

ARTICLES

AN ASSESSMENT OF EUROSISTEM STAFF MACROECONOMIC PROJECTIONS



Producing accurate and reliable projections of key macroeconomic variables, including real GDP and inflation, is of particular importance for central banks. This article reviews the performance of Eurosystem staff macroeconomic projections since their first publication in 2000. Overall, while euro area GDP has, on average, been overestimated, there has been a tendency to underestimate HICP inflation. Projection errors for both variables were significantly higher during the recent crisis period, particularly during the recession in 2009. While multiple factors have contributed to the overall projection errors, the analysis of errors in the assumptions upon which the projections are conditioned suggests that unexpected oil price developments played a key role. The projection performance of Eurosystem staff compares reasonably well with that of other international institutions and private sector forecasters. While broadly in line with other forecasters with respect to real GDP growth, the Eurosystem achieved the highest relative accuracy in projecting HICP inflation.

I INTRODUCTION

Forecasting future economic developments is important for many agents in the economy, including central banks. Given that monetary policy has a delayed effect on the economy, it is essential for central banks to have the best possible projections of economic developments for the years ahead, in particular regarding inflation rates and real GDP growth. This article evaluates the accuracy and reliability of the Eurosystem staff macroeconomic projections¹, and also addresses the possible sources of errors. In this respect, (technical) assumptions made for each projection exercise, such as assumptions about the price of oil or world economic growth developments, are reviewed. Furthermore, to evaluate their relative accuracy, the performance of Eurosystem staff projections is measured by comparing them with the projections made by other international institutions and the private sector. This article focuses on the Eurosystem staff projections, published each June and December, in order to provide the largest possible sample of projections and to facilitate inter-institutional comparisons, as the Eurosystem staff projections are published much closer in time to the projections of other international institutions than the ECB staff projections. The remainder of the article is structured as follows. Section 2 examines the main characteristics of the existing framework for Eurosystem and ECB staff projections. Section 3.1 reviews the Eurosystem staff projections, while Section 3.2 analyses the possible causes of errors, looking particularly at the role of errors in assumptions. Section 4 then compares errors in the Eurosystem staff projections with those made by other forecasters. Section 5 offers some concluding remarks.

2 THE FRAMEWORK FOR EUROSISTEM STAFF PROJECTIONS

Before reviewing the performance of the Eurosystem staff projections, this section briefly reviews their main characteristics.² The Eurosystem/ECB staff projection exercises are carried out four times a year. Since December 2000, the ECB has published the Eurosystem staff macroeconomic projections twice a year, in June and December. During the projection exercises, ECB and national central bank staff members collaborate closely and jointly decide upon the projections to be published. Since September 2004, these projections have been complemented by the ECB staff macroeconomic projections, which are also published twice a year, in March and September. In all

1 Similar assessments from other international institutions can be found in: Cabanillas, L.G. and Terzi, A., "The accuracy of the European Commission's forecasts re-examined", *Economic Papers*, No 476, European Commission, 2012; Vogel, L., "How Do the OECD Growth Projections for the G7 Economies Perform? A Post-Mortem", *OECD Working Papers*, No 573, OECD Economics Department, 2007; and Timmermann, A., "An Evaluation of the *World Economic Outlook* Forecasts", *IMF Staff Papers*, Vol. 54, No 1, 2007, pp. 1-33.

2 For a more detailed description, see *A guide to Eurosystem staff macroeconomic projection exercises*, ECB, Frankfurt am Main, June 2001.

four exercises, headline HICP inflation, headline GDP and the main expenditure components are projected for the current year and one year ahead.³ In order to account for the uncertainty attached to such projections, the Governing Council decided to publish ranges instead of point forecasts. These ranges are calculated by considering the magnitude of previous projection errors, i.e. the difference between the actual outcome and the projected value. The ranges are set at twice the average absolute value of these differences.⁴

The projections are conditioned on certain assumptions and combine the results produced by conventional models with the knowledge and judgement of economic experts.⁵ The assumptions cover world demand projections, oil and other commodity prices, the exchange rate, short- and long-term interest rates and fiscal variables. These assumptions are constructed in a variety of ways. Some assumptions are akin to projections (e.g. world demand), some are based on information about market futures (e.g. oil prices), and others are based on “no changes” (e.g. the exchange rate). In addition, fiscal policy measures are only taken into account if they have been approved by the national parliament, or have already been defined in detail and are likely to pass the legislative process. Consequently, the projections are not necessarily the best predictors of future outcomes, particularly over longer timespans. Section 3.2 elaborates on how these assumptions are calculated and on the role they play in the overall projection errors.

3 REVIEWING EUROSISTEM STAFF PROJECTION ERRORS

3.1 ERRORS IN PROJECTING REAL GDP AND HICP INFLATION

This section presents an assessment of the Eurosystem staff projections for real GDP and HICP inflation in the euro area during the period 2000-2012. The annual projections have been assessed by analysing errors in both the current-year projections and the one-year-ahead projections. In general, forecasting errors are defined as the difference between the actual outcome and the projected value. Thus, the size of the forecasting errors and the assessment of the forecasting performance are influenced by the particular vintage of data used to calculate the actual outcomes (e.g. the flash estimate, second/third estimate or latest available data). It is common for macroeconomic data to be revised as more comprehensive information becomes available and methodological changes are implemented. Even after some time, data are still subject to a certain amount of uncertainty, and may be revised. For example, euro area GDP benchmarks are revised approximately every five years to reflect advances in the methodology used in their calculation.⁶

For the purposes of this article, in order to ensure that the estimate of the variables incorporates a sufficient amount of information about the economy and, at the same time, reflects the economic assessment made at the time, the outcome of the variable one year after each projection exercise

3 In December each year, in addition to the current-year and one-year-ahead projections, two-year-ahead projections are also made.

4 For a detailed description of how the ranges are calculated, see *A guide to Eurosystem staff macroeconomic projection exercises*, ECB, Frankfurt am Main, June 2001, p.15; “New procedure for constructing ECB staff projection ranges”, September 2008; and “New procedure for constructing Eurosystem and ECB staff projection ranges”, December 2009. All three documents are available on the ECB’s website (<http://www.ecb.int>).

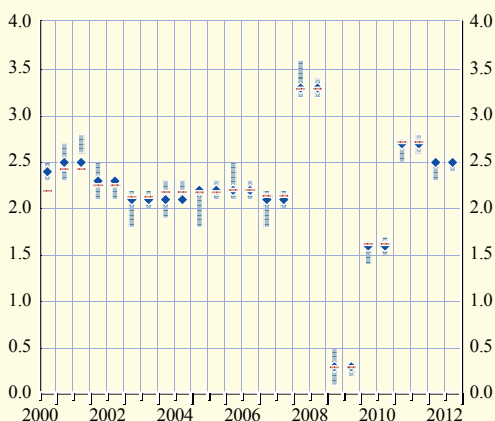
5 For more details on the models see, for example, Christoffel, K., Coenen, G. and Warne, A., “The new area-wide model of the euro area: a micro-founded open-economy model for forecasting and policy analysis”, *Working Paper Series*, No 944, ECB, October 2008; Dieppe, A., González Pandiella, A. and Willman, A., “The ECB’s new multi-country model of the euro area: NMCM – simulated with rational expectations”, *Working Paper Series*, No 1315, ECB, April 2011; and Dieppe, A., González Pandiella, A., Hall, S. and Willman, A., “The ECB’s new multi-country model of the euro area: NMCM – with boundedly rational learning expectations”, *Working Paper Series*, No 1316, ECB, April 2011.

6 For more details, see the article entitled “Revisions to GDP estimates in the euro area”, *Monthly Bulletin*, ECB, April 2009.

**Chart 1 HICP inflation: current-year
projection ranges and actual outcomes**

(annual percentage change)

- ◆ actual outcome (June exercise following year)
- ▬ latest available data
- ▬ projection range



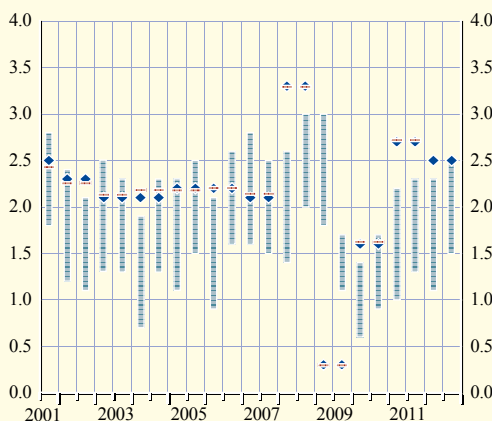
Sources: ECB calculations and Eurostat.

Note: For each year, both the June and December Eurosystem staff macroeconomic projections are shown (except for 2000, where only the December projection is shown).

**Chart 2 HICP inflation: one-year-ahead
projection ranges and actual outcomes**

(annual percentage change)

- ◆ actual outcome (June exercise following year)
- ▬ latest available data
- ▬ projection range



Sources: ECB calculations and Eurostat.

Note: For each year, both the June and December Eurosystem staff macroeconomic projections are shown (except for 2001, where only the December projection is shown).

is chosen as the actual outcome.⁷ Taking into account the usual release dates, this incorporates the third release of euro area GDP data and the full release of HICP inflation data.

Charts 1 and 2 present the projection ranges of the Eurosystem staff projections for euro area HICP inflation since December 2000, together with the actual outcomes. Also, for purposes of comparison, the latest available data vintage is shown. Overall, revisions to HICP inflation data have been small, as shown in Charts 1 and 2 by the proximity of the diamonds and the red horizontal bars, which indicate the actual outcome as registered one year after the projection and the latest available data respectively. Looking at the actual outcome one year after the projection, in all but one of the 25 cases, HICP inflation turned out to lie within the range projected by Eurosystem staff in the current-year projections.⁸ With respect to the one-year-ahead projections, the picture is somewhat different. In 12 of the 23 exercises, the one-year-ahead projection range of HICP inflation covered its actual outcome. In the remaining cases, inflation was underestimated nine times and overestimated twice.

Comparing the actual outcomes with the projection ranges for real euro area GDP growth leads to similar conclusions (see Charts 3 and 4). While the clear majority of current-year projections were accurate (in 19 of 25 cases the actual outcome fell within the range projected by Eurosystem staff, with four over- and two underestimations), the one-year-ahead projections were less accurate.

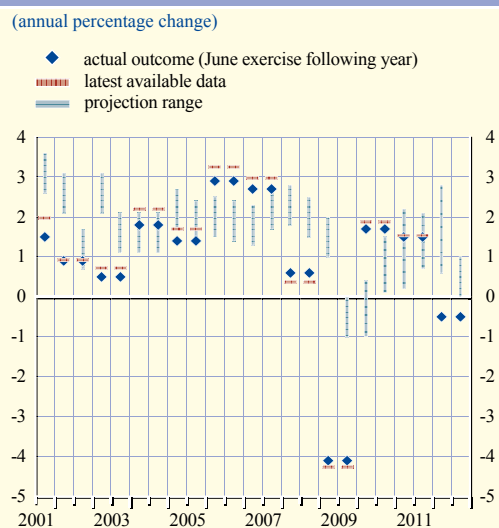
⁷ Models and assessments are often based on real-time data and the first available outcome often receives most attention. However, if the purpose of the forecast is to predict the final and actual state of the economy, then using the first available outcome is questionable. At the same time, using the latest available outcome gives greater weight to the impact of statistical changes. As an exception, in order to include the projections for 2012 in the assessment, the flash estimate for 2012 real GDP was used.

⁸ Note that, for the current-year projections made in December, most of the actual outcome is already known; this is also indicated by the smaller range in the December exercise compared with the June exercise.

Chart 3 Real GDP: current-year projection ranges and actual outcomes



Chart 4 Real GDP: one-year-ahead projection ranges and actual outcomes



Although real GDP growth fell within the one-year-ahead projection range in seven cases, output growth was overestimated in 11 exercises and underestimated in five.⁹

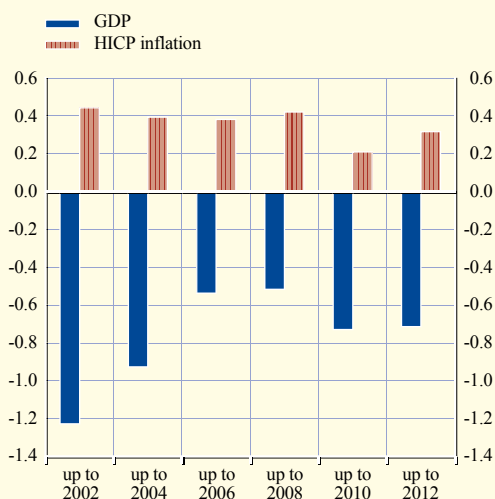
As noted above, the Governing Council decided to publish the projections for real GDP growth and HICP inflation in ranges, to account for their uncertain nature. However, in order to facilitate a comparison with other forecasters who publish point projections, a purely technical simplification is employed throughout the remainder of the article in that the mid-point of the projection range for both real GDP growth and HICP inflation is used. The projection error for each variable is derived by subtracting the mid-point of the projection range from the actual outcome (as defined above). The projection performance is assessed in terms of bias (as measured by the mean projection error) and the size of the projection errors (as measured by the root mean squared error, or RMSE). Charts 5 and 6 present the mean errors and RMSEs in the one-year-ahead projections for GDP growth and HICP inflation.

While euro area GDP has, on average, been overestimated, the opposite is true for HICP inflation. Before 2008 there was a downward trend in the bias in Eurosystem staff projections for euro area GDP growth, but this trend reversed with the start of the global financial crisis in late 2008. Both bias and RMSEs increased to a noticeable extent up to 2010, followed by a small decrease from 2010 to 2012. The pattern for HICP inflation projections is somewhat different: the bias declined slightly between 2002 and 2006, then increased again as inflation rose in 2007 and 2008, fuelled by significant increases in oil and food prices, before falling again. The RMSEs for the one-year-ahead HICP inflation projections were falling up to 2006, but have since risen again, reflecting significant fluctuations in inflation that were not predicted.

⁹ A comparison of the third estimate with the latest available data (including all ex post revisions) reveals that GDP growth figures are subject to sizeable revisions. The range of total data revisions is between -0.2 and +0.5 percentage point. GDP growth has, on average, been revised upwards throughout the sample period; negative revisions only occurred in 2008 and 2009 following the global financial crisis. For more details, see the box entitled “Revisions to euro area GDP growth”, *Monthly Bulletin*, ECB, April 2011.

Chart 5 Mean errors in one-year-ahead projections (actual outcome minus projection) since 2000

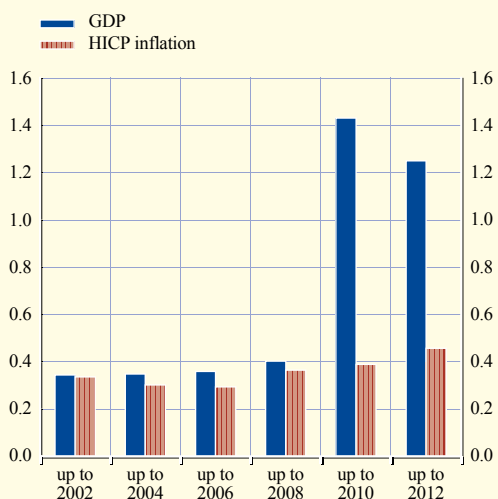
(percentage points)



Source: ECB calculations.

Chart 6 Root mean squared errors in one-year-ahead projections since 2000

(percentage points)



Source: ECB calculations.

Overall, it can be concluded that HICP inflation projections have, on average, been negatively biased, i.e. HICP inflation was underestimated, while real GDP projections have been positively biased, i.e. real GDP growth was overestimated. Moreover, the projection errors for both variables were significantly higher during the crisis period, particularly during the recession in 2009.

3.2 CAUSES OF PROJECTION ERRORS

Various factors contributed to the pattern and magnitude of the projection errors analysed in Section 3.1. This section highlights a number of these factors, which are likely to have had a significant impact on the overall error. In particular, the assumptions upon which the projections are conditioned, including technical assumptions about commodity prices, interest and exchange rates, and assumptions about world demand and fiscal policies, are potential sources of error.

TECHNICAL ASSUMPTIONS

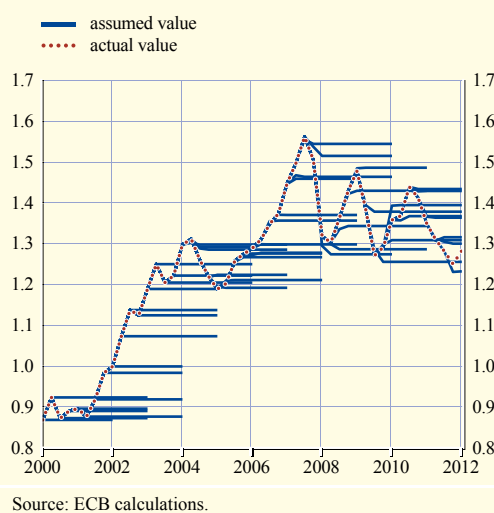
The technical assumptions about interest rates and commodity prices are based on market expectations. The assumption about short-term interest rates is of a purely technical nature. Short-term rates are measured by the three-month EURIBOR, with market expectations derived from futures rates.¹⁰ Also, market expectations are used with respect to long-term interest rates, i.e. ten-year government bond yields. Similarly, futures prices are employed to make assumptions

¹⁰ The decision to base short-term interest rates on market expectations was implemented for the first time in the June 2006 exercise (see the box entitled "Technical Assumptions", *Monthly Bulletin*, ECB, June 2006). Previously, short-term interest rates were assumed to remain constant over the projection horizon.

about the oil price and non-energy commodity prices.¹¹ Moreover, exchange rates are assumed to remain unchanged over the projection horizon, at the average levels prevailing shortly before the cut-off date of each exercise.

Errors in the technical assumptions affected the overall projection accuracy. Chart 7 shows the assumed and actual USD/EUR exchange rate, which tended, on average, to be underestimated during the assessed sample period (i.e. the appreciation of the euro vis-à-vis the US dollar over the sample period was not predicted). All other factors being equal, one result of this error could have been an overestimation of net export contributions to growth and, in turn, an overestimation of real GDP growth. It could also have contributed to higher HICP inflation projections.

Chart 7 Assumed and actual USD/EUR exchange rate



At the same time, over most of the assessed sample period oil prices were underestimated. In annual percentage deviation terms, the one-year-ahead oil price projections were, on average, 13% lower than the actual oil price over the sample period.¹² This is vital to the explanation of why euro area HICP inflation was underestimated. For example, estimates indicate that a 20% increase in crude oil prices has an overall impact of between 0.4 and 0.8 percentage point on headline HICP inflation, depending on the initial oil price.¹³ Considering the order of magnitude of the bias in HICP inflation projections (about 0.4 percentage point before the start of the crisis in 2008 – see Chart 5), it seems that errors in projecting oil prices contributed significantly to the overall error. Internal ECB models indicate that using observed ex post oil prices as assumptions upon which the projections are conditioned would have significantly reduced both the projection bias and the RMSEs in the HICP inflation projections.

11 The prices of other non-energy commodities are assumed to follow futures up until one year ahead, and thereafter to evolve in line with global economic activity.
 12 For more details on the oil price assumptions and the errors made in estimating oil prices during the assessed sample period, see the box below.
 13 For more detailed information, see “Energy markets and the euro area macroeconomy”, *Occasional Paper Series*, No 113, ECB, Frankfurt am Main, June 2010.

Box

OIL PRICE PROJECTIONS

In the Eurosystem and ECB staff projections, assumptions about the development of oil prices are based on the futures prices of Brent crude oil. In this approach, the h -period forecast of the price of oil is given by the price of the oil futures contract at maturity h .¹ Many other central

1 The h -months-ahead forecast of the price of oil is the average price over the previous ten business days of a futures contract with a maturity of h months.

banks (e.g. the Federal Reserve System, the Bank of England and the Bank of Canada) and international organisations (e.g. the IMF) use oil futures prices as predictors of spot prices in their macroeconomic projections.

Several features of futures prices make them an appealing tool for making assumptions about the price of oil. First, futures prices provide direct information about investors' expectations of the future price of oil. Second, in theory, futures prices should embody all the information available to market participants, hence serving as transparent market-based forecasts of the price of oil. Finally, they are a relatively simple forecasting tool and easy to explain, which makes it easier to communicate the underlying assumptions behind the Eurosystem and ECB staff projections.

At the same time, however, it is well known that oil futures prices are not identical to the expected price of oil. First, the futures prices of risky assets such as oil can deviate from the expected spot price because of a "risk premium" component. Furthermore, unlike purely financial assets, storable commodities carry additional costs (e.g. storage costs) and benefits (e.g. holding physical inventories for consumption), which may also affect the relationship between futures prices and the expected future spot price. Under normal circumstances, this generally causes oil futures prices to underestimate the actual oil price.²

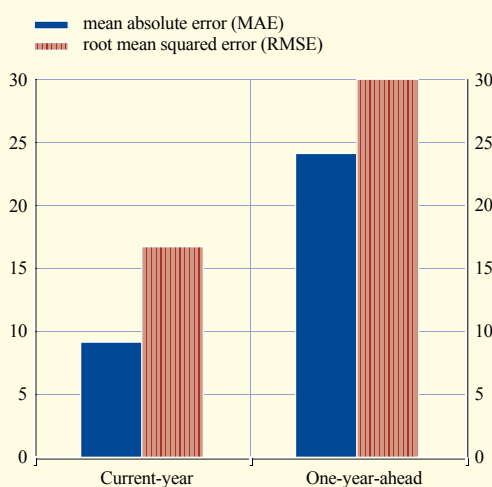
Evaluation of oil price projections

In order to evaluate the Eurosystem staff oil price projections for the current year and one year ahead, the mean absolute error (MAE) and the root mean squared error (RMSE) are used as measures of projection performance. For each calendar year, the two projection rounds are evaluated together. For 2011, for example, the average of the June and December projections for 2011 was taken as being current-year, and 2012 as being one-year-ahead.³

Chart A shows the average MAE and RMSE for the current year and for one year ahead, based on the oil price projections for the period 2000-2012. Unsurprisingly, the average projection errors for the current year are smaller than those for one year ahead. According to the MAE measure, the current-year projections deviated, on average, by about 9% from actual oil prices, while the one-year-ahead projections deviated, on average, by about 24%. The higher RMSE value for both horizons indicates, however, that the MAE masks important variations in the projection performance over time. This is

Chart A Average projection errors for oil prices (2000-2012)

(percentage points)



Source: ECB calculations.

² For more details, see "What can the oil futures curve tell us about the outlook for oil prices?", *Quarterly Bulletin 2012 – Q1*, Vol. 52, No 1, Bank of England, 2012.

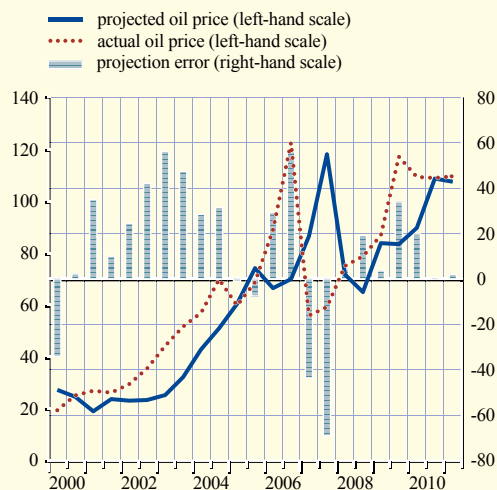
³ Although only the Eurosystem staff projections are discussed, the conclusions about the performance of the oil price projections are the same for the ECB staff projections. For more information, see the box entitled "The forecast bias for euro area HICP inflation", *Monthly Bulletin*, ECB, June 2012.

because, when compared with the MAE, the RMSE assigns greater importance to large projection errors.

To look at this time variation in more detail, Chart B shows the one-year-ahead projection errors (calculated as the percentage difference between actual and projected oil prices) together with the evolution of actual oil prices and the Eurosystem staff projections. Over most of the period under consideration, the futures-based oil price projections underestimated actual oil prices, as the projection error is mostly positive. On average, the oil price projections were 13% lower than the actual oil price. The largest deviations, initially positive and subsequently negative, were recorded during the period 2007-09. This was due to the sharp oil price fluctuations in the run-up to the financial crisis and its aftermath. As the futures curve is usually fairly flat over the forecasting horizon, large and sudden changes in actual oil prices tend to result in large projection errors. As oil prices broadly stabilised towards the end of the evaluation sample, the projection errors also became considerably smaller.

Chart B One-year-ahead oil price projections and actual oil price developments

(USD per barrel; percentages)



Source: ECB calculations.

FISCAL POLICIES

As a general rule, the fiscal policy assumptions aim to be prudent and realistic. For fiscal measures requiring parliamentary approval, the projections thus only incorporate measures that have been approved by national parliaments, or that have already been defined in detail and are likely to pass the legislative process. Policy measures are not included in the projections if they have not yet been well defined, or if they are unlikely to be approved. Projections for items that are determined mainly by discretionary decisions are, in principle, based on a most likely norm, in the absence of other information.

The fiscal assumptions and projections are independent from governments' official forecasts and are produced in close cooperation between the national central banks of the euro area countries and the ECB. They include the latest available information concerning fiscal developments in individual euro area countries and the most recent plans regarding fiscal policy measures. The effects of measures that are included in the projections for government revenue and expenditure are assessed independently from the governments' official estimates.

As a result, future measures that have not yet been approved by national parliaments, or that are not yet sufficiently detailed, as well as other unforeseen fiscal measures, are likely to contribute to the overall projection errors.

Looking back, Eurosystem staff fiscal assumptions contained fairly small mean projection errors in the period prior to the start of the economic crisis in 2008. However, the recent crisis period was characterised by consolidation efforts which were significantly more extensive than had

been assumed in the projections for these years. Downward revisions to the growth outlook in the recent period can, therefore, partly be attributed to changes in fiscal assumptions.¹⁴ In a similar vein, unforeseen measures in the form of indirect taxes or administered prices also contributed, to a certain extent, to the errors in the HICP inflation projections, leading to an underestimation of inflation, as information on these measures was often not available in advance. Typically, the effect of errors in fiscal assumptions on the projection performance is greater for later projection years, for which fiscal plans are usually less well defined.

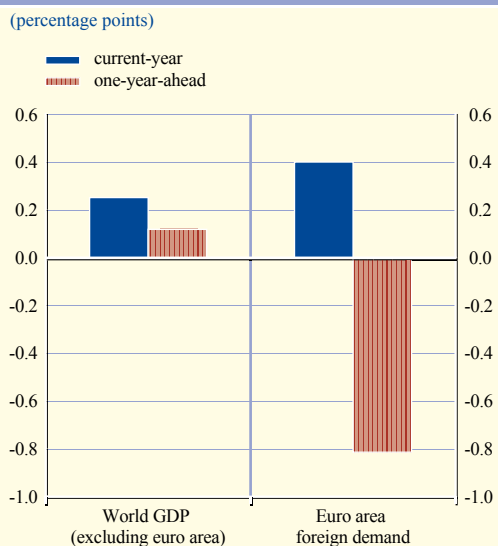
WORLD DEMAND

Projections for the international environment of the euro area are a key input for the Eurosystem staff projections, because they subsume information on the transmission of a broad range of global shocks to the euro area. Over the past 12 years, the euro area has been exposed to a number of pronounced global economic shocks, such as the bursting of the “dot-com” bubble in 2000-01 or the global financial crisis in 2008-09. Given the linkages between global and euro area business cycles, as well as their synchronisation, the global environment has significant implications for euro area activity and inflation.¹⁵

Two key global variables feature prominently in the Eurosystem staff projections: world GDP (excluding the euro area) and world demand for euro area exports. The projections for world GDP are computed as a weighted average of the GDP projections for individual countries and regions. World demand for euro area exports is defined as the geometric average of the import volumes of the euro area’s trading partners, weighted by their share of total euro area exports.¹⁶

Overall, the Eurosystem world GDP projections have been too pessimistic, both for the current year and for one year ahead. From December 2000, Eurosystem staff current-year projections underestimated world GDP growth by 0.3 percentage point, on average. For the one-year-ahead projections, the mean projection errors were smaller (see Chart 8). Thus, the bias in the world GDP growth projections appears to be rather modest, taking into account the fact that the world economy grew, on average, by 4.2% (with a standard deviation of 1.7) over this period. World demand for euro area exports has also been somewhat underestimated in the current-year projections (see Chart 8), broadly in line with the errors in projections for growth

Chart 8 Mean errors in projections for world GDP growth (excluding euro area) and euro area foreign demand



Source: ECB calculations.

14 Another source of uncertainty surrounding macroeconomic projection errors is the size of short-run fiscal multipliers. For more information on this topic, see the box entitled “The role of fiscal multipliers in the current consolidation debate”, *Monthly Bulletin*, ECB, December 2012. One of the findings is that the size of a fiscal multiplier is sensitive to various factors, such as the composition of fiscal measures, the credibility of the fiscal strategy and the structural features of the economy, such as the number of credit-constrained households.

15 See, for instance, Di Mauro, F., Dees, S. and Lombardi, M., *Catching the Flu from the United States: Synchronisation and Transmission Mechanisms to the Euro Area*, Palgrave Macmillan, Basingstoke, 2010.

16 See Hubrich, K. and Karlsson, T., “Trade consistency in the context of the Eurosystem projection exercises: an overview”, *Occasional Paper Series*, No 108, ECB, March 2010.

in world GDP. However, the one-year-ahead projections for foreign demand were too optimistic. Overall, the magnitude of the bias was modest, amounting to around 0.8 percentage point in the one-year-ahead projections, which compares to an average growth rate of 5.4% (and a standard deviation of 6.3) over the sample period.

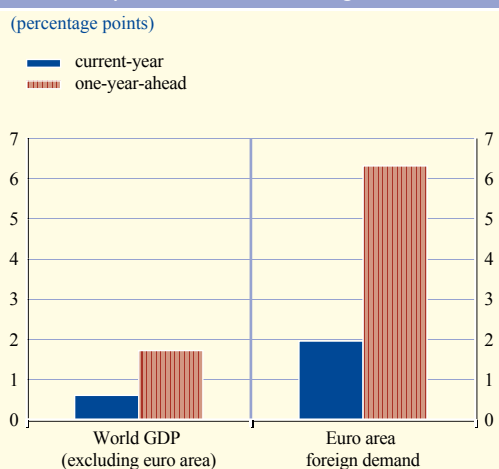
Chart 9 shows the accuracy of the projections for the international environment of the euro area, assessed on the basis of the RMSE. Overall, the pattern of RMSEs is as expected; for both economic activity and trade, the errors are larger in the one-year-ahead projections than in the current-year projections. Furthermore, RMSEs are roughly three times larger for trade than for GDP, reflecting the higher level of volatility in international trade dynamics and highlighting the fact that it is particularly difficult to make projections for trade.

OTHER FACTORS

In addition to errors in the assumptions upon which the projections are conditioned, several other factors could have had an impact on projection errors. One of these factors may be potential output. Given that potential output projections can be particularly useful in providing guidance for projecting real GDP growth towards the end of the projection horizon, errors in projecting potential GDP growth are likely to have an impact on real economic output projections. As an illustration, Chart 10 depicts revisions to euro area potential output growth as published by the European Commission. While, for example, in 2007 potential economic growth for 2009 was projected to be more than 2%, ex post revisions show that potential output in this year was overestimated by around 1.5 percentage points. Overall, these revisions to potential growth help to explain, to some extent, the overestimation of real GDP growth, as well as the underestimation of HICP inflation.

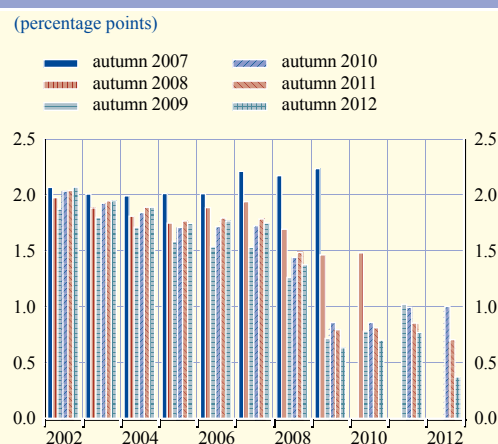
Moreover, food price shocks were also an obvious source of error. For example, over the period studied in this report, weather-related food price shocks and foot and mouth disease significantly contributed to non-energy HICP inflation in the euro area.

Chart 9 Root mean squared errors in projections for world GDP growth (excluding euro area) and euro area foreign demand



Source: ECB calculations.

Chart 10 Euro area potential output projections



Source: European Commission forecast database.
Note: The euro area aggregate covers the 12 countries which were members of the euro area in 2001.

Overall, it could be concluded that errors in assumptions play a significant role in explaining overall projection errors. In particular, if oil price developments and fiscal policy assumptions had been correctly projected during the crisis period, much of the bias identified in HICP inflation projections would have been removed. The bias in real GDP projections could also partly be explained by the errors in assumptions, particularly those concerning the oil price and world demand growth, as well as by the fact that potential growth was overestimated.

4 COMPARISON WITH OTHER FORECASTERS

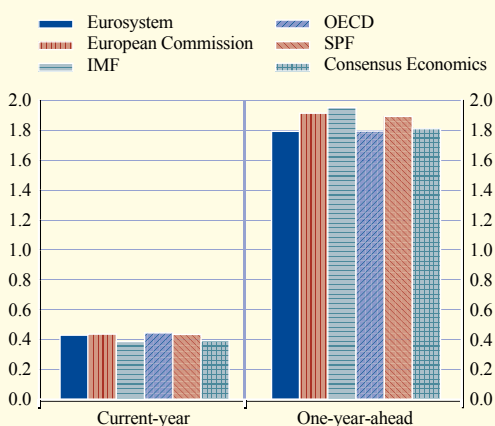
The assessment in the previous section needs to be accompanied by a comparison of the performance of different forecasters, to put errors in Eurosystem staff macroeconomic projections in perspective. This section compares the projection errors of the Eurosystem with those of the IMF, the OECD, the European Commission and private sector forecasters (included in the ECB's Survey of Professional Forecasters (SPF) and Consensus Economics), covering all available exercises from December 2000 to December 2012.¹⁷ In order to provide appropriate points of comparison with the other institutions, only the biannual Eurosystem staff macroeconomic projections are evaluated (not the ECB staff projections). To calculate the errors, the same approach is employed as in the previous section.

Charts 11 and 12 present the RMSEs for annual euro area projections of GDP growth and HICP inflation respectively, for the period 2000-2012. For the current-year projections of GDP growth, the errors in the Eurosystem staff projections are slightly larger than in the projections of the IMF and Consensus Economics, and marginally smaller than in those of the European Commission and the OECD. The Eurosystem's performance in forecasting current-year HICP inflation compares more favourably, having the lowest RMSE among the group of institutions. For the one-year-ahead projections, the Eurosystem's performance compares reasonably favourably for GDP growth, while it again has the highest relative accuracy for euro area HICP inflation.

¹⁷ The assumptions upon which the projections are conditioned cover broadly similar variables for all the international institutions.

Chart 11 Root mean squared errors in real GDP projections: comparison among forecasters from 2000 to 2012

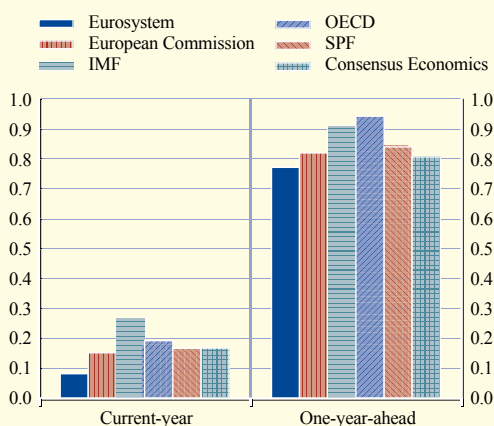
(percentage points)



Sources: ECB, OECD, IMF, European Commission, Survey of Professional Forecasters (SPF) and Consensus Economics.

Chart 12 Root mean squared errors in HICP inflation projections: comparison among forecasters from 2000 to 2012

(percentage points)



Sources: ECB, OECD, IMF, European Commission, Survey of Professional Forecasters (SPF) and Consensus Economics.

Chart 13 Real GDP: range of projection errors (mean absolute errors), compared among forecasters

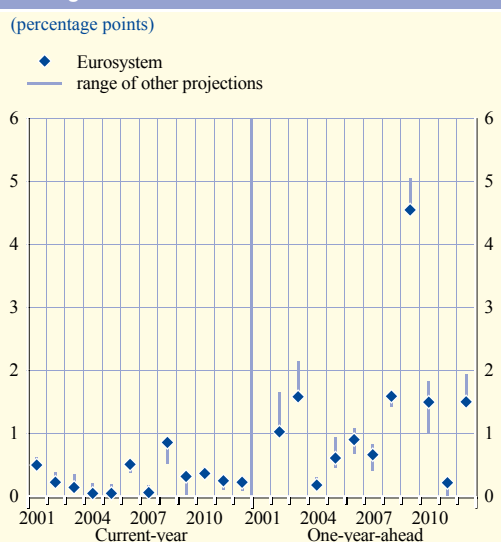
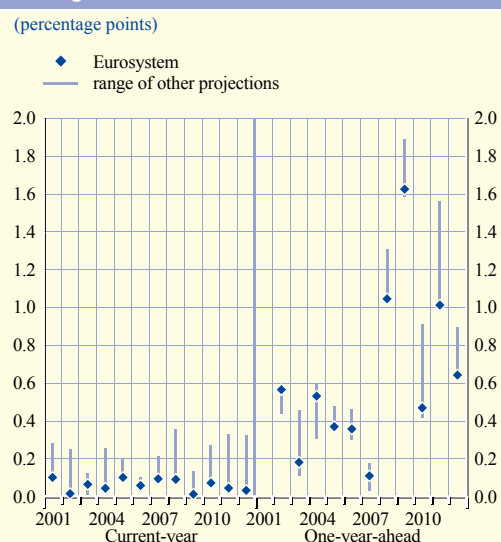


Chart 14 HICP inflation: range of projection errors (mean absolute errors), compared among forecasters



The projection accuracy of all institutions was influenced substantially by the financial crisis. The impact of the crisis on the forecasting performance is displayed in Charts 13 and 14, which show the range of mean absolute errors in the projections for real GDP and HICP inflation among the institutions for the period 2001-2012. Both the variation in projections (among the institutions) and the magnitude of the errors are higher for one-year-ahead projections than for current-year projections. Moreover, one-year-ahead projection errors increased substantially following the global financial crisis in 2008 and the subsequent recession, as did the variation in projections between different institutions. In particular, the one-year-ahead projections for 2009 clearly contain the largest errors. All institutions overestimated both GDP and HICP inflation in their one-year-ahead forecasts for 2009, demonstrating that the failure to predict the depth of the crisis was widespread across institutions and not limited to the Eurosystem staff projections.¹⁸ By contrast, the strength of the recovery in both GDP and HICP inflation was clearly underestimated in 2010. Thus, the crisis had a significant impact on forecasting accuracy, and on one-year-ahead forecasting performance in particular.

Although forecasting accuracy clearly deteriorated during the crisis, the Eurosystem's performance compares reasonably well with that of other forecasters. For the current-year projections of GDP growth, the Eurosystem's projections were among the most accurate until 2008. At the same time, as seen in Chart 14, the Eurosystem had among the smallest projection errors for both current-year and one-year-ahead euro area HICP inflation for each year after the crisis began.

One caveat in comparing forecasts from various institutions is that they are prepared at different points in time, which in practice implies that institutions have different information sets when they conduct their forecasts. This may have an impact on relative performance, although the problem

¹⁸ See Kenny, G. and Morgan, J., "Some lessons from the financial crisis for the economic analysis", *Occasional Paper Series*, No 130, ECB, October 2011.

is partly mitigated by comparing forecasts that are produced at almost the same point in time. However, a fair comparison of the forecasting performance among institutions should, ideally, quantitatively correct for the differences in timing, i.e. the different cut-off dates for the data used to produce the projections, otherwise the comparison may still be misleading.¹⁹

5 CONCLUDING REMARKS

It is extremely important that the ECB publishes economic projections that are as accurate and reliable as possible. This article reviews the Eurosystem staff macroeconomic projections and evaluates their accuracy in projecting euro area real GDP growth and HICP inflation. The assessment of the annual projections is made by analysing projection errors for the current year and for one year ahead, covering all available exercises from December 2000 to December 2012.

Overall, while euro area GDP has, on average, been overestimated, there has been a tendency to underestimate HICP inflation. The accuracy of the projections deteriorated following the start of the global financial crisis in 2008 and the subsequent recession, indicating that projecting economic activity and price developments is particularly difficult in turbulent times. Although projection accuracy clearly deteriorated during the crisis, the Eurosystem nevertheless performed reasonably well compared with other international institutions and private forecasters. In fact, the Eurosystem achieved the highest relative accuracy among institutions for current-year and one-year-ahead HICP inflation projections. A number of factors may have contributed to the overall projection errors, such as the assumptions upon which the projections are conditioned. Although there are clearly many potential sources of error, it seems that errors in projecting oil prices had the most significant effect on the overall error. Correctly anticipating oil price developments would have reduced the projection errors for both euro area GDP growth and, particularly, for HICP inflation. In addition, fiscal policy assumptions in particular (e.g. indirect tax changes) have, in recent years, been a significant source of error in HICP inflation projections. Moreover, unexpected food price developments and exchange rate changes that were not fully anticipated had an impact on the overall projection errors. However, other factors, such as errors in projecting potential output, may also have played an important role.

¹⁹ This has also been discussed in Andersson, M. K. and Aranki, T., "Forecasters' ability – what do we usually assess and what would we like to assess?", *Sveriges Riksbank Economic Review*, No 3, Sveriges Riksbank, 2009, pp. 26-51.