EUROPEAN CENTRAL BANK

EUROSYSTEM

OCCASIONAL PAPER SERIES
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In 2007 all ECB publications feature a motif taken from the €20 banknote.

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* We are grateful for the encouragement and comments we received from Steven Keuning, Werner Bier, Gabriel Quiros, Henning Ahnert and Adrian Page as well as from several other fora where this topic has been discussed.

1 The views expressed in this paper are those of the authors and do not necessarily reflect those of the European Central Bank.

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ISSN 1607-1484 (print)
ISSN 1725-6534 (online)

CONTENTS

ABSTRACT

The preparations for the introduction of the euro in 1999 involved the need for a new set of statistics for the euro area. Since then, significant progress has been made with regard to the coverage, timeliness and accuracy of these statistics. The reliability of the first releases – i.e. their stability in the process of later revisions – is an important quality-related feature. New data releases for the euro area have generally shown a very small or no bias, i.e. data revisions have been very modest and comparable with those of, for example, the United States or Japan. Despite the relatively small size of revisions, however, their combination with the low growth of the euro area economy may have drawn attention to such revisions of economic data for the euro area. This paper quantifies the revisions to selected key indicators in the period from the start of Monetary Union in 1999 to July 2007 and compares them with the corresponding medium-term averages (1999-2006). The analysis covers the euro area, its six largest member countries, the United Kingdom, the United States and Japan. For this purpose, available time series for the various periods involved are used, series that record all revisions to published statistical data releases. The analysis is carried out separately for GDP growth and its expenditure components, for employment, unemployment rates, compensation per employee, labour cost indicators, industrial production, retail trade turnover and consumer prices.

Overall, the evidence presented in this paper suggests that euro area data releases have generally shown a very small or no bias and have been more stable than those for individual euro area countries. Furthermore, recent euro area data show levels of revisions similar to those of the past, or levels of revisions that stabilised after the implementation of harmonised statistical concepts had largely been completed.

JEL classification: E01, E21, E24, E31, E5

NON-TECHNICAL SUMMARY

This paper quantifies recent revisions to selected economic indicators, compares them with medium-term averages of revisions and links them to average growth rates. The analysis covers the euro area, its six largest member countries (Belgium, Germany, Spain, France, Italy and the Netherlands), the United Kingdom and – where data availability permits – the United States and Japan. The focus is on three aspects of revisions, namely (i) their average absolute size, (ii) the potential bias of first estimates (measured by the average difference between the first and the most recent releases), and (iii) the stability of first releases (measured by the range of revisions, and cumulated revisions since the first releases). In most cases, the analysis covers revisions for data from 1999 onwards and focuses on period-on-period growth rates.

The main results of the analysis are as follows:

1. The first releases of euro area data have been more stable than data for individual euro area countries, as revisions tend to cancel out at the euro area aggregate level. This underlines the role of euro area statistics for euro area analysis. The first releases for the euro area aggregates show a very small or no bias. In particular, this is the case for revisions of data released as from 2001. Revisions of 1999 and 2000 data were more substantial, also on account of the implementation, at the time, of new legal requirements for statistics (e.g. the European System of Accounts 1995 (ESA 95)).

2. At the euro area level, revisions for 2005 and 2006 data have thus far not been higher than for past periods. However, results released in 2005 and, particularly, in 2006 and 2007 will be subject to further revisions. Despite the relatively small revisions, their combination with the relatively low growth of the euro area economy in the past may have increased the perceived uncertainty concerning the releases of euro area economic indicators. In relative terms, average absolute revisions have often exceeded average growth: in particular, this applies to data on euro area retail trade and industrial production.

3. Euro area releases for quarterly GDP volume growth have been particularly stable since 2001/2002; the highest revisions equalled 0.3 percentage point. GDP expenditure components have been subject to larger revisions. In particular, this concerns the estimates for the quarter-on-quarter growth of gross fixed capital formation, exports and imports. Revisions of the first release of euro area GDP volume growth for the first quarter have been slightly higher than revisions for other quarters.

4. In general, monthly general economic statistics are more volatile and subject to higher revisions than lower-frequency data. First releases for euro area quarterly employment and labour cost growth rates have been quite stable, with the largest revisions equalling 0.3 percentage point. The first releases of monthly industrial production and unemployment statistics have been more volatile. The first results for compensation of employees' data and, in particular, for retail trade turnover statistics have been revised quite substantially. The HICP flash estimate has been unbiased and revisions exceeded 0.1 percentage point only in exceptional cases.

5. The euro area statistics published today differ substantially from the euro area statistics published at the start of Monetary Union. Most first releases are published with a higher country coverage and are also far more timely than in 1999. At the same time, their reliability has certainly not deteriorated, and has even increased in several cases.

6. Revision studies have a number of caveats; low revisions are not necessarily proof of accurate measurement practices; cross-country differences in revision policies

influence the results of revision studies; revision analyses depend on the selected time range; and definitive conclusions on the reliability and the absence of a bias of first estimates require a long revision history. Yet, the provision of information about the magnitude of revisions, and the reasons for them, may enhance both the assessment of backdata and the interpretation of the most recent statistics.

I BACKGROUND

This note quantifies and analyses revisions to selected key macroeconomic variables used by the ECB.

As a rule, most economic statistics are revised after the initial release. Revisions are necessary in order to improve the accuracy and level of detail of economic statistics,[1] but entail costs for both producers and users. Producers of statistics aim to optimise both the provision of accurate, timely and comprehensive statistics and the stability of published data. Revision policies are interrelated with release practices, i.e. the ways in which revised statistics are made available to the public.[2] Despite some progress, national revision practices in European countries continue to differ considerably, and this may lead to "noise" in the aggregated figures. In its conclusions on the 2005 EFC Status Report, the Ecofin Council requested a "closer coordination of release, revision and dissemination practices".[3]

Revisions are, in general, the result of *new information* becoming available. Another source for revisions is the introduction of *conceptual changes*, in order to cope with a changing environment or improvements (e.g. enhanced source statistics and/or the availability of better deflators for some product groups). As many infra-annual statistics are *adjusted for seasonal and working-day variations*, changes in the concomitant adjustment factors can also cause revisions. An additional dimension of revisions exists when *different geographical or institutional layers* contribute to the production of aggregate statistics, e.g. when country results are used to compile euro area aggregates. In principle, the latter should be revised each time a new country figure is released, which would mean that euro area statistics are revised almost continuously. Obviously, this does not facilitate their interpretation and analysis. Finally, revisions can result from the *correction of errors* in source data or in computations. Generally, these reasons apply to both *primary* statistics (e.g. statistical data collected directly from a reporting entity) as well as to *derived* statistics (statistics compiled using primary statistics, e.g. national accounts). Two major examples are explained in Box 1.

Ideally, any revision analysis should distinguish standard revisions to first estimates that are due to improved information from other factors. Important other factors for euro area statistics are the implementation of harmonised statistical concepts, improvements to the timeliness of first estimates and changes in the country coverage of the first estimates. For euro area statistics, however, it is not possible to separate these effects, as the revision policies are currently not coordinated across Member States, so that many euro area revisions reflect both improved information and some changes in methods or concepts in one or more euro area countries.

1 Initial estimates are typically based on incomplete source information and can only be made at a rather aggregate level.
2 The trade-off between reliability and timeliness, both integral parts of data quality, is not discussed in this paper.
3 See Ecofin Council, Conclusions on the EFC Status Report and on EU Statistical Governance, 8 November 2005.

Table 1 Timeliness and country coverage rates for selected euro area indicators

	Timeliness [1]		Country coverage rate [2]	
Indicator	Early-1999	End-2006	Early-1999	End-2006
GDP	75	45	77	95
Industrial production	104	43	85	97
Retail trade turnover	90	36	70	100

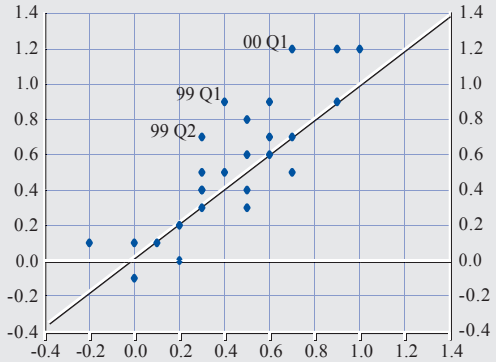
Sources: Eurostat and ECB.
1) Number of calendar days after the end of the reference period; one month = 30 days.
2) Percentage of the euro area.

Chart 1 Revisions to euro area GDP and industrial production data

(quarterly rate)

GDP

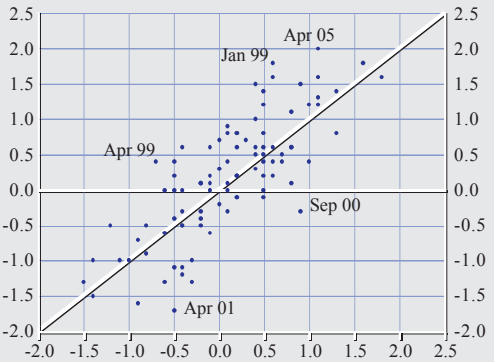
x-axis: first release
y-axis: current data



(monthly rate)

industrial production

x-axis: first release
y-axis: current data



The table on the previous page illustrates the improvements to timeliness and coverage for three of the euro area indicators.

Revisions analyses as carried out in this paper[4] have a specific objective: they evaluate the reliability of the first estimates. However, low revisions are not necessarily proof of accurate measurement. For example, some statistical offices do not recompile long back series after methodological revisions, because of resource constraints. Of course, the relatively small average revisions that can then be computed for those series do not signal a best practice. The same applies if statistics are revised less because the first estimate becomes available much later or because late information (e.g. definitive accounts of local governments) is simply not incorporated at any point in time. Bearing these caveats in mind, informing users, both ex ante and ex post, about the magnitude of revisions, and the reasons for them, may aid them in the interpretation of both backdata and the most recent data. In addition, it allows for some cost-benefit analysis of compiling very timely, high-frequency statistics.

4 More details and tabular results are provided in Annex 1.

Box 1

EXAMPLES OF RECENT ONE-OFF REVISIONS: NATIONAL ACCOUNTS AND EMPLOYMENT STATISTICS[1]

In the course of 2005 and 2006, two statistical domains have been enhanced by introducing important methodological changes, namely national accounts and employment statistics.

In 2005, GDP and *national accounts* data for both the euro area and individual Member States were subject to revisions due to the implementation of (i) the introduction of a chain-linking of

1 More details on revisions to national accounts and employment data are provided in Annex 2, entitled "Statistical changes to the national accounts for the euro area and its six largest countries", and in Annex 3, entitled "Statistical changes to the employment statistics for the euro area, Germany and Spain".

annual and quarterly volume series, (ii) the new partial allocation to final demand of indirectly measured financial intermediation services (i.e. the interest margin, also called FISIM) and (iii) the benchmark revisions that must be implemented once every five to ten years. These changes reflected improvements in the accuracy and comparability of euro area and Member States' national accounts, and had been scheduled and agreed well in advance. Nevertheless, (the timing of) their introduction differed across countries. This caused some difficulties when interpreting euro area and national releases of these methodological changes. On the other hand, our analysis shows that the implementation of these statistical enhancements has implied relatively moderate revisions to euro area GDP volume growth. Revisions to annual growth rates ranged between 0.1 and 0.3 percentage point, and the profile of seasonally adjusted GDP volume growth was revised only slightly. Nominal euro area GDP levels were revised upwards by 1.2%, on average. Revisions to GDP growth and nominal GDP have been very pronounced for Spain and the Netherlands, mainly as a result of improved source data. Following the major revision of euro area national accounts on 30 November 2005, euro area data have been subject to further revisions as some Member States have completed the implementation of these major changes in their national accounts in 2006-2007. The effect of these revisions was progressively included in Eurostat's releases of euro area national accounts, along with the effect of other regular revisions that statistical institutes carry out. A better coordination may be expected for the next major revision (foreseen for 2011).

Euro area *employment levels* statistics have been relatively unstable, in particular due to large revisions in Spanish and German data, while growth rates were less affected. Euro area levels were revised upwards by, on average, 1.5%. Main reasons were new information from the population census in Spain and improved sources in Germany. The revisions concerned, in particular, part-time employment. All forms of data collection for employment statistics are subject to some degree of uncertainty. Registers may be flawed due to the exclusion of unrecorded ("grey" and illegal) employment or inaccurate recording, or they may not be available in time for the release of first employment estimates. Business or household surveys may be inaccurate due to surveying characteristics. Furthermore, also in this case, the lack of a coordinated revision timetable in the euro area Member States means that (relatively small) changes to euro area data occur at a very high frequency. Finally, at a country level, headline employment and unemployment (level and change) estimates are compiled in different ways and are typically not fully consistent.

2 QUANTITATIVE ANALYSIS OF REVISIONS TO SELECTED INDICATORS

2.1 FRAMEWORK OF THE ANALYSIS

The selection of indicators is determined by their relevance for business cycle analysis and, especially for labour market indicators, by their higher data uncertainty when producing this paper. The analysis focuses on revisions to these headline indicators for the euro area, its six largest countries (representing almost 90% of euro area GDP), the United Kingdom and, where data availability permitted, the United States and Japan. All calculations are done using published, rounded growth rates (and levels, as in the case of the unemployment rate).

The following *key economic indicators* are included in this quantitative analysis of revisions:

- *GDP volume growth* (seasonally adjusted quarter-on-quarter growth);
- *GDP expenditure components* (seasonally adjusted quarter-on-quarter growth);
- *employment* (total civilian, seasonally adjusted quarter-on-quarter growth);
- *unemployment* (total, ILO definition, seasonally adjusted rate);
- *compensation per employee* (total, seasonally adjusted quarter-on-quarter growth);
- *labour cost index* (total, seasonally adjusted quarter-on-quarter growth);
- *industrial production* (excluding construction, seasonally adjusted month-on-month growth);
- *retail trade turnover* (total, constant prices, seasonally adjusted month-on-month growth); and
- *consumer price index* (total, year-on-year growth).

At least two periods of revisions are investigated: more *recent revisions*, covering observations for 2005 – 2006 (first quarter of 2005 to fourth quarter of 2006), and *earlier revisions*, covering observations from January 2002 to December 2004 (first quarter of 2002 to fourth quarter of 2004). The comparison of these two periods might indicate whether data uncertainty increased in 2005-2006.[5] Where data availability permits, a third, *longer-term period* is included, covering observations from January 1999 onwards for the euro area, the United States and Japan. The analysis covers releases available up to July 2007.

Revision analyses require complete data archives containing all historic data vintages. From June 2001 onwards, all *underlying data* for the euro area and the EU countries are taken from the internal database of the ECB's Directorate General Statistics (DG-Statistics), in which all incoming vintages of data from Eurostat have been recorded.[6] For earlier periods, data are taken from the published versions of the ECB's Monthly Bulletin. The latter, however, are a less suitable source because they do not reflect the intermediate revisions that occur between Monthly Bulletin cut-off dates and because there may be cases where the Monthly Bulletin already contains a revised second release, rather than the initial first release. Euro area data prior to 2002 exclude Greece. Vintages of data for the United

5 As the most recent releases are subject to further revisions, revisions in these two periods are not yet fully comparable.

6 The analysis in this paper is only possible due to the high frequency and good quality of data transmission arrangements between the European Commission (Eurostat) and the ECB. The transmission is supplemented by good cooperation on methodological issues. While every effort has been made to ensure revisions due to incorrect data transmissions have been eliminated from the analysis, the volume of data involved may mean that this validation process was not totally perfect. For previous uses of this source for revision analyses, see also the Box 5, entitled "Improvements to euro area GDP and national accounts", in the December 2005 issue of the ECB's Monthly Bulletin and "*2005 EFC Status Report on Information Requirements in EMU*", Annex III, November 2005.

States, Japan and the first releases of the GDP before 2002 for the EU countries are supplied by the OECD, derived from databases used for the production of the (monthly) publication entitled "Main Economic Indicators".[7]

This paper assesses *total revisions*, i.e. the difference between the latest (current) value for an observation and the value of its first release, as well as *successive revisions*, defined as the sum of all revisions to observations since their first release. Successive revisions may be relevant, because a low total revision may hide a series of positive and negative revisions, which would have caused data uncertainty in the meantime.[8]

7 A comprehensive euro area real-time database – currently including the euro area aggregates published in the ECB's Monthly Bulletin from January 2001 to December 2006, as well as other financial and monetary statistics – has been set up jointly by the ECB and the Euro Area Business Cycle Network (EABCN) and is available on the EABCN website. This is a first output of the EABCN-RTDB project, which aims at constructing a harmonised real-time database for the euro area and EU countries. For further information on the project, see http://www.eabcn.org.

8 More details on data quality frameworks, revision indicators and a brief review of relevant literature are provided in Annex 4.

Box 2

REVISION INDICATORS

A) Total revisions

Total revisions are calculated as the absolute difference between the current data and the first release of the statistics concerned. This measure excludes all intermediate revisions and is the most important measure of reliability as it provides information on the overall stability of the first release. For example, a low absolute average of total revisions points to an almost unrevised first release.

Average total revisions
Average of the difference between the latest available value and the first release for each observation period. This measure indicates a possible *bias of the first release*.

Average absolute revisions
Average of the absolute difference between the latest available value and the first release for each observation period, regardless of its respective sign. This measure indicates the *stability of the first release*. As a relative measure, the ratio of average absolute revisions and the related average growth rate are also provided.

Range of total revisions
Highest and lowest total revisions to the first release for all observation periods. This range indicates the *volatility of the first release*. The total range covers all the revisions and may include outliers; the 90% range discards the largest 10% of the revisions.

B) Successive revisions

Successive revisions are calculated by accumulating all revisions to the first release, i.e. this measure includes all intermediate revisions and provides complementary information on the fluctuations of the first release caused by later revisions.

Average Cumulative Absolute Revisions
For each observation period, the sum of revisions, regardless of their respective sign, is accumulated. The average for all observation periods may then be a useful supplementary indicator for the *volatility of the first release* as some euro area statistics are revised several times a month and any "latest-to-first" comparison may hide revisions carried out in the meantime.

C) Memorandum item: Average quarterly/monthly growth rate

The average growth rates are helpful when assessing the impact of average revisions of the economic indicator, since the size of the acceptable revisions is likely to depend on the trend growth of the underlying series.

2.2 RESULTS

Complete tables with the euro area and country data can be found in Annex 1.

2.2.1 GDP VOLUME GROWTH (QUARTERLY)

The first "flash" estimate of the euro area quarter-on-quarter GDP volume growth rate is published with a country coverage of around 96% of euro area GDP within around 45 days after the end of the reference quarter. Further breakdowns for the expenditure, production and income side are published in two subsequent releases, at around *t+63* and *t+103* days. GDP is estimated from various basic statistics and sources, including administrative data, censuses, surveys of businesses and households, and typically summarises billions of transactions in one single number. Regular revisions are the result of incorporating improved quarterly or annual source data, whereas benchmark revisions undertaken at intervals of five years reflect improved multi-annual source data or methodological improvements.

Despite some critical comments on GDP revisions in publications of early 2006,[9] our analysis of revisions leads to a rather favourable assessment of the reliability of the first estimates of euro area and Member States' quarterly headline GDP growth. From 1999 to 2006, the first *euro area* estimate exhibits a relatively small bias of 0.1 percentage point (i.e. there are somewhat more positive than negative revisions) and is relatively stable (i.e. the average absolute revision is below 0.2 percentage point), but this should be seen in comparison with a long-term average GDP growth of 0.5%. The range of total revisions is between -0.2 percentage point and +0.5 percentage point, suggesting some volatility. Chart 2 shows that relatively high GDP growth rates in the period from the first quarter of 1999 to the first quarter of 2001 were revised upwards, while revisions for subsequent observations with usually around or below average growth rates were smaller, but also mostly upwards. It is difficult, however, to infer clear conclusions on the possible relation between the size of growth rates and revisions (i.e. the possible cyclicality of

9 See "Euro area GDP – Initial estimate may underestimate 4Q05 GDP growth", JP Morgan Economic Research, 13 February 2006 and "GDP growth – A numbers racket", The Economist, 18 February 2006.

Chart 2 Euro area – GDP volume growth

(seasonally adjusted, quarter-on-quarter)

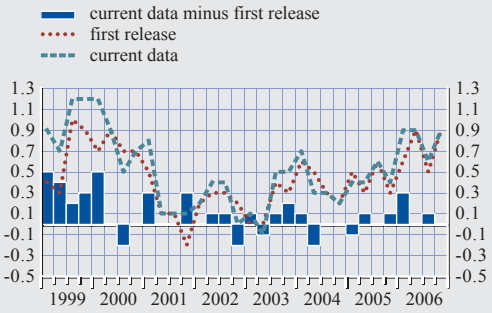


Table 2 Euro area – GDP volume growth

(seasonally adjusted, quarter-on-quarter)

	Total revisions (latest minus first release)				Successive revisions	Memo item:
			Range of revisions			
Observations	Average revision	Average absolute revision (relative to average growth)	Total	90%	Average cumulative absolute revision	Average quarterly growth
2005Q1 - 2006Q4	0.06	0.09 (14%)	-0.1 to 0.3	-0.1 to 0.1	0.19	0.65
2002Q1 - 2004Q4	0.02	0.10 (32%)	-0.2 to 0.2	-0.2 to 0.1	0.58	0.31
1999Q1 - 2006Q4	0.09	0.14 (26%)	-0.2 to 0.5	-0.2 to 0.4	-	0.54

Source: ECB calculations based on Eurostat data.

revisions) as the period under investigation is (inevitably) too short and because there may be specific reasons for the less reliable first estimates in the period from the first quarter of 1999 to the first quarter of 2001. The revisions did not occur at one point in time, but are the result of successive upward revisions to the underlying country data. These estimates may have been surrounded by higher-than-usual uncertainty due to the implementation of the European System of Accounts 1995 (ESA 95) which some statistical offices were finalising in that period. In addition, a lower country coverage of these first estimates (around 77% of euro area GDP) may also explain part of the revisions. This is suggested by upward revisions entailed in the second estimates with a country coverage of around 90%.[10] Disregarding the observations for the period from the first quarter of 1999 to the first quarter of 2001 – as indicated in the second line[11] of Table 2 – one finds that the first estimate exhibits no bias, is more stable (an average absolute revision of 0.1) and has a low volatility.

The introduction of benchmark revisions and improved methods by countries and Eurostat in 2005 and 2006 did not lead to significant changes in quarterly GDP growth rates in the period covered by the analysis. Furthermore, on average, the quarterly results for 2005-2006 were not revised more than those of earlier quarters, nor more than before the benchmark revisions had been introduced. In relative terms, the size of the growth rate published with the first estimate was revised, on average, by 14% for the latest two years, while it was revised, on average, by 26% for the entire period.

An analysis of the revisions to first estimates for *expenditure components* may provide further useful information for the analysis of GDP volume growth (see Table 3 and Annex 2). While the first estimates for consumption and foreign trade variables are revised, on average, by +0.1 percentage point, a bias of 0.4 percentage point is observed for gross fixed capital formation. The first estimates of expenditure components are less stable and far more volatile than those of GDP. This is most pronounced for gross fixed capital formation (e.g. an average absolute revision of 0.5 percentage point, in comparison with an average growth of 0.7 percentage point) as well as for exports and imports (average absolute revision of 0.7 percentage point, in comparison with an average growth of 1.4 percentage point respectively). These higher revisions have to be seen against the background of the relatively high quarterly growth rates. The higher uncertainty that surrounds the expenditure components cancels out at the aggregate GDP level. Similar to aggregate GDP growth, one notices significant upward revisions to initially already relatively high growth rates of expenditure components in the period from the first quarter of 1999 to the first quarter of 2001.

10 For more information on 1999/2000 revisions see also "*Revisions to quarterly national accounts for the euro area*", Box 4, ECB Monthly Bulletin, August 2001.

11 Similar reductions in bias and volatility (and increases in stability) are observed when the revision analysis is carried out from 2000 Q2 onwards (not shown in the table). In addition, taking the period from 2003 Q1 onwards shows that the release of flash estimates has not negatively affected the reliability of the first estimate.

Table 3 Euro area – GDP expenditure components

(seasonally adjusted, quarter-on-quarter; first quarter of 1999 to fourth quarter of 2006)

	Total revisions (latest minus first release)				Memo item:
		Average absolute revision (relative to average growth)	Range of revisions		Average quarterly growth
Observations	Average revision		Total	90%	
Private consumption	0.09	0.24 (53%)	-0.3 to 0.9	-0.3 to 0.7	0.45
Government consumption	0.09	0.25 (53%)	-0.4 to 0.7	-0.3 to 0.7	0.47
Gross fixed capital formation	0.38	0.51 (76%)	-0.5 to 1.8	-0.4 to 1.6	0.67
Changes in inventories [1]	-0.03	0.17	-0.3 to 0.7	-0.3 to 0.6	-
Exports	0.12	0.72 (50%)	-1.3 to 2.1	-1.2 to 2.1	1.43
Imports	0.12	0.65 (48%)	-1.5 to 2.4	-1.2 to 1.2	1.35

Source: ECB calculations based on Eurostat data.
1) Revisions to the contribution of changes in inventories to quarterly GDP growth; changes in inventories excluding acquisitions of valuables.

Also at the *national level* (see tables in Annex 1), the analysis does not provide evidence for a significant bias in the first estimate of headline GDP volume growth in the six largest euro countries. Since 1999, average revisions have not significantly exceeded ±0.1 percentage point, with the exception of Spain (0.2 percentage point) and this includes the effect of the 2005 benchmark revisions. However the volatility of first estimates is significantly higher than for euro area data. As regards the possible relation between the size of GDP growth and revisions, one notices that for Germany and France relatively high initial estimates have been revised significantly upwards. As for euro area aggregate GDP growth, these above average revisions mainly relate to the period from the first quarter of 1999 to the first quarter of 2001.

The average revision to the quarters of 2005-2006 is broadly in line with the long-term average revision, although revisions for recent quarters have, on average, been somewhat smaller in absolute terms, particularly for Belgium and Spain.

First releases of both the *United Kingdom* and the *United States* [12] have been slightly biased and their volatility has been higher than that of the euro area results, although the average growth rates in these countries have also been higher. GDP growth for *Japan* is revised, on average, by -0.2 percentage point and is comparatively volatile with a range of revisions between -2.7 percentage point and +2.0 percentage point.

2.2.2 EMPLOYMENT (QUARTERLY)

Up to mid-2006 no official euro area employment estimates were available. Instead, first estimates of euro area employment data (national accounts definition, expressed in number of persons) were compiled by the ECB's DG Statistics around 100 days after the reference quarter, with an underlying country coverage of at least 80%. From mid-2006 Eurostat started a regular release of employment data with a flash estimate at 75 days after the reference quarter and a full release at 100 days. At a country level, the national accounts data are compiled by amalgamating administrative, household

12 The average revisions and the range of revisions are smaller than those published by the BEA in its press releases (e.g. a bias of 0.1 percentage point). This is because the BEA's published information on revisions is based on a longer time horizon and excludes the most recent years (i.e. it relates to the years from 1982 to 2002). For a further discussion of US GDP revisions, see also B. Aruoba, "Data revisions are not well behaved", CEPR/EABCN Discussion Paper No 5271, Centre for Economic Policy Research, October 2005. The author uses US GDP vintages from 1965 and finds both that GDP first estimates are biased and that the revisions are predictable. For a discussion of UK GDP revisions, see also H. Robinson, "Revisions to quarterly GDP growth and its production (output), expenditure and income components", *Economic Trends*, Office for National Statistics, December 2005.

Table 4 Euro area – employment

Observations	Total revisions				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average quarterly growth rate
			Total	90%		
2005Q1 - 2006Q4	-0.03	0.10 (37%)	-0.2 to 0.2	-0.2 to 0.1	0.30	0.27
2002Q1 - 2004Q4	0.11	0.14 (81%)	-0.1 to 0.3	-0.1 to 0.3	0.78	0.17

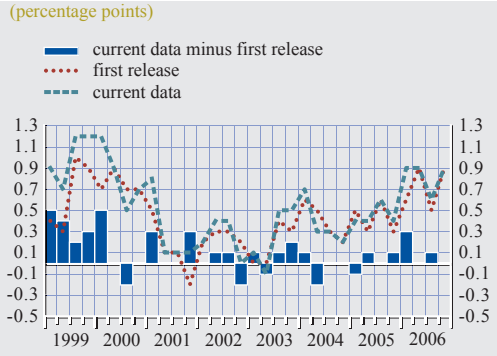
Source: ECB calculations based on Eurostat data.

and business survey estimates of employment, as well as incorporating information from censuses – revisions to this data set can therefore come from many sources. The revision analysis combines information from the data previously released by the ECB and that which is now available from Eurostat. The analysis begins in 2002 because appropriate source data for earlier periods are not available.

The average revision of the quarter-on-quarter growth rate of total *euro area* employment data in 2005-2006 was 0.0 percentage point indicating no bias, a slight improvement compared to earlier revisions (0.1 percentage point). The highest single revisions equal 0.2 percentage point. The average absolute revisions were only 0.1 percentage point; this concerns both earlier and recent revisions. The absolute cumulative amount of revisions is relatively high, suggesting some volatility in the euro area results. The fact that the euro area aggregate was, when calculated by the ECB, recalculated each time new data become available for any of the countries is likely to have had an effect on this measure. Overall, the euro area growth figures are considered to be rather stable and unbiased, but the small revisions must also be seen against the background of the small average growth rate of the quarterly series. Changes in the level data are examined in more detail in Annex 3.

Chart 3 Euro area – employment

(percentage points)



The euro area revisions of the employment measure mask some more significant but counter-balancing patterns at a *national level*. In particular, data for Spain (average revision between 2002 and 2004 equals 0.4 percentage point) have shown larger revisions since 2002, which was mainly due to the incorporation of updated population data. These reflect changes recorded in the latest census, which was undertaken in 2001 (there are similar but smaller effects for Belgium and Italy). The revisions in 2005-6 were smaller, suggesting that the effects of the census update were coming to an end. Germany saw several administrative changes in the methods used to count employed persons (Hartz reforms/"one euro jobs"). This led to some ongoing volatility in the data (see also Annex 3). The revisions of quarter-on-quarter percentage changes in employment data (calculated on the basis of non-seasonally adjusted data) in the Netherlands are relatively high.

The employment data for the *United Kingdom* show a small bias, and the data for the *United States* display no bias. According to available data vintages from the OECD, employment data for *Japan* are revised relatively infrequently.

Table 5 Euro area – unemployment

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute Revision (relative to monthly rate)	Range of revisions		Average cumulative absolute revision	Average monthly rate
			Total	90%		
Jan2005 - Dec2006	-0.03	0.06 (1%)	-0.2 to 0.1	-0.2 to 0.1	0.36	8.23
Jan2002 - Dec2004	-0.13	0.13 (1%)	-0.5 to 0.0	-0.5 to 0.0	0.66	8.56
Jan1999 - Dec2006	-0.38	0.39 (5%)	-1.2 to 0.1	-1.1 to 0.1	-	8.41

Source: ECB calculations based on Eurostat data.

2.2.3 UNEMPLOYMENT RATES (MONTHLY)

First estimates of euro area harmonised unemployment rate data are released by Eurostat around 30 days after the reference quarter, normally with a coverage of the euro area that is above 90%.[13] They are compiled by extrapolating harmonised European Labour Force Survey (LFS) data with available monthly indicators for each Member State. Revisions in the 2005 data were due mostly to changes in the German unemployment system (e.g. a change in the eligibility criteria for unemployment benefits). Similar to employment data, new data coming from population censuses can also have a marked effect on revisions. In 2002, a Regulation[14] was established that defined unemployment at the EU level. The implementation of this Regulation led to an increase in revisions for data prior to 2002.

In 2005-2006, the average revision of the month-on-month change in total *euro area* unemployment data was virtually stable (-0.1 percentage point) and in a narrow range, i.e. between -0.2 and +0.1 percentage point. The average is slightly lower than the revisions to data from 2002 to 2004. Relatively high revisions were reported for the period before 2002, for which current unemployment rates are about 1 percentage point below the initial estimates. As mentioned previously, this is partly due to a new Regulation that came into force in 2002. The average absolute revisions were at similarly low levels (0.1 percentage point) for more recent periods. From the beginning of 2005, all EU Member States (except Luxembourg) conduct a continuous LFS, yielding quarterly average data. Eurostat therefore changed its calculation methods, with the aim of using quarterly instead of annual benchmarks. This may lead to more frequent but smaller data revisions in the future. Overall, the euro area unemployment rate data are considered to be fairly stable and unbiased for the periods after 2001.

Data on the *revisions to euro area country data* are available only from 2002. The spread of the revisions over the period from 2002 to 2004 was around 1 percentage point and, in the case of Belgium and Spain, close to 2 percentage points. This may be partly explained by the

13 This 90% coverage includes extrapolations of Greek and Italian data, which are only available at a quarterly frequency.

14 Commission Regulation (EC) No 1897/2000 of 7 September 2000 implementing Council Regulation (EC) No 577/98 on the organisation of a labour force sample survey in the Community concerning the operational definition of unemployment (Official Journal of the European Union (OJ), L 228, 8 September 2000, p.18).

Chart 4 Euro area – unemployment

(Percentage points)

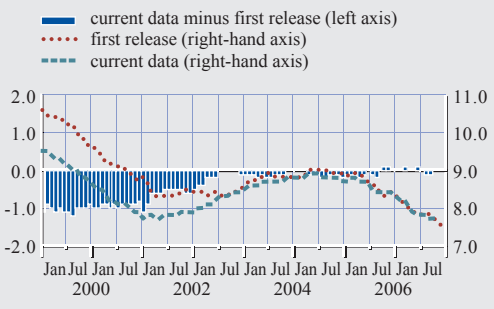


Table 6 Euro area – compensation per employee

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average quatrerly growth rate
			Total	90%		
2005Q1 - 2006Q4	0.05	0.20 (41%)	-0.5 to 0.3	-0.5 to 0.2	0.78	0.49
2002Q1 - 2004Q4	-0.05	0.20 (38%)	-0.5 to 0.4	-0.5 to 0.3	1.75	0.52

Source: ECB calculations based on Eurostat data.

yearly re-benchmarking of the data at that time. Belgium and Spain had incorporated changes to their data as a result of information from the latest census and had adjusted the scaling factors of survey data.

The unemployment figures in the *United Kingdom* are more stable than those in the euro area. The United Kingdom has used a continuous LFS for some time, so that there has been no need to re-benchmark the monthly results to annual LFS data. Furthermore, headline monthly results are calculated as three-month averages, which limits the effect of revisions. The data for the *United States* and *Japan* are rarely revised.

2.2.4 COMPENSATION PER EMPLOYEE (QUARTERLY)

First estimates of the euro area data on compensation per employee are usually compiled around 100 days after the reference quarter. The euro area country coverage is generally around 80%. Both components are estimated as part of the quarterly national accounts, which integrate statistics from many sources. Therefore, the revisions may have various causes. Revisions to the compensation data tend to be higher than the revisions to employment data. The revision analysis only begins in 2002 because appropriate data for earlier periods are not available.

Data on quarterly *euro area* compensation per employee in 2005-2006 were revised by +0.1 percentage point, on average, signalling a minor upward bias in the first release. Stability (average absolute revision) has remained broadly satisfactory. However, the 90% range of total revisions shows a noticeable volatility in the first release, especially if the relatively low average growth rate of the indicator is taken into account. The data for first quarters of the year tend to be revised more: the three highest (downward) revisions occurred in the first quarters of the five most recent years.

Turning to the major *euro area countries*, the bias and volatility are high for Belgium, Germany, Spain, Italy and the Netherlands. The range of the revisions is sizeable in all countries, especially for backdata and particularly for the Netherlands and, although to a lower extent, for Germany (this can mainly be attributed to the introduction of changes in the national accounts that affected the estimates of both compensation and employment). Relative absolute revisions to country data are sometimes very high

Chart 5 Euro area – compensation per employee

(percentage points)

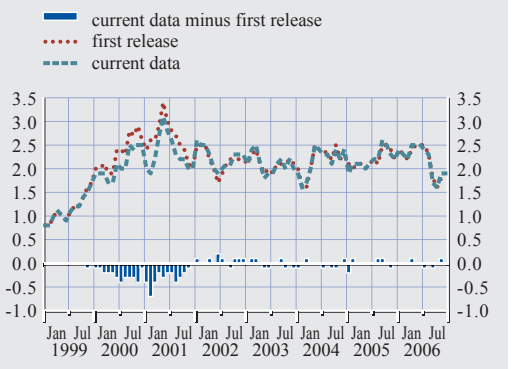


Table 7 Euro area – labour cost index

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average quarterly growth rate
			Total	90%		
2005Q1 - 2006Q4	0.00	0.08 (13%)	-0.2 to 0.1	-0.2 to 0.1	0.25	0.58
2002Q1 - 2004Q4	0.02	0.13 (17%)	-0.2 to 0.2	-0.2 to 0.2	1.06	0.73

Source: ECB calculations based on Eurostat data.

(especially for Germany and the Netherlands), but are due primarily to the low growth rates.

Historic data vintages for the analysis of revisions *in* the *United States* and *Japan* were not available for this study.

2.2.5 LABOUR COST INDEX (QUARTERLY)

First estimates of the euro area labour cost index (LCI) are released around 80 days after the reference quarter, with full breakdowns (by industry and by labour cost components) and a country coverage of around 80%. The revision analysis begins in 2002 only because appropriate source data are not available for earlier periods. Data sources used for the compilation vary from country to country and include sample surveys and administrative sources (e.g. tax records). Regular quarterly revisions of the LCI have typically been the result of improved source data. With the phasing-in of the new Council Regulation,[15] several Member States introduced methodological improvements (France, Italy, the Netherlands and the United Kingdom, for instance, in June and September 2005), resulting in noticeable revisions to backdata for Spain and the Netherlands.

Despite these changes, the average revision of the quarterly *euro area* labour cost index suggests no bias in the first release, both for recent and for earlier observations. The instability of the first release has been relatively modest, with around 0.1 percentage point average absolute revisions. Relative absolute revisions have also been limited (around 15%). In terms of volatility, the range of revisions remained practically the same for recent observations. Overall, the revision indicators show a very similar picture for earlier and more recent observations in all three of the dimensions examined. A cyclical pattern could not be identified.

Looking at the larger *euro area countries* for which data are published, there appears to be no significant bias in the first estimates, but a relatively wide range of revisions can be observed for backdata (especially for Spain and the Netherlands, where it is explained by the introduction of a new data source). The stability of the first release improved for all countries

15 Since 2003, the LCI has been based on the Regulation No 450/2003 of the European Parliament and of the Council of 27 February 2003 concerning the labour cost index (OJ L 69, 13 March 2003, p. 1), whereas it was formerly collected under a gentlemen's agreement. See also Box 4, entitled "New series of hourly labour costs in the euro area", in the July 2005 issue of the ECB's Monthly Bulletin.

Chart 6 Euro area – labour cost index

(percentage points)

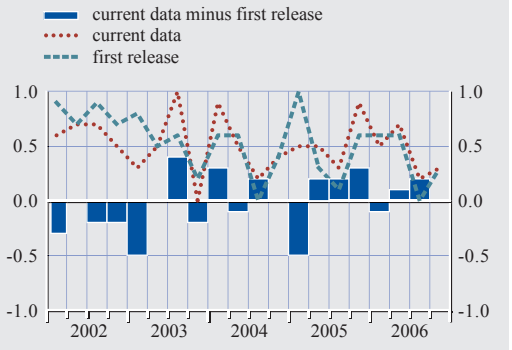


Table 8 Euro area – industrial production

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average monthly growth rate
			Total	90%		
Jan2005 - Dec2006	0.11	0.35 (117%)	-1.0 to 1.2	-1.0 to 0.7	1.25	0.30
Jan2002 - Dec2004	0.10	0.35 (350%)	-0.7 to 1.0	-0.7 to 0.7	3.35	0.10
Jan1999 - Dec2006	0.09	0.41 (228%)	-1.2 to 1.2	-0.7 to 1.0	-	0.18

Source: ECB calculations based on Eurostat data.

examined. Data for Belgium are lacking, while some data for Italy are confidential.

Revisions to data for the *United Kingdom* indicate relatively unbiased first releases, but a volatility that exceeds that of the euro area data revisions. Corresponding data on revisions of similar labour cost measures for the *United States* and *Japan* are not available in the ECB databases.

2.2.6 INDUSTRIAL PRODUCTION (MONTHLY)

Euro area monthly industrial production data are released with a country coverage of almost 97% approximately 43 days after the reference month. In addition to the headline figure, further breakdowns (e.g. by main industrial groupings) are provided. The main method to collect information on industrial production is by means of a business sample survey. Regular revisions are due to late responses of enterprises and the update of seasonal factors. Occasional revisions are caused by changes at intervals of five years in the base year of the index (in some countries), or by benchmarking to annual statistics.

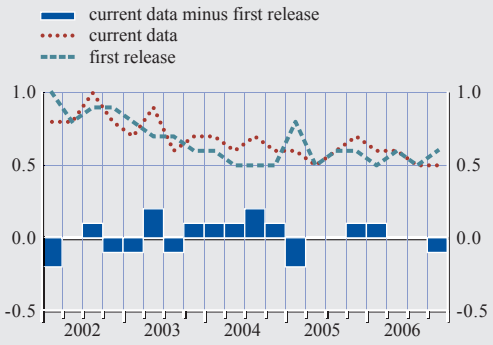
Euro area industrial production has a bias of 0.1 percentage point, but is subject to some uncertainty with an average absolute revision of 0.4 percentage point, and 90% of all revisions between -0.7 percentage point and 1.0 percentage point for the periods as from 1999. These revisions are sizeable in comparison with an average monthly growth rate of around 0.2%. Unlike national results, which are usually revised only once between successive releases, the euro area industrial production estimate is updated whenever new or revised national data are published, leading to, in general, many successive revisions. This is due to the lack of coordination of national release calendars. Revisions to data in 2005-2006 are, on average, similar to earlier periods. Revisions to December data have not been higher than the average.

With regard to *euro area countries*, the industrial production index series for France, Italy and Spain do not show significant revisions on average. However, the range of total revisions is comparatively large (as in the case of France, for instance, where 90% of revisions are between -12 percentage point and +1.2 percentage point). The average revision is more pronounced for Germany (+0.2 percentage point). The highest average revisions are observed for Belgium (+0.4 percentage point) and the Netherlands (+0.3 percentage point). The series for these two countries are also somewhat volatile. The range of successive revisions for Belgian industrial production is striking; there are many successive revisions, with differing signs for each observation. The revisions for the Netherlands are partly caused by the fact that in this country are these series made consistent with the quarterly national accounts as and when they become available. The 2005-2006 revisions at the country level were in line with the long-term average for all countries, with the exception of Belgium.

Average revisions and volatility for both the *United Kingdom* and *Japan* are similar to the results for the largest euro area countries, while

Chart 7 Euro area – industrial production

(percentage points)



the results for the *United States* are unbiased and relatively stable.[16]

2.2.7 RETAIL TRADE TURNOVER (MONTHLY)

First estimates of euro area retail trade turnover are released in limited detail (total, food and non-food) and with a complete euro area country coverage (100%) around 36 days after the reference month; the full euro area details become available one month later. Retail trade turnover is mainly collected via enterprise sample surveys; in addition, some countries make use of administrative sources (VAT declarations). Regular revisions to retail trade data are due mainly to late responses of enterprises, aside from the update of seasonal factors. Occasional major revisions are usually caused by changes in the base year.

In 2005-2006, the average revision of *euro area* retail trade turnover statistics was virtually unbiased, while the average monthly growth rate was 0.16 percentage point. For earlier periods, the average revisions were also close to zero. The average absolute revisions were substantial over the whole period from 1999 to 2006 (0.4 percentage point) and over the period from 2002 to 2004 (0.6 percentage point). Between 2002 and 2004, the 90%-range (-2.3 and +0.8 percentage point) indicates a relatively high volatility of the first estimates. Increased absolute revisions have been recorded around the turn of a year, with downward revisions for the January observations. Furthermore, the absolute cumulative revisions have been high (10.6 percentage point). This is due to the uncoordinated release calendars of countries, which necessitates many revisions at the euro area level. Another reason for this volatility may have been the introduction of the euro area flash estimate in April 2004, which helped to bring the release of euro area results considerably forward (from *t+60* to *t+35*), but perhaps at the cost of initially decreasing the reliability. In 2005-2006, the average of absolute cumulative revisions is notably lower (at 2.1 percentage point). All in all, the overall reliability and stability of euro area retail trade turnover statistics leaves room for further improvement. In relative terms, revisions exceed the average

16 For further analysis of revisions to the US industrial production index, see also N.R. Swanson and D. van Dijk, "Are statistical reporting agencies getting it right? Data rationality and business cycle asymmetry", *Journal of Business and Economic Statistics*, January 2006.

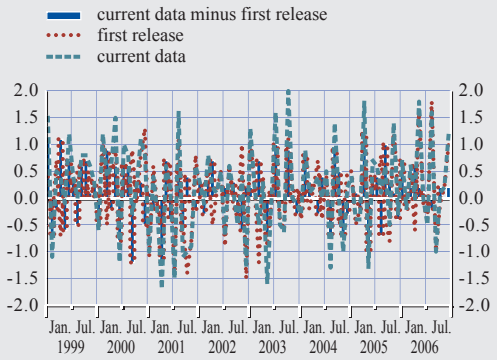
Table 9 Euro area – retail trade turnover

	Total revisions				Successive revisions	Memo item:
		Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average monthly growth rate
Observations	Average revision		Total	90%		
Jan2005 - Dec2006	-0.03	0.23 (150%)	-0.6 to 1.0	-0.6 to 0.2	2.12	0.16
Jan2002 - Dec2004	0.03	0.60 (668%)	-2.3 to 2.3	-2.3 to 0.8	10.58	0.09
May1999 - Dec2006	0.00	0.42 (300%)	-2.3 to 2.3	-0.8 to 1.0	-	0.14

Source: ECB calculations based on Eurostat data.

Chart 8 Euro area – retail trade turnover

(percentage points)



monthly growth rate significantly. For the entire period (1999 to 2006), the average absolute revision is around three times higher than the average growth rate.

In most *euro area countries*, revisions in 2005-2006 are quite pronounced. The range of revisions for the period from 2002 to 2004 is also relatively high, often reaching several percentage points, e.g. in Germany (-5.8 to 3.5). Only the data for Italy (-0.9 to +0.9) shows a somewhat lower volatility and no significant average revision. Particularly unreliable are the first releases for Belgium, Germany and France. High absolute cumulative revisions for the historic averages in Belgium (11 percentage points), Germany (10 percentage points) and the Netherlands (8.4 percentage points) confirm a significant volatility in their first estimates. Germany and France show particularly high downward revisions to January observations.

In the *United Kingdom*, average absolute revisions are at levels similar to those in the euro area. The bias of the first estimate and the average absolute revisions for the *United States* and *Japan* are relatively small and comparable with euro area results. Higher revisions for the periods around the turn of the year are observed for Japan.

2.2.8 CONSUMER PRICE INDEX (MONTHLY)

The flash estimate of the HICP for the euro area is generally released on the last day of the reference month, with coverage of national data usually amounting to 95%.[17] The full euro area breakdown, compiled from the complete set of national data, becomes available at around t+17. Most consumer prices are collected by sample surveys in outlets. Regular revisions only occur for the HICP flash estimate (published for the first time in October 2001) and have different causes: first, a revision of the national data underlying the estimate; second, a different development of inflation in the countries that did not provide an input in the flash estimate; and, third, the volatility of the seasonal pattern and some atypical developments in the HICP sub-components. Finally, rounding effects can have an impact. Occasional and coordinated revisions can be caused by improvements in the coverage and compilation methodology of the national indices.

The average total revisions of the *euro area* data are zero. This indicates that there is currently no bias in the HICP flash estimate. The range of revisions exceeds 0.1 percentage point only in exceptional cases. In the case of the 63 flash estimate releases included in this study, it is exact in 30 cases, 0.1 percentage point different from the final estimate in 29 cases and 0.2 percentage point off the mark in only 3 cases.[18] In relative terms, the revisions are also minor. This is confirmed by the similar results in the first and second parts of the table below. Slightly higher average absolute revisions occur in 2000 and 2001, due to the successive extensions of the geographical, population and product coverage of the HICP. Furthermore, specific national revisions due to improved quality adjustment procedures

17 Initially, the coverage of the flash estimate was only around 50% and incorporated national flash estimates from Germany and Italy. The coverage has since been successively improved.

18 See further details in the Box entitled "Assessing the reliability of Eurostat's euro area HICP flash estimate" in the January 2006 edition of the Monthly Bulletin.

Table 10 Euro area – HICP

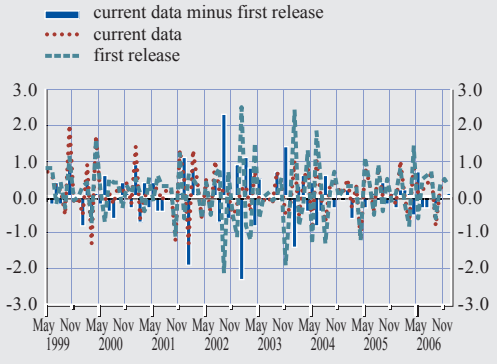
Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average annual rate
			Total	90%		
Jan2005 - Dec2006	0.00	0.04 (2%)	-0.2 to 0.1	-0.2 to 0.1	0.05	2.19
Jan2002 - Dec2004	0.01	0.06 (3%)	-0.1 to 0.2	-0.1 to 0.1	0.09	2.16
Jan1999 - Dec2006	-0.06	0.10 (5%)	-0.7 to 0.2	-0.4 to 0.1	-	2.05

Source: ECB calculations based on Eurostat data.

and a new weighting scheme in Germany and the inclusion of sales prices in Spain and Italy also affected the euro area HICP in these earlier periods.

As regards the individual *euro area countries* examined, the average overall revisions are likewise close to zero. The ranges of overall and successive revisions are slightly higher for Germany, Spain and Italy. During 2006, the German HICP data were revised 6 times by 0.1 percentage point. A similar situation applies to the estimate for Italy; this was revised 3 times, once by 0.2 percentage point. The HICP flash estimate for Spain was only revised once by 0.1 percentage point. The ranges of revisions are higher for Spain and the Netherlands in the periods before 2005. However, they were mainly the result of one-off improvements in the compilation of the indices.

Chart 9 Euro area – HICP



In the *United States*, the CPI is revisable in principle, but only a few revisions have ever occurred and these mainly concerned the correction of mistakes. In *Japan*, the CPI is not revisable as a matter of principle, which does not necessarily point to a more accurate final estimate. However, some revisions do occur with the 5-yearly rebasing procedure, as was the case in August 2006 when the index moved to the 2005 base year.

3 CONCLUSIONS

In summary, the first releases of euro area headline indicators generally have an only very small or no bias in the period covered by this analysis. The first estimates of GDP expenditure components, in particular those of gross fixed capital formation and foreign trade components, are less stable and more volatile than those of GDP itself. Overall, there is no evidence that revisions in 2005-2006 have been systematically higher than earlier revisions. Employment data and Labour Cost Indices show little or no bias. Monthly retail sales and industrial production indicators show, as expected, relatively high revisions in comparison with quarterly data. There does not appear to be any cyclicality in euro area revisions; however, as available historic vintages of revisions cover only a few years, any relationship between the size of the revisions and the phase of the business cycle cannot be excluded a priori.

Larger revisions have occurred for euro area retail trade indicators and for compensation per employee statistics, due to sometimes high revisions in national data. In particular for euro area retail trade, the timeliness of the first release was recently advanced from 65 to 35 days and this might have contributed to the high revisions of early estimates. For GDP and unemployment, revisions have been higher in 1999 and 2000, mainly as a result of new statistical concepts that were introduced at that time.

At the euro area country level, revisions are often somewhat higher, but they often cancel out in the euro area aggregation. From a euro area perspective, it is important that national releases and revisions are synchronised to the extent possible and without jeopardising the timeliness of national data, in order to further increase the stability of euro area aggregates. In particular, progress towards a coordinated revision policy, both for regular and for occasional major revisions, is therefore desirable.

Finally, it is important for users that, in the communication of economic statistics (e.g in press releases), sufficient background information on revisions is provided as this is important for the analysis of the results, and would facilitate the use of these statistics.

ANNEX I
REVISION INDICATORS USED IN THE ANALYSIS

INDICATORS

A) TOTAL REVISIONS

Total revisions are calculated as the absolute difference between the current data and the first release of the statistics concerned. This is an important measure of reliability as it provides information on the overall stability of the first release. For example, a low absolute average of total revisions points to an almost unrevised first release.

Average revisions

Average of the difference between the latest available value and the first release for each observation period. This measure indicates a possible *bias of the first release*.

Average absolute revisions

Average of the absolute difference between the latest available value and the first release for each observation period, regardless of the respective sign. This measure indicates the *stability of the first release*. As a relative measure, the ratio of average absolute revisions to the average growth rate is provided (where a value of 100% indicates average absolute revisions of the growth rates of the same magnitude as the average growth rate of the indicator).

Range of revisions

Highest and lowest total revisions to the first release for all observation periods. This range indicates the *volatility of the first release*. The total range covers all the revisions and may include outliers, while the 90% range discards the largest 10% of the revisions.

B) SUCCESSIVE REVISIONS

Successive revisions are calculated by accumulating all revisions to the first release and provide complementary information on the fluctuations of the first release caused by revisions.

Average cumulative absolute revisions

For each observation period, the sum of revisions, regardless of the respective sign, is accumulated. The average for all observation periods may then be a useful supplementary indicator for the *volatility of the first release* as some euro area statistics are revised several times a month and "latest-to-first" comparison may hide revisions carried out in the meantime.

C) MEMORANDUM ITEM: AVERAGE QUARTERLY/ MONTHLY/ANNUAL GROWTH RATE

The average growth rates are helpful when assessing the impact of average revisions of the economic indicator, since the size of the acceptable revisions is likely to depend on the trend growth of the underlying series.

Data sources

From *June 2001* onwards, all *underlying data* for the euro area and for the EU countries are taken from the *internal database of the ECB's Directorate General Statistics (DG-Statistics)*, in which all incoming vintages of data from Eurostat are recorded. This also includes the data revised between the official releases (in the case of industrial production and retail sales turnover, for instance, this may amount to as many as 5-6 euro area data vintages per month). While every effort has been made to ensure revisions due to incorrect data transmissions or other technical errors have been eliminated from the analysis, the volume of data involved may mean that this data validation process is not totally perfect.

For *earlier periods*, the euro area data are taken from the published versions of the ECB's Monthly Bulletin. The latter, however, are a less suitable source because they do not reflect the intermediate revisions occurring between Monthly Bulletin cut-off dates and because there may be cases where the Monthly Bulletin contains an already revised second release, rather than the initial first release. Euro area data prior to 2002 exclude Greece.

Vintages of data for the *United States and Japan, as well as the first releases of GDP data*

for the EU countries before 2002 have been supplied by the Organisation for Economic Co-operation and Development (OECD), derived from databases used for the production of the (monthly) publication entitled "Main Economic Indicators".

Revisions available up to early July 2007 are reported. For data received from the OECD, revisions up to July 2007 are included.

Table 11 Gross domestic product – revision indicators

(seasonally (and partly working day-) adjusted, quarter-on-quarter volume change; in percentage points)

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average quarterly growth
			Total	90%		
Euro area						
2005Q1 - 2006Q4	0.06	0.09 (14%)	-0.1 to 0.3	-0.1 to 0.1	0.19	0.65
2002Q1 - 2004Q4	0.02	0.10 (32%)	-0.2 to 0.2	-0.2 to 0.1	0.58	0.31
1999Q1 - 2006Q4	0.09	0.14 (26%)	-0.2 to 0.5	-0.2 to 0.4	-	0.54
Belgium						
2005Q1 - 2006Q4	0.09	0.16 (28%)	-0.2 to 0.4	-0.2 to 0.2	0.24	0.58
2002Q1 - 2004Q4	0.12	0.32 (62%)	-0.4 to 0.6	-0.4 to 0.6	0.77	0.52
1999Q1 - 2006Q4	0.08	0.38 (67%)	-1.0 to 1.2	-0.8 to 0.6	-	0.57
Germany						
2005Q1 - 2006Q4	0.14	0.26 (37%)	-0.4 to 0.4	-0.4 to 0.3	0.29	0.7
2002Q1 - 2004Q4	-0.11	0.26 (867%)	-0.6 to 0.4	-0.6 to 0.2	0.46	0.03
1999Q1 - 2006Q4	0.07	0.28 (70%)	-0.6 to 0.6	-0.6 to 0.6	-	0.40
Spain						
2005Q1 - 2006Q4	0.05	0.08 (9%)	-0.1 to 0.3	-0.1 to 0.1	0.13	0.94
2002Q1 - 2004Q4	0.13	0.18 (25%)	-0.1 to 0.6	-0.1 to 0.3	0.50	0.73
1999Q1 - 2006Q4	0.17	0.27 (29%)	-0.5 to 0.9	-0.3 to 0.7	-	0.92
France						
2005Q1 - 2006Q4	0.03	0.13 (29%)	-0.2 to 0.2	-0.2 to 0.2	0.50	0.45
2002Q1 - 2004Q4	0.07	0.18 (40%)	-0.3 to 0.4	-0.3 to 0.3	1.17	0.45
1999Q1 - 2006Q4	0.07	0.20 (38%)	-0.4 to 0.6	-0.3 to 0.4	-	0.53
Italy						
2005Q1 - 2006Q4	0.05	0.10 (23%)	-0.1 to 0.2	-0.1 to 0.2	0.10	0.43
2002Q1 - 2004Q4	-0.03	0.17 (131%)	-0.3 to 0.2	-0.3 to 0.2	0.23	0.13
1999Q1 - 2006Q4	0.04	0.19 (51%)	-0.4 to 0.9	-0.3 to 0.4	-	0.37
Netherlands						
2005Q1 - 2006Q4	0.03	0.28 (45%)	-0.6 to 0.4	-0.6 to 0.4	0.93	0.62
2002Q1 - 2004Q4	0.21	0.36 (164%)	-0.3 to 1.0	-0.3 to 0.9	1.86	0.22
1999Q1 - 2006Q4	0.12	0.31 (58%)	-0.6 to 1.2	-0.3 to 0.9	-	0.53
United Kingdom						
2005Q1 - 2006Q4	-0.01	0.11 (18%)	-0.3 to 0.2	-0.3 to 0.1	0.31	0.60
2002Q1 - 2004Q4	0.10	0.18 (26%)	-0.4 to 0.4	-0.4 to 0.3	0.75	0.68
1999Q1 - 2006Q4	0.11	0.20 (30%)	-0.4 to 0.6	-0.2 to 0.4	-	0.67
United States						
2005Q1 - 2006Q4	0.10	0.18 (23%)	-0.3 to 0.6	0.0 to 0.2	0.20	0.80
2002Q1 - 2004Q4	-0.08	0.23 (20%)	-0.7 to 0.3	-0.3 to 0.3	0.51	0.77
1999Q1 - 2006Q4	-0.06	0.28 (41%)	-1.0 to 0.6	-0.7 to 0.3	-	0.69
Japan						
2005Q1 - 2006Q4	-0.09	0.41 (64%)	-1.1 to 0.6	-0.5 to 0.3	1.01	0.64
2002Q1 - 2004Q4	-0.19	0.31 (135%)	-1.0 to 0.4	-0.6 to 0.2	2.69	0.23
1999Q1 - 2006Q4	-0.15	0.57 (150%)	-2.7 to 2.0	-1.1 to 0.7	-	0.38

Source: ECB calculations based on data from Eurostat and the OECD.

Table 12 Euro area - gross domestic product expenditure components – revision indicators

(seasonally (and partly working day-) adjusted, quarter-on-quarter volume change; in percentage points)

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average quarterly growth
			Total	90%		
Private consumption						
2005Q1 - 2006Q4	0.09	0.24 (59%)	-0.2 to 0.5	-0.2 to 0.4	0.41	0.40
2002Q1 - 2004Q4	0.07	0.20 (60%)	-0.3 to 0.4	-0.3 to 0.3	1.30	0.34
1999Q1 - 2006Q4	0.09	0.24 (53%)	-0.3 to 0.9	-0.3 to 0.7	-	0.45
Government consumption						
2005Q1 - 2006Q4	0.10	0.30 (64%)	-0.3 to 0.7	-0.3 to 0.6	1.05	0.47
2002Q1 - 2004Q4	0.01	0.19 (49%)	-0.3 to 0.7	-0.3 to 0.3	2.31	0.39
1999Q1 - 2006Q4	0.09	0.25 (53%)	-0.4 to 0.7	-0.3 to 0.7	-	0.47
Gross fixed capital formation						
2005Q1 - 2006Q4	0.36	0.44 (38%)	-0.3 to 1.1	-0.3 to 0.9	1.19	1.15
2002Q1 - 2004Q4	0.43	0.56 (227%)	-0.4 to 1.8	-0.4 to 0.9	3.01	0.25
1999Q1 - 2006Q4	0.38	0.51 (76%)	-0.5 to 1.8	-0.4 to 1.6	-	0.67
Changes in inventories[1]						
2005Q1 - 2006Q4	0.00	0.08	-0.2 to 0.1	-0.1 to 0.1	-	-
2002Q1 - 2004Q4	-0.08	0.15	-0.3 to 0.2	-0.3 to 0.1	-	-
1999Q1 - 2006Q4	-0.03	0.17	-0.3 to 0.7	-0.3 to 0.6	-	-
Exports						
2005Q1 - 2006Q4	-0.20	0.40 (23%)	-0.8 to 0.5	-0.8 to 0.3	1.48	1.77
2002Q1 - 2004Q4	-0.20	0.70 (76%)	-1.3 to 1.3	-1.3 to 0.8	3.05	0.92
1999Q1 - 2006Q4	0.12	0.72 (50%)	-1.3 to 2.1	-1.2 to 2.1	-	1.43
Imports						
2005Q1 - 2006Q4	0.04	0.34 (22%)	-0.6 to 0.8	-0.6 to 0.3	1.31	1.57
2002Q1 - 2004Q4	0.05	0.70 (59%)	-1.3 to 1.2	-1.3 to 1.1	3.67	1.18
1999Q1 - 2006Q4	0.12	0.65 (48%)	-1.5 to 2.4	-1.2 to 1.2	-	1.35

Source: ECB calculations based on data from Eurostat.
1) Revisions to the contributions of changes in inventories to quarterly GDP growth; changes in inventories exclude acquisitions of valuables.

Table 13 Employment – revision indicators

(seasonally adjusted, quarter-on-quarter growth rate; in percentage points)

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average quarterly growth rate
			Total	90%		
Euro area						
2005Q1 - 2006Q4	-0.03	0.10 (37%)	-0.2 to 0.2	-0.2 to 0.1	0.30	0.27
2002Q1 - 2004Q4	0.11	0.14 (81%)	-0.1 to 0.3	-0.1 to 0.3	0.78	0.17
Belgium						
2005Q1 - 2006Q4	0.08	0.15 (54%)	-0.2 to 0.3	-0.2 to 0.3	0.18	0.28
2002Q1 - 2004Q4	0.04	0.09 (147%)	-0.1 to 0.3	-0.1 to 0.2	0.19	0.06
Germany						
2005Q1 - 2006Q4	-0.08	0.15 (126%)	-0.4 to 0.2	-0.4 to 0.1	0.20	0.12
2002Q1 - 2004Q4	0.09	0.16 (-188%)	-0.20 to 0.40	-0.20 to 0.30	0.46	-0.08
Spain						
2005Q1 - 2006Q4	0.01	0.06 (8%)	-0.1 to 0.2	-0.1 to 0.1	0.11	0.81
2002Q1 - 2004Q4	0.37	0.38 (49%)	-0.1 to 0.7	-0.1 to 0.6	0.63	0.79
France						
2005Q1 - 2006Q4	0.03	0.03 (14%)	0.0 to 0.1	0.0 to 0.1	0.18	0.17
2002Q1 - 2004Q4	0.00	0.05 (89%)	-0.2 to 0.1	-0.2 to 0.1	0.40	0.06
Italy						
2005Q1 - 2006Q4	-0.10	0.30 (166%)	-0.7 to 0.8	-0.7 to 0.0	0.70	0.18
2002Q1 - 2004Q4	0.03	0.40 (138%)	-1.3 to 0.6	-1.3 to 0.6	1.10	0.29
Netherlands (non-adjusted data)						
2005Q1 - 2006Q4	-0.01	0.26 (96%)	-0.6 to 0.6	-0.6 to 0.4	0.29	0.27
2002Q1 - 2004Q4	0.02	0.62 (-492%)	-0.8 to 1.2	-0.8 to 1.1	1.02	-0.13
United Kingdom						
2005Q1 - 2006Q4	0.08	0.08 (39%)	0.0 to 0.2	0.0 to 0.2	0.08	0.19
2002Q1 - 2004Q4	0.10	0.20 (82%)	-0.2 to 0.5	-0.2 to 0.4	0.92	0.24
United States						
2005Q1 - 2006Q4	0.01	0.01 (3%)	0.0 to 0.1	0.0 to 0.0	0.01	0.50
2002Q1 - 2004Q4	0.03	0.04 (12%)	-0.1 to 0.2	0.1 to 0.1	0.11	0.35
Japan						
2005Q1 - 2006Q4	0.01	0.06 (41%)	-0.1 to 0.2	-0.1 to 0.1	0.06	0.15
2002Q1 - 2004Q4	0.01	0.18 (-149%)	-0.3 to 0.4	-0.2 to 0.3	0.26	-0.12

Source: ECB calculations based on data from the ECB (euro area), from Eurostat (EU countries) and from the OECD (United States and Japan).

Table 14 Unemployment rate – revision indicators

(seasonally adjusted, monthly change; in percentage points)

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to monthly rate)	Range of revisions		Average cumulative absolute revision	Average monthly rate
			Total	90%		
Euro area						
Jan. 2005 - Dec. 2006	-0.03	0.06 (1%)	-0.2 to 0.1	-0.2 to 0.1	0.36	8.23
Jan. 2002 - Dec. 2004	-0.13	0.13 (1%)	-0.5 to 0.0	-0.5 to 0.0	0.66	8.56
Jan. 1999 - Dec. 2006	-0.38	0.39 (5%)	-1.2 to 0.1	-1.1 to 0.1	-	8.41
Belgium						
Jan. 2005 - Dec. 2006	0.09	0.30 (4%)	-0.6 to 0.5	-0.6 to 0.4	0.69	8.35
Jan. 2002 - Dec. 2004	0.27	0.40 (5%)	-0.7 to 1.1	-0.7 to 0.7	1.07	8.03
Germany						
Jan. 2005 - Dec. 2006	-0.03	0.11 (1%)	-0.3 to 0.2	-0.3 to 0.1	0.33	8.90
Jan. 2002 - Dec. 2004	-0.13	0.20 (2%)	-0.6 to 0.2	-0.6 to 0.1	1.07	8.93
Spain						
Jan. 2005 - Dec. 2006	-0.01	0.39 (4%)	-0.9 to 0.8	-0.9 to 0.6	0.98	8.84
Jan. 2002 - Dec. 2004	-0.50	0.50 (5%)	-2.1 to 0.0	-2.1 to -0.2	1.43	10.94
France						
Jan. 2005 - Dec. 2006	0.34	0.41 (4%)	-0.2 to 0.8	-0.2 to 0.7	0.88	9.56
Jan. 2002 - Dec. 2004	0.00	0.20 (2%)	-0.6 to 0.3	-0.6 to 0.2	0.52	9.27
Italy						
Jan. 2005 - Dec. 2006	-0.01	0.09 (1%)	-0.2 to 0.2	-0.2 to 0.2	0.24	7.25
Jan. 2002 - Dec. 2004	-0.18	0.28 (3%)	-0.5 to 0.5	-0.5 to 0.1	0.45	8.36
Netherlands						
Jan. 2005 - Dec. 2006	-0.09	0.14 (3%)	-0.3 to 0.2	-0.3 to 0.1	0.36	4.31
Jan. 2002 - Dec. 2004	-0.14	0.18 (5%)	-0.5 to 0.2	-0.5 to 0.1	0.56	3.67
United Kingdom						
Jan. 2005 - Dec. 2006	0.00	0.05 (1%)	-0.2 to 0.1	-0.2 to 0.1	0.14	5.04
Jan. 2002 - Dec. 2004	0.01	0.03 (1%)	-0.1 to 0.1	-0.1 to 0.1	0.11	4.90
United States						
Jan. 2005 - Dec. 2006	0.00	0.00 (0%)	-0.1 to 0.0	-0.1 to 0.0	0.01	4.85
Jan. 2002 - Dec. 2004	-0.01	0.04 (1%)	-0.1 to 0.1	-0.1 to 0.1	0.06	5.77
Jan. 1999 - Dec. 2006	-0.01	0.03 (1%)	-0.1 to 0.2	-0.1 to 0.1	-	4.99
Japan						
Jan. 2005 - Dec. 2006	0.00	0.00 (0%)	0.0 to 0.0	0.0 to 0.0	0.00	4.28
Jan. 2002 - Dec. 2004	0.00	0.00 (0%)	0.0 to 0.0	0.0 to 0.0	0.00	5.11
Jan. 1999 - Dec. 2006	0.00	0.02 (0%)	-0.2 to 0.1	-0.1 to 0.1	-	4.79

Source: ECB calculations based on data from Eurostat (euro area and EU countries) and from the OECD (United States and Japan).

Table 15 Compensation per employee – revision indicators

(seasonally (and partly working day-) adjusted, quarter-on-quarter growth rate; in percentage points)

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average monthly growth rate
			Total	90%		
Euro area						
2005Q1 - 2006Q4	0.05	0.20 (41%)	-0.5 to 0.3	-0.5 to 0.2	0.78	0.49
2002Q1 - 2004Q4	-0.05	0.20 (38%)	-0.5 to 0.4	-0.5 to 0.3	1.75	0.52
Belgium						
2005Q1 - 2006Q4	0.16	0.29 (41%)	-0.3 to 0.7	-0.3to 0.7	0.96	0.70
2002Q1 - 2004Q4	-0.06	0.28 (55%)	-1.0 to 0.5	-1.0 to 0.2	1.38	0.50
Germany						
2005Q1 - 2006Q4	0.11	0.14 (143%)	-0.1 to 0.4	-0.1 to 0.3	0.56	0.10
2002Q1 - 2004Q4	-0.13	0.41 (209%)	-1.6 to 0.6	-1.6 to 0.4	1.18	0.20
Spain						
2005Q1 - 2006Q4	0.03	0.10 (13%)	-0.3 to 0.3	-0.3 to 0.1	0.48	0.77
2002Q1 - 2004Q4	-0.31	0.41 (67%)	-1.0 to 0.5	-1.0 to 0.1	1.29	0.61
France						
2005Q1 - 2006Q4	0.05	0.13 (17%)	-0.1 to 0.3	-0.1 to 0.2	0.68	0.76
2002Q1 - 2004Q4	0.16	0.23 (29%)	-0.3 to 0.6	-0.3 to 0.4	0.96	0.79
Italy						
2005Q1 - 2006Q4	0.13	0.48 (94%)	-0.8 to 0.8	-0.8 to 0.6	1.00	0.50
2002Q1 - 2004Q4	0.12	0.43 (66%)	-0.7 to 1.4	-0.7 to 0.9	2.03	0.66
Netherlands (non-adjusted data)						
2005Q1 - 2006Q4	0.24	0.69 (279%)	-1.4 to 2.2	-1.4 to 0.8	1.59	0.25
2002Q1 - 2004Q4	0.27	2.49 (254%)	-2.6 to 4.6	-2.6 to 4.6	4.31	0.98
United Kingdom (non adjusted, only available up to 2005Q2)						
2002Q1 - 2004Q4	-0.09	0.58 (54%)	-2.6 to 1.0	-2.6 to 0.6	1.63	1.06

Source: ECB calculations based on data from Eurostat.

Table 16 Labour cost index – revision indicators

(seasonally and working day-adjusted, quarter-on-quarter growth rate; in percentage points)

	Total revisions (latest minus first release)				Successive revisions	Memo item:
			Range of revisions			
Observations	Average revision	Average absolute revision (relative to average growth)	Total	90%	Average cumulative absolute revision	Average quarterly growth rate
Euro area						
2005Q1 - 2006Q4	0.00	0.08 (13%)	-0.2 to 0.1	-0.2 to 0.1	0.25	0.58
2002Q1 - 2004Q4	0.02	0.13 (17%)	-0.2 to 0.2	-0.2 to 0.2	1.06	0.73
Belgium						
2005Q1 - 2006Q4	-0.05	0.55 (111%)	-1.9 to 1.4	-1.9 to 0.4	0.55	0.49
2002Q1 - 2004Q4	0.02	0.25 (38%)	-0.5 to 0.7	-0.5 to 0.3	0.42	0.66
Germany						
2005Q1 - 2006Q4	0.06	0.16 (78%)	-0.3 to 0.4	-0.3 to 0.2	0.39	0.21
2002Q1 - 2004Q4	-0.14	0.33 (78%)	-0.6 to 0.4	-0.6 to 0.4	1.54	0.42
Spain[1]						
2005Q1 - 2006Q4	-0.05	0.13 (14%)	-0.3 to 0.2	-0.3 to 0.1	0.23	0.92
2002Q1 - 2004Q4	-0.06	1.14 (103%)	-2.9 to 5.7	-2.9 to 0.3	2.73	1.11
France						
2005Q1 - 2006Q4	0.00	0.25 (30%)	-0.4 to 0.5	-0.4 to 0.2	0.45	0.85
2002Q1 - 2004Q4	0.19	0.36 (40%)	-0.4 to 1.7	-0.4 to 0.7	1.01	0.90
Italy (data confidential)						
Netherlands						
2005Q1 - 2006Q4	0.07	1.10 (198%)	-2.3 to 3.0	-2.3 to 0.9	2.25	0.56
2002Q1 - 2004Q4	0.1	1.08 (113%)	-1.9 to 1.8	-1.9 to 1.7	4.25	0.96
United Kingdom						
2005Q1 - 2006Q4	0.18	0.48 (54%)	-1.0 to 1.4	-1.0 to 0.5	1.45	0.88
2002Q1 - 2004Q4	0.37	1.20 (96%)	-1.6 to 2.2	-1.6 to 1.8	2.30	1.25

Source: ECB calculations based on data from Eurostat
1) The wide ranges and high cumulative absolute revisions for Spain are caused by the introduction of a new data source (which replaced former estimations).

Table 17 Industrial production – revision indicators

(seasonally and working day-adjusted, month-on-month growth rate; in percentage points)

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average monthly growth rate
			Total	90%		
Euro area						
Jan. 2005 - Dec. 2006	0.11	0.35 (117%)	-1.0 to 1.2	-1.0 to 0.7	1.25	0.30
Jan. 2002 - Dec. 2004	0.10	0.35 (350%)	-0.7 to 1.0	-0.7 to 0.7	3.35	0.10
Jan. 1999 - Dec. 2006	0.09	0.41 (228%)	-1.2 to 1.2	-0.7 to 1.0	-	0.18
Belgium						
Jan. 2005 - Dec. 2006	0.59	1.26 (423%)	-2.1 to 5.2	-2.1 to 2.5	5.19	0.30
Jan. 2002 - Dec. 2004	0.39	1.32 (876%)	-3.0 to 5.1	-3.0 to 2.2	8.38	0.15
Germany						
Jan. 2005 - Dec. 2006	0.19	0.51 (107%)	-1.5 to 1.4	-1.5 to 1.1	1.16	0.48
Jan. 2002 - Dec. 2004	0.21	0.63 (411%)	-1.5 to 2.1	-1.5 to 1.0	2.70	0.15
Spain						
Jan. 2005 - Dec. 2006	0.08	0.33 (104%)	-1.7 to 0.7	-1.7 to 0.6	0.73	0.32
Jan. 2002 - Dec. 2004	-0.04	0.58 (483%)	-1.5 to 1.3	-1.5 to 0.7	1.80	0.12
France						
Jan. 2005 - Dec. 2006	0.01	0.42 (1289%)	-1.6 to 1.0	-1.6 to 0.8	1.23	0.03
Jan. 2002 - Dec. 2004	0.01	0.66 (755%)	-1.2 to 1.2	-1.2 to 1.2	3.19	0.09
Italy						
Jan. 2005 - Dec. 2006	0.10	0.35 (139%)	-0.8 to 0.7	-0.8 to 0.6	1.02	0.25
Jan. 2002 - Dec. 2004	0.06	0.37 (-667%)	-1.6 to 1.4	-1.6 to 0.6	2.22	-0.05
Netherlands						
Jan. 2005 - Dec. 2006	0.05	0.93 (1923%)	-1.9 to 2.3	-1.9 to 1.7	1.93	0.05
Jan. 2002 - Dec. 2004	0.28	1.67 (4386%)	-4.6 to 7.9	-4.6 to 2.0	3.99	0.04
United Kingdom						
Jan. 2005 - Dec. 2006	-0.04	0.23 (-245%)	-0.9 to 0.7	-0.9 to 0.2	0.73	-0.09
Jan. 2002 - Dec. 2004	0.09	0.48 (1561%)	-1.0 to 1.2	-1.0 to 0.6	1.62	0.03
United States						
Jan. 2005 - Dec. 2006	0.03	0.25 (94%)	-0.6 to 0.5	-0.5 to 0.4	0.52	0.27
Jan. 2002 - Dec. 2004	-0.04	0.24 (116%)	-0.6 to 0.6	-0.5 to 0.3	0.84	0.21
Jan. 1999 - Dec. 2006	0.00	0.27 (170%)	-0.9 to 0.9	-0.6 to 0.5	-	0.16
Japan						
Jan. 2005 - Dec. 2006	0.04	0.58 (145%)	-1.4 to 1.4	-1.2 to 1.2	0.79	0.40
Jan. 2002 - Dec. 2004	0.10	0.51 (166%)	-1.1 to 1.5	-1.0 to 1.0	0.92	0.31
Jan. 1999 - Dec. 2006	0.02	0.82 (455%)	-3.8 to 2.5	-1.8 to 1.5	-	0.18

Source: ECB calculations based on data from Eurostat (euro area and EU countries) and from the OECD (United States and Japan).

Table 18 Retail trade turnover – revision indicators

(seasonally and working day-adjusted, month-on-month volume change; in percentage points)

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average monthly growth rate
			Total	90%		
Euro area						
Jan. 2005 - Dec. 2006	-0.03	0.23 (150%)	-0.6 to 1.0	-0.6 to 0.2	2.12	0.16
Jan. 2002 - Dec. 2004	0.03	0.60 (668%)	-2.3 to 2.3	-2.3 to 0.8	10.58	0.09
May 1999 - Dec. 2006	0.00	0.42 (300%)	-2.3 to 2.3	-0.8 to 1.0	-	0.14
Belgium						
Jan. 2005 - Dec. 2006	0.18	1.26 (-2079%)	-2.5 to 3.1	-2.5 to 2.6	6.84	-0.06
Jan. 2002 - Dec. 2004	-0.12	1.08 (2147%)	-4.4 to 3.4	-4.4 to 1.6	11.01	0.05
Germany						
Jan. 2005 - Dec. 2006	0.26	0.87 (391%)	-2.1 to 2.7	-2.1 to 1.2	5.13	0.22
Jan. 2002 - Dec. 2004	0.03	1.42 (5201%)	-5.8 to 3.5	-5.8 to 1.8	10.06	0.03
Spain						
Jan. 2005 - Dec. 2006	0.02	0.29 (166%)	-0.8 to 1.3	-0.8 to 0.3	0.90	0.17
Jan. 2002 - Dec. 2004	-0.08	0.63 (215%)	-2.4 to 1.5	-2.4 to 0.8	2.90	0.29
France						
Jan. 2005 - Dec. 2006	-0.43	0.48 (462%)	-1.3 to 0.4	-1.3 to 0.0	1.35	0.10
Jan. 2002 - Dec. 2004	-0.02	1.04 (475%)	-3.7 to 2.2	-3.7 to 1.6	2.58	0.22
Italy						
Jan. 2005 - Dec. 2006	0.04	0.18 (-715%)	-0.5 to 0.6	-0.5 to 0.4	0.75	-0.03
Jan. 2002 - Dec. 2004	-0.06	0.40 (-351%)	-0.9 to 0.9	-0.9 to 0.5	4.12	-0.11
Netherlands						
Jan. 2005 - Dec. 2006	0.15	0.52 (165%)	-1.0 to 1.6	-1.0 to 1.3	1.24	0.31
Jan. 2002 - Dec. 2004	0.11	0.68 (-545%)	-2.00 to 1.90	-2.0 to 1.1	8.35	-0.12
United Kingdom						
Jan. 2005 - Dec. 2006	-0.02	0.34 (112%)	-0.9 to 1.3	-0.9 to 0.4	1.25	0.30
Jan. 2002 - Dec. 2004	-0.07	0.38 (114%)	-1.4 to 1.0	-1.4 to 0.3	5.60	0.33
United States						
Jan. 2005 - Dec. 2006	-0.11	0.44 (254%)	-1.2 to 1.1	-1.2 to 0.6	0.92	0.17
Jan. 2002 - Dec. 2004	-0.21	0.52 (248%)	-1.3 to 1.6	-1.1 to 0.7	2.04	0.21
Jan. 1999 - Dec. 2006	-0.23	0.51 (269%)	-1.6 to 1.6	-1.2 to 0.7	-	0.19
Japan						
Jan. 2005 - Dec. 2006	-0.10	0.52 (6082%)	-2.5 to 1.2	-1.2 to 1.1	1.02	0.01
Jan. 2002 - Dec. 2004	-0.03	0.94 (3285%)	-3.1 to 2.2	-2.2 to 1.3	2.09	0.03
Jan. 1999 - Dec. 2006	0.02	0.75 (23630%)	-3.1 to 2.2	-1.9 to 1.6	-	0.00

Source: ECB calculations based on data from Eurostat (euro area and EU countries) and from the OECD (United States and Japan).

Table 19 HICP – revision indicators

(non-seasonally adjusted year-on-year growth rate; in percentage points)

Observations	Total revisions (latest minus first release)				Successive revisions	Memo item:
	Average revision	Average absolute revision (relative to average growth)	Range of revisions		Average cumulative absolute revision	Average annual rate
			Total	90%		
Euro area						
Jan. 2005 - Dec. 2006	0.00	0.04 (2%)	-0.2 to 0.1	-0.2 to 0.1	0.05	2.19
Jan. 2002 - Dec. 2004	0.01	0.06 (3%)	-0.1 to 0.2	-0.1 to 0.1	0.09	2.16
Jan. 1999 - Dec. 2006	-0.06	0.10 (5%)	-0.7 to 0.2	-0.4 to 0.1	-	2.05
Belgium						
Jan. 2005 - Dec. 2006	0.00	0.01 (1%)	-0.1 to 0.1	-0.1 to 0.0	0.02	2.44
Jan. 2002 - Dec. 2004	0.00	0.01 (0%)	-0.1 to 0.1	-0.1 to 0.0	0.02	1.64
Germany						
Jan. 2005 - Dec. 2006	-0.04	0.07 (4%)	-0.3 to 0.2	-0.3 to 0.1	0.10	1.84
Jan. 2002 - Dec. 2004	0.02	0.11 (8%)	-0.2 to 0.3	-0.2 to 0.2	0.21	1.40
Spain						
Jan. 2005 - Dec. 2006	-0.01	0.02 (0%)	-0.1 to 0.1	-0.1 to 0.0	0.03	3.48
Jan. 2002 - Dec. 2004	0.03	0.03 (1%)	0.0 to 0.6	0.0 to 0.1	0.05	3.24
France						
Jan. 2005 - Dec. 2006	0.00	0.00 (0%)	0.0 to 0.0	0.0 to 0.0	0.00	1.91
Jan. 2002 - Dec. 2004	0.00	0.02 (1%)	-0.1to 0.1	-0.1 to 0.0	0.03	2.15
Italy						
Jan. 2005 - Dec. 2006	-0.01	0.05 (2%)	-0.3 to 0.2	-0.3 to 0.1	0.08	2.20
Jan. 2002 - Dec. 2004	0.00	0.06 (2%)	-0.3 to 0.2	-0.3 to 0.1	0.08	2.56
Netherlands						
Jan. 2005 - Dec. 2006	-0.02	0.02 (1%)	-0.1 to 0.0	-0.1 to 0.0	0.03	1.57
Jan. 2002 - Dec. 2004	-0.08	0.08 (3%)	-0.4 to 0.1	-0.4 to 0.0	0.10	2.49
United Kingdom						
Jan. 2005 - Dec. 2006	0.00	0.01 (1%)	-0.1 to 0.1	-0.1 to 0.0	0.01	2.18
Jan. 2002 - Dec. 2004	-0.01	0.02 (2%)	-0.1 to 0.1	-0.1 to 0.0	0.02	1.32
United States						
Jan. 2005 - Dec. 2006	0.00	0.00	0.0 to 0.0	0.0 to 0.0	0.00	2.46
Jan. 2002 - Dec. 2004	0.00	0.03	-0.1 to 0.1	-0.1 to 0.1	0.03	1.69
Jan. 1999 - Dec. 2006	0.02	0.03	-0.1 to 0.2	-0.1 to 0.1	-	2.04
Japan						
Jan. 2005 - Dec. 2006	-0.15	0.21	-0.6 to 0.3	-0.5 to 0.2	0.21	-0.02
Jan. 2002 - Dec. 2004	0.00	0.00	0.0 to 0.0	0.0 to 0.0	0.00	-0.39
Jan. 1999 - Dec. 2006	-0.06	0.11	-0.6 to 0.4	-0.5 to 0.2	-	-0.37

Source: ECB calculations based on data from Eurostat (euro area and EU countries) and from the OECD (United States and Japan).

ANNEX 2
STATISTICAL CHANGES TO THE NATIONAL ACCOUNTS OF THE EURO AREA AND ITS SIX LARGEST COUNTRIES

1 INTRODUCTION

In the period 2005 to mid-2007 revisions to euro area and Member States' national accounts have been the result of statistical improvements which result in more accurate and internationally comparable national accounts statistics. Methodological changes like the introduction of chain-linking to determine GDP volume growth and direct measures for output volume growth in government-related services are required by EU legislation,[1] and are needed for the adequate monitoring of the Stability and Growth Pact, for instance. The availability of more accurate volume growth figures is also important for assessing the progress towards the targets set out in the Lisbon strategy. Another methodological change required by EU legislation concerns the allocation to demand categories of the interest margin, or financial intermediation services indirectly measured (FISIM), an issue that was left unresolved by the ESA 95 in 1996 and that mainly affects the level of nominal GDP. The introduction of these methodological improvements coincided with the regular revisions, at intervals of five years, of the benchmarks in 2005, which are necessary to take into account new and improved source data that may become available only on a multi-annual basis. These revisions had been agreed upon and were announced well in advance.

It should be noted that revisions of the national accounts benchmarks are commonly used to integrate numerous improvements into previously published estimates. While the publications of national statistical institutes usually include some qualitative and – in fewer cases – quantitative information on major single factors that caused revisions, a comprehensive breakdown of contributions to the revisions is not published.

2 REVISIONS TO EURO AREA NATIONAL ACCOUNTS IN 2005 [2]

On 30 November 2005, in the first regular release for the third quarter of 2005, Eurostat introduced *chain-linked volume measures* in euro area annual and quarterly national accounts statistics. The introduction of chain-linking improves the accuracy of volume growth measures as it involves applying an annually changing weighting structure, using values at the prices of the previous year, rather than a fixed weighting structure that is updated only once every five years. If fixed weights are used for a prolonged period, they become less and less relevant over time, and lead to biased GDP volume growth estimates.

The chain-linking of euro area statistics, as published in November 2005, however, has *not led to large revisions to the volume growth of euro area GDP and its components* (cf. Chart 9). The reason is that several countries (e.g. Germany, Spain and the Netherlands) had already introduced a chain-linking of quarterly data earlier in 2005, or even long before that. The change to chain-linking for the euro area aggregates on 30 November 2005 only relates to the use of annually changing country weights (rather than using the country weights of the fixed base year 1995). Chart 10 shows that the *profile of seasonally and working day-adjusted GDP volume growth was revised only slightly, with revisions of around 0.1 percentage point* in the period under investigation.

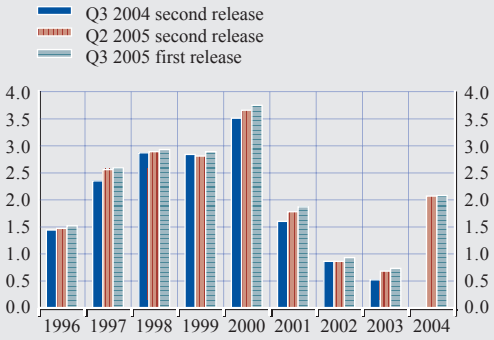
In parallel, Eurostat introduced a new allocation to demand categories of the imputed output of financial intermediaries, FISIM. Previously,

1 In addition, some Member States have introduced further methodological changes, e.g. the use of hedonic deflators for investment by the Statistische Bundesamt (German Federal Statistical Office) (see also Deutsche Bundesbank, "Revision der Volkswirtschaftlichen Gesamtrechnungen (VGR) für Deutschland", *Monatsbericht*, May 2005).

2 For further information, see Box 5, entitled "Improvements to euro area GDP and national accounts", in the December 2005 issue of the ECB's Monthly Bulletin and Eurostat's website (http://europa.eu.int/estatref/info/sdds/en/na/na_changes2005.pdf).

Chart 10 Annual euro area GDP volume growth

(percentages)



Sources: Eurostat and ECB calculations.

FISIM was recorded as intermediate consumption by a nominal (sector or) branch of activity. In the new treatment of FISIM, GDP levels increase through the allocation of part of FISIM to final consumption and exports. *The allocation of FISIM led to a revision of euro area GDP levels by +1.2%, on average. The effect on GDP volume growth rates is negligible, according to the information available from Eurostat.*

3 REVISIONS TO SELECTED MEMBER STATES' NATIONAL ACCOUNTS IN 2005

Tables 20 and 21 provide an overview of the combined effect of the implementation of the above-mentioned statistical changes on annual GDP volume growth and nominal GDP levels in Belgium[3], Germany, Spain, France and the Netherlands for the period from 2001 to 2004. According to this, the revisions to annual GDP volume growth have been particularly marked in Spain and the Netherlands. Nominal GDP levels – used, for example, to calculate government deficit and debt ratios – have been revised upwards by, on average, between 1.4% and 4.6%, mainly as a result of the impact of the new treatment of FISIM and the use of improved source data and methods. It is noticeable that for Spain and the Netherlands, the high revisions to GDP volume growth and nominal GDP levels are largely due to specific statistical changes. As regards Spain, significant upward revisions to population estimates (varying from 339,000 persons in 2000 to 1,589,000 persons in 2004) as a result of incorporating the 2001 census and the use of Population Register data are the main factor determining the revisions (see also Annex 3). The revision of the national accounts of the Netherlands also reflects the use of improved source data, including a revised balance of payments and new labour market and production statistics.

3 For Belgium, this revision does not yet reflect the introduction of chain-linked volume measures.

Table 20 Overview of revisions to annual GDP volume growth

	Belgium (30 September 2005)		Germany (28 April 2005)		Spain (19 May 2005)	
	Revision (pp)	New growth (%)	Revision (pp)	New growth (%)	Revision (pp)	New growth (%)
2001	+ 0.3	+1.0	+ 0.4	+ 1.2	+ 0.7	+ 3.5
2002	+ 0.6	+ 1.5	+ 0.1	+ 0.2	+ 0.5	+ 2.7
2003	- 0.3	+ 0.9	+ 0.1	0.0	+ 0.4	+ 2.9
2004	- 0.3	+ 2.6	0.0	+ 1.6	+ 0.4	+ 3.1

	France (20 May 2005)		Netherlands (6 July 2005)	
	Revision (pp)	New growth (%)	Revision (pp)	New growth (%)
2001	0.0	+ 2.1	n.a.	n.a.
2002	0.0	+ 1.2	- 0.5	+ 0.1
2003	+ 0.3	+ 0.8	+ 0.8	- 0.1
2004	- 0.3	+ 2.3	+ 0.3	+ 1.7

Source: Eurostat and national statistical institutes.

Table 21 Revisions to nominal GDP levels

(percentages)

	Belgium (1995-2002)	Germany (1991-2004)	Spain (2000-2004)	France (1993-2003)	Netherlands (2001-2004)
Average revision	+1.9	+2.0	+3.3	+1.3	+4.6

Source: Eurostat and national statistical institutes.

4 FURTHER REVISIONS TO NATIONAL ACCOUNTS IN 2006-2007

Following the major revision of euro area national accounts on 30 November 2005, euro area data have been subject to further revisions as some Member States have completed the implementation of these major changes in their national accounts in 2006-2007. The *Italian* statistical institute published its major revision of the annual national accounts for the period 2001 to 2004 on 1 March 2006, while the results for the periods from 1992 to 2000 were already published in December 2005. The corresponding revised quarterly national accounts for Italy were made available on 28 March 2006. Focusing on the most recent period, revisions to annual GDP volume growth ranged between -0.3 percentage point and zero percentage point (see Table 22), mainly due to the introduction of chain-linked volume measures. Nominal GDP levels have been revised upwards by 2.6%, on average, largely due to the introduction of improved methods and source data (1.8%) and the allocation of FISIM to demand categories (0.8%).

Chain-linked volume measures were introduced in the national accounts for *Belgium* on 26 October 2006, along with the introduction of improved volume measures for non-market education services and other activities, leading to an average revision of annual GDP volume growth of around ±0.1 percentage point. The *French* statistical institute published chain-linked volume measures for quarterly national accounts on 15 May 2007, causing an average revision of quarter-on-quarter GDP volume growth of ±0.1 percentage point.

The effect of these revisions was progressively included in Eurostat's releases of euro area national accounts, along with the effect of other regular revisions that statistical institutes carry out (e.g. when annual source data become available or when seasonal parameters are updated). Eurostat's first regular release of euro area national accounts for the first quarter of 2007, published on 1 June 2007, includes the overall effect all of the above-mentioned major revisions, as well as that of the more recent regular revisions carried out by Member States. Chart 11 shows that this has entailed only small revisions to euro area quarter-on-quarter GDP volume growth.

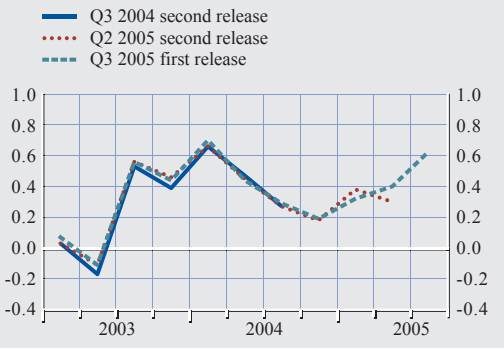
Table 22 Revisions to annual GDP volume growth – Italy

	Italy (1 March 2006)	
	Revision (pp)	New growth (%)
2001	0.0	+ 1.8
2002	- 0.1	+ 0.3
2003	- 0.3	0.0
2004	- 0.1	+ 1.1

Source: Eurostat and ISTAT.

Chart 11 Quarter-on-quarter euro area GDP volume growth

(percentages; seasonally and partly working-day-adjusted)



Sources: Eurostat and ECB calculations.

5 SUMMARY AND CONCLUSIONS

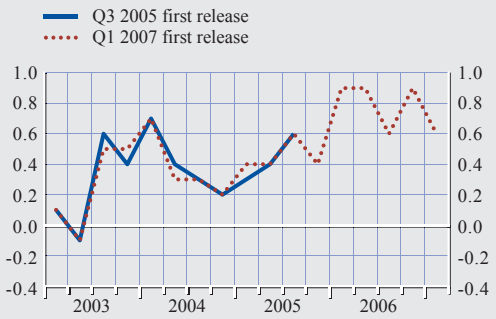
In the period 2005 to mid-2007, euro area and Member States' GDP and national accounts data have been subject to revisions due to the implementation of important statistical changes, which constitute clear improvements as a result of the use of improved methods and source data.

The *implementation of these changes has caused relatively moderate revisions of euro area GDP volume growth estimates.* The revisions to annual growth rates ranged from 0.1 percentage point to 0.3 percentage point, and the profile of seasonally adjusted GDP growth was revised only slightly. *Nominal euro area GDP levels were revised upwards by 1.2%, on average.* At the country level, however, revisions to GDP growth and nominal GDP have been more sizable, particularly for Spain and the Netherlands, mainly as a result of improved source data.

While the effect of the revisions on euro area GDP growth rates has been small, the *coordination of the actual implementation of these major changes among Member States has been inadequate.* The changeover timetable for EU countries ranges over almost three years, starting in 2004 and ending in 2007. These differences in implementation dates, as well as the short length of backdata that are initially provided reduce the comparability between countries over an extended interim period. This underlines the need for further efforts to harmonise euro area statistics well in advance, not only in terms of statistical methods and concepts, but also in terms of better coordinated national release and, in particular, revision policies.

Chart 12 Quarter-on-quarter euro area GDP volume growth

(percentages; seasonally and partly working-day-adjusted)



Sources: Eurostat and ECB calculations.

ANNEX 3
STATISTICAL CHANGES TO THE EMPLOYMENT STATISTICS IN THE EURO AREA, GERMANY AND SPAIN

1 INTRODUCTION

Revision analysis has shown that euro area employment changes are generally stable (see main paper), but the same does not hold true for their levels. Up to mid-2006 no official euro area employment estimates were available. Instead, first estimates of euro area employment data (national accounts definition, expressed in number of persons) were compiled by the ECB's DG Statistics around 100 days after the reference quarter, with an underlying country coverage of at least 80%. From mid-2006 Eurostat started a regular release of employment data with a flash estimate at 75 days after the reference quarter and a full release at 100 days. The revision analysis combines information from the data previously released by the ECB and that which is now available from Eurostat.

For two euro area countries, namely Germany and Spain, employment levels were revised significantly, which is examined in more detail in this annex.

2 EURO AREA DATA

In the first quarter of 2007, over 141 million persons were employed in the euro area. The average revision of data in 2005-2006 was +129,000 persons, or +0.09% of the total. Revisions between 2002 and 2004 were far higher – the average was +1.5 million persons (1.1%), measured as the difference between the latest and the first release.

One source of revisions to euro area results concerns gaps in the country coverage at the time of the compilation of the first results. In this case, the ECB when it was the producer of the data interpolated available annual data and/or its forecasts supplied by the European Commission's Directorate General for Economic and Financial Affairs (DG-ECFIN) until the first statistical data were released for the countries. While the revision due to this effect was small in previous years, it accounted for an upward correction of around 225,000 persons in 2005-2006, due to the stronger-than-expected employment growth in the countries concerned (e.g. +3.7% in Greece). In the meantime data availability has improved allowing Eurostat estimates to be published with more underlying data and therefore not needing to rely on forecasts.

Table 23 shows indicators for total and successive revisions of employment levels for the euro area and for selected euro area countries. For each of the observation periods, the average revision points to the bias of the first estimate. In order to scale the amount of the average revision to the total employment level, the average revision as a percentage of the average employment level during each of the observation periods is shown, in addition to the range of the revisions and average cumulative absolute revision.

Examining the data of selected Member States highlights that *Germany* and *Spain* have contributed most to the revisions of euro area data. Together, these two countries account for a share of 42% in total euro area employment. High upward revisions in these national statistics therefore translate into high revisions of euro area data. Germany has an average revision of 1.3%, or half a million persons, between 2002 and 2004, while Spain's average revision is in excess of 7% (1.2 million persons) in the same period. While Germany's average revision reverted to a more normal range in 2005-2006, Spain's data remained somewhat volatile, in terms of both levels and growth rates. Furthermore, for Belgium, Italy and the Netherlands, the range of upward and downward revisions was substantial.

3 SPECIAL DEVELOPMENTS IN GERMAN AND SPANISH DATA

The national accounts employment data should be in accordance with the definitions set by the national accounts *("working at least one*

Table 23 Euro area employment level revisions

(thousands)

Observations	Total revisions (latest minus first release) Average revision	Average revision in%	Range of revisions Total
Euro area			
2005Q1 - 2006Q4	129	0.09	9 to 373
2002Q1 - 2004Q4	1,500	1.11	902 to 2027
Belgium			
2005Q1 - 2006Q4	9	0.22	-1 to 24
2002Q1 - 2004Q4	38	0.93	1 to 190
Germany			
2005Q1 - 2006Q4	-3	-0.01	-137 to 121
2002Q1 - 2004Q4	506	1.30	346 to 678
Spain			
2005Q1 - 2006Q4	210	1.08	0 to 392
2002Q1 - 2004Q4	1,270	7.09	1004 to 1643
France			
2005Q1 - 2006Q4	104	0.41	1 to 212
2002Q1 - 2004Q4	87	0.35	-76 to 204
Italy			
2005Q1 - 2006Q4	-46	-0.19	-349 to 249
2002Q1 - 2004Q4	-109	-0.45	-281 to 76
Netherlands (non-adjusted data)			
2005Q1 - 2006Q4	40	0.49	-31 to 103
2002Q1 - 2004Q4	-14	-0.17	-97 to 69

Sources: Eurostat (country data) and ECB calculations.

hour per week for a resident producer unit"). Estimates for the non-official economy should be included. Revisions can come from many sources. Administrative data can be affected by changing eligibility criteria (e.g. changes in thresholds for social security payments); survey data may be affected by non-response (e.g. of immigrants) and by revisions caused by population censuses, which are used to gross up the survey sample; definitions may change over time and cause difficulties in adjusting backdata to the new definitions, etc.

3.1 GERMANY

German employment data that are based on the national accounts are derived from numerous sources, the most important of which is the monthly social security register. First monthly estimates are published 30 days after the reference month. This involves quite extensive estimation, especially for non-social security-based employment. According to the German national statistical institute (NSI), it takes six months to reach a coverage of 80% in the statistical sources. As a consequence, the first and final estimates of the monthly level have differed by up to ±0.3 percentage point.[1]

In addition, a large one-off increase in the German employment level series was implemented in May 2005, with revisions ranging from +170,000 persons in 1991 to approximately +420,000 persons in 2004. A smaller increase in the series (140,000 persons) had already been reported in August 2002.

The 2005 employment increase was due to, for example, improved information on employment in the transport and telecommunications services, modified surveys of the retail trade and small businesses and changes in the methodology of collecting employment statistics (from

1 See Statistisches Bundesamt (German Federal Statistical Office), "Erwerbstätigenrechnung im Rahmen der Volkswirtschaftlichen Gesamtrechnungen", January 2006.

April 2003). Furthermore, an ongoing source of revisions has been the underreporting of very small jobs, paying up to €400 a month ("mini-jobs"). This group of persons who hold only mini-jobs comprises 4.7 million people (about 12% of total German employment), and increased significantly up to 2004. Revisions were also caused by difficulties in recording previously unemployed persons who are now employed in new government employment schemes (302,000 "one-euro jobs" in October 2005). While better data on mini-jobs contributed significantly to the revisions of employment levels, the effect on measured hours worked was far less marked, given the low average number of working hours of these workers. For the years from 2002 to 2004, the number of employed persons was revised by 1.3%, and the number of hours worked by 0.8%.

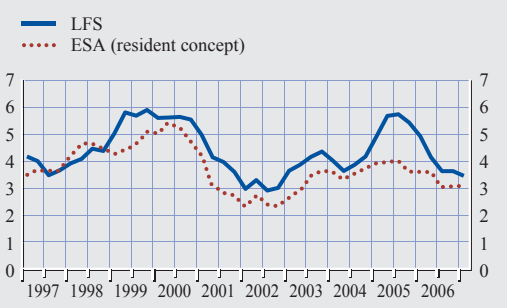
In addition, Germany introduced changes in the main household survey in this field. European legislation required Germany to establish a continuous Labour Force Survey (LFS) from 2005 onwards. For the time being, a temporary monthly telephone survey is the main source. Those results have proved to be rather volatile and may also have led to some volatility in the employment estimate of the national accounts, including its seasonal pattern.

3.2 SPAIN

At the end of 2001, Spain conducted its decennial population census. In line with other changes in the Spanish national accounts (see Annex 2), Spain incorporated the major revision to its employment series with the May 2005 data release. This caused a jump of between 1 and 1.3 million persons for the years from 2002 to 2004 in the employment level series (the revision of full-time equivalents reached 1 million in 2004). Revisions were incorporated as from 1996. This also had an effect on the employment growth rate, because the level shift was not uniform over time; in the period from 2000 to 2003, annual average growth rates in the Spanish LFS[2] were 1.1%, while that in 2004 was 1.4%. This is in line with the census which showed that immigration had previously been underestimated. If one disregards this one-off change, the Spanish revisions are not exceptional.

Chart 13 Spanish employment – LFS and national accounts

(annual percentage changes)



Source: Eurostat.

Another source of data uncertainty concerns the differences between the main Spanish employment series that are used for national accounts. Chart 1 shows the current LFS data set and compares it with the national accounts data. The employment growth differs significantly, with LFS growth estimates systematically higher than national accounts estimates after 1998. Between the first quarter of 1996 and the first quarter of 2007, the LFS rose 59%, while the national accounts measure rose 48%. The national accounts statistics are closer to administrative data sources than the LFS.

It should also be noted that the Spanish LFS has been revised several times in recent years, as part of Europe-wide harmonisation. This may mean that long-term comparisons have become less reliable. The most recent change was introduced in 2005, and both the Banco de España and the Spanish NSI have published LFS growth estimates adjusted for the statistical break.

2 See also Banco de España, "The Revision of the EPA figures", *Bank of Spain Economic Bulletin*, April 2005.

4 SUMMARY AND CONCLUSIONS

The relatively high revisions to the euro area employment levels in 2005-2006 were largely due to changes in German and Spanish employment statistics. While the 2005-2006 revisions to quarterly German employment levels were mainly a result of new and improved data sources, more improvements are in the pipeline, so that further revisions cannot be excluded. For Spain, the May 2005 data release included a substantial upward revision of the whole employment series, mainly related to the incorporation of information from the decennial census. Revisions of hours worked and full-time equivalent employment were smaller in both countries, since the new data improved, in particular, the coverage of part-time employment.

ANNEX 4
REVIEW OF REVISION INDICATORS

1 INTRODUCTION

The ECB, as well as other users of statistics, pay considerable attention to the quality of statistics, as the availability of trustworthy and timely data is crucial for purposes of monetary policy.[1] Quality of statistics is usually addressed in the context of a broader quality framework. The *IMF's Data Quality Assessment Framework (DQAF)*[2] aims to foster communication between users and compilers of statistics, and to provide a structure and a common language for data quality. The framework covers all the dimensions relevant for a quality assessment of macro-economic statistics, namely: integrity, methodological soundness, accuracy and reliability, serviceability and accessibility. While the framework is a generic concept which can be applied to various statistical areas, the indicators chosen to operationally assess the quality of statistics may differ depending on the statistical domain, the purpose (e.g. one-off, regular studies) and target audience (e.g. research community, public at large). Revision indicators are a gauge of reliability (i.e. the closeness of the first estimate to subsequent estimates) and provide users with information on the likelihood of future revisions.

2 QUANTITATIVE REVISION INDICATORS

Many different revision indicators exist in the literature. The indicators used in this study have been chosen because they are applicable to different key macroeconomic statistics and because they cover the three key aspects of revisions that are generally distinguished: (i) stability, i.e. were the revisions small or high, (ii) bias, i.e. were they mostly in the same direction and (iii) volatility, i.e. were there many changes in between the first and the final estimate. These indicators, which are also used in other existing revision studies, are discussed in the next paragraphs. It should be borne in mind that there is no 'ideal indicator: as all indicators provide summary information on a particular aspect of the frequency distribution, they should be analysed jointly, rather than separately.

2.1 STABILITY INDICATORS

Measures of stability compare the absolute value of the first estimate published with the absolute value of the latest estimate in order to determine whether revisions have been sizable. The following stability indicators are used in this study:

AVERAGE ABSOLUTE REVISIONS

Average of the absolute difference between the latest available value and the first release for each observation period, regardless of their sign, divided by the number of observations. This measure avoids offsetting effects on the indicator from negative and positive revisions. Expressed in absolute percentage points, it indicates the average size of revisions, but it cannot provide an indication of directional bias, if any.[3]

RANGE OF TOTAL REVISIONS

Highest and lowest total revisions to the first release for all observation periods. This range provides further information on the volatility of the first release. The total range covers all the revisions and may include outliers; the 90% range discards the largest 10% of the revisions.

RELATIVE ABSOLUTE REVISION

This measure relates the average absolute revision (as defined above) to the average growth rate in the period under investigation, thereby giving an indication of the average size of the likely revision, in percent of the average growth rate.

1 See proceedings from the ECB Conference on Statistics: "Euro area statistics – Challenges for the future" June 2002.
2 The IMF framework is available at: http://dsbb.imf.org/Applications/web/dqrs/dqrsdqaf/. Similar frameworks exist, e.g. Eurostat's Quality Framework for European Statistics, which concentrates on the quality characteristics of the statistical products, following the ISO 8402-1986 definition. Eurostat's framework is available at: http://epp.eurostat.cec.eu.int/portal/page?_pageid=2273,1,2273_47141302&_dad=portal&_schema=PORTAL
3 "Revisions to quarterly GDP estimates: A comparative analysis for seven large OECD countries"; OECD (N. Ahmad, S. Bournot, F. Koechlin), Paris, 2005.

These measures are commonly used in the literature. Commonly used are the *mean absolute revision* or *average absolute revision*, i.e. the absolute sum of the differences between latest/current value and the first release, divided by the number of observations.

Other examples of stability indicators include the *variance or standard deviation*.

2.2 BIAS INDICATORS

Measures of bias aim to identify the sign of revisions (upward/downward) to determine whether revisions tend to be in one direction (or not). Our study uses the *average revision*, i.e. the sum of the differences between latest and the first release.

Additional indicators on the bias include the *ratio of upward over downward revisio*ns, and the *t-statistic,* (i.e. the ratio of the mean revision to the standard deviation of the mean) to test whether the observed mean is significantly different from zero.

2.3 VOLATILITY INDICATORS

Measures of volatility compare successive revisions to the first estimate in order to determine whether there have been many (and sizable) revisions between the first estimate and the latest estimate for a particular observation. To this end, our study uses the *average cumulative absolute revisions*. For each observation period, the sum of revisions, regardless of their sign, is periods may then be a useful supplementary indicator for the volatility of the first release as some euro area statistics are revised several times a month and "latest to first" comparison may hide revisions carried out in the meantime.

3 BRIEF LITERATURE REVIEW

The above-mentioned indicators on stability and bias are commonly used in the literature on revision studies. Average revision, (relative) average absolute revision and range of total revision are measures that are – amongst others - included in press releases and specific articles[4] on revisions in quarterly national accounts estimates by, for example, the statistical institutes of the UK (ONS), the US (BEA) and the new series of quality reports of DE (Destatis). These indicators have also been recommended for use in regular publication in press releases or studies by the joint Eurostat/European Central Bank Task Force[5] on output quality in Quarterly National Accounts and in Balance of Payments statistics.[6]

Aruba uses for his US data set starting in 1965 besides mean, ranges and standard deviations also significance tests and autocorrelation measures.[7] *Garret* and *Vahey* use for the UK (dataset starting between the 1960s and 1980s) summary statistics for means, mean absolute errors and standard deviations, as well as tests for bias.[8] The analysis of revisions during the phases of business cycles requires long and preferably consistent time series. In the analysis by *Swanson* and *van Dijk*[9], business cycle asymmetries of revisions were detected for US time series of industrial production and industrial producer prices over the period from the early 1960s to 2004. In conclusion, the findings show "a clear increase in revision volatility during recessions, suggesting that earlier data are less reliable in tougher economic times" and "that early releases of data growth rates are also more volatile during recessions."

4 See for example "Revisions to quarterly GDP growth", L. Akritidis, Economic Trends No. 594 May 2003, ONS or "Revisions in quarterly GDP of OECD countries", T. Di Fonzo, October 2005, OECD.

5 The 2002 fourth progress report of the Economic and Financial Committee (EFC) on the Statistical Requirements in the EMU states that more work is needed to operationally assess the various dimensions of quality. As a result this Task Force was established.

6 For a more comprehensive overview, please see "Quantitative Quality Indicators for Statistics: An Application to Euro Area Balance of Payments Statistics", ECB (V. Damia, C. Picón Aguillar), Occasional Papers, November 2006; and "Joint ECB's DG-S/Eurostat Task Force on the quality of quarterly national accounts - Final report", http://www.cmfb.org/main-topics/statistical.htm

7 See "Data revisions are not well behaved", CEPR Discussion Paper No.5271, October 2005.

8 See "UK Real-Time Macro Data Characteristics", A. Garratt, S.P. Vahey, Economic Journal, February 2006.

9 "Are statistical agencies getting it right? Data rationality and business cycle asymmetry"; N. Swanson, D. van Dijk; Journal of Business and Economic Statistics, January 2006.

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ISSN 1607-1484