

**Documentation of statistics for  
Productivity 2018**

## 1 Introduction

The purpose of the statistics is to calculate the growth in labor productivity and to detect what causes this growth. Labor Productivity is an important component in the analysis of the economy. In 2003 the labor accounts on employment and hours was incorporated in the national accounts. Since then it has been possible to calculate the growth in labor productivity (and the causes) back to 1966.

## 2 Statistical presentation

Productivity is basically a measure of how efficiently you use your resources (labor, capital, etc.) when producing goods and services. By using a method based on a production function and other assumptions it is possible to determine the causes of labor productivity. With the KLEMS method you can equivalently determine the causes of output productivity (output per hour worked).

### 2.1 Data description

Labor productivity (LP) is defined as the real value of Gross value added (GVA) per hour worked. The calculations are based on figures from market activity. In the statistic "Productivity" the growth in LP is derived from contributions from four sources: It capital deepening (It capital per hour worked) Non-it capital deepening Educational level Total factor productivity (TFP)

The method used in the statistic is based on Jorgenson et al. (2002), "Growth of U.S. Industries and Investments in Information Technology and Higher Education", and OECD (2001), "Measuring productivity. Measurement of aggregate and industry-level productivity growth".

In November 2010 the statistic was supplemented with the so called KLEMS method. The productivity measurement for this method is output (excl. other taxes less subsidies on production) per hours worked. The KLEMS method calculates the contributions from K, L, E, M and S (Capital, Labor and intermediate consumption of Energy, Materials and Services). After the publication of figures for 2013 the production of the KLEMS statistics has been put on hold.

### 2.2 Classification system

Statistics Denmark's industrial classification DBO7, which is a Danish version of the EU NACE, rev. 2. and the UN's ISIC, rev. 4, contains a number of standard classifications: the 127, 36, 19, and 10 classifications.

Productivity is calculated from national accounts figures. The national accounts classification of 117 industries corresponds - with few deviations - to the 127 standard classification and the 117 industries of the national accounts can be aggregated to the other standard classifications. For this reason, productivity figures can easily be compared to and used in connection with other statistics that are based on the DBO7-standard classifications.

Internationally there is a high degree of comparability with the productivity figures of other countries because the Danish productivity figures is compiled in accordance with the definitions in the European System of National Accounts ESA2010.

### 2.3 Sector coverage

All industries according to Danish Industrial Classification of All Economic Activities 2007 (DBO7).

## 2.4 Statistical concepts and definitions

Labor productivity (Gross value added per hour worked): Labor productivity is defined as the real value of Gross value added per hour worked. The calculations are based on figures from market activity, i.e. the total economy excluding the sectors: General government (S.13) and NPISH (S.15).

It capital: covers:

- Computer hardware
- Telecommunication equipment
- Computer software and databases

Non-it capital: covers:

- Dwellings
- Buildings other than dwellings
- Other structures and land improvements
- Transport equipment
- Machinery and equipment excl. It capital (see definition above)
- Weapon systems
- Cultivated biological resources
- Research and development
- Mineral exploration and evaluation
- Entertainment, literary or artistic originals and other intellectual property products

Labor quality: The index of labor quality measures the contribution of substitution among the components of labor input to the volume obtained from a given number of hours. Labor quality is thus an indicator of the quality of the input of labor hours and captures the compositional change in the working force. The heterogeneity among the employees is here based on their educational attainment, and therefore the index is called educational level. The educational attainment of the employees are divided into five educational categories:

- Basic school
- Vocational
- Some college no BA
- BA
- More than BA

Output productivity (output per hour worked): Output productivity is defined as the real value of output per hour worked. Output is here defined as production excl. other taxes less subsidies on production. The calculations are based on figures from market activity, i.e. the total economy excluding the sectors: General government (S.13) and NPISH (S.15).

## 2.5 Statistical unit

For the compilation of output, intermediate consumption, taxes linked to production and subsidies, wages and salaries, employment, fixed capital formation and depreciation, the statistical unit is the local kind-of-activity unit. For the compilation of distributive and financial transactions, which cannot be divided up unambiguously among the individual kind-of-activity units belonging to a decision making unit (enterprise), the unit is the larger institutional unit, which in most cases will be the same as the legal unit which is the enterprise.

## **2.6 Statistical population**

All units generating Danish economic activity.

## **2.7 Reference area**

Denmark.

## **2.8 Time coverage**

1966-2018 for Labor Productivity (the last year will appear in the name of the publication). 1966-2018 for Productivity (the last year will appear in the name of the publication).

## **2.9 Base period**

Gross value added is compiled as chain volume indices (chained values) with 2010 as base year. This is an attempt to isolate the volume part of the monetary values.

## **2.10 Unit of measure**

Percent and index.

## **2.11 Reference period**

1966 - 2018

## **2.12 Frequency of dissemination**

Annually.

## **2.13 Legal acts and other agreements**

Act on Statistics Denmark § 6 and §§ 8 - 12.

Council Regulation (EU) No 549/2013 of May 21 2013 on the European system of national and regional accounts in the European Union (ESA2010) (OJ L 174 26.06.2013, p. 1).

## **2.14 Cost and burden**

There is no direct burden of response since data are collected for other purposes.

## **2.15 Comment**

For a theoretical background and methods for deriving growth of productivity: "Growth of U.S. Industries and Investments in Information Technology and Higher Education", Jorgenson, D.W., Ho, M.S. and Stiroh, K. J. 2002 and "Measurement of aggregate and industry-level productivity growth", OECD 2001. The later can be downloaded from OECD's homepage: <http://www.oecd.org>

## **3 Statistical processing**

Labor productivity is defined as the real value of Gross value added (GVA) per hour worked. The calculations are based on figures from market activity from national accounts, i.e. the total economy excluding the sectors: General government (S.13) and NPISH (S.15). The sources used for calculating the productivity growth is fixed capital, Labor force education statistics and sector account figures for Gross value added and hours worked.

### **3.1 Source data**

The sources used for calculating labor productivity (LP) are sector figures from the national accounts on Gross value added and hours worked.

The sources used for calculating the productivity growth (the causes of the growth in LP) is the above, fixed capital and statistics of education. For the computation of KLEMS we use data from the input-output tables to split intermediate consumption into energy, materials and services.

### **3.2 Frequency of data collection**

Annual.

### **3.3 Data collection**

Not relevant for this statistics.

### **3.4 Data validation**

The sources for the statistic have been published before they are received and therefore they have already been validated. When the sources are received they are compared to the numbers already published.

### **3.5 Data compilation**

The data compilation is conducted on the most detailed level. Labor productivity is computed by 117 industries and Productivity is computed by 69 industries. Labor productivity is defined as the real value of Gross value added (GVA) per hour worked. The calculations are based on figures from market activity from national accounts, i.e. the total economy excluding the sectors: General government (S.13) and NPISH (S.15). The Total is however based on figures for the total economy.

The growth in Labor productivity is derived from contributions from four sources: · It-capital deepening (computed with figures from the capital stock) · Non-it capital deepening (computed with figures from the capital stock) · Educational level (computed with figures from labor force education statistics) · Total factor productivity (computed residually when Labor productivity and the three above numbers are computed)

The KLEMS method is based on output per hour worked and is therefore derived from contributions from the above four sources (calculated in another way than by the GVA-method above) and the three sources below (computed with figures from the input-output tables): · Intermediate consumption of Energy · Intermediate consumption of Materials · Intermediate consumption of Services

### **3.6 Adjustment**

Normally no corrections to data are made.

## **4 Relevance**

The national accounts (including Productivity statistics) constitute core indicators of the analyses of economic growth. Users are primary researchers, economic departments and organizations.

The division of national accounts continuously evaluates feedback from our users.

### **4.1 User Needs**

Labor Productivity is published separate and as a part of the publication "productivity". Both publications constitute core indicators of the analyses of economic growth. Users are primary researchers, economic departments and organizations.

### **4.2 User Satisfaction**

The division of national accounts continuously evaluates feedback from our users.

### **4.3 Data completeness rate**

This statistic is not mentioned in any regulations etc. Data for this statistic is primarily from other publications in the national accounts. These publications are all covered by EU regulations.

## **5 Accuracy and reliability**

The uncertainty on productivity growth is closely related to the uncertainty on the figures used from the national accounts. In addition, there is uncertainty connected with the assumptions made, for example in relation to production functions. No traditional measure of the error margins for the variables described by the statistic is available.

### **5.1 Overall accuracy**

The inaccuracy of this statistic relates to the inaccuracy of the figures used from the national accounts. See documentation of statistics for Annual national accounts. In addition, there is uncertainty connected with the assumptions made, for example in relation to production functions.

In the danish documentation note [En kvalitetsvurdering af timeproduktiviteten på brancheniveau](#) an assessment is made of how usable each industry's productivity growth rates is in productivity analyzes.

### **5.2 Sampling error**

Not relevant for these statistics.

### **5.3 Non-sampling error**

The inaccuracy of this statistic relates to the inaccuracy of the figures used from the national accounts. See documentation of statistics for Annual national accounts.

### **5.4 Quality management**

Statistics Denmark follows the recommendations on organisation and management of quality given in the Code of Practice for European Statistics (CoP) and the implementation guidelines given in the Quality Assurance Framework of the European Statistical System (QAF). A Working Group on Quality and a central quality assurance function have been established to continuously carry through control of products and processes.

### **5.5 Quality assurance**

Statistics Denmark follows the principles in the Code of Practice for European Statistics (CoP) and uses the Quality Assurance Framework of the European Statistical System (QAF) for the implementation of the principles. This involves continuous decentralized and central control of products and processes based on documentation following international standards. The central quality assurance function reports to the Working Group on Quality. Reports include suggestions for improvement that are assessed, decided and subsequently implemented.

## 5.6 Quality assessment

This statistic is based on the Danish national accounts.

When the national accounts were based on the definitions in the European System of National Accounts ESA2010, the national accounts were at the same time undergoing a major revision, which means that all the levels were examined and evaluated, among other things for the sake of the Gross National Income compilations, which form the basis of a considerable amount of the financial contribution from Denmark to the EU.

A reasonable accuracy of the national accounts figures is maintained by compiling the product balances at a very detailed level. Furthermore, the compilation of the central variable GDP is to the greatest extent possible compiled from the point of view: production, expenditure and income.

In the danish documentation note [En kvalitetsvurdering af timeproduktiviteten på brancheniveau](#) an assessment is made of how usable each industry's productivity growth rates is in productivity analyzes. The idea comes from The Danish productivity commissions report 1, p.14 in which the quality of the productivity figures on industries is specified.

## 5.7 Data revision - policy

Statistics Denmark revises published figures in accordance with the [Revision Policy for Statistics Denmark](#). The common procedures and principles of the Revision Policy are for some statistics supplemented by a specific revision practice.

## 5.8 Data revision practice

Labor productivity is consistent with the rest of the national account. By the end of the year national accounts figures from year minus 3 are declared final. Thus the figures from 2011 was declared final in December 2014.

## 6 Timeliness and punctuality

First version of preliminary yearly national accounts (NA) figures are published end of March the following year. First version of Labor productivity (LP) for that year is published in May. The final figures for NA are published in November 3 years after the reference year. The final version of LP for that year is published in December. In February/March Productivity growth (Total factor productivity, KLEMS etc.) is published. The productivity statistics are usually published according to schedule.

### 6.1 Timeliness and time lag - final results

First version of preliminary yearly national accounts (NA) figures are published end of March the following year. At the same time the first version of Labor productivity (LP) for that year is published. The final figures for NA are published in November 3 years after the reference year. The final version of LP for that year is also published November. In February/March Productivity growth (Total factor productivity, KLEMS etc.) is published.



## **6.2 Punctuality**

The productivity statistics are usually published according to schedule.

## **7 Comparability**

This statistic is based on national accounts. Therefore this statistic is consistent with respect to national accounts and comparable over time. Moreover this statistic is comparable to other countries productivity figures if they are also based on ESA2010.

### **7.1 Comparability - geographical**

Internationally there is a high degree of comparability with the national accounts of other countries because the Danish national accounts are compiled in accordance with the definitions in the European System of National Accounts ESA2010.

For all countries the productivity growth (including the Labor productivity) is based on data from the national accounts. Therefore it is possible to compare productivity figures across borders.

### **7.2 Comparability over time**

One of the fundamental goals when compiling national accounts statistics is to achieve a high degree of comparability over time. The statistical sources are therefore adapted in order to be consistent with the concepts of the national accounts. Fundamental changes of nomenclatures as for example classification of industries, changes in definitions as a result of new guidelines as well as new and better sources will inevitably lead to changes in the national accounts and thus in the growth of productivity and its sources. A thorough revision of the data in national accounts was undertaken in the year 2014.

### **7.3 Coherence - cross domain**

Statistics Denmark's industrial classification DBO7, which is a Danish version of the EU NACE, rev. 2. and the UN's ISIC, rev. 4, contains a number of standard classifications: the 127, 36, 19, and 10 classifications.

The final national accounts classification of 117 industries corresponds - with few deviations - to the 127 standard classification and the 117 industries of the national accounts can be aggregated to the other standard classifications. For this reason, national accounts figures can easily be compared to and used in connection with other statistics that are based on the DBO7-standard classifications.

However, comparisons with other statistics at a detailed industry level will often show differences, partly because of differences in definitions of variables, and partly because of the calendar year delimitation of the national accounts and its requirement of total coverage of the economic activity.

### **7.4 Coherence - internal**

There is per se fully internal consistency in the National Accounts.

## **8 Accessibility and clarity**

These statistics are published yearly in a Danish press release and in the StatBank under [Productivity](#).

### **8.1 Release calendar**

The publication date appears in the release calendar. The date is confirmed in the weeks before.

### **8.2 Release calendar access**

The Release Calendar can be accessed on our English website: [Release Calendar](#).

### **8.3 User access**

Statistics are always published at 8:00 a.m. at the day announced in the release calendar. No one outside of Statistics Denmark can access the statistics before they are published.

### **8.4 News release**

These statistics are published yearly in a Danish press release.

### **8.5 Publications**

[Link to Publications](#).

### **8.6 On-line database**

The statistics are published in the StatBank under [Productivity](#) in the following tables:

- [NP23](#): Labour productivity by industry and price unit
- [NP25](#): Productivity by industry, type and price unit
- [NP25V](#): Growth Accounts by industry, type and price unit
- [NP28](#): Productivity, KLEMS by industry, type and price unit

### **8.7 Micro-data access**

Basic material is stored electronically. In some cases more detailed material can be made available on a service basis at a charge.

### **8.8 Other**

Not relevant for these statistics.

### **8.9 Confidentiality - policy**

[Data Confidentiality Policy](#) for Statistics Denmark.

## **8.10 Confidentiality - data treatment**

Not relevant for these statistics.

## **8.11 Documentation on methodology**

For a theoretical background and methods for deriving growth of productivity: "Growth of U.S. Industries and Investments in Information Technology and Higher Education", Jorgenson, D.W., Ho, M.S. and Stiroh, K. J. 2002 and "Measurement of aggregate and industry-level productivity growth", OECD 2001. The later can be downloaded from OECD's homepage: <http://www.oecd.org>

A detailed description of sources and methods is published in (Danish) the theme publication, *Produktivitetsudviklingen i Danmark. 1966-2003*. Since then part of the method has changed, see the Danish publication *Nyt fra Danmarks Statistik* nr. 430 from 2010. The 3rd of November 2010 the traditional productivity measurement was supplemented by the KLEMS-method, see the Danish publication *Nyt fra Danmarks Statistik* nr.485 from 2010.

## **8.12 Quality documentation**

Results from the quality evaluation of products and selected processes are available in detail for each statistics and in summary reports for the Working Group on Quality.

## **9 Contact**

The administrative placement of this statistics is in the division of National Accounts. The person responsible is Magnus B. Eriksen, tel. +45 39 17 36 68, e-mail: [mbe@dst.dk](mailto:mbe@dst.dk)

### **9.1 Contact organisation**

Statistics Denmark

### **9.2 Contact organisation unit**

National Accounts, Economic Statistics

### **9.3 Contact name**

Magnus B. Eriksen

### **9.4 Contact person function**

Responsible for the statistics

### **9.5 Contact mail address**

Sejrøgade 11, 2100 Copenhagen

**9.6 Contact email address**

mbe@dst.dk

**9.7 Contact phone number**

+45 39 17 36 68

**9.8 Contact fax number**

+45 39 17 39 99