EUROPEAN CENTRAL BANK

EUROSYSTEM

WORKING PAPER SERIES

NO 836 / DECEMBER 2007

REPORTING BIASES AND SURVEY RESULTS

EVIDENCE FROM EUROPEAN PROFESSIONAL FORECASTERS

by Juan Angel García
and Andrés Manzanares

EUROPEAN CENTRAL BANK

EUROSYSTEM

WORKING PAPER SERIES

NO 836 / DECEMBER 2007

REPORTING BIASES AND SURVEY RESULTS

EVIDENCE FROM EUROPEAN PROFESSIONAL FORECASTERS [1]

by Juan Angel García[2]
and Andrés Manzanares[3]

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

1 We are grateful to Geert Bekaert, Bernhard Bodenstorfer, Claus Brand, José Marín and Thomas Werner for useful comments and suggestions. Any remaining errors are our responsibility. The views expressed are our own and do not necessarily reflect those of the European Central Bank.
2 Capital Markets and Financial Structure Division, European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany; e-mail: juan_angel.garcia@ecb.int
3 Risk Management Division, European Central Bank, Kaiserstrasse 29, 60311 Frankfurt am Main, Germany; e-mail: andres.manzanares@ecb.int

Address
Kaiserstrasse 29
60311 Frankfurt am Main, Germany

Postal address
Postfach 16 03 19
60066 Frankfurt am Main, Germany

Telephone
+49 69 1344 0

Website
http://www.ecb.europa.eu

Fax
+49 69 1344 6000

Telex
411 144 ecb d

The statement of purpose for the ECB Working Paper Series is available from the ECB website, http://www.ecb.europa.eu/pub/scientific/wps/date/html/index.en.html

ISSN 1561-0810 (print)
ISSN 1725-2806 (online)

CONTENTS

Abstract

Using data from the ECB's Survey of Professional Forecasters, we investigate the reporting practices of survey participants by comparing their point predictions and the mean/median/mode of their probability forecasts. We find that the individual point predictions, on average, tend to be biased towards favourable outcomes: they suggest too high growth and too low inflation rates. Most importantly, for each survey round, the aggregate survey results based on the average of the individual point predictions are also biased. These findings cast doubt on combined survey measures that average individual point predictions. Survey results based on probability forecasts are more reliable.

Keywords: *point estimates, subjective probability distributions, Survey of Professional Forecasters (SPF), survey methods*

JEL Classification: C42, E31, E47

Non-technical summary

Expectations for key macroeconomic variables like inflation and GDP growth are fundamental for economic decisions. Surveys that collect the views of professional forecasters on the outlook for those variables receive a great deal of attention nowadays. On a regular basis, all central banks scrutinise survey results to infer the outlook for the economy and to gauge their credibility. Researchers use survey data as stylised facts to motivate their work or to assess the predictions of their models. Market participants check the most recent macroeconomic forecasts to be aware of available information. Yet, central banks, researchers, market participants and media focus only on the aggregate results of each survey round.

Survey users, and the institutions that commission the surveys, appear to assume that the reported point predictions correspond to the means of the panelists' subjective probability forecasts. Survey questionnaires, however, do not explicitly request panelists to report the mean of their forecasts, nor any other specific measure of central tendency (median/mode). What forecasters' point predictions actually represent is therefore unclear. This lack of information casts doubt on the usual practice of summarising survey results by averaging the point predictions across forecasters. Without specific knowledge of what the individual point predictions are, the interpretation of their average (or median) is also unclear. Depending on the panelists' reporting preferences, the average of point predictions may well be an average of heterogeneous central tendencies (means, medians and modes), a number without any meaningful interpretation. The correct interpretation of the survey results therefore requires an understanding of the reporting practices of survey participants.

This paper analyses the reporting practices of participants in the ECB's Survey of Professional Forecasters by comparing their point predictions and the central tendencies of their probability forecasts. We find that point estimates often differ from the mean/median/mode of the corresponding probability distributions, and that discrepancies tend to present favourable scenarios, i.e. too high growth and too low inflation rates. These results support recent findings for the short-term forecasts from the US SPF. Furthermore, our findings are robust across forecast horizons, and across methodologies to estimate the central tendencies of the SPF probability forecasts. We therefore conclude that those two features are intrinsic features of the reporting practices of survey participants.

We would like to stress that our results should not be interpreted as suggesting that survey data are fundamentally flawed and should be discarded. Much to the contrary, a key message from our results is that further research on the reporting practices of forecasters is very much needed. Evidence on a favourable reporting bias is available for two major surveys that request both point and probability forecasts for macroeconomic variables (see Engelberg, Manski and Williams [2007], Clements [2007] for the US SPF, and this paper for the ECB's SPF) and, to a lesser extent, for the Bank of England's Survey of External Forecasters (SEF) (see Boero, Smith and Wallis [2007]). Providing an explanation for those reporting practices is beyond the scope of this paper, but our results also suggest that future research should consider the potential role of asymmetries in the probability forecasts. Further research on this topic should consider robustness to the necessary assumptions to find evidence of asymmetries in either forecasters' loss functions or forecasters' density forecasts, or both, which could help explain the stylised facts reported here.

Our results also have implications for the institutions commissioning macroeconomic surveys. These institutions should ask their panelists to report more specific information about their forecasts, preferably requesting probability forecasts or, at least, detailed information on their reporting practices. This additional information should enable the publication of more reliable measures of combined forecasts. Surveys are widely used for a variety of purposes and are likely to be used further in the near future. Further research and additional information from the panelists are key to strengthen even further the use of survey data.

1 Introduction

Do we use survey results correctly? Surveys that collect the views of professional forecasters on the outlook for key macroeconomic variables, particularly GDP growth and inflation, receive a great deal of attention nowadays.[1] On a regular basis, all central banks scrutinise survey results to infer the outlook for the economy and to gauge their credibility. Researchers use survey data as stylised facts to motivate their work or to assess the predictions of their models. Market participants check the most recent macroeconomic forecasts to be aware of available information. Yet, central banks, researchers, market participants and media focus only on the aggregate results of each survey round. The average of the individual point predictions is used to summarise the survey results. But does it? And, if so, how accurately? This is our concern here.

Survey users, and the institutions that commission the surveys, appear to assume that the reported point predictions correspond to the means of the panelists' subjective probability forecasts. Survey questionnaires, however, do not explicitly request panelists to report the mean of their forecasts, nor any other specific measure of central tendency (median/mode). What forecasters' point predictions actually represent is therefore unclear. This lack of information casts doubt on the usual practice of summarising survey results by averaging the point predictions across forecasters. Without specific knowledge of what the individual point predictions are, the interpretation of their average (or median) is also unclear. Depending on the panelists' reporting preferences, the average of point predictions may well be an average of heterogeneous central tendencies (means, medians and modes), a number without any meaningful interpretation. The correct interpretation of the survey results therefore requires an understanding of the reporting practices of survey participants.

To find out what the reported point predictions are, we need information about the probability forecasts underlying those point predictions. For this purpose, we use a new dataset, from the Survey of Professional Forecasters of the European Central Bank (the ECB's SPF henceforth).[2] In every quarterly survey, together with point predictions, the ECB's SPF requests probabilities for the real GDP growth and inflation falling within a range of predetermined intervals, i.e. a density forecast in the form of a histogram.

Using the methodology introduced in García and Manzanares [2007] to estimate the panelists' subjective density forecast, we compare the means (and medians/modes) of those densities with the reported point predictions. We investigate panelists' reporting

[1] A general concern about survey data is that participants have little incentive to provide their true expectations. However, the superior forecasting performance of surveys recently documented by Ang *et al.* [2007] casts doubt on such concerns and is likely to have contributed to reviving interest in survey data.

[2] See www.ecb.int/stats/ prices/indic/forecast/html/index.en.html.

practices across three different horizons (one year ahead, two years ahead and a longer horizon of five years ahead), and for two key forecast variables, GDP growth and inflation. We analyse about 1,400 point and probability forecasts for each variable and each horizon for the period 1999Q1-2006Q4. We then assess the impact of the discrepancies between the individual point predictions and the probability forecasts on the aggregate survey results.

Our main findings are as follows. As regards the reporting practices of survey participants, the comparison of the estimated central tendencies of the probability forecasts and the reported point predictions provides two key pieces of evidence. First, point predictions often differ from the mean/median/mode of the corresponding probability distributions. Second, the discrepancies between the point predictions and the central tendencies show a favourable bias, i.e. point forecasts tend to be too high for real GDP growth and too low for inflation.

These findings are robust across forecast horizons. For example, focusing on the mean of the probability forecasts, for forecasts one year, two years and five years ahead, the average reporting bias of inflation point predictions is -0.08%, -0.06% and -0.02%, reflecting that 73%, 64% and 57% of the inflation point predictions are lower than the mean of the corresponding probability forecast. In contrast, for growth forecasts, the average reporting bias of point predictions is positive for the three horizons (0.01%, 0.04% and 0.05% respectively). Although the average bias appears to be limited, it conceals significant individual reporting biases with respect to the mean of the probability forecasts: discrepancies of 0.2% are quite common in our sample. Moreover, the favourable reporting bias in the point predictions holds for the three main location measures suggested by probability theory, namely the mean, the median and the mode.

As regards the aggregate survey results, the impact of the individual reporting biases on the average of the point predictions is both qualitatively and quantitatively important. For each survey round, we compare the average of the reported point predictions with two alternative measures based on the probability forecasts: the mean of the combined probability distribution constructed by averaging the individual histograms, and the average of the means of the subjective individual probability forecasts. We show that: (i) aggregate survey results are also biased: on average, inflation figures are biased downwards and GDP growth figures upwards; (ii) the size of the bias however varies across survey rounds, variables and forecast horizons, thereby making it rather difficult to correct for it. Overall, inflation results appear more distorted than growth ones. For example, the use of point predictions leads to a downward bias in the level of long-term inflation expectations, of about 0.05% on average, and is also misleading about the direction of their changes over time, two distortions that are crucial for anybody interested in monitoring developments in long-term inflation expectations.

This paper belongs to a recent stream of literature that analyses the rationality of macroeconomic forecasts, not in terms of the information used in their production but rather in terms of their internal consistency. Using US SPF data, Engelberg, Manski and Williams [2007] and Clements [2007] provide evidence of a favourable reporting bias in the individual point predictions for GDP growth and inflation forecast one year ahead. We use a different dataset, and an alternative methodology to estimate the central tendencies of the probability forecasts, and we also show that the favourable reporting bias holds for longer forecast horizons. Our results strengthen the findings for individual forecasts in US survey data. Our emphasis is however on their impact on the aggregate survey results because central bankers, researchers, market participants and media usually just focus on them. Boero, Smith and Wallis [2006] also investigate the reporting practices of participants in the Bank of England's Survey of External Forecasters (SEF) but the evidence seems to be less conclusive for UK survey data.

The documentation of inconsistencies between point and probability forecasts have also triggered interest in the potential explanatory role of asymmetric loss functions (see Patton and Timmermann [2007], Clements [2007] and Capistrán and Timmermann [2006]). This line of research has so far focused on US SPF data. Our findings for the ECB's SPF could generate further interest in investigating the reasons behind those inconsistencies in euro area forecasts. As a contribution to this line of research, we also provide some evidence that the asymmetries in the subjective density forecasts are a potential factor behind the heterogeneity in survey respondents' reporting practices that we find in our analysis.

Our findings cast doubt on the interpretation of combined measures that average individual point predictions, and strengthen the case for focusing on the probability forecasts. From the probability forecasts we can calculate more reliable estimates of the combined forecast. Furthermore, we can also gauge the uncertainty and asymmetries in perceived risks surrounding the baseline forecast, which will improve our understanding of many economic phenomena.

The remainder of the paper is organised as follows. Section 2 introduces the ECB's Survey of Professional Forecasters and describes the key features of its dataset. Section 3 provides the comparison between the reported point forecasts and the probability distributions. We assess the impact of the individual reporting biases on the survey results in Section 4. Section 5 discusses some potential explanations for the presence of reporting biases and stresses asymmetries in the subjective probability distributions as a potential cause. Finally, Section 6 concludes.

2 The ECB's Survey of Professional Forecasters

The European Central Bank (ECB) has since 1999 conducted a quarterly survey of expectations for euro area key macroeconomic variables. The survey is called the ECB's Survey of Professional Forecasters (SPF) to reflect that all panelists are European experts who regularly forecast inflation and the real GDP growth rate. In addition to point predictions, the ECB's SPF also requests probability forecasts. Specifically, like for the US SPF, panelists assign probabilities to the forecast variable falling into pre-specified ranges, i.e. a probability forecast in the form of a histogram.[3] This section focuses in some detail on the key features that are fundamental for our purpose of investigating the reporting practices of professional forecasters in macroeconomic surveys. A full description of the history, background and characteristics of the ECB's SPF can be found in García [2003].

Several features of the ECB's SPF help improve the comparison between the point and probability forecasts with respect to the (US) SPF. First, in every survey round the ECB's SPF requests forecasts over fixed-length horizons of one and two years ahead.[4] In terms of available information those fixed-length horizons largely compensate for the short sample since its inception in 1999.[5] Second, the ECB's SPF also requests point estimates and probability forecasts over a longer horizon (five years ahead). This allows for assessing the robustness of the important results of Engelberg *et al.* [2007] and Clements [2007] for the US SPF by comparing point predictions and central tendencies of probability forecasts at short and longer horizons. Third, the ECB's SPF requests that probability mass be allocated within half-a-percentage-point intervals rather than the full-percentage intervals of the US SPF questionnaire. That width allows for computing tighter bounds for the central tendencies of the probabilistic forecasts, thereby allowing for a closer comparison with the reported point predictions. Finally, the ECB's SPF has requested panelists to report point predictions for the same horizons as the probability forecasts since its inception, so the comparison can be carried out for the whole sample available.[6]

Table 1 provides a description of the ECB's SPF data that we use in our analysis.

[3] To our knowledge, the US SPF, the ECB's SPF, the SPF of the Monetary Authority of Singapore and the Survey of External Forecasters (SEF) conducted by the Bank of England are the only surveys requesting probability forecasts on a regular basis.

[4] The US SPF only requests probability forecasts for the current and the next calendar year. Calendar-year horizons are less suitable for our purpose here because forecasts have different horizons every quarter.

[5] Other limitations of the short sample available cannot be overcome. For instance, Engelberg *et al.* [2007] also investigate the persistence of reporting practices by tracking forecasters over their 1992-2005 sample.

[6] One of the reasons why Engelberg *et al.* [2007] restrict their sample to the period from 1992 onwards is that before 1981 US SPF panelists only provided price *level* forecasts, which are not directly comparable with the probability forecasts.

Specifically, we analyse forecasts over three different horizons: one year ahead, two year ahead, and the longer-term horizon of five years ahead. Despite using only seven years of data (1999Q1-2006Q4), for one-year and two-year-ahead horizons we base our results on approximately 1,400 point and probability forecasts. As in 1999 and 2000 long-term expectations were only requested in the first quarter surveys, and there are less replies reporting long than short-term forecasts every survey round, the number of available observations for the five-year-ahead horizon is somewhat lower. Both for GDP growth and inflation our results for long-term forecasts are nonetheless based on almost 1,000 observations.

3 Comparing individual point predictions and the central tendencies of probability forecasts

Forecasts are, by nature, probabilistic statements. A subjective probability forecast should therefore underpin survey point predictions. In the SPF questionnaires (and in the surveys commissioned by other institutions and companies) forecasters are however not asked to provide any specific feature of their subjective probability distribution. The ECB's SPF questionnaire for example simply requests a "point estimate".[7] In terms of the underlying distribution, the natural candidates for those point estimates from the perspective of probability theory are the mean, the median, and, under certain circumstances, the mode. Strictly speaking, however, what the reported point predictions represent is unclear.

This paper compares the ECB's SPF point predictions and the probability forecasts. We would like to stress that our comparison of the survey point predictions and the central tendencies of the probability distributions focuses on their internal consistency. We seek evidence on the reporting practices of forecasters under the assumption that both point predictions and the probability distributions are given careful deliberation and reflect the true forecasts of panelists. To evaluate the information content of those two pieces of information, we estimate central tendency measures of the panelists' subjective density forecasts using the methodology of García and Manzanares [2007]. The next section briefly describes our methodology and Appendix A provides further technical details.

[7] See http://www.ecb.int/stats/pdf/spfquestionnaire.pdf for a sample questionnaire.

3.1 Estimating central tendency measures from the SPF histograms

To estimate central tendencies (and higher-order moments) of the SPF probability forecasts, we follow recent literature and fit a continuous density to the SPF histograms. Our methodology however departs from existing approaches in two fundamental aspects, namely the choice of a fitting criterion and the choice of underlying density.

As fitting criterion we propose a small departure from maximum likelihood estimation. The reason behind our choice is that extracting reliable risk measures from the SPF histograms requires an efficient and robust estimator. We interpret the SPF histograms as a discretised version of the (true) density forecast. We assume that the discretisation reflects how many "draws" from the true density lie within each of the pre-specified intervals in the questionnaire, and therefore interpret the reported probabilities as the realisation of a multinomial random variable. In this context, least squares, the fitting criterion usually employed in existing literature on SPF data, is not efficient. In addition, we search for a robust fitting criterion. Although these estimators provide the desired large sample properties, more robust power distance estimators however underperform with respect to maximum likelihood estimation in terms of efficiency in small samples (in our context small number of draws). We therefore choose our fitting criterion within that family of estimators taking into account the small sample properties of the power divergence estimators and the characteristics of the SPF data. An inspection of the SPF data suggests that (numerical) robustness to *inliers* (i.e. intervals with much lower observed probability than the theoretical density suggests, for example related to rounding) is fundamental. Monte Carlo simulations specifically designed to match those particularities of the SPF data confirm that a small departure from maximum likelihood estimation seems optimal for the SPF data, in line with existing results (Lindsay [1994], Cressie and Read [1988]).

As underlying density we employ a potentially skewed distribution, Azzalini's [1985] skew-normal family. Although recent SPF work neglects it, skewness is a crucial feature of any forecast. For the comparison with the point forecasts in particular, the presence of skewness in the probability forecasts is fundamental because the mean, the median and the mode of the density forecast differ, thereby increasing the potential options for the reported point predictions. Moreover, if the SPF probability forecasts are skewed, neglecting asymmetries in the theoretical density leads to biased estimates for the central tendency measures. Monte Carlo evidence confirms that these two methodological contributions lead to significant accuracy gains in the estimation of the central tendency measures from the SPF histograms.

3.2 Point predictions and central tendencies of probability forecasts

The comparison of the estimated central tendencies of the probability forecasts and the reported point predictions provides two key results. First, point estimates often differ from the mean/median/mode of the corresponding probability distributions. Second, on average, the discrepancies between the point predictions and the central tendencies show a systematic sign for each variable. Specifically, point predictions have a favourable bias, i.e. compared with the central tendencies of the probability forecasts the reported point forecasts tend to be too high for real GDP growth and too low for inflation.

Figure 1 shows the (cross-sectional) distribution of reporting biases (differences between the individual point prediction and the mean of the corresponding probability forecast). Panels A, B and C respectively display the reporting biases for one-year, two-years and five-year-ahead forecasts. The left column shows the bias in inflation forecasts and the right one in the growth forecast.

These histograms illustrate the two results mentioned above, namely the presence of a reporting bias in the point predictions and its favourable sign. The average reporting bias of inflation point predictions is negative for the three horizons (-0.08%, -0.06% and -0.02% respectively for forecasts one year, two years and five years ahead). Consistent with those average biases, 73%, 64% and 57% of the inflation point predictions are found below the mean of the corresponding probability forecast. In contrast, for growth forecasts, the average reporting bias of point predictions is positive for the three horizons (0.01%, 0.04% and 0.05% respectively).

Furthermore, our finding of a favourable reporting bias in the point predictions is also robust across the three main location measures suggested by probability theory, namely the mean, the median and the mode. Indeed, the results for the estimated median and the estimated mode of the probability forecasts are similar: for example, as regards inflation forecasts, the average reporting bias for the median and the mode are respectively -0.07% and -0.04% one year ahead, -0.04% and -0.02% two year ahead and -0.02% in both cases five years ahead. In addition to their favourable bias, these results show that the reported point predictions are likely to be a heterogeneous set of central tendencies. This heterogeneity casts doubt on the use of the average of the reported point predictions to summarise the results of each survey round.

Our results provide strong support for existing findings of a favourable reporting bias in the point predictions of the US SPF. Engelberg *et al.* [2007] and Clements [2007] report inconsistencies between point and probability forecasts for GDP growth and inflation one year ahead. We use an alternative methodology to estimate the central tendencies of the probability forecasts, and also show that the favourable reporting bias holds at longer forecast horizons. As an additional robustness check, in Appendix B we provide a further comparison between the ECB's SPF point predictions and the central tendencies of the probability forecasts based on a non-parametric analysis. The presence of a favourable reporting bias in point predictions also holds for the two variables and across forecast horizons.[8] We therefore conclude that the presence of a favourable bias is an intrinsic feature of the forecasters' reporting practices.[9]

The size of the average bias appears to be limited, but Figure 1 also shows that the average biases conceal significant individual reporting biases with respect to the mean of the probability forecasts. Discrepancies of 0.2% are quite common in our sample. Formally, for the inflation forecasts, the standard deviation of the reporting biases is about 0.16, and somewhat higher, at about 0.18, for growth forecasts, for both variables constant across forecast horizons. Moreover, again, bias dispersion holds for the mode and the median of the probability forecasts.[10] Note that this evidence reflects the results over 28 survey rounds. The presence of a favourable reporting bias and its dispersion over that sample make it worth investigating the impact of the individual reporting bias in the aggregate survey results published every survey round.

4 Reporting biases and the aggregate survey results

We now investigate the quantitative impact of the individual reporting biases on the aggregate survey results regularly published after each survey round. For euro area surveys, the common practice to summarise the survey results is to average the individual point predictions. The reporting biases found in individual point predictions warns against such a practice for two main reasons. First, from a conceptual point of view, individual point predictions may reflect different location measures depending on the reporting preferences of the forecaster. Previous sections show that, on average, individual point predictions cannot be taken as the mean/median/mode of their corresponding probability

[8] Non-parametric analyses use the histograms to obtain lower and upper bounds for the mean/median/mode. Focusing on the mean, out of the 1,539 inflation point forecasts one-year ahead in our sample, 172 (i.e. about 11%) were out of the bounds for the means of their density forecast, more than 80% of them below the lower bound. For the 1,493 growth forecasts one year ahead, 183 (i.e. 12%) were out of bounds, 60% above. Furthermore, survey point forecasts are also biased across longer forecast horizons: for forecasts five years ahead, 11% of inflation forecasts and 14% of growth forecasts are out of bounds for the mean forecast, 65% below for the case of inflation and 80% above for growth. Appendix B provides further results.

[9] Engelberg *et al.* [2007] also provide evidence against "rounding" practices driving these findings.

[10] The standard deviation of the reporting biases for the median is similar to that of the mode, around 0.15 in the inflation forecasts and 0.17 in the growth forecasts. For the mode, dispersion is significantly higher, around 0.21 and 0.30 in inflation and growth forecasts respectively.

forecasts. Averaging the reported point predictions without precise knowledge of the central tendency they represent most likely leads to an aggregation across different location measures, a number with difficult, if any, logical interpretation. Second, from a practical point of view, the presence of a favourable bias at individual level casts doubts on the usual practice of averaging the reported point predictions. Focusing on the probability distributions solves those two problems.

We compare the average of the point predictions with two alternative measures of combined forecasts based on the means of the probability forecasts. First, we consider the mean of the combined (or aggregate) probability forecast. The aggregate probability distribution is the average of the histograms reported by the panelists and is also regularly reported after each survey round. We focus on its mean rather than on other location measures because, in the case of the ECB's SPF, it is the average of the point forecasts (not the median as in the US SPF) what is usually reported after each survey round. Second, as a robustness check, we consider the average of the means of the individual probability forecasts.

In Figure 2, Panel A shows the quarterly profile of the three alternative measures of combined expectations for inflation and GDP growth one year ahead. The strong comovement between the alternative measures, for both variables, is visible in the chart. The bars depicting the difference between the average of point predictions and the mean of the combined distribution however suggest a distinct impact of the individual reporting bias across variables. The average of point predictions provides a systematical, although time-varying, downward bias (of about -0.1% on average). The favourable reporting bias in individual point predictions also leads to a downward bias in their average every survey round. This downward bias is particularly important because, during the review period, forecasts for euro area inflation have tended to under-predict actual inflation outcomes. The fact that persistent inflation under-prediction has not led to a correction in the (favourable) reporting bias reinforces the conclusion that such biases seem an intrinsic feature of forecasters' reporting practices that cannot be overlooked. In contrast to inflation forecasts, point and the probability-based combined growth forecasts one year ahead differ in many survey rounds but there is a similar number of upward and downward biases, with no systematical sign in the bias.

The analysis over different forecast horizons reveals additional distortions in the information provided by the average of the point predictions, particularly for long-term inflation expectations. Panel B displays the combined forecast measures two years ahead. The average of point predictions shows a systematical favourable bias, with combined inflation forecasts persistently lower and combined growth forecasts higher than the probability forecasts suggest. Panel C shows that differences between point and probability-based measures of combined forecasts also persist over longer horizons. For inflation, the average of point predictions is systematically biased downwards. Importantly, however, point and probability-based measures of longer-term inflation expectations, in addition to differing in the level, move in diverging directions at times, exhibiting a low correlation of about 0.6. This low correlation, on top of the presence of the level bias, undermines the reliability of point-based averages in monitoring of long-term inflation expectations.

As regards long-term growth, the favourable bias we find at individual level makes the average of point predictions at survey frequency be biased upwards. Yet, the point and probability-based combined forecasts do exhibit a fairly strong comovement (their correlation is about 0.97). Therefore, level bias aside, their signal in terms of the direction of changes in expectations appears to be consistent with the probability-based measures, in contrast to the case of long-term inflation expectations.

Overall, our results suggest that the reporting biases found in the individual point predictions also bias the average of point predictions in every survey round. The size and characteristics of the bias vary over survey rounds and forecast horizons, but, overall, appear to be more important for inflation forecasts than for growth forecasts. Indeed, our results suggest that the use of survey point predictions leads to differences in the level of inflation expectations. These differences are quantitatively and qualitatively important for anybody interested in monitoring developments in long-term inflation expectations.

5 Asymmetries in forecasts and reporting biases

The previous sections report the presence of substantial inconsistencies between the point predictions and the probability forecasts of the ECB's SPF panelists. This section briefly discusses some of the leading explanations for the presence of those inconsistencies and provides some additional evidence based on the potential asymmetries present in the SPF probability forecasts.[11]

One potential explanation for the tendency to report favourable point forecasts is that forecasters' loss functions are asymmetric. Patton and Timmermann [2007] show that, given certain plausible conditions, the optimal point forecast under asymmetric loss may well be a quantile of probability distribution rather than the mean. For example, if a forecaster weights the costs of over-prediction more heavily than the costs of under-prediction, this could explain the reporting of lower inflation point forecasts than the mean

[11] Ehrbeck and Waldmann [1996], or Ottaviani and Sorensen [2006] stressed that forecasters may strategically choose not to report their true beliefs to attract media attention, for reputational considerations, etc. Those incentives seem less relevant for SPF participants, because the surveys are conducted by central banks, replies remain anonymous and media tends to focus on the combined forecasts and not on individual figures, but our findings may also call for investigation along those lines.

of the probability forecast. Finding supporting evidence for asymmetries in the forecasters' loss functions is hard: the loss functions are unobservable and their characteristics have to be assumed, which may lead to a lack of robustness in the conclusions.[12]

An alternative explanation that has received less attention so far is that the panelists' density forecasts can be asymmetric. If the density forecast is asymmetric, the mean, the mode and the median differ, and the differences directly depend on the degree of asymmetry of the distribution. Given that forecasters are not requested to provide any specific central tendency measure as point prediction, different panelists may choose to report different measures of central tendency even for symmetric loss functions. For a given asymmetric density forecast, the optimal point prediction under a (standard) quadratic loss function would be the mean of the density forecast, but it could be different from the mean under other symmetric loss functions (for example it would be the median under the so-called L_1 loss function).

By moving beyond the assumption of symmetry when modeling the distributions underlying the SPF histograms, the presence of asymmetries in the density forecasts can however be investigated empirically. As described in Section 3.1, we follow here García and Manzanares [2007] methodology, which, by fitting a potentially skewed distribution to the reported histograms, can capture potential asymmetries present in the SPF probability forecasts.

Figure 3 depicts the degree of asymmetry in the individual density forecasts (x-axis) and the individual reporting bias (distance from the point prediction) for the mean (Panel A) and the mode (Panel B) of the probability forecasts (y-axis). We use here inflation expectations for the intermediate horizon of two years ahead as an illustration, but results hold for the three forecast horizons. If all the panelists were reporting the mean of their distributions, the points in Panel A should be evenly distributed with respect to the horizontal axis while a positive relationship should be appreciated in Panel B. Inversely should all forecasters report the mode of their distributions, Panel A would exhibit a negative relationship while Panel B would appear balanced.

Looking at the results for the mean, a negative relationship could be observed between the size of the reporting bias (with respect to the mean) and the skewness of the probability distributions. Specifically, negative skewness is associated with large (and positive) reporting biases with respect to the mean of the distribution, while (strongly) positive skew is associated to negative values for the reporting bias. Taking the distance mean *minus* mode as a proxy for the skew of the distribution, those results would then be consistent

[12] For instance, Capistrán and Timmermann [2006] provide supporting evidence for asymmetric loss functions, while Clements [2007] finds that the presence of asymmetric loss functions can explain only a relatively minor part of the favourable bias of the point forecasts in the US SPF data.

with some forecasters reporting the *mode* rather than the mean of their (asymmetric) density forecasts. Panel B however also warns against concluding that panelists report the mode of their distributions. Indeed, Panel B shows a positive relationship between the value of the reporting bias (with respect to the mode) and the skewness of the probability distributions. This evidence suggests that some panelists may report the mean of their distributions while others may report the mode, thereby leading to an heterogeneous set of point predictions. Again, averaging those point predictions results in a measure difficult to interpret as a combined forecast.

6 Concluding remarks

This paper has analysed the reporting practices of participants in the ECB's Survey of Professional Forecasters by comparing their point predictions and the central tendencies of their probability forecasts. We find that point estimates often differ from the mean/median/mode of the corresponding probability distributions, and that discrepancies tend to present favourable scenarios, i.e. too high growth and too low inflation rates. These results support recent findings for the short-term forecasts from the US SPF. Furthermore, our findings are robust across forecast horizons, and across methodologies to estimate the central tendencies of the SPF probability forecasts. We therefore conclude that those two features are intrinsic features of the reporting practices of survey participants.

For survey users, these results have two important implications. First, researchers, market participants, central banks and the general public should be aware that the interpretation of the published aggregate results is far from straightforward. For example, we show that survey users interested in monitoring inflation expectations over time should take into account that, by focusing on the average of point predictions, they could be monitoring a level of long-term inflation expectations that is biased downwards. Second, our results strengthen the case for focusing on the probabilistic forecasts as advocated by Engelberg *et al.* [2007] based on their US SPF analysis. From the probability forecasts we can calculate more reliable estimates of the combined forecast. Furthermore, we can also gauge the uncertainty and asymmetries in perceived risks surrounding the baseline forecast, which will improve our understanding of many economic phenomena.

We would like to stress that our results should not be interpreted as suggesting that survey data are fundamentally flawed and should be discarded. Much to the contrary, a key message from our results is that further research on the reporting practices of forecasters is very much needed. Evidence on a favourable reporting bias is available for two major surveys that request both point and probability forecasts for macroeconomic variables (see

Engelberg *et al.* [2007], Clements [2007] for the US SPF, and this paper for the ECB's SPF) and, to a lesser extent, for the Bank of England's Survey of External Forecasters (SEF) (see Boero *et al.* [2006]). Providing an explanation for those reporting practices is beyond the scope of this paper, but our results also suggest that future research should consider the potential role of asymmetries in the probability forecasts. Further research on this topic should consider robustness to the necessary assumptions to find evidence of asymmetries in either forecasters' loss functions or forecasters' density forecasts, or both, which could help explain the stylised facts reported here.

Our results also have implications for the institutions commissioning macroeconomic surveys. These institutions should ask their panelists to report more specific information about their forecasts, preferably requesting probability forecasts or, at least, detailed information on their reporting practices. This additional information should enable the publication of more reliable measures of combined forecasts. Surveys are widely used for a variety of purposes and are likely to be used further in the near future. Further research and additional information from the panelists are key to strengthen even further the use of survey data.

Appendix A: Estimating central tendency measures from the SPF probability distributions

This appendix draws on García and Manzanares [2007a] and describes our methodology to analyse the SPF probability forecasts. The ECB's SPF asks panelists to assign probability to future inflation falling within some predetermined intervals. The subjective probability forecasts are therefore reported in the form of histograms. As part of the published survey results, the individual histograms are aggregated across panelists to construct a *combined* probability forecast, which reflects the average probability assigned to each interval in every survey round.

We interpret the SPF histograms as a discretised version of an unknown density forecast, f_k, of each forecaster $k = 1, \ldots, K$. A thorough analysis of the information content of the SPF probability forecasts requires to elicit the underlying density forecast from the reported frequencies. In theory, the probabilities assigned to each survey interval should correspond to the integrals of the underlying density function $p_{ik} := \int_{\alpha_{i-1}}^{\alpha_i} f_k(x)dx$ over each of the intervals (α_{i-1}, α_i), $i = 1, \ldots, I$, where $\alpha_0 := -\infty$, and $\alpha_I := \infty$. In practice, however, it is unlikely that survey participants discretisise their subjective density forecast by computing those integrals.

As a working assumption, we interpret the reported probabilities as the proportion of "random draws" sampled from the subjective density forecast that lie within each of the intervals (α_{i-1}, α_i). Without loss of generality, we assume that the unknown density function f_k belongs to a suitable parametric family of distributions f_{ϱ_k} where $\varrho_k \in \Theta \subseteq R^r$ and r is the number of parameters characterising the family. Formally, we interpret the probabilities assigned to each interval by the kth forecaster ($\{\widehat{p}_{ik}\}$, $i = 1, \ldots, I$) as realisations of a multinomial random variable with I classes. In this multinomial framework, the observed frequencies are a sufficient statistic for estimating the theoretical probabilities.

A.1. The choice of fitting criterion

The inference problem is to find the parameters of the unknown density function to match the reported frequencies of the SPF histograms. We base our choice of fitting criterion on its properties to handle the peculiarities of the SPF data. To estimate the parameters of the unknown density function and match the frequencies in the SPF histograms, long-sample properties (consistency, asymptotic normality and asymptotic efficiency) are desirable, but the robustness of the estimator in small samples is crucial.

Recent work estimating parametric densities from the SPF histograms (Giordani and Söderlind [2003], Rich and Tracy [2006], Engelberg *et al.* [2007], D'Amico and Orphanides [2006]) uses least squares as fitting criterion, i.e. minimising the sum of the squared deviations between the theoretical and the observed probabilities over the set of intervals. For the SPF data, the LS criterion (although consistent) is however not efficient. The LS criterion assigns equal weight to the fitting errors for each interval. An efficient criterion would instead assign different weights to the fitting errors depending on the probability assigned to each interval, thereby exploiting the bell shape structure of the SPF histograms to improve the estimation. In this multinomial framework, maximum likelihood suggests using the Pearson Chi-Square criterion.

To improve the robustness of the estimator in the context of multinomial distributions, Cressie and Read [1988] consider departures from maximum likelihood estimation within the family of "power divergence estimators". Indexed by the parameter $\tau \in R$, the family is defined as the estimators obtained by minimising the following expression with respect to ϱ:[14]

$$I^{\tau}(\widehat{p}, p) = \frac{1}{\tau(\tau+1)} \sum_{i=0}^{I} \widehat{p}_i \left[\left(\frac{\widehat{p}_i}{p_i(\varrho)} \right)^{\tau} - 1 \right] \qquad (1)$$

Although these estimators provide the desired large sample properties, more robust power distance estimators underperform with respect to maximum likelihood estimation in terms of efficiency in small samples (in our context a small number of draws). We therefore choose our fitting criterion (i.e. the optimal τ) within that family of estimators taking into account the small sample properties of the power divergence estimators and the characteristics of the SPF data. We find that a positive, though relatively low, value of the parameter τ ($\tau = 0.2$) seems optimal for the SPF data, in line with existing results (Lindsay [1994], Cressie and Read [1988]).

A.2. The theoretical density function: the skew-normal

The second novelty of our methodology is the choice of a potentially skewed density function: the skew-normal distribution (see Azzalini [1985]), a relatively parsimonious density function (fully defined by three parameters) that provides a direct one-to-one mapping between its three parameters and the mean, variance and skewness of the distribution. Importantly for our purposes in this paper, the Skew-Normal class, though very flexible in its shape, always remains unimodal, and its median lies between the mean and the mode.

The Skew-Normal class $SN(\lambda)$ is built, as in the case of normal distributions, by shifting and resealing a standard distribution with density function defined as $f_\lambda(z) := 2\varphi(z)\Phi(\lambda z)$, $z \in \mathbb{R}$, where φ and Φ are the standard normal density and distribution functions, respectively, and $\lambda \in R$ is the shape parameter (note that λ=0 is just the

[14] The Chi-Square criteria of Pearson and Neyman, the Hellinger distance, and the Kullbach-Leibler divergence for instance belong to this family of estimators. It a can also be shown that maximum likelihood is a limiting case of this family when $\tau \rightarrow 0$.

standard normal). A general random variable Y is said to be skew-normal distributed when it can be written as

$$Y = \mu + \sigma \left(\frac{Z - E[Z]}{\sqrt{V(Z)}} \right) \qquad Z \sim \mathcal{S}N(\lambda)$$

The first three central moments of Y are then expressed as $E[Y]=\mu$; $V(Y)=\sigma^2$ and $SK(Y)=\gamma_1=\left(2b^2-1\right) b\delta^3 / \left(1-b^2\delta^2\right)^{3/2}$, where $b=\sqrt{2/\pi}$ and $\delta=\lambda/\sqrt{\left(1+\lambda^2\right)}$. Taking into account the small sample properties and robustness of the fitting criterion is particularly important in the analysis of the SPF data. Our approach, being robust to data inliers, can be uniformly applied across the panel of forecasters thereby providing a coherent analysis of all the data available. Previous research has instead often been forced to make additional assumptions for the estimation of the densities of those forecasters who fill in a low number of intervals in the questionnaire, thereby employing several different approaches across the panel of respondents.[15]

Appendix B: Non-parametric evidence on biases

The ECB's SPF histograms do not fully describe the panelist's subjective density forecast. The reported probabilities however help bound the potential values of the central tendency measures of those density forecasts. Specifically, by placing all the probability mass assigned to each interval at its lower (upper) endpoint, the resulting weighted mean/median can be taken as the lower (upper) bound for the central tendency in question.[16] Finding bounds for the mode is however more difficult, because, in principle, interval data do not define the mode of a distribution. In what follows we assume that the mode is contained in the interval with the highest probability mass.

If the reported point forecasts lie within those probability bounds, the hypothesis that the reported point forecast is the median/mean/mode cannot be rejected. Otherwise, we can conclude that the reported point prediction does not correspond to the central tendency measure. For each of the three forecast horizons (one year ahead, two years ahead and the longer horizon of five years ahead) and the three central tendency measures (mean/median/mode), Table A1 reports the number and the percentage of cases in which the panelists' reported point predictions lie outside the bounds (on either side). For example, the two entries in the row of the mean in the upper left corner for HICP

[15] For instance, Engelberg *et al.* [2007] chose a triangular distribution for those forecasters reporting less than three bins and a beta distribution for the rest, and D'Amico and Orphanides [2006] proposed to estimate mean uncertainty from the cumulative distribution of the standard deviations by means of a gamma distribution truncated at low uncertainty values.

[16] Engelberg *et al.* [2007], Clements [2007] and Boero *et al.* [2006] also employ those assumptions.

inflation forecasts 12 months ahead, which are 172 and 11%, mean that 172 reported point estimates, that is 11% of all point forecasts for that horizon in our sample, were outside the bounds for the means calculated using the reported probabilities.

Table A1 gives three key pieces of evidence. First, about 10% of the reported point predictions are not consistent with the bounds for the mean/median/mode. Second, inconsistent point predictions are reported for both forecast variables. Finally, inconsistencies arise both at short and at longer horizons: the proportion of reported point forecasts outside the bounds implied by the probability distributions of the ECB's SPF is quite similar for the three horizons. For example, 11%, 9% and 11% of inflation point predictions are outside the bounds for the mean at the one-year, two-year and five-year-ahead horizons respectively; for growth, those percentages are respectively 12%, 15% and 14%. The results for the median and the mode of the distribution also share those patterns.[17]

The inconsistencies reflect a "favourable" reporting bias. With respect to the corresponding interval bounds based on the probability forecasts, the reported point forecasts tend to be below for inflation and above for GDP growth rates (see Table A2). Moreover, favourable reporting is present both at short and at long-term forecast horizons. In the case of the bounds for the mean, for each of the three horizons 84%, 64% and 65% of the inconsistencies found in inflation forecasts correspond to point predictions below the lower bound, while 56%, 74% and 81% of the inconsistent growth forecasts are above the upper bound.[18]

[17] The mode shows a lower number of inconsistencies but this just reflects the wider bounds for the mode than for the mean/median when the highest probability is assigned to more than one questionnaire bin.

[18] The results for the mode of growth distributions are somewhat contradictory, but they reflect the difficulties to bound the mode satisfactorily. As shown in the main text, the direct estimation of the mode supports the presence of a favourable reporting bias.

References

Azzalini, A, "A class of Distributions which Includes the Normal ones ", *Scandinavian Journal of Statistics*, 12, 171-178, 1985.

Ang, A., G. Bekaert, and M. Wei, "Do Macro Variables, Asset Markets or Surveys Forecast Inflation Better?", *Journal of Monetary Economics, forthcoming,* 2007.

Boero, G., J. Smith and K. Wallis, "Uncertainty and Disagreement in Economic Prediction: The Bank of England Survey of External Forecasters", *Economic Journal, forthcoming.*

Capistrán, C. and A. Timmermann, "Disagreement and Biases in Inflation Expectations", *mimeo*, Department of Economics, University of California.

Clements, M., "Internal Consistency of Survey Respondents' Forecasts: Evidence Based on the Survey of Professional Forecasters", *manuscript*, Department of Economics, University of Warwick, 2007.

Cressie, N. and T.R.C. Read, "*Goodness-of-fit statistics for discrete multivariate data*", New York, Springer Verlag, 1988.

D'Amico, S. and A. Orphanides, "Uncertainty and Disagreement in Economic Forecasting", Board of Governors of the Federal Reserve, *mimeo,* 2006.

Engelberg, J., C. F. Manski, and J. Williams, "Comparing the Point Predictions and Subjective Probability Distributions of Professional Forecasters", *Journal of Business and Economic Statistics*, *forthcoming*.

Evans, G. W., and S. Honkapohja, "*Learning and Expectations in Macroeconomics*", Princeton, Princeton University Press, 2001.

Ehrbeck, T., and R. Waldmann, "Why are Professional Forecasters Biased? Agency versus Behavioral Explanations", *Quarterly Journal of Economics*, 111(1), 21–40, 1996.

García, J.A., "An Introduction to the ECB's Survey of Professional Forecasters", ECB Occasional Paper, No. 8, September 2003.

García, J.A. and A. Manzanares, "What can Probabilistic Forecasts tell us about Inflation Risks?", ECB Working Paper Series, *forthcoming*.

García, J.A. and A. Manzanares, "Forecast Disagreement", European Central Bank, *mimeo.*

Giordani, P., and P. Söderlind, "Inflation Forecast Uncertainty", European Economic Review, 47, 1037-1059, 2003.

Lahiri, K., C. Teigland, and M. Zaporowski. "Interest Rates and the Subjective Probability Distribution of Inflation Forecasts", *Journal of Money, Credit and Banking, 20,* 233-248, 1988.

Lindsay, B.G., "Efficiency versus Robustness: the case for Minimum Hellinger Distance and Related Methods", *Annals of Statistics*, 22, 1081-1114, 1994.

Ottaviani, M., and P. N. Sorensen, "The Strategy of Professional Forecasting ", *Journal of Financial Economics*, 81, 441–466, 2006.

Patton, A. J., and A. Timmermann, "Testing Forecast Optimality under Unknown Loss", *manuscript*, University of California, San Diego.

Pewsey, A., "Problems of Inference for Azzalini's Skew-Normal Distribution", *Journal of Applied Statistics*, 27, 859-870, 2000.

Rich, R., and J. Tracy, "The Relationship between Expected Inflation, Disagreement, and Uncertainty: Evidence from Matched Point and Density Forecasts", Federal Reserve Bank of New York Staff Reports, No. 253, July 2006.

Table 1: Description of the ECB's SPF data, 1991Q1-2006Q4

	Inflation forecasts		
	12 months ahead	24 months ahead	Five years ahead
No. of observations*	1,539	1,397	972
Average per round	49	44	38
	Real GDP growth forecasts		
	Four quarters ahead	Eight quarters ahead	Five years ahead
No. of observations*	1,493	1,358	975
Average per round	47	43	38

*Number of replies providing both point and probability forecasts.

Table A1: Inconsistencies between point predictions and bounds

	Panel A: Inflation forecasts					
	12 months ahead		24 months ahead		Five years ahead	
	Number	Percentage	Number	Percentage	Number	Percentage
Mean	172	11%	127	9%	109	11%
Median	128	8%	96	7%	58	6%
Mode	87	6%	80	6%	41	4%
	Panel B: Real GDP growth forecasts					
	Four quarters ahead		Eight quarters ahead		Five years ahead	
	Number	Percentage	Number	Percentage	Number	Percentage
Mean	183	12%	210	15%	142	14%
Median	119	8%	150	11%	96	10%
Mode	86	6%	100	7%	54	5%

Table A2: Evidence of favourable bias in point predictions

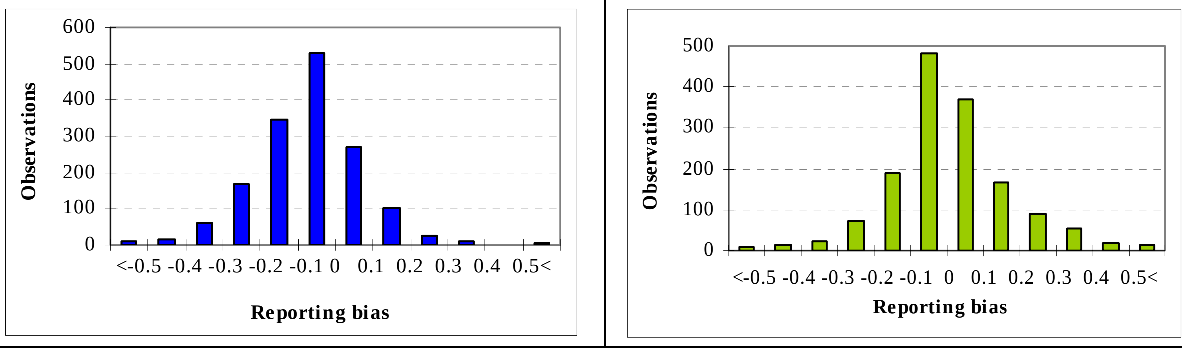
	Inflation forecasts					
	12 months ahead		24 months ahead		Five years ahead	
	Above bound	Below bound	Above bound	Below bound	Above bound	Below bound
Mean	16%	84%	36%	64%	35%	65%
Median	16%	84%	31%	69%	31%	69%
Mode	26%	74%	31%	69%	27%	63%

	Real GDP growth forecasts					
	Four quarters ahead		Eight quarters ahead		Five years ahead	
	Above bound	Below bound	Above bound	Below bound	Above bound	Below bound
Mean	56%	44%	74%	26%	81%	19%
Median	50%	50%	66%	34%	71%	29%
Mode	35%	65%	41%	59%	41%	59%

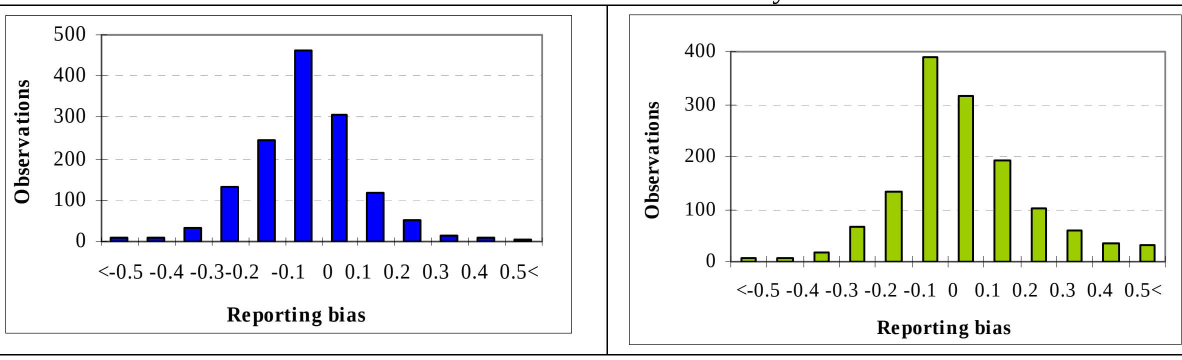
Figure 1: Distribution of individual reporting biases

Inflation forecasts	Real GDP growth forecasts

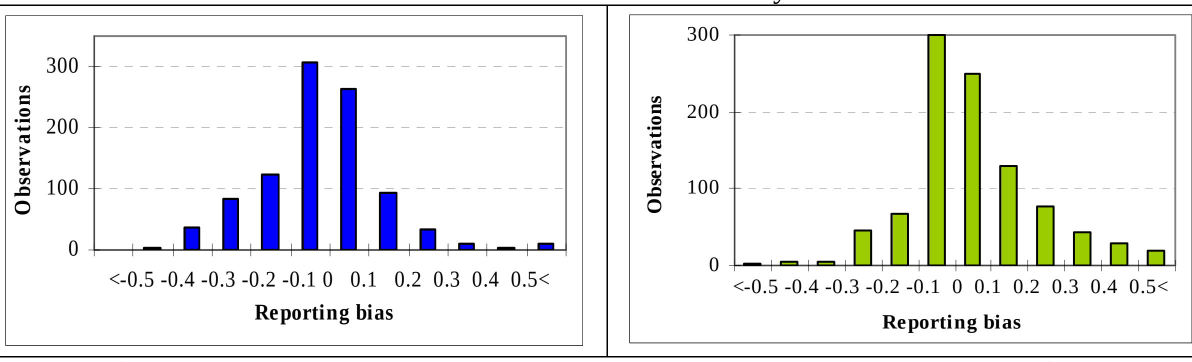
Panel A: Macroeconomic forecasts one year ahead



Panel B: Macroeconomic forecasts two years ahead



Panel C: Macroeconomic forecasts five years ahead

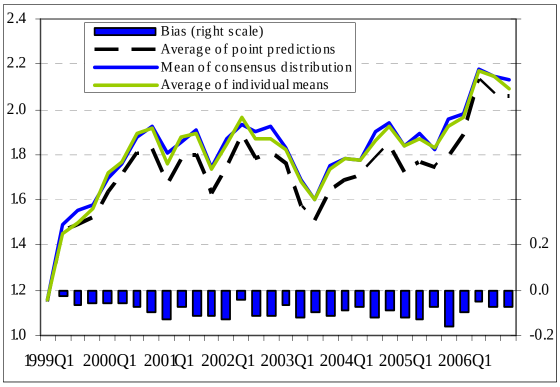


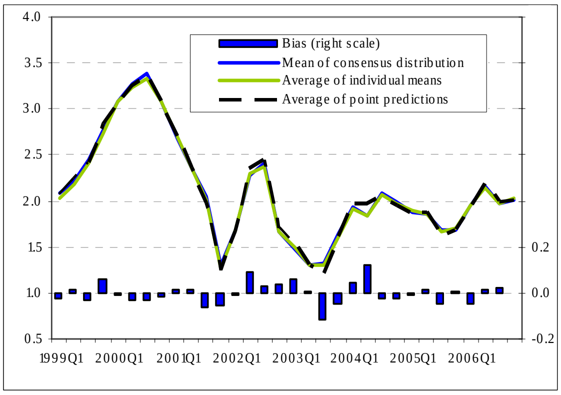
Note: X-axis figures in percentages. The reporting bias is calculated as the reported point prediction minus the mean of the corresponding probability forecast. The mean is estimated by fitting a continuous density to the SPF histograms following García and Manzanares [2007] (see Appendix A for details).

Figure 2. Point and probability-based measures of combined expectations

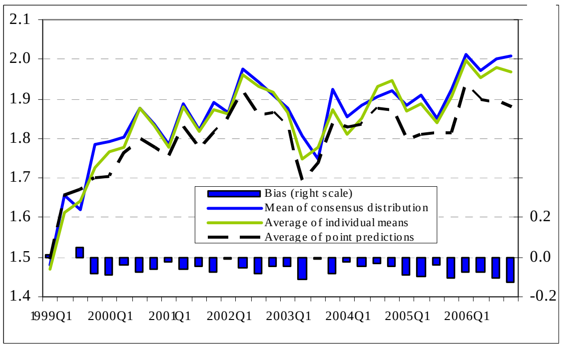
Inflation forecasts | **Real GDP growth forecasts**

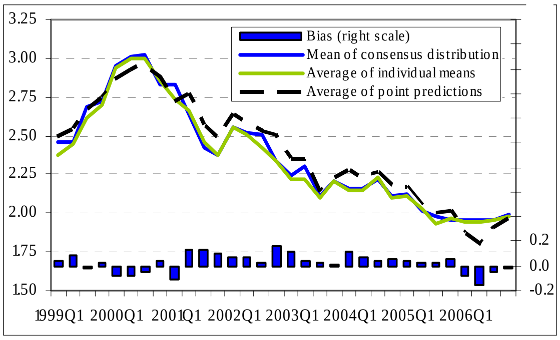
Panel A: Macroeconomic forecasts one year ahead



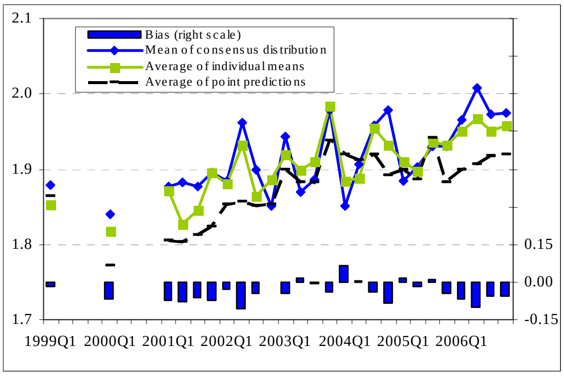


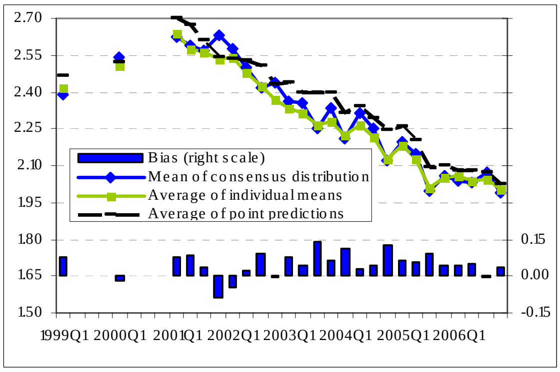
Panel B: macroeconomic forecasts two years ahead





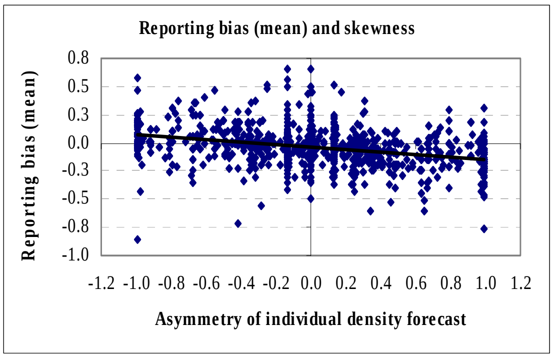
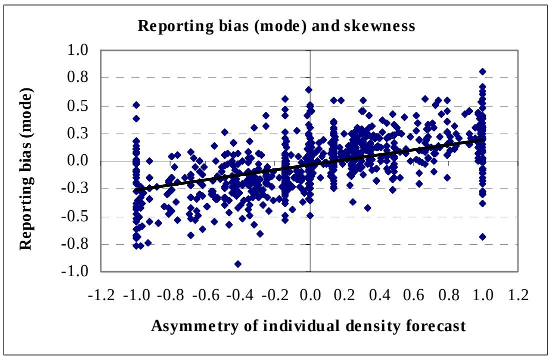
Panel C: Macroeconomic forecasts five years ahead





Note: All figures in percent. The means of the individual and combined probability distributions are estimated by fitting a continuous density to the SPF histograms following García and Manzanares [2007]. The combined probability distribution is the average of the individual histograms reported by the panelists. Bias, measured by the right scale, refers to the average of the point predictions minus the mean of the combined probability distribution.

Figure 3: Forecast skew and reporting bias (point prediction minus central tendency)

Panel A: Mean	Panel B: Mode
	

European Central Bank Working Paper Series

For a complete list of Working Papers published by the ECB, please visit the ECB's website (http://www.ecb.europa.eu).

807 "Cross-border lending contagion in multinational banks" by A. Derviz and J. Podpiera, September 2007.

808 "Model misspecification, the equilibrium natural interest rate and the equity premium" by O. Tristani, September 2007.

809 "Is the New Keynesian Phillips curve flat?" by K. Kuester, G. J. Müller und S. Stölting, September 2007.

810 "Inflation persistence: euro area and new EU Member States" by M. Franta, B. Saxa and K. Šmídková, September 2007.

811 "Instability and nonlinearity in the euro area Phillips curve" by A. Musso, L. Stracca and D. van Dijk, September 2007.

812 "The uncovered return parity condition" by L. Cappiello and R. A. De Santis, September 2007.

813 "The role of the exchange rate for adjustment in boom and bust episodes" by R. Martin, L. Schuknecht and I. Vansteenkiste, September 2007.

814 "Choice of currency in bond issuance and the international role of currencies" by N. Siegfried, E. Simeonova and C. Vespro, September 2007.

815 "Do international portfolio investors follow firms' foreign investment decisions?" by R. A. De Santis and P. Ehling, September 2007.

816 "The role of credit aggregates and asset prices in the transmission mechanism: a comparison between the euro area and the US" by S. Kaufmann and M. T. Valderrama, September 2007.

817 "Convergence and anchoring of yield curves in the euro area" by M. Ehrmann, M. Fratzscher, R. S. Gürkaynak and E. T. Swanson, October 2007.

818 "Is time ripe for price level path stability?" by V. Gaspar, F. Smets and D. Vestin, October 2007.

819 "Proximity and linkages among coalition participants: a new voting power measure applied to the International Monetary Fund" by J. Reynaud, C. Thimann and L. Gatarek, October 2007.

820 "What do we really know about fiscal sustainability in the EU? A panel data diagnostic" by A. Afonso and C. Rault, October 2007.

821 "Social value of public information: testing the limits to transparency" by M. Ehrmann and M. Fratzscher, October 2007.

822 "Exchange rate pass-through to trade prices: the role of non-linearities and asymmetries" by M. Bussière, October 2007.

823 "Modelling Ireland's exchange rates: from EMS to EMU" by D. Bond and M. J. Harrison and E. J. O'Brien, October 2007.

824 "Evolving U.S. monetary policy and the decline of inflation predictability" by L. Benati and P. Surico, October 2007.

825 "What can probability forecasts tell us about inflation risks?" by J. A. García and A. Manzanares, October 2007.

826 "Risk sharing, finance and institutions in international portfolios" by M. Fratzscher and J. Imbs, October 2007.

827 "How is real convergence driving nominal convergence in the new EU Member States?" by S. M. Lein-Rupprecht, M. A. León-Ledesma, and C. Nerlich, November 2007.

828 "Potential output growth in several industrialised countries: a comparison" by C. Cahn and A. Saint-Guilhem, November 2007.

829 "Modelling inflation in China: a regional perspective" by A. Mehrotra, T. Peltonen and A. Santos Rivera, November 2007.

830 "The term structure of euro area break-even inflation rates: the impact of seasonality" by J. Ejsing, J. A. García and T. Werner, November 2007.

831 "Hierarchical Markov normal mixture models with applications to financial asset returns" by J. Geweke and G. Amisano, November 2007.

832 "The yield curve and macroeconomic dynamics" by P. Hördahl, O. Tristani and D. Vestin, November 2007.

833 "Explaining and forecasting euro area exports: which competitiveness indicator performs best?" by M. Ca' Zorzi and B. Schnatz, November 2007.

834 "International frictions and optimal monetary policy cooperation: analytical solutions" by M. Darracq Pariès, November 2007.

835 "US shocks and global exchange rate configurations" by M. Fratzscher, November 2007.

836 "Reporting biases and survey results: evidence from European professional forecasters" by J. A. García and A. Manzanares, December 2007.

ISSN 1561-0810