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LABOUR PRODUCTIVITY INDICATORS

COMPARISON OF TWO OECD DATABASES
PRODUCTIVITY DIFFERENTIALS & THE BALASSA-SAMUELSON EFFECT

ORGANISATION
FOR ECONOMIC
CO-OPERATION
AND DEVELOPMENT

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INTRODUCTION

1. A conceptual look: Why measure labour productivity?

Productivity is commonly defined as a ratio of a volume measure of output to a measure of input use.[1] Among other productivity measures such as multi-factor productivity or capital productivity, labour productivity is particularly important in the economic and statistical analysis of a country. Labour productivity is a revealing indicator of several economic indicators as it offers a dynamic measure of economic growth, competitiveness, and living standards within an economy. It is the measure of labour productivity (and all that this measure takes into account) which helps explain the principal economic foundations that are necessary for both economic growth and social development.[2]

2. Labour productivity: A relationship between production and factors of production

Although the ratio used to calculate labour productivity provides a measure of the efficiency with which inputs are used in an economy to produce goods and services, it can be measured in various ways. Labour productivity is equal to the ratio between a volume measure of output (gross domestic product or gross value added) and a measure of input use (the total number of hours worked or total employment).[3]

Labour productivity = volume measure of output / measure of input use

Volume measure of output:
The volume measure of output reflects the goods and services produced by the workforce. Numerator of the ratio of labour productivity, the volume measure of output is measured either by gross domestic product (GDP) or gross value added (GVA). Although these two different measures can both be used as output measures, there is normally a strong correlation between the two (Table 1.2). There is a preference for value added as taxes are excluded.

Measure of input use:
The measure of input use reflects the time, effort and skills of the workforce. Denominator of the ratio of labour productivity, the input measure is the most important factor that influences the measure of labour productivity (Table 1.3). Labour input is measured either by the total number of hours worked of all persons employed or total employment (head count).

There are both advantages and disadvantages associated with the different input measures that are used in the calculation of labour productivity. It is generally accepted that the total number of hours worked is the most appropriate measure of labour input because a simple headcount of employed persons can hide changes in average hours worked, caused by the evolution of part-time work or the effect of variations in overtime, absence from work or shifts in normal hours. However, the quality of hours-worked estimates is not always clear. In particular, statistical establishment and household surveys are difficult to use because of their varying quality of hours-worked estimates and their varying degree of international comparability.[4]

[1] OECD Publications. *Measuring productivity – OECD Manuel: measurement of aggregate and industry-level productivity growth*. 2001, page 11.
[2] OECD Publications. *Measuring productivity – OECD Manuel: measurement of aggregate and industry-level productivity growth.* 2001, chapter 2.
[3] The use of different labour input and output measures can decrease comparability among international labour productivity measures.
[4] OECD Publications. *Measuring productivity – OECD Manuel: measurement of aggregate and industry-level productivity growth*. 2001, page 39.

In contrast, total employment is easier to measure than the total number of hours worked. However, total employment is less recommended as a measure of labour productivity because it neither reflects changes in the average work time per employee nor changes in multiple job holdings and the role of self-employed persons (nor in the quality of labour).[5]

3. Objectives: Labour productivity and uses

The OECD Statistics Directorate (STD) publishes series on labour productivity for all OECD member countries. The two principal databases that provide such series are the OECD Productivity Database, first published in March 2003, and the OECD System of Unit Labour Cost and Related Indicators, first published in March 2007.

Although these two databases both provide series on labour productivity for the same countries, each database calculates labour productivity in a different way. In particular, the calculation of both the output and labour input measures differs according to the database used. Therefore, correlations of labour productivity growth differ for several OECD member countries between the two databases.

This report has two principal objectives, the first of which is to compare the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators. Comparing these two databases will both illustrate the different ways of measuring labour productivity and demonstrate how labour productivity growth varies when different input and output measures are used. Additionally, correlations between series of labour productivity growth for the total economy will serve to validate the two databases in relation to one another.

The second objective of this report is to give a practical application of the OECD System of Unit Labour Cost and Related Indicators, given that it is a relatively new OECD database. This is important because it is the only OECD database that publishes labour productivity data according to economic activity. To do this, a composite indicator of labour productivity in industry versus market services is created in addition to a proxy for relative prices between these same two sectors. The composite indicator is then used to test a well known economic theory, the Balassa-Samuelson effect.

[5] OECD Publications. *Measuring productivity – OECD Manuel: measurement of aggregate and industry-level productivity growth.* 2001, page 40.

I. DIFFERENCES BETWEEN THE OECD PRODUCTIVITY DATABASE AND THE OECD SYSTEM OF UNIT LABOUR COST AND RELATED INDICATORS

A. DIFFERENT METHODOLOGIES USED BY THE OECD STATISTICS DIRECTORATE TO MEASURE LABOUR PRODUCTIVITY

A1. OECD Productivity Database

The OECD Productivity Database is a joint product of four OECD Directorates: Statistics Directorate (STD); Directorate for Science, Technology and Industry (STI); Directorate for Employment, Labour and Social Affairs (ELS); and, the Economics Department (ECO). This database aims at bringing together those series that are judged best suited for productivity analysis. Additionally, this database aims at allowing an international comparison of estimates for labour productivity and multi-factor productivity for the total economy in addition to capital services by type of asset.[6]

The OECD Productivity Database publishes annual series of labour productivity growth and levels for the total economy for all OECD member countries and a range of economic / geographical zones. This database also includes annual estimates for capital services and multi-factor productivity for twenty OECD countries at the total economy level; the database is updated once a year.

In the OECD Productivity Database, labour productivity has only one definition: labour productivity per hour. This is calculated as gross domestic product per hour worked. For each country, GDP refers to gross domestic product in volume terms (real GDP), in national currency, at constant prices. For economic / geographical zones, GDP refers to real GDP in US dollars, constant Purchasing Power Parities (PPPs), OECD base year 2000.

In the OECD Productivity Database, measures of labour productivity growth are presented as indices (OECD base year 2000 = 100) or in rates of change, while levels are presented related to the United States (US = 100).

Sources used by this database are: the OECD System of National Accounts (SNA), the OECD Employment Outlook (EMO), the OECD Economic Outlook (EO), OECD Labour Force Statistics (ALFS) and national sources.[7]

A2. The OECD System of Unit Labour Cost and Related Indicators

The OECD System of Unit Labour Cost and Related Indicators provides annual and quarterly time series for unit labour cost indicators and related series for the economic activities according to the International Standard Industrial Classification (ISIC Rev. 3): total economy; manufacturing; industry; construction; trade, transport and communication; finance and business services; market services; and business sector excluding agriculture.[8] Data are available for all OECD member countries, nine non-member countries, the Euro area and selected geographical zones.

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[6] OECD Productivity Database: www.oecd.org/statistics/productivity.
[7] OECD Publications. *OECD Labour Productivity and Unit Labour Cost Indicators.* 2008, page 3.
[8] International Standard Industrial Classification of all Economic Activities (ISIC) Third Revision: http://www.ilo.org/public/english/bureau/stat/class/isic.htm.

Unit labour costs (ULC) measure the average cost of labour per unit of output. They are calculated as the ratio of total labour costs to real output, or equivalently, as the ratio of mean labour costs per hour to labour productivity (output per hour). As such, a ULC represents a link between productivity and the cost of labour in producing output. In this database, time series are presented in level, index and growth form where the base year of real output is 2000.[9]

The related indicators include annual time series for: exchange rate adjusted unit labour cost; labour income share ratio; labour productivity per unit labour input; labour productivity per employed person; labour productivity per hour worked; labour compensation per unit labour input; labour compensation per employee; labour compensation per employee hour worked; labour compensation per unit labour input indices ($US PPP adjusted); labour compensation per employee ($US PPP adjusted); labour compensation per hour ($US PPP adjusted); unit labour cost; total labour costs; real output; nominal output; total employment to employees ratio: total employment (hours worked and persons); employees (hours worked and persons). All data in this database are updated on a quarterly basis.

In the OECD System of Unit Labour Cost and Related Indicators, labour productivity is defined in two ways: labour productivity per hour; or labour productivity per person employed. The headline measure is therefore: labour productivity per unit labour input (total number of hours worked by those in employment and / or total employment in persons).

Labour productivity per hour is defined as real output (gross value added) divided by total hours worked by all persons in employment. All data for the total number of hours worked comes from the OECD System of National Accounts (SNA).[10]

Labour productivity per person employed is defined as real output (gross value added) divided by total employed persons. Data series are available for all countries except Iceland. Besides the exception for Turkey, the sole source for total employment data is the SNA.[11]

Labour Productivity per unit labour input is defined as real output divided by total labour input. The labour input measure used is total hours worked by those in employment for the following OECD member countries: Australia, Austria, Canada, Denmark, Finland, France, Germany, Greece, Hungary, Italy, Korea, Netherlands, Norway, Slovak Republic, Spain, Sweden and Switzerland.[12] For all other countries total employment in persons is used as the labour input measure.[13]

The principal source used by this database is: the OECD System of National Accounts (SNA).[14]

[9] Main Economic Indicators, Sources and definitions: http://stats.oecd.org/mei/default.asp?lang=e&subject=19.
[10] Main Economic Indicators, Sources and definitions: http://stats.oecd.org/mei/default.asp?lang=e&subject=19.
[11] Main Economic Indicators, Sources and definitions: http://stats.oecd.org/mei/default.asp?lang=e&subject=19.
[12] Data for total hours worked by those in employment is also used for the following non-member countries: Bulgaria, Cyprus, Estonia and Lithuania. Footnote by Turkey: The information in this document with reference to « Cyprus » relates to the southern part of the Island. There is no single authority representing both Turkish and Greek Cypriot people on the Island. Turkey recognizes the Turkish Republic of Northern Cyprus (TRNC). Until a lasting and equitable solution is found within the context of United Nations, Turkey shall preserve its position concerning the "Cyprus issue".
Footnote by all the European Union Member States of the OECD and the European Commission: The Republic of Cyprus is recognized by all members of the United Nations with the exception of Turkey. The information in this document relates to the area under the effective control of the Government of the Republic of Cyprus.
[13] Data for total employment in persons is also used for the non-member countries: Slovenia and Latvia.
[14] OECD Publications. *OECD Labour Productivity and Unit Labour Cost Indicators.* 2008, page 4.

B. DIFFERENCES BETWEEN THE OECD PRODUCTIVITY DATABASE AND THE OECD SYSTEM OF UNIT LABOUR COST AND RELATED INDICATORS

The only time series that the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators have in common is labour productivity for the total economy. However, there are noticeable differences between how the two databases are maintained and how the labour productivity measure is calculated.

The main differences between measures of labour productivity published by each database can be grouped into the following four categories:

- Updating policies;
- Source data;
- Output measures; and,
- Labour input measures.

B1. Updating policies

Although the SNA is the principal source of labour productivity data for both the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators, each database applies different updating policies.

More specifically, the OECD Productivity Database is updated once per year whereas the OECD System of Unit Labour Cost and Related Indicators is updated on a quarterly basis (normally as soon as new data are available). This can create differences between the published series, even if they have the same source.

B2. Source Data

As is shown in Table 1.1, both databases use the same source for the output measure.

While there are overlaps in where the databases source their data for the input measure, there are also reasonable differences.

The OECD Productivity Database uses the SNA (maintained by the National Accounts Division (NAD) of the OECD's Statistics Directorate) as its preferred source for labour input data. However, where data is not available in the SNA, the OECD Productivity Database also sources data from the OECD Employment Outlook (EMO), the OECD Economic Outlook (EO), OECD Annual Labour Force Statistics (ALFS) and national sources. All output data are sourced from the SNA.[15]

Unlike the OECD Productivity Database, the OECD System of Unit Labour Cost and Related Indicators sources all of its labour input data from the SNA besides an exception for Turkey. For Turkey, all labour input data are sourced from ALFS[16]. The OECD System of Labour Cost and Related Indicators sources all of its output data from the SNA (Annex 1).

[15] OECD Publications. *OECD Labour Productivity and Unit Labour Cost Indicators.* 2008, pages 4, 5.
[16] The recent move by TurkStat to SNA93 has increased the expectation that Turkey will start to provide labour data to the OECD via the national accounts questionnaires soon.

Table 1.1. Differences between the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators

	OECD Productivity Database	OECD System of Unit Labour Cost and Related Indicators
Labour Input Measure (I)	Total number of hours worked by those in employment, defined as average hours worked multiplied by the corresponding and consistent measure of employment for each particular country.	Total employment in persons, where data for total number of hours worked by those in employment are not available in the SNA.
Output Measure (II)	Gross domestic product (expenditure-based), national currency, constant prices, OECD base year (currently 2000).	Gross value added excluding FISIM[17], national currency, constant prices, OECD base year (currently 2000).
Labour Input Measure Sources	SNA; EMO; EO; ALFS; and national sources.	SNA; and ALFS.
Output Measure Sources	SNA.	SNA.
Updating Policies	Once per year.	Quarterly.
Labour Productivity Measure (II) / (I)	Labour productivity per hour.	Labour productivity per hour or labour productivity per person employed (if hours data not available).

B3. Output Measure

For both the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators, the output measure is at constant prices. According to the SNA, constant prices are obtained by directly factoring changes over time in the values of flows or stocks of goods and services into two components reflecting changes in the prices of the goods and services concerned and changes in their volumes (i.e. changes in "constant price terms").[18] However, there are differences in the output measures used by each database.

The OECD Productivity Database uses expenditure-based gross domestic product, in national currency, constant prices, OECD base year (currently 2000) as its output measure. According to the SNA, expenditure-based GDP is defined as the total final expenditures at purchasers' prices.[19]

This database uses expenditure-based GDP as its output measure for two principal reasons. First, expenditure-based GDP is often available on a more regular basis than other output measures, such as gross value added. Additionally, this output measure is more coherent with other time series published by the OECD Productivity Database, namely capital services by type of asset, multi-factor productivity, productivity levels and GDP per capita. In particular, Purchasing Power Parities (applied in the measure of expenditure-based GDP) are used in the calculation of temporal productivity series (i.e. in levels) to increase international comparability. Therefore, this output measure is also used for all other labour productivity measures in the OECD Productivity Database.

[17] Financial intermediation services indirectly measured.
[18] OECD Publications. *National Accounts of OECD Countries Volume I: Main Aggregates 1995-2006*. 2008, page 365.
[19] OECD Publications. *National Accounts of OECD Countries Volume I: Main Aggregates 1995-2006*. 2008, page 366.

In contrast, the OECD System of Unit Labour Cost and Related Indicators uses gross value added excluding financial intermediation services indirectly measured (FISIM), in national currency, constant prices, OECD base year (currently 2000) as its output measure. According to the SNA, gross value added measures the contribution to GDP made by an individual producer, industry or sector. It is the value of output less the value of intermediate consumption.[20]

This output measure is used for two primary reasons:

- Gross value excludes those activities for which no labour input is attached and therefore is a truer measure. Examples are: FISIM, taxes less subsidies on products and the statistical discrepancy (as compiled by some national statistics offices).
- In addition to labour productivity series for the total economy, the OECD System of Unit Labour Cost and Related Indicators also publishes labour productivity series for economic activities according to the International Standard Industrial Classification of All Economic Activities (ISIC Rev. 3). Included in the ISIC Rev. 3 are total economy; manufacturing; industry; construction; trade, transport and communication; finance and business services; market services; and business sector excluding agriculture. Gross value added, derived from the measure of output-based GDP, is the only output measure divided into economic activities. Therefore, the OECD System of Unit Labour Cost and Related Indicators applies this output measure when calculating all labour productivity series.

As is shown in Table 1.2, there is a strong correlation between the different output measures used by the two databases except for certain countries such as Australia and the Slovak Republic.

[20] OECD Publications. *National Accounts of OECD Countries Volume I: Main Aggregates 1995-2006*. 2008, page 367.

Table 1.2. Correlations: Output measures used by the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators

Country	Common Period	Correlations: GDP and Gross Value Added
Australia	1971-2006	*0.837*
Austria	1971-2006	0.987
Belgium	1971-2006	0.961
Canada	1971-2005	0.982
Czech Republic	1991-2006	0.989
Denmark	1971-2006	0.957
Finland	1971-2006	0.988
France	1971-2006	0.975
Germany	1971-2007	0.990
Greece	1971-2006	0.953
Hungary	1992-2006	0.955
Ireland	1971-2006	0.953
Italy	1971-2006	0.997
Japan	1971-2006	0.972
Korea	1971-2006	0.998
Luxemburg	1971-2006	0.926
Mexico	1971-2004	0.999
Netherlands	1971-2006	0.996
New Zealand	1971-2005	0.908
Norway	1971-2006	0.922
Poland	1993-2006	0.994
Portugal	1971-2006	0.964
Slovak Republic	1994-2006	*0.861*
Spain	1971-2006	0.981
Sweden	1971-2006	0.934
Switzerland	1971-2006	0.989
United Kingdom	1971-2006	0.977
United States	1971-2005	0.935

Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

B4. Labour Input Measure

Labour productivity can be calculated by using different labour input measures. Both the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators use the total number of hours worked by those in employment as their preferred labour input measure. Those in employment include: employees; employers and self-employed; and unpaid family workers.

In the OECD Productivity Database, the total number of hours worked by those in employment is defined as the average number of hours worked, multiplied by a corresponding and consistent measure of employment for each particular country. The SNA is the default source for this data. However, for those countries and years for which the SNA does not provide information on hours worked, other data sources

such as the EMO, the EO, the ALFS and national sources are used. The total number of hours worked by those in employment is the only labour input measure used by this database.

In contrast, the OECD System of Unit Labour Cost and Related Indicators uses input measures other than the total number of hours worked in employment, namely total employment in persons, if hours data are not available in the SNA. Persons included in total employment include: employees; employers and self-employed; and unpaid family workers.

Additionally, this database sources *all* labour input data from the SNA (there is an exception for Turkey).

In general, time series on total employment are normally longer than those on the total number of hours worked by those in employment. This implies that where a country has only a short time series of hours worked by those in employment available, the historical series will be linked in the OECD System of Unit Labour Cost and Related Indicators to the series on total employment to extend the series length.

In summary, the following input measures are found in the OECD System of Unit Labour Cost and Related Indicators[21]:

- Total number of hours worked by those in employment: Australia, Austria, Bulgaria, Canada, Cyprus, Denmark, Estonia, Finland, France, Germany, Greece, Hungary, Italy, Korea, Lithuania, Netherlands, Norway, Slovak Republic, Spain, Sweden and Switzerland;
- Total employment in persons[22]: all member countries;
- Total number of hours worked by those in employment linked to total employment in persons using the first common period link method.

The use of different labour input measures is the main source of variation found between labour productivity measures published in the two databases. Table 1.3 shows that in most cases, when both databases use the total number of hours worked in employment as the labour input measure, there is a strong correlation in labour productivity growth rates between the two databases. In contrast, when the OECD System of Unit Labour Cost and Related Indicators uses either total employment in persons or total number of hours worked in employment linked to total employment in persons as the labour input measure, the correlation of labour productivity growth rates between the two databases weakens.

[21] Main Economic Indicators, Sources and definitions: http://stats.oecd.org/mei/default.asp?lang=e&subject=19.
[22] Data for total employment in persons is not available for Iceland. It is, however, available for non-member countries: Slovenia and Latvia.

Table 1.3. Labour productivity growth correlations between the OECD Productivity Database (PROD) and the OECD System of Unit Labour Cost and Related Indicators (ULC)[23]

Country	ULC	PROD	Common Period	Labour productivity growth correlations ULC - PROD
Australia	Hours	Hours	1995-2005	0.865
Austria	Hours	Hours	1996-2006	0.940
Belgium	Employment	Hours	1971-2006	0.749
Canada	Hours	Hours	1971-2005	0.938
Czech Republic	Employment	Hours	1996-2006	0.737
Denmark	Hours	Hours	1971-2006	0.937
Finland	Hours	Hours	1976-2006	0.956
France	Hours	Hours	1991-2006	0.944
Germany	Hours	Hours	1992-2006	0.932
Greece	Hours	Hours	1996-2006	0.605
Hungary	Hours	Hours	1996-2006	0.974
Ireland	Employment	Hours	1971-2006	0.664
Italy	Hours	Hours	1981-2006	0.990
Japan	Employment	Hours	1971-2006	0.845
Korea	Hours	Hours	1993-2006	0.929
Luxemburg	Employment	Hours	1986-2006	0.816
Mexico	Employment	Hours	1996-2004	0.794
Netherlands	Hours	Hours	1971-2005	0.769
New Zealand	Employment	Hours	1990-2005	0.154
Norway	Hours	Hours	1971-2006	0.923
Poland	Employment	Hours	2001-2006	0.366
Portugal	Employment	Hours	1987-2004	0.162
Slovak Republic	Hours	Hours	1996-2006	0.893
Spain	Hours	Hours	1996-2006	0.845
Sweden	Hours	Hours	1981-2006	0.880
Switzerland	Hours	Hours	1992-2006	0.963
United Kingdom	Employment	Hours	1971-2006	0.688
United States	Employment	Hours	1971-2005	0.557

Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

While as a whole the correlations as presented in the table are strong, there are notable exceptions for New Zealand, Poland and Portugal. Breaking the situation down further for these countries, the issue in all cases is coming from the use of different labour input variables between the two databases (however the overall correlation in New Zealand is not helped by the volume measure of output correlation of 0.908 between the two databases). Although these low correlations are being further investigated for both databases in all cases, some preliminary observations can be made:

[23] In the OECD System of Unit Labour Cost and Related Indicators, labour productivity estimates are available for the non-member countries listed earlier.

- New Zealand: The New Zealand fiscal year ends 31 March and Employment data on this basis is supplied to the SNA and thus used on this basis in the OECD System of Unit Labour Cost and Related Indicators. However, as the OECD Labour Productivity Database uses both EO and EMO Hours data which is calendar based the low correlation is not unexpected.
- Poland: There is a high likelihood that the shortness of the overlapping period of correlation calculation, 2001-2006, is directly impacting on the result. As such, caution should be attached to this result.
- Portugal: The current correlation is undertaken on SNA Employment which has subsequently been updated. The expectation is that the correlation will strengthen significantly once the new SNA Employment data is incorporated into the OECD System of Unit Labour Cost and Related Indicators.

C. Comparison Between the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators

C1. Labour productivity growth for the total economy

As shown in the following country examples, differences in the labour input measure used is the main source of dissimilarity between labour productivity measures published by both the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators. When both databases use the total number of hours worked in employment as the labour input measure, there is a strong correlation of labour productivity growth rates for the total economy. However, when the two databases use different labour input measures, the correlation of labour productivity growth rates for the total economy are observed to decrease.

The table below contains the acronyms used in the following graphs that represent labour productivity growth for the total economy:

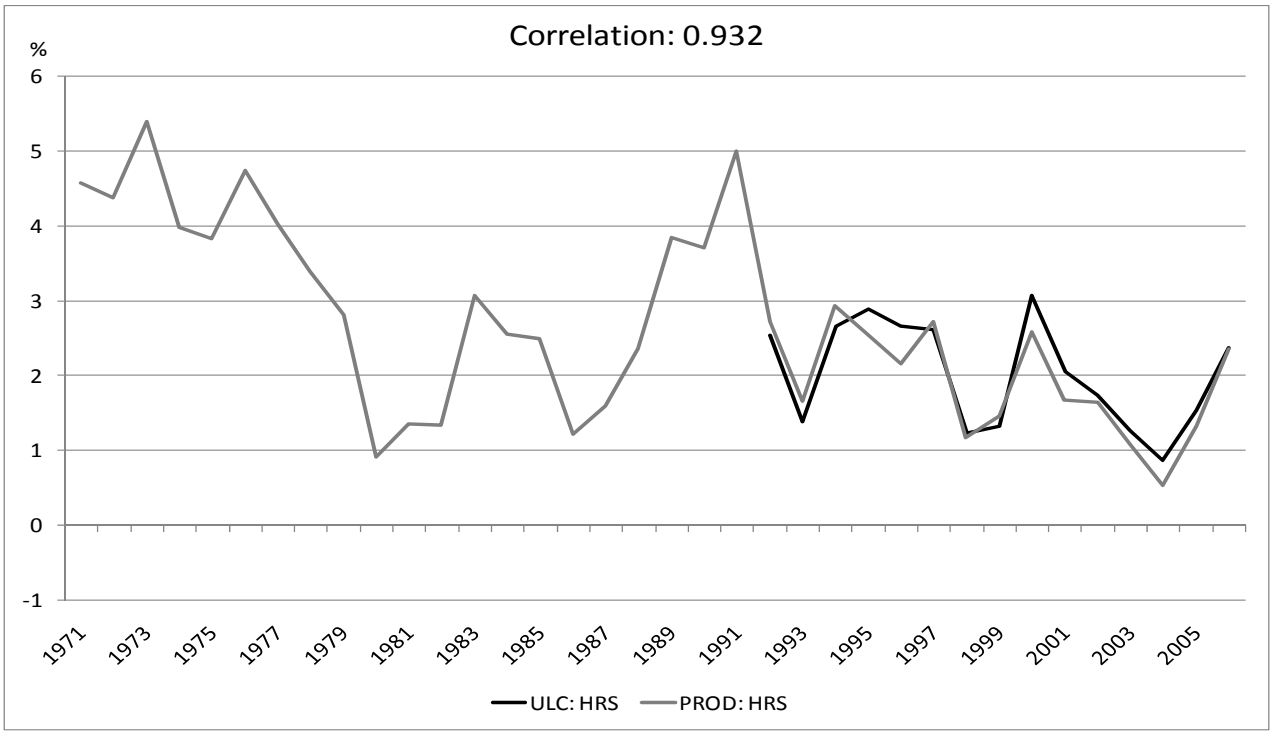
Acronym	Term
ULC	OECD System of Unit Labour Cost and Related Indicators.
PROD	OECD Productivity Database.
HRS	Labour productivity growth series for the total economy using total number of hours worked in employment as the labour input measure.
EMP	Labour productivity growth series for the total economy using total employment in persons as the labour input measure.
HRS & EMP	Labour productivity growth series for the total economy using total number of hours worked in employment as the labour input measure and linked to historical time series of labour productivity growth for the total economy using total employment in persons as the labour input measure (series available in index form, OECD base year (currently 2002 = 100) and in growth rates).

Germany

As is shown in the graphs below, the correlations of labour productivity growth for the total economy between the two databases vary depending on the labour input measure used. For Germany, when both the OECD System of Unit Labour Cost and Related Indicators and the OECD Productivity Database use the total number of hours worked in employment as the labour input measure, there is a correlation of 0.932 (ULC data from 1991). When the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure, the correlation decreases from 0.932 to 0.780.

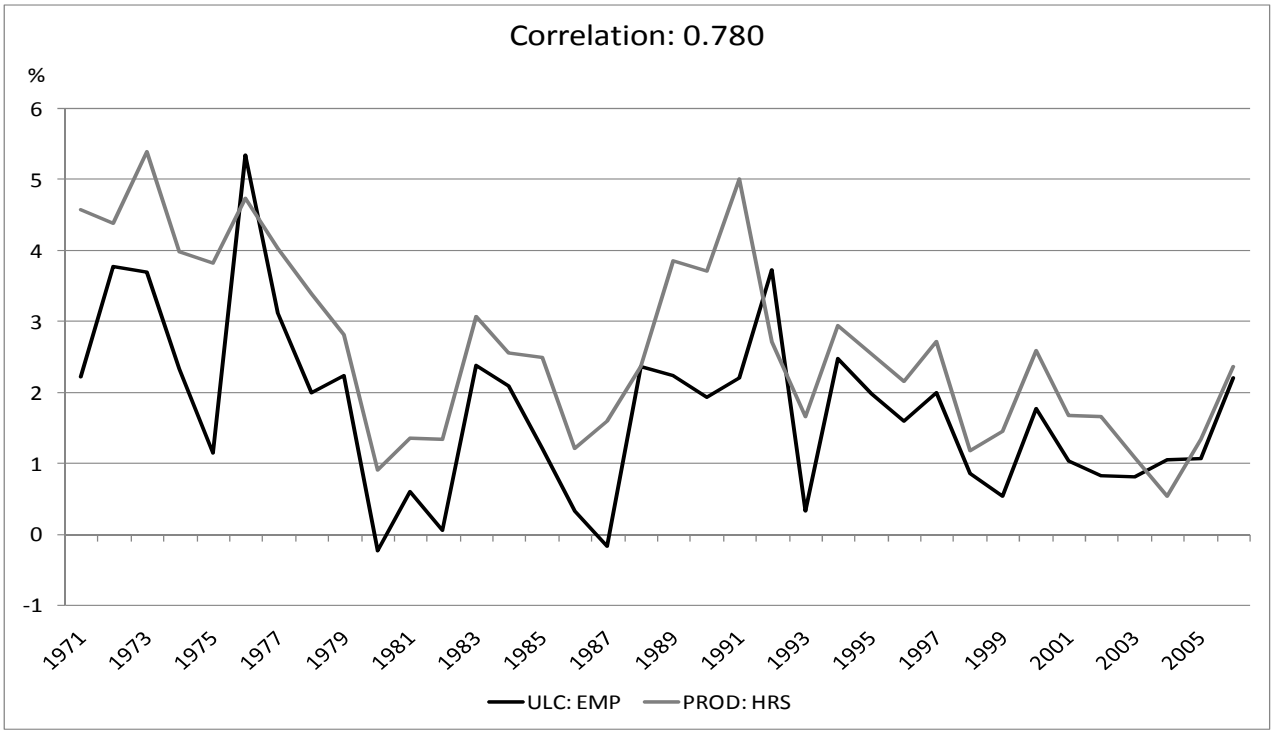
When the OECD System of Unit Labour Cost and Related Indicators uses the series on labour productivity per unit labour input, the correlation of labour productivity growth for the total economy decreases from 0.932 – when the total number of hours worked in employment is the only labour input measure used – to 0.712. The series on labour productivity per unit labour input links the series on labour productivity per hour and labour productivity per person employed. For Germany, the series on labour productivity per hour is available dating from 1991. This series is linked in 1991 to the series on labour productivity per person employed. In this case, the correlation of labour productivity growth for the total economy between the two databases of 0.712 is observed to be lower than that of 0.780, obtained when using the series on labour productivity per person employed as the only labour input measure. This could possibly be explained by the fact that the series on labour productivity per hour post 1991 represents data from Unified Germany whereas the series on labour productivity per person employed prior to 1991 represents data from Western Germany.

Germany: ULC using HRS as the Labour Input Measure



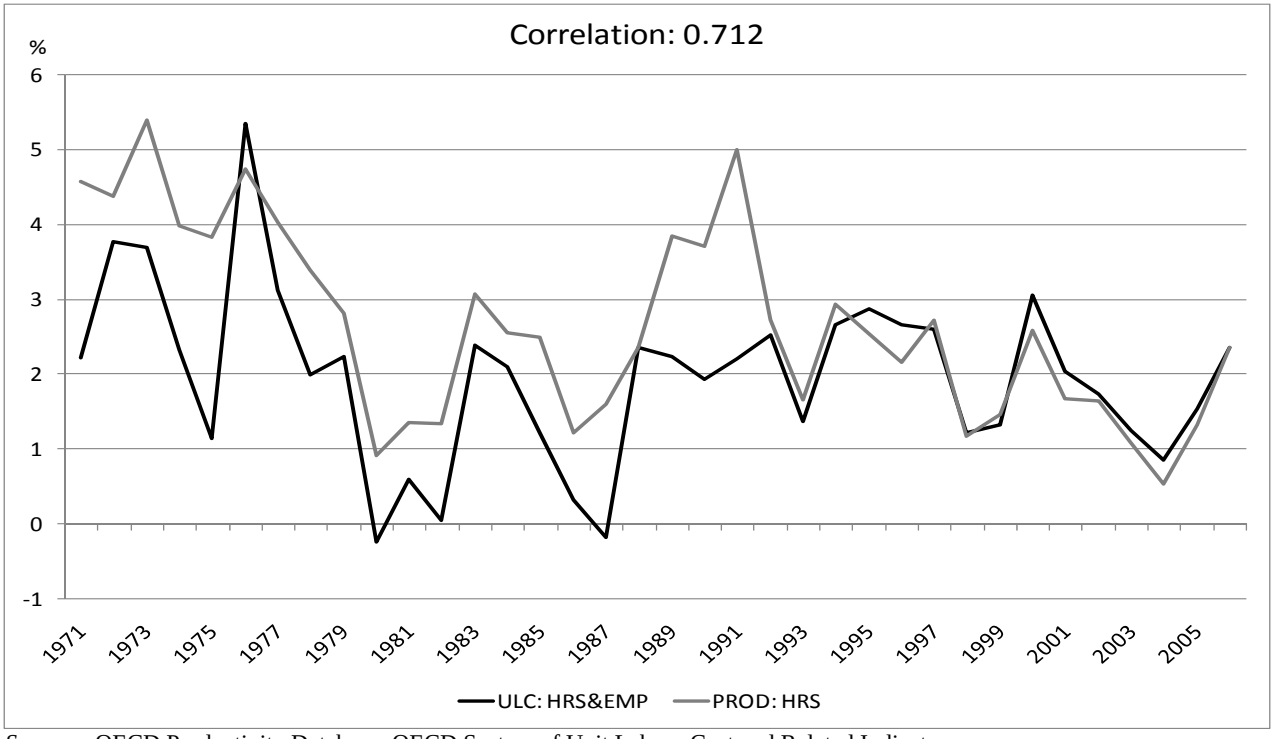
Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Germany: ULC using EMP as the Labour Input Measure



Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Germany: ULC using HRS & EMP as the Labour Input Measure



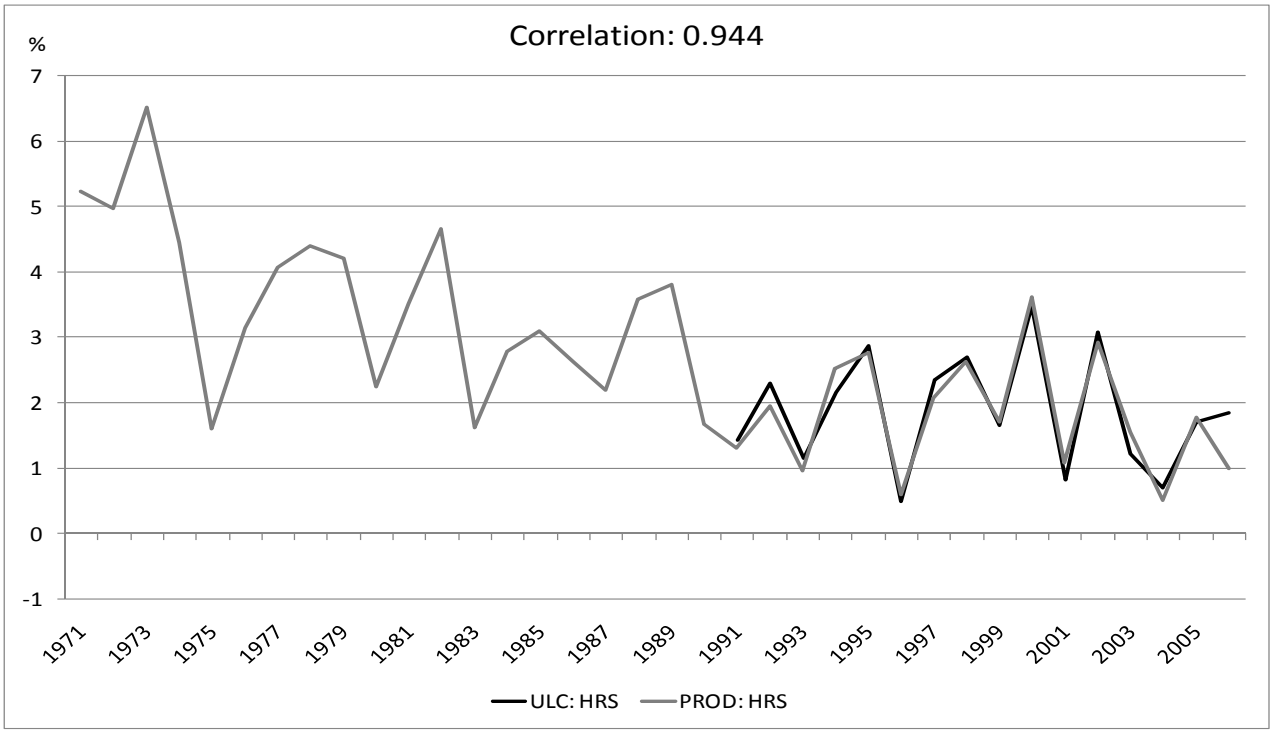
Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

France

For France, when both the OECD System of Unit Labour Cost and Related Indicators and the OECD Productivity Database use the total number of hours worked in employment as the labour input measure, there is a correlation of labour productivity growth for the total economy of 0.944 (ULC data dating from 1990). When the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure (ULC data dating from 1970) the correlation decreases from 0.944 to 0.775.

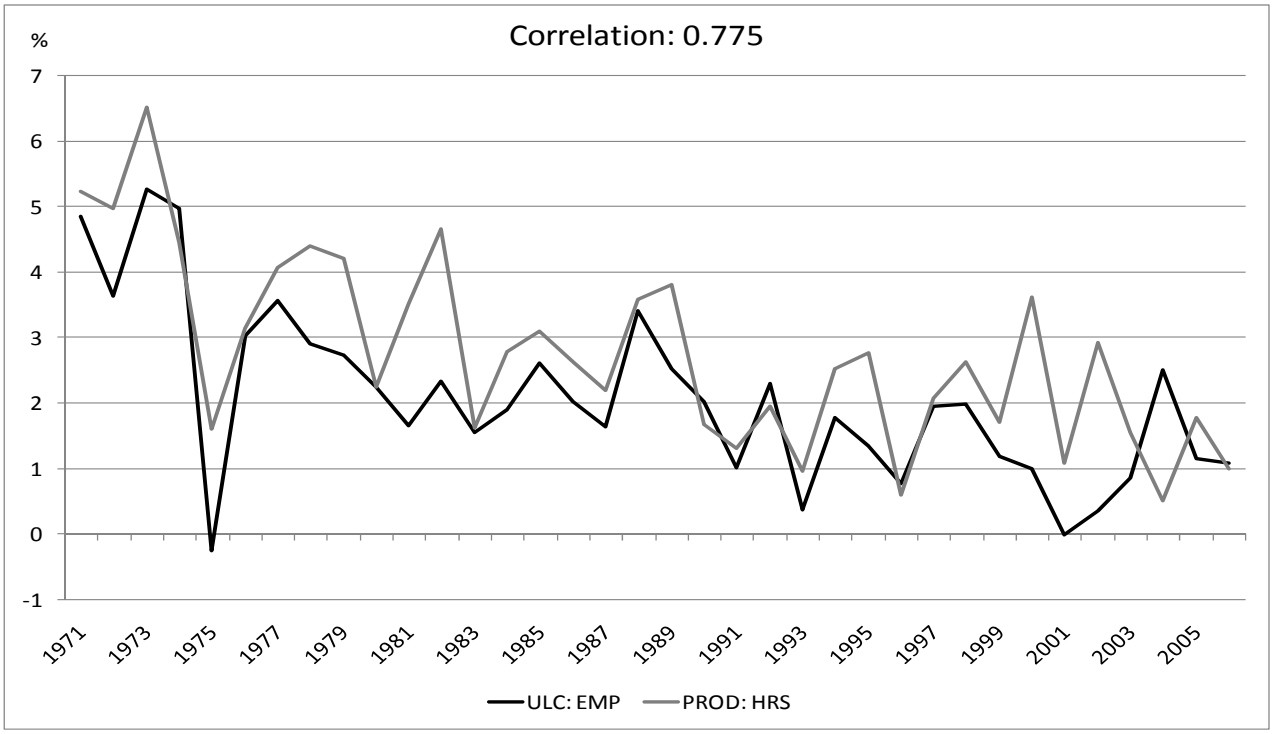
When the OECD System of Unit Labour Cost and Related Indicators uses the series on labour productivity per unit labour input, the correlation of labour productivity growth for the total economy decreases from 0.944 to 0.853. For France, the series on labour productivity per hour is available dating from 1990. It is linked in 1990 to the series on labour productivity per person employed. The correlation of 0.853, obtained when using the series on labour productivity per unit labour input is observed to be stronger than the correlation of 0.755 obtained when using total employment in persons as the labour input measure.

France: ULC using HRS as the Labour Input Measure



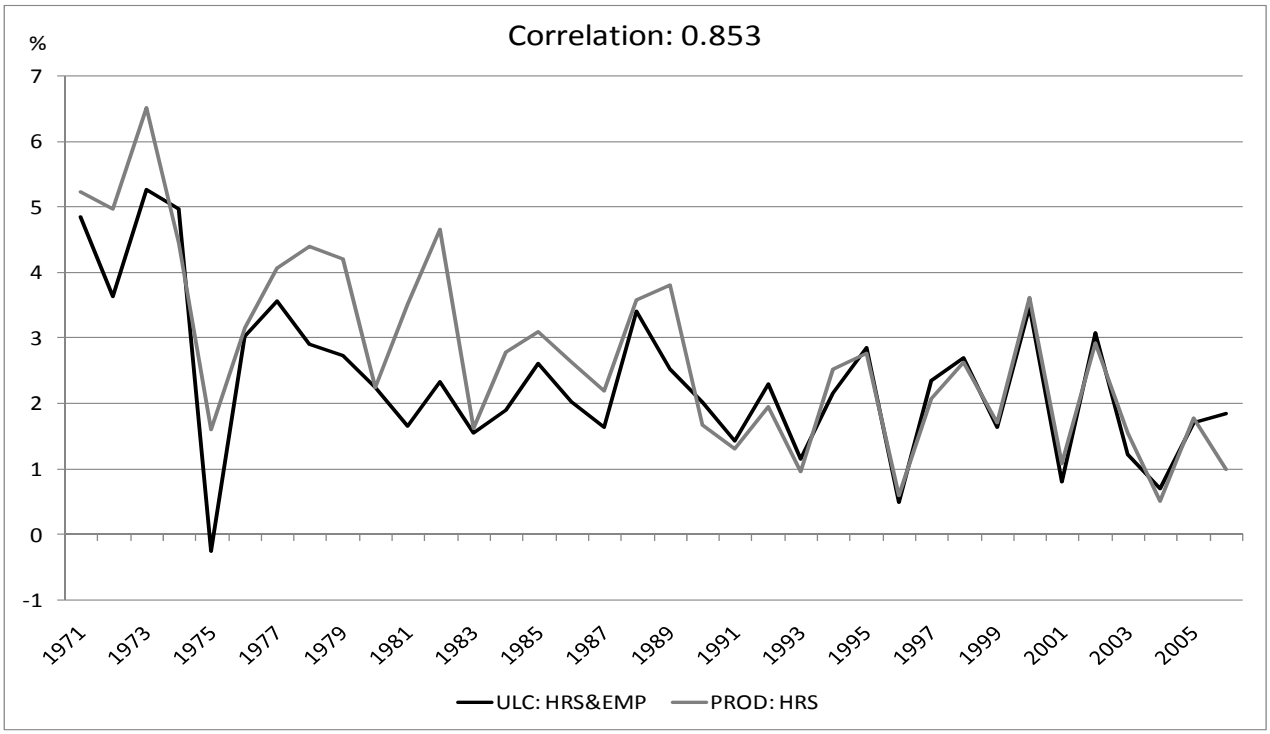
Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

France: ULC using EMP as the Labour Input Measure



Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

France: ULC using HRS & EMP as the Labour Input Measure



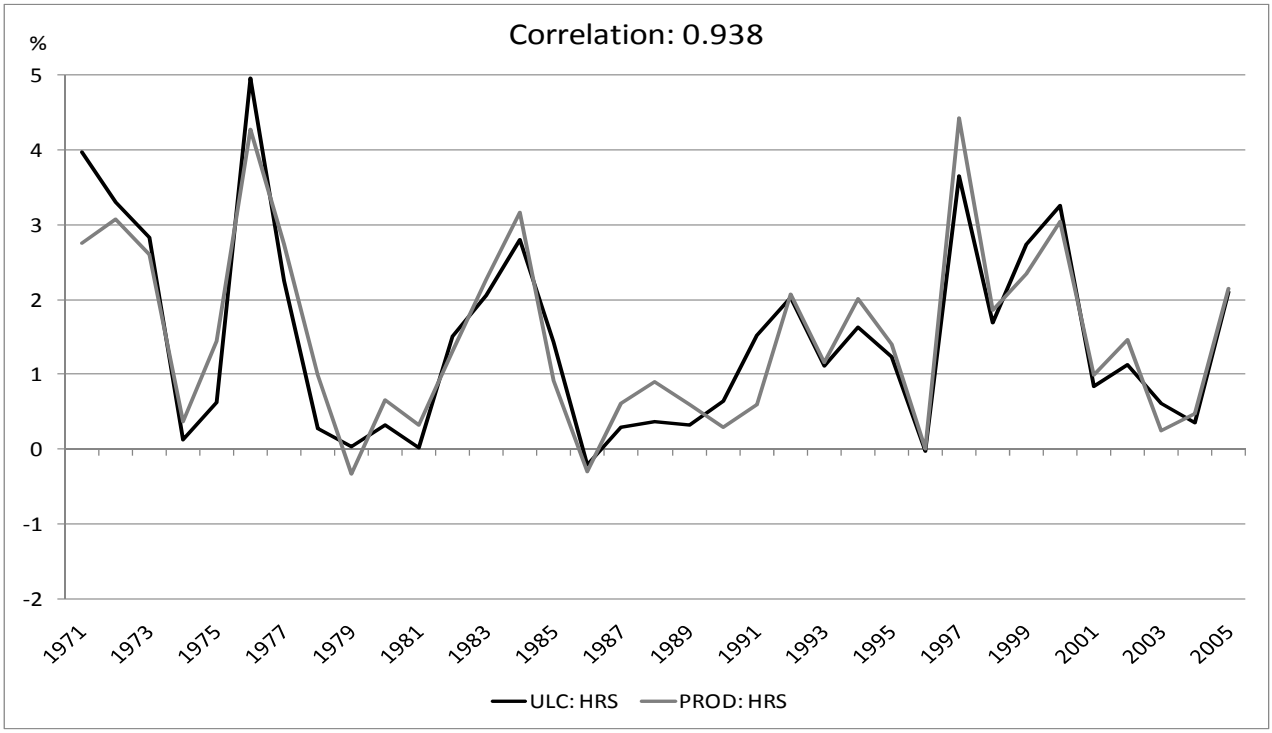
Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Canada

For Canada, when both the OECD System of Unit Labour Cost and Related Indicators and the OECD Productivity Database use the total number of hours worked in employment as the labour input measure, there is a correlation of labour productivity growth for the total economy of 0.938 (ULC data dating from 1970). When the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure (ULC data dating from 1970) the correlation decreases from 0.938 to 0.841.

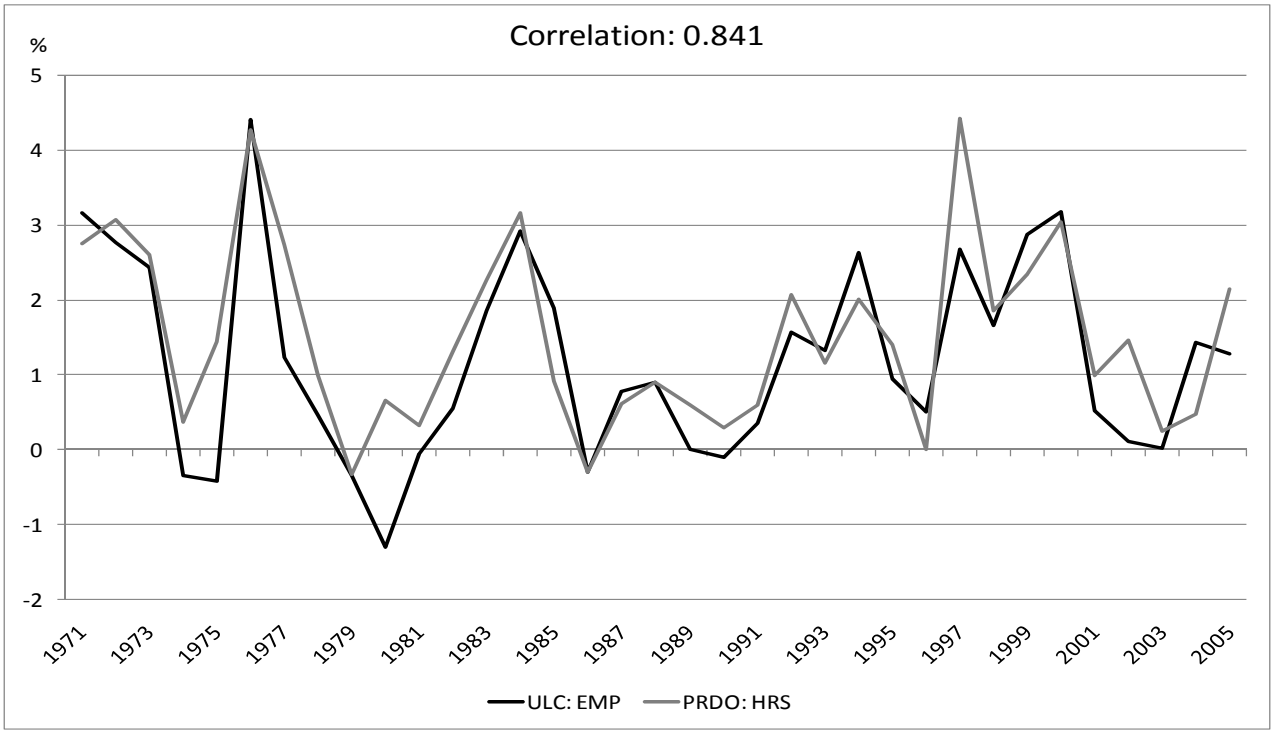
In the OECD System of Unit Labour Cost and Related Indicators, labour input data on both the total number of hours worked in employment and total employment in persons is available dating from 1970. Therefore, the total number of hours worked in employment is the sole labour input measure used in the calculation of the series on labour productivity per unit labour input, as this is the preferred method used to calculate labour productivity. The correlation of labour productivity for the total economy is observed to be stronger when the total number of hours worked in employment is the only labour input measure used.

Canada: ULC using HRS as the Labour Input Measure



Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Canada: ULC using EMP as the Labour Input Measure



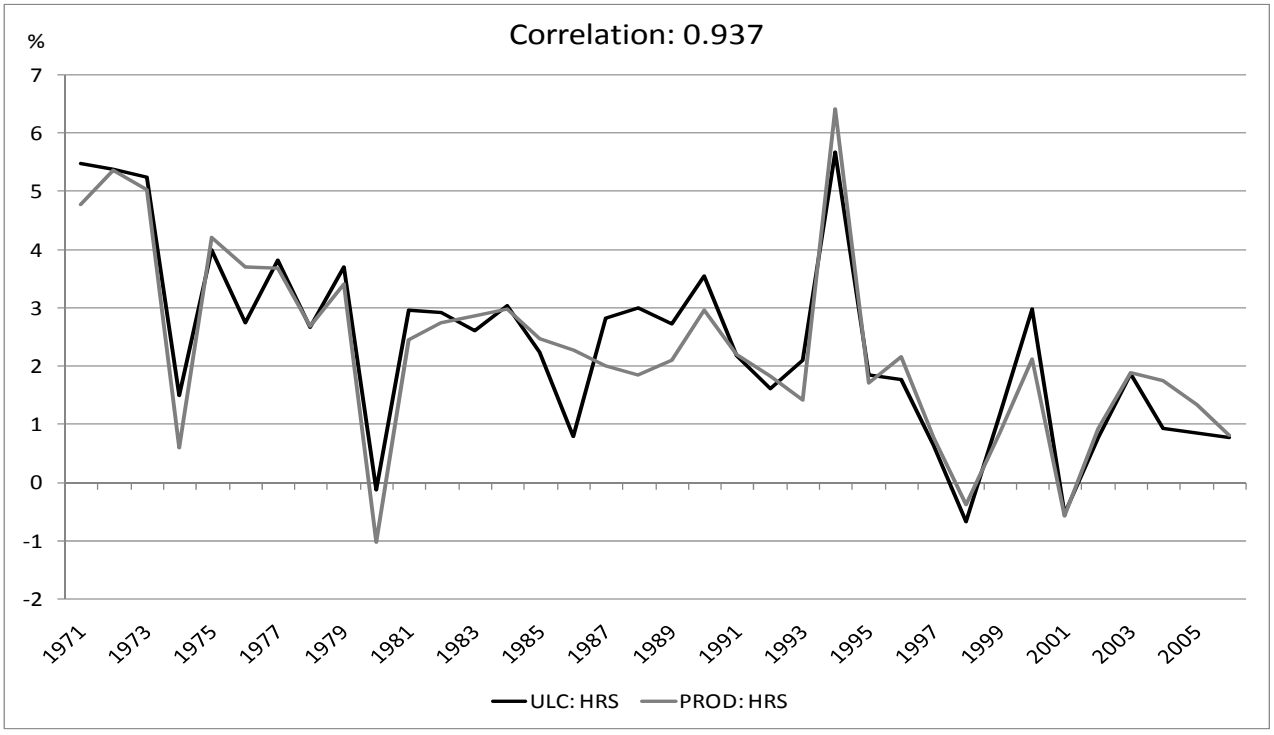
Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Denmark

For Denmark, when both the OECD System of Unit Labour Cost and Related Indicators and the OECD Productivity Database use the total number of hours worked in employment as the labour input measure, there is a correlation of labour productivity growth for the total economy of 0.937 (ULC data dating from 1970). When the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure (ULC data dating from 1970) the correlation decreases from 0.937 to 0.516.

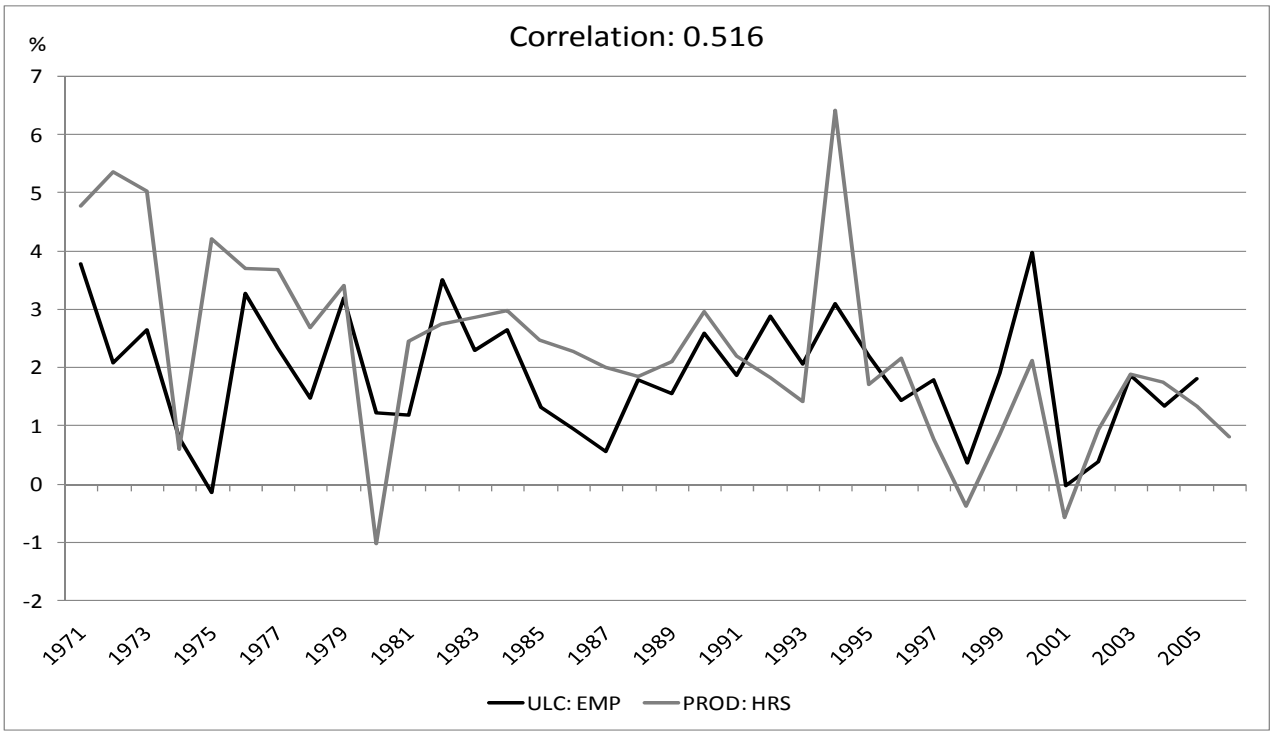
As is the case for Canada, the series on labour productivity per hour and the series on labour productivity per person employed are both available in the OECD System of Unit Labour Cost and Related Indicators dating from 1970. Therefore, the total number of hours worked in employment is the sole labour input measure used in the calculation of the series on labour productivity per unit labour input. It is observed that the correlation of labour productivity for the total economy is stronger when the total number of hours worked in employment is the only labour input measure used.

Denmark: ULC using HRS as the Labour Input Measure



Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Denmark: ULC using EMP as the Labour Input Measure



Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

C2. Four Central and Eastern European Countries, currently members of the European Union

In both OECD databases, labour productivity time series for the four Central and Eastern European Countries (Slovak Republic, Hungary, Czech Republic and Poland) are shorter than for other OECD member countries. This is explained by an unavailability of reliable source data for these countries before the fall of the Berlin Wall in 1989; national statistics bureaus only started publishing reliable data in the mid-1990s. The start year of labour productivity data for these four countries in both OECD databases ranges from 1993 to 2001. Because the labour productivity time series for these countries are shorter than for other OECD member countries, the correlations of labour productivity growth for the total economy are often lower than for other OECD member countries for which there are longer time series. This is especially true when different labour input measures are used.

Slovak Republic

For the Slovak Republic, when both the OECD System of Unit Labour Cost and Related Indicators and the OECD Productivity Database use the total number of hours worked in employment as the labour input measure, there is a correlation of labour productivity growth for the total economy of 0.893 (ULC series start year 1996; PROD series start year 1995). When the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure (ULC series start year 1995) the correlation decreases from 0.893 to 0.376.

This large decrease can partially be explained by the differences in labour productivity measures that result when different labour input measures are used by both OECD databases. In particular, for 2002 and 2003, the OECD Productivity Database calculates labour productivity growth for the total economy at 7.85% and 6.82%, respectively, when using the total number of hours worked in employment as the labour input measure. In contrast, the OECD System of Unit Labour Cost and Related Indicators calculates labour productivity growth for the total economy at 3.93% and 2.73%, respectively, for these same two years when using total employment in persons as the labour input measure. A strong correlation between output measures (GDP and gross value added) is observed for the entire period 1994 to 2006 (Annex 2).

The difference between the two labour input measures used could possibly be explained by a new labour code, adopted by the Slovak government in 2001 and entered into effect in April 2002. This increased the maximum working hours permitted by the first labour code (introduced in 1965 and repeatedly amended after 1990) to 40 hours per week and nine hours per day. Furthermore, at a referendum on Slovakia's European Union entry in 2003, parliament approved to revise the labour code to increase the maximum overtime work from eight hours to 20 hours per week and from 150 to 250 hours per year.[24]

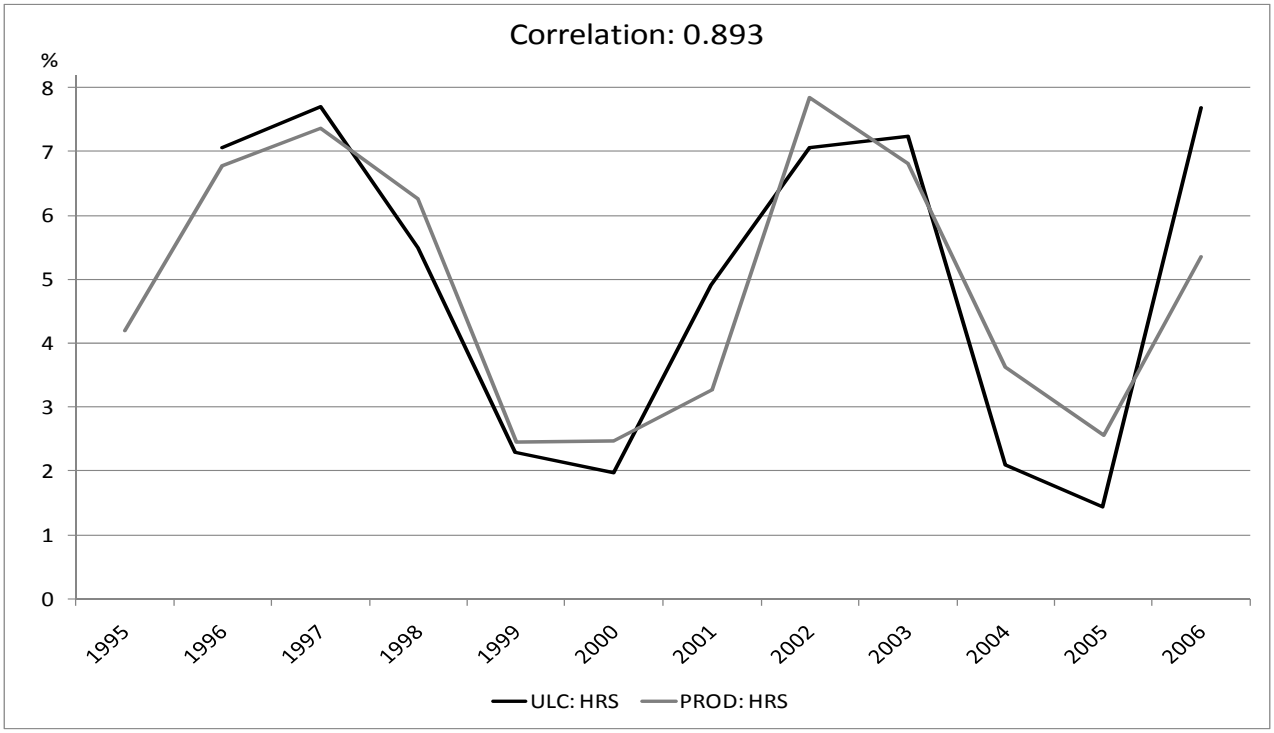
However, the increases in maximum working hours and overtime work permitted coincided with "job destruction associated with the transition to a market economy… [and specifically] the intensification of restructuring in the industrial and financial sectors in 1999 and 2000." [25] The failure of employment to adapt effectively to such rapid structural change could possibly explain the slow growth in total employment for these two years and thus the large difference observed between labour productivity measures in the two databases.

Removing the data points from 2002 and 2003 gives a correlation of labour productivity growth for the total economy of 0.645 when the OECD Productivity Database uses the total number of hours worked in employment as the labour input measure and the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons.

In the OECD System of Unit Labour Cost and Related Indicators, for the Slovak Republic, the start year for the series on labour productivity per hour is 1996 and the start year for the series on labour productivity per person employed is 1995. Because there is only a one year difference between the start year for these two series, they are not linked when calculating the series on labour productivity per unit labour input. Instead, the total number of hours worked in employment is the only labour input measure used. The correlation of labour productivity for the total economy is observed to be stronger when the total number of hours worked in employment is the only labour input measure used.

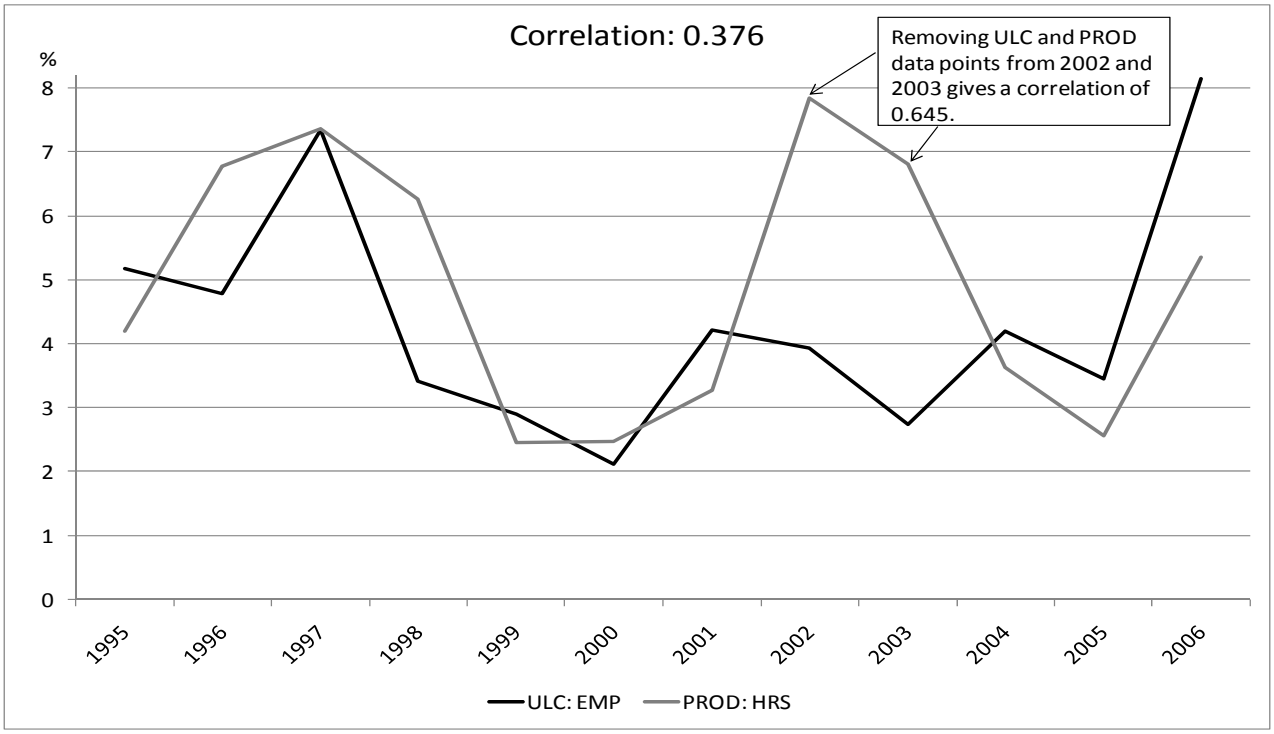
[24] OECD Publications. *OECD Economic Surveys: Slovak Republic*. Volume 2004/1. March 2004, page 160; Volume 2002/11. June 2002, page 103.
[25] OECD Publications. *OECD Economic Surveys: Slovak Republic*. Volume 2002/11. June 2002, pages 71, 73.

Slovak Republic: ULC using HRS as the labour input measure.



Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Slovak Republic: ULC using EMP as the labour input measure.



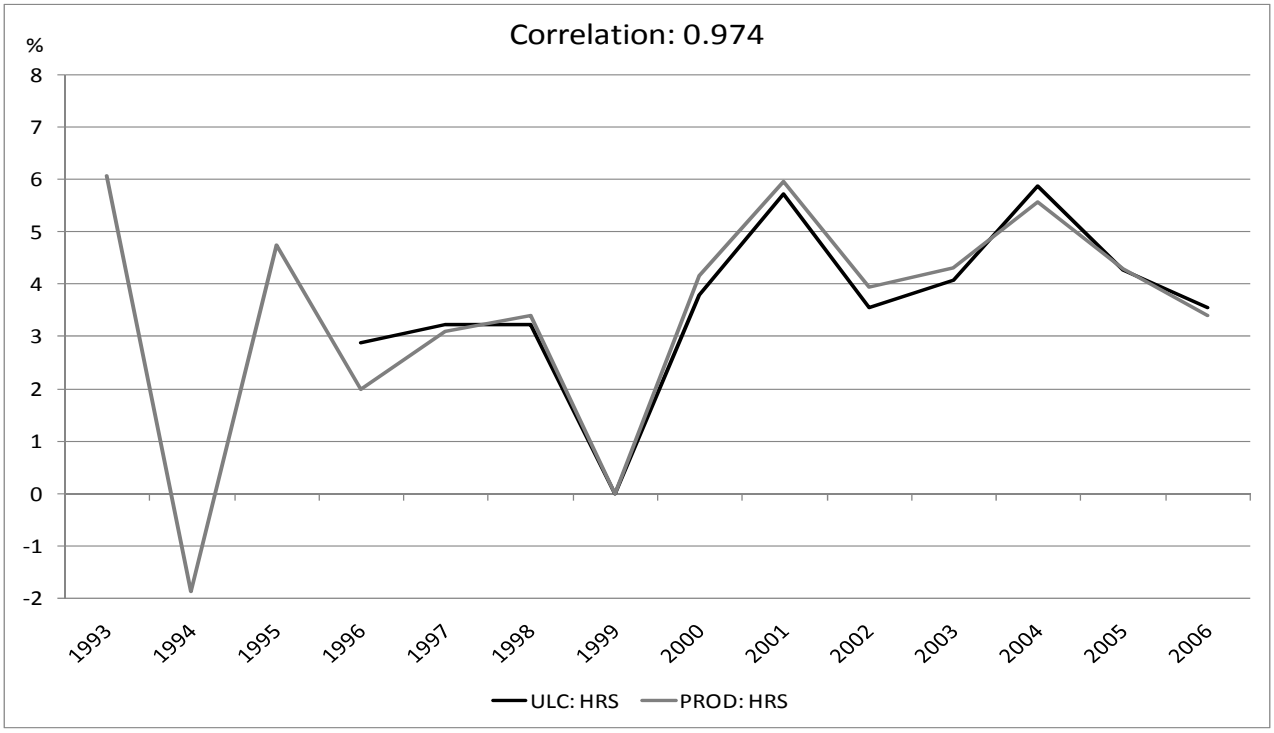
Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Hungary

For Hungary, when both the OECD System of Unit Labour Cost and Related Indicators and the OECD Productivity Database use the total number of hours worked in employment as the labour input measure, there is a correlation of labour productivity growth for the total economy of 0.974 (ULC series start year 1996; PROD series start year 1992). When the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure (ULC series start year 1993) the correlation decreases from 0.974 to 0.218. This large decrease could possibly be explained by a probable outlier in 1994, found in the series on labour productivity per hour in the OECD Productivity Database. Removing this data point gives a correlation of labour productivity for the total economy of 0.777 when the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure.

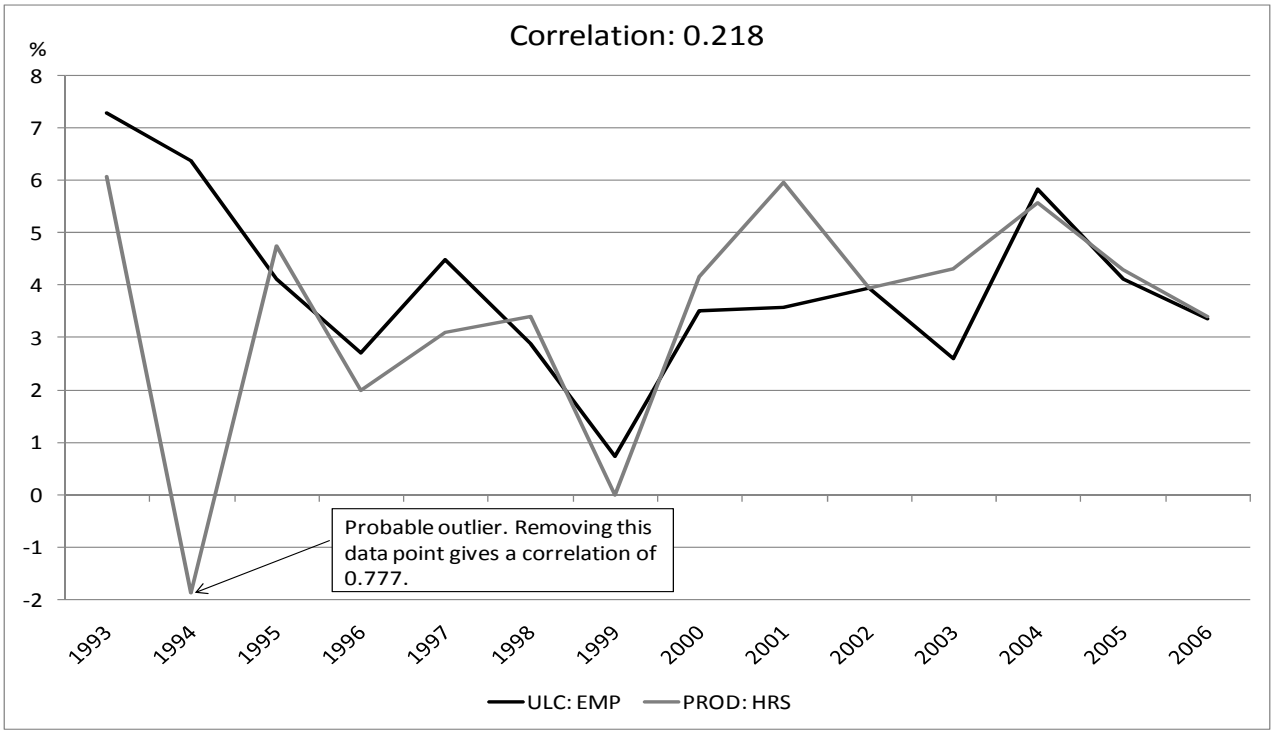
In the OECD System of Unit Labour Cost and Related Indicators, for Hungary, there is a three year difference between the start year for the series on labour productivity per hour (1993) and labour productivity per person employed (1996). Because the time gap in the start year for these two series is very small, linking is not undertaken when calculating the series on labour productivity per unit labour input. Instead, the total number of hours worked in employment is the only labour input measure used. The correlation of labour productivity for the total economy is observed to be stronger when the total number of hours worked in employment is the only labour input measure used. This holds even if the probable outlier in 1994 is excluded from the correlation of labour productivity growth for the total economy when the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure.

Hungary: ULC using HRS as the labour input measure.



Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Hungary: ULC using EMP as the labour input measure.

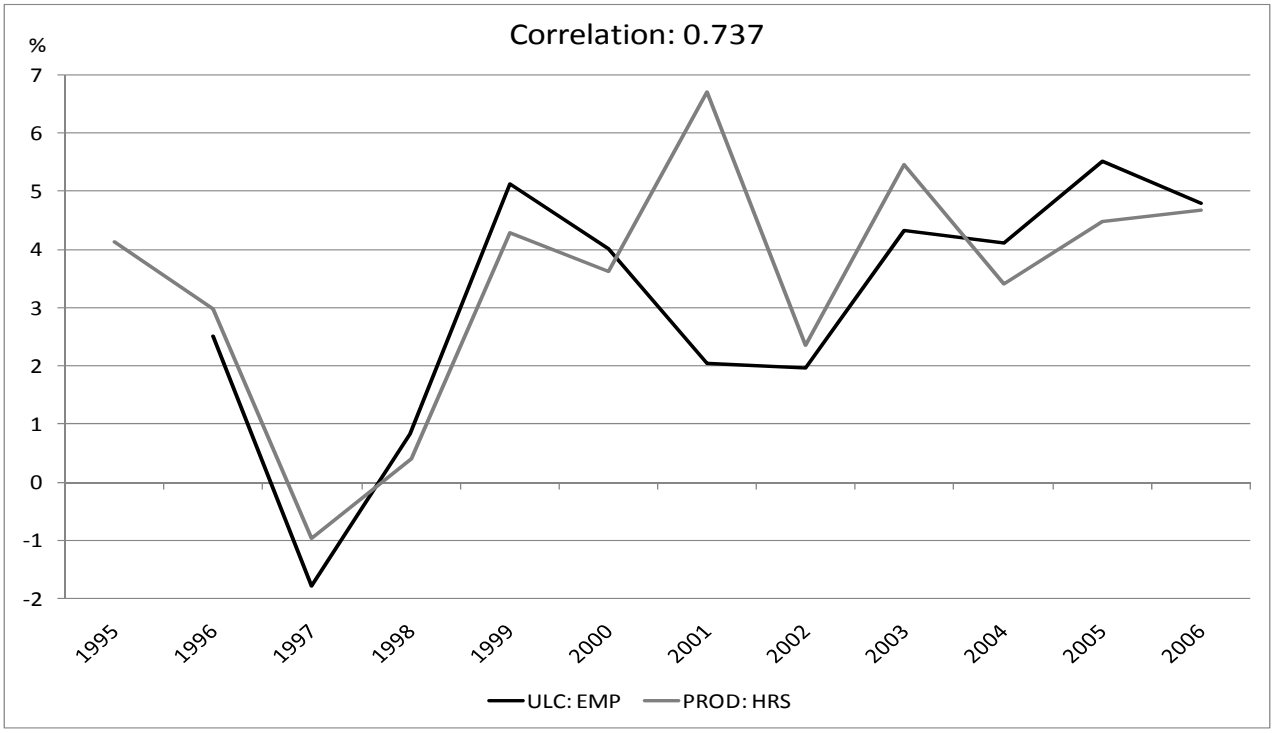


Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Czech Republic

For the Czech Republic, the OECD System of Unit Labour Cost and Related Indicators only publishes labour productivity series using total employment in persons as the labour input measure. When this labour input measure is used for the series on labour productivity per person employed, (ULC series start year 1996; PROD series start year 1994) the correlation of labour productivity growth for the total economy is 0.737. This correlation is observed to be fairly strong.

Czech Republic: ULC using EMP as the labour input measure.



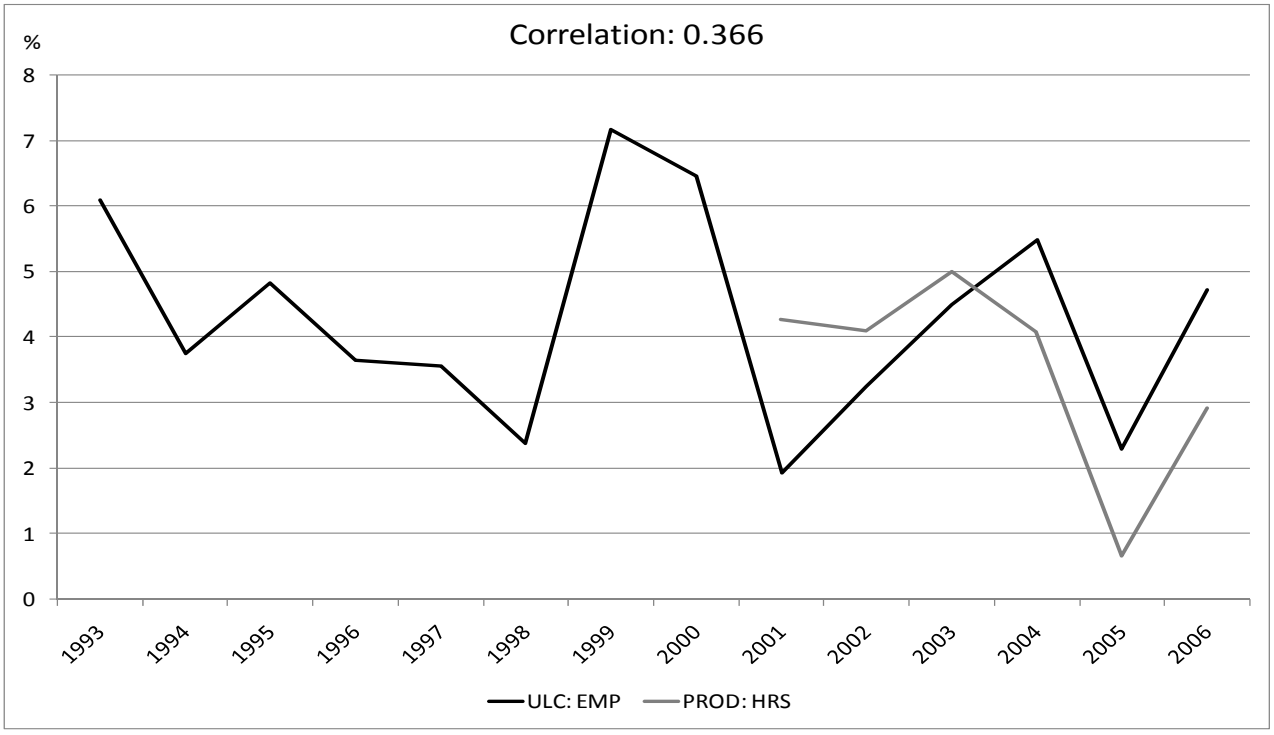
Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

Poland

For Poland, as is the case for the Czech Republic, the OECD System of Unit Labour Cost and Related Indicators only publishes labour productivity series using total employment in persons as the labour input measure. However, it is important to note that labour productivity time series for Poland are much shorter than those for the other Central and Eastern European Countries, in particular the labour productivity time series found in the OECD Productivity Database. In this database, the first year for which labour productivity data are available is 2000. In the OECD System of Unit Labour Cost and Related Indicators, the first year for which labour productivity data – calculated using total employment in persons as the labour input measure – are available is 1992.

When the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure, there is a correlation of labour productivity growth for the total economy of 0.366. This low correlation could possibly be explained by the short time series as the common period between the series found in the two databases is only six years.

Poland: ULC using EMP as the labour input measure.



Sources: OECD Productivity Database; OECD System of Unit Labour Cost and Related Indicators.

C3. Some Conclusions

As demonstrated, when both the OECD System of Unit Labour Cost and Related Indicators and the OECD Productivity Database use the same labour input measure in the calculation of labour productivity series, the total number of hours worked in employment, the correlations of labour productivity growth for the total economy are strong. However, when the OECD System of Unit Labour Cost and Related Indicators uses total employment in persons as the labour input measure, the correlations of labour productivity growth for the total economy decrease.

Besides certain exceptions, notably Germany, when the OECD System of Unit Labour Cost and Related Indicators links labour productivity series calculated using the total number of hours worked in employment as the labour input measure to those calculated using total employment in persons as the labour input measure (labour productivity per unit labour input), the correlations of labour productivity growth for the total economy decrease in relation to when both databases use the same labour input measure. In general, the correlations obtained when the OECD System of Unit Labour Cost and Related Indicators uses the series on labour productivity per unit labour input are stronger than those obtained when it uses the series on labour productivity per person employed.

For all OECD countries for which there are not short time series, fairly strong correlations of labour productivity growth for the total economy are observed, even when the two databases do not use the same labour input measure. Likewise, strong correlations of output measures (GDP and gross value added) are observed between the two databases.

A comparison can only be performed between the two databases for the economic activity – Total Economy – as this is the only activity covered in the OECD Productivity Database. If an economist or a statistician wanted to study labour productivity for an individual economic activity, they would have to use the OECD System of Unit Labour Cost and Related Indicators as this database publishes labour productivity data according to economic activity.

Therefore, the second part of this report will address labour productivity in *Industry* and *Market Services*[26] for four OECD Central and Eastern European Countries (CEECs) in comparison with the Euro area by using data from the OECD System of Unit Labour Cost and Related Indicators. This will serve as a demonstration of how this recent OECD database can be applied in practice. Because series on labour productivity per hour are not available for all four CEECs, notably for Poland and the Czech Republic, series for labour productivity per person employed will be used.

[26] Market services consist of ISIC activities G to K.

II. ANALYSIS OF LABOUR PRODUCTIVITY IN INDUSTRY AND SERVICES: AN ILLUSTRATION OF THE OECD SYSTEM OF UNIT LABOUR COST AND RELATED INDICATORS

A. RECENT HISTORICAL BACKGROUND: FOCUS ON INDUSTRY AND SERVICES SECTORS

A1. Slovak Republic

Since 1989, the Slovak Republic has experienced two revolutions: the velvet revolution in 1989 that marked the end of the communist regime and a market-oriented revolution in 1998, beginning when the Dzurinda-led government came to power. These two revolutions, in addition to several economic reforms, have helped the Slovak Republic transition from a centrally planned to a market-oriented economy. Indeed, international trade between the Slovak Republic and Western countries has largely increased since 1998.

Before independence in 1993, most of the Slovak Republic's industrial production was concentrated in large enterprises focusing on "heavy industry", principally arms, steel, chemical products and electricity. However, the separation of the Czech and Slovak Republics allowed the Slovak Republic to expand its industrial production base and vary the products which it produced. In particular, both industrial production and exports largely increased in the early 1900s when multinational organizations both invested in and opened representative offices in the Slovak Republic, the most important being Volkswagen. Since 1991, Volkswagen has invested €1,300 million in the Slovak Republic. Also, in 2002 it transferred some of its production from France and Spain to the Slovak capital city, Bratislava. In addition to expansion in industry, the services sector largely expanded after the approval of the new labour code in 2002 (previously discussed). Whereas in 1990 the services sector employed approximately 35% of the active labour force, it employed 57% in 2006.[27]

In more recent years, economic reforms have helped engender rapid productivity growth (close to 5% per person employed in 2005-2006) and strengthen growth prospects. Particularly, following 2004 presidential elections, the new government introduced reforms aimed at raising employment rates, improving education outcomes and removing barriers to product market competition. Additionally, the new government also "reiterated its commitment to Slovakia's entry into the euro area in January 2009."[28]

A2. Hungary

Although Hungary actively engaged in international trade before its transition towards a market-oriented economy, the end of the communist period – early 1990s – was characterized by the adoption of several measures aimed at instituting a market economy and further opening the Hungarian economy to world trade. Specifically, in early 1991 the government introduced a four-year economic program, focusing on three elements: the acceleration of privatization, controlling inflation and preparations for the convertibility of the national currency. The transition period affected production in Hungary differently than it did for other CEECs: production in industry – the most important sector before the transition – decreased as production in services increased. By the early 2000s, growth in services – driven by productivity increases in telecommunications, banking and tourism – overtook growth in industry. Indeed, increases in industrial

[27] Ryder, Andrew . Economy (Slovakia), in Europa World online. London, Routledge. Smith College. Retrieved 21 May 2008 from http://www.europaworld.com/entry/sk.ec.
[28] OECD Publications. *OECD Economic Surveys: Slovak Republic*. Volume 2007/7. April 2007, page 8.

production for the period 2001 to 2006 were inferior to growth in the services sector during the same period, especially in transport, communications and hotels and catering.[29]

Recently, Hungary has been promoting foreign direct investment (although this was somewhat the case before transition) to increase its industrial exports and maintain equilibrium between the industrial and service sectors. According to the 2007 OECD Economic Survey on Hungary, "export-based manufacturing, linked to foreign direct investment, continues to be the key motor of growth, though service industries for both domestic and foreign markets are also expanding." [30] Foreign direct investment from companies such as General Motors, General Electric, Suzuki and Ericsson has brought both new technology and knowledge to the country, helping Hungary generate increases in industrial production and exports.[31]

A3. Czech Republic

After the end of the communist period, the Czech Republic rapidly started the transition process. Privatization and price liberalization quickly increased the Czech Republic's international competitiveness. In addition to a rapid expansion of new small businesses and a reorientation of export trade from East to West (developed market economies accounted for 57% of exports in 1993 and rose to 90% in 2005), its location in Central Europe attracted investment from several multinational companies. Increased foreign direct investment contributed to industrial production growth. Principally, the sale of Škoda Auto in 1991 to Volkswagen stimulated increases in both automobile production and exports (from 180,000 in 1989 to more than 220,000 in 2006). Volkswagen also encouraged inward investments to the components industry, stimulating economic modernization and further industrial exports (an additional 6% of total exports in 2001).[32] According to the 2008 OECD Economic Survey on the Czech Republic, foreign direct investment and manufactured exports (of which the largest single sector is vehicle manufacture), play a central role in the economy.[33] Indeed, manufactured export growth is the principal contributor to real GDP growth (over 6% between 2005 and 2007). Between 2005 and 2006 manufactured exports increased by 14.7%. Such increases were driven by augments in industrial output of 9.7% and in transport equipment of 20.6%.[34]

As is the case in industry, the Czech Republic's services sector has also largely expanded since the beginning of the transition process. The fast growth experienced in two branches of the services sector: public administration, defence and compulsory social security; and commerce and repairs and hotels and catering reflects both "a 'catching up' process, as [these branches] were grossly underdeveloped under central planning…and new demand from higher domestic spending and increased tourism."[35]

A4. Poland

The transition of the Polish economy – the final stage represented by Poland's entry to the European Union in 2004 – re-established market institutions and encouraged participation in international trade. Under the communist system, international trade was not a priority: the European Bank for Reconstruction and Development estimate that total market-based trade in 1989 was approximately 15% of GDP. However, economic reforms initiated in 1990, specifically privatization, price liberalization and foreign direct

[29] Berry, Richard Ross. Economy (Hungary), in Europa World online. London, Routledge. Smith College. Retrieved 21 May 2008 from http://www.europaworld.com/entry/hu.ec.
[30] OECD Publications. *OECD Economic Studies: Hungary*. Volume 2007/10. Mai 2007, page 22.
[31] Berry, Richard Ross. May 2008.
[32] Myant, Martin. Economy (The Czech Republic), in Europa World online. London, Routledge. Smith College. Retrieved 21 May 2008 from http://www.europaworld.com/entry/cz.ec.
[33] OECD Publications. *OECD Economic Surveys: Czech Republic*. Volume 2008/8. April 2008, page 15, 17.
[34] Myant, Martin, May 2008.
[35] Myant, Martin, May 2008.

investment encouragement, engendered international trade. Indeed, the 2006 total volume of trade was equal to 80% of GDP. The immediate effect of the 1990 economic reforms was an increase in both service activities and light industries (e.g. textiles and leather). However, foreign direct investment by companies such as Daewoo, Ford and General Motors later in the transition process provided new technologies which allowed for the expansion of engineering-based industries. Transfers of technology were accompanied by increases in labour productivity in export sectors. Today, "Polish workers in exporting sectors are increasing their productivity faster than workers in many basic service sectors."[36]

A5. Euro area

The Euro area encompasses fifteen economies, all different from one another. Some are among the wealthiest in the world or are rapidly expanding, others are behind in terms of living standards or are experiencing economic slowdown. The creation of the Economic Monetary Union (EMU) during the 1990s (and the single currency) had two principal objectives: to ensure price stability and to encourage economic integration.[37] Although all Euro area member countries have achieved price stabilization, the progress towards economic integration is more ambiguous. Business cycles have become more synchronized and price levels are converging, however, there are still observed differences in inflation differentials within Euro area countries.[38]

It is important to compare the Euro area with the CEECs – as economies in the catch-up process – for two main reasons linked to inflation, real exchange rates and labour productivity. First, it is noted that inflation in the CEECs is often higher than in the rest of the Euro area. This, however, is not problematic because the inflation differentials in the CEECs are driven by a catch-up process, backed by productivity improvements in the traded goods sector.[39] Secondly, "catching-up economies are expected to have a steady appreciation of their real exchange rate [compared to the Euro area] as productivity and price levels converge to those of their more mature trading partners. This increase in the relative price level is usually attributed to differences in relative productivity growth between tradables and non-tradables."[40]

B. Analysis of the Balassa-Samuelson Effect

B1. Traded goods and non-traded goods sectors

Two articles written independently by Bela Balassa (1964) and Paul A. Samuelson (1964) introduced the theory that relative prices and the appreciation of real exchange rates can be explained by higher productivity growth in sectors exposed to international competition than productivity growth in sectors sheltered from this competition.[41] The findings exposed in these two articles have become known as the Balassa-Samuelson effect.

The traded goods sector, exposed to international competition, is comprised primarily of industrial and agricultural goods. The non-traded goods sector, sheltered from international competition, refers primarily to services within a domestic economy (goods that are unprofitable when traded on international markets because of high transportation costs).

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[36] Jensen, Camilla. Economy (Poland), in Europa World online. London, Routledge. Smith College. Retrieved 21 May 2008 from http://www.europaworld.com/entry/pl.ec.
[37] OECD Publications: *OECD Economic Surveys: Euro Area.* Volume 2006/16, January 2007, pages 10, 17.
[38] OECD Publications: *OECD Economic Surveys: Euro Area.* Volume 2006/16, January 2007, page 10.
[39] OECD Publications: *OECD Economic Surveys: Euro Area.* Volume 2006/16, January 2007, page 10.
[40] OECD Publications: *OECD Economic Surveys: Euro Area.* Volume 2006/16, January 2007, page 47.
[41] Analyses Économiques, *Existe-il un effet Balassa dans les pays candidats à l'Union européenne ?* N°33, mars 2004.

B2. Theoretical Background

The Balassa-Samuelson effect is based on the observation that historically, productivity growth in the traded goods sector tends to rise faster than in the non-traded goods sector. The implications of this observation are used to propose a theory explaining changes in the relative price of non-tradable to tradable goods.

The Balassa-Samuelson (BS) model is a traditional Ricardian trade model, amended to include non-traded goods. Given the law of one price, the price of tradable goods – exposed to international competition – tends to equalize across countries whereas the price of non-tradable goods – sheltered from this competition – does not. Faster productivity growth in the traded goods sector stimulates wage increases in this sector which, given wage equalization, entail higher wages in the entire economy. The producers of non-tradable goods will be able to pay the higher wages only by increasing relative prices in this sector. However, because gains to productivity in the non-traded goods sector are lower than in the traded goods sector, this increases the relative price of non-traded goods. [42]

To express the BS model, we define the two goods (tradables (*T*) and non-tradables (*NT*)) and the two production factors (labour (*L*) and capital (*K*)). The price of tradable goods conforms to the law of one price – under perfect competition – with marginal costs. *L* has perfect domestic mobility and *K* has perfect domestic and international mobility. Therefore, a small open economy takes the world interest rate (*r*) as given. Wage rates (*W*) in both sectors are determined by respective marginal costs in addition to the world price of tradable goods. Economies with higher productivity levels in the traded goods sector will therefore have higher wages and thus higher prices of non-tradable goods.

The BS model makes three assumptions: (1) perfect domestic and international competition; (2) perfect domestic mobility of production factors *L* and *K*; and (3) perfect international capital mobility.

The BS model is defined by the following equations:

The traded and non-traded goods sectors for a small open economy are characterized by Cobb-Douglas production functions:

In the traded goods sector: $Y^T = A^T (L^T)^\gamma \ (K^T)^{1-\gamma}$ (1)

In the non-traded goods sector: $Y^{NT} = A^{NT} (L^{NT})^\delta \ (K^{NT})^{1-\delta}$ (2)

where *Y* represents the output of traded and non-traded goods and *A* represents productivity. Given the model's assumptions of perfect capital mobility and perfect competition, profit maximization applies. Therefore, in the traded goods sector:

$$\frac{\partial Y^T}{\partial K^T} = \ R^T \ = \ (1-\gamma) A^T (L^T)^\gamma \ (K^T)^{-\gamma}$$

$$R^T = (1-\gamma) A^T \left(\frac{K^T}{L^T}\right)^{-\gamma} \quad (3)$$

[42] Analyses Économiques, *Existe-il un effet Balassa dans les pays candidats à l'Union européenne ?* N°33, mars 2004; OECD Publications, *Trade and Competitiveness in Argentina, Brazil and Chile: not as easy as A-B-C*. 2004, page 41; Klau, Marc and Mihaljek, Dubravko, *The Balassa-Samuelson Effect in Central Europe: a disaggregated analysis*. Bank for International Settlements. April 2004, pages 2-3.

$$\frac{\partial Y^T}{\partial L^T} = W^T = \gamma A^T (L^T)^{\gamma-1} (K^T)^{1-\gamma}$$

$$W^T = \gamma A^T \left(\frac{K^T}{L^T}\right)^{1-\gamma} \quad (4)$$

In the non-traded goods sector:

$$\frac{\partial Y^{NT}}{\partial K^{NT}} = R^{NT} = (1-\delta) A^{NT} (L^{NT})^{\delta} (K^{NT})^{-\delta}$$

$$R^{NT} = \frac{P^{NT}}{P^T} (1-\delta) A^{NT} \left(\frac{K^{NT}}{L^{NT}}\right)^{-\delta} \quad (5)$$

$$\frac{\partial Y^{NT}}{\partial L^{NT}} = W^{NT} = \delta A^{NT} (L^{NT})^{\delta-1} (K^{NT})^{1-\delta}$$

$$W^{NT} = \frac{P^{NT}}{P^T} \delta A^{NT} \left(\frac{K^{NT}}{L^{NT}}\right)^{1-\delta} \quad (6)$$

where R is the rental rate on capital (determined in world markets), W is the wage rate (measured in tradables) and $\left(\frac{P^{NT}}{P^T}\right)$ is the relative price of non-tradables to tradables. Given wage equalization, W^T is assumed to be equal to W^{NT}.

Given Cobb-Douglas constant returns to scale production functions, equation (3) implies a unique level of $\left(\frac{K^T}{L^T}\right)$, consistent with the world rate return on capital. Therefore, given $\left(\frac{K^T}{L^T}\right)$, equation (4) determines the economy-wide wage rate (W). Equations (5) and (6) determine therefore $\left(\frac{K^{NT}}{L^{NT}}\right)$ and $\left(\frac{P^{NT}}{P^T}\right)$.

Log-differentiating equations (1) – (6) gives the Balassa Samuelson equation:

$$\Delta \frac{P^{NT}}{P^T} = \Delta p^{NT} - \Delta p^T = \left(\frac{\delta}{\gamma}\right) \Delta a^T - \Delta a^{NT} \quad (7)$$

Where lower-case letters denote logarithms and Δa^T and Δa^{NT} are productivity growth rates in both the traded and non-traded goods sectors (Annex 2).

It is important to note that if all three assumptions of the model are met, the relative price of tradables to non-tradables $\left(\frac{P^{NT}}{P^T}\right)$ will be determined by the supply side. If labour intensity in the non-traded goods sector is greater than in the traded goods sector ($\delta > \gamma$), then even balanced productivity growth ($\Delta a^T = \Delta a^{NT}$) will lead to an appreciation of the relative price of non-tradable goods. The change in relative prices will be equal to the productivity growth differential only if labour intensities are the same between the tradable and non-tradable goods sectors ($\delta = \gamma$).[43]

[43] OECD Publications, *Trade and Competitiveness in Argentina, Brazil and Chile: not as easy as A-B-C*. 2004, page 26; Klau, Marc and Mihaljek, Dubravko, *The Balassa-Samuelson Effect in Central Europe: a disaggregated analysis*. Bank for International Settlements. April 2004, page 2-3.

C. Empirical Application: The Balassa-Samuelson Effect in Four Central and Eastern European Countries Compared to the Euro area

C1. The methodology used to test the Balassa-Samuelson effect

According to the Balassa-Samuelson effect, the relative price of non-tradable goods is driven by the productivity growth differential between the traded goods and non-traded goods sectors. Productivity gains in the traded goods sector typically exceed those in the non-traded goods sector. This induces wage increases in the traded goods sector, which equalize across the entire economy. Because productivity gains are lower in the non-traded goods sector, the relative price of non-traded goods increases faster than for traded goods. This creates an increase in the price level of the entire economy.

To verify that productivity growth in the traded goods sector is more rapid than in the non-traded goods sector, ratios between labour productivity of tradables to non-tradables are calculated. To represent the traded goods sector, data from the annual series of labour productivity per person employed for industry are used. According to the International Standard Industry Classification (ISIC Rev. 3), industry includes: mining and quarrying (C); manufacturing (D); and electricity, gas and water supply (E). To represent the non-traded goods sector, data from the annual series of labour productivity per person employed for market services are used. According to the ISIC Rev. 3, market services include: wholesale and retail trade; repair of motor vehicles, motorcycles and personal household goods (G); hotels and restaurants (H); transport, storage and communications (I); financial intermediation (J); and real estate, renting and business activities (K).

Although the ratio between labour productivity in the traded and non-traded goods sectors is used to show that labour productivity increases faster in the traded-goods sector than in the non-traded goods sector, certain weakness with this measure should be noted. Specifically, the data used to measure the traded goods sector are highly aggregated and include industries whose output is traded only to a small extent (e.g. electricity, gas and water supply). Additionally, certain challenges with the calculation of service sector data make it difficult to measure the volume of service activities (Box 2.1).

BOX 2.1. CHALLENGES MEASURING LABOUR PRODUCTIVITY IN THE SERVICE SECTOR

In addition to other changes in labour input already mentioned, growth in labour productivity can arise from more intensive uses of capital, which may be more evident within at least some aspects of industry (e.g. mining and quarrying and equipment manufacturing) than in some service industries which are more labour intensive (e.g. legal services). Measuring productivity in service industries is particularly difficult because of the problem of measuring the volume (i.e. output) of service activities. Consequently, the quality of measuring the outputs of services can differ across countries, thus affecting the quality of labour productivity measures and ultimately unit labour costs. One concern is where countries continue to use labour input measures (e.g. total number of hours worked or total employment) as a proxy for output in some service activities which implies zero labour productivity growth (although an aggregate level adjustment for 'estimated' labour productivity growth may be made). It is therefore possible that productivity growth in services for those countries measuring services output in this way may be understated in the long-term.

Furthermore, it is more challenging to measure the volume of output (used in the numerator of productivity measures) for many services (in particular business services) than for industry activities. This is because measuring output in volume is usually done by measuring the total value of production over a period (e.g. month, quarter, year), divided by the change in price. The value of service production is generally easy to measure because it usually equates to the total value of sales as there are no inventories or stocks of services (e.g. compared to goods). However, the change in price is often difficult to measure. This is because in order to measure the price change of a service between two periods, the compiler needs to clearly define the service and make sure that it does not change in any way between the two periods. As many services (particularly business services) are one off or depend on the client, or are constantly changing in the market place, achieving the consistency in service output to measure price change from period to period is very difficult, and very expensive for statistics offices as sophisticated methods are required and much information from businesses needs to be collected.

Consequently, shortcuts are often taken and certain assumptions are often made that may not be entirely valid, such as assuming that the total change in the volume of service output would be equivalent to the change in the volume of inputs (e.g. total number of hours worked or total employment which are easier to measure), as mentioned above.

The OECD in collaboration with Eurostat compiled a manual to help countries measure price change in service industries (http://www.oecd.org/dataoecd/44/40/36274111.pdf). The OECD has also compiled a manual on measuring output in service industries (http://www.oecd.org/dataoecd/9/55/37799074.pdf).

To test the theory that the relative price of non-tradables rises faster than that of tradables, ratios between prices of non-traded and traded goods are calculated. The consumer price index (CPI) for services less housing is used to represent prices in the non-traded goods sector and the Producer Price Index (PPI) for industry is used to represent prices in the traded goods sector (Annex 4). Under certain hypotheses (Annex 2), the relative price ratio $\left(\frac{P^{NT}}{P^{T}}\right)$ and the real exchange rate $\left(E \cdot \frac{P}{P^{*}}\right)$ trend together.

Indeed, Table 2.1 shows that for certain CEECs, there is a strong correlation between relative prices estimated using the CPI/PPI ratio and the real effective exchange rate whereas for other CEECs and the Euro area this is not the case. Specifically, there is a strong correlation between relative prices and the real effective exchange rate for the Slovak Republic, the Czech Republic and Hungary. This correlation is weaker for Poland and the Euro area (a negative correlation is observed for the Euro area).

The correlations between these two relative price measures are calculated using the ratio of relative prices between the non-traded and traded goods sectors and the series on the real effective exchange rate. The series on the real effective exchange rate, published by the OECD Economics Department, is CPI based and calculated for 42 countries.

Table 2.1. Correlations: CPI/PPI and real effective exchange rate

Country	Common Period	Correlations: CPI/PPI and real effective exchange rate
Slovak Republic	1995-2007	0.925
Hungary	1995-2007	0.986
Czech Republic	1995-2007	0.958
Poland	1996-2007	0.617
Euro area	1995-2007	-0.121

Source: OECD, Main Economic Indicators.

When there is a weak correlation for the ratio of relative prices between the non-traded and traded goods sectors and the series on the real effective exchange rate, it is more difficult to analyse the Balassa-Samuelson effect. Therefore, the series on the real effective exchange rate is included in the following graphs to serve as a benchmark for relative prices.

C2. Application of the OECD System of Unit Labour Cost and Related Indicators

For each CEEC and the Euro area, there are two graphs to represent the Balassa-Samuelson effect. The first graph has two scales: the left scale represents the ratio of labour productivity between the traded and non-traded goods sectors and the relative price ratio between the non-traded and traded goods sectors. The right scale represents the real effective exchange rate, in index form, OECD base year 2000 = 100. For the second graph, both the relative productivity ratio and the relative price ratio are represented as indices, base year 1996 = 100. The series of the real effective exchange rate is also rebased, 1996 = 100. In order to make a more accurate comparison between productivity differentials and the real effective exchange rate for each CEEC and the Euro area, a double productivity ratio is also computed. For the Slovak Republic, Hungary, the Czech Republic and Poland, the double productivity ratio is calculated as the domestic productivity differential (ratio of labour productivity between the traded and non-traded goods sectors) compared to that of the Euro area. For the Euro area, the double productivity ratio is computed as the Euro area's productivity differential compared to that of the United States (the Euro area's main trade partner). By representing the data in these two different ways, the following graphs allow us to better analyse the Balassa-Samuelson effect both domestically and internationally.

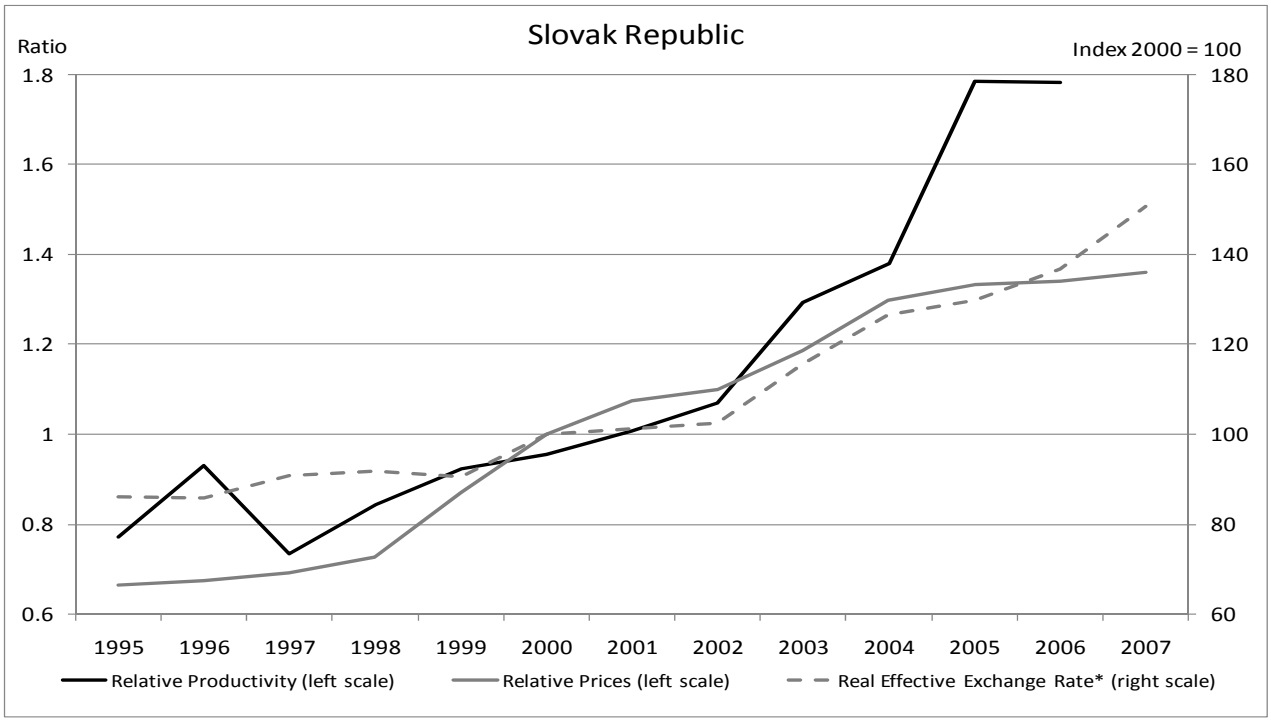
Slovak Republic

As is shown in graph (1) for the Slovak Republic, labour productivity in industry has increased more rapidly than in market services during the period 1995 to 2006. Additionally, the trend in the ratio between relative prices of non-traded and traded goods follows the trend in labour productivity for the same years. However, despite these general tendencies, the Balassa-Samuelson effect is only partially fulfilled. Specifically, since 2002, the ratio between labour productivity in the traded and non-traded goods sectors has increased faster than the ratio between relative prices in the non-traded and traded goods sectors. The strong correlation (0.925) between the relative price ratio and the series on the real effective exchange rate supports the hypothesis that these two relative price indicators trend together.

Graph (2) also shows that the relative productivity ratio and the relative price ratio increased since 1995. However, unlike graph (1), it is observed that the relative price of non-traded to traded goods tends to increase faster than the relative productivity ratio during the period 1995 to 2006. Graph (2) also shows that since 2002, the relative productivity ratio (represented as an index) has been converging toward the relative price ratio. When represented as an index, a gap is observed between the relative price ratio and the series on the real effective exchange rate. This observation challenges the hypothesis that the relative price ratio and the real effective exchange rate have the same tendencies. Judging by the relative price ratio (as an index), relative prices have been rising faster than relative productivity since 1995. Also, judging by the series on the real effective exchange rate, relative productivity has been rising faster than relative prices since 2004. It is likely that the real indicator of relative prices lies between the two indicators used.

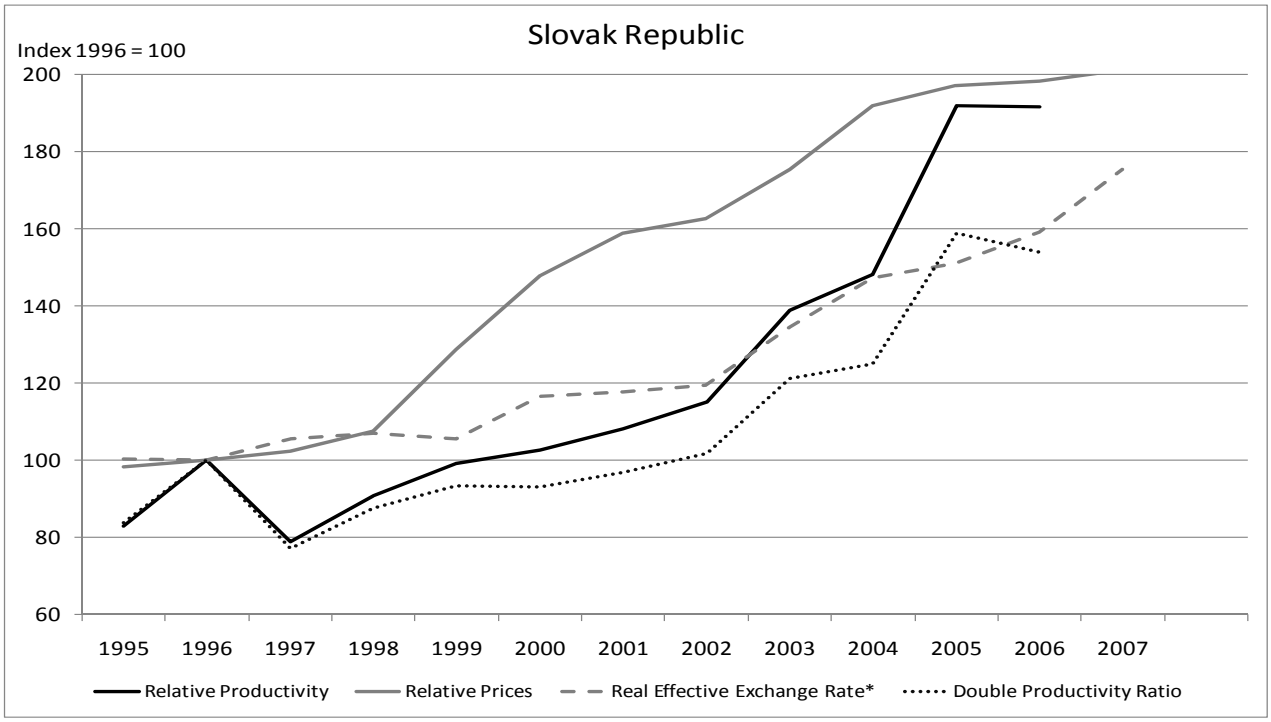
The double productivity ratio represented in graph (2) indicates that the productivity differential in the Slovak Republic has increased more rapidly than that of the Euro area since 1995. Unlike the relative productivity ratio for the Slovak Republic, the double productivity ratio remains below the series on the real effective exchange rate during the period 1995 to 2004, and after 2005. This observation has to be taken into account when assessing the potential for appreciation of the real effective exchange rate in the Slovak economy.

Graph 1.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

Graph 2.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

Hungary

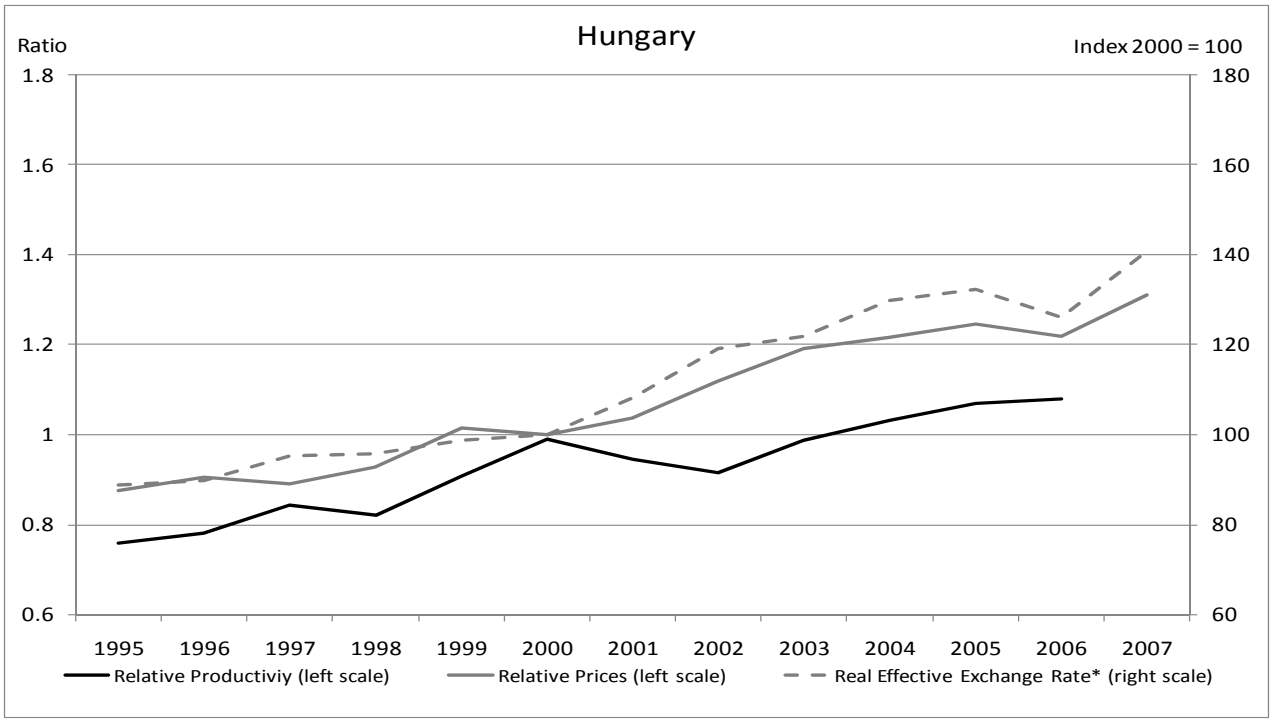
As is shown in graph (1) for Hungary, labour productivity in industry has increased more rapidly than in market services during the period 1995 to 2006. Additionally, the ratio between relative prices in market services and industry is observed to have risen between 1995 and 2007. The widening gap between the relative price indicators (the relative price ratio and the real effective exchange rate) and the relative productivity ratio indicates an appreciation of relative prices compared to relative productivity. Furthermore, the strong correlation (0.986) between the relative price ratio and the series on the real effective exchange rate reinforces the hypothesis that the relative price ratio and the real effective exchange rate trend together.

For Hungary, unlike for the Slovak Republic, the ratio of labour productivity between the traded and non-traded goods sectors does not follow the trend of either the relative price ratio or the series on the real effective exchange rate. It is unknown if this tendency continues in 2007 and 2008 because the time series of labour productivity per person employed in both industry and market services in the OECD System of Unit Labour Cost and Related Indicators is not available after 2006.

The faster growth of relative prices (measured by the real effective exchange rate and the relative price ratio) than relative labour productivity could be a source of economic concern if Hungary were to join the Euro area. Indeed, the Hungarian government abandoned their goal of joining the Euro area in 2008 and again in 2010.

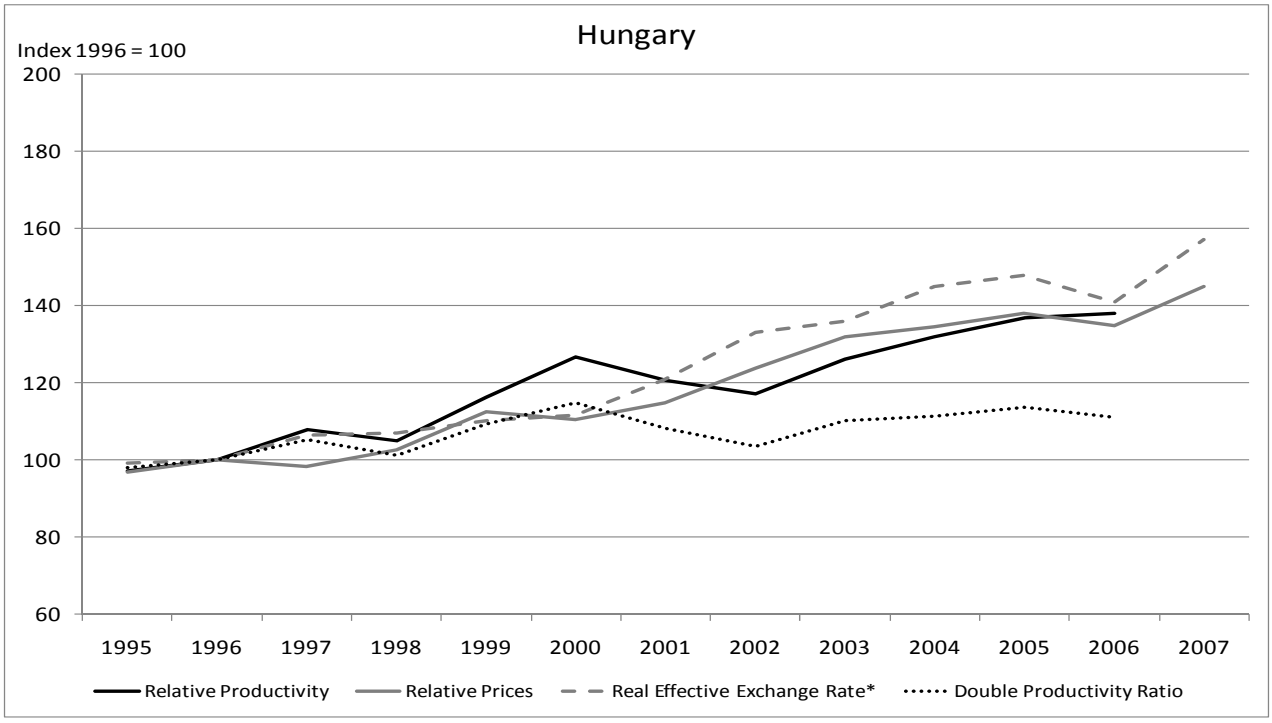
Graph (2) also shows that both the relative price ratio and the series on the real effective exchange rate increase more rapidly than the relative productivity ratio (all three time series represented as indices). Furthermore, the double productivity ratio shows that the domestic labour productivity differential has been increasing only slightly faster than for the Euro area since 1995, as it remains fairly close to its 1996 index. The seemingly widening gap between the double productivity ratio and the series on the real effective exchange rate reinforces the previous observation that the faster growth of relative prices than relative productivity could be a potential source of concern in the Hungarian economy.

Graph 1.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

Graph 2.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

Czech Republic

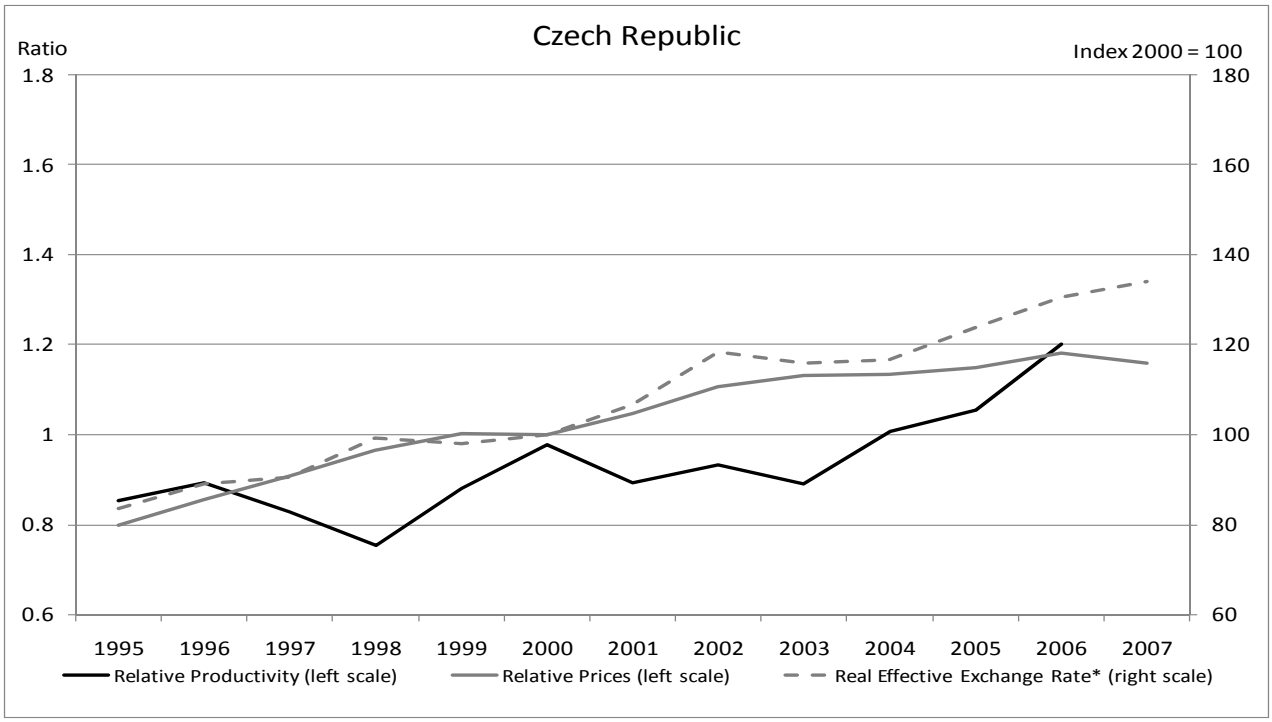
As is shown in graph (1) for the Czech Republic, labour productivity in industry is observed to have increased more rapidly than labour productivity in market services during the period 1995 to 2006. Additionally, relative prices in market services are observed to have increased more rapidly than in industry during the period 1995 to 2007. However, even though the ratio between relative prices in market services and industry has a tendency to increase faster than the ratio between labour productivity in industry and market services during the period 1996 to 2006, the relative productivity ratio has been rapidly approaching the relative price ratio since 2003.

Looking more closely at the two relative price indicators, we observe that in 2004 the series on the real effective exchange rate increases whereas the relative price ratio decreases. This observation challenges the hypothesis that the relative price ratio and the real effective exchange rate are closely correlated. It is likely that the true relative price indicator lies between these two indicators.

As is the case for the first graph, graph (2) shows an upward trend in the relative productivity ratio between labour productivity in industry and market services during the period 1995 to 2006. Similarly, the ratio between relative prices in market services and industry is observed to increase more quickly than the relative productivity ratio (both represented as indices). This trend holds for the series on the real effective exchange rate. Both graphs show that the relative productivity ratio has been approaching relative prices as measured both by the real effective exchange rate and the relative price ratio since 2003. This indicates improvements in the Czech Republic's economic performance, driven by increasing labour productivity in the traded goods sector.

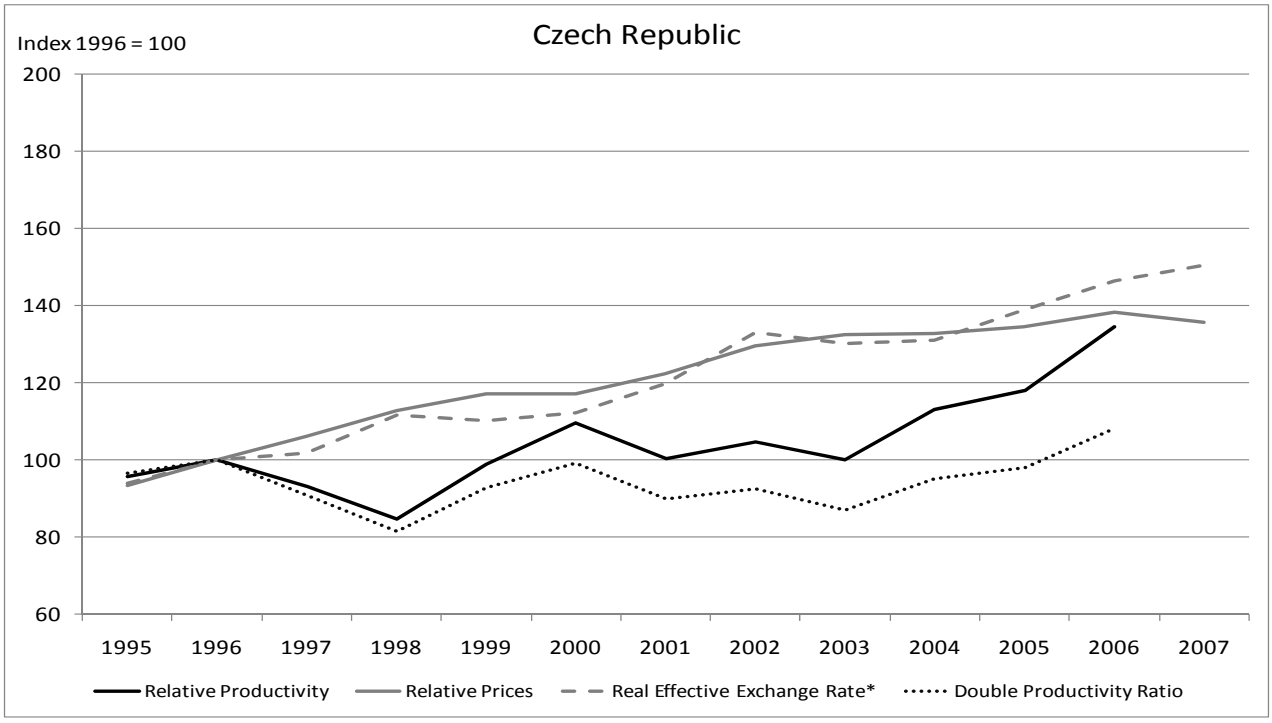
The upward trend in the double productivity ratio indicates that the labour productivity differential in the Czech Republic has been increasing more rapidly than for the Euro area since 1995. However, as is the case for both the Slovak Republic and Hungary, the double productivity ratio remains below the relative productivity ratio during the entire period 1995 to 2006.

Graph 1.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

Graph 2.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

Poland

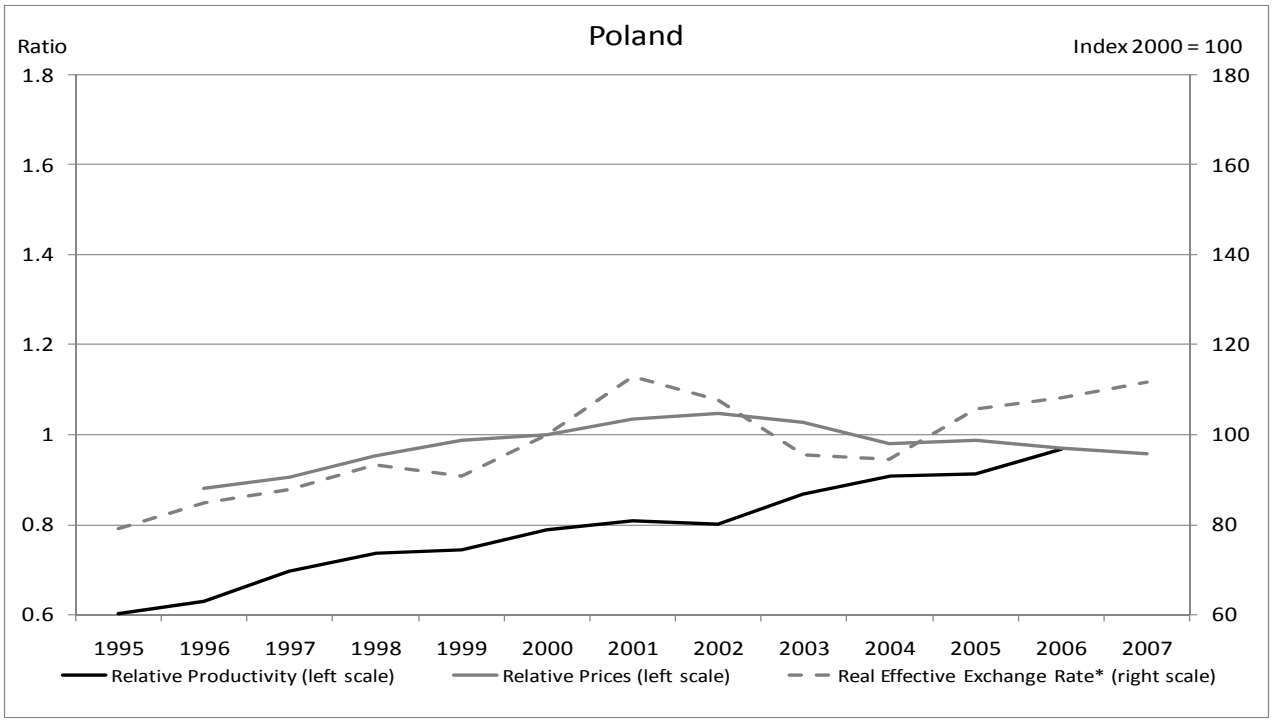
As is shown in graph (1) for Poland, labour productivity in industry is observed to have increased more rapidly than labour productivity in market services during the period 1995 to 2006. Additionally, relative prices in market services are observed to have increased more rapidly than in industry during the period 1995 to 2003. In 2003, one year before Poland joined the European Union, the relative price ratio is observed to decrease.

For Poland, the relative price ratio is observed to increase faster than the relative productivity ratio during the period 1995 to 2005. However, the relative productivity ratio has been converging towards the relative price ratio since 2002. This indicates improvements in Poland's economic performance, driven by labour productivity growth in the traded goods sector.

However, as is the case for the Czech Republic, we observe that between 2003 and 2007, the series on the real effective exchange rate increases while the relative price ratio decreases. The divergence between these two relative price indicators challenges the hypothesis that the relative price ratio and the real effective exchange rate are closely correlated.

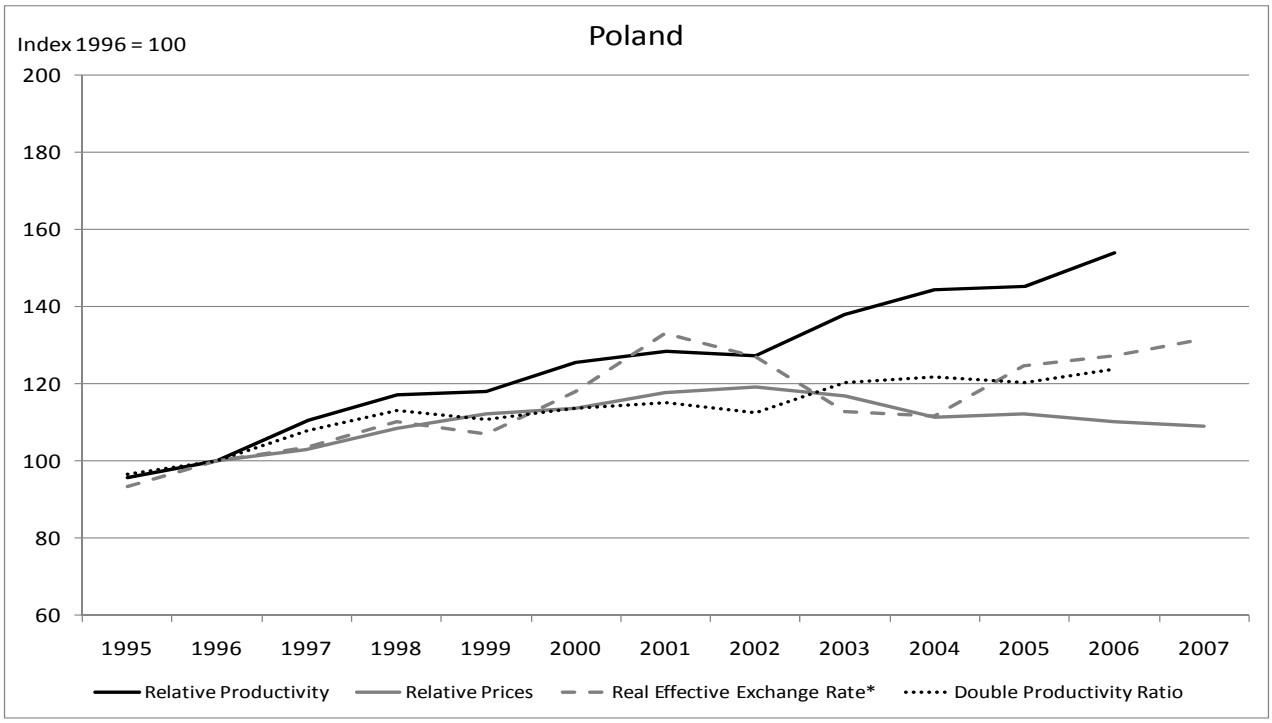
Graph (2) better illustrates the tendency of labour productivity in industry to increase faster than in market services. Yet, whereas the relative productivity ratio tends to increase more rapidly than the series on the real effective exchange rate for all years after 2002, the double productivity ratio and the series on the real effective exchange rate are closely correlated.

Graph 1.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

Graph 2.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

Euro area

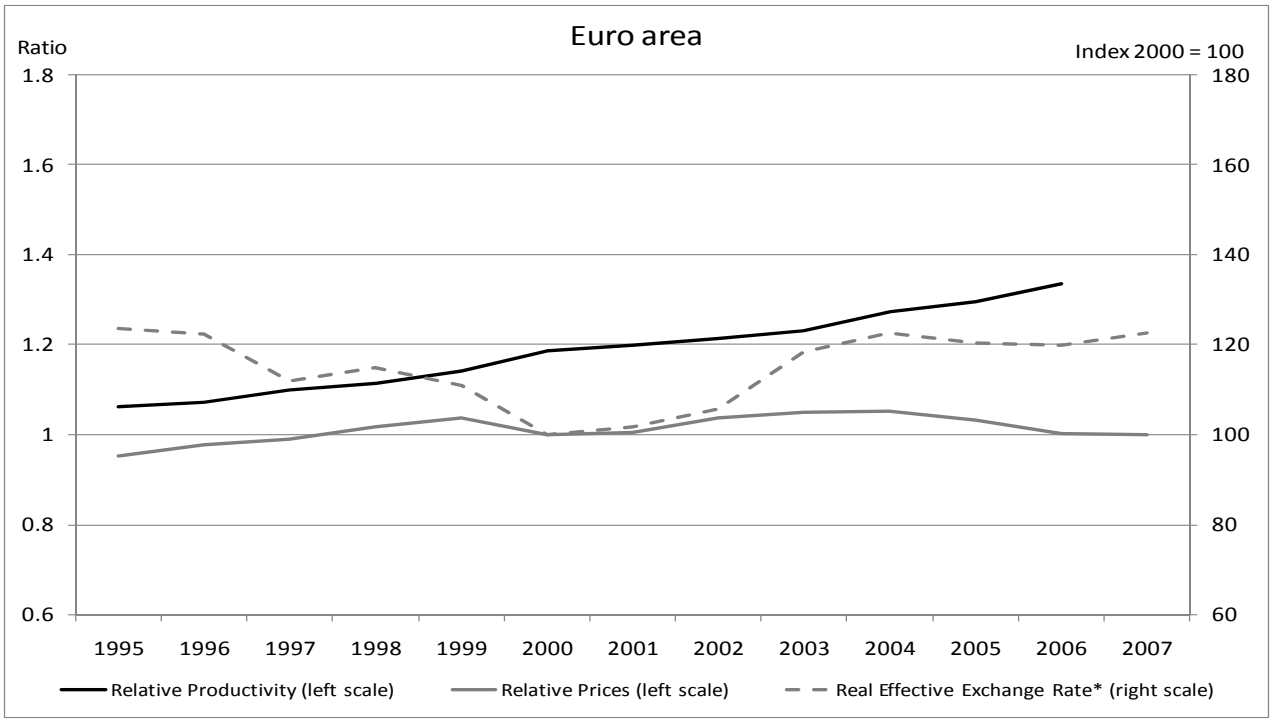
As is shown in graph (1) for the Euro area, labour productivity in industry is observed to have increased more rapidly than labour productivity in market services during the period 1995 to 2006. Additionally, relative productivity is observed to rise faster than relative prices during this same period. We notice, however, that relative prices in industry have increased more rapidly than in market services since 2002. As could be expected, this trend somewhat contradicts the Balassa-Samuelson effect.

It is interesting to note that the trend in relative prices is opposite of the trend in the series on the real effective exchange rate for the period 1995 to 1999, and after 2004. This observation shows that, in the case of the Euro area, the relative price ratio and the real effective exchange rate have different drivers.

Judging by the series on the real effective exchange rate, prices in the Euro area have risen more slowly than world prices, partially compensating for the nominal appreciation of the Euro.

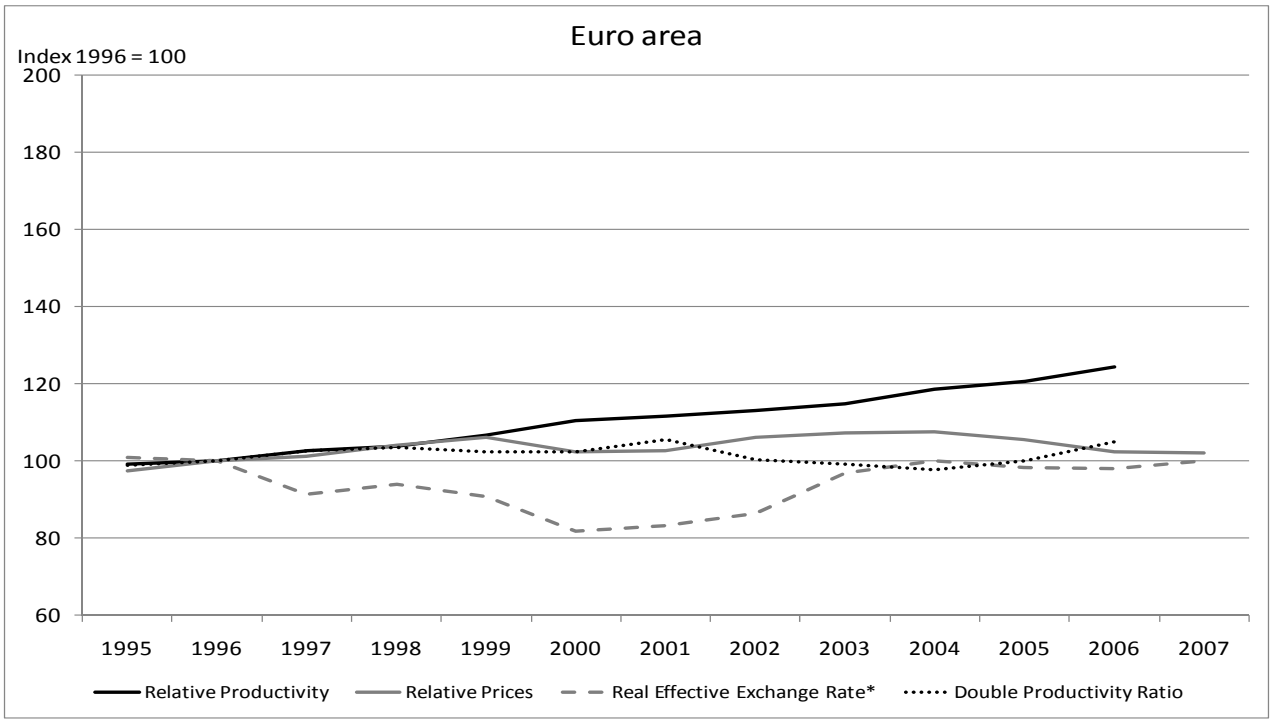
Graph (2) shows as well that the trend in the relative productivity ratio and the real effective exchange rate rises whereas the relative price ratio (represented as an index) decreases. It is interesting to note that the double productivity ratio remains very close to the 1996 index during the entire period 1995 to 2006. This indicates that the productivity differential in the Euro area is approximately the same as that in the United States – the Euro area's main trade partner – during this period.

Graph 1.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

Graph 2.



*CPI based and calculated for 42 countries.
Source: OECD, Main Economic Indicators.

CONCLUSION

The measure of labour productivity is a very important indicator of economic growth, competitiveness, and changes in the living standards in an economy. Defined as the ratio between a volume measure of output and a measure of input use, labour productivity can be calculated in more than one way.

At the OECD, the two principal databases that publish series on labour productivity (the OECD Productivity Database and the OECD System of Unit Labour Cost and Related Indicators) calculate labour productivity using different output and labour input measures. The different measures used in their labour productivity calculations create differences between labour productivity measures published for the same OECD member countries. Labour productivity growth correlations between the two databases demonstrate that the labour input measure has the most influence on the labour productivity measure. Additionally, differences between labour input measures are the main factor explaining variations between labour productivity measures for the total economy in the two OECD databases.

For all OECD member countries for which there are long time series, we generally observe strong labour productivity growth correlations for the total economy, even when different labour input measures are used. However, for OECD member countries for which there are short time series (e.g. the four Central and Eastern European Countries), labour productivity growth correlations for the total economy between the two databases are sometimes observed to be weaker. This is especially the case when different labour input measures are used. The access to short time series for the CEECs could be having some impact on the lower labour productivity growth correlations observed for these countries. This is because less data are available than for the other OECD member countries tested. In turn, having fewer data points reduces the common period between data series and as a result it is necessary to be careful in considering correlations for which short time series are used. The observed strong labour productivity growth correlations for the total economy – acknowledging somewhat weaker correlations for countries with short time series – validate the two OECD databases in relation to one another.

The validation of the two OECD databases allows us to give a practical application to the OECD System of Unit Labour Cost and Related Indicators in the second part of the report. This is important for two principal reasons. First, the OECD System of Unit Labour Cost and Related Indicators is a relatively new OECD database. For this reason, it may not be known as well as the OECD Productivity Database by external users. Secondly, the OECD System of Unit Labour Cost and Related Indicators publishes labour productivity series according to economic activity, whereas Total Economy is the only activity covered in the OECD Productivity Database. Therefore, the creation of two composite indicators (the ratio of labour productivity growth between industry and market services and the ratio of relative prices between market services and industry) demonstrates how the OECD System of Unit Labour Cost and Related Indicators can be used in testing a well known economic theory, the Balassa-Samuelson effect.

The Balassa-Samuelson effect for the Euro area and the four CEECs, all OECD member countries, appears to be only partially fulfilled for these countries and the economic zone. Although there is a tendency for labour productivity growth in industry to increase more rapidly than labour productivity growth in market services for all CEECs and the Euro area, the relative price indicator does not always follow this trend. For example, in both Poland and the Euro area, the relative price ratio (represented as an index) tends to decrease. Also, for certain CEECs, notably Hungary and the Czech Republic, the growth in the relative price ratio and the series on the real effective exchange rate remain higher than growth in the relative labour productivity ratio for all years for which data are available. These observations go somewhat against the Balassa-Samuelson effect.

Furthermore, the composite indicator of relative prices and the real effective exchange rate do not always trend together, even though one can expect this tendency. For example, differences between these two relative price indicators are observed for the Slovak Republic, the Czech Republic, Poland and the Euro area. For the Slovak Republic, the relative price ratio (represented as an index) exceeds the relative productivity ratio. However, the series on the real effective exchange rate remains below the relative productivity ratio for the period 1998 to 2006. Likewise, for the Czech Republic, the series on the real effective exchange rate increases for the period 1995 to 2007, whereas the relative price ratio decreases for all years after 2004. The same tendencies are observed for Poland for the period 2003 to 2007. For the Euro area, the trend in relative prices is observed to be opposite of that for the series on the real effective exchange rate for the period 1995 to 1999 and after 2004.

When the double productivity ratio is calculated (i.e. the domestic productivity differential compared to that of the Euro area), the domestic productivity differential is observed to increase faster than that of the Euro area for the Slovak Republic, Hungary, the Czech Republic and Poland. In the case of the Euro area, the double productivity ratio (calculated as the Euro area's productivity differential compared to that of the United States) is observed to remain close to its 1996 index during the entire period 1995 to 2006. This indicates relatively equal productivity growth in both the Euro area and the United States.

From this work, the OECD Structural Economic Statistics Division of the Statistics Directorate could decide to publish the composite indicator of relative productivity growth between industry and market services in the future. Given that the measure of the real effective exchange rate is a good approximation of relative prices within an economy, it would be interesting to integrate the relative productivity indicator into an appropriate OECD publication. Such an addition would allow relative productivity trends to be compared with trends in the real effective exchange rate, which is an important policy question.

ANNEX 1. SOURCE DATA USED BY THE OECD SYSTEM OF UNIT LABOUR COST AND RELATED INDICATORS AND THE OECD PRODUCTIVITY DATABASE

Abbreviations of source data used by the OECD System of Unit Labour Cost and Related Indicators and the OECD Productivity Database.

Abbreviation	Term
ULC	OECD System of Unit Labour Costs and Related Indicators
PROD	OECD Productivity Database
SNA	OECD System of National Accounts
ALFS	OECD Annual Labour Force Statistics
EO	OECD Economic Outlook
EMO	OECD Employment Outlook
STAN	OECD Structural Analysis (STAN) Database
ABS	Australian Bureau of Statistics

OECD System of Unit Labour Cost and Related Indicators (ULC) and OECD Productivity Database (PROD): Source data used to estimate total number of hours worked by those in employment.														
	Australia (ULC)	**Australia (PROD)**	**Austria (ULC)**	**Austria (PROD)**	**Belgium (ULC)**	**Belgium (PROD)**	**Canada (ULC)**	**Canada (PROD)**	**Czech Republic (ULC)**	**Czech Republic (PROD)**	**Denmark (ULC)**	**Denmark (PROD)**	**Finland (ULC)**	**Finland (PROD)**
1970		ABS				EO	SNA	SNA			SNA	SNA		EMO
1971		ABS				EO	SNA	SNA			SNA	SNA		EMO
1972		ABS				EO	SNA	SNA			SNA	SNA		EMO
1973		ABS				EO	SNA	SNA			SNA	SNA		EMO
1974		ABS				EO	SNA	SNA			SNA	SNA		EMO
1975		ABS				EO	SNA	SNA			SNA	SNA	SNA	SNA
1976		ABS				EO	SNA	SNA			SNA	SNA	SNA	SNA
1977		ABS				EO	SNA	SNA			SNA	SNA	SNA	SNA
1978		ABS				EO	SNA	SNA			SNA	SNA	SNA	SNA
1979		ABS				EO	SNA	SNA			SNA	SNA	SNA	SNA
1980		ABS				EO	SNA	SNA			SNA	SNA	SNA	SNA
1981		ABS				EO	SNA	SNA			SNA	SNA	SNA	SNA
1982		ABS				EO	SNA	SNA			SNA	SNA	SNA	SNA
1983		ABS				EMO	SNA	SNA			SNA	SNA	SNA	SNA
1984		ABS				EMO	SNA	SNA			SNA	SNA	SNA	SNA
1985		ABS				EMO	SNA	SNA			SNA	SNA	SNA	SNA
1986		ABS				EMO	SNA	SNA			SNA	SNA	SNA	SNA
1987		ABS				EMO	SNA	SNA			SNA	SNA	SNA	SNA
1988		ABS	SNA			EMO	SNA	SNA			SNA	SNA	SNA	SNA
1989		ABS	SNA			EMO	SNA	SNA			SNA	SNA	SNA	SNA
1990		ABS	SNA			EMO	SNA	SNA			SNA	SNA	SNA	SNA
1991		ABS	SNA			EMO	SNA	SNA			SNA	SNA	SNA	SNA
1992		ABS	SNA			EMO	SNA	SNA			SNA	SNA	SNA	SNA
1993		ABS	SNA			EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
1994	ABS	ABS	SNA			EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
1995	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
1996	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
1997	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
1998	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
1999	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
2000	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
2001	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
2002	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
2003	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
2004	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
2005	ABS	ABS	SNA	SNA		EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
2006			SNA								SNA		SNA	

OECD System of Unit Labour Cost and Related Indicators (ULC) and OECD Productivity Database (PROD): Source data used to estimate total number of hours worked by those in employment.																
	France (ULC)	France (PROD)	Germany (ULC)	Germany (PROD)	Greece (ULC)	Greece (PROD)	Hungary (ULC)	Hungary (PROD)	Iceland (ULC)	Iceland (PROD)	Ireland (ULC)	Ireland (PROD)	Italy (ULC)	Italy (PROD)	Japan (ULC)	Japan (PROD)
1970		EMO		EMO						EO		EO		EMO		EMO
1971		EMO		EMO						EO		EO		EMO		EMO
1972		EMO		EMO						EO		EO		EMO		EMO
1973		EMO		EMO						EO		EO		EMO		EMO
1974		EMO		EMO						EO		EO		EMO		EMO
1975		EMO		EMO						EO		EO		EMO		EMO
1976		EMO		EMO						EO		EO		EMO		EMO
1977		EMO		EMO						EO		EO		EMO		EMO
1978		EMO		EMO						EO		EO		EMO		EMO
1979		EMO		EMO						EO		EO		EMO		EMO
1980		EMO		EMO				EMO		EO		EO	SNA	EMO		EMO
1981		EMO		EMO				EMO		EO		EO	SNA	EMO		EMO
1982		EMO		EMO				EMO		EO		EO	SNA	EMO		EMO
1983		EMO		EMO		EMO		EMO		EO		EMO	SNA	EMO		EMO
1984		EMO		EMO		EMO		EMO		EO		EMO	SNA	EMO		EMO
1985		EMO		EMO		EMO		EMO		EO		EMO	SNA	EMO		EMO
1986		EMO		EMO		EMO		EMO		EO		EMO	SNA	EMO		EMO
1987		EMO		EMO		EMO		EMO		EO		EMO	SNA	EMO		EMO
1988		EMO		EMO		EMO		EMO		EO		EMO	SNA	EMO		EMO
1989		EMO		EMO		EMO		EMO		EO		EMO	SNA	EMO		EMO
1990	SNA	SNA		EMO		EMO		EMO		EO		EMO	SNA	EMO		EMO
1991	SNA	SNA	SNA	SNA		EMO		EMO		EMO		EMO	SNA	EMO		EMO
1992	SNA	SNA	SNA	SNA		EMO		EMO		EMO		EMO	SNA	EMO		EMO
1993	SNA	SNA	SNA	SNA		EMO		EMO		EMO		EMO	SNA	SNA		EMO
1994	SNA	SNA	SNA	SNA		EMO		EMO		EMO		EMO	SNA	SNA		EMO
1995	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO		EMO	SNA	SNA		EMO
1996	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO		EMO	SNA	SNA		EMO
1997	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO		EMO	SNA	SNA		EMO
1998	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO		EMO	SNA	SNA		EMO
1999	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO		EMO	SNA	SNA		EMO
2000	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO		EMO	SNA	SNA		EMO
2001	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO		EMO	SNA	SNA		EMO
2002	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO		EMO	SNA	SNA		EMO
2003	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO		EMO	SNA	SNA		EMO
2004	SNA	SNA	SNA	SNA	SNA	EMO	SNA	SNA		EMO		EMO	SNA	EMO		EMO
2005	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA		EMO		EMO	SNA	EMO		EMO
2006	SNA		SNA		SNA		SNA						SNA			

OECD System of Unit Labour Cost and Related Indicators (ULC) and OECD Productivity Database (PROD): Source data used to estimate total number of hours worked by those in employment.														
	Korea (ULC)	Korea (PROD)	Luxemburg (ULC)	Luxemburg (PROD)	Mexico (ULC)	Mexico (PROD)	Netherlands (ULC)	Netherlands (PROD)	New Zealand (ULC)	New Zealand (PROD)	Norway (ULC)	Norway (PROD)	Poland (ULC)	Poland (PROD)
1970								EMO		EO	SNA	SNA		
1971								EMO		EO	SNA	SNA		
1972								EMO		EO	SNA	SNA		
1973								EMO		EO	SNA	SNA		
1974								EMO		EO	SNA	SNA		
1975								EMO		EO	SNA	SNA		
1976								EMO		EO	SNA	SNA		
1977								EMO		EO	SNA	SNA		
1978								EMO		EO	SNA	SNA		
1979								EMO		EO	SNA	SNA		
1980		EMO						EMO		EO	SNA	SNA		
1981		EMO						EMO		EO	SNA	SNA		
1982		EMO						EMO		EO	SNA	SNA		
1983		EMO		EMO				EMO		EO	SNA	SNA		
1984		EMO		EMO				EMO		EO	SNA	SNA		
1985		EMO		EMO				EMO		EO	SNA	SNA		
1986		EMO		EMO				EMO		EMO	SNA	SNA		
1987		EMO		EMO				EMO		EMO	SNA	SNA		
1988		EMO		EMO				EMO		EMO	SNA	SNA		
1989		EMO		EMO				EMO		EMO	SNA	SNA		
1990		EMO		EMO				EMO		EMO	SNA	SNA		
1991		EMO		EMO		EMO		EMO		EMO	SNA	SNA		
1992	SNA	SNA		EMO		EMO		EMO		EMO	SNA	SNA		
1993	SNA	SNA		EMO		EMO		EMO		EMO	SNA	SNA		
1994	SNA	SNA		EMO		EMO		EMO		EMO	SNA	SNA		
1995	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		
1996	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		
1997	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		
1998	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		
1999	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		
2000	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		EMO
2001	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		EMO
2002	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		EMO
2003	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		EMO
2004	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		EMO
2005	SNA	SNA		EMO		EMO	SNA	EMO		EMO	SNA	SNA		EMO
2006	SNA						SNA				SNA			

OECD System of Unit Labour Cost and Related Indicators (ULC) and OECD Productivity Database (PROD): Source data used to estimate total number of hours worked by those in employment.																
	Portugal (ULC)	Portugal (PROD)	Slovak Republic (ULC)	Slovak Republic (PROD)	Spain (ULC)	Spain (PROD)	Sweden (ULC)	Sweden (PROD)	Switzerland (ULC)	Switzerland (PROD)	Turkey (ULC)	Turkey (PROD)	United Kingdom (ULC)	United Kingdom (PROD)	United States (ULC)	United States (PROD)
1970						EO		EMO		EO				EMO		EMO
1971						EO		EMO		EO				EMO		EMO
1972						EO		EMO		EO				EMO		EMO
1973						EO		EMO		EO				EMO		EMO
1974						EO		EMO		EO				EMO		EMO
1975						EO		EMO		EO				EMO		EMO
1976						EO		EMO		EO				EMO		EMO
1977						EMO		EMO		EO				EMO		EMO
1978						EMO		EMO		EO				EMO		EMO
1979						EMO		EMO		EO				EMO		EMO
1980						EMO	SNA	SNA		EO				EMO		EMO
1981						EMO	SNA	SNA		EO				EMO		EMO
1982						EMO	SNA	SNA		EO				EMO		EMO
1983						EMO	SNA	SNA		EO				EMO		EMO
1984						EMO	SNA	SNA		EO				EMO		EMO
1985						EMO	SNA	SNA		EO				EMO		EMO
1986		EMO				EMO	SNA	SNA		EO				EMO		EMO
1987		EMO				EMO	SNA	SNA		EO				EMO		EMO
1988		EMO				EMO	SNA	SNA		EO				EMO		EMO
1989		EMO				EMO	SNA	SNA		EO				EMO		EMO
1990		EMO				EMO	SNA	SNA		EO				EMO		EMO
1991		EMO				EMO	SNA	SNA	SNA	SNA				EMO		EMO
1992		EMO				EMO	SNA	SNA	SNA	SNA				EMO		EMO
1993		EMO				EMO	SNA	SNA	SNA	SNA				EMO		EMO
1994		EMO		EMO		EMO	SNA	SNA	SNA	SNA				EMO		EMO
1995		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
1996		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
1997		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
1998		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
1999		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
2000		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
2001		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
2002		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
2003		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
2004		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA				EMO		EMO
2005		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	EO				EMO		EMO
2006			SNA		SNA		SNA									

OECD System of Unit Labour Cost and Related Indicators (ULC) and OECD Productivity Database (PROD): Source data used to estimate total employment in persons.														
	Australia (ULC)	**Australia (PROD)**	**Austria (ULC)**	**Austria (PROD)**	**Belgium (ULC)**	**Belgium (PROD)**	**Canada (ULC)**	**Canada (PROD)**	**Czech Republic (ULC)**	**Czech Republic (PROD)**	**Denmark (ULC)**	**Denmark (PROD)**	**Finland (ULC)**	**Finland (PROD)**
1970	STAN	ABS			STAN	EO	SNA	SNA			SNA	SNA	SNA	EMO
1971	STAN	ABS			STAN	EO	SNA	SNA			SNA	SNA	SNA	EMO
1972	STAN	ABS			STAN	EO	SNA	SNA			SNA	SNA	SNA	EMO
1973	STAN	ABS			STAN	EO	SNA	SNA			SNA	SNA	SNA	EMO
1974	STAN	ABS			STAN	EO	SNA	SNA			SNA	SNA	SNA	EMO
1975	STAN	ABS			STAN	EO	SNA	SNA			SNA	SNA	SNA	SNA
1976	STAN	ABS	SNA		STAN	EO	SNA	SNA			SNA	SNA	SNA	SNA
1977	STAN	ABS	SNA		STAN	EO	SNA	SNA			SNA	SNA	SNA	SNA
1978	STAN	ABS	SNA		STAN	EO	SNA	SNA			SNA	SNA	SNA	SNA
1979	STAN	ABS	SNA		STAN	EO	SNA	SNA			SNA	SNA	SNA	SNA
1980	STAN	ABS	SNA		STAN	EO	SNA	SNA			SNA	SNA	SNA	SNA
1981	STAN	ABS	SNA		SNA	EO	SNA	SNA			SNA	SNA	SNA	SNA
1982	STAN	ABS	SNA		SNA	EO	SNA	SNA			SNA	SNA	SNA	SNA
1983	STAN	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1984	STAN	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1985	SNA	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1986	SNA	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1987	SNA	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1988	SNA	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1989	SNA	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1990	SNA	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1991	SNA	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1992	SNA	ABS	SNA		SNA	EMO	SNA	SNA			SNA	SNA	SNA	SNA
1993	SNA	ABS	SNA		SNA	EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
1994	SNA	ABS	SNA		SNA	EMO	SNA	SNA		EMO	SNA	SNA	SNA	SNA
1995	SNA	ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
1996	SNA	ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
1997	SNA	ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
1998	SNA	ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
1999	SNA	ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
2000	SNA	ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
2001	SNA	ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
2002	SNA	ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
2003	SNA	ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
2004		ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
2005		ABS	SNA	SNA	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA	SNA	SNA
2006			SNA		SNA				SNA		SNA		SNA	

OECD System of Unit Labour Cost and Related Indicators (ULC) and OECD Productivity Database (PROD): Source data used to estimate total employment in persons.																
	France (ULC)	France (PROD)	Germany[1] (ULC)	Germany (PROD)	Greece (ULC)	Greece (PROD)	Hungary (ULC)	Hungary (PROD)	Iceland (ULC)	Iceland (PROD)	Ireland (ULC)	Ireland (PROD)	Italy (ULC)	Italy (PROD)	Japan (ULC)	Japan (PROD)
1970	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1971	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1972	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1973	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1974	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1975	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1976	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1977	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1978	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1979	SNA	EMO	SNA	EMO						EO	STAN	EO	SNA	EMO	SNA	EMO
1980	SNA	EMO	SNA	EMO				EMO		EO	STAN	EO	SNA	EMO	SNA	EMO
1981	SNA	EMO	SNA	EMO				EMO		EO	STAN	EO	SNA	EMO	SNA	EMO
1982	SNA	EMO	SNA	EMO				EMO		EO	STAN	EO	SNA	EMO	SNA	EMO
1983	SNA	EMO	SNA	EMO		EMO		EMO		EO	STAN	EMO	SNA	EMO	SNA	EMO
1984	SNA	EMO	SNA	EMO		EMO		EMO		EO	STAN	EMO	SNA	EMO	SNA	EMO
1985	SNA	EMO	SNA	EMO		EMO		EMO		EO	STAN	EMO	SNA	EMO	SNA	EMO
1986	SNA	EMO	SNA	EMO		EMO		EMO		EO	STAN	EMO	SNA	EMO	SNA	EMO
1987	SNA	EMO	SNA	EMO		EMO		EMO		EO	STAN	EMO	SNA	EMO	SNA	EMO
1988	SNA	EMO	SNA	EMO		EMO		EMO		EO	STAN	EMO	SNA	EMO	SNA	EMO
1989	SNA	EMO	SNA	EMO		EMO		EMO		EO	STAN	EMO	SNA	EMO	SNA	EMO
1990	SNA	SNA	SNA	EMO		EMO		EMO		EO	STAN	EMO	SNA	EMO	SNA	EMO
1991	SNA	SNA	SNA	SNA		EMO		EMO		EMO	STAN	EMO	SNA	EMO	SNA	EMO
1992	SNA	SNA	SNA	SNA		EMO	SNA	EMO		EMO	STAN	EMO	SNA	EMO	SNA	EMO
1993	SNA	SNA	SNA	SNA		EMO	SNA	EMO		EMO	STAN	EMO	SNA	SNA	SNA	EMO
1994	SNA	SNA	SNA	SNA		EMO	SNA	EMO		EMO	STAN	EMO	SNA	SNA	SNA	EMO
1995	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO	SNA	EMO	SNA	SNA	SNA	EMO
1996	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO	SNA	EMO	SNA	SNA	SNA	EMO
1997	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO	SNA	EMO	SNA	SNA	SNA	EMO
1998	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO	SNA	EMO	SNA	SNA	SNA	EMO
1999	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO	SNA	EMO	SNA	SNA	SNA	EMO
2000	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO	SNA	EMO	SNA	SNA	SNA	EMO
2001	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO	SNA	EMO	SNA	SNA	SNA	EMO
2002	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO	SNA	EMO	SNA	SNA	SNA	EMO
2003	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA		EMO	SNA	EMO	SNA	SNA	SNA	EMO
2004	SNA	SNA	SNA	SNA	SNA	EMO	SNA	SNA		EMO	SNA	EMO	SNA	EMO	SNA	EMO
2005	SNA	EMO	SNA	SNA	SNA	EMO	SNA	SNA		EMO	SNA	EMO	SNA	EMO	SNA	EMO
2006	SNA		SNA		SNA		SNA				SNA		SNA		SNA	

1. Source data from 1970 – 1990 refer to SNA data for Western Germany.

OECD System of Unit Labour Cost and Related Indicators (ULC) and OECD Productivity Database (PROD): Source data used to estimate total employment in persons.														
	Korea (ULC)	Korea (PROD)	Luxemburg (ULC)	Luxemburg (PROD)	Mexico (ULC)	Mexico (PROD)	Netherlands (ULC)	Netherlands (PROD)	New Zealand (ULC)	New Zealand (PROD)	Norway (ULC)	Norway (PROD)	Poland (ULC)	Poland (PROD)
1970	SNA						SNA	EMO		EO	SNA	SNA		
1971	SNA						SNA	EMO		EO	SNA	SNA		
1972	SNA						SNA	EMO		EO	SNA	SNA		
1973	SNA						SNA	EMO		EO	SNA	SNA		
1974	SNA						SNA	EMO		EO	SNA	SNA		
1975	SNA						SNA	EMO		EO	SNA	SNA		
1976	SNA						SNA	EMO		EO	SNA	SNA		
1977	SNA						SNA	EMO		EO	SNA	SNA		
1978	SNA						SNA	EMO		EO	SNA	SNA		
1979	SNA						SNA	EMO		EO	SNA	SNA		
1980	SNA	EMO					SNA	EMO		EO	SNA	SNA		
1981	SNA	EMO					SNA	EMO		EO	SNA	SNA		
1982	SNA	EMO					SNA	EMO		EO	SNA	SNA		
1983	SNA	EMO		EMO			SNA	EMO		EO	SNA	SNA		
1984	SNA	EMO		EMO			SNA	EMO		EO	SNA	SNA		
1985	SNA	EMO	SNA	EMO			SNA	EMO		EO	SNA	SNA		
1986	SNA	EMO	SNA	EMO			SNA	EMO		EMO	SNA	SNA		
1987	SNA	EMO	SNA	EMO			SNA	EMO		EMO	SNA	SNA		
1988	SNA	EMO	SNA	EMO			SNA	EMO		EMO	SNA	SNA		
1989	SNA	EMO	SNA	EMO			SNA	EMO		EMO	SNA	SNA		
1990	SNA	EMO	SNA	EMO			SNA	EMO	SNA	EMO	SNA	SNA		
1991	SNA	EMO	SNA	EMO		EMO	SNA	EMO	SNA	EMO	SNA	SNA		
1992	SNA	SNA	SNA	EMO		EMO	SNA	EMO	SNA	EMO	SNA	SNA	STAN	
1993	SNA	SNA	SNA	EMO		EMO	SNA	EMO	SNA	EMO	SNA	SNA	STAN	
1994	SNA	SNA	SNA	EMO		EMO	SNA	EMO	SNA	EMO	SNA	SNA	STAN	
1995	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	STAN	
1996	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	
1997	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	
1998	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	
1999	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	
2000	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	EMO
2001	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	EMO
2002	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	EMO
2003	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	EMO
2004	SNA	SNA	SNA	EMO	SNA	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	EMO
2005	SNA	SNA	SNA	EMO		EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	EMO
2006	SNA		SNA				SNA				SNA		SNA	

OECD System of Unit Labour Cost and Related Indicators (ULC) and OECD Productivity Database (PROD): Source data used to estimate total employment in persons.																
	Portugal (ULC)	Portugal (PROD)	Slovak Republic (ULC)	Slovak Republic (PROD)	Spain (ULC)	Spain (PROD)	Sweden (ULC)	Sweden (PROD)	Switzerland (ULC)	Switzerland (PROD)	Turkey (ULC)	Turkey (PROD)	United Kingdom (ULC)	United Kingdom (PROD)	United States (ULC)	United States (PROD)
1970						EO	STAN	EMO		EO	ALFS		ALFS	EMO	SNA	EMO
1971						EO	STAN	EMO		EO	ALFS		ALFS	EMO	SNA	EMO
1972						EO	STAN	EMO		EO	ALFS		ALFS	EMO	SNA	EMO
1973						EO	STAN	EMO		EO	ALFS		ALFS	EMO	SNA	EMO
1974						EO	STAN	EMO		EO	ALFS		ALFS	EMO	SNA	EMO
1975						EO	STAN	EMO		EO	ALFS		ALFS	EMO	SNA	EMO
1976						EO	STAN	EMO		EO	ALFS		ALFS	EMO	SNA	EMO
1977	STAN					EMO	STAN	EMO		EO	ALFS		ALFS	EMO	SNA	EMO
1978	STAN					EMO	STAN	EMO		EO	ALFS		ALFS	EMO	SNA	EMO
1979	STAN					EMO	STAN	EMO		EO	ALFS		SNA	EMO	SNA	EMO
1980	STAN				SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1981	STAN				SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1982	STAN				SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1983	STAN				SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1984	STAN				SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1985	STAN				SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1986	STAN	EMO			SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1987	STAN	EMO			SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1988	STAN	EMO			SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1989	STAN	EMO			SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1990	STAN	EMO			SNA	EMO	SNA	SNA		EO	ALFS		SNA	EMO	SNA	EMO
1991	STAN	EMO			SNA	EMO	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
1992	STAN	EMO			SNA	EMO	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
1993	STAN	EMO			SNA	EMO	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
1994	STAN	EMO	SNA	EMO	SNA	EMO	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
1995	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
1996	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
1997	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
1998	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
1999	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
2000	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
2001	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
2002	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
2003	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
2004	SNA	EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	SNA	ALFS		SNA	EMO	SNA	EMO
2005		EMO	SNA	SNA	SNA	SNA	SNA	SNA	SNA	EO	ALFS		SNA	EMO	SNA	EMO
2006			SNA		SNA				SNA		ALFS		SNA			

ANNEX 2. SERIES DATA USED BY THE OECD SYSTEM OF UNIT LABOUR COST AND RELATED INDICATORS (ULC) AND THE OECD PRODUCTIVITY DATABASE (PROD) – GROWTH RATES

Germany

	ULC: Labour productivity per hour	ULC: Labour productivity per person employed	ULC: Labour productivity per unit labour input	PROD: Labour productivity per hour	ULC: Gross value added	PROD: Gross domestic product
1970						
1971		2.23	2.23	4.58	2.69	3.13
1972		3.78	3.78	4.38	4.35	4.30
1973		3.69	3.69	5.39	4.94	4.78
1974		2.33	2.33	3.98	1.36	0.89
1975		1.15	1.15	3.83	-1.39	-0.87
1976		5.35	5.35	4.74	4.92	4.95
1977		3.13	3.13	4.02	3.36	3.35
1978		2.00	2.00	3.38	3.00	3.01
1979		2.25	2.25	2.80	4.22	4.15
1980		-0.23	-0.23	0.91	1.44	1.41
1981		0.60	0.60	1.35	0.72	0.53
1982		0.05	0.05	1.33	-0.72	-0.40
1983		2.39	2.39	3.07	1.46	1.57
1984		2.10	2.10	2.55	2.98	2.82
1985		1.22	1.22	2.49	2.64	2.33
1986		0.32	0.32	1.21	2.25	2.29
1987		-0.17	-0.17	1.60	1.22	1.40
1988		2.37	2.37	2.36	3.82	3.71
1989		2.25	2.25	3.85	4.17	3.90
1990		1.94	1.94	3.70	5.15	5.26
1991		2.21	2.21	5.00	5.08	5.11
1992	2.53	3.73	2.53	2.72	2.22	2.23
1993	1.38	0.33	1.38	1.66	-1.00	-0.80
1994	2.66	2.48	2.66	2.93	2.38	2.66
1995	2.88	1.98	2.88	2.53	2.21	1.89
1996	2.66	1.60	2.66	2.16	1.33	0.99
1997	2.61	2.00	2.61	2.72	1.90	1.80
1998	1.23	0.86	1.23	1.18	2.07	2.03
1999	1.32	0.54	1.32	1.45	1.90	2.01
2000	3.07	1.77	3.07	2.58	3.68	3.21
2001	2.05	1.04	2.05	1.68	1.48	1.24
2002	1.74	0.83	1.74	1.65	0.27	0.00
2003	1.25	0.81	1.25	1.08	-0.15	-0.22
2004	0.86	1.05	0.86	0.53	1.45	1.06
2005	1.54	1.07	1.54	1.33	0.98	0.78
2006	2.36	2.21	2.36	2.36	2.84	2.87
2007					2.87	2.49

Sources: OECD System of Unit Labour Cost and Related Indicators; OECD Productivity Database.

France

	ULC: Labour productivity per hour	ULC: Labour productivity per person employed	ULC: Labour productivity per unit labour input	PROD: Labour productivity per hour	ULC: Gross value added	PROD: Gross domestic product
1970						
1971		4.86	4.86	5.23	5.32	5.23
1972		3.64	3.64	4.97	4.26	4.65
1973		5.26	5.26	6.51	6.72	6.55
1974		4.96	4.96	4.44	5.87	4.48
1975		-0.25	-0.25	1.60	-1.12	-0.97
1976		3.03	3.03	3.14	3.85	4.41
1977		3.57	3.57	4.06	4.43	3.55
1978		2.90	2.90	4.39	3.40	3.95
1979		2.74	2.74	4.21	3.26	3.53
1980		2.25	2.25	2.24	2.51	1.69
1981		1.65	1.65	3.51	1.26	0.92
1982		2.33	2.33	4.66	2.46	2.43
1983		1.55	1.55	1.62	1.23	1.20
1984		1.90	1.90	2.79	1.67	1.49
1985		2.61	2.61	3.10	1.83	1.71
1986		2.01	2.01	2.63	2.39	2.45
1987		1.64	1.64	2.20	2.41	2.49
1988		3.40	3.40	3.58	4.34	4.60
1989		2.53	2.53	3.81	4.26	4.16
1990		2.01	2.01	1.67	2.82	2.64
1991	1.43	1.01	1.43	1.31	1.12	1.02
1992	2.29	2.30	2.29	1.94	1.71	1.37
1993	1.15	0.37	1.15	0.95	-0.92	-0.91
1994	2.16	1.77	2.16	2.52	1.92	2.22
1995	2.86	1.35	2.86	2.76	2.25	2.12
1996	0.49	0.77	0.49	0.60	1.15	1.11
1997	2.35	1.95	2.35	2.08	2.40	2.24
1998	2.70	1.99	2.70	2.62	3.54	3.50
1999	1.65	1.19	1.65	1.70	3.24	3.30
2000	3.48	1.00	3.48	3.62	3.71	3.91
2001	0.81	0.00	0.81	1.08	1.78	1.85
2002	3.08	0.35	3.08	2.93	0.97	1.03
2003	1.22	0.86	1.22	1.55	0.99	1.09
2004	0.71	2.50	0.71	0.51	2.61	2.47
2005	1.71	1.16	1.71	1.77	1.61	1.71
2006	1.85	1.08	1.85	1.00	1.85	1.99

Sources: OECD System of Unit Labour Cost and Related Indicators; OECD Productivity Database.

Canada

	ULC: Labour productivity per hour	ULC: Labour productivity per person employed	ULC: Labour productivity per unit labour input	PROD: Labour productivity per hour	ULC: Gross value added	PROD: Gross domestic product
1970						
1971	3.98	3.16	3.98	2.76	5.25	4.12
1972	3.31	2.77	3.31	3.07	5.51	5.45
1973	2.83	2.43	2.83	2.60	7.21	6.96
1974	0.13	-0.34	0.13	0.36	3.57	3.69
1975	0.64	-0.42	0.64	1.44	1.12	1.82
1976	4.96	4.40	4.96	4.27	5.89	5.20
1977	2.26	1.23	2.26	2.73	3.01	3.46
1978	0.29	0.47	0.29	1.00	3.32	3.95
1979	0.05	-0.34	0.05	-0.33	4.07	3.81
1980	0.33	-1.30	0.33	0.66	1.87	2.16
1981	0.03	-0.05	0.03	0.33	3.02	3.50
1982	1.51	0.56	1.51	1.31	-2.61	-2.86
1983	2.06	1.85	2.06	2.26	2.68	2.72
1984	2.80	2.93	2.80	3.15	5.45	5.81
1985	1.44	1.89	1.44	0.92	5.07	4.78
1986	-0.20	-0.29	-0.20	-0.30	2.76	2.42
1987	0.30	0.79	0.30	0.61	3.93	4.25
1988	0.37	0.91	0.37	0.91	4.43	4.97
1989	0.33	0.01	0.33	0.60	2.38	2.62
1990	0.65	-0.09	0.65	0.30	0.53	0.19
1991	1.53	0.36	1.53	0.59	-1.43	-2.09
1992	2.03	1.57	2.03	2.06	0.85	0.88
1993	1.13	1.33	1.13	1.16	2.45	2.34
1994	1.64	2.63	1.64	2.00	4.50	4.80
1995	1.24	0.95	1.24	1.40	2.62	2.81
1996	-0.02	0.51	-0.02	0.00	1.42	1.62
1997	3.66	2.68	3.66	4.42	4.20	4.23
1998	1.70	1.66	1.70	1.85	3.94	4.10
1999	2.74	2.88	2.74	2.34	5.61	5.53
2000	3.25	3.17	3.25	3.05	5.52	5.23
2001	0.84	0.52	0.84	0.99	1.55	1.78
2002	1.13	0.11	1.13	1.46	2.63	2.93
2003	0.62	0.03	0.62	0.24	2.14	1.88
2004	0.36	1.43	0.36	0.48	3.20	3.07
2005	2.10	1.28	2.10	2.15	2.94	3.07
2006				0.70		2.76

Sources: OECD System of Unit Labour Cost and Related Indicators; OECD Productivity Database.

Denmark

	ULC: Labour productivity per hour	ULC: Labour productivity per person employed	ULC: Labour productivity per unit labour input	PROD: Labour productivity per hour	ULC: Gross value added	PROD: Gross domestic product
1970	1.22	0.03	1.22			
1971	5.49	3.78	5.49	4.78	3.65	3.00
1972	5.38	2.09	5.38	5.37	4.22	4.18
1973	5.24	2.65	5.24	5.03	3.97	3.76
1974	1.49	0.79	1.49	0.61	0.03	-0.82
1975	3.99	-0.14	3.99	4.22	-1.41	-1.22
1976	2.75	3.27	2.75	3.70	5.11	6.09
1977	3.82	2.34	3.82	3.68	2.14	1.98
1978	2.66	1.49	2.66	2.69	2.25	2.28
1979	3.71	3.20	3.71	3.40	4.26	3.95
1980	-0.13	1.23	-0.13	-1.01	0.52	-0.37
1981	2.97	1.18	2.97	2.46	-0.37	-0.89
1982	2.92	3.52	2.92	2.75	3.89	3.71
1983	2.62	2.31	2.62	2.87	2.39	2.65
1984	3.05	2.65	3.05	2.98	4.25	4.17
1985	2.23	1.33	2.23	2.48	3.75	4.03
1986	0.80	0.95	0.80	2.28	3.43	4.95
1987	2.83	0.56	2.83	2.01	1.09	0.29
1988	3.00	1.79	3.00	1.85	1.03	-0.14
1989	2.73	1.57	2.73	2.11	1.15	0.57
1990	3.55	2.59	3.55	2.97	2.09	1.48
1991	2.18	1.86	2.18	2.20	1.25	1.30
1992	1.61	2.89	1.61	1.84	1.75	1.98
1993	2.11	2.06	2.11	1.42	0.57	-0.09
1994	5.68	3.11	5.68	6.42	4.80	5.53
1995	1.85	2.21	1.85	1.71	3.19	3.07
1996	1.76	1.43	1.76	2.17	2.44	2.84
1997	0.63	1.80	0.63	0.79	3.02	3.20
1998	-0.67	0.37	-0.67	-0.37	1.87	2.16
1999	1.16	1.91	1.16	0.85	2.88	2.56
2000	2.99	3.98	2.99	2.14	4.39	3.53
2001	-0.53	-0.02	-0.53	-0.56	0.74	0.71
2002	0.77	0.40	0.77	0.93	0.32	0.47
2003	1.86	1.86	1.86	1.88	0.36	0.38
2004	0.94	1.35	0.94	1.75	1.31	2.13
2005	0.85	1.81	0.85	1.34	2.56	3.06
2006	0.78		0.78	0.82	3.48	3.52

Sources: OECD System of Unit Labour Cost and Related Indicators; OECD Productivity Database.

Slovak Republic

	ULC: Labour productivity per hour	ULC: Labour productivity per person employed	ULC: Labour productivity per unit labour input	PROD: Labour productivity per hour	ULC: Gross value added	PROD: Gross domestic product
1970						
1971						
1972						
1973						
1974						
1975						
1976						
1977						
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985						
1986						
1987						
1988						
1989						
1990						
1991						
1992						
1993						1.90
1994					2.90	6.21
1995		5.18		4.21	5.39	5.84
1996	7.06	4.79	7.06	6.78	7.21	6.94
1997	7.70	7.36	7.70	7.37	6.02	5.74
1998	5.49	3.42	5.49	6.26	2.97	3.69
1999	2.29	2.90	2.29	2.45	0.15	0.32
2000	1.96	2.11	1.96	2.48	0.24	0.72
2001	4.91	4.21	4.91	3.27	4.83	3.23
2002	7.06	3.93	7.06	7.85	3.38	4.12
2003	7.24	2.73	7.24	6.82	4.57	4.16
2004	2.09	4.20	2.09	3.63	3.84	5.42
2005	1.44	3.45	1.44	2.56	4.87	6.04
2006	7.68	8.15	7.68	5.36	10.64	8.27

Sources: OECD System of Unit Labour Cost and Related Indicators; OECD Productivity Database.

Hungary

	ULC: Labour productivity per hour	ULC: Labour productivity per person employed	ULC: Labour productivity per unit labour input	PROD: Labour productivity per hour	ULC: Gross value added	PROD: Gross domestic product
1970						
1971						
1972						
1973						
1974						
1975						
1976						
1977						
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985						
1986						
1987						
1988						
1989						
1990						
1991						
1992					-5.07	-3.06
1993		7.28		6.08	0.55	-0.58
1994		6.36		-1.86	4.27	2.95
1995		4.12		4.75	0.55	1.49
1996	2.89	2.69	2.89	2.00	2.20	1.32
1997	3.22	4.48	3.22	3.12	4.68	4.57
1998	3.23	2.87	3.23	3.41	4.68	4.86
1999	0.01	0.73	0.01	0.01	4.15	4.15
2000	3.79	3.49	3.79	4.18	4.81	5.20
2001	5.72	3.56	5.72	5.98	3.82	4.07
2002	3.55	3.93	3.55	3.95	3.97	4.37
2003	4.08	2.60	4.08	4.33	3.92	4.18
2004	5.88	5.82	5.88	5.57	5.12	4.81
2005	4.27	4.12	4.27	4.29	4.11	4.13
2006	3.57	3.34	3.57	3.41	4.03	3.88

Sources: OECD System of Unit Labour Cost and Related Indicators; OECD Productivity Database.

Czech Republic

	ULC: Labour productivity per hour	ULC: Labour productivity per person employed	ULC: Labour productivity per unit labour input	PROD: Labour productivity per hour	ULC: Gross value added	PROD: Gross domestic product
1970						
1971						
1972						
1973						
1974						
1975						
1976						
1977						
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985						
1986						
1987						
1988						
1989						
1990						
1991					-9.40	-11.62
1992					0.26	-0.51
1993					1.20	0.06
1994				2.11	2.47	2.22
1995				4.13	5.14	5.94
1996		2.52	2.52	2.98	3.46	4.03
1997		-1.78	-1.78	-0.96	-1.60	-0.73
1998		0.84	0.84	0.41	-0.72	-0.76
1999		5.13	5.13	4.29	1.54	1.34
2000		4.02	4.02	3.62	3.83	3.65
2001		2.06	2.06	6.70	2.52	2.46
2002		1.96	1.96	2.35	2.53	1.90
2003		4.33	4.33	5.45	2.92	3.60
2004		4.12	4.12	3.40	4.48	4.49
2005		5.52	5.52	4.48	6.55	6.37
2006		4.80	4.80	4.67	6.77	6.36

Sources: OECD System of Unit Labour Cost and Related Indicators; OECD Productivity Database.

Poland

	ULC: Labour productivity per hour	ULC: Labour productivity per person employed	ULC: Labour productivity per unit labour input	PROD: Labour productivity per hour	ULC: Gross value added	PROD: Gross domestic product
1970						
1971						
1972						
1973						
1974						
1975						
1976						
1977						
1978						
1979						
1980						
1981						
1982						
1983						
1984						
1985						
1986						
1987						
1988						
1989						
1990						
1991						-7.02
1992						2.52
1993		6.10	6.10		3.59	3.74
1994		3.76	3.76		4.81	5.29
1995		4.84	4.84		6.72	6.95
1996		3.66	3.66		5.66	6.24
1997		3.57	3.57		6.45	7.09
1998		2.40	2.40		4.80	4.98
1999		7.18	7.18		4.28	4.52
2000		6.46	6.46		3.99	4.25
2001		1.94	1.94	4.26	1.30	1.21
2002		3.25	3.25	4.09	1.34	1.44
2003		4.50	4.50	5.00	3.62	3.87
2004		5.50	5.50	4.08	5.17	5.35
2005		2.30	2.30	0.65	3.28	3.62
2006		4.73	4.73	2.92	6.21	6.13

Sources: OECD System of Unit Labour Cost and Related Indicators; OECD Productivity Database.

ANNEX 3. DERIVATION OF THE BALASSA-SAMUELSON EQUATION

Let $k^T = \frac{K^T}{L^T}$, $k^{NT} = \frac{K^{NT}}{K^{NT}}$ and $p^N = \frac{P^{NT}}{P^T}$

To find k^T, we know that:

$$R^T = (1-\gamma)A^T\left(\frac{K^T}{L^T}\right)^{-\gamma} \quad (3)$$

Therefore,

$$R^T = (1-\gamma)A^T(k^T)^{-\gamma}$$

$$(k^T)^{-\gamma} = \frac{R^T}{(1-\gamma)A^T}$$

$$k^T = \left(\frac{R}{(1-\gamma)A^T}\right)^{\frac{1}{-\gamma}} \quad (3')$$

To find k^{NT}, we know that:

$$R^{NT} = \frac{P^{NT}}{P^T}(1-\delta)A^{NT}\left(\frac{K^{NT}}{L^{NT}}\right)^{-\delta}$$, where $\frac{P^{NT}}{P^T}$ represents relative prices. (5)

Therefore,

$$R^{NT} = (1-\delta)A^{NT}(k^{NT})^{-\delta}$$

$$(k^{NT})^{-\delta} = \frac{R^{NT}}{(1-\delta)A^{NT}}$$

$$k^{NT} = \left(\frac{R}{(1-\delta)A^{NT}}\right)^{\frac{1}{-\delta}} \quad (5')$$

Substitute equation (3') into equation (4):

$$W^T = \gamma A^T\left(\left(\frac{R}{(1-\gamma)A^T}\right)^{\frac{1}{-\gamma}}\right)^{1-\gamma}$$

$$W^T = \gamma A^T\left(\frac{R}{(1-\gamma)A^T}\right)^{\frac{1-\gamma}{-\gamma}} \quad (4')$$

Substitute equation (5') into equation (6):

$$W^{NT} = p^N \delta A^{NT} \left(\left(\frac{R}{(1-\delta)A^{NT}} \right)^{\frac{1}{-\delta}} \right)^{1-\delta}$$

$$W^{NT} = p^N \delta A^{NT} \left(\frac{R}{p^N(1-\delta)A^{NT}} \right)^{\frac{1-\delta}{-\delta}} \quad (6')$$

Set equation (4') equal to equation (6'). This holds because *W* (given price equalization) is assumed to be the same in both the traded and non-traded goods sectors:

$$\gamma A^T \left(\frac{R}{(1-\gamma)A^T} \right)^{\frac{1-\gamma}{-\gamma}} = p^N \delta A^{NT} \left(\frac{R}{p^N(1-\delta)A^{NT}} \right)^{\frac{1-\delta}{-\delta}}$$

Take logs:

$$\log\gamma + \log A^T + \frac{1-\gamma}{-\gamma}(\log R - \log(1-\gamma) - \log A^T)$$
$$= \log p^N + \log\delta + \log A^{NT} + \frac{1-\delta}{-\delta}\left(\log R - \log p^{\mathrm{N}} - \log(1-\delta) - \log A^{NT}\right)$$

Collect the terms:

$$\log p^N \left(1 - \frac{1-\delta}{-\delta}\right) = \log A^T \left(1 - \frac{1-\gamma}{-\gamma}\right) - \log A^{NT} \left(1 - \frac{1-\delta}{-\delta}\right)$$
$$+ \left(\log R \left(\frac{1-\gamma}{-\gamma} - \frac{1-\delta}{-\delta}\right) + \log\gamma - \frac{1-\gamma}{-\gamma}\log(1-\gamma) - \log\delta + \log\frac{1-\delta}{-\delta}\log(1-\delta)\right)$$

$\log p^N \left(\frac{1}{\delta}\right) = \log A^T \left(\frac{1}{\gamma}\right) - \log A^{NT} \left(\frac{1}{\delta}\right) + c$, where *R* is given and *c* is a constant equal to:

$$\left(\log R \left(\frac{1-\gamma}{-\gamma} - \frac{1-\delta}{-\delta}\right) + \log\gamma - \frac{1-\gamma}{-\gamma}\log(1-\gamma) - \log\delta + \log\frac{1-\delta}{-\delta}\log(1-\delta)\right).$$

$$\log p^N = c\delta + \log A^T \left(\frac{\delta}{\gamma}\right) - \log A^{NT}$$

Differentiate this expression to find the Balassa-Samuelson equation (7):

$$(\log p^N)' = \left(\log\left(\frac{P^{NT}}{P^T}\right)\right)' = \Delta\frac{P^{NT}}{P^T} = \Delta p^{NT} - \Delta p^P; \text{ and}$$

$$\left(c\delta + \log A^T \left(\frac{\delta}{\gamma}\right) - \log A^{NT}\right)' = 0 + \left(\frac{\delta}{\gamma}\right)\Delta a^T - \Delta a^{NT}$$

Therefore,

$$\Delta p^{NT} - \Delta p^T = \left(\frac{\delta}{\gamma}\right)\Delta a^T - \Delta a^{NT} \quad (7)$$

Where lower-case letters denote logarithms and Δa^T and Δa^{NT} are growth rates of total factor productivity in the traded and non-traded goods sectors.[44]

[44] Klau, Marc; Mihaljek, Dubravko, *The Balassa-Samuelson Effect in Central Europe: a disaggregated analysis*. Bank for International Settlements. April 2004.

To see the link with the real effective exchange rate, we first define aggregate prices both at home and abroad (foreign prices are indicated by "*"):

$$p = \alpha p^{NT} + (1-\alpha)p^{T} \tag{8}$$

$$p^{*} = \alpha p^{NT^{*}} + (1-\alpha)p^{T^{*}} \tag{8'}$$

where lower-case letters denote logarithms, p^{T} represents the price of tradable goods, p^{NT} represents the price of non-tradable goods and α represents the share of non-tradable goods in the economy.

The real effective exchange rate is defined as:

$$q = \frac{E \cdot P}{P^{*}}$$

where E represents the nominal exchange rate, P represents domestic prices, and P^{*} represents international prices. Taking logarithms gives:

$$\log q = \log\left(\frac{E \cdot P}{P^{*}}\right)$$

$$\log q = \log E + \log P + \log 1 - \log P^{*}$$

$$\log q = \log E + \log P + 0 - \log P^{*}$$

$$\log q = \log E + \log P - \log P^{*}$$

$$q = e + p - p^{*} \tag{9}$$

where lower-case letters denote logarithms. Substituting equations (8) and (8') into equation (9) gives equation (10):

$$q = e + (\alpha p^{NT} + (1-\alpha)p^{T}) - \left(\alpha p^{NT^{*}} + (1-\alpha)p^{T^{*}}\right)$$

$$q = e + \alpha p^{NT} + (1-\alpha)p^{T} - \alpha p^{NT^{*}} - (1-\alpha)p^{T^{*}}$$

$$q = e + \alpha p^{NT} + p^{T} - \alpha p^{T} - \alpha p^{NT^{*}} - p^{T^{*}} + \alpha p^{T^{*}}$$

$$q = \left(e + p^{T} - p^{T^{*}}\right) + \alpha\left[(p^{NT} - p^{T}) - \left(p^{NT^{*}} - p^{T^{*}}\right)\right] \tag{10}$$

We notice that the term $\left(e + p^{T} - p^{T^{*}}\right)$ is the real effective exchange rate (*q)* in the traded goods sector and $\left[(p^{NT} - p^{T}) - \left(p^{NT^{*}} + p^{T^{*}}\right)\right]$ represents the relative price of non-tradable to tradable goods both at home and abroad.

Given the law of one price, $\left(E \cdot P^{T} = P^{T^{*}}\right)$, in log terms and in changes in the traded goods sector, then:

$$\log E = \log\left(\frac{P^{T^{*}}}{P^{T}}\right)$$

$$\Delta e = \Delta p^{T^{*}} - \Delta p^{T}, \text{ or } \Delta p^{T^{*}} = \Delta e + \Delta p^{T} \tag{11}$$

Given equation (11) and putting equation (10) in changes, the first term of equation (10) is equal to zero:

$$\left(\Delta e + \Delta p^{T} - \Delta p^{T^*}\right) = \left(\Delta e + \Delta p^{T} - (\Delta e + \Delta p^{T})\right) = 0$$

Therefore,

$$\Delta q = \alpha\left[(\Delta p^{NT} - \Delta p^{T}) - \left(\Delta p^{NT^*} + \Delta p^{T^*}\right)\right].$$

Given that α is a constant, we notice that the real effective exchange rate is an approximation for the relative price of non-traded to traded goods: [45]

$$q \approx \Delta p^{NT} - \Delta p^{T} \qquad (12)$$

[45] Klau, Marc; Mihaljek, Dubravko. *The Balassa-Samuelson Effect in Central Europe: a disaggregated analysis*. Bank for International Settlements. April 2004, page 2-3; OECD Publications. *Trade and Competitiveness in Argentina, Brazil and Chile: Not as Easy as A-B-C.* 2004, page 48.

ANNEX 4. DATA USED IN THE CALCULATION OF THE BALASSA-SAMUELSON EFFECT FROM THE OECD SYSTEM OF UNIT LABOUR COST AND RELATED INDICATORS

Slovak Republic

	Labour productivity per person employed (level) - Industry	Labour productivity per person employed (level) - Market Services	Consumer Price Index - Services less housing (index form, base year 2000 = 100)	Producer Price Index - Industry (index form, base year 2000 = 100)	Real effective exchange rate (index form, base year 2000 = 100)
1995	334,325.80	433,461.84	52.11	78.40	86.10
1996	363,919.97	390,780.78	55.12	81.60	85.92
1997	337,358.75	459,176.67	58.99	85.30	90.76
1998	382,211.71	452,581.50	64.05	88.00	91.84
1999	418,245.87	452,623.49	79.51	91.40	90.65
2000	424,245.94	443,975.49	100.00	100.00	100.00
2001	450,849.05	447,738.86	114.17	106.40	101.21
2002	462,456.82	431,871.02	119.32	108.60	102.51
2003	546,267.50	422,339.15	139.36	117.60	115.56
2004	601,768.55	435,919.82	157.91	121.70	126.54
2005	703,040.43	393,562.74	169.60	127.40	129.66
2006	771,943.27	432,557.68	185.10	138.10	136.60
2007			191.52	140.90	150.58

Source: OECD System of Unit Labour Cost and Related Indicators; OECD Main Economic Indicators.

Hungary

	Labour productivity per person employed (level) - Industry	Labour productivity per person employed (level) - Market Services	Consumer Price Index - Services less housing (index form, base year 2000 = 100)	Producer Price Index - Industry (index form, base year 2000 = 100)	Real effective exchange rate (index form, base year 2000 = 100)
1995	2,278,196.48	3,007,854.14	45.44	51.90	88.69
1996	2,365,995.80	3,029,653.71	57.36	63.43	89.58
1997	2,588,847.66	3,072,650.40	68.34	76.81	95.11
1998	2,666,135.12	3,255,633.74	79.43	85.57	95.79
1999	2,812,528.24	3,097,882.37	91.21	89.76	98.61
2000	3,033,945.98	3,065,992.95	100.00	100.00	100.00
2001	3,000,538.18	3,182,274.52	109.78	105.72	108.16
2002	3,073,480.39	3,362,166.35	116.77	104.38	119.16
2003	3,390,313.35	3,439,994.47	125.79	105.47	121.74
2004	3,652,530.48	3,544,837.21	133.01	109.27	129.73
2005	3,878,031.28	3,628,138.44	140.33	112.46	132.34
2006	4,118,109.73	3,818,141.06	146.09	119.78	126.16
2007			156.86	119.61	140.77

Source: OECD System of Unit Labour Cost and Related Indicators; OECD Main Economic Indicators.

Czech Republic

	Labour productivity per person employed (level) - Industry	Labour productivity per person employed (level) - Market Services	Consumer Price Index - Services less housing (index form, base year 2000 = 100)	Producer Price Index - Industry (index form, base year 2000 = 100)	Real effective exchange rate (index form, base year 2000 = 100)
1995	335,556.48	393,012.66	65.26	81.75	83.64
1996	352,581.36	395,129.14	73.24	85.73	89.10
1997	342,625.69	413,270.07	81.66	90.01	90.67
1998	324,697.66	430,337.22	91.04	94.39	99.36
1999	376,733.99	427,549.59	95.49	95.35	98.01
2000	417,354.02	427,450.86	100.00	100.00	100.00
2001	405,427.52	453,249.76	107.51	102.81	106.71
2002	425,471.36	455,551.51	113.03	102.25	118.51
2003	434,329.65	487,311.43	115.24	101.92	115.92
2004	489,574.06	485,681.33	122.05	107.72	116.72
2005	534,781.49	507,675.90	127.42	110.99	123.78
2006	612,031.86	509,801.18	133.04	112.72	130.52
2007			135.84	117.32	134.04

Source: OECD System of Unit Labour Cost and Related Indicators; OECD Main Economic Indicators.

Poland

	Labour productivity per person employed (level) - Industry	Labour productivity per person employed (level) - Market Services	Consumer Price Index - Services less housing (index form, base year 2000 = 100)	Producer Price Index - Industry (index form, base year 2000 = 100)	Real effective exchange rate (index form, base year 2000 = 100)
1995	32,070.33	53,324.16	52.65		79.09
1996	34,800.40	55,368.52	63.75	72.45	84.82
1997	38,107.68	54,829.29	73.79	81.50	87.84
1998	39,873.49	54,101.41	83.51	87.59	93.33
1999	44,280.08	59,626.20	91.50	92.67	90.66
2000	50,079.24	63,486.76	100.00	100.00	100.00
2001	51,633.65	63,922.34	105.32	101.76	112.87
2002	53,563.13	66,962.57	107.79	102.84	107.72
2003	58,680.90	67,663.54	108.53	105.50	95.55
2004	64,367.05	70,890.26	110.73	112.96	94.61
2005	66,154.72	72,452.25	112.30	113.74	105.79
2006	71,905.81	74,258.18	112.79	116.31	108.06
2007			114.00	118.88	111.64

Source: OECD System of Unit Labour Cost and Related Indicators; OECD Main Economic Indicators.

Euro area

	Labour productivity per person employed (level) - Industry	Labour productivity per person employed (level) - Market Services	Consumer Price Index - Services less housing (index form, base year 2000 = 100)	Producer Price Index - Industry (index form, base year 2000 = 100)	Real effective exchange rate (index form, base year 2000 = 100)
1995	44931.80	42270.70	90.18	94.61	123.5
1996	45600.16	42495.76	92.8	94.96	122.32
1997	47321.80	43026.46	95.09	95.99	111.81
1998	48147.24	43220.84	97.02	95.39	114.9
1999	49365.00	43187.13	98.54	95	110.94
2000	51575.72	43494.06	100	100	100
2001	52205.23	43567.83	102.5	102.06	101.85
2002	52861.13	43556.31	105.72	101.95	105.67
2003	53766.96	43663.48	108.44	103.4	118.41
2004	55950.57	43926.65	111.27	105.76	122.49
2005	57267.64	44231.30	113.79	110.13	120.21
2006	59473.62	44539.20	116.07	115.79	119.79
2007			118.96	119.07	122.59

Source: OECD System of Unit Labour Cost and Related Indicators; OECD Main Economic Indicators.

United States

	Labour productivity per person employed (level) - Industry	Labour productivity per person employed (level) - Market Services
1995	62,980.64	55,262.85
1996	64,575.87	56,894.87
1997	66,771.45	58,925.94
1998	70,599.96	61,975.26
1999	75,237.30	63,616.21
2000	79,196.92	64,504.78
2001	79,539.96	66,253.83
2002	85,750.96	66,944.87
2003	89,216.54	67,893.31
2004	96,577.47	69,929.88
2005	98,227.33	71,614.67
2006	99,582.66	73,971.20

Source: OECD System of Unit Labour Cost and Related Indicators

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