STATISTICS DENMARK

Documentation of statistics for Productivity 2011

Statistics Denmark
Sejrøgade 11
DK 2100 København Ø

STATISTICS DENMARK

1 Introduction

Labor Productivity is an important component in the analysis of the economy.

The purpose of publication "productivity" is to detect the sources behind the labor productivity growth. This enables us to understand the sources behind the productivity growth in a better way than what one can do using the labour productivity growth statistics. The implementation of the revised labor accounts on employment and hours ensures that an important source for productivity calculations is now available. Another significant source, the compilation of fixed capital that provides a picture of the productive capacity of the economy's capital stock has been accessible since February 2001. Both sources are compiled according to guidelines in the present European national accounting system, ESA2010. Moreover, time series for the capital stock of ICT has been composed, in order to quantify the significance of the increasing growth of investments in ICT (and software). Finally the aspect of a higher level of education in the labor force is being taken into account based on detailed information on the composition of employees and their education. In November 2010 we supplemented the method based on GDP at factor cost with the so-called KLEMS-method. The productivity measurement for this method is output 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).

2 Statistical presentation

Labor productivity is defined as the real value of GDP at factor cost 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 deepning
- Non-it capital deepning
- Educational level
- Total factor productivity

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 GDP-method above) and the three sources below:

- Intermediate consumption of Energy
- Intermediate consumption of Materials
- Intermediate consumption of Services

2.1 Data description

Labor productivity is defined as the real value of GDP at factor cost 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). The Total is however based on figures for the total economy.

Changes in labor productivity may on the other hand arise from other sources than a changing labour input. Input of capital and other factors of production may change, or a development in technology may occur. On account of this, it is important to come up with a measure of productivity, that is build on the relation between GDP at factor cost and the input of all production factors. This is named total factor productivity (TFP).

STATISTICS DENMARK

Total factor productivity is calculated as an index of GDP at factor cost divided by an index of the total input of production factors. Total factor productivity can be interpreted as an indicator of efficiency, due to developed technology, more efficient organization of the working process within firms etc. The measure consequently expresses, how much of the productivity growth, that is not just a result of an increased level of production factors.

Increasing capital deepening will under normal circumstances cause the labor productivity to grow, since e.g. machines can replace employees. And thereby attaining more GDP at factor cost with an unaltered or smaller input of labor. Capital deepening is decomposed as it and non-it capital deepening.

It-capital covers

- Information and communication technology (ICT)
- Software

Non-it capital covers

- Machinery and equipment excl. ICT
- Transport equipment
- Buildings and structures
- Livestock
- Software
- Mineral Exploration
- Entertainment, literary or artistic originals

The final source to labor productivity growth is from 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

The calculations and the procedure for the KLEMS-method (output divided by the number of labor working hours) are almost as above, although it contains three more production factors (intermediate consumption of energy, materials and services).

2.2 Classification system

Statistics Denmark's industrial classification DB07, 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 DB07-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 (DB07).

2.4 Statistical concepts and definitions

Arbejdsproduktivitet: Arbejdsproduktivitet er lig BFI (bruttofaktorindkomst) i kædede værdier pr. arbejdstime

2.5 Statistical unit

Productivity is calculated from national accounts figures. 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

The first year will always be 1966. The last year will appear in the name of the publication. At the moment it is 2013 for Labor Productivity and 2011 for Productivity.

2.9 Base period

GDP at factor cost 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

Labor productivity and productivity refer to the year as a period.

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 by other offices in Statistics Denmark.

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 Educaiton", 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

STATISTICS DENMARK

3 Statistical processing

Labor productivity is defined as the real value of GDP at factor cost 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
- Non-it capital deepening
- Educational level
- Total factor productivity

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 GDP-method above) and the three sources below:

- Intermediate consumption of Energy
- Intermediate consumption of Materials
- Intermediate consumption of Services

3.1 Source data

The sources used for calculating labor productivity (LP) are sector figures from the national accounts on GDP at factor cost and hours worked.

The sources used for calculating the productivity growth (the courses of 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 comsumption into energy, materials and services.

3.2 Frequency of data collection

Annual.

3.3 Data collection

Not relevant for these statistics.

3.4 Data validation

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

3.5 Data compilation

The sources for the statistic have been published before they are received and therefore they normally don't have to be compiled.

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 based on figures from the National Accounts. The National Accounts is in alignment with the following regulations:

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).

Commission Decision 98/715 Official Journal of the European Communities, 16 December 1998, L 340, p. 33

5 Accuracy and reliability

The uncertainty on productivity growth (including the Labor productivity) 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 and their assumptions.

No traditional measure of the error margins for the variables described by the statistic is available. In principle such a measure is not possible.

5.1 Overall accuracy

The inaccuracy of this statistic relates to the inaccuracy of the figures used from the national accounts.

5.2 Sampling error

Not relevant for these statistics.

5.3 Non-sampling error

Is not calculated. See "Overall accuracy".

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.

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.

STATISTICS DENMARK

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. 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.

6.2 Punctuality

The productivity statistics are usually published according to schedule.

7 Comparability

See "Comparability - geographical".

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 DB07, 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 DB07-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

- Statbank Denmark
- News from Statistics Denmark

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 Calender can be accessed on our English website: Release Calender.

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

See News from statistics Denmark: Nyt fra Danmarks Statstik - Nationalregnskab og offentlige finanser.

8.5 Publications

Link to Publications.

8.6 On-line database

Tables in Statbank.

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

No other access.

8.9 Confidentiality - policy

Not relevant for these statistics.

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

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