9. MAIN SOURCES OF QUARTERLY LABOUR PRODUCTIVITY DATA FOR THE EURO AREA

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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 short-term economic analysis. The ECB has for several years calculated euro area productivity estimates and published them in its Monthly Bulletin. The calculation used is GDP per person employed, taken from the European System of Accounts 1995 (ESA95) national accounts. While this calculation is acknowledged to be a less than perfect measurement, there is a scarcity of other suitable data for the euro area, especially data fulfilling the timeliness requirement. The ECB also 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 at the ECB. The third section describes the rationale underlying the choice of data. The fourth section gives an overview of some ancillary productivity data sources used by the ECB for short-term analysis. The concluding section explains some ongoing and expected improvements in data quality which will help to improve labour productivity estimates.

Current calculation and results

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

\[ \text{Labour productivity} = \frac{\text{GDP at constant prices}}{\text{Number of people in employment}} \]

Any views expressed are only those of the authors and do not necessarily represent the views of the ECB.

For analysis of long-term productivity developments in the euro area see the article entitled “Labour productivity developments in the euro area: aggregate trends and sectoral patterns”, in the July 2004 issue of the ECB’s Monthly Bulletin.

3 Eurostat compiles national accounts for the euro area by converting the national data to a common currency and summing them. This common currency is the euro from 1999 onwards and the ECU prior to 1999. When the pre-1999 conversion is carried out, variations in exchange rates between the national currencies and the common currency may affect the growth rates of the individual components. The aggregated growth rate may therefore diverge from the average of the national growth rates expressed in national currency. To avoid this, a correction coefficient is applied to the growth rates published by Eurostat for periods before 1999.
While the quarterly GDP volume data are available from Eurostat for the euro area and for all euro area countries, the labour input data are not available with the timeliness required. The ECB therefore calculates its own estimate of employment, 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’s estimation process is described below.

**Compiling euro area employment indices**

The ECB compiles its euro area employment indices on the basis of quarterly employment data provided by the individual countries, insofar as they are available. Data are taken in the following order of preference according to availability:

1. quarterly, seasonally adjusted
2. quarterly, non-adjusted
3. interpolated annual data

For Portugal, only annual data are available; for Ireland, annual data supplement quarterly data (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 programme Census X-12 ARIMA.

**T 9 – 1 Timeliness and availability of QNA employment estimates**

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<td>Germany*</td>
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<tr>
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<tr>
<td>Finland</td>
<td>70</td>
<td>Q1 1975–Q2 2005</td>
</tr>
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</table>

Source: ECB and Eurostat; 1 Number of days after the end of the quarter when data became available to the ECB.

* German employment data have also 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.

For an overview of the ECB’s requirements in this field see also “Review of the requirements in the field of General Economic Statistics”, ECB, December 2004.

Estimates are calculated for total employment, self-employment and employees, and broken down on the basis of NACE A6.
Euro area aggregates are then calculated using a country weighted average of quarter-on-quarter growth rates of individual countries. The weights used are calculated annually for each index series. At each observation the euro area weight is calculated as the sum of the weights of the countries for which data are available, 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 a weight in excess of 90%). For the latest 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 yielded satisfactory results, with employment growth rates tending to show little short-term volatility.

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 on the basis of the latest year for which national data are available.

**Deriving a euro area employment level series**

An annual aggregate is calculated using the available country data, selected 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

The index created above is applied to the latest available annual average figure. Furthermore, as the aggregation is based on 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 to the respective breakdowns in proportion to the size of the non-balanced data.

**Results**

Using the above calculations, per-head labour productivity figures are available around 75 days after the reference period, with a breakdown by six main economic activities. Table 9–2 provides an overview of the most recent euro area labour productivity growth figures as published in the ECB’s Monthly Bulletin (October 2005).

**Overview of the sources and methodology**

**a) Output component**

For the output component, the ECB estimate draws on euro area aggregate QNAs published by Eurostat. National accounts data are compiled according to the accounting definitions and methodology adopted in the ESA95 Regulation\(^{147}\). Member States submit quarterly and

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The flash estimate gives figures for EU and euro area quarterly GDP volume growth within 45–48 days after the end of the reference quarter. The first release, which includes value added at constant prices 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 countries 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 the countries for which data are available 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 all releases. The flash estimate and the first release cover approximately 96% of euro area GDP.

It should be noted that the ECB’s headline figures refer to the whole economy, i.e. they include the government sector. As the latter represents a non-negligible part of the economy (around 12% of euro area value added), not including it could present a misleading picture. Ideally, the whole economy measure should be broken down into the business and government sectors, but in the absence of quarterly volume (and employment) data by institutional sector this is not possible. Furthermore, unlike productivity estimates published for the US economy, euro area GDP (and productivity) figures are not adjusted for the implicit value added component of owner-occupied housing (for which no corresponding 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.
b) Labour input component

National accounts employment measures are considered the most exhaustive employment measures, as well as best suited for international comparisons. Moreover, their definition is consistent with the output data. Labour productivity is usually calculated in terms of either 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 in euro area productivity growth and level figures. Chart 1 compares quarter-on-quarter labour productivity growth per hour worked and per person employed for Germany. It shows that, over the last three years, labour productivity per hour was on average 0.1 percentage points higher. This suggests that the difference between per-person and per-hour-based measures tends to be small in the short term. Nevertheless, per-hour-based measures are important for longer-term comparisons, as well as for a detailed analysis at industry level when contractual working arrangements are changed.

An additional issue centres on the comparability of international data on hours worked. The harmonisation and revision of such data is foreseen in the forthcoming revisions of the System of National Accounts (SNA), ESA and ILO/ICLS resolutions. Harmonisation is particularly needed in the recording of, among other things, time spent on stand-by,
education and training, travelling, home office work, on-call work, rest periods, and absences. Additionally, the need to accommodate labour market changes and to clarify borderline cases related to modern work arrangements (such as home office work and flexible working hours) will need to be examined.

There is a certain difference between the SNA93 definition of employment and that of the ESA95. 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. This has led to a situation where most European countries favour the persons concept, while countries such as the United States and Japan often present data in terms of the number of jobs. This again supports the use of labour input data expressed as hours worked. To date, however, no official data exist for euro area total hours worked, although data should have been published by all Member States by end-2004 as a result of an amendment to the ESA Regulation.

In addition, an 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. The quality of input of one employee differs from that of another, which is not captured in the current productivity data. Factors that will determine this input level include personal characteristics of employees, such as 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.

Other short-term productivity measures

While national accounts-based data are considered the main productivity indicators for the ECB, 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 under the Short-Term Statistics (STS) Regulation and data produced by NTC Research, i.e. the purchasing managers’ indices (PMI) on productivity.
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 has a monthly frequency and is released at about t+45 days. The index of employment is released at a monthly frequency for Belgium, Germany, Italy, Luxembourg, Austria, and Portugal, while the other euro area countries provide only quarterly information on employment. Consequently, euro area aggregates for employment are currently released only on a quarterly basis by Eurostat, after about t+48 days, i.e. as soon as the coverage of 60% is reached (as for other STS statistics).

Graph 9–2 shows a comparison of seasonally adjusted quarter-on-quarter euro area labour productivity growth in industry based on STS and QNA data. It is clear from the chart 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 points, while over the last four quarters it is -0.1 percentage points (the average absolute differences are 0.4 percentage points and 0.6 percentage points, respectively).

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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).
In order for STS data to provide really useful supplementary information on labour productivity, improvements are needed. In particular, the index of employment should ideally become a timely monthly indicator\(^\text{155}\), which would also improve country coverage for the euro area aggregate. Furthermore, it should be noted that, while at the 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 released by Eurostat for the euro area at quarterly frequency (again, since only Belgium, Germany, Italy, Luxembourg, Austria, and Portugal publish monthly information) after about \(t+48\) days.

Graph 9–3 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 in the last four quarters it was 0.1 percentage points (the average absolute differences were 0.2 percentage points and 0.3 percentage points, respectively).

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155 The amended STS Regulation (Regulation (EC) No 1158/2005 of 6 July 2005 amending Regulation (EC) No 1165/98) still has a reference period of 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).
c) PMI productivity index

The NTC Research productivity index for the euro area is derived from data collected from panels of companies that participate in the 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 in each company’s productivity. The information for each company is then combined using a weighting system based on company size, and an overall “diffusion” index produced for each sector. These indices vary between 0 and 100, with levels of 50.0 signalling no change on the previous month. Readings above 50.0 signal an improvement on the previous month; readings below 50.0 signal deterioration. The greater the divergence from 50.0, the greater the rate of change signalled. The indices are seasonally adjusted. The national data are aggregated 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 (around 80% of euro area GDP).

As graph 9–4 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 interpreted with caution.

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 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’ ESA95 national accounts data are undergoing major changes\(^{156}\) 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

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\(^{156}\) For more information, see the box entitled “Major changes in euro area and Member States’ national accounts” in the June 2005 issue of the ECB’s Monthly Bulletin.
(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 their international comparability, particularly with the United States, where similar practices have 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 presenting chain-linked volume measures for the annual and quarterly EU/euro area 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 is the availability of a quarterly euro area aggregate of hours worked data. These data are presently only available from three euro area countries (Germany, the Netherlands and Finland); however, a full coverage of the euro area is one of the priorities for improving European statistics. Initial ECB investigations suggest that hours worked 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, providing valuable supplementary information.
However, there is still considerable room for improvement before these STS-based indicators meet ECB user requirements in full. Above all, both the index of employment and the index of hours worked for the euro area need to become 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 United States. At present, the timeliness standard of 45 days after the reference period has been met for euro area quarterly GDP volume growth. A similar objective for quarterly employment estimates has not yet been reached (the current delay for ECB-calculated data is 75 days). Eurostat plans to publish early employment estimates for the first time in 2006 with a timeliness of around $t+72$ days (and $t+60$ by end-2007), which would allow quarterly labour productivity growth estimates to be published within the same period.

**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 was released for the first time for euro area data for the first quarter of 2005. One problem that will need to be overcome is the integration of the data from this source with data from ESA national accounts sources. The ECB considers 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.

**Conclusions**

The ECB currently uses euro area productivity data from three sources. The main source is national accounts, with results per person employed. STS sources are also valuable as they provide more detailed and timely information – which has proven to be a reliable early indicator as regards the direction of productivity changes – but differences between the growth rates derived from these data and those calculated on the basis of national accounts may be sizeable. The most important improvements 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 STS 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.
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