SHORT-TERM FORECASTS OF ECONOMIC ACTIVITY IN THE EURO AREA

Given the lags in the publication of statistical information on economic developments, higher frequency data from economic indicators are an important source of information for monitoring economic activity. This article describes some of the tools available for the short-term forecasting of euro area GDP growth from such data. These tools provide valuable input for monetary policy, as they improve the understanding of ongoing economic developments and thereby help in assessing inflation trends in a forward-looking manner.

1 INTRODUCTION

In view of the lags in the publication of economic data and statistical estimates of macroeconomic variables, the monitoring of current economic conditions is based on incomplete data. In particular, the monitoring of GDP growth must rely on indicators that are released with a higher frequency and that are available ahead of the release of the national accounts data. The monitoring of current economic conditions is an important input for monetary policy, as it facilitates the timely detection of underlying changes in economic activity and thereby may also affect the assessment of the economic outlook and associated risks in the context of a monetary policy strategy aimed at preserving price stability over the medium term.

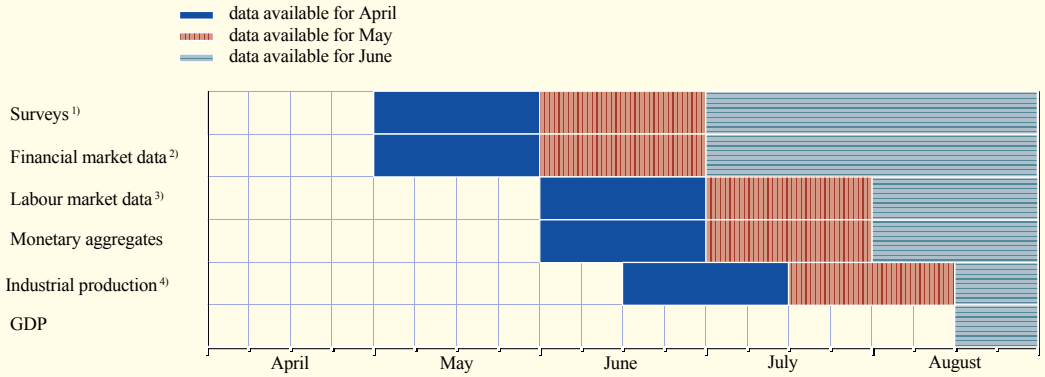
For the euro area, a flash estimate of GDP is released by Eurostat about six weeks after the end of the reference quarter. For instance, the flash estimate for the second quarter of 2008 will become available in mid-August 2008. As regularly reported in the ECB's Monthly Bulletin, there are many data releases available for assessing the most recent economic developments. Important data for this purpose include monthly data on economic activity, such as industrial production, retail sales and unemployment. In addition, various data are available that reflect market sentiment and expectations about future economic activity, such as business and consumer surveys, as well as financial market data. The range of data that contain information about the current economic situation is much wider and also includes monetary and trade statistics and data on the international environment.

By way of an example, the table depicts the data release calendar for important indicators referring to the second quarter of the year in a stylised way. The horizontal time axis is broken down into weeks, thereby showing the availability of the various indicators as time goes by. As noted above, the GDP flash estimate for the second quarter becomes available in mid-August. Before that, there is a constant influx of data that provide an increasing amount of information on economic activity within the quarter. Release dates of the individual data vary substantially. For instance, financial market data are published on a daily basis and, hence, monthly averages of these data, which are used in the models discussed below, are immediately available at the end of the month. Similarly, consumer and business surveys are published at the end of the reference month, or early in the month thereafter. Data on monetary aggregates and the unemployment rate are available with a delay of about one month, while industrial production data are published about six weeks after the end of the reference month. Hence, a full set of indicators for the second quarter is not available any earlier than the flash estimate of GDP.

This article reviews the application of statistical tools to obtain short-term forecasts of quarterly euro area GDP from these higher frequency indicators. It discusses the use of these tools in real-time applications and assesses the information content of individual data releases. In practice, the delay in the publication of GDP data means that GDP growth in the current quarter, and occasionally the previous quarter, needs to be "forecasted".

Generally, these tools for monitoring economic activity deliver quantitative estimates and short-term forecasts of GDP ahead of the release of the flash estimate. In this respect, they are suitable for efficiently processing

Stylised weekly data release calendar



Sources: Eurostat and ECB.
1) At the euro area level there are two main sources for survey data, namely the results of the Joint Harmonised EU Programme of Business and Consumer Surveys and those of the Purchasing Managers Surveys conducted by NTC Economics, United Kingdom.
2) Includes monthly data for exchange rates, interest rates, and commodity and equity prices.
3) Includes the unemployment rate and monthly indices of employment. For illustrative purposes, the table shows only the release of the unemployment rate.
4) Includes overall industrial production and numerous series at sub-sector levels.

and synthesising information contained in a large data set. Indicators appear to differ in respect of the information content they have for predicting euro area GDP, and different indicators may occasionally give diverging signals. Therefore, when confronted with a large number of economic indicators, a purely judgmental approach has severe limitations in terms of its ability to produce a comprehensive and consistent assessment.

2 SHORT-TERM FORECASTING OF GDP ON THE BASIS OF MONTHLY DATA

The purpose of the statistical methods described in this section is to obtain short-term forecasts of quarterly GDP growth from the higher frequency data presented in the table by taking advantage of the earlier publication of the latter. This approach is often referred to as one of "bridging" monthly and quarterly information.

There are two main issues when it comes to optimising forecasts obtained by "bridging" in order to exploit the available information in an efficient way. The first issue relates to the staggered release of the monthly data. Monthly indicators are released with different publication lags. Hence, data availability differs across indicators, and the latest observations on survey and financial data refer to a more recent period than the other indicators. For short-term forecasts to be reliable, tools must be able to make efficient use of all observations available at a given point in time. This also allows forecasts to be updated after each new data release.

The second major issue in the short-term forecasting of GDP growth is the need to take a large number of potentially informative monthly indicators into consideration. While forecasts may, in principle, be based on a small set of selected indicators, using many indicators has the advantage of enhancing the robustness of the resulting forecasts. A number of studies have argued that large data sets tend to yield more precise forecasts than data sets which only comprise a selected set of indicators.

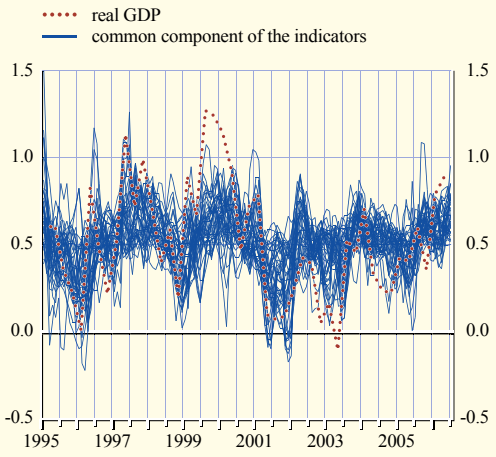
Two approaches have been pursued in this respect, namely forecast averaging on the basis of many bridge equations and dynamic factor models. Forecast averaging derives the final GDP forecast in the form of an average of forecasts based on a number of different equations, where the individual equations contain a few selected indicators. Dynamic factor models, in turn, are

designed to extract the common movements from a large set of data series and to synthesise them into a few artificial latent factors, which represent the main sources of variation in the data set.

The two methods are briefly described in the box. Both methods aim to extract the underlying common tendencies across the set of indicators, while abstracting the idiosyncratic irregular movements in individual series. Their use is warranted by the fact that many indicators of economic activity tend to move closely together. This is exemplified in Chart 1, which illustrates the close co-movements of 41 selected series related to economic activity (mostly industrial production, survey and labour market data) alongside euro area GDP growth. More precisely, the chart shows the common component in the quarterly rates of change of the series, as explained by a factor model, in comparison with quarterly GDP growth.

Chart 1 Real euro area GDP and selected monthly indicators

(quarter-on-quarter percentage GDP growth)



Sources: Eurostat and ECB calculations.
Note: The vertical scale refers to percentage GDP growth. The monthly data are appropriately standardised to match the mean and variability of GDP growth. The factor model used is described in the box.

Box

METHODS FOR THE SHORT-TERM FORECASTING OF EURO AREA GDP GROWTH

All methods described in this article comprise two steps. Consider a simple forecasting equation, which predicts quarterly GDP growth in a certain period t (gdp_t) from a certain indicator (x_t):

$$gdp_t = c + \beta x_t + u_t \quad (1)$$

where c and u_t denote a constant and a residual term respectively, while β denotes the coefficient related to the monthly indicator. When using this equation in real time, monthly observations for the indicator are often incomplete within the quarter. The missing observations must be forecasted in order to obtain a quarterly value of x_t. Standard time series models may be used for this purpose, as is the case for the forecast averaging system of bridge equations.

Forecast averaging from bridge equations

Bridge equations used to forecast euro area activity should generally be cross-checked against each other because, given the uncertainties surrounding the results, it may be misleading to rely only on one of them. A study by Diron employs 8 equations to forecast euro area GDP directly.[1] These equations make use of data on industrial production, construction output, retail sales, unemployment, etc. An extension of this approach is based on equations to predict the aggregate

1 M. Diron, "Short-term forecasts of euro area real GDP growth: an assessment of real-time performance based on vintage data", ECB Working Paper No 622, 2006.

euro area demand components of GDP, from which another forecast for euro area GDP can be derived. For each of the expenditure components, the forecast is obtained as the average of forecasts from around ten equations. In Section 3 of the article, the bridge equation forecast is based on an average of all the equations described above.

Dynamic factor models

With the dynamic factor model approach, factors can be constructed from the monthly data set and forecasted over the desired horizon. GDP growth can then be predicted from the factors in a second step as described in equation (1) above. The factors represent linear combinations of the observable monthly data, which are constructed to explain to the maximum extent possible the variation in the latter. A dynamic factor model developed by Angelini et al. uses 88 series, including data on industrial production, surveys, labour markets and financial markets for the euro area as well as international variables.[2] The model builds on earlier work by Giannone et al. and allows efficient forecasts of factors to be obtained in the presence of different lags in the publication of the data.[3] Extended models have also been developed to produce forecasts of the demand and value added components as well as models for the major euro area economies.

It should also be noted that many central banks and other policy-making institutions have developed similar tools for the short-term forecasting of GDP growth. For instance, the EuroCOIN indicator, presented by Altissimo et al., provides a coincident indicator of euro area trend GDP growth based on a large data set.[4]

2 E. Angelini, G. Camba-Mendez, D. Giannone, L. Reichlin and G. Rünstler, "Short-term forecasts of euro area GDP", CEPR Discussion Paper 6746, 2008.
3 D. Giannone, L. Reichlin and D. Small, "Nowcasting GDP and inflation", CEPR Discussion Paper 5178, 2005, forthcoming in the Journal of Monetary Economics.
4 F. Altissimo, R. Cristadoro, M. Forni, M. Lippi and G. Veronese, "New EuroCOIN: tracking economic growth in real time", CEPR Discussion Paper 5633, 2007.

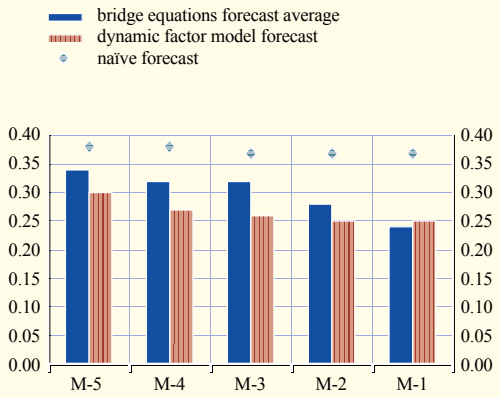
3 ILLUSTRATIVE APPLICATION OF THE TOOLS

Based on the stylised data release calendar (see the table), this section presents some empirical results obtained by using the tools described in the box, including the evolution of forecasting precision over time as more monthly data become available for the quarter considered. In this context, the influence of the individual data on the forecast is also assessed.

The average uncertainty of a sequence of forecasts of quarter-on-quarter real GDP growth in the second quarter, conducted in five consecutive months, can be seen in Chart 2. More precisely, the forecast evaluation exercise replicates the forecasts conducted mid-month after the release of industrial production data. Each forecast uses only the information that was available at the time. The uncertainty measure used is the root mean squared error (RMSE), which is evaluated from the third quarter of 1998 to the third quarter of 2005. The chart illustrates the decline in uncertainty over time, as information increases. The first forecast, conducted five months ahead of the data release, improves only marginally upon a naïve forecast (which assumes unchanged quarter-on-quarter GDP growth from the previous quarter). As more information comes in, the forecast uncertainty declines and is some 40% below the RMSE of a naïve forecast one month ahead of the release of the flash estimate.

Chart 2 Evolution of GDP forecast precision

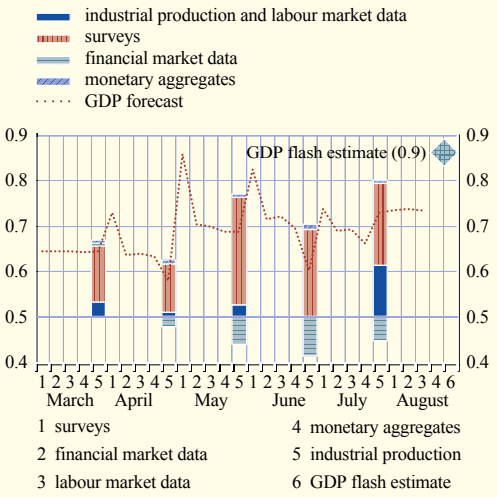
(root mean squared error of percentage GDP growth, 1998-2005)



Source: ECB calculations.
Notes: The horizontal axis shows the months remaining until the GDP release. For example, the Q2 GDP forecast M-5 is done using the data structure that was available in mid-March, while the flash estimate is released in August (Month M). While care was taken to replicate the data release calendar as depicted in the table, final data releases are used in the forecast evaluation exercise. Note that the uncertainty of the naïve forecast changes as a new observation for GDP growth in the previous quarter becomes available.

Chart 3 Contributions of data groups to the GDP forecast for the second quarter of 2006

(quarter-on-quarter percentage growth; quarter-on-quarter percentage contributions)



Sources: Eurostat and ECB calculations.
Note: For further information on the data groups and their release dates, see the table. The contributions are expressed in terms of deviations from average GDP growth.

The relative performance of the two methods, illustrated by the two bars in Chart 2, suggests that the dynamic factor model-based forecasts tend to be more precise than the forecast averages derived from bridge equations – at least at longer horizons. However, for the final forecast conducted one month ahead of the GDP data release, the performance of the bridge equations is about equal to that of the dynamic factor model. One reason for the shifts in relative performance over time is the richer information set exploited by the dynamic factor model and, in particular, the more extensive use of survey and financial market data. On account of their earlier availability, survey and financial market data are an important source of information at longer forecasting horizons, whereas industrial production data, and "hard" data in general, gain importance only for the final forecasts, when they become available for the quarter of reference.[1]

Chart 3 shows an example of the evolution of forecasts for the second quarter of 2006, as derived from the dynamic factor model following the various data releases within the period from mid-March to mid-August. The example illustrates the analysis of information obtained from individual data releases and makes clear that such releases may occasionally provide conflicting signals on economic activity. After predicting values slightly above 0.6% throughout March, the forecast jumped to above 0.8% with the release of survey data for April. It fell back thereafter, once other data had come in. However, survey data continued to give positive signals, as also evidenced by the increases in forecasted values after the various releases of survey data. The final forecasts produced from mid-July then remained above 0.7%, due to a positive contribution from industrial production data. According to the flash estimate, quarter-on-quarter GDP growth was 0.9%, while the final outcome was 1.0 %.

1 See M. Banbura and G. Rünstler, "A look into the factor model black box: publication lags and the role of hard and soft data in forecasting GDP", ECB Working Paper No 751, 2007.

4 CONCLUSIONS

Policy-makers depend on accurate information, including reliable short-term analysis of economic activity. The lags in the publication of national accounts data imply that current GDP growth must be assessed on the basis of higher frequency data from indicators which are published earlier than the national accounts estimates. The tools for the euro area that have been discussed in this article synthesise the information contained in a large set of indicators in an efficient way. Short-term forecasts of GDP from these data also provide important inputs into macroeconomic projections, as they help to improve the understanding of economic developments in the current quarter and the subsequent quarter. Such forecasts are optimally based on a range of tools using different methodologies in order to enhance robustness, and are usually combined with expert judgement when preparing macroeconomic projections beyond the short term.