divisions 50-74	Divisions 61-83
Real estate, renting and business activities	Divisions 68-82	Divisions 70-74	Division 83

The STAN industry list includes alternative aggregates for use when comparing *Gross Value Added*, *Employment* or *Gross fixed capital formation* or derived indicators (such as productivity) across countries. "Non-agriculture business sector excluding Real estate" (STAN industry code D05-82X) and "Business sector services excluding Real estate" (code D45-82X) do not include "Real Estate Activities" (ISIC Rev. 4 Division 68). Real estate activities contribute over 10% of total OECD area *Gross Value Added* - a significant proportion of which consists of rental income, both actual rent and "Imputed rent of owner-occupied dwellings", with no associated labour input. The inclusion of "Real Estate Activities" can distort productivity measures, particularly as its volume growth can differ significantly from that of "Other Business Services.

"Non-agriculture business sector excluding Real estate" also does not include the following activities that may distort productivity measures:

- "Agriculture, Forestry and Fishing" (ISIC Rev.4 Divisions 01-03). Productivity in agriculture is more affected by weather conditions than other industries. Thus, observed productivity variations may reflect differences in weather in particular years. In addition, problems measuring *Employment* can occur in some countries where family members are involved in activities but not registered accordingly (differences in reporting practices related to family members).
- "Community, Social and Personal Services" (ISIC Rev. 4 Division 84-99). This mainly consists of non-market activities such as "Public Administration", "Education" and "Health Services". Measurement of *Output* and volume measures of public services is challenging and varies across countries. Many countries use labour input (such as *Employment*) growth to estimate *Output* volume growth in "Public Administration", which may undermine the validity of indicators such as

productivity. In most countries, "Education" and "Health Services" volume estimates are based on output indicators but challenges remain related to adjustments to account for changes in the quality of service provided. In addition, the extent to which these services are public varies across countries. In this context, one should note that this is not the only area where some assumptions are made regarding productivity. Some countries for example use wage based indices adjusted for (estimated) productivity changes as deflators in service industries. Significant assumptions about *Gross Value Added* per employee rates may also be used to estimate the output of unregistered employees

Further discussion on the measurement of *Output* and volume measures in public sector services can be found in Chapter 1 of OECD's Handbook on Measurement of the Volume Output of Education and Health Services, Schreyer, P. (2010).

The industry list is also designed to provide users with enough detail to focus on detailed ICT activities (based on a taxonomy developed by OECD, 2011); R&D-intensive activities based on taxonomy introduced by Galindo-Rueda and Verger (2016); and a new taxonomy of digital intensive sectors (Calvino, F. et al., 2018), while taking into consideration general data availability across countries.

Table 3.2. Alternative ISIC rev. 4 aggregates provided in STAN database

Description	ISIC rev. 4
Business sector services excluding Real estate	Divisions 45-66,69-82
Non-agriculture business sector excluding Real estate	Divisions 05-66,69-82
Information industries	Divisions 26, 58-60 ,61, 62-63
ICT industries- detail definition	Divisions 61, 62, Groups 261-264, 268, 582, 631, 951 and Classes 4651, 4652
ICT industries- 2 digit definition	Divisions 26, 61, 62-63
Energy-producing activities	Divisions 05-06, 19, 35
Manufacture of goods for medical purposes	Division 21 and Groups 266, 325
High R&D intensive activities (2-digit definition)	Divisions 21, 26, 72
Medium-high R&D intensive activities (2-digit definition)	Divisions 20 ,27, 28, 29-30, 58, 62-63
High- and Medium-high R&D intensive activities (2-digit definition)	Divisions 20-21, 26-28, 29-30, 58, 62-63, 72
High R&D intensive activities (3-digit definition)	Divisions 21 ,26, 72 and Groups 303, 582
Medium-high R&D intensive activities (3-digit definition)	Divisions 20, 27, 28, 29, 62-63 and Groups 252, 302, 304, 309, 325
High- and Medium-high R&D intensive activities (3-digit definition)	Divisions 20-21, 26-28 ,29, 62-63, 72 and Groups 252, 302, 303, 304, 309, 325, 582
Low digital intensive industries	Divisions: 01-03, 05-09, 10-12, 35-39, 41-43, 49-53, 55-56, 68, 97-98
Medium- low digital intensive industries	Divisions: 13-15, 19-23, 24-25, 85, 86-88
Medium- high digital intensive industries	Divisions: 16-18, 26-28, 31-33, 45-47, 58-60, 84, 90-93
High digital intensive industries	Divisions: 29-30, 61, 62-63, 64-66, 69-82, 94-96

Also taken into account is compatibility with related OECD data sets such as ANBERD and OECD's Input-Output tables (see 2.3.2) and, the level of detail requested in the joint OECD/Eurostat official Annual National Accounts questionnaire.

Box 3.1. STAN industry list ISIC rev.4

Description	ISIC Rev.4	
TOTAL [A-U]	**01-99**	x
Agriculture, hunting, forestry and fishing [A]	**01-03**	x
Agriculture, hunting and forestry	01-02	o
Crop and animal production, hunting and related service activities	01	o
Forestry and logging	02	o
Fishing and aquaculture	03	o
Industry including energy [B-E]	**05-39**	x
Mining and quarrying [B]	**05-09**	x
Mining and quarrying of energy producing materials	05-06	
Mining and quarrying except energy producing materials	07-08	
Mining support service activities	09	
Manufacturing [C]	**10-33**	x
Food products, beverages and tobacco [CA]	10-12	x
….Food products and beverages	10-11	
……..Food products	10	
……..Beverages	11	
….Tobacco products	12	
Textiles, wearing apparel, leather and related products [CB]	13-15	x
….Textiles and wearing apparel	13-14	
……..Textiles	13	
……..Wearing apparel	14	
….Leather and related products	15	
Wood and paper products, and printing [CC]	16-18	x
….Wood and products of wood and cork, except furniture	16	o
….Paper and paper products	17	o
….Printing and reproduction of recorded media	18	o
Chemical, rubber, plastics, fuel products and other non-metallic mineral products	19-23	
….Coke and refined petroleum products [CD]	19	x
….Chemical and pharmaceutical products	20-21	
……..Chemicals and chemical products [CE]	20	x
……..Basic pharmaceutical products and pharmaceutical preparations [CF]	21	x
….Rubber and plastics products, and other non-metallic mineral products [CG]	22-23	x
……..Rubber and plastics products	22	o
……..Other non-metallic mineral products	23	o
Basic metals and fabricated metal products, except machinery and equipment [CH]	24-25	x
….Basic metals	24	o
……..Iron and steel	241+2431	
……..Non-ferrous metals	242+2432	
….Fabricated metal products, except machinery and equipment	25	o
……..Manufacture of weapons and ammunition	252	
…….. Manufacture of other fabricated metal products; metalworking service activities	25X	
Machinery and equipment	26-28	
….Electrical, electronic and optical equipment	26-27	
……..Computer, electronic and optical products [CI]	26	x
……..ICT manufacturing	261-264+268	
……..Manufacture of irradiation, electromedical and electrotherapeutic equipment	266	
……..Other electronic and optical products	265+267	
……..Electrical equipment [CJ]	27	x
….Machinery and equipment n.e.c. [CK]	28	x
Transport equipment [CL]	29-30	x
….Motor vehicles, trailers and semi-trailers	29	o
….Other transport equipment	30	o
……..Building of ships and boats	301	
……..Air and spacecraft and related machinery	303	
……..Military fighting vehicles	304	
……..Railroad equipment and transport equipment n.e.c.	302+309	
Furniture; other manufacturing; repair and installation of machinery and equipment [CM]	31-33	x
….Furniture, other manufacturing	31-32	o
……..Manufacture of medical and dental instruments and supplies	325	
….Repair and installation of machinery and equipment	33	o
Electricity, gas and water supply; sewerage, waste management and remediation activities [D-E]	**35-39**	
….Electricity, gas, steam and air conditioning supply [D]	35	x
….Water supply; sewerage, waste management and remediation activities [E]	36-39	x
……..Water collection, treatment and supply	36	o
……..Sewerage, waste collection, treatment and disposal activities; materials recovery; remediation activities and other waste management services	37-39	o
Construction [F]	**41-43**	x

x: present in the SNA A*10, A*21 or A*38 lists; o: present in the SNA A*64 list

Description	ISIC Rev.4	
Wholesale and retail trade; Repair of motor vehicles and motorcycles; Transportation and storage; Accommodation and food service activities [G-I]	**45-56**	x
Wholesale and retail trade, repair of motor vehicles and motorcycles [G]	45-47	x
....Wholesale and retail trade and repair of motor vehicles and motorcycles	45	o
....Wholesale trade, except of motor vehicles and motorcycles	46	o
..... of which: Wholesale of ICT products	4651+4652	
....Retail trade, except of motor vehicles and motorcycles	47	o
Transportation and storage [H]	49-53	x
....Land transport and transport via pipelines	49	o
....Water transport	50	o
....Air transport	51	o
....Warehousing and support activities for transportation	52	o
....Postal and courier activities	53	o
Accommodation and food service activities [I]	55-56	x
...Accommodation	55	
...Food and beverage service activities	56	
Information and communication [J]	**58-63**	x
Publishing, audiovisual and broadcasting activities [JA]	58-60	x
....Publishing activities	58	o
.....Publishing of books, periodicals and other publishing activities	581	
.....Software publishing	582	
....Audiovisual and broadcasting activities	59-60	o
Telecommunications [JB]	61	x
IT and other information services [JC]	62-63	x
....Computer programming, consultancy and related activities	62	
....Information service activities	63	
..... of which: Data processing, hosting and related activities; web portals	631	
Financial and insurance activities [K]	**64-66**	x
Financial service activities, except insurance and pension funding	64	o
Insurance, reinsurance and pension funding, except compulsory social security	65	o
Activities auxiliary to financial service and insurance activities	66	o
Real estate, renting and business activities [L]	**68-82**	
Real estate activities	**68**	x
.... of which: imputed rents of owner-occupied dwellings	68A	
Professional, scientific and technical activities; administrative and support service activities [M-N]	**69-82**	x
Professional, scientific and technical activities [M]	69-75	x
....Legal and accounting activities; activities of head offices; management consultancy activities; architecture and engineering activities; technical testing and analysis [MA]	69-71	x
.....Legal and accounting activities; activities of head offices; management consultancy	69-70	o
.....Legal and accounting activities	69	
.....Activities of head offices; management consultancy activities	70	
.....Architectural and engineering activities; technical testing and analysis	71	o
....Scientific research and development [MB]	72	x
....Advertising and market research; other professional, scientific and technical activities; veterinary activities [MC]	73-75	x
.....Advertising and market research	73	o
.....Other professional, scientific and technical activities; veterinary activities	74-75	o
.....Other professional, scientific and technical activities	74	
.....Veterinary activities	75	
Administrative and support service activities [N]	**77-82**	x
....Rental and leasing activities	77	o
....Employment activities	78	o
....Travel agency, tour operator, reservation service and related activities	79	o
....Security and investigation activities; services to buildings and landscape activities; office admini	80-82	o
Community, social and personal services [O-U]	**84-99**	
Public administration and defence; compulsory social security; education; human health and social work activities [O-Q]	**84-88**	x
Public administration and defence; compulsory social security [O]	84	x
Education [P]	85	x
Human health and social work activities [Q]	86-88	x
....Human health activities [QA]	86	x
....Residential care and social work activities [QB]	87-88	x
Arts, entertainment, repair of household goods and other services [R-U]	**90-99**	x
Arts, entertainment and recreation [R]	90-93	x
....Creative, arts and entertainment activities; libraries, archives, museums and other cultural activities; gambling and betting activities	90-92	o
....Sports activities and amusement and recreation activities	93	o
Other service activities [S]	94-96	x
....Activities of membership organizations	94	o
....Repair of computers and personal and household goods	95	o
.....of which: Repair of computers and communication equipment	951	
....Other personal service activities	96	o
....Activities of households as employers; undifferentiated activities of households for own use [T]	97-98	x
Activities of extraterritorial organizations and bodies [U]	99	x

4. Variables in STAN

4.1. Variable definitions

To meet the basic requirements of international research and analysis in areas such as productivity, competitiveness and general structural change, STAN covers a variety of variables. The notes below provide general descriptions of the variables based on the System of National Accounts 2008 (SNA08) definitions. Where national practices are known to differ, appropriate information is provided in the STAN Country Notes.

4.1.1. The production account

The production account is a cornerstone of industry analysis, which allows the construction of industry performance indicators – essentially based on the aggregation of production accounts of enterprises or establishments allocated to the same industrial activity. It should be noted that productive activities are included, if they are within the definition of the production boundary of the SNA08 framework. In SNA08, the production as an economic activity is defined as "an activity, carried out under the responsibility, control and management of an institutional unit, that uses inputs of labour, capital, and goods and services to produce outputs of goods and service" (SNA08 para. 6.2). This definition excludes almost all production of services by households for own use except the own-account production of housing services by owner-occupiers and the production of domestic and personal services by employing paid domestic staff.

Output or *Production* (**PROD**) is defined as the value of goods and services (including knowledge capital products) produced in a year, whether sold or stocked.

The related measure *Turnover* (not present in STAN) corresponds to the actual sales in a given period and can be greater than *Output* (*Production*) if all produced goods and services are sold together with unsold output from previous periods (i.e. drawing on inventories) or, can be smaller when some produced goods are not sold in the accounting period and recorded as inventories. While *Output* and *Turnover* will be different in a year, their averages over a long period of time should converge (depending on how perishable the stock is).

Intermediate consumption (**INTI**) represents the value of inputs of goods and services into processes of production that are used up within the accounting period – these include energy, materials, services (including any rentals for machinery and equipment but not capital services from own machinery and equipment, which are included within *Value Added* and recorded as a *Consumption of fixed capital* (see 4.1.2).

Gross Value added (**VALU**) for a particular industry represents its contribution to national GDP. It is sometimes referred to as GDP by industry. It is not directly measured. In general, it is calculated as the difference between *Output (*and *Intermediate consumption* (SNA08 para. 6.70).

Gross Value added comprises:

- *Labour costs* (compensation of employees, see 4.1.2),
- *Consumption of Fixed Capital*,

- *Taxes less Subsidies* (the nature of which depends on the valuation used – see Table 4.1, but according to SNA08 basic prices are recommended - all OECD countries publish *Gross Value Added* in basic prices with exception of Japan and New Zealand in producer's prices), and
- *Net Operating Surplus and Net Mixed Income* (see 4.1.2).

Some care should be taken with the interpretation of *Output* (*Production*), since it includes *Intermediate consumption*. Any output of intermediate goods and services consumed within the same sector is also recorded as output of the sector. For this reason, *Gross Value Added* is often considered a better measure of output.

Valuation of Gross Value Added

Three types of *Gross Value added* measures are presented in STAN depending on the extent to which taxes and subsidies are included. Estimates of *Gross Value Added* at Factor costs are available for almost all countries (except Israel and Switzerland), *Gross Value Added* at Basic prices is preferred but for some countries *Gross Value Added* at Producer's prices is the only measure available by industry. *Gross Value Added* at Purchasers or Market prices are not presented in STAN. Table below summarises different valuations of *Value Added* and the relationships between them.

Table 4.1. Valuation of Gross Value Added

Gross Value Added at **Factor costs**	Consists of Compensation of Employees and Gross Operating Surplus.
+ *other* taxes less subsidies on *production*[1]	These consist mostly of current taxes (and subsidies) on the labour or capital employed, such as payroll taxes or current taxes on vehicles and buildings
= Gross Value Added at **Basic prices**	
+ taxes less subsidies on *products*(*not including import duties and VAT*)	These consist of taxes (and subsidies) payable per unit of some good or service produced, such as turnover taxes and excise duties
= Gross Value Added at **Producer's prices**	
+ taxes less subsidies on *imports*	
+ Trade and transport costs	
+ Non- deductible VAT	
= Gross Value Added at **Purchasers' prices**	Purchasers' prices are those which purchasers pay for the goods and services they acquire or use, excluding deductible VAT by the purchaser. Sometimes the term Market prices is used in the context of aggregates such as GDP

Note: This table draws on the concepts outlined in the 2008 version of the SNA08. All OECD member countries have now implemented SNA08 (or the EU equivalent, ESA10) which recommends the use of Basic Prices and Producer's prices (as well as Purchaser's Prices for Input-Output tables).

In STAN, the variable VALU represents *Gross Value Added* at *basic prices* following the SNA08 recommendations. Note that while *Output (Production)* is also valued in *basic prices*, *Intermediate consumption* by industry is valued at *purchasers' prices*; *Gross Value added* at *basic prices* is equal to the difference between *Output (Production)* at *basic prices* and *Intermediate consumption* at *purchaser's prices.* In an Input-Output framework the separate transactions by type of product can be valued both at basic and at producer's prices. Example in Box 4.1 provides a numerical illustration of different valuations of *Gross* V*alue Added* using data by activity for Italy.

Box 4.1. Valuation of Value Added

Numerical example - Italy 2012 (EUR millions)

ISIC Rev.4		Gross Value Added at **Factor costs**	Other taxes, less subsidies, **on production**	Gross Value Added at **Basic prices**	Taxes, less subsidies, **on products**	Gross Value Added at **Producer's prices**
Name	Divisions	VAFC	OTXS	VALU		
Agriculture, forestry and fishing	01 to 03	31 755	-3 316	28 438	-214	28 225
Mining and quarrying	05 to 09	5 225	112	5 337	-2	5 335
Manufacturing	10 to 33	211 848	7 176	219 023	41 112	260 136
Electricity, gas, steam and air conditioning supply	35	20 054	1 632	21 686	7 323	29 009
Water supply; sewerage, waste management and remediation activities	36 to 39	11 108	463	11 571	119	11 690
Construction	41 to 43	80 206	2 515	82 722	1 942	84 664
Wholesale and retail trade; Repairs; Transportation and storage; Accommodation and food	45 to 56	281 015	7 524	288 539	-10 272	278 268
Information and communication	58 to 63	56 787	2 421	59 208	-123	59 085
Financial and insurance activities	64 to 66	71 339	4 668	76 007	7 587	83 594
Real estate activities	68	180 855	16 135	196 990	1 361	198 351
Professional, scientific and technical activities; Administrative and support service activities	69 to 82	120 344	3 579	123 924	9 831	133 755
Public administration and defence; Compulsory social security; Education; Human health and social work activities	84 to 88	226 850	9 645	236 495	159	236 654
Arts, entertainment and recreation, repair of household goods and other services	90 to 99	51 302	875	52 176	7 704	59 880
Total	01 to 99	1 348 689	53 429	1 402 118	66 528	1 468 646

Note: Shaded data are provided in STAN
Source: Italian National Institute of Statistics, *DATI.ISTAT,* (Accounts aggregates by industry (NACE Rev.2) – Edition: Mar-2014). (Accessed on 03 May 2018)

Gross Value added volumes and deflators

National statistical agencies typically derive constant price data or volume indices by applying detailed deflators based on "*Producer Price indices*" (PPIs) or "*Consumer price indices"* (CPIs) derived from surveys. Most OECD countries use annually re-weighted chained **Laspeyres** methodology to produce aggregate volumes. Exceptions are the United States and Canada who derive annually re-weighted chained **Fisher** aggregates from quantity indices of detailed sectors.

National statistical offices calculate *Gross Value Added* volumes (**VALK**) by using either a single indicator method - (SNA08 para. 15.135) or double-deflation method - (SNA08 para. 15.133). In double-deflation *Output (Production)* and *Intermediate consumption* are deflated at the most detailed level of products and *Gross Value Added* volumes are

calculated as the difference. In the single indicator method, deflators for *Gross Output* are applied directly to *Gross Value added*. Chained indices are preferable when quality-adjusted or *hedonic* deflators (see Schreyer, 2002) have been used in IT sectors (as is the case in the United States). Although the SNA08 recommends double deflation, the choice between single indicator method and double-deflation method is left to judgement depending on data quality and availability. Double deflation method allows prices of inputs to deviate from prices of output. However, the data requirements are more extensive and since, in some cases, *Gross Value Added* may be a relatively small residual of two large numbers, it can lead to biased results from relatively small errors in the accuracy of deflation.

Table 4.2. Summary of the production account variables provided in STAN

Variable	Current price	Volume	Deflator	Previous year pricigoode	SNA code
Output (Production),	PROD	PRDK	PRDP	PKPY	P1
Intermediate consumption	INTI	INTK	INTP	IKPY	P2
Gross value added	VALU	VALK	VALP	VKPY	B1G
Gross value added at factor costs	VAFC	-	-	-	B1G

4.1.2. The generation of income account

The generation of income account represents records of incomes of institutional units accrued from its engagement in production, including through the ownership of the assets used for the production of goods and services. The major part of the income is *Compensation of employees* (**LABR**). LABR comprises of *Wages and Salaries of Employees* (**WAGE**) paid by producers to employees for work done over the accounting period as well as **supplements**[6] such as employers' contributions to social security, private pensions, health insurance, life insurance and similar schemes. When available, *Wages and salaries* is given separately in STAN.

Note that *Labour costs* can exceed *Gross Value Added* in certain cases. For example, when heavy losses are incurred within an industry or, more generally, when an industry's *Net Operating Surplus* (see below) is negative and/or it receives significant subsidies.

Taxes less subsidies on production (**OTXS**) consist of taxes payable or subsidies receivable on goods or services produced, and other taxes or subsidies on production, such as those payable on the labour, machinery, buildings or other assets used in production.

Consumption of Fixed Capital (**CFCC**) represents the reduction in the value of fixed assets used in production resulting from physical deterioration, normal obsolescence or normal accidental damage.

Operating Surplus and mixed income (**NOPS**) measures the surplus or deficit accruing from production before taking account of any interest or similar charges payable on financial assets borrowed, and any rent payable for the leasing of natural resources by the enterprise and/or interest, rent or similar receipts receivable on assets owned by the

[6] Not part of STAN, but can be calculated

enterprise. It implicitly includes the remuneration of the self-employed (owners and family members).

Some countries only provide *Gross Operating Surplus and mixed income* (**GOPS**) which includes CFCC. Otherwise, CFCC and *Net Operating Surplus and mixed income* are provided separately.

Table 4.3. Summary of the income account variables provided in STAN

Variable	Current price	SNA code
Labour costs (compensation of employees)	LABR	D1
Gross wages and salaries	WAGE	D11
Gross operating surplus and gross mixed income	GOPS	B2G_B3G
Net operating surplus and net mixed income	NOPS	B2N_B3_N
Consumption of fixed capital	CFCC	K1
Other taxes less subsidies on production	OTXS	D29_D39

4.1.3. Employment

Measures of employment by industry differ across countries with variants of some of the following being provided:

- "*Hours worked*"- preferably, measures of hours actually worked;
- "*Headcounts*" - actual number engaged, number of employees (full- and part-time);
- "*Number of jobs*" - those with more than one job (full- or part-time), are counted more than once;
- "*Full-time equivalent jobs*" (FTE) - where adjustments are made for part-time employment.

For most countries, headline *Total Employment* by activity tables are based on persons. However, the "*Number of jobs*" is preferred by some (e.g. Canada, Israel, Mexico and the United States), while others use some notion of full-time equivalence (e.g. Switzerland). In addition, while many countries use quarterly averages for annual employment data, some countries use mid-year estimates (employment for a particular day, week or month each year). For the latter, whether or not the underlying time series have been seasonally adjusted or not can make a notable difference to the levels.

SNA 2008 recommends "*Number of jobs*" as it is deemed more useful in indicating how industry-specific needs for labour shape the production process than "*Headcounts*". For the purposes of productivity measurement SNA08 also recommends providing "*Hours worked*" (actually worked, not just paid for) and/or "*Full-time equivalent jobs*" (which is defined as total hours worked divided by average annual hours worked in full-time jobs or average contract hours).

For many countries the ultimate source for employment data are business surveys, labour force surveys, household surveys and/or infrequent censuses with adjustments being made to make them more relevant in a National Accounts context.

In STAN, the variables **EMPN** and **EMPE** represent "*Headcounts*" unless otherwise specified; in some cases "*Number of jobs*", while *Full-time equivalent jobs* (**FTEN** and

FTEE) are provided whenever available. **HRSN** and **HRSE** contain *Hours worked* data available (ideally hours actually worked). Exact definitions are provided in the STAN Country Notes.

Total employment (EMPN and FTEN) includes all persons engaged in domestic production while *Number of employees* (EMPE and FTEE) excludes the *Self-employed* (SELF) and unpaid family workers. The domestic concept of employment (recommended in SNA08) is generally used by OECD countries - all persons engaged in the domestic production of a country are included whether or not they are resident in that country.

A comprehensive discussion on the measurement of labour inputs can be found in Chapter 4 of OECD's Manual on Productivity Measurement (OECD, 2001) or in Chapter 3 of OECD's Compendium of Productivity Indicators 2018 (OECD, 2018a).

Table 4.4. Summary of employment related variables provided in STAN

Variable	Persons/Jobs	Full-time equivalents	Hours	SNA code
Total employment	EMPN	FTEN	HRSN	ETO
Employees	EMPE	FTEE	HRSE	EEM
Self employed	SELF	SELF	-	ESE

4.1.4. The capital account

The capital account records the transactions in non-financial assets by institutional units. *Gross fixed capital formation* (**GFCF**) consists of acquisitions, less disposals, of tangible assets (such as machinery and equipment, transport equipment, livestock, constructions and weapon systems) and intangible assets (such as research and development, mineral exploration, computer software and databases) used for more than one year (assets used up in less than one year are generally considered intermediate inputs). **GFCF** does not include Capital formation assets such as acquisitions of land, mineral, energy and other uncultivated natural resources (although their improvement and development are included).

Note that purchases or own account production of research and development by an industry, except in cases where it is clear that this activity doesn't serve to provide future benefits but are produced for sale, now should be recorded as capital formation under SNA08 (see Recommendation 19 from OECD, 2009a). Previously they were treated as *Intermediate consumption*. Only exception is the ISIC Rev. 4 Division 72, where the expenditures on purchases of R&D should be recorded as *Intermediate consumption,* except in cases when a specific information exists that the unit doesn't acquire the R&D products for sale (see Recommendation 20 form OECD, 2009a). In addition, weapons systems are now also recognized as produced assets under SNA08.

Gross Capital Stock (**CAPG**) represents the volume of existing capital assets available to producers and is the sum of all past investments in assets with each vintage valued at prices "as new" - regardless of the age and condition of the assets. It is a gross measure in the sense that it accounts for neither depreciation nor physical efficiency losses of capital goods - it reflects only the retirement of goods.

Net Capital Stock (**CAPN**) is the value of all vintages of assets to owners where valuation reflects market prices for new and used assets. It is sometimes referred to as Wealth Capital Stock as it reflects current monetary values of capital goods rather than continuing utility.

An alternative measure, preferred for productivity analysis, is *Productive Capital Stock* which attempts to measure more accurately the level of services provided by the assets in question by taking into account reduction in utility (or efficiency decline), rather than depreciation in value, before retirement. Currently, this measure is not presented in STAN.

A comprehensive discussion on the measurement of capital inputs can be found in

(i) Chapter 5 of OECD's Manual on Productivity Measurement (OECD, 2001),

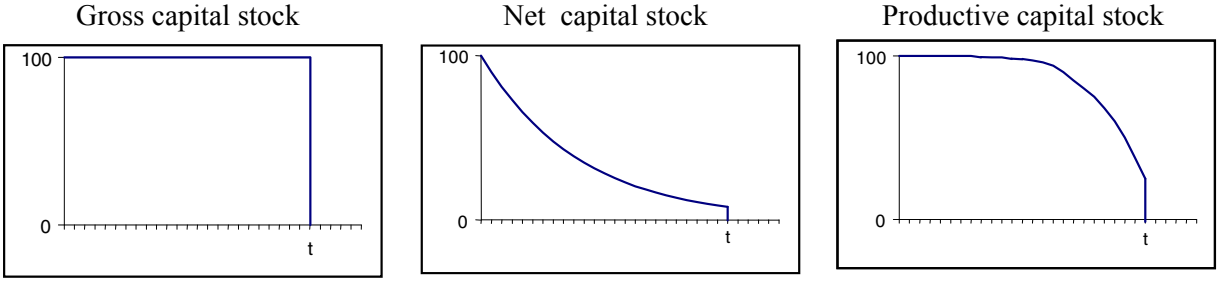
(ii) Handbook on Deriving Capital Measures of Intellectual Property Products (OECD, 2009a),

(ii) OECD's manual on Measuring Capital (OECD, 2009b),

(iii) OECD Capital Services Estimates: Methodology and a First Set of Results (Schreyer et al., 2003)

As a simple illustration of one of the differences between capital stock measures - a particular asset may have the following decay patterns before retirement at time *t*, depending on which measure of capital stock is being considered:

Figure 4.1. Different valuation of capital stock



Currently, only capital stock data by activity that are provided by national authorities are presented in STAN. No attempt is made to make estimates for other countries (based on the perpetual inventory model, for example).

For the purpose of ICT related analysis, STAN also comprises, where available, a special asset aggregate for each of the previous measures that merges together ICT equipment (Computer hardware and Telecommunication equipment) and Computer software and databases assets. Capital formation variables available in STAN are summarised in the table below.

Table 4.5. Summary of the capital account variables provided in STAN

Variable	Current price/replacement cost	Volume	Deflator	Previous year price/ replacement cost	SNA code
Gross fixed capital formation	GFCF	GFCK	GFCP	GKPY	P51
Gross fixed capital formation of ICT equipment and software	GFCF_ICT	GFCK_ICT	GFCP_ICT	GKPY_ICT	P51N1113I+ P51N1122
Gross capital stock	CAPG	CPGK	-	CGPY	N11G
Gross capital stock of ICT equipment and software	CAPG_ICT	CPGK_ICT	-	CGPY_ICT	N1113IG+ N1122G
Net capital stock	CAPN	CPNK	-	CNPY	N11N
Net capital stock of ICT equipment and software	CAPN_ICT	CPNK_ICT	-	CNPY_ICT	N1113IN+ N1122N

4.2. Derived variables and indicators

Using the variables described above, the following additional measures are calculated by economic activity and included in the STAN database:

Table 4.6. Derived variables

Implicit deflators	$VALP = \frac{VALU}{VALK} * 100$ $PRDP = \frac{PROD}{PRDK} * 100$ $INTP = \frac{INTI}{INTK} * 100$ $GFCP = \frac{GFCF}{GFCK} * 100$	*Current prices* series divided by *chain- linked volume series with reference year 2015* in national currencies
Number of self-employed	$SELF = EMPN - EMPE$	Difference between *Total Employment* and *Number of Employees.*
Gross Value added at factor costs	$VAFC = LABR + CFCC + NOPS$ or $VAFC = LABR + GOPS$	*Gross Value Added* at factor costs consists of *Compensation of employees*, *Consumption of Fixed Capital* and *Net Operating Surplus*

4.3. Variable coverage

Full detail of current data coverage by country, variable and industry is provided in the related files of the STAN online database on OECD.STAT and on the STAN internet page. Variable coverage for each country depends on:

- Whether national statistical offices or central banks for some countries (e.g. Belgium, Chile or Korea) compile the measures by industrial activity in their Annual National Accounts.
- The extent of "backward revisions" made by national statistical offices after revisions to their National Accounts, for example, to comply with recommendations of the international manual SNA08 or the European equivalent ESA10.
- The availability and coverage of business survey/ census data (e.g. Structural Business Statistics, SBS) to make estimates for detailed sectors.

In general, gaps in the data are not filled if reliable alternative data sources are not available. Constant ratios or constant shares to extend times series are not applied. Researchers may fill gaps using techniques which best fit the needs of their study.

4.4. Units

The units used to present data in STAN are:

- Current prices data (PROD, INTI, VALU, GFCF, LABR, etc.): millions of national currency (euro for Eurozone countries).*
- Volumes (PRDK, INTK, VALK, GFCK and GFCK_ICT) and capital stock data (CPGK, CPGK_ICT, CPNK and CPNK_ICT): chain linked volumes presented in the price of the reference year (2015) in millions of national currency.
- Previous year prices (PKPY, IKPY, VKPY, GKPY and GKPY_ICT) and previous year's replacement cost data (CGPY, CGPY_ICT, CNPY and CNPY_ICT): chain linked series with reference year (t-1) in millions of national currency
- Deflators (PRDP, INTP, VALP, GFCP and GFCP_ICT): index number with the reference year (2015) value equal to 100.
- Employment data (EMPN, EMPE, FTEN, FTEE and SELF): thousands of persons or jobs. The priority is to collect data in persons but for some countries, measure in jobs might be the only available (e.g. Canada) or more fitting for productivity analysis (e.g. United States).
- Hours worked (HRSN and HRSE) in million hours worked.

The 'Units_EN.xlsx' file, disseminated with other related STAN files, contains a summary of all units by country and variable. For data in the national currency, the file provides an overview of historical currency changes within the target period. This information is essential for countries joining a monetary union, where the year of accession and ISO code of the previous currency is provided. It is the case of Euro Area countries where, as standard, all historical series, before the accession, are converted using the fixed exchange rate at the date of accession. The historical exchange rate changes are, therefore, not reflected in the series. Another caveat of this approach is that the calculation of Euro area total before accession does not have economic sense. For a more detailed discussion of the implications of the adoption of a common currency on economic statistics see (Schreyer and Suyker, 2002).

Further details of units used for each country are provided in the STAN Country Notes. See Annex 6 for an example of transformation of different prices measures using chain-linked Laspeyres volumes aggregation.

5. Estimations in STAN

STAN is updated on a country-by-country basis with new country tables, or updated tables, being made available as soon as they are ready. The first step is to ensure that the maximum amount of publicly available National Accounts by activity data have been compiled to act as the **primary source**. For countries that do not use ISIC Rev. 4 or NACE Rev. 2, the data are then converted from the national industrial classification to ISIC Rev. 4 using a country-specific conversion key.

The next step is to ensure that the latest available ISIC Rev. 4 business survey data (from SSIS and SBS) has been loaded into the STAN system together with data from earlier versions of STAN and ANA, approximately converted to ISIC Rev. 4. These are the **secondary sources**. For each variable, if (i) more industry detail is available from the secondary sources than the latest (SNA08) National Accounts, and/or (ii) any of the secondary sources extend further back in time than the latest National Accounts, a general estimation program is run to fill in as many gaps as possible. The estimation program differs for current prices and volumes.

5.1. Current price

Using the hierarchical nature of the industry list used in STAN (see Annex 3), the estimation program performs the following:

- Starting from the top level of the hierarchy, where data are available from the primary source (e.g. ISIC Rev. 4 Divisions 13-15), the time-series correlations between the primary source and the secondary sources are calculated to choose the best secondary source (such as industrial survey data or old National Accounts series). The selected secondary source is either used for filling in further detail (e.g. to estimate detailed ISIC Rev. 4 Divisions 13, 14 and 15) or where necessary extending the series backwards.
- To estimate missing detail, the chosen secondary source data are adjusted for each year according to the relationship between the primary source and secondary source data at the lowest level that they coincide (e.g. ISIC Rev. 4 Divisions 13-15). The implicit assumption being that the relative distribution of the secondary source data within the subgroup is valid for the primary source (i.e. National Accounts). In general, extra detail is only estimated for current price measures.
- To extend series backwards, the chosen secondary source data are linked to the primary source data at the first available year for the primary source data.
- Further adjustments to the estimates may be made to ensure that data in each level of the hierarchy of the industry list sum to the data at the superior level of the hierarchy.
- Finally, to ensure consistency across different methods of GDP calculation; discrepancies from estimated values are assigned to variables INTI, NOPS and OTXS. These are calculated after the estimation procedure is finished as follows:

Table 5.1. Calculation of balancing variables

Intermediate consumption	Net operating surplus	Other taxes on production
$INTI = PROD - VALU$	$NOPS = GOPS - CFCC$	$OTXS = VALU - GOPS - LABR$

5.2. Volumes measures

All OECD member countries now use annually re-weighted chain-linked methodology to calculate aggregated volume measures. The chain-linking method significantly improves time consistency of volumes compared to fixed based method because constant prices series become less relevant the further away they are from the base year – especially if there are significant changes in prices. By chain-linking volumes, price change effects are reduced but time series lose their additivity. 'Non- additivity' means that variables and industries do not sum to higher aggregates within hierarchical structures except for the reference year and the next consecutive year. One solution to the 'non-additivity' is to convert volumes series to previous year's prices. This is only possible when national statistical offices use **Laspeyres** indices to aggregate industries. Previous year's price series is a volume measure similar to series with reference year but its reference year is changing every year. The estimation procedure is designed to take into account the "non-additivity" of volumes but preserves the volume changes of the secondary source. The estimation procedure for volumes consists of seven steps:

1. If missing, chain-linked volume measures *CLV* with reference year *r* need to be calculated for each country *c*, industry *i* and year *t* in both primary and secondary sources. The calculation has two steps: from current ($p_t^{c,i} q_t^{c,i}$) and previous ($p_{t-1}^{c,i} q_t^{c,i}$) year's price series the Quantity indices are calculated using formula 1 from Table 5.2.
2. In the second step, the chain-linked volumes are obtained using Quantity indices and current price series (formula 2 from Table 5.2). Countries employing chained-linked **Fisher** volumes usually only provide volume series or quantity indices.
3. After selecting the volume series from the secondary source with the highest correlation with the primary source; growth rates of the secondary source are linked to the primary source at the first available year of the primary source data.
4. After times series are estimated backwards, chain-linked volumes are converted to previous year prices using formula 3 from Table 5.2.
5. Adjustments to the estimates in previous year prices may be made to ensure that data in each level of the hierarchy of the industry list sums to the data at the parent level of the hierarchy taking advantage of additivity of previous year price series.
6. If a secondary source contains more detailed information than the primary source, missing detail is filled. The estimated and adjusted current price series is converted to chain-linked volumes by dividing by the deflators calculated from the secondary source (formula 4 from Table 5.2). This series is converted to previous year price (formula 3 from Table 5.2) and adjusted to match the higher aggregate values, see example in Annex 5.
7. Although volumes are aggregated to STAN industries following national practices (for example, chained-linked **Fisher** aggregates are calculated for the United States, chained **Laspeyres** aggregates for France), **all estimated values** using secondary sources (STAN backward or detail estimates) adopt **Laspeyres** chain-linked aggregates in order to be able to ensure hierarchical consistency within industries and across measures, see example in Annex 6.

Table 5.2. Calculation of different volume measures

	Formula	Note
1. Quantity index	$QI_t^{c,i} = \begin{cases} t = y: \ QI_y^{c,i} = 1 \\ t > y: \ \prod_y^t \frac{p_{t-1}^{c,i} q_t^{c,i}}{p_{t-1}^{c,i} q_{t-1}^{c,i}}, \end{cases}$	where y is the earliest year of current price available, e.g. 1995
2. Chain- linked volumes	$CLV_t^{c,i} = \frac{QI_t^{c,i}}{QI_r^{c,i}} p_r^{c,i} q_r^{c,i},$	where r is the reference year, e.g. 2015
3. Previous year prices	$PYP_t^{c,i} = \frac{CLV_t^{c,i}}{CLV_{t-1}^{c,i}} p_{t-1}^{c,i} q_{t-1}^{c,i}$	
4. Deflator	$DEF_t^{c,i} = \frac{p_t^{c,i} q_t^{c,i}}{CLV_t^{c,i}}$	

5.3. Quality control checking

One of the main contributions of STAN database is the extensive quality control of estimates. The estimation procedure relies upon a relatively large collection of data sources (see Section 3) with different vintages of data. The same data sources are used for quality control. Industry estimates are compared across sources in an interactive graphical environment mainly with earlier versions of STAN or earlier vintages of National Accounts data from national and other sources from international organisations.

Ratios of variables (for example LABR over HRSE, VALU over PROD, VALK over EMPN) and industries (for example industry share on total industry, total manufacturing or total services) are checked for consistency, while taking account of why some anomalies may occur and comparisons with other countries or sources are made.

Consistency with other OECD National Accounts based data and previous estimates is verified. For each country, after completion of the estimation process, the estimates are checked for periods of hyper growth (defined as 100% year on year growth) or hyper decline (50% year on year decline). Finally, the following list of ratios are calculated and checked for periods of hyper growth (50% year on year growth) or hyper decline (33% year on year decline). A set of additional constraints (or basic properties) related to the ratios are also e.g. the value of deflators should not be negative.

Table 5.3. Checking- List of ratios

Name	Formula	Additional constraint
LABRshVALU	LABR/VALU	<1
WAGEshLABR	WAGE/LABR	<1
CFCCshVALU	CFCC/VALU	<1
VALKovEMPN	VALK/EMPN	-
VALKovHRSN	VALK/HRSN	-
LABRovEMPE	LABR/EMPE	-
LABRovHRSE	LABR/HRSE	-
VALUshPROD	VALU/PROD	<1
INTIshPROD	INTI/PROD	<1
VALUshINTI	VALU/INTI	-
HRSEovEMPE	HRSE/EMPE	-
HRSNovEMPN	HRSN/EMPN	-
ICTshGFCF	GFCF_ICT/GFCF	<1
ICTshCAPN	CAPN_ICT/CAPN	<1
ICTshCAPG	CAPG_ICT/CAPG	<1
PRDP	PROD/PRDK	>0
INTP	INTI/INTK	.>0
VALP	VALU/VALK	>0
GFCP	GFCF/GFCK	>0
GFCP_ICT	GFCF_ICT /GFCK_ICT	>0
CPNP	CAPN/CPNK	>0
CPGP	CAPG/CPGK	>0
CPNP_ICT	CAPN_ICT /CPNK_ICT	>0
CPGP_ICT	CAPG_ICT /CPGK_ICT	>0

6. Country notes and data notes in the STAN application

6.1. Country notes

Since notes for individual countries can change quite frequently, they are not included in this documentation. Instead, they are provided as part of the STAN data tables.

In the Excel files, the country notes are provided on the first page. Information provided includes:

- Information about the availability of National Accounts from national statistical offices,
- Links to the appropriate website for National Accounts,
- Local industrial classification used for National Accounts,
- National reference year for volumes,
- Units used for each variable presented,
- Definitions of variables (e.g. valuation of employment-jobs/persons),
- Departures from the STAN ISIC Rev.4 industry list. In other words, where sectors are included in others or excluded from aggregate sectors. Such occurrences are more frequent when a country does not use either ISIC Rev.4 or NACE Rev.2 breakdowns (for example, Canada uses NAICS),
- Any other pertinent information concerning the data presented.

Figure 6.1. Country note example for Austria

AUSTRIA - Country notes	
General	
Principal Source:	Statistik Austria
National website for NA tables:	http://www.statistik.at/web_en/statistics/Economy/national_accounts/index.html
Industrial classification used:	ÖNACE 2008 (NACE Rev. 2)
National reference year:	2015
Availability of National Accounts by activity data from national sources:	1995-2018: 2-digit NACE Rev. 2 (ISIC Rev. 4)
	Any other figures, for earlier periods or more detailed activities (such as 3- or 4-digit ISIC), are Secretariat estimates - shaded grey in the tables. See also the data notes in STANi4_AUT_M.XLS
Variables	
PROD, PRDK	*At basic prices*
VALU, VALK	*At basic prices*
INTI, INTK	*At purchaser's prices*
EMPN, EMPE	*Headcounts*
PRDK, INTK, VALK, GFCK, GFCK_ICT, CPGK, CPGK_ICT, CPNK, CPNK_ICT	*Annually re-weighted chained Laspeyres*
Industries	
Mining and quarrying of energy producing materials (05-06) includes *Mining of metal ores* (07), *Mining and quarrying except energy producing materials* (07-08) excludes *Mining of metal ores* (07)	
Further notes	

6.2. Data notes

Where data points have been estimated, this is highlighted in the OECD.STAT STAN cube by a footnote and in the meta-data Excel file. A summary of footnotes is given below:

Table 6.1. Data notes

Data note label	Footnote description
a	Estimates based on earlier vintages of National Accounts or STAN data. Notably, SNA93 ISIC Rev. 3 and ISIC Rev. 4 versions of the STAN database (which may incorporate estimates based on old ISIC Rev.2 SNA68 National Accounts for aggregate sectors and, old ISIC Rev.2 industry survey data for manufacturing activities)
b	Estimates based on detailed Structural Business Statistics (SBS) or industry census data: either published by OECD (ISIC Rev.4) and/or Eurostat (NACE Rev.2) or drawn directly from national sources (and converted from national industry classifications to ISIC Rev.4)
c	Estimates based on national Supply and Use tables (SUTs) or Input-Output tables.
d	Estimates based on other related measures coming from official annual National Accounts compiled according to the latest definitions (e.g. estimates of EMPN based on FTEN)
e	Estimates based on Annual Labour Force Statistics
x	Estimates based on analytical databases from national research groups, for more detailed information see country notes
p	Aggregate calculated after STAN estimation procedures have been completed

Further information concerning estimates in STAN can be found in chapter 5.

7. Recommended uses, limitations and next steps

It is recommended that STAN is primarily used for broad analyses, especially at the detailed level of activity where many data points are estimated. For example, looking at trends or average growth rates and shares over a number of years, or general modelling. This also applies to any indicators that may be calculated (see Annex 1 for examples). Where the data points are official National Accounts (often at more aggregate industry levels) there is scope for more precise analyses such as looking at year-on-year growth rates.

STAN is based on data that Member countries provide. Detailed data collections independent of national statistical offices are not performed. In other words, we do not have the scope to build up National Accounts compatible tables from detailed data using consistent methodologies across countries.

Therefore, when comparing variables or indicators across countries, users should refer to the STAN Country Notes (see part 6.1) to check for industry inclusions and variable definitions. Some compromises may be necessary in terms of the level of detail analysed.

As the current version of STAN is based on the most recent benchmark revisions of National Accounts (based on 2015 in many OECD countries), users can expect regular updates of this version of the database in for the next four to five years, before a new version is considered. Possibly more: given the impact of the pandemic on data collection and economic development, a benchmark revision based on the year 2020 may not be ideal for analysis of productivity or structural change.

At the time of this publication the new STAN database contains 27 countries, but the aim is to cover all OECD member countries for as many indicators as possible. If the quality of underlying data is sufficient, future updates of STAN will also include estimates for non-OECD member countries[7] but only for a very limited number of measures (e.g. production account and employment measures).

In future updates, the industry and variable coverage may change based on the needs of STAN users. Potential additions include measures of foreign trade or structure of demand from National Accounts; new industry aggregations and/or new, more detailed, industry estimates.

From early 2021, we plan to re-introduce a suite of "STAN indicators", published on OECD.STAT, with basic indicators such as Gross Value Added and Employment industry shares of total economy, investment intensity, unit labour costs and labour productivity based on the STAN database. For the latest news on the STAN database and related indicators, users are encouraged to consult the dedicated web page: http://oe.cd/stan.

[7] Notably G20, non-OECD EU member countries and other ICIO target countries

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Appendix

Annex 1: Examples of indicators

Most of the indicators described below are found in OECD's STAN Indicators dataset which uses STAN and ANBERD as the main sources of data. Some are published in OECD's Science, Technology and Industry Scoreboard.

Basic indicators

(i) For a number of variables, simple industry shares in the total can provide first insights into the industrial composition of OECD economies. Analysing shares over time gives an indication of any structural changes that have taken place. For example, for industry *i* and country *c*, the following can be calculated:

Table A.1. Basic indicators- shares

Gross Value Added shares	Employment shares	Investment shares
$VASH_i^k = \frac{VALU_i^c}{VALU_{DTOTAL}^c} * 100$	$EMSH_i^c = \frac{EMPN_i^c}{EMPN_{DTOTAL}^c} * 100$	$INSH_i^c = \frac{GFCF_i^c}{GFCF_{DTOTAL}^c} * 100$

(ii) Simple ratios of variables can provide further insights:

Table A.2. Basic indicators- ratios

Labour share of value added*	Gross Value added share of Output	Investment intensity
$LAVA_i^c = \frac{LABR_i^c}{VALU_i^c} * 100$	$VAPO_i^c = \frac{VALU_i^c}{PROD_i^c} * 100$	$INVI_i^k = \frac{GFCF_i^c}{PROD_i^c} * 100$

Note: *Labour Costs can exceed Value added whenever heavy losses are incurred within a sector.

(iii) STAN variables can be combined with those from other data sets with compatible industry lists. For example, using R&D expenditures from ANBERD (see section 4.3.1), industry distribution of R&D efforts within and across OECD countries can be analysed. A frequently used indicator is R&D intensity, calculated as either R&D expenditures as a percentage of production or as a percentage of *Gross Value Added*:

Table A.3. Basic indicators- R&D intensity

R&D intensity based on gross value added	R&D intensity based on Output
$RDIV_i^c = \frac{ANBERD_i^c}{VALU_i^c} * 100$	$RDIP_i^k = \frac{ANBERD_i^c}{PROD_i^c} * 100$

At OECD, R&D intensities are used to help identify high R&D intensive industries, see (Galindo-Rueda and Verger, 2016).

(iv) Finally, when definitions of variables vary across countries, it may be useful to express a ratio for industries relative to the ratio for total industries. For example, with definitions of employment varying across countries, labour compensation per employee by industry could be expressed relative to labour compensation per employee for the total:

$$LAEM_i^c = \frac{\left(\frac{LABR_i^c}{EMPE_i^c}\right)}{\left(\frac{LABR_{DTOTAL}^c}{EMPE_{DTOTAL}^c}\right)} * 100$$

Productivity and competitiveness indicators

There is much interest in productivity growth by industry and other indicators of competitiveness by industry. STAN can be a useful source for analysts.

Table A.4. Productivity and competitiveness indicators

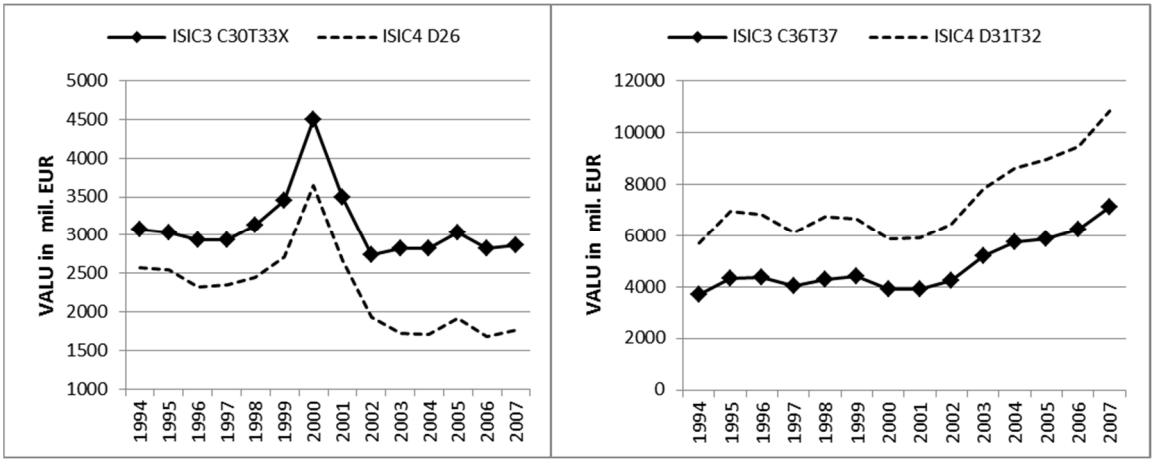
Labour productivity levels*	Unit labour cost	Productivity growth
$LPTY_i^c = \frac{VALK_i^c}{EMPN_i^c}$	$VAPO_i^c = \frac{LABR_i^c}{VALK_i^c}$	Details concerning estimation of labour productivity and multi-factor productivity (MFP) growth by industry can be found in OECD's Manual on Productivity Measurement.

Note: *Employment is given here as a measure of labour input. Where available, hours worked data are more appropriate.

Annex 2: STAN ISIC rev. 3 to STAN ISIC rev. 4 conversion example

ISIC rev. 3 version of STAN database (STANi3) is the only source of historical series for some countries, mainly those not included in the previous ISIC rev. 4/ SNA 1993 version of STAN. In that case, the original STANi3 data were transformed to ISIC rev. 4 applying the conversion key outlined in Table A.6.Transformed series were linked to the last available observations to extended backwards using growth rates of STANi3 equivalents. As seen from Figure A.1 even at the 2 digit industry detail the converted ISIC rev. 3 and ISIC rev. 4 series, compiled within the same System of National Accounts framework (SNA93), may have a substantially different level but are highly correlated (correlation coefficient between C30T33X and D26 has value 0.9 and 0.998 between C36T37 and D31T32).

Figure A.1. Selected ISIC rev. 4 industries and approximate ISIC rev. 3 equivalents for Netherlands



Note: All series are compiled according to SNA93.

Finally, some adjustments might be applied in order to ensure the consistency within the hierarchical structure. Figure A.2 shows an example of using STANi3 for extension of National Accounts data beyond 1995. It is clear that also at the highly aggregated level mapping of ISIC rev. 3 does not fit the ISIC rev. 4 data exactly, but both series are highly correlated (see Table A.5 for correlation coefficients). That is why STANi3 data cannot be used directly but only the growth rates of the secondary source are used to extend the primary source backwards.

Figure A.2. Example of backwards estimates of Gross Value Added for Belgium

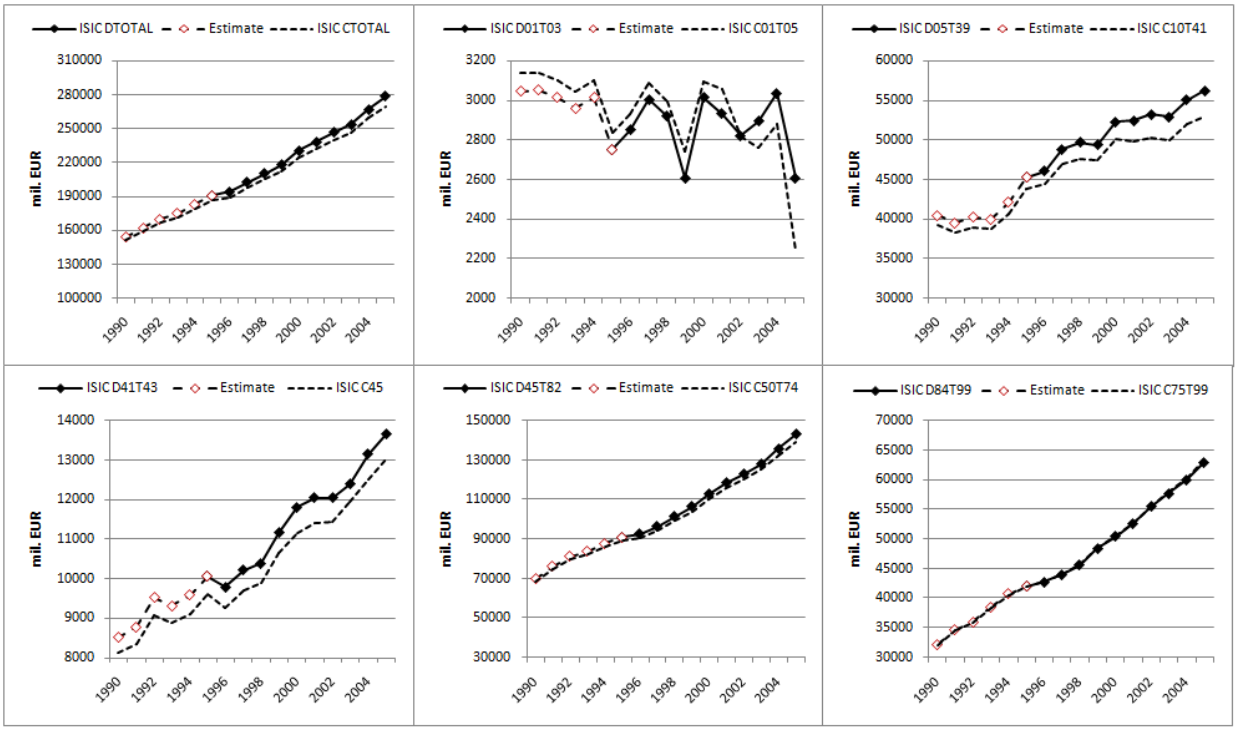


Table A.5. Correlation coefficients for STANi3 and STAN SNA08 ISIC rev.4 data, Belgium

ISIC rev. 3	ISIC rev. 4	Correlation coefficient
CTOTAL	DTOTAL	0.99997
C01T05	D01T03	0.77703
C10T41	D05T39	0.99853
C45	D41T43	0.99878
C50T74	D45T82	0.99993
C75T99	D84T99	0.99995

Table A.6. ISIC rev. 3 to ISIC rev. 4 conversion table for backward estimates

ISIC Rev. 4		ISIC Rev. 3
TOTAL		**TOTAL**
01 to 03	**A**	**01 to 05**
01 to 02		01 to 02
01		01
02		02
03		05
05 to 39	**B to E**	**10 to 41 + 90**
05 to 09	**B**	**10 to 14**
05 to 06		10 to 12
07 to 09		13 to 14
10 to 33	**C**	**15 to 37**
10 to 12	CA	15 to 16
10 to 11		15
12		16
13 to 15	CB	17 to 19
13 to 14		17 to 18
13		17
14		18
15		19
16 to 18	CC	20 to 22
16		20
17		21
18		*(22)**
*19 to 23**	CD to CG	23 to 26
19	CD to CG	23
20 to 21	CE to CF	24
22 to 23	DG	25 to 26
22		25
23		26
24 to 25	CH	27 to 28
24		27
25		28
26 to 28*	CI to CK	29 to 33
26 to 27*	CI to CJ	30 to 33
26	CI	30 + 32 + 33
27	CJ	31
28	CK	29
29 to 30	CL	34 to 35
29		34
30		35
31 to 33	CM	36

ISIC Rev. 4		ISIC Rev. 3
*35 to 39**	*D to E*	*37 + 40 to 41 + 90*
35	**D**	**40**
36 to 39	**E**	**37 + 41 + 90**
36		41
37 to 39		37 + 90
41 to 43	**F**	**45**
45 to 82	G to N	50 to 74
45 to 56	**G to I**	**50 to 55 + 60 to 63**
45 to 47	G	50 to 52
45		50
46		51
47		52
49 to 53	H	60 to 63
49		60
50		61
51		62
52		63
53		*(64)**
55 to 56	I	55
58 to 63	**J**	*(22, 64, 92)** + 72*
58 to 60	JA	*(22, 92)**
61	JB	*(64)**
62 to 63	JC	72
64 to 66	**K**	**65 to 67**
64		65
65		66
66		67
68 to 82	L to N	70 to 74
68	**L**	**70**
69 to 82	**M to N**	**71 to 74**
*84 to 99**	O to U	75 to 99
84 to 88	**O to Q**	**75 + 80 + 85**
84	**O**	**75**
85	**P**	**80**
86 to 88	**Q**	**85**
90 to 99	**R to U**	**91 + 92 + 93 + 95**
90 to 93	**R**	**92**
94 to 96	**S**	**91 + 93**
97 to 98	**T**	**95**
99	**U**	**99**

SNA A10 list

**Special STAN aggregates (for linking with ISIC Rev. 4 aggregates)*

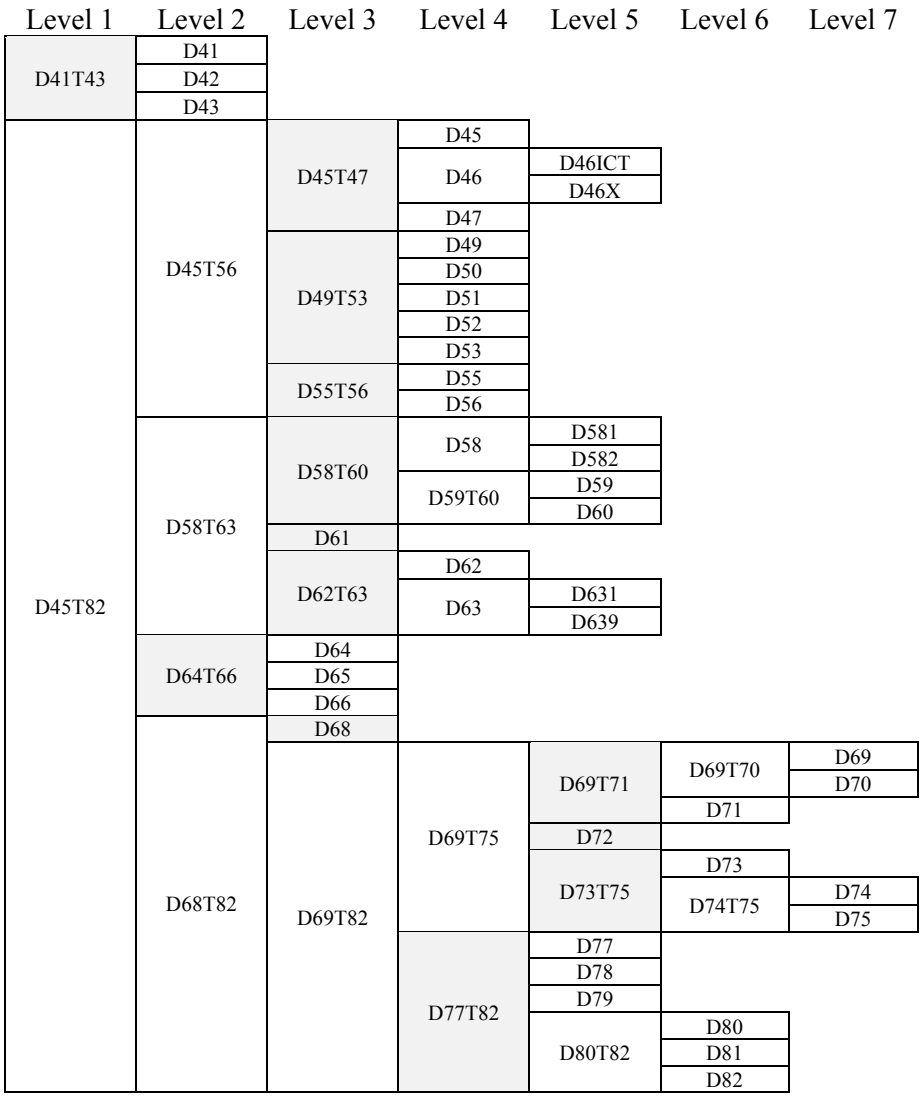
() applying constant shares based on earliest ISIC Rev. 4 data*

The other aggregates in **bold** complete the A21 list (A to U)

Annex 3: Hierarchical structure of industries in STAN for top- down adjustment

Table A.7. Hierarchical structure of industries in STAN

Level 1	Level 2	Level 3	Level 4	Level 5	Level 6	Level 7
D01T03	D01T02	D01				
		D02				
	D03					
D05T39	D05T09	D05T06	D05			
			D06			
		D07T08	D07			
			D08			
		D09				
	D10T33	D10T12	D10T11	D10		
				D11		
			D12			
		D13T15	D13T14	D13		
				D14		
			D15			
		D16T18	D16			
			D17			
			D18			
		D19T23	D20T21	D20		
				D21		
			D22T23	D22		
				D23		
			D19			
		D24T25	D24	D241T31		
				D242T32		
			D25	D252		
				D25X		
		D26T28	D26T27	D26	D26ICT	
					D266	
					D26X	
				D27		
			D28			
		D29T30	D29			
			D30	D301		
				D303		
				D30X	D304	
					D302A9	
		D31T33	D31T32	D31		
				D32	D325	
					D32X	
			D33			
	D35T39	D35				
		D36T39	D36			
			D37T39	D37		
				D38		
				D39		


Level 1
Level 2
Level 3
Level 4
Level 5
Level 6
Level 7
D41T43
D41
D42
D43
D45T82
D45T56
D45T47
D45
D46
D46ICT
D46X
D47
D49T53
D49
D50
D51
D52
D53
D55T56
D55
D56
D58T63
D58T60
D58
D581
D582
D59T60
D59
D60
D61
D62T63
D62
D63
D631
D639
D64T66
D64
D65
D66
D68
D68T82
D69T82
D69T75
D69T71
D69T70
D69
D70
D71
D72
D73T75
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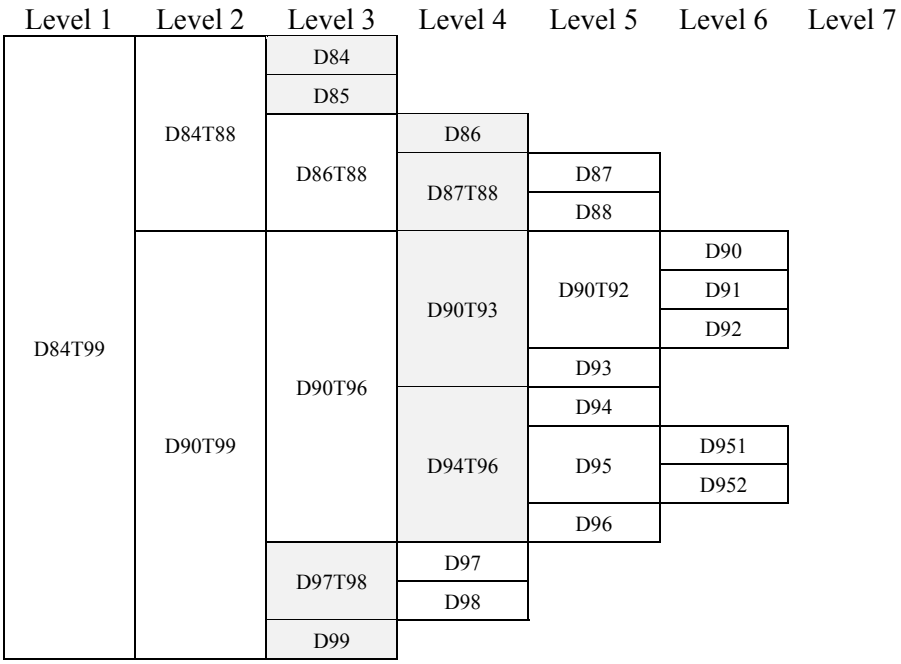
D77
D78
D79
D80T82
D80
D81
D82



Note: Shaded industries corresponds to A38 aggregate

Annex 4: Changeover of SNA standards- the industry detail perspective, example for Finland

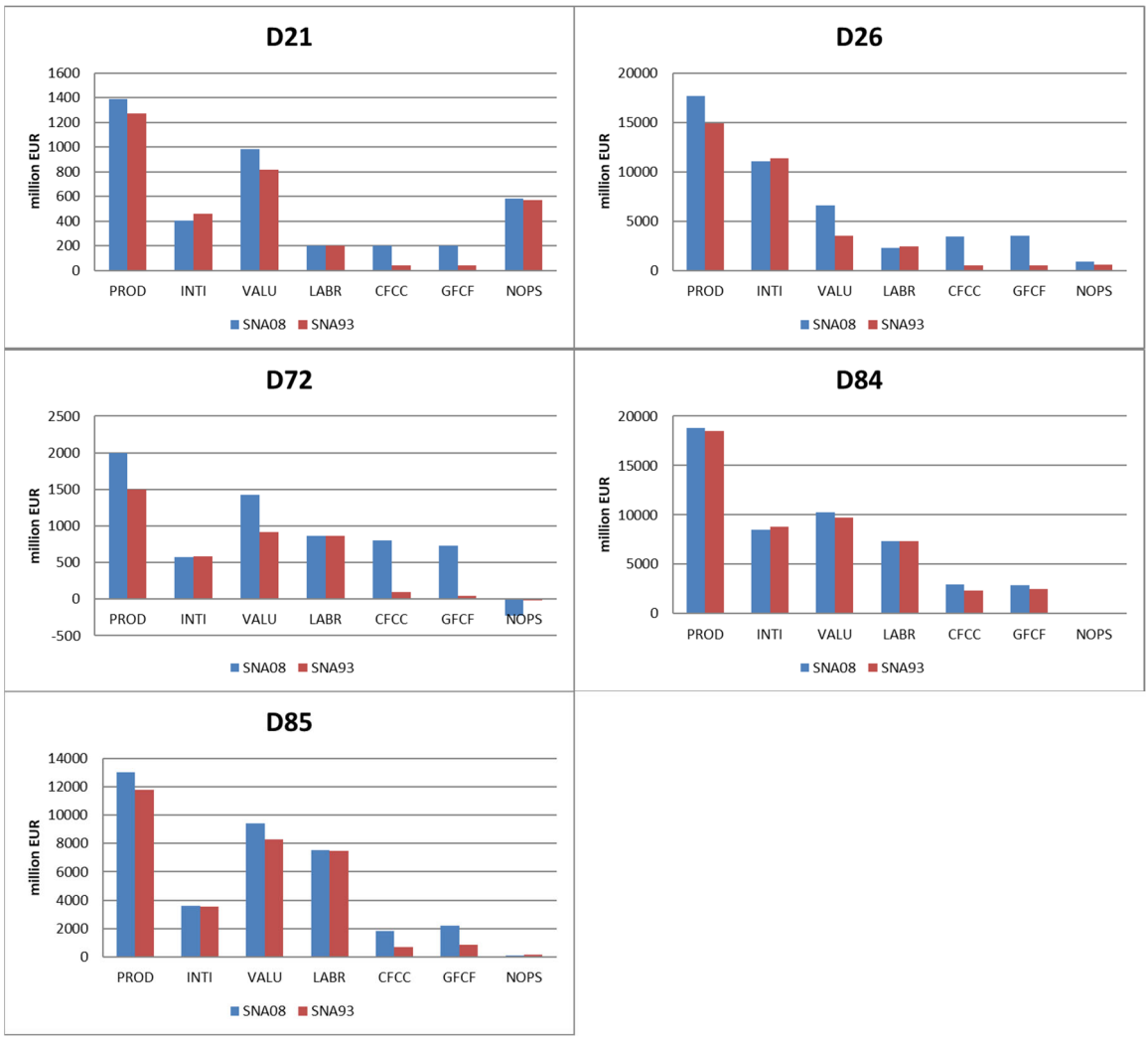
As seen from Figure 1.1, Finland belongs to the group of OECD countries that were most affected by the change in SNA standards. The overall increase in GDP due to revision was around **4.7%,** but the impact of the statistical benchmark revision is relatively small, about 0.5% of GDP. On the other hand, the impact due to the change in standards amounted to 4.2% of GDP. Table A.8 shows the sectoral effect of the revision; industries are sorted by the relative size of the revision for *Gross Value Added* between SNA 1993 and SNA 2008 standards in 2010. The most affected are all high R&D intensive 2-digit industries (based on taxonomy proposed in Galindo-Rueda and Verger, 2016): Pharmaceuticals, Manufacture of computer, electronic and optical products and, Scientific research and development (D21, D26 and D72). In the absolute terms, the biggest change was recorded for public sectors Education and Public administration (D84 and D85). In the next part, we will focus on the impact of the SNA changes by measure for industries cited above.

Table A.8. Finland – Percentage changes in Gross Value Added between STAN SNA08 and SNA93 versions, by A38 ISIC rev. 4 industry, 2010

Industry	Relative difference	Rank	Industry	Relative difference	Rank
D26	87.8%	1	D24T25	3.9%	20
D72	55.7%	2	D10T12	3.3%	21
D21	20.8%	3	D73T75	2.9%	22
D27	19.4%	4	D31T33	2.6%	23
D13T15	16.7%	5	D94T96	2.4%	24
D85	13.8%	6	D68T82	2.2%	25
D28	12.5%	7	D55T56	1.7%	26
D05T09	11.9%	8	D90T93	1.5%	27
D20	11.0%	9	D35	1.1%	28
D36T39	9.1%	10	D41T43	0.8%	29
D19	8.9%	11	D45T47	0.7%	30
D29T30	7.7%	12	D77T82	0.6%	31
D84	6.0%	13	D86	0.1%	32
D62T63	5.5%	14	D49T53	0.0%	33
D61	4.7%	15	D87T88	-0.1%	34
D69T71	4.6%	16	D01T03	-0.4%	35
D16T18	4.4%	17	D68	-0.6%	36
D58T60	4.4%	18	D64T66	-3.9%	37
D22T23	4.3%	19	D97T98	-6.1%	38

A closer look at the production, income and capital account variables for each industry confirms assumptions that the increase in *Gross Value Added* is caused by the capitalization of R&D or Weapons systems for "Public Administration". As expected, the decrease in *Intermediate consumption* is offset by the increase in the *Consumption of fixed capital*. Interestingly, *Gross operating surplus* was also affected by the revision of standards that leads to the overall growth of *Output* (*Production*). The revision has almost no effect on *Labour compensation* and *Other taxes on production*.

Figure A.3. Finland- Measure decomposition of selected industries, 2010



A more interesting picture paints the comparison of price evolution for the selected industries (Figure A.4). The revision did not have any effect on the price evolution of the production account variables *Output* (*Production*), *Intermediate consumption* or *Gross Value Added*. For ”Business sector” industries and “Education” the changeover of standards had a direct effect on growth dynamics of prices of *Gross fixed capital formation* (GFCP), but almost no effect on dynamics of investment prices of “Public administration” industry (Figure A.5).

Figure A.4. Finland- Price change correlation between SNA93 and SNA08, selected industries by measure

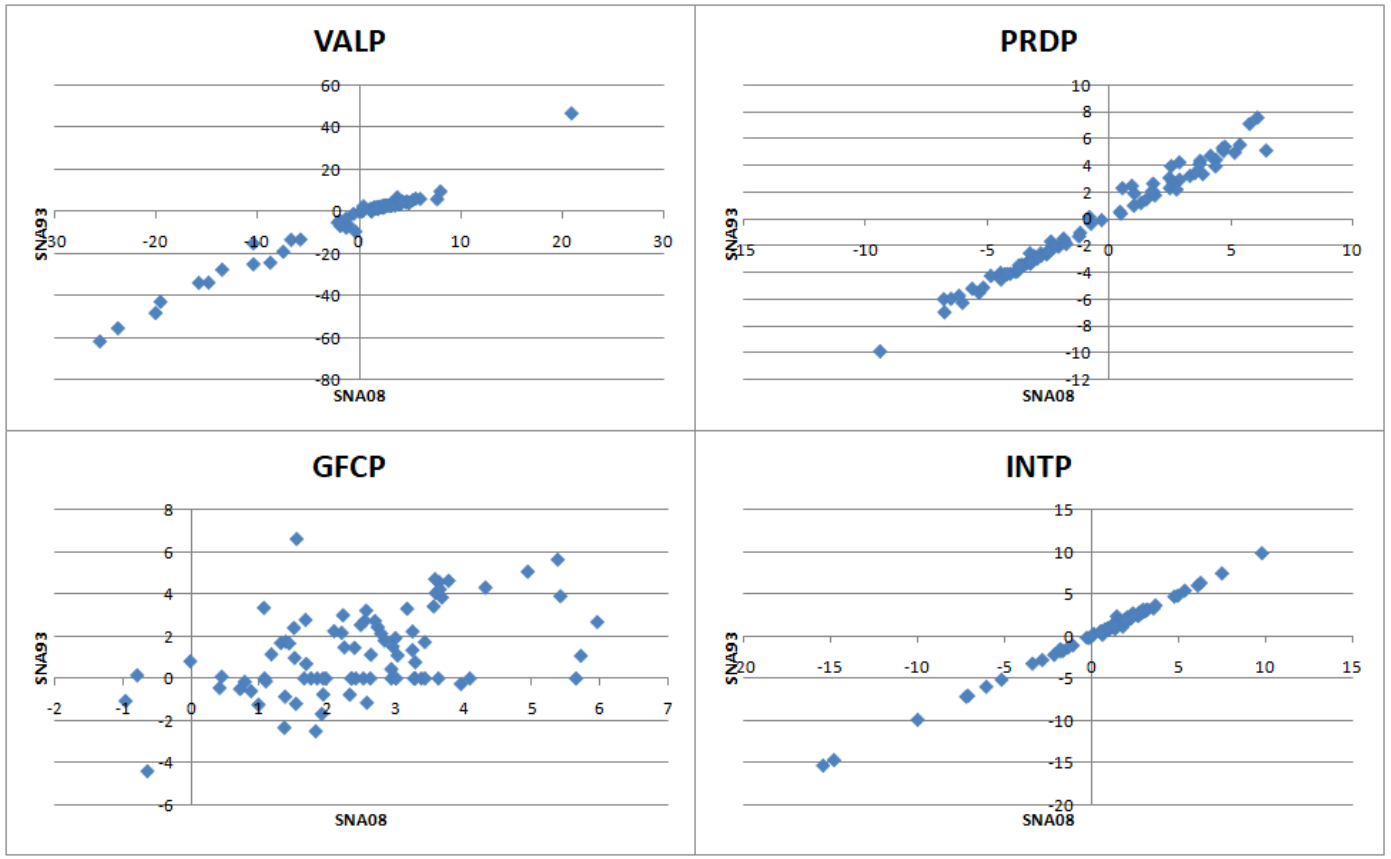
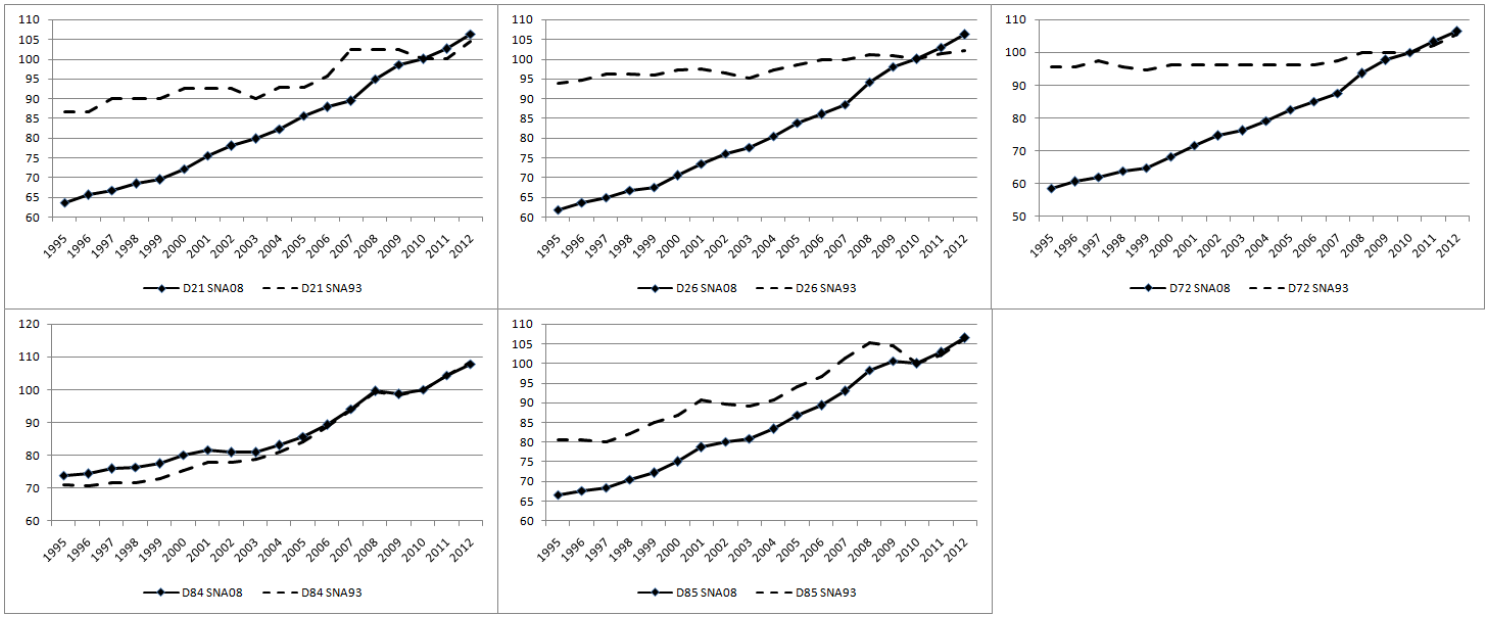


Figure A.5. Finland- GFCP by industry



Annex 5: Chain- linked Laspeyres detail estimation- example LEVEL1 industry detail in Slovak Republic

Output (*Production*) volumes for Slovak Republic are only available from the Slovak Statistical office (NSO) at the total industry level. Using industry detail provided in SUTs in previous year prices, it is possible to estimate industry detail up to 2-digit ISIC but only for the year 2014 to 2016. The PRDK and PROD values from SUTs differ from SNA in year 2014, as seen from table A5.1, so it is not possible to use them directly. In this Annex, we show an example of the Production volumes detail estimation for LEVEL1 industry detail in STAN database.

Table A5.1. Output (Production) volumes by source and LEVEL1 industry

PRDK				PROD			
NSO	**2014**	**2015**	**2016**	**NSO**	**2014**	**2015**	**2016**
DTOTAL	167 986	181 278	189 174	*DTOTAL*	170 336	181 278	186 396
SUT	**2014**	**2015**	**2016**	**SUT**	**2014**	**2015**	**2016**
DTOTAL	173 761	181 278	189 174	*DTOTAL*	176 192	181 278	186 396
D01T03	5 533	4 345	4 627	*D01T03*	5 646	4 345	4 417
D05T39	77 861	82 048	84 743	*D05T39*	80 496	82 048	81 665
D41T43	12 907	13 733	13 096	*D41T43*	12 839	13 733	12 936
D45T82	59 974	62 561	67 064	*D45T82*	60 048	62 561	67 364
D84T99	17 477	18 592	19 645	*D84T99*	17 164	18 592	20 015

Firstly, the deflator from SUT is calculated using formula 4 from table 5.2:

Table A5.2. SUT deflators

PRDP	2014	2015	2016
DTOTAL	1.014	1	0.985
D01T03	1.020	1	0.955
D05T39	1.034	1	0.964
D41T43	0.995	1	0.988
D45T82	1.001	1	1.004
D84T99	0.982	1	1.019

Then the volumes are calculated using current price series from SNA database and dividing it by SUT deflators.

Table A5.3. Output (Production) volume calculated

PROD from SNA				PRDK calculated			
	2014	**2015**	**2016**	**SUT**	**2014**	**2015**	**2016**
DTOTAL	170 336	181 278	186396	*DTOTAL*	167 986	181 278	189 174
D01T03	4 427	4 345	4417	*D01T03*	4 339	4 345	4 627
D05T39	78 471	82 048	81665	*D05T39*	75 902	82 048	84 743
D41T43	11 644	13 733	12936	*D41T43*	11 706	13 733	13 096
D45T82	58 730	62 561	67364	*D45T82*	58 658	62 561	67 064
D84T99	17 065	18 592	20015	*D84T99*	17 376	18 592	19 645

The last step is to transform calculated volumes to previous year prices and benchmark it to total industry previous year price series from NSO:

Table A5.4. Calculated PKPY

	2015	2016
DTOTAL	183 814	189 174
D01T03	4 434	4 627
D05T39	84 824	84 743
D41T43	13 660	13 096
D45T82	62 637	67 064
D84T99	18 259	19 645

Annex 6: Chain- linked Laspeyres volumes aggregation- example for D20T21 VALK in Czech Republic

As mentioned in chapter 5, the chain-linked volumes are not additive. In STAN, the following 3-step procedure is employed to derive aggregate volumes:

1. Aggregate estimates of peer industries in current prices

Table A6.1. Gross Value Added current price aggregation

	D20T21	D20	D21	Formula
2005	44411	29991	14420	D20T21=D20+D21
2006	43460	28489	14971	D20T21=D20+D21
2007	44811	30175	14636	D20T21=D20+D21
2008	43676	29715	13961	D20T21=D20+D21
2009	37547	22635	14912	D20T21=D20+D21
2010	44416	28149	16267	D20T21=D20+D21
2011	45690	29861	15829	D20T21=D20+D21
2012	47712	31324	16388	D20T21=D20+D21
2013	45724	29255	16469	D20T21=D20+D21
2014	57678	39127	18551	D20T21=D20+D21
2015	57803	40096	17707	D20T21=D20+D21
2016	52217	34340	17877	D20T21=D20+D21
2017	65880	46446	19434	D20T21=D20+D21
2018	62609	42550	20059	D20T21=D20+D21

2. Using current price and chain-linked volume series to calculate previous year price series

Table A6.2. Previous year price series calculation for D20

	VALU	VALK	VKPY	Formula
2005	29991	31679.3		
2006	28489	28843.2	27306.0	VALK_2006/VALK_2005*VALU_2005
2007	30175	31502.9	31116.0	VALK_2007/VALK_2006*VALU_2006
2008	29715	37283.5	35711.9	VALK_2008/VALK_2007*VALU_2007
2009	22635	36263.4	28902.0	VALK_2009/VALK_2008*VALU_2008
2010	28149	36627.1	22862.0	VALK_2010/VALK_2009*VALU_2009
2011	29861	32581.7	25040.0	VALK_2011/VALK_2010*VALU_2010
2012	31324	32782.5	30045.0	VALK_2012/VALK_2011*VALU_2011
2013	29255	29651.2	28332.0	VALK_2013/VALK_2012*VALU_2012
2014	39127	36815.9	36324.0	VALK_2014/VALK_2013*VALU_2013
2015	40096	40096	42613.0	VALK_2015/VALK_2014*VALU_2014
2016	34340	37506	37506.0	VALK_2016/VALK_2015*VALU_2015
2017	46446	48713	44601.0	VALK_2017/VALK_2016*VALU_2016
2018	42550	46014.4	43873.0	VALK_2018/VALK_2017*VALU_2017

3. Summing over previous year price series to derive aggregate

Table A6.3. Summing previous year price series for calculation of D20T21 in previous year prices

	D20T21	D20	D21	Formula
2006	41889.1	27306.0	14583.0	D20T21=D20+D21
2007	45652.0	31116.0	14536.0	D20T21=D20+D21
2008	50851.0	35711.9	15139.0	D20T21=D20+D21
2009	42534.9	28902.0	13632.9	D20T21=D20+D21
2010	39225.1	22862.0	16363.1	D20T21=D20+D21
2011	42557.0	25040.0	17517.0	D20T21=D20+D21
2012	45761.0	30045.0	15716.0	D20T21=D20+D21
2013	45663.0	28332.0	17331.0	D20T21=D20+D21
2014	53970.9	36324.0	17647.0	D20T21=D20+D21
2015	60373.0	42613.0	17760.0	D20T21=D20+D21
2016	55034.0	37506.0	17528.0	D20T21=D20+D21
2017	64459.0	44601.0	19858.0	D20T21=D20+D21
2018	64145.0	43873.0	20272.0	D20T21=D20+D21

4. Chain- linking

Table A6.4. D20T21 chain- linking and conversion to reference year = 2015

	VALU	VKPY	QI	Formula	VALK	Formula
2005	44411		1	QI_2005=1	44532.0	QI_2005/QI_2015*VALU_2015
2006	43460	41889.1	0.9432	QI_2005*VKPY_2006/VALU_2005	42003.2	QI_2006/QI_2015*VALU_2015
2007	44811	45652.0	0.9908	QI_2006*VKPY_2007/VALU_2006	44121.8	QI_2007/QI_2015*VALU_2015
2008	43676	50851.0	1.1243	QI_2007*VKPY_2008/VALU_2007	50068.9	QI_2008/QI_2015*VALU_2015
2009	37547	42534.9	1.0950	QI_2008*VKPY_2009/VALU_2008	48760.7	QI_2009/QI_2015*VALU_2015
2010	44416	39225.1	1.1439	QI_2009*VKPY_2010/VALU_2009	50940.0	QI_2010/QI_2015*VALU_2015
2011	45690	42557.0	1.0960	QI_2010*VKPY_2011/VALU_2010	48808.0	QI_2011/QI_2015*VALU_2015
2012	47712	45761.0	1.0977	QI_2011*VKPY_2012/VALU_2011	48883.8	QI_2012/QI_2015*VALU_2015
2013	45724	45663.0	1.0506	QI_2012*VKPY_2013/VALU_2012	46784.5	QI_2013/QI_2015*VALU_2015
2014	57678	53970.9	1.2401	QI_2013*VKPY_2014/VALU_2013	55222.7	QI_2014/QI_2015*VALU_2015
2015	57803	60373.0	1.2980	QI_2014*VKPY_2015/VALU_2014	57803.0	QI_2015/QI_2015*VALU_2015
2016	52217	55034.0	1.2358	QI_2015*VKPY_2016/VALU_2015	55034.0	QI_2016/QI_2015*VALU_2015
2017	65880	64459.0	1.5256	QI_2016*VKPY_2017/VALU_2016	67936.4	QI_2017/QI_2015*VALU_2015
2018	62609	64145.0	1.4854	QI_2017*VKPY_2018/VALU_2017	66147.2	QI_2018/QI_2015*VALU_2015