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**Research Report**

## Some lessons from the financial crisis for the economic analysis

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EUROPEAN CENTRAL BANK

EUROSYSTEM

**OCCASIONAL PAPER SERIES**

**NO 130 / OCTOBER 2011**

**SOME LESSONS  
FROM THE FINANCIAL  
CRISIS FOR THE  
ECONOMIC ANALYSIS**

by Geoff Kenny  
and Julian Morgan



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# SOME LESSONS FROM THE FINANCIAL CRISIS FOR THE ECONOMIC ANALYSIS<sup>1</sup>

by Geoff Kenny  
and Julian Morgan

NOTE: This Occasional Paper should not be reported as representing the views of the European Central Bank (ECB). The views expressed are those of the authors and do not necessarily reflect those of the ECB.

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## ABSTRACT

The economics profession in general, and economic forecasters in particular, have faced some understandable criticism for their failure to predict the timing and severity of the recent economic crisis. In this paper, we offer some assessment of the performance of the Economic Analysis conducted at the ECB both in the run up to and since the onset of the crisis. Drawing on this assessment, we then offer some indications of how the analysis of economic developments could be improved looking forward. The key priorities identified include the need to: i) extend existing tools and/or develop new tools to account for important feedback mechanisms, for instance, improved real-financial linkages and non-linear dynamics; ii) develop ways to handle the complexity arising from the presence of multiple models and alternative economic paradigms; and iii) given the limitations of point forecasts, to further develop risk and scenario analysis around baseline projections.

**KEY WORDS:** EURO AREA, FINANCIAL CRISIS, MACRO ECONOMIC FORECASTING

**JEL CLASSIFICATION:** E02, E30, E2, C53

**NON-TECHNICAL SUMMARY**

This paper draws on the experiences during the run up to, and since the onset of, the recent financial crisis to offer some indications of how the analysis of economic developments could be improved. In the first section, the paper recalls the key economic and financial drivers of the crisis, highlighting the role of financial shocks linked to the re-pricing of risk, asset prices and financing costs. A number of important non-financial elements are also emphasised, such as confidence and uncertainty shocks and deepening international linkages.

In Section 2, the predictive failure of macroeconomic tools and expert judgement widely shared by institutional and private forecasters alike (as reflected in the macroeconomic projections in specific periods strongly impacted by the crisis) is documented for both short and medium-term horizons. One of the main conclusions to be drawn from the analysis here is that the errors made by forecasters largely relate to the size of the shocks impacting the economy. Nevertheless, economic tools and models as well as expert judgement also failed to identify the importance and strength of key transmission and amplification channels, especially those linked to financial markets and uncertainty.

Hence, the third section of our paper identifies a number of factors which, with the benefit of hindsight, could have received more attention from those conducting economic analysis during the period of crisis. These include the leading indicator properties of various financial variables, the prevalence of the non-linear dynamics often neglected in economic tools and the signalling aspect of confidence and uncertainty indicators. In addition, there would appear to be a case for relying more on judgement than on the results of mechanical tools, particularly in the immediate aftermath of unprecedented events (such as the collapse of Lehman Brothers in September 2008).

Lastly, in the final section of the paper, we identify a possible way forward, particularly in respect of the main priorities for developing the economic analysis. The key priorities identified include the need to: i) extend existing tools and/or develop new tools to account for important aspects, for instance, improved real-financial linkages and non-linear dynamics; ii) develop ways to handle the complexity arising from the presence of multiple models and alternative economic paradigms; and iii) given the limitations of point forecasts, to further develop risk and scenario analysis around baseline projections.

## I INTRODUCTION

Economists, both those inside and outside policy institutions, pay considerable attention to analysing conjunctural economic developments. This helps them to better understand the current state of the economy and to make predictions about future developments. The analysis of economic developments forms a key element of the stability-oriented monetary policy strategy of the European Central Bank (ECB) aimed at achieving price stability.<sup>1</sup> More specifically, the economic analysis provides a forward-looking perspective on the outlook for and risks to price stability over the short to medium-term and therefore complements, and can be cross-checked with, an analysis of monetary developments that is particularly suited to explaining the evolution of price developments in the medium to long run.<sup>2</sup>

In this paper, we focus on the approaches adopted for analysing the economic conjuncture and attempt to draw out some key lessons from the experiences made during the financial crisis. Although we concentrate on the methods widely used in central banks and international organisations, the conclusions reached are also likely to be relevant for all those engaged in conjunctural analysis.

In contrast to monetary analysis, economic analysis can be characterised as focusing largely on models that are based on an assessment of economic variables and, in particular, the interplay between demand and supply in goods and labour markets. In the context of the ECB, an important part of the insights emerging from the economic analysis is summarised in the regular macroeconomic projections of Eurosystem and ECB staff which are published each year in June and December and in March and September, respectively.

The economic analysis also incorporates *financial* information to the extent that it is relevant for this assessment. Needless to say, such information proved to be a key part of the economic analysis during the crisis, where there

was a clear tendency for financial shocks to have an impact on the “real” demand and supply for goods and services and also for additional feedback effects from developments in the real economy to the financial sector.

Given the important challenges posed by the financial crisis to the economic analysis, it now seems timely to take a step back and try to assess what possible insight can be gleaned from the performance of the economic analysis *during* the run-up to and *since* the onset of the crisis, and to already offer some indications as to how it may be improved in the light of our recent experience.

The paper is structured as follows. In the first section, we recall the key economic and financial drivers of the crisis, highlighting the role of financial shocks linked to risk re-pricing, asset prices and financing costs for both firms and households. In addition, a number of important non-financial elements are also emphasised, such as confidence and uncertainty shocks, inventory adjustment as well as more intensive international linkages generated via trade.

In Section 2, the poor performance of macroeconomic tools and expert judgement, as reflected in the macroeconomic projections of the crisis period, is documented for both short and medium-term horizons. More importantly, we note that the large deterioration in the accuracy of macroeconomic forecasts was

1 This two-pillar approach has proved very successful, both as a device for processing and introducing a large set of complex and diverse information and for structuring the presentation of the factors underpinning the monetary policy decisions of the Governing Council. In particular, the information extracted from the two pillars is regularly presented to the public at the press conference that immediately follows the meeting in which the Governing Council takes its monetary policy decision for the euro area. It is also subsequently explained in the Monthly Bulletin of the ECB. Given the possibility of differing and even conflicting messages emerging from the analysis based on these pillars, a careful cross-checking of monetary and economic developments ensures the robustness of the analysis behind monetary policy decisions.

2 In a recent contribution, Papademos and Stark (2010) consider the possible enhancement of the monetary analysis while drawing on the lessons learnt from the financial crisis of 2007-10. For the rapidly expanding field of financial stability analysis, Trichet (2011) discusses the intellectual challenges ahead.



widely shared by institutional and private sector forecasters alike, including the ECB and the Eurosystem. One of the main conclusions to be drawn from the analysis here is that the errors made by forecasters largely relate to the large size of the shocks impacting the economy. Having said this, however, it would appear that the various tools used (including both reduced form and more structural macroeconomic models) failed to identify the importance and strength of key transmission and amplification channels, especially those linked to financial markets and uncertainty. Furthermore, such factors do not appear to have been adequately taken into account by experts when deciding upon the judgemental adjustments that are often made to refine the output of model-based forecasting exercises.

The third section of the paper builds on the preceding discussion and attempts to identify a number of factors which, with the benefit of hindsight, the economic analysis *could* – and in our view *should* – have paid more attention to during the crisis. These would include: i) the leading indicator properties of various financial variables; ii) the prevalence of the non-linear dynamics that are intrinsically linked to a crisis environment and yet often neglected in our tools; and iii) the signalling aspect of confidence and uncertainty indicators. In addition, it is argued that when the crisis intensified, particularly following the collapse of Lehman Brothers in September 2008, the economic analysis might have relied more on judgement rather than on the results of mechanical tools. In extracting these lessons, we recognise the possibility of “hindsight bias” in such assessments, which would caution against our ability to exploit the insights gained in “real time” and in future crises.

Lastly, in the final section of the paper, we identify some priorities for the way forward so that the economic analysis is developed further to take advantage of the lessons learnt and becomes more robust and adaptive to changing economic circumstances. The key priorities identified include: i) the need to extend existing

tools and also to develop new tools in order to account for important aspects, such as improved real-financial linkages and non-linear dynamics; ii) to develop ways to handle the complexity arising from the presence of multiple models and alternative economic paradigms; and iii) given the limitations of point forecasts, for those conducting macroeconomic projections to consider further developing the characterisation of uncertainty surrounding the outlook as well as enriching the existing tools for identifying and quantifying the impact of important risks.

## 2 UNDERSTANDING THE KEY DRIVERS OF THE CRISIS

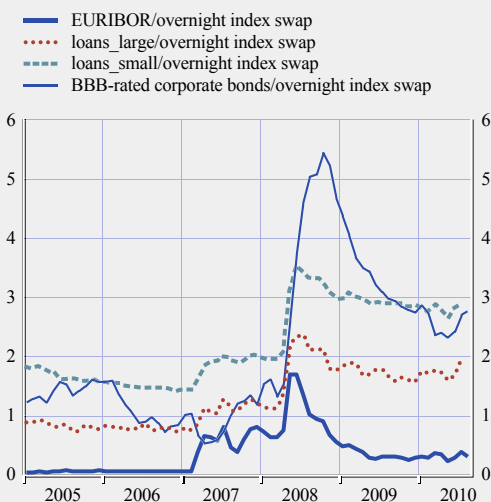
While some parts of the global economy already showed signs of a slowdown in growth in late 2006 and early 2007, financial factors undoubtedly played a strong role in triggering and subsequently amplifying the macroeconomic effects of the crisis. The first such factor was the rise in overall financing costs within the financial sector and, by extension, for firms and households (see Chart 1). Following a significant deterioration of conditions in the US housing market, a sharp increase in perceived default and liquidity risk precipitated a dramatic global re-pricing of risk. The result was an outbreak of turbulence in global money markets in August 2007; a development which signalled the onset of the financial crisis.

With regard to the euro area, the financial nature of this global shock was reflected most clearly in money market spreads and also in bank lending rate spreads for loans to households and non-financial corporations. The latter accentuated markedly after the collapse of Lehman Brothers in September 2008; a period in which there was a further sharp rise in spreads and overall financing costs that weighed heavily on euro area growth, most notably on investment spending.

A second financial factor was the more general deterioration in asset markets beyond the US housing market. Sharp declines in stock prices (see Chart 2), and also in many countries in house prices, brought about a worsening in balance sheets for firms and households, thereby reinforcing the negative dynamics associated with increased perceptions of risk and higher

Chart 1 Financial market spreads

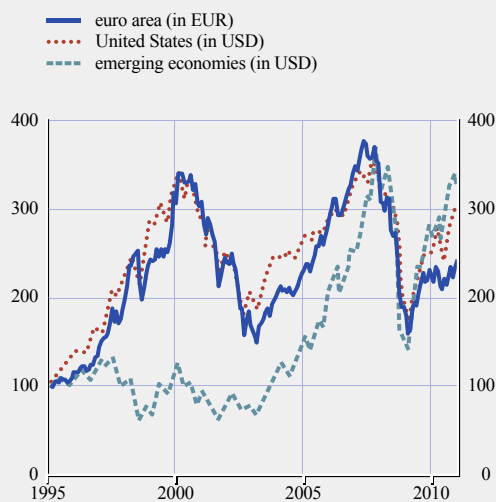
(in basis points)



Sources: Reuters and the ECB (including ECB calculations).  
 Note: An overnight indexed swap (OIS) is an interest rate swap where the periodic floating rate of the swap is exchanged for an overnight index. In this chart, the 3-month OIS rate, which is based on the 3-month euro overnight index average (EONIA), is used to calculate the spreads. "EURIBOR" refers to the 3-month euro interbank offered rate. "loans\_large" refers to the interest rates applied by monetary financial institutions (MFIs) to loans to non-financial corporations of over €1 million with a floating rate and an initial rate fixation period of up to one year. "loans\_small" refers to MFI interest rates on loans to non-financial corporations of up to (and including) €1 million with a floating rate and an initial rate fixation period of up to one year. Meanwhile, "BBB-rated corporate bonds" refers to the euro-denominated non-financial corporate bond index calculated by Bank of America Merrill Lynch including maturities of over one year.

Chart 2 Stock prices

(index; 31 January 1995 = 100)



Source: Datastream (regional market indices).

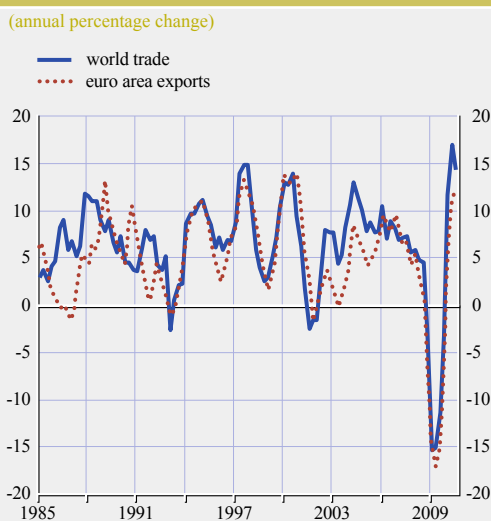
financing costs. Coupled with a decline in confidence and real economic conditions, these developments were ultimately associated with a marked reduction in lending to firms and households in the euro area.

There was also evidence of an additional non-price mechanism at play.<sup>3</sup> For example, according to the Bank Lending Survey (BLS) of the ECB, credit standards for loans to households and corporations tightened significantly. This survey first started pointing to a tightening of credit standards (realised and expected) for private sector loans during the course of 2007 and the situation worsened considerably in the second half of 2008. In the case of loans to households, bank credit tightening was particularly linked to declining prospects for the housing market and the general macroeconomic outlook. The latter was also a key factor behind the tighter funding conditions faced by firms, albeit being reinforced by industry and firm-specific considerations as well as the high costs associated with the deterioration in the balance sheets and capital positions of banks.<sup>4</sup>

While financial factors were certainly central to triggering and subsequently amplifying the recessionary dynamics at play, it is important to highlight the significant non-financial elements involved. In particular, there was a generalised collapse in business and consumer confidence that was highly synchronised across the main developed economies in the Organisation for Economic Co-operation and Development (OECD). With regard to euro area firms, the associated increase in uncertainty most likely contributed to a postponement of investment spending plans. Households also exhibited a sharp increase in precautionary behaviour, as reflected in the dramatic rise in the household saving rate for the euro area.<sup>5</sup>

In addition, following the collapse of Lehman Brothers, global trade went into free fall (Chart 3), thereby amplifying the international transmission of the shock and the synchronicity of its effects. The contraction of trade flows had a big impact on economies such as those in the

Chart 3 World trade and euro area exports



Sources: Eurostat and the IMF.

euro area. Ironically, the strong international linkages associated with the development of global supply chains, which had partially underpinned the robust growth in world trade in the period prior to the crisis, may actually have reinforced the downward spiral of the fourth quarter of 2008 and the first quarter of 2009.<sup>6</sup> Reflecting these strong international linkages, the volume of euro area goods exports declined on average by over 16% in 2009, compared with 2008. Indeed, the weakness of euro area exports largely explains why the collapse in euro area GDP was significantly larger than the average decline in output experienced during previous systemic crises in the OECD countries.<sup>7</sup>

3 See, for example, ECB (2009a) and Ciccarelli, Maddaloni and Peydro (2010).

4 See, for example, Box 3 in the Monthly Bulletin of February 2009 in which the results of the previous month's Bank Lending Survey are reported and analysed.

5 Box 6 in the Monthly Bulletin of August 2009 discusses the implications of this heightened uncertainty for economic prospects in the euro area.

6 This explanation for the severity of the crisis on global trade is discussed in Anderton and Kenny (2011).

7 See ECB (2009b).

Another important “real” factor behind the sharp adjustment in output and international trade during this period was a severe adjustment in inventories, reflecting the heightened costs – both actual and perceived – of holding or accumulating inventories in an environment of uncertain future demand. Indeed, evidence from business surveys, such as the harmonised business surveys of the European Commission and the Eurozone Manufacturing Purchasing Managers’ Index (PMI), is consistent with the idea of some involuntary inventory accumulation during the crisis followed by a period in which excess inventory holdings were run down.<sup>8</sup> For example, retailers may have reduced their stocks of finished goods by purchasing fewer goods from manufacturers, while manufacturers, in turn, were likely to have reduced their own stocks of materials and other inputs.<sup>9</sup> Lastly, the volatility of inventory adjustment in 2008 and 2009 may also have reflected less willingness on the part of suppliers to extend trade credit or trade finance in an environment of increased risk aversion and heightened sensitivity to credit risk. Trade credit may also have contributed to exacerbating the above-mentioned (dramatic) decline in international trade in some countries.<sup>10</sup>

To help conclude this review of the key economic drivers of the crisis, Chart 4 below attempts to provide a graphic summary – from the euro area perspective – of some of the main features that have been identified to date. It is important to emphasise that this figure focuses on what were the key triggers, propagation and amplification mechanisms rather than on providing any account of what ultimately “caused” the crisis.

With the benefit of hindsight, as Chart 4 would underline, the financial sector was the trigger for economic developments during the crisis – a fact that contrasts with most of the standard business cycle analysis of the past 30 years, where the financial sector is seen as being more passive and not always considered central to understanding cyclical dynamics. The developments that

occurred were very much in line with the strand of research which emphasises the importance of financial frictions and non-financial factors, such as uncertainty shocks impacting households and firms.

One key element highlighted in Chart 4 is the *feedback loops* which may exist within the financial sector and also between the financial and non-financial sectors of the economy. Another key aspect underlined is the role of policy-makers and the impact of policy measures on private sector agents. A large number of crisis management policies were implemented in both the financial and non-financial sectors, many of which can be assessed to have had benign effects in terms of stabilising the economic situation. Also notable, however, was the contribution of the government sector to raising uncertainty, especially regarding the build-up of fiscal imbalances and sovereign risk in some countries. This was particularly evidenced by the 2010 increase in the long-term government bond yields of a number of euro area countries, following a rapid deterioration in their fiscal position.

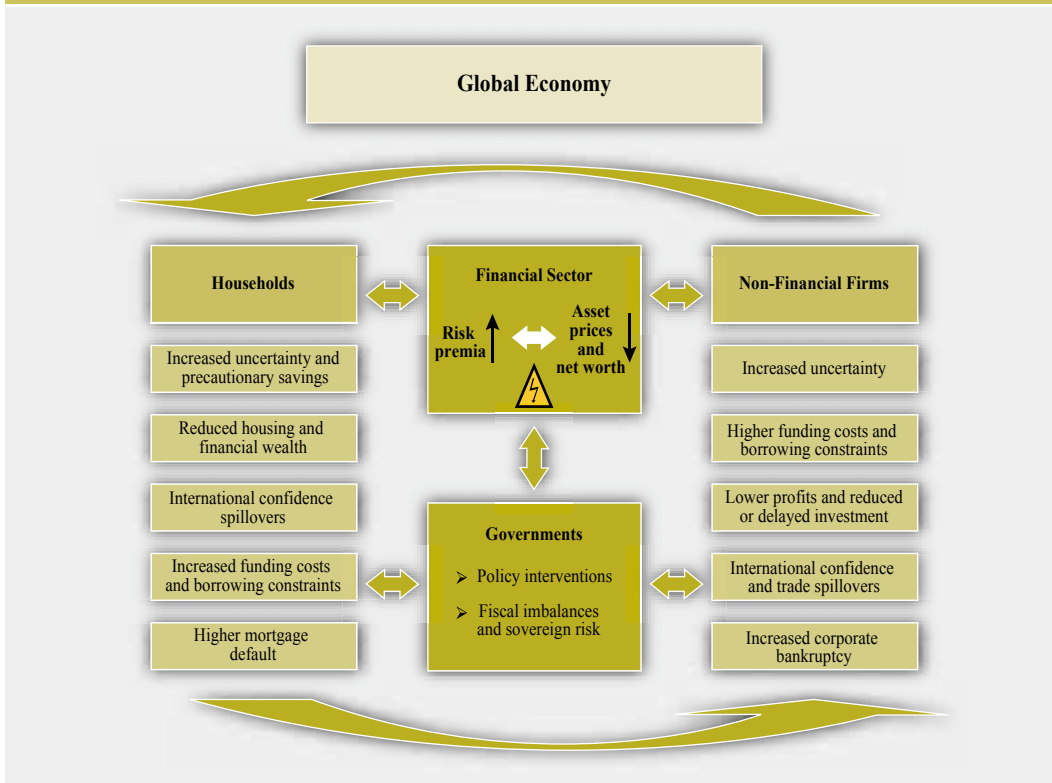
Furthermore, Chart 4 very clearly shows the complexity of the interactions across sectors and policy agents. Such complexity poses many challenges for the economic analysis, particularly in relation to the use of models. These often make use of simplifying assumptions regarding the exogeneity of certain variables and thus effectively exclude particular feedback channels.

8 De Rougement (2011) also discusses the role of inventories during the global recession precipitated by the financial crisis.

9 The evidence on inventory adjustment during the crisis is discussed in more detail in Box 5 of the Monthly Bulletin of May 2009.

10 Considerable challenges arise in attempting to identify particular channels, mechanisms or frictions behind the collapse in global trade. For example, Eaton, Kortum, Neiman and Romalis (2011) question whether this collapse resulted from factors impeding international transactions or, more simply, whether it was due to goods being heavily traded in international markets. Their findings suggest that the collapse in global trade was largely related to the latter rather than specific factors impeding trade per se (although for a small number of countries such factors were in fact more relevant).

Chart 4 The 2007-10 financial crisis: key trigger, propagation and amplification mechanisms



In conclusion, the macroeconomic developments that occurred during the financial crisis of 2007-10 have been so dramatic and extreme that they could be seen as a “once-in-a-century” event – a perspective which, arguably, may imply some limitation on what can be learnt for economic analysis during more normal times. Such extreme fluctuations are also characteristic of an environment of panic, reflecting human responses to the absence of trust and the materialisation of fear and contagion or what economists tend to call “Knightian” uncertainty. At the same time, the financial crisis has clearly cast considerable doubt on the so-called “Great Moderation”<sup>11</sup>, thereby suggesting that the level of macroeconomic instability and volatility recently observed may possibly be more prevalent or more frequently occurring when viewed from a forward-looking perspective.

In this respect, our future work may have much to learn from our understanding of these recent developments.

<sup>11</sup> The “Great Moderation”, a term coined by Stock and Watson (2002), refers to the reduction in the volatility of the business cycles of many advanced economies that started in the mid-1980s.

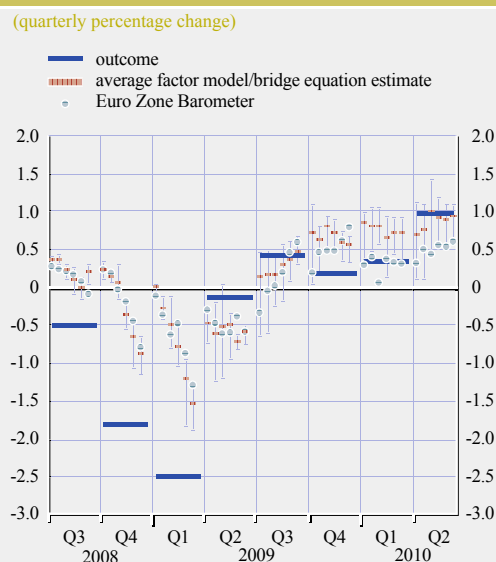
### 3 HOW DID THE ECONOMIC ANALYSIS FARE DURING THE CRISIS?

#### 3.1 THE NEAR-TERM OUTLOOK

As discussed in the introduction, the economic analysis provides an important analytical input into monetary policy deliberations, generating timely and, ideally, accurate information on the economic situation and outlook. One key element in the preparation of such projections is our assessment of the current state of the economy in real time or what are sometimes referred to as “early estimates” of GDP.<sup>12</sup> These include a “backcast” of output developments in the previous quarter (required, given the substantial lags in the publication of national accounts), a “nowcast” for the current quarter and a near-term “forecast” for the quarter to follow. A large array of tools is commonly used to make an assessment of the current economic situation and its likely evolution over the short term. These feature tools attempting to synthesise the information available for a large cross section of high frequency indicators (e.g. from surveys and financial markets) and to extrapolate their short-term trends. The latter tools include dynamic factor models which attempt to average over a large number of data series as well as simpler “bridge” equations linking key indicators to the components of euro area demand.<sup>13</sup>

Chart 5 displays some early estimates of euro area GDP obtained from a range of differing specifications for bridge and factor models. These have been constructed using the vintages of data that were available at the time in order to illustrate the difficulties of such mechanical estimates over the period concerned. For each quarterly GDP outcome, there are six early estimates based on data at intervals of roughly two weeks (ranging from forecasts to backcasts, as described above). The dynamic factor models and bridge equations estimated use aggregate euro area data as well as data at the sectoral, expenditure component and country level.

Chart 5 Early estimates of euro area GDP from a range of factor models and bridge equations plus the Euro Zone Barometer



Sources: Calculations using factor models/bridge equations and the Euro Zone Barometer of MJEconomics.

For simplicity, we report the range of outcomes for quarterly euro area GDP as a vertical line, while the mean is shown in the horizontal reddish brown line. What is striking is the clear failure of all models to capture the period of exceptional macroeconomic weakness in the fourth quarter of 2008 and the first quarter of 2009. It is also noteworthy that broadly similar forecast errors were also made by private forecasters (as reported in the Euro Zone Barometer).

Although, most estimates demonstrate some convergence towards the outcome as more short-term economic information becomes available, even the final estimates for 2008Q4 and 2009Q1 (made available just prior to the official release of GDP data) point to a significantly higher, albeit negative, GDP growth rate than the rate of between -2.0% and -2.5% actually registered. A key failure

<sup>12</sup> See, for instance, ECB (2008a).

<sup>13</sup> Such tools and their application are described in some detail in Banbura, Giannone and Reichlin (2010).

of the economic analysis during the crisis was therefore its inability to deliver reliable information on the current state of the economy; information which could have been used to help shape the more medium-term outlook. There are a number of reasons for this poor predictive performance. For example, there is the fact that tools are estimated over sample periods where such sharp volatility in growth dynamics has not previously been observed. Also, most, if not all, of the models used are essentially designed with the assumption of a stationary environment with mean reversion in growth dynamics, while the crisis developments were undoubtedly non-stationary in nature.

Complications in the identification of seasonal factors (given the large fluctuation in GDP and other macroeconomic time series around the turn-of-the-year 2008-09) as well as possible changes in the signalling power of survey data (due to an exceptionally strong adjustment in consumer and corporate sentiment) may have played a further role.<sup>14</sup> More specifically, most survey data are reported as balance statistics summarising the *qualitative* and *subjective* assessments of survey respondents. As such, they may not always have a direct, stable or linear relationship with actual developments in related economic series (e.g. as regards output, consumption, employment and prices). Lastly, as the recovery started to take hold, growth dynamics may have been driven by factors that are not easily incorporated into our short-term tools. For example, a number of government policies were introduced (such as the car scrapping premium) which positively impacted growth dynamics in the second half of 2009.<sup>15</sup>

### 3.2 MEDIUM-TERM PROJECTIONS

In the midst of the financial crisis, the imprecise nature of the information on the current and near-term state of the euro area economy was also accompanied by substantially higher medium-term projection errors for euro area GDP and, to a lesser extent, consumer price inflation, as measured by the Harmonised Index of Consumer Prices (HICP).

Chart 6 Evolution of euro area GDP forecasts for 2009

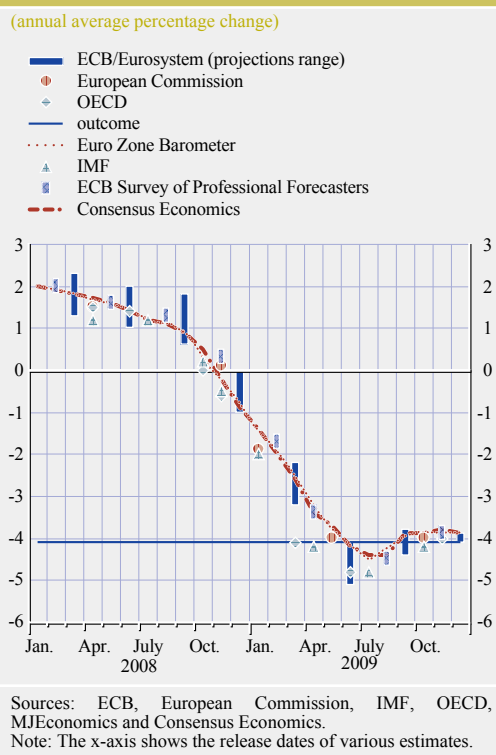


Chart 6 plots the evolution of ECB and Eurosystem projections for euro area GDP in 2008 and 2009, together with the corresponding projections from a range of private sector entities (MJEconomics (Euro Zone Barometer), Consensus Economics and ECB Survey of Professional Forecasters) and international organisations (the IMF, the OECD and the European Commission). In contrast to the projections from other institutions, those of staff within the ECB and the Eurosystem are presented in the form of ranges rather than as point estimates. The use of ranges acknowledges the inevitable uncertainty surrounding macroeconomic projections and, based on the current method, the width of the ranges is

<sup>14</sup> For a discussion of the challenges posed by the crisis linked to the interpretation of seasonally adjusted data, see Box 7 in the Monthly Bulletin of August 2009.

<sup>15</sup> Box 5 in the Monthly Bulletin of December 2010 reviews developments in the euro area and the global car industry, and highlights the role of vehicle scrapping schemes and massive government bailouts in some countries.

calibrated such that it is consistent with a 57.5% confidence interval.<sup>16</sup>

It is clear that all of the projections in this chart were strongly lagging actual developments; only in late 2008 did public and private sector institutions begin to make downward adjustments to their growth forecasts for 2009, albeit while clearly underestimating the severity of the downward spiral that was taking place at that time. As regards the projections of the ECB and the Eurosystem staff, despite the attempt to capture the role of forecast uncertainty via the publication of projection ranges, the scale of subsequent forecast errors is suggestive of the wider uncertainty prevailing in this period. Indeed, only by mid-2009 were the available forecasts coming close to the eventual outcome of a decline in average annual euro area GDP of just over 4%.

A similar, though less dramatic, pattern can be seen when looking at forecasts for

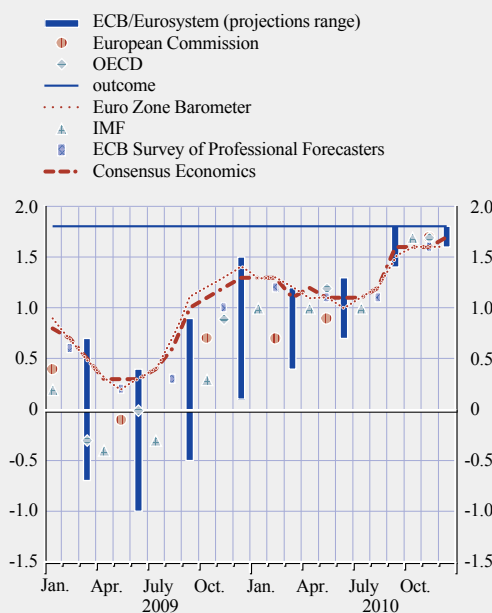
2010 (see Chart 7). In this case, forecasters systematically underestimated the strength of the recovery. In the first half of 2009, most forecasters expected very slow growth in 2010, with a fair proportion of them even anticipating a fall in output. As more positive news emerged in the second half of 2009, the forecasts were steadily revised upwards but still remained well short of the final outcome until the last quarter of the year.

The evidently lagging nature of the information contained in most projections, together with the large projection errors made, highlights the inability of standard macroeconomic tools to deliver accurate point forecasts during times of heightened economic stress. Indeed, economic developments during periods of crisis and instability are, by their very nature, exceedingly unpredictable.

A relevant question with regard to the performance of forecasters is whether it is realistic to expect them to predict the timing of crises. Ex ante it may be impossible to identify the particular source, trigger mechanism and timing of a crisis event.<sup>17</sup> To the extent that such factors could have been identified, they might merely have just brought forward the materialisation of the crisis itself. In this respect, there may be some hindsight bias in an ex post analysis of forecast errors, reflecting a tendency to believe – having knowledge of the key factors at the centre of the crisis – that we should have identified in a more timely manner its onset. Arguably, it is in the period after the onset

**Chart 7 Evolution of euro area GDP forecasts for 2010**

(annual average percentage change)



Sources: ECB, European Commission, IMF, OECD, MJEconomics and Consensus Economics.  
Note: The x-axis shows the release dates of various estimates.

16 See ECB (2009c). Various methods have been employed by staff at the ECB to compute these ranges. From the first publication of the staff projections of the ECB and the Eurosystem (December 2000) until June 2008, the published projection ranges for each variable and horizon represented twice the mean absolute projection error constructed on the basis of an analysis of historical projection errors. These published ranges were derived using a short sample of projection errors which was not updated over time. Another, model-based method was used for the staff projections published from September 2008 to September 2009, while in December 2009 the method for calculating the ranges was further updated to take account of the most recent projection errors and to allow for some correction for very extreme observations or outliers.

17 This has been likened to seismologists anticipating the timing of an earthquake (Spaventa, 2009).



of the crisis, and not before it, that the scope for improvements in predictability may lie. For example, prior to the dramatic events of September and October 2008, the possibility for enhancing our projections was probably very low. However, in the light of the key events that took place (such as the outbreak of contagion in the financial sector), forecasters might have identified better the severity and likely evolution of the macroeconomic events that were to unfold.<sup>18</sup>

The above poor performance is partially related to inaccuracies in terms of the technical (e.g. interest rates, stock prices, exchange rates, commodity prices) or other relevant underlying assumptions or forecasts (e.g. for external demand) that are used to underpin the euro area macroeconomic projections.<sup>19</sup> For example, the over-prediction of euro area inflation in the wake of the financial crisis is inevitably linked to errors in fundamental assumptions about oil and other commodity prices, namely that they would evolve in line with the expectations embedded in commodity futures contracts.

However, as regards GDP growth, it is unlikely that the scale of the observed projection errors can be explained by errors in technical assumptions alone. Rather, given the scale of the deterioration in forecast performance highlighted by Charts 6 and 7, these errors were most likely also a reflection of inadequacies in both our forecasting tools and expert judgements (as projections include judgemental adjustments). Such shortcomings may have resulted in an inability to identify the degree of persistence in the shocks impacting the euro area and/or an underestimation of their associated transmission and propagation mechanisms (e.g. the likely feedback loops between the real economy and the financial sector highlighted in Chart 4).

The preceding analysis clearly demonstrates that forecast errors were remarkably high during the crisis period, perhaps reflecting *both* the unpredictability of events *and* shortcomings in our models or expert judgement. Nevertheless, and in line with the evidence in Charts 6 and 7,

it is important to note that the projections of the ECB and the Eurosystem were not systematically worse than those of other institutions over this period. In other words, the failure to predict the depth of the crisis was widespread among professional economists and not just specific to forecasters at these institutions.

It should also be acknowledged that, given the truly exceptional nature of the financial crisis, it is not surprising that forecast errors were exacerbated during this period. Moreover, even if forecasters were consistently underestimating the severity of the economic contraction, they did at least offer some reliable qualitative signals for policy-makers. For example, the staff projections of the ECB for March 2009 predicted that euro area GDP growth would be negative in 2009, ranged between -3.2% and -2.2%. What this implied was the worst recession since the end of World War II – an assessment which was undoubtedly borne out by subsequent developments.

### 3.3 ANALYSIS OF UNCERTAINTY AND RISKS

One feature evident in Charts 6 and 7 is the relative proximity of the macroeconomic projections from the different institutions and the analysts in the private sector. Given the nature and magnitude of the shock hitting the global economy and the considerable uncertainty that existed at the time, it is perhaps surprising that there was not greater divergence between private and institutional forecasters. In particular, to the extent that agents have different models or adapt their forecasts at different speeds in response to economic news, one would expect large shocks to be associated with higher levels of forecaster disagreement.

<sup>18</sup> Caballero (2010) emphasises the clear limits to improvements in prediction during periods of crises: “Modern Cassandras will always claim to have seen the crisis coming. What they will not tell you is how many times they saw things coming that never materialized or how the specific mechanisms behind the crisis are different from those on which their predictions were based”.

<sup>19</sup> The technical assumptions underpinning the macroeconomic projections of staff in the ECB and the Eurosystem are regularly described in a box in the Monthly Bulletin. See, for example, Box 8 in the December 2010 issue of the ECB Monthly Bulletin.

However, the similarity of projections on the part of professional forecasters and institutions publishing projections might be seen as symptomatic of some “herding” behaviour.

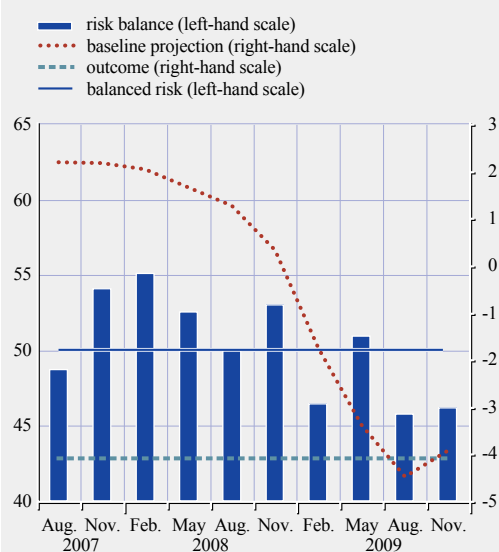
More detailed sources of information on individual forecasters do, however, suggest heightened disagreement. According to the Survey of Professional Forecasters (SPF) of the ECB, which is based on a panel of approximately 90 separate forecasters, the standard deviation of the individual one-year ahead forecasts for euro area GDP – a measure of forecaster disagreement – increased from below 0.2 percentage point in late 2007 to above 0.6 percentage point in the second quarter of 2009.<sup>20</sup>

Notwithstanding the above evidence on disagreement about point forecasts, there may also have been a tendency to reflect the deterioration in the outlook during the crisis more in the analysis and the communication of risks surrounding projections, rather than in revisions to the baseline or central scenario. For example, in summarising the view of the Governing Council in December 2008, the Monthly Bulletin of the ECB states that “...the economic outlook remains surrounded by an exceptionally high degree of uncertainty. Risks to economic growth lie on the downside”. One distinct message emerging from recent experience may thus be that point forecasts have limitations, especially during periods of macroeconomic instability. During such times, the analysis of the risks accompanying our outlook may prove to be a more informative source of input into monetary policy discussions. Chart 8 below provides some further evidence on the real time role of expert risk assessments during the crisis, drawing on information from the SPF conducted by the ECB.

The chart shows the baseline projection from various vintages of the SPF, together with the corresponding risk balance indicator extracted from the probability forecasts also collected under the survey. The risk balance indicates

**Chart 8 Risk analysis for 2009 GDP growth forecasts from the Survey of Professional Forecasters of the ECB**

(probability balance and annual growth rates)



Source: The Survey of Professional Forecasters of the ECB.  
 Note: The *risk balance* is extracted from the aggregate density in the SPF and refers to the probability, in percentage terms, of observing an outcome that is lower than the average point forecast for 2009 in each survey over the period.

the probability of observing growth lower than the point forecast as indicated in each survey over the period. It is noteworthy that the risk analysis seems to point to a sharp increase in downside risks in late 2007 and that the SPF correctly identified more significant downside risks over the course of 2008 (with the survey round of August 2008 being a notable exception). Also, the risk analysis highlighted an intensification of those risks in November 2008.

On the other hand, given that the survey continued to predict positive growth rates for 2009 in the November 2008 round, there is clear evidence that the severity of the downside risks was underestimated during the period when the actual free fall in activity (described in Section 1)

<sup>20</sup> Chart 11 in Section 3 of this paper highlights the upward impact of increased forecaster disagreement on overall forecast uncertainty. The increase in forecaster disagreement is very much in line with other stylised facts on the behaviour of forecaster disagreement over the business cycle. For example, *Dovern et al. (2009)* demonstrate that disagreement about real variables has a strong tendency to intensify during periods of recession.

was already taking place. Furthermore, in the February 2009 survey, when the point forecast for 2009 had been revised downwards to signal decidedly negative growth, the upside skew in the SPF risk assessment was providing a clearly erroneous signal concerning the state of the economy. Overall, the experience with the SPF probability forecasts during the crisis period is somewhat mixed and thus suggests the necessity of exploring new ways to improve the usefulness of such indicators in the future.

### 3.4 MACROECONOMIC MODELS

The large projection errors recently experienced would imply that there is still significant room for improvement among professional and institutional forecasters; a theme that we shall return to in the remainder of this paper. As indicated previously, the financial crisis has also pointed to weaknesses in the macroeconomic models which support our projections. In particular, criticism has been directed at state-of-the-art dynamic stochastic general equilibrium (DSGE) models, although much of this is actually just as relevant to the other, more traditional, “workhorse” models used for forecasting in central banks, including those implemented within the Eurosystem.<sup>21</sup>

Mainstream macro models have been criticised for having unrealistic assumptions (e.g. perfect information and rational expectations) and for paying little or no attention to financial frictions, the role of the banking sector and to non-linear dynamics or interrelationships. The crisis has therefore provided a strong impetus to modelling research, particularly in terms of enriching the role of the financial sector and in attempting to relax other important assumptions, such as rationality and linearity.

Despite these criticisms, DSGE and other traditional macroeconomic models remain very useful tools. For example, they can be used to help test the internal consistency of a particular economic theory with the data and may, thus, provide clues about the essential facts that need to be considered when interpreting business

cycle dynamics. In this regard, the structural interpretation of the shocks in DSGE models means that they may have an important value in helping to interpret economic developments as they unfold. This real time “interpretative function” of models also applies to some of the short-term forecasting tools. For example, a significant recent advance in the use of factor models has been the ability to trace how economic news shapes revisions to early estimates of GDP.<sup>22</sup>

To give an idea of the interpretative value of models, Chart 9 presents the historical decomposition of euro area GDP developments using the New Area-Wide Model (NAWM) of the ECB for the period from early 2007 to mid-2010. Although the financial sector plays only a passive role in the NAWM<sup>23</sup>, the model provides nonetheless an insightful interpretation of the crisis events as they unfolded at the time. In particular, the NAWM emphasises the strong role of international factors – linked to external demand and the importance of international linkages noted earlier in Section 1 – in contributing negatively to euro area GDP growth, especially during the initial phase of the downturn and when the free fall in activity occurred around the turn-of-the-year 2008-09.

Considering the downturn from this perspective, it is clear from the NAWM interpretation that several important domestic factors also contributed negatively to the evolution of euro area GDP. For instance, the strong role played by risk premia in depressing domestic demand, resulting in relatively weak investment and heightened precautionary behaviour among euro area households. In addition, nominal adjustment – especially downward wage

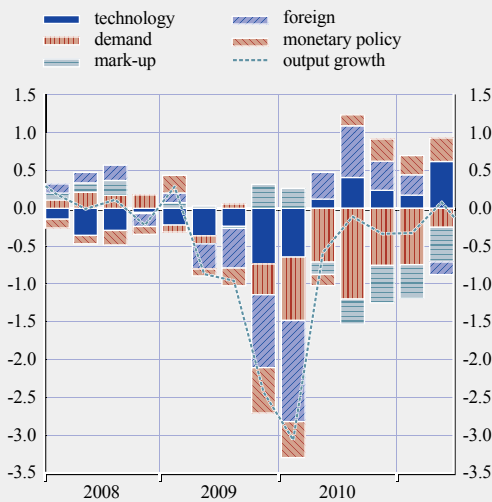
21 Economists such as Buiter (2009), Akerlof and Shiller (2009) and Krugman (2010) have argued that the current generation of micro-founded theory-based models represent a wrong turn for the economics profession. On the other hand, Lucas (2009) provides a more positive assessment of these models.

22 See Banbura, Giannone and Reichlin (2010).

23 See Christoffel, Coenen and Warne (2008). Ongoing research is aimed at extending the NAWM to include financial frictions. Meanwhile other models in use at the ECB, such as that of Christiano, Motto and Rostagno (2003), already incorporate important financial frictions.

**Chart 9 NAWM decomposition of GDP growth from the vantage point of the September 2010 staff macroeconomic projection exercise (MPE) of the ECB**

(quarterly percentage change and contributions in percentage points)



Source: Calculations based on Christoffel, Coenen and Warne (2008).

Note: The chart shows the contribution of various groups of structural shocks to the deviation of output growth from its steady state rate of growth (0.5% quarter-on-quarter).

adjustment – was relatively limited in the period immediately following the large negative shocks to output and demand. This contributed further to the prolongation of the downturn, as reflected in the visibly negative impact of the mark-up shocks to GDP growth. The NAWM interpretation also helps to identify the function of negative supply side factors (technology shocks) that may have been linked to dampened prospects for euro area potential growth around the turn-of-the-year 2008-09. Lastly, the model determines the role of monetary policy measures in helping to stimulate the economy from mid-2009 onwards.<sup>24</sup>

This section has highlighted the widespread failure to predict the macroeconomic developments that occurred during the crisis as well as their severity. Although such a failure may not be all that surprising, given that existing tools were largely developed with “normal” business cycle fluctuations in mind, it still raises questions about the appropriateness of using such tools during periods of exceptional

macroeconomic volatility. This calls for further work to assess the appropriate economic tools for periods of macroeconomic stress and the extent to which the output of these tools should also reflect off-model information (e.g. expert judgement) in order to help reduce forecast errors in times of extreme macroeconomic turbulence.

<sup>24</sup> The fact that the contribution of monetary policy is not positive before mid-2009 (and is even negative) may reflect that in the NAWM the policy contribution captures only the interest rate effect which is restricted by the zero lower bound. Moreover, non-standard monetary policy measures are not included in the model.

#### 4 THE BENEFIT OF HINDSIGHT: WHAT SHOULD WE HAVE PAID MORE ATTENTION TO?

The experience with macroeconomic tools and projections during the period of financial crisis offers an important opportunity – with the benefit of hindsight – to identify the factors and developments to which the economic analysis could have paid more attention. This insight may also help establish where improvements are required and the priority areas for future tool development. Four particular areas are highlighted below.

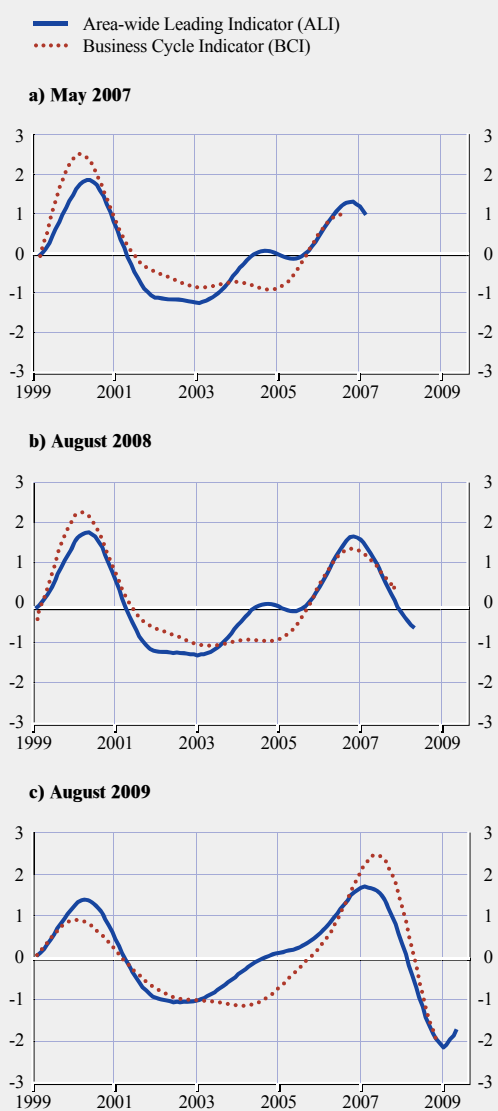
##### 4.1 FINANCIAL FACTORS

Given the role of the financial sector during the crisis, it would appear that economic forecasts could have been improved if more weight had been given to financial variables. A number of studies have found, for instance, that stock prices can be informative for GDP developments.<sup>25</sup> Indeed, the importance of financial factors was appreciated in real-time by ECB/Eurosystem staff forecasters who took account of tighter financing conditions emanating from wider financial market spreads as well as tighter credit standards in their projections.<sup>26</sup>

A new monthly Area-wide Leading Indicator (ALI) for the euro area business cycle has recently been developed which seeks to exploit the possible leading indicator properties of particular financial series.<sup>27</sup> The ALI is derived by choosing nine leading series, including a number of financial variables and survey-based confidence measures. As demonstrated in Chart 10, it can help to predict – in real time – the euro area business cycle during the recession of 2008-09 and the following upturn. As can be seen from the chart, on the eve of the crisis (May 2007), the ALI was already indicating that the cyclical peak had passed. Prior to the intensification of the crisis in the autumn of 2008, the ALI was signalling a move into a below trend phase of the cycle and by mid-summer 2009 there were the first tentative signs that the cyclical trough had passed.

Chart 10 Turning point predictions – Area-wide Leading Indicator (ALI)

(standardised deviation from trend)



Sources: De Bondt and Hahn (2010).

Note: The BCI refers to the deviation of economic activity (measured by monthly industrial production excluding construction) from its trend level using a one-sided band pass filter. The ALI is shifted by the five months it leads the BCI.

Aside from the clear need to develop reduced form indicators and short-term forecasting tools

25 See, for instance, De Bondt (2009) and Anderson and D'Agostino (2008).

26 As indicated, for instance, in the text accompanying the ECB/Eurosystem staff projections disclosed at the time (e.g. the December 2007 and June 2008 issues of the Monthly Bulletin).

27 Such an approach is proposed in De Bondt and Hahn (2010).

adequately reflecting the information content of financial variables, an additional challenge will be the incorporation of financial frictions and financial intermediation into forecasting models. It has long been known that financial markets are imperfect due to, *inter alia*, information asymmetries between borrowers and lenders as well as the costly enforcement of financial contracts. In this regard, research which predates the financial crisis has highlighted the importance of such frictions in the propagation of crises and as a key amplifier and source of business cycle fluctuations.<sup>28</sup> For the euro area, in particular, the role of financial frictions in driving the cyclical dynamics has been underlined by the Christiano, Motto and Rostagno (CMR) model.<sup>29</sup> Despite these examples, it seems fair to say that financial frictions have not played a major role in large-scale macroeconomic models.<sup>30</sup> Much work remains to be done in this field in terms of assessing which frictions are most important and whether models with financial frictions can meaningfully characterise the nature of financial crises. It is also unclear whether such models can be useful in real time for analysing economic developments and informing policy-makers about the possible impact of differing policy responses.

#### 4.2 NON-LINEARITIES

Standard tools based on a stationary and linear environment can serve us well in providing point estimates for GDP growth and inflation during “normal times”. However, they are far less reliable during periods of extreme economic and financial turbulence where non-linearities and non-stationarities are likely to be prevalent. This suggests that non-linear models are worth investigating, although there is very mixed evidence as to whether they can reliably improve forecasting performance in real time.<sup>31</sup>

The possible relevance of non-linear effects can be investigated with regime-switching models, distinguishing between periods of low and high growth. Such methods attempt to incorporate the uncertainty associated with our knowledge of the state of the economy and allow, to some

extent, for divergent economic dynamics, depending on the particular economic conditions prevailing at a given point in time. Such tools can also utilise the information contained in financial variables to help identify the timing of regime changes. This type of model, when applied to the period of financial crisis, shows a clear increase in the probability of the euro area entering a recession around six months in advance of the start of the 2008-09 recession.<sup>32</sup>

While such tools thus appear to hold some potential – particularly in terms of interpreting or understanding developments – it is important to bear in mind the limitations that may apply to them in practice. With the benefit of hindsight, it is often possible to find a “good” non-linear model that “fits” the data for a crisis period. However, in real time, such methods may pose substantial challenges that could limit their actual usefulness for out-of-sample prediction. In other words, such models may explain features in data that do not occur very frequently, but if these features are not present in the forecast period or the crisis in question, then they are unlikely to be of benefit at that time.

#### 4.3 CONFIDENCE, EXPECTATIONS AND UNCERTAINTY

In line with the analysis presented in Sections 1 and 2, a generalised collapse in business and

<sup>28</sup> See, for example, Bernanke and Gertler (1989) and Bernanke, Gertler and Gilchrist (1999).

<sup>29</sup> See Christiano, Motto and Rostagno (2003). De Fiore and Tristani (2009) propose a calibrated model with asymmetric information under which shocks have a strong impact on spreads and on economic growth. In particular, the decline in investment is of the same magnitude as that observed during the recent crisis.

<sup>30</sup> See Fagan and Morgan (2005) for a comprehensive, albeit somewhat dated, description of the main macroeconomic models used by euro area central banks.

<sup>31</sup> Harding and Pagan (2002) find little evidence that certain non-linearities are important to the nature of business cycles. See Teräsvirta (2006) for a review of the experience with non-linear models in economic forecasting. Similarly, in an earlier review article, Clements, Franses and Swanson (2004) conclude that simple, reliable and easy to use non-linear model specification, estimation and forecasting procedures will only be readily available in the distant future.

<sup>32</sup> See Bellégo and Ferrara (2009) for the euro area. For the US, Hubrich and Tetlow (2010) use a Markov-Switching VAR model to examine economic dynamics under regimes of financial stress and non-stress.

consumer confidence (both in the euro area and globally) was a central feature of the recent recession. There are mixed views among macroeconomists about the value added of survey-based measures of confidence and how they should be used in practice, together with hard data and macro models and other economic tools. Traditionally, confidence indicators have been treated by macroeconomists as providing some information for the short-term assessment, especially in situations where other “hard” indicators are lagging. But many are sceptical about whether such indicators provide more information than that contained in other variables.

There have also been some examples (around the time of noteworthy events) where confidence measures have reacted much more strongly than the subsequent hard data that they might have been expected to track.<sup>33</sup> Furthermore, given the extremely low values realised by some confidence measures at certain points in time, there is the possibility of non-linear response patterns from the balance statistics reported in some surveys. Nevertheless, in the recent crisis, there was clearly a strong “crisis of confidence” and such measures generally did not provide misleading signals and could have been relied upon more as the crisis intensified in the latter part of 2008.<sup>34</sup>

Even among those macroeconomists who regard confidence measures as helpful in the near-term, confidence has often been disregarded as a major driver of medium-term economic developments for which more fundamental factors (such as income, real wages and employment) play the dominant role. However, the recent crisis has certainly highlighted that confidence indicators may provide important information about the development of private sector perceptions regarding uncertainty and that this is a factor that may have substantial implications for the real economy.

For example, given the irreversibility of investment decisions, heightened uncertainty may be associated with a sudden sharp stop in

investment expenditures related to a connected increase in the “option value” of waiting. Similarly, heightened uncertainty about future income prospects may cause households to delay consumption and to increase their savings. Recent work shows that confidence indicators can have some predictive power to explain euro area private consumption expenditure, even when controlling for more usual explanatory factors (such as income, wealth and employment). In particular, these indicators appear to matter especially in periods of heightened uncertainty (featuring financial crises or geopolitical tensions) where they may play a significant role.<sup>35</sup> There may also be substantial non-linear effects on real activity associated with shocks to uncertainty.<sup>36</sup>

A related aspect concerns the formation of private sector expectations; something which may also be partially captured by new approaches to analysing how agents “learn” about economic developments. A good example of this is to be found within the learning mechanisms of the New Multi-Country Model (NMC) of the ECB which allow the forward-looking components driving investment and consumption decisions to adjust downwards in response to negative economic news. This analysis has also pointed to some clear divergences across the euro area regarding the impact of the crisis on households’ and firms’ expectations about economic prospects.<sup>37</sup>

Overall, there would seem to be a need to further develop indicators of uncertainty and to possibly incorporate such indicators into macroeconomic models. One potentially rich source of information on uncertainty is the SPF of the ECB which can combine the signals from measures of forecaster disagreement with

33 These would include consumer confidence around the time of the Long-Term Capital Management crisis and industrial confidence following the attacks of “September 11”.

34 See ECB (2008).

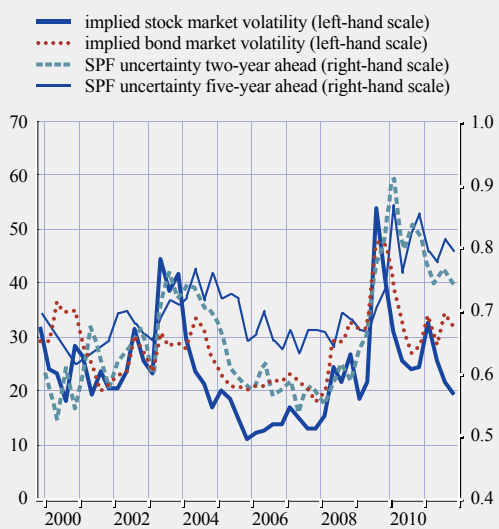
35 See Dees and Soares Brinca (2011).

36 See Bloom (2009).

37 See Dieppe, González Pandiella, Hall and Willman (2011) and Dieppe, González Pandiella, and Willman (2011).

## Chart 11 Confidence channels and output uncertainty

(left-hand scale: index points; right-hand scale: percentage points)



Sources: Bloomberg, the SPF of the ECB and ECB calculations.

information from the density forecasts of survey participants (see Chart 11 which also shows some data on implied volatility in financial markets). The latter may also signal the extent to which changes in uncertainty are seen as only affecting the short to medium term, or are expected to be more persistent, given that the SPF provides information on perceived uncertainty over different time horizons, i.e. for one, two and up to five years ahead. In this respect, a notable feature during the crisis was the widespread upward shift of uncertainty indicators relating to GDP, as observed in Chart 11. The concurrent upward shift in both short and long-term uncertainty indicators may help explain the strength of the precautionary behaviour of firms and households during the most intensive phases of the crisis.

### 4.4 JUDGEMENT

In its narrowest sense, judgement can be defined as what one adds to the mechanical results of a model or tool in order to produce a given projection (although it can also encompass the choice of which models or tools to use). Judgement

has always played a role in projections and can take the form of “add-factors” in traditional macroeconomic models or “structural shocks” in DSGE models. Expert judgement is included into models to take account of elements not present in these models and it may be calibrated using another tool thought to be more reliable or to contain additional relevant information in a given set of circumstances. A key challenge in improving the nature of the judgement used in the economic analysis and in projections is to ensure that there are some rigorous foundations underpinning its formation and that expert judgement should not simply involve “best guesses” or unsubstantiated opinions.

In large-scale models, judgement allows for many additional factors to be taken into account. These would include influences such as confidence, adjustments for possible non-linear impacts and financial factors, all of which could stem from other tools. In calibrating their judgement, experts should place a strong emphasis on understanding the sources and determinants of forecast errors in real time as well as their economic interpretation (e.g. whether they reflect structural change or demand shocks) and thereby help to form an understanding of the likely persistence of recent shocks. In this respect, judgement can also be of help in the assessment of which tools are likely to prove most reliable at any particular point in time.

The use of judgement also provides an opportunity to depart from the standard economic paradigms that are embedded in our macroeconomic models. For instance, such tools typically do not take account of departures from rational behaviour (e.g. “fairness” considerations in labour economics, the role of simple rules of thumb when forming expectations, information cascades, herding and panic behaviour in financial markets and modelling of excessive risk-taking behaviour) plus the existence of highly persistent disequilibria and imbalances. Considerations of this nature can be exceedingly complex to model and it is not realistic (or even desirable) to expect them to be incorporated into



our workhorse models to a significant extent, so it is necessary to develop auxiliary models or tools. Of course, allowing such factors to influence our thinking and hence the judgement we put into a projection, requires an openness to depart from the standard paradigms.

#### 4.5 INTERNATIONAL LINKAGES

The crisis has highlighted the need to pay greater attention to the international dimension of economic analysis, especially in the context of highly integrated international financial systems and more closely integrated production processes (e.g. via global supply chains).<sup>38</sup> Whilst many of the shortcomings in the international projections are simply reflections of the same failings which can be seen in projections for the euro area, the crisis has shown that there is a particular need to pay more attention to the international transmission of both financial and confidence factors.

There is also evidence of a link between US and euro area confidence, as US confidence shocks can have a significant impact on euro area confidence indicators in the short term.<sup>39</sup> Lastly, as regards inflation, the crisis highlighted a dramatic change in the outlook linked to sharp fluctuations in global commodity prices within the context of a rapidly changing environment for global and euro area growth. This would indicate that there is considerable merit in enhancing our understanding of global inflationary developments. This particularly relates to global supply and demand imbalances and commodity price developments in the context of rapid changes in global economic activity.

38 One particular aspect concerns trade. When global trade declined very sharply at the end of 2008, there was a marked decline in the volume of goods-in-transit (for instance, those subject to shipping). The consequences of this were similar to that of an inventory adjustment (which was also taking place at the time). Hence, a better understanding of the dynamics of trade flows is important, especially if such a situation were to arise once again in the future.

39 Dees and Soares Brinca (2011).

## 5 WHAT IS THE WAY FORWARD?

In the light of the preceding discussion, a number of key directions for future work can be emphasised. These include the need to: i) extend existing tools and develop new tools, where appropriate; ii) develop ways to better handle the complexity arising from more tools and models; and (iii) given the limited information of point forecasts, to further develop the analysis of risk and the measurement and assessment of forecast uncertainty. Certainly, such developments cannot be expected to eliminate forecast errors, particularly when economic conditions are extreme, but they should enhance our toolkit for interpreting and projecting economic developments as well as the related risks and, thereby, contribute to an enhancement of the overall economic analysis.

### 5.1 EXTEND EXISTING TOOLS AND DEVELOP NEW ONES

The need to take better account of the factors listed in Section 3 would imply putting an emphasis (where possible) on extending existing tools to reflect such factors and, where such extensions are not possible, to develop new tools that better capture them. In the case of short-term forecasting tools, models already exist that incorporate large information sets, including many of the financial (e.g. spreads, asset prices, loans) and non-financial (e.g. confidence, trade spillovers) factors assessed to have been important during the crisis. Nonetheless, some efforts could be directed at extending the range of available information that is incorporated into the short-term assessment tools, including high-frequency information and that gleaned from non-official sources (e.g. such as Google Trends, automated teller machines and electricity consumption).<sup>40</sup> Furthermore, new datasets linked to the Household Finance and Consumption Survey and the Survey of Access to Finance of SMEs can also be utilised.<sup>41</sup> Although such data sources are not very timely and hence cannot be used for conjunctural analysis, they may still help inform us about the key features and structures that might

prove central to a proper understanding of developments during periods of economic and financial instability.

A major additional challenge would appear to be to identify those economic variables, estimates and forecasts likely to be of most relevance at any given point in time. The development of reliable tools capturing possibly relevant non-linearities and the prediction or identification of turning points would also be particularly useful. With regard to larger scale models, there is a need to continue developing more realistic models, especially as concerns the treatment of financial frictions and modelling of expectations formation.

### 5.2 DEVELOP WAYS TO BETTER HANDLE COMPLEXITY

While the crisis has certainly provided much impetus to the development of new tools and the extension of existing ones along the lines noted above, a continuing challenge will be to expand models *both* meaningfully *and* tractably.<sup>42</sup> In respect of this, it is unlikely to be feasible (e.g. due to data limitations) or optimal (e.g. due to the need to understand core model properties) to include all innovations in one all-encompassing model. This would suggest a need to further develop the existing “suite of models” approach, whereby the analysis embedded in a given workhorse model can be supplemented by insights from other models; ones which could be extended to incorporate additional relevant information or missing elements (e.g. financial

40 See, for instance, Varian and Choi (2009) on Google Trends. Esteves (2009) considers the usefulness of ATM and Point of Sale (POS) information in forecasting and finds some gains in the nowcasting of non-durable consumption in Portugal. Fenz and Schneider (2009) have also investigated the use of truck mileage data in Austria.

41 See “Survey Data on Household Finance and Consumption - Research Summary and Policy Use” in the Occasional Paper Series of the ECB (No 100, January 2009) and also the “Survey on the access to finance of small and medium-sized enterprises” (ECB website <http://www.ecb.europa.eu/stats/money/surveys/sme/html/index.en.html>).

42 See Papademos (2010). In addition, Spaventa (2009) mentions the practical difficulties of expanding models to include plausible descriptions of the financial sector as one of the explanations for the limited progress in this area.

factors, confidence and behavioural factors and non-linear dynamics). Consequently, an important strength of the suite of models approach is that it may help avoid a hierarchy of models that is inflexible and time-invariant and where one particular model, *as a rule*, is considered to be superior or more reliable than the others. Instead, this approach places more of an emphasis on model selection, allowing for the fact that models which appear central to the understanding of the macro economy during some periods may prove to be less relevant – or even irrelevant – during others (and vice versa).

The practical and conceptual limitations to the development of a single, all-encompassing model also highlight the potential value in the application of forecast combination techniques. Under forecast combination, the projections derived from different models or paradigms are averaged together in a manner which may improve the overall forecast performance. Combined forecasts may therefore help hedge against the possible poor performance of any individual forecasting model due to sudden changes in the economic environment. In this respect, combination methods that are able to identify and switch the focus to other possibly better performing models and indicators during periods of extreme volatility need to be built into the framework for the short-term assessment. A key practical challenge is, however, the development of methods to identify in *real time* which models, forecasts or tools should receive the highest weight – certainly, no easy task.<sup>43</sup>

### 5.3 DEVELOP FURTHER THE RISK ANALYSIS

The crisis has shown the need to look beyond point forecasts and pay more attention to risks.<sup>44</sup> Moreover, the scope for improving point forecasts in real time is likely to be fairly limited – particularly during crisis episodes and around turning points. Therefore, the economic analysis should place a strong emphasis and priority on risk assessments around the baseline projections.

In order to better understand risks, greater consideration needs to be given to the factors that might drive alternative scenarios as well as their likelihood. In this regard, there would be clear benefits in drawing on the increased monitoring of disequilibria and imbalances in euro area countries – for instance, those affecting public finances, asset markets, international trade and financial flows – when constructing risk scenarios that might involve a rapid correction of such imbalances. Such an emphasis on risk assessment may also call for the development of other qualitative and probabilistic indicators highlighting the likelihood of certain events (e.g. a “recession” or “deflation”) or other information on forecast uncertainty that can be extracted from density forecasts (e.g. the spread or skew of the forecast distribution).

More generally, it should be required that models and tools are able to provide measures of uncertainty along with their point forecasts.<sup>45</sup> Moreover, consistent with the suite of models approach, it may not be appropriate to rely on a single measure of uncertainty from any specific tool. Indeed, as with point forecasts, there may be significant gains from combining the information on forecast uncertainty from competing density forecasts.<sup>46</sup> An example of this can be seen in the aggregate uncertainty measure from the Survey of Professional Forecasters of the ECB discussed in Section 3. However, further efforts are needed to explore alternative ways to optimally combine competing models or expert assessments of uncertainty.

43 Recent research related to the SPF of the ECB by Genre, Kenny, Meyler and Timmermann (2010) has also pointed to potential gains from forecast combination (see also Kenny, 2010). In particular, more optimal combination weights yield improvements in forecast performance for GDP (both on average and for the period of crisis).

44 The tendency to underestimate risk was powerfully emphasised in the book by Taleb (2007) which was written just before the onset of the recent financial crisis.

45 As, for instance, in the Bayesian VAR tool for short-term inflation forecasting of Giannone, Lenza, Momferatou, and Onorante (2010).

46 For instance, a combination of Gaussian densities will tend to exhibit non-Gaussian features such as skewness and fat tails. Such combinations may therefore better approximate underlying uncertainty if the “true” density is non-Gaussian. See, for example, Hall and Mitchell (2007).

## 6 CONCLUSIONS

The economics profession in general, and economic forecasters in particular, have faced some understandable criticism for their failure to predict the timing and severity of the recent economic crisis. Although many pointed to the emergence of economic imbalances, the speed and depth of the recession were still a major shock to most, if not all, economists. As we have documented, this can be seen in the widespread failure to anticipate the large decline in GDP that occurred in late 2008 and early 2009, or even to diagnose such developments correctly at the time that they were taking place.

Various macroeconomic models and tools can offer plausible explanations for economic developments during the crisis, which is certainly helpful for our understanding of this period. However, as an input into forward-looking policy deliberations, economic analysis must strive to provide more than reasonable ex post assessments of such crises and to develop tools that can also help inform us ex ante. In this context, we have argued that there is a need to develop tools which take greater account of financial factors and also to develop and explore the usefulness of non-linear models. While it may well be the case that financial factors and non-linear behaviour may not be important in “normal” times, it is essential that such models are part of the available “toolkit” or “suite of models”. Forecasters must then use their judgement or other model selection criteria to assess which model or tool is likely to be the most relevant at any specific point in time. To supplement this judgement, particularly in situations when model uncertainty is high, further emphasis could also be placed on developing ways to optimally combine diverse forecasts from differing tools.

Some more general lessons, which would also apply in normal times, would seem to be the need to take greater account of international linkages and to broaden the range of information that is analysed. As regards international linkages, it is clearly necessary to look beyond the trade

channel and to examine the transmission of both financial and confidence shocks. As regards information, there is a need to extend the focus of short-term assessment tools and to find ways to include very high frequency information and information gleaned from non-official sources. Finally, the crisis has shown the necessity of looking beyond point forecasts and giving greater consideration to risk.

What has been proposed above would appear to offer a promising but challenging agenda for professional economists in the coming years. However, while there seems to be some prospect of progress, it is likely that macroeconomic forecasters will continue to make significant forecast errors in the years ahead. Predicting the timing of crises which may be linked to the bursting of asset price bubbles or the rapid correction of imbalances accumulated over a number of years is an inherently difficult – if not impossible – task.<sup>47</sup> Nevertheless, by considering such factors and the risks of alternative scenarios, the economic analysis can at the very least aim to provide more useful information to policy-makers.

<sup>47</sup> See, for instance, the recent work by Harding and Pagan (2010) on predicting recessions.

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