Axel A Weber: The role of forecasting for central banks

Keynote address by Professor Axel A Weber, President of the Deutsche Bundesbank, at the conference on "Forecasting and monetary policy", organised by the Deutsche Bundesbank, Freie Universität Berlin and the Viessmann European Research Centre, Berlin, 23 March 2009.

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Ladies and gentlemen,

It is a great pleasure for me to participate in this conference and to be able to share with you some views on what contribution forecasting can make to monetary policy.

1 The role of forecasting in the Eurosystem

The reason why central bankers have a strong interest in forecasting is straightforward: because of substantial and variable lags in the monetary policy transmission mechanism, central banks cannot influence current inflation and output. Given these time lags, it is widely recognised that monetary policy should be forward-looking and take a medium-term perspective. Furthermore, the publication of forecasts helps to anchor the expectations of firms and households, thereby making the central bank more effective in fulfilling its objective. As a consequence, forecasts for inflation, output and other macroeconomic variables are an essential input in the monetary policy decision-making process.

Forecasting also has an important role to play in the Eurosystem, albeit a less prominent one than in central banks pursuing an inflation-targeting strategy. The Eurosystem's Governing Council bases its comprehensive assessment of the risks to price stability and its policy decisions on a broad spectrum of information provided by two analytical tools: the economic analysis and the monetary analysis. The monetary analysis assesses medium to long-term developments in inflation based on the well-established relationship between money and prices over long horizons. Monetary analysis takes into account developments in a wide range of monetary indicators including M3, its components and counterparts, notably credit, and measures of excess liquidity. The economic analysis identifies short to medium-term risks to price stability. It includes regular monitoring of a broad set of non-monetary economic and financial variables, such as developments in overall output, labour market developments and financial market indicators. Projections of key macroeconomic variables carried out by Eurosystem staff are also an integral part of the economic analysis..

Of course, differences in strategy mean forecasts play a somewhat different role in the Eurosystem than at central banks pursuing an inflation targeting strategy: For example, it is important to note that these forecasts are carried out under the sole responsibility of the Eurosystem staff, not the Governing Council. In contrast to decision-making bodies at inflation-targeting central banks, such as the Bank of England's MPC, the ECB Governing Council exerts no influence on the forecasts and their assumptions. In our two-pillar strategy, forecasts do not represent an all-encompassing tool – as would be the case for pure inflation targeters. Instead, projections are merely one input factor in the economic analysis, which, together with the monetary analysis, supports the robustness of the Governing Council's assessment of risks to price stability.

Despite these differences in monetary policy strategy, the Eurosystem publishes its projections for inflation and output four times a year. This is done for reasons of transparency, and, not least, to better guide expectations of future monetary policy actions. In addition, many national central banks (NCBs) in the euro area, including the Bundesbank, have started publishing their national GDP and inflation projections as part of their communication strategy. These projections are a useful by-product of the Eurosystem's

regular staff projections, which are carried out jointly by the ECB and the NCBs Central banks therefore have a natural interest in applying the best forecasting methods available. Economic and research departments at central banks aim to incorporate the latest academic developments in forecasting methods into their forecasting practice – provided they turn out to be an improvement on the existing procedures.

Against this backdrop, I would like to discuss some of the developments that have lately been of interest in the Eurosystem and at the Bundesbank. First, I will touch on recent developments in short-term forecasting and then elaborate on the uncertainty and risk of macroeconomic forecasts.

2 Recent progress in short-term forecasting

To enhance policy effectiveness, the Eurosystem has spent a lot of resources on developing forecast methods and models and, as a result, we have seen substantial progress in recent years.

Let me start by saying that there is as yet no unique or best approach to forecasting in central banks; in general, however, central banks try to pursue full-information strategies. In many cases, the forecast procedure may be best described as model-based forecasting complemented by valuable information from experts. With respect to model-based forecasting, most central banks have adopted a so-called "suite-of-models" approach. Instead of relying on just one model, they employ a large variety of different econometric models and a broad set of monitored time series. The suite-of-models approach has the advantage that it takes into account model uncertainty to some extent and does not neglect potentially important information.

As for the individual design of a central bank's forecast model, it may differ with respect to variable coverage, econometric rigour and the economic theory it incorporates. Basically, however, macroeconomic variables can be predicted in two different ways: structural macroeconometric models, which include traditional multi-equation models and DSGE models, and short-term forecast models, usually based on time-series analysis.

Although structural macroeconometric models remain workhorses used for forecasting and policy simulations, short-term forecast models have received increasing attention in the Eurosystem in recent years. Why is the short-term horizon so important? For the reasons I have already mentioned, monetary policy decisions require timely information on the current state of the economy. Such information is not always available, however. GDP as an important indicator of macroeconomic activity is, for instance, released with a considerable time delay and only once a quarter. In Germany, GDP is released about five to six weeks after the end of the reference quarter. For example, we expect the Federal Statistical Office to release first-quarter GDP data on 15 May 2009.

To allow an assessment of developments in real activity in the current quarter, the central bank's economists must therefore provide a so-called "nowcast". Hundreds of variables including high-frequency indicators are, in principle, available for this purpose. Think, for instance, of financial or survey data. But as policy-makers pursue a full-information strategy, central bankers would like to sum up the (at times conflicting) information content of all these variables into a single measure.

The workhorse models (structural multiple-equation models and DSGE models) are based on quarterly data only and are therefore ill-suited to evaluate the vast amount of high-frequency data available. By contrast, modern short-term forecast models are well able to process large datasets. What is more, they can also deal with datasets that are unbalanced because data is sampled at different frequencies (monthly – quarterly) or is subject to different publication lags, leading to missing observations at the end of the sample (the "ragged edge" of multivariate data).

The most prominent recent examples of such short-term models are: large factor models, mixed-frequency state-space models, bridge equations, or mixed-data sampling (MIDAS) regressions. Unlike structural macro models and DSGE models, these models are not based on economic theory, but on modern time-series econometrics. Research in the Eurosystem and at the Bundesbank shows that exploiting mixed-frequency data is indeed useful for forecasting, as balancing the data and time aggregation to quarterly frequency would lead to a loss of information at the end of the sample.[1] Furthermore, it has been shown that these models work particularly well for short horizons, whereas structural macroeconometric models or DSGE models tend to perform well in the medium and long term.[2]

This highlights that short-term models are not substitutes for traditional macroeconometric and DSGE models. However, they do add another piece of valuable information to the entire forecasting process. To my mind, short-term models should therefore be regarded as complementary tools in the large "suite of models" used within central banks.

3 Uncertainty and risk in macroeconomic forecasts

While the central tendency of a forecast, the point forecast, generally receives most public attention, forecast uncertainty and forecast risks are two other important features in forecasting exercises. Uncertainty and risk are two different things. I am therefore going to cover them separately.

Point forecasts are surrounded by uncertainty, and knowledge about the degree of forecast uncertainty is essential for decision-makers. Basically, we can identify five sources of forecast uncertainty:

- Uncertainty about future shocks to endogenous variables (eg shocks to consumption or labour demand),
- Uncertainty about assumptions concerning exogenous variables (eg assumptions about oil prices and exchange rates),
- Uncertainty about model parameters (eg marginal propensity to consume),
- Uncertainty about data (eg revisions of GDP) and
- Uncertainty about models (eg linear or non-linear effects of oil prices on GDP).

Ranking these sources of forecast uncertainty according to their importance is a difficult task, since their impact depends on the variable and the forecast horizon being studied. Moreover, the effects of these sources of forecast uncertainty are not independent of each other. Finally, an extremely large variety of models would be needed to evaluate the effects of model uncertainty. However, in a given model, uncertainty about future shocks and assumptions concerning exogenous variables often turn out to be greater contributors to aggregate uncertainty than uncertainty about parameters and data.

Although the sources of forecast uncertainty are known, forecast uncertainty is of course itself uncertain, and must therefore be estimated. Many forecasting institutions convey information about forecast uncertainty by using projection ranges when publishing their forecasts. In practice, a variety of measures of uncertainty can be used to compute these projection ranges:

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[1] See Schumacher C and J Breitung (2008), Real-time forecasting of German GDP based on a large factor model with monthly and quarterly data, International Journal of Forecasting, 24, 368-398; Marcellino M and C Schumacher (2007), Factor-MIDAS for now- and forecasting with ragged-edge data: A model comparison for German GDP, Deutsche Bundesbank Discussion Paper No 34/07.

[2] See Wang, MC (2009), Comparing the DSGE model with the factor model: an out-of-sample forecasting experiment, Journal of Forecasting 28, 167-182.

- Dispersion of board members' point forecasts (eg Federal Reserve),
- Confidence intervals based on past forecast errors and the judgement of board members (eg Bank of England) and
- Dispersion measures derived from past forecast errors, such as the mean of absolute past forecast errors (eg Bundesbank and, until recently, Eurosystem staff projections).

The computation of Eurosystem staff projection ranges was changed in autumn of last year. Instead of deriving them from past forecast errors, these ranges are now based on Bayesian Vector Autoregressions (BVARs) that account for shock and estimation uncertainty. The ranges are conditional on assumptions on several exogenous variables such as oil prices, exchange rates and foreign demand.

In general, model-based projection ranges have two possible advantages over calculating uncertainty based on past errors. If the sample of forecast errors is small, the uncertainty about past forecast uncertainty can be large. Moreover, in the case of structural change, past forecast uncertainty can be a misleading measure of future forecast uncertainty. But the structural change can be incorporated into a model from which uncertainty is derived.

However, model-based projection ranges also have two major disadvantages. First, the effects of model uncertainty are ignored. Second, information not contained in the model variables, which is typically incorporated into the forecast by means of subjective adjustments by the forecaster, is ignored.

How to best represent forecast uncertainty is still the subject of intensive discussions in the Eurosystem, and a final decision has yet to be taken. Furthermore, it should be taken into account that forecast uncertainty may vary markedly over time, so that neither past forecast uncertainty nor the forecast uncertainty derived from models is always a good basis for assessing current forecast uncertainty. This is one of the reasons why the forecast uncertainty conveyed by the ranges of the Eurosystem staff projections may be supplemented with a qualitative assessment by the ECB Governing Council. (For example, in December 2008, when year-end uncertainty was rising, the Governing Council concluded that in its "view …, the economic outlook remains surrounded by an exceptionally high degree of uncertainty.").

In addition to uncertainty, forecasts might be subject to upward or downward risks. That is, realised data might be more or less likely to come in above the point forecast than below the point forecast. Information about risks can be of great relevance to decision-makers. If risks to price stability lie on the upside, this could, for example, call for a more restrictive policy response than risks on the downside.

As in the case of forecast uncertainty, the risks to the forecast are, of course, difficult to quantify and have to be estimated. To begin with, these estimations often rely on subjective assessments of risks. These assessments can start with input variables (eg risks to oil prices, exchange rates or the output gap), which are then aggregated to determine the risk to the relevant variable (such as inflation or output). However, risks might also reflect the asymmetry of views in a decision-making body. For example, the views held by a minority within such a body could represent a risk.

Forecasting institutions convey information about forecast risks in different ways: in a quantitative manner, they are communicated by the shape of a density forecast (eg Bank of England) and in a qualitative manner, they are communicated verbally (eg ECB Governing Council).

While quantitative risk statements appear more precise at first glance, it should not be forgotten that, in general, it is extremely difficult to forecast risks to a forecast. It either requires correct assumptions to be made about the risks to the input variables and correct aggregation, in other words, a correct model. Or it requires the asymmetry of views in a

decision-making body to correctly reflect the true asymmetry of the forecast density. Doubts have been expressed as to whether these requirements can be fulfilled in a satisfactory manner.[3] I am therefore rather sceptical about the ability to forecast macroeconomic risks in a precise, quantitative manner. To my mind, assessing risks only in a qualitative, verbal manner strikes a good balance between expressing our view on the degree of uncertainty related to the forecast and, at the same time, showing an awareness of the general limitations of risk assessments.

4 Current assessment of economic development

Forecasting risk and uncertainty is currently of particular interest to central bankers, as forecast uncertainty has reached a comparatively high level. Because the scale and speed of the current economic downturn is unlike anything seen in the last few decades, forecast uncertainty can at present be incorporated into econometric analyses to a limited extent only. Conversely, "judgement-based risk management" has become extremely important.

However, despite an active exchange between modellers and macroeconomic experts, economic forecasts for 2009 and 2010 have repeatedly been revised downward since last autumn as downside risk has been realised both in the euro area and globally. Yet from now onwards, with substantial macroeconomic stimulus under way and extensive financial system rescue schemes in place, the risks to the economic outlook in the euro area should become more balanced. On the one hand, confidence and growth effects may be stronger than anticipated as a result of the enormous scale of expansionary monetary and fiscal policies worldwide. On the other hand, there remains, of course, the risk that the economic downturn in the euro area might become more severe than the staff projections indicate, for instance because of negative feedback effects from the financial system. Nevertheless, the degree of uncertainty surrounding the outlook for both the economy and inflation remains substantial.

In order to fulfil our mandate and to contribute to financial stability and sustainable economic growth, the Eurosystem has been providing unlimited liquidity support to the euro-area banking system since October last year. The Governing Council has decided to continue the non-standard liquidity support beyond the end of 2009 in any case. As a direct consequence of this ample supply of liquidity, the Eurosystem has augmented its balance sheet by more than 600 billion euro since the start of the financial crisis in August 2007. At the same time, our monetary policy operations are having a visible effect on overnight money market rates in the euro area. Furthermore, the ECB Governing Council has cut interest rates sharply to unprecedented levels. And we still have room to cut interest rates further.

But it is essential to bear in mind that an expansionary monetary policy comes at the price of creating a breeding ground for future risks to price stability. It might therefore prove useful to keep at hand instruments that enable us to reverse our monetary policy stance at the first signs of a recovery of the financial sector.

5 Conclusion

Ladies and gentlemen, I have highlighted some aspects that lie at the heart of each and every central bank engaged in forecasting, and I have mentioned a number of issues that are particularly relevant to the state of play in the Eurosystem in general and the Bundesbank in particular.

I hope that our conference will help stimulate further research into forecasting. The diversity of modelling approaches as well as their empirical testing enriches the wealth of experience

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[3] See Knüppel, M and G Schultefrankenfeld (2008), How informative are Risk Forecasts? An Examination of the Bank of England's Risk Forecasts, Bundesbank Discussion Paper 14/2008.

available to monetary policymakers. This helps to draw further conclusions for a robust and successful monetary policy in a continuously evolving economic landscape and, hence, helps to maintain price stability in the long run.

Thank you for your attention.