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MAIN SOURCES FOR QUARTERLY LABOUR PRODUCTIVITY DATA FOR THE EURO AREA

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Abstract

In its Monthly Bulletin, the European Central Bank (ECB) publishes highly aggregated euro area labour productivity growth data based on ESA 95 national accounts data. The productivity data are currently available on a quarterly basis for the whole economy and for six main economic activities. The paper provides an overview of the sources and methods behind these euro area productivity growth estimates. It also compares the national accounts based estimates with supplementary productivity measures for the euro area that may be obtained from other sources (e.g. monthly Short-Term Statistics). Finally, the paper discusses future developments in euro area statistics that are likely to improve the quality and international comparability of euro area productivity growth estimates.

1. Introduction

Labour productivity and its measurement is an important issue for the European Central Bank (ECB). Growth in productivity is key for non-inflationary growth. In addition to structural (annual) data, the ECB requires relatively highly aggregated and timely data on productivity growth for purposes of short-term economic analyses. The ECB has for several years calculated euro area productivity estimates and published them in the ECB Monthly Bulletin. The calculation used is GDP per person employed taken from the ESA95 national accounts. This calculation is acknowledged to be a less than perfect measurement but reflects the scarcity of other suitable data for the euro area, fulfilling, in particular, the timeliness requirement. Furthermore, the ECB uses a number of supplementary euro area productivity indicators from both quantitative and qualitative surveys which are explained in this note.

The next section of this paper describes the current calculation of quarterly labour productivity data in the ECB. Section 3 describes the rationale underlying the choice of data. Section 4 gives an overview of some ancillary productivity data sources that are used within the ECB for short-term analysis. The concluding section explains some ongoing and expected improvements in data quality which will also help improving labour productivity estimates.[1]

2. Current calculation and results

The ECB currently calculates quarterly labour productivity data using national accounts series and using the following formula.

Labour productivity = GDP at constant prices / Number of people in employment (domestic definition)[2]

While the quarterly GDP volume data are available directly from Eurostat for the euro area and for all euro area countries, the labour input data are not available with the timeliness required.[3] Therefore, the ECB calculates its own estimate of employment[4] which becomes available about 75 days after the end of the reference quarter. This is about 30 days ahead of Eurostat's employment estimates, which are published as part of the second regular release of euro area and EU quarterly national accounts (QNA). The ECB estimation process for this is described below.

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[1] For analysis of long-term productivity developments in the euro area see *"Labour productivity developments in the euro area: aggregate trends and sectoral patterns"*, ECB Monthly Bulletin July 2004.

[2] Eurostat compiles national accounts for the euro area by summing up the national data after converting them to a common currency. This common currency is the euro from 1999 onwards and the ECU prior to 1999. When this pre-1999 conversion is carried out, variations of exchange rates between the national currency and the common currency may affect the growth rate of each individual component. The aggregated growth rate may diverge from the average of the national growth rates expressed in national currency. To avoid this, the official growth rates are corrected by applying a correction coefficient to the growth rates published by Eurostat for periods before 1999.

[3] For an overview of the ECB requirements in this field see also *"Review of the requirements in the field of General Economic Statistics"*, ECB December 2004.

[4] Estimates are calculated for Total employment, self employment and employees and broken down by NACE A6.

Compiling a euro area employment index

Where quarterly employment data are directly available from Member States, they are used for euro area aggregation. Data are taken in the following order of preference according to availability:

1) Quarterly, seasonally adjusted;

2) Quarterly, non-adjusted;

3) Interpolated annual data.

Only annual data are available for Portuguese data; annual data supplement quarterly data for Ireland (prior to 1997). Where data are not available from a particular Member State in a seasonally adjusted form, the ECB makes its own adjustment using the seasonal adjustment programme Census X-12 ARIMA..

Table 1: Timeliness and availability of QNA employment estimates

	Timeliness 2005q1[1]	**Availability**
Euro area	74	1991q1-2005q1
Belgium	160	1981q1-2005q1
Germany[5]	54	1991q1-2005q2
Greece	n/a	n/a
Spain	56	1980q1-2005q2
France	50	1978q1-2005q2
Ireland	126	1998q1-2005q2
Italy	71	1970q1-2005q2
Luxemburg	111	1995q1-2005q1
Netherlands	42	1987q1-2005q2
Austria	74	1988q1-2005q1
Portugal	n/a	n/a
Finland	70	1975q1-2005q2

Source: ECB and Eurostat data

[1] *Days after end of the quarter that data were available to the ECB.*

Aggregation to a euro area aggregate is then performed using a weighted average of quarter-on-quarter growth rates. The weights used are calculated annually for each series as the contribution of the indicator/breakdown to the euro area total for the same indicator/breakdown. At each observation the euro area weight is built-up as the sum of the country weights where data exist, and the index is calculated only for observations where this weight is above 80% (this is only a factor at the end of the series - most of the series is calculated using in excess of 90% weight). For the final two observations, the growth rate of the last available data is replicated for countries where data are missing provided actual data coverage is higher than 80%. This admittedly simple extrapolation procedure has proven to yield satisfactory results, as employment growth rates tend to show little short-term volatility.

[5] German employment data have been extended historically using West German employment series and break adjusting them in 1991. The historical series is created by applying the annual percentage changes of the West German series to the 1991 unified German data. The resultant series is also used to estimate historical euro area data back to 1980.

The aggregation is then performed as the sum of the (country quarterly growth rates * annually changing country weights) / total available euro area weight. From these aggregated growth rates, an index is created based on the latest year where data are available for Member States.

Deriving a euro area employment level series

An annual aggregate is calculated using the available country data in the following order of preference:

1) average of the four quarters of non-adjusted quarterly data;

2) average of the four quarters of seasonally adjusted quarterly data;

3) annual data.

From the latest available annual average figure we apply the index created above. Furthermore, as the aggregation is made from the available seasonally-adjusted country data for each breakdown, the procedure above leaves some small accounting inconsistencies. To ensure accounting identities, a balancing procedure is used and the inconsistencies are allocated in proportion to the size of the non-balanced data.

Results

Using the above calculations, per head labour productivity results are available around 75 days, with a breakdown by six main economic activities. Table 2 provides an overview of the most recent euro area labour productivity growth figures as published in the ECB's Monthly Bulletin (October 2005).

Table 2: Euro area labour productivity growth (annual percentage changes)

		By economic activity					
	Total	Agriculture, hunting, forestry and fishing	Mining, manufacturing and energy	Construction	Trade, repairs, hotels and restaurants, transport and communication	Financial, real estate, renting and business services	Public administration, education, health and other services
2001	0.3	-0.8	1.4	0.3	1.2	-1.4	0.4
2002	0.1	1.6	1.5	-0.2	0.6	-1.2	-0.1
2003	0.5	-2.2	2.0	0.3	0.1	0.0	-0.1
2004	1.2	8.6	3.4	0.1	0.8	-0.8	0.8
2004 Q2	1.6	8.9	4.8	0.8	1.1	-0.5	1.2
Q3	1.2	10.5	4.0	-1.3	0.5	-0.9	0.8
Q4	0.7	8.9	1.7	-0.7	1.3	-1.0	0.5
2005 Q1	0.6	2.6	2.2	-2.3	2.0	-0.4	-0.4
Q2	0.4	1.7	2.1	-0.8	1.2	-0.5	-0.7

Source: ECB calculations based on Eurostat data, seasonally adjusted data.

3. Overview of the sources and methodology

a) Output component

For the output component, the ECB estimate draws on euro area aggregate quarterly national accounts published by Eurostat. National accounts data are compiled according to the accounting definitions and methodology adopted in the ESA95 Regulation[6]. Member States submit national accounts data to Eurostat. On the basis of the available quarterly and annual information in the Member States, Eurostat estimates European quarterly national accounts (QNA) aggregates.

The flash estimate covers EU and euro area quarterly GDP volume growth within 45-48 days after the end of the reference quarter. The first release which contains i.a. constant prices value added and its A6 activity breakdown is published 65 days after the end of the reference quarter and is used for the first productivity estimates. As not all euro area Member States publish quarterly results with the same timeliness, Eurostat has to use an estimation procedure. Most countries comply or are close to complying with the legal deadline of t+70 days. The methodology is based on a temporal disaggregation technique, which assumes that the relationship valid on an annual level between the euro area total and the total of available Member States is also valid on a quarterly basis.

The principle for compiling the main QNA aggregates for the EU and the euro area is the same for the three releases. The only difference is the amount of available quarterly information. The coverage reaches for example approximately 84%, and 97% of euro area GDP for the flash and first releases.

It should be noted that the ECB's headline figures refer to the whole economy, so including the government sector. As the latter represents a non-negligible part of the economy (around 12% of the euro area value added), not including it may present a misleading picture. Ideally, the whole economy measure should be broken down by business and government sectors, but in the absence of quarterly volume (and employment) data by institutional sector this is not possible.[7]

b) Labour input component

As they are the most comparable and exhaustive measure of employment available, national accounts employment measures are considered best suited for international comparisons. Moreover, their definition is consistent with output data. Labour productivity is usually calculated either in terms of output per person employed or output per hour worked. The latter measure is considered more appropriate since the development of output per person employed is also influenced by the number of hours worked. Over an extended period, given the increasing importance of part-time work, the use of output per person employed is likely to lead to a downward bias of productivity growth and level figures in the euro area.

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6 Council Regulation (EC) No 2223/96 of 25 June 1996, published in the Official Journal L310 of 30/11/1996. Council and European Parliament Regulation (EC) No 1267/2003, published in the Official Journal L180/1 of 18/07/2003.

7 Furthermore, unlike productivity estimates publised for the US economy, the euro area GDP numbers are not adjusted for the implicit value added component of owner-occupied housing (for which no corresponding measure of the labour input measure is recorded in the accounts to reflect house owners work on maintaining their houses). However, this effect is not likely to matter significantly for short-term analysis.

Chart 1 below compares quarter-on-quarter labour productivity growth per hour and per person employed for Germany, for which over the last three years, labour productivity per hour was on average 0.1 percentage point higher. This suggests that the difference between per person and per hours based measures tends to be small in the short-term, but the use of hours worked based measures are important for longer term comparisons. Moreover, hours worked based measures are important for a detailed analysis at industry level, when contractual working arrangements are changed.

Source: ECB calculations based on Eurostat data.

An additional issue regards the comparability of international data on hours worked. Currently, harmonisation and revision of this data is foreseen in the forthcoming revisions of SNA, ESA and ILO/ICLS resolutions. In particular, harmonisation in the recording of, amongst others, time spent on education and training, stand-by time, travelling, home office work, on-call work, rest periods and absences is needed. Additionally, the need to accommodate labour market changes and to clarify borderline cases related to modern work arrangements (home office work, flexible working hours etc.) will need to be examined.

An OECD investigation[8] has shown that there is a difference between the SNA 93 definition of employment and that of the ESA 95. The SNA seems to give priority to the concept of jobs, rather than the concept of persons while the ESA recommends the use of persons and additionally gives more precise definitions of employment. This has led to a situation with most European countries favouring the employment concept, while data for other countries e.g. the United States and Japan are often presented in terms of the number of jobs. This again supports the use of employment data expressed as a volume

[8] Employment and hours worked data in the national accounts (François Lequiller, OECD) October 2004.

measure (i.e. hours worked). However, to date, no official data exist for euro area total hours worked[9] although data was foreseen to be published from all Member States by end 2004 as a result of an amendment to the ESA Regulation[10].

An additional aspect that is not considered in the ECB quarterly estimate is the issue of labour quality. Labour quality is of concern in a more structural analysis of productivity development[11]. The quality of input from one employee differs from another and this is not captured in the current productivity data. Factors that will determine this input level include personal characteristics of persons employed, such as average educational attainment and experience in the labour market. Labour quality evolves over time and in response to changing labour market conditions. As a result, the euro area stock of human capital and the associated returns to human capital also change over time, thus contributing to changes in labour productivity. Best practice in the area of productivity measurement suggests that changes in labour quality should be taken into account by using a quality-adjusted number of hours actually worked as a measure of labour input.

4. Other short-term productivity measures

While national accounts based data are considered the main productivity indicators for the ECB, other supplementary information is also used, particularly if the extra data are available with a higher frequency, better timeliness or more detail. There are two principal sets of these supplementary data. Data which can be constructed from the variables collected in the Short Term Statistics Regulation (STS) and data produced by NTC Research – the PMI productivity indices.

a) STS based results per person employed

STS data represent the timeliest and most detailed set of indicators for output, prices and the labour market for industrial activity. Labour productivity growth can be analysed on the basis of the industrial production index and the index of employment. These data are compiled using the methodology detailed in the STS Regulation, based on business surveys, and are available by Main Industrial Groupings (MIGs) and by NACE divisions. The euro area industrial production index is of a monthly frequency and released at about t+45 days. The index of employment is released at a monthly frequency for Germany, Italy, Belgium, Austria, Portugal and Luxembourg, while the other euro area countries only have quarterly information on employment. Consequently, quarterly euro area aggregates for employment are currently only released on a quarterly basis by Eurostat, after about t+48 days, i.e. as soon as coverage of 60% is reached (as for other STS statistics).

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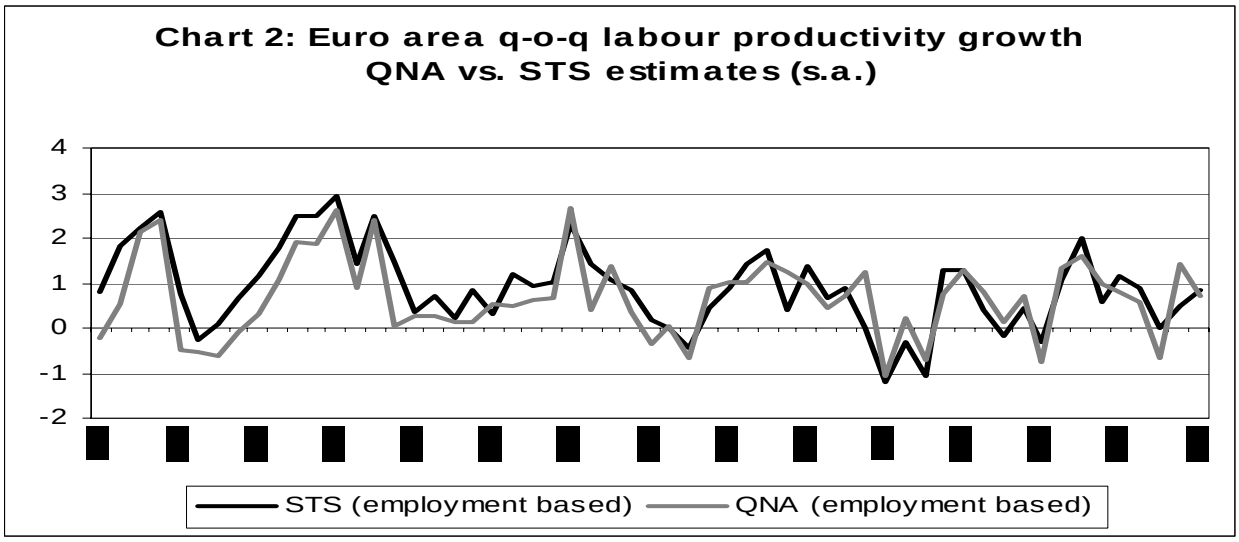
[9] An important issue for this data when it becomes available will be the ESA requirement for data on hours *actually* worked. While data on hours remunerated is relatively simple to collect the amount of unpaid overtime worked is much more difficult.

[10] Council Regulation (EC) 1267/2003 of 16 June 2003 , OJ N° L 180 of 18 July 2003 , pp.1.

[11] See the Box "*Developments in euro area labour quality and implications for labour productivity growth*", scheduled for publication in ECB Monthly Bulletin October 2005.

Chart 2 shows a comparison of seasonally adjusted quarter-on-quarter euro area labour productivity growth in industry based on Short-term Statistics and Quarterly National Accounts data[12]. It is clear from the graph that, at least for industry, STS derived labour productivity data can serve as reasonable approximation of QNA derived data. The average difference between the two series over the last three years is 0.1 percentage point (p.p.), while it is -0.1 p.p. over the last four quarters (the average absolute difference is 0.4 p.p. and 0.6 p.p. respectively).



Source: ECB calculations based on Eurostat data.

In order for STS data to be really useful as a supplementary labour productivity, improvements are needed, particularly for the index of employment, which should ideally become a timely monthly indicator[13] allowing also improved country coverage for the euro area aggregate. Furthermore, it should be noted that while at a euro area aggregate level STS labour productivity data appear to be a good proxy of the corresponding QNA data, the story may be somewhat different at an individual country level. Some countries benchmark STS against national accounts data and consequently show no difference, while other countries benchmark STS against structural business statistics (SBS) or do not benchmark at all.

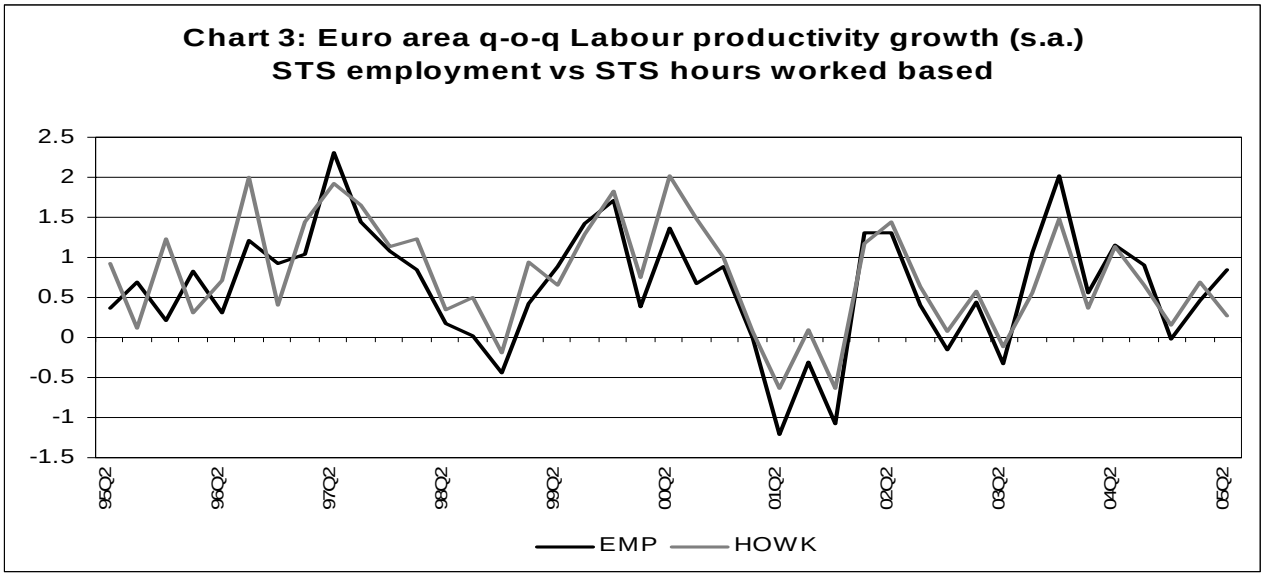
b) STS based results per hour worked

In addition to the index of employment, STS data are also available as an index of hours worked. The latter is also released by Eurostat for the euro area at quarterly frequency (again, with only Germany, Italy, Belgium, Austria, Portugal and Luxembourg publishing monthly information) after about t+48 days.

[12] For more information on methodological differences, see *"Benchmarking of Short-term statistics with other sources: what is available and an empirical comparison with quarterly national account,"* R. Barcellan and E. Mazzucato (Eurostat).

[13] Also in the amended STS Regulation (Regulation (EC) No 1158/2005 of 6 July 2005 amending Regulation (EC) No 1165/98), the reference period remains at least a quarter. The delay in which countries have to deliver STS employment data to Eurostat has been reduced from three to two months (+15 days for Member States whose value added represents less than 3%)of the EU total.

Chart 3 compares seasonally adjusted quarter-on-quarter euro area labour productivity growth in industry based on STS employment and STS hours worked data. It is clear that both series describe largely the same evolution. Over the last three years, the average difference was approximately zero, while it was 0.1 p.p. in the last four quarters (the average absolute difference was 0.2 p.p. and 0.3 p.p. respectively).



Source: ECB calculations based on Eurostat data.

c) PMI productivity index

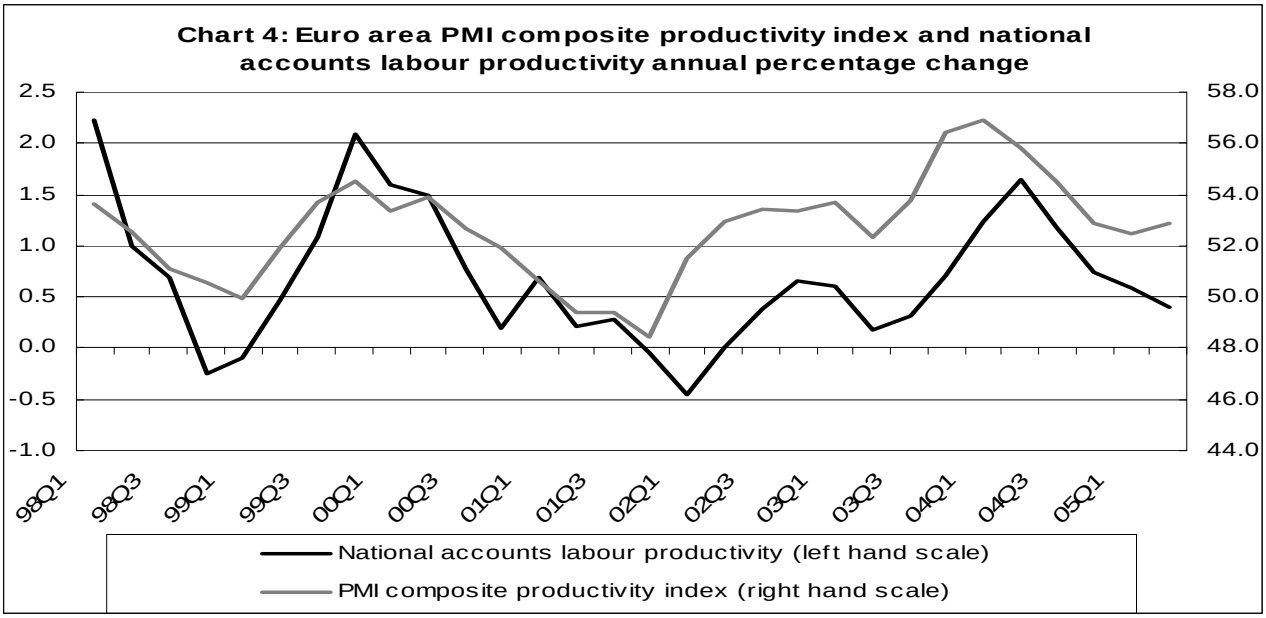
The NTC Research Productivity Index for the euro area is derived from data collected from NTC Research's panels of companies that participate in the Purchasing Managers' Index (PMI) surveys of business conditions across Europe. It is the timeliest indicator for euro area productivity developments.

NTC analyses the output and employment data for each survey respondent to produce a single figure measure of the rate of change of each company's productivity. The information for each company is then combined using a weighting system relating to company size, thus to produce an overall "diffusion" index for each sector. These indexes vary between 0 and 100, with levels of 50.0 signalling no change on the previous month. Readings above 50.0 signal an improvement or increase on the previous month. Readings below 50.0 signal deterioration or decrease on the previous month. The greater the divergence from 50.0, the greater the rate of change signalled. The indexes are seasonally adjusted. The national data are weighted together with weights determined by GDP in order to form euro area and European Union indicators.

Data are available at a monthly frequency from January 1998 and are published around 15 days after the month in question. The series cover the manufacturing and service sectors, excluding the public sector. Services are further broken down into separate indices for financial services, business-to-business services, IT and computing, travel and transport, communications, hotels, restaurants and catering and all consumer services. However, the available details for the "manufacturing" and "services" aggregates are not fully consistent with official statistics. For example, "diversified financial services" and the manufacturing of "luxury consumer goods" are not available from official statistics. For the euro area,

the total and the split for manufacturing and services are available. Underlying data for manufacturing are collected from eight of the euro area countries (representing around 92% of euro area GDP; for services, five euro area countries are covered, representing around 80% of euro area GDP).

As Chart 4 shows, the index has historically shown good leading indicator properties for euro area industrial productivity trends, although changes can sometimes be misleading (perhaps due to the relatively small sample) and therefore need to be used with caution.



Source: ECB calculations based on Eurostat and NTC data.

5. Future developments

This section highlights the main ongoing and future developments in the source data that the ECB uses to calculate labour productivity. These are likely to allow for higher quality estimates to be produced in the future.

- National accounts output measures

In the course of 2005 and 2006 euro area and EU Member States' ESA 95 national accounts data undergoes major changes[14] as a result of the introduction of (i) chain-linking of annual and quarterly series at constant prices, (ii) a new treatment of financial services indirectly measured (FISIM) and (iii) new methods for compiling government output, as well as benchmark revisions. These changes improve both the quality of the national accounts and the international comparability, particularly with the US where similar practices have already been in place since the late 1990s. They will be introduced in Member States' national accounts on a staggered basis up to the end of 2006. Eurostat plans to begin

[14] For more information, see Box *6 "Major changes in euro are and Member States' national accounts"* in the ECB's Monthly Bulletin June 2005.

presenting chain-linked volume measures for the annual and quarterly European aggregates with the first regular release for the third quarter of 2005 on 30 November 2005, when it will have sufficient coverage of Member States' annual and quarterly national accounts. With the same release, Eurostat plans to implement the allocation of FISIM in both annual and quarterly European aggregates.

- Improved availability of hours worked data

As mentioned in Section 3, a further expected improvement will be the availability of a quarterly euro area aggregate of hours worked data. This data are presently only available from three euro area countries (Germany, the Netherlands and Finland) but a full coverage of the euro area is one of the priorities for improving European statistics. Initial ECB investigations suggest that hours data taken from labour force surveys are not reliable proxies as they tend to overestimate hours worked. The provision of hours worked data in the national accounts - an integrated system of factor input and output – is therefore crucial.

- Short-term Statistics

Our review of the available sources for short-term euro area labour productivity growth indicators has shown that STS based euro area labour productivity indicators can complement the corresponding QNA based indicators, with valuable supplementary information. However, there is still considerable room for improvement in order for these STS based indicators to meet ECB user requirements. These improvements mainly relate to both euro area index of employment and index of hours worked becoming monthly series with an improved timeliness and improved country coverage.

- Improved timeliness of quarterly labour productivity data

Both quarterly GDP volume growth and quarterly employment estimates are Principal European Economic Indicators (PEEIs). PEEIs cover a broad range of (non-financial) macroeconomic statistics for which tight production deadlines are set out to reach standards of availability and timeliness comparable to those of the US. At present, the timeliness standard of 45 days after the reference period has been met for euro area quarterly whole economy GDP volume growth. A similar objective for quarterly employment estimates has not yet been reached (current delay for ECB calculated data: 75 days). Eurostat is planning to publish early employment estimates for the first time in 2006 with a timeliness of around t+55 days, which would allow for the publication of quarterly labour productivity growth estimates within the same delay.

- Accounting for labour quality

In the longer-term, it is hoped that more work will be possible on adjusting the estimates to account for labour quality. An ongoing source for these data in the euro area may be the continuous Labour Force Survey which is expected to start giving quarterly euro area data from the first quarter of 2005. One problem that will need to be overcome for this aspect is the integration of the data from this source with ESA national accounts sources. The ECB considers that a regular compilation of annual national accounts including employment by educational level, age group and gender (and by industry) to be an area for further work.

6. Conclusions

The ECB is using euro area productivity data from three sources. The main source is national accounts, with results per person employed. Short-term statistics sources are valuable as they provide more detailed and timely information, which have proven to be a reliable early indicator as regards the direction of productivity changes, however differences in derived growth rates may be sizeable. The most important improvement required by the ECB for euro area productivity estimates concern the availability of hours worked data from national accounts, and better timeliness of national accounts and short-term statistics data. Moreover, in the medium and longer term more statistical information as regards the composition and quality of labour input is desirable in order to support structural analysis of productivity growth and levels.