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How informative are aggregated inflation expectations? Evidence from the ECB Survey of Professional Forecasters

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Abstract

This study examines aggregated short- and long-term inflation expectations in the unbalanced panel of the ECB Survey of Professional Forecasters. The focus of the study is on heterogeneity of expectations and changing panel composition. First, we compare two sub-groups of survey respondents divided on the basis of forecast accuracy. Then, we examine possible differences between regular and irregular forecasters. Finally, we assess the relevance of aggregated forecast revisions in the unbalanced panel by constructing alternative forecast revisions based on the set of sub-panels of fixed composition. The results show that, because of heterogeneity across individual views, aggregated inflation expectations in the ECB SPF must be analysed also on a micro level.

Key words: Survey data, Aggregated inflation expectations, Euro area, ECB SPF

JEL Classification: C53, E37, E31

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1 Introduction

Aggregated expectations in the ECB Survey of Professional Forecasters (ECB SPF) are based on an unbalanced panel. The group of survey respondents varies over time due to voluntary survey participation and idiosyncratic shocks affecting forecasters' survey activity. Compositional changes in the panel can cause aggregation problems if the forecasters are very heterogeneous and participation in the survey is not completely random, i.e. statistically independent of forecasters' views.

Euro area inflation has been persistently low for several years and risks of deflation and de-anchoring of long-term inflation expectations have been widely debated recently. When inflation expectations are analysed using the ECB SPF, one needs to assess whether changing panel composition has substantial impacts on aggregated survey information. Especially long-term inflation expectations need to be carefully examined due to the relatively small number of survey responses. The unbalanced panel may cause bias in aggregation, if forecasters are very heterogeneous and the survey does not truly represent the whole forecaster population.

This paper analyses aggregated short and long-term ECB SPF inflation expectations in 1999Q1-2015Q3 by focusing on heterogeneity of expectations and varying panel composition. We study the average point forecasts and corresponding average individual uncertainties (i.e. average standard deviations of individual probability distributions). We compare forecasters with accurate and inaccurate forecasting performance, as well as forecasters who participate in the survey regularly and irregularly. We also assess the relevance of aggregated forecast revisions in the unbalanced panel by constructing alternative forecast revisions based on the set of sub-panels of fixed composition.

We provide evidence that aggregated inflation expectations in the ECB SPF can partly reflect changes in panel composition. Therefore, expectations must be analysed also on a micro level. The paper proceeds as follows. The ECB SPF is described in section 2 and empirical analyses are reported in sections 3-5. Conclusions are drawn in section 6.

2 Data description

The ECB SPF is a quarterly survey started in 1999Q1.[3,4] In every survey round, each forecaster is asked to report, inter alia, their expectations for the euro area inflation rate, which is defined as the year-on-year percentage change in the Harmonised Index of Consumer Prices (HICP).The ECB SPF also provides information on forecast uncertainty: survey respondents are asked to report how they assess the probability of the forecasted inflation outcome falling within the pre-determined ranges (bins).[5] Using individual probability histograms, we can construct subjective uncertainty series on a micro level. The average individual uncertainty (i.e. the average standard deviation of the individual probability distributions) measures how confident the average survey respondent is when forecasting inflation.[6,7]

Six different forecast horizons are surveyed by the ECB SPF, but here we focus only on a short-term rolling forecast horizon and a long-term forecast horizon. The short-term rolling forecast horizon refers to one year ahead of the month for which the latest official release of the HICP inflation rate is available. For example, in the 2015Q1 survey (after release of the HICP inflation rate in December 2014) the forecasters were asked to report their expectations for the HICP inflation rate in December 2015. The long-term forecast horizon depends on the quarter,

[3] The ECB SPF survey is described both in Bowles et al. (2007) and in the ECB Monthly Bulletin article "Fifteen years of the ECB Survey of Professional Forecasters" (January 2014).

[4] Detailed information about the survey as well as the complete micro data set can be downloaded from http://www.ecb.europa.eu/stats/prices/indic/forecast/html/index.en.html.

[5] Forecasters attach probabilities to pre-determined ranges, which means that constructing the standard deviations of the probability distributions is somewhat problematic. We assume that all the probability for a certain range relates to the mid-point of that range. Both side ranges are open-ended. In the case of the lowest (highest) open-ended range, we fix all the probability at one percentage point below (above) the left (right) end-point of that range. After the onset of the financial crisis more negative ranges were added to the inflation histograms. The new extreme values were not used very often, and when used the probability of a forecasted inflation outcome was typically small. Therefore, the importance of this change is not devastating for our analysis.

[6] Forecast disagreement (standard deviation of point forecasts) has also been used to proxy inflation uncertainty, although in fact, it reflects polarization of individual views. Aggregated uncertainty (the standard deviation of the aggregated probability distribution) also measures forecast uncertainty. Since the variance of the aggregated probability distribution is equal to the sum of the average variance of the individual probability distributions (i.e. individuals' uncertainty) and the variance of the point estimates (i.e. disagreement), the three measures of uncertainty are closely related.

[7] Giordani and Söderlind (2003) have paid attention to possible impacts of outliers on the standard deviation of point forecasts and have defined the quasi-standard deviation of point forecasts. It is constructed by taking half of the difference between 84th and 16th percentiles of point forecasts. Forecast uncertainty can also be measured by combined forecast uncertainty (see Conflitti 2015 and Giordani and Södelind 2003). Combined forecast uncertainty is the average variance of individual distributions (i.e. individuals' uncertainty) minus the variance of the point estimates (i.e. disagreement). Combined forecast uncertainty is not defined, if the variance of the point estimates is larger than the average variance of the individual distribution.

in which the survey is conducted: in the Q1 and Q2 survey rounds it refers to forecasts four calendar years ahead and in the Q3 and Q4 survey rounds to forecasts five calendar years ahead. For example, in the 2014Q1 and 2014Q2 surveys, the long-term referred to calendar year 2018 and in the 2014Q3 and 2014Q4 surveys to calendar year 2019. Euro area inflation expectations in the ECB SPF have been analysed in many recent studies (see for example, Conflitti 2012, Rich et al. 2012, Tsenova 2012, Andrade and Le Bihan 2013 and Kenny et al. 2014).[8]

Figures 1 and 2 display the history of short and long-term inflation expectations in the unbalanced ECB SPF panel. The lowest and highest survey responses, the mean and median values, as well as 5th and 75th percentiles are reported in both figures.[9] In Appendix 1 the average of inflation expectations is compared to the actual HIPC inflation rate. Forecast dispersions and average individual uncertainties are also compared in Appendix 1. More detailed information about individual uncertainties is given in Appendix 2.

Short-term forecasts are mainly driven by base effects (see figure 1). After the onset of the financial crisis there was more variation and a wider range of short-term expectations than before (in 2009 both positive and negative inflation rates were forecasted), but the distribution of short-term expectations has been relatively stable for the whole sample.

[INSERT FIGURE 1 HERE]

Aggregated long-term inflation expectations have been remarkable stable since 1999Q1 (see figure 2). Even in the middle of the financial crisis, when the range of individual survey responses was extremely wide, the average of long-term inflation expectations was very close to the ECB inflation target. The distribution of long-term inflation expectations was somewhat wider in the early 2000s and around the end of the sample compared to the years 2006-2013. Appendix 1 indicates that forecast dispersions increased temporarily to a very high level in 2009 (and also in 2012 and 2015 in the case of short-term expectations) compared to the pre-crisis years. It is clear that forecast uncertainty is higher in the long run, as shown in Appendices 1 and 2.

[8] Conflitti (2012) and Rich et al. (2012) analyse forecast uncertainty and disagreement. Tsenova (2012) examines anchoring of long-term inflation expectations and Andrade and Le Bihan (2013) forecast revisions. The focus in Kenny et al. (2014) is on forecasters' risks assessments.

[9] Each percentile indicates the value below which a certain percentage of expectations fall. Median represents a consensus measure (50 per cent of expectations are below median value) and the difference between 75th and 25th percentiles measures how expectations are dispersed in the middle of the distribution.

[INSERT FIGURE 2 HERE]

Figures 3 and 4 indicate that professional forecasters change their views only gradually. Aggregated inflation expectations in periods *t* and *t-1* are highly correlated both in short and long-term forecast horizons, but only long-term expectations are highly correlated with the other lags. Inflation uncertainties are very persistent: in all cases the serial correlations are somewhat higher for short-term than for long-term inflation uncertainty.

[INSERT FIGURE 3 HERE]

[INSERT FIGURE 4 HERE]

3 Varying panel composition and inflation expectations on a micro level

Next, we consider varying panel composition and individual survey responses in the ECB SPF. Figure 5 indicates that, on average, aggregated short-term (long-term) inflation forecasts have been based on 51 (45) survey responses. The crisis seems to have reduced survey activity to some extent, and the number of forecasters has been persistently lower in the third than in other quarters due to the holiday season. [10] The sample size in the ECB SPF is relatively small, especially in the case of long-term expectations. However, it is larger than in many other corresponding surveys: the number of survey participants is around 40 in the US SPF and 20-30 in the Bank of England SPF.

[INSERT FIGURE 5 HERE]

If the number of forecasters is the same in two consecutive quarters, it does not necessarily mean that the group of forecasters is exactly the same in both periods. In figure 6, the Dropped in series refers to the number of forecasters who joined the survey and the Dropped out series to the number of forecasters who left the survey in each period compared to the previous period. On average, eight professionals joined and nine left the survey in each current quarter compared to the previous quarter.

[INSERT FIGURE 6 HERE]

[10] According to Bowles et al. (2010) the performance of the ECB SPF in the Q3 round is not noticeably different from other quarters.

Figure 7 illustrates the heterogeneity of forecasters in four different survey rounds. In each scatter graph, the individual short-term point forecasts are measured on the x-axis and inflation uncertainties on the y-axis. The corresponding averages are denoted by straight lines. Figure 7 confirms the fact that the financial crisis contributed to more dispersed views of both inflation and inflation uncertainty. At the same time, the average point forecast decreased and the average forecast uncertainty increased.

[INSERT FIGURE 7 HERE]

Next, we consider changes of inflation expectations on a micro level. Arrows in figures 8 and 9 indicate how individual survey respondents changed their views between 2008Q3 (just before the Lehman Brothers collapse) and 2009Q2 (in the middle of the crisis). The bold arrows summarise the corresponding average changes of expectations. According to figure 8 the crises clearly lowered the average short-term expectations and there was quite a lot of variation of across individual forecast revisions. The average short-term individual uncertainty was almost unchanged between the two periods, although some forecasters revised their views of forecast uncertainty.

[INSERT FIGURE 8 HERE]

The impact of the crisis on long-term expectations was only marginal, although some forecast revisions were found on a micro level (see figure 9).

[INSERT FIGURE 9 HERE]

4 Heterogeneity of inflation expectations

Next, we examine heterogeneity of ECB SPF inflation expectations in more detail and pay attention to varying panel composition. First, our focus is on aggregated levels of survey information, after which we analyse aggregated forecast revisions.

The ECB SPF panel consists of around 100 professional forecasters, representing both financial and non-financial institutions in the European Union.[11] Since professionals are quite heterogeneous with respect to level of expertise and forecasting method, forecast accuracy varies across forecasters. According to the special questionnaire conducted by the ECB (ECB

[11] To be precise, in the ECB SPF a forecaster refers to an institution, not a person.

2014), short-term inflation forecasts are based on different methods (judgement is also used), and long-term expectations typically follow the ECB inflation target or trends in actual inflation. [12]

Nechio (2015) examines long-term PCE inflation expectations in the US SPF by separating the forecasters into two sub-groups based on forecast accuracy of inflation one year ahead. The group of accurate forecasters includes those survey respondents whose RMSE (root mean squared error) values are less than or equal to the average RMSE of all forecasters. Correspondingly, in the group of inaccurate forecasters, RMSE values of all group members are above the average RMSE. When comparing aggregated expectations in the two sub-groups, Nechio (2015) finds that the evolution of aggregated long-term inflation expectations in recent years is mainly due to changing views of inaccurate forecasters.[13]

We apply the Nechio (2015) approach to the ECB SPF data by considering also inflation expectations one year ahead. After calculating RMSEs for each forecaster in the whole sample, we divide the forecasters into two groups on the basis of forecast ability: half of the survey respondents are included in the group of *accurate forecasters* and the rest in the group of *inaccurate forecasters*. Then we calculate aggregated expectations for both groups.

We also investigate whether differences across forecasters can be explained by differences in forecasting activity. We form two separate groups of forecasters. A forecaster belongs to the group of *regular forecasters* in the current quarter, if he/she responded to the survey also in the previous quarter. If, instead, a forecaster replied to the survey only in the current survey round (and not in the previous one), it belongs to the group of *irregular forecasters*. Since only *regular forecasters* are able to consider their forecast error in the previous quarter and modify their earlier models/judgements accordingly, it is reasonable to assume that their expectations formation may differ from those of *irregular forecasters*, whose forecasting is likely to be more challenging and time-consuming. Any difference between regular and irregular forecasting

[12] The special questionnaire reveals that short-term inflation expectations are typically based on reduced form models, such as single equation, vector autoregressive (VAR) or vector error correction (VEC) models. As regards long run inflation, over 80 per cent of short-term forecasts are judgement-based or model-based but with judgmental adjustments (81 per cent follow the ECB inflation target, and 54 per cent follow trends in actual inflation). Financial market indicators, trends in wage growth and other forecast surveys are all used by 30 per cent and fiscal indicators by 20 per cent of forecasters, in forecasting inflation 4-5 years ahead.

[13] When comparing medians of long run PCE inflation forecasts and their ranges, Nechio (2015) removes the top and bottom 10 per cent of survey respondents.

may be a sign that aggregated expectations based on the unbalanced panel partly reflect the changing group of forecasters. Regular survey participation is somewhat more common in short-term than in long-term forecasting.[14,15]

Differences between alternative aggregates of short-term inflation expectations are only minor, but in the early 2000s and at turning points after 2007 *irregular forecasters* had somewhat divergent views of euro area inflation compared to other groups (see figure 10). Comparison also reveals that the short-term inflation expectations of *accurate forecasters* were relatively high in 2002-2004 and relatively low after 2011. In table 1 only one correlation coefficient (between *irregular forecasters* and the aggregate based on all observations) is below 0.98.

[INSERT FIGURE 10 HERE]

[INSERT FIGURE 11 HERE]

According to figure 11, the alternative aggregates of long-term inflation expectations were somewhat dispersed already in the pre-crisis years, and the differences seem to have widened even stronger after the Lehman Brothers collapse. Again, in the early 2000s *accurate forecasters* had higher, and after 2007 lower, long-term expectations compared with the other groups. There has been considerable variation in aggregated expectations of *irregular forecasters*: after 2007 the mean of their expectations has been above 2 per cent and below 1.8 per cent several times. Near the end of the sample, the alternative aggregates are still quite dispersed and vary between 1.8 and 1.9 per cent. Appendix 3 shows that aggregated short and long-term uncertainties of *irregular forecasters* have been very volatile compared to those of *regular forecasters.*[16]

Next, we use the Wilcoxon Rank Sum test in order to assess whether survey activity is statistically independent of forecasters' views.[17] According to the null hypothesis of this non-parametric test, *regular* and *irregular forecasters* represent the same distribution. Here we

[14] The share of short-term *regular forecasters* varies between 34 and 53 and the average share is 42. The corresponding share in long-term forecasting varies between 28 and 46 and the average is 37.
[15] We continue our analysis of regular and irregular forecasting in the next section, when focusing on aggregated forecast revisions.
[16] Low correlation between accurate/inaccurate forecasters and the group of all forecasters in table 1 reflects low numbers of survey responses in some quarters (the division of forecasters into two groups is based on average RMSEs in the whole sample).
[17] See Tanizaki (2004) for a description of the Wilcoxon Rank Sum test.

focus on those time periods after 2007 in which the differences between aggregated expectations of *regular* and *irregular forecasters* are the widest. The p-values of the test are reported in table 2. They indicate that the null hypothesis, according to which inflation expectations are statistically independent of forecasting activity, is always rejected at the 5 per cent significance level. Therefore, we provide evidence that aggregated expectations in the ECB SPF partly reflect changing panel composition.

5 Aggregated forecast revisions

Next, we examine changing panel composition by focusing on aggregated forecast revisions. We follow Engelberg et al. (2011), who study changes in short-term aggregated inflation expectations in the US SPF.[18] In that study only forecasts for four quarters ahead are examined, but we analyse point forecasts and inflation uncertainties in both the short and long-term.

We denote the *intersection* group of forecasters by the term $N_t(1,1)$. All forecasters in this group have responded to the survey in two consecutive periods (t and $t+1$). Correspondingly, forecasters who have responded to the survey only in period t belong to group $N_t(1,0)$ and forecasters who participate in the survey only in period $t+1$ belong to group $N_t(0,1)$.[19]

Aggregated forecast revisions in the unbalanced panel are based on the *composition* group of forecasters. In this group forecasters responded to the survey at least in one period in two consecutive survey rounds, and the aggregated forecast revisions are based on the formula: $\Delta_{tC} \equiv mean[exp_{(t+1)} \mid i \varepsilon N_t(1,1) \cup N_t(0,1)] - mean[exp_t \mid i \varepsilon N_t(1,1) \cup N_t(1,0]$. In this case the panel composition is not fixed, since two distinct group of forecasters are compared for periods t and $t+1$.

We construct alternative aggregated forecast revisions based on the *intersection* group of forecasters. In this case we consider a set of sub-panels of fixed composition. For each sub-panel, which includes only two quarters (1999Q1-1999Q2, 1999Q2-1999Q3,..., 2015Q2–2015Q3), we calculate aggregated forecast revisions as: $\Delta_{tI} \equiv mean[(exp_{(t+1)} \mid i \varepsilon N_t(1,1)] - mean[exp_t \mid i \varepsilon N_t(1,1)]$. Comparison of aggregated forecast revisions for the *composition* group

[18] See also Stark (2004) for an analysis of changing panel composition in the US SPF survey.
[19] In the previous section we analysed aggregated levels of expectations in groups $N_t(1,1)$ and $N_t(0,1)$.

and *intersection* group of forecasters reveals the possible impacts of a varying panel on aggregated survey information.

The Engelberg et al. (2011) method of constructing aggregated forecast revisions based on the *intersection* group of forecasters is quite straightforward, but it is somewhat problematic due to the clearly reduced number of observations. By using the additional information in survey responses of groups $N_t(1,0)$ and $N_t(0,1)$, we can construct lower and upper bounds around aggregated forecast revisions: we assume that in every quarter, missing values for groups $N_t(1,0)$ and $N_t(0,1)$ lie in some range. More specifically, we assume that in every sub-sample, the unobserved forecast revisions in groups $N_t(1,0)$ and $N_t(0,1)$ are no larger (smaller) than the largest (smallest) forecast revisions observed in the group $N_t(1,1)$. Lower and upper limits for aggregated forecast revisions (K_{tL} and K_{tU}) are therefore defined as follows:

$$K_{tL} = [min(exp_{(t+1)i} - exp_{ti}),\ i\ \varepsilon\ N_t(1,1)] \quad (1)$$

and

$$K_{tU} = [max(exp_{(t+1)i} - exp_{ti}),\ i\ \varepsilon\ N_t(1,1)]. \quad (2)$$

The range of forecast revision for every forecaster in group $N_t(1,0)$ is expressed as

$$exp_{ti} + K_{tL} \leq exp_{(t+1)i} \leq exp_{ti} + K_{tU}. \quad (3)$$

Correspondingly, the range of forecast revision for every forecaster in group $N_t(0,1)$ can be written as:

$$exp_{(t+1)i} - K_{tU} \leq exp_{ti} \leq exp_{(t+1)i} - K_{tL}. \quad (4)$$

First, we calculate ranges for all individual forecasters in groups $N_t(1,0)$ and $N_t(0,1)$; then we construct bounds for aggregated forecast revisions in the *union* group of forecasters: $\Delta_{tU} \equiv mean(exp_{(t+1)} | i\ \varepsilon\ N_t(1,1)\ U\ N_t(1,0)\ U\ N_t(0,1)) - mean(exp_t | i\ \varepsilon\ N_t(1,1)\ U\ N_t(1,0)\ U\ N_t(0,1))$. When constructing the lower bound for Δ_{tU}, we set the forecast in period $t+1$ at its lower bound for all forecasters in group $N_t(1,0)$ and at its upper bound for all forecasters in group $N_t(0,1)$. Correspondingly, we set the forecast in period $t+1$ at its upper bound for all forecasters in group

$N_t(1,0)$ and at its lower bound for all forecasters in group $N_t(0,1)$, when constructing the upper bound.[20]

[INSERT FIGURE 12 HERE]

[INSERT FIGURE 13 HERE]

Figures 12 and 13 show aggregated forecast revisions both in the original unbalanced panel and in a set of sub-panels of fixed composition. Lower and upper bounds for aggregated forecast revisions are reported using dash lines.

Figures 12 and 13 indicate that aggregated forecast revisions based on alternative methods are highly correlated. Only in the middle of the financial crisis (at the end of 2009), do the two forecast revisions differ: according to the unbalanced panel, both aggregated short and long-term inflation forecasts were revised downwards, whereas a set of sub-panels of fixed-composition indicates forecast revision upwards.

The constructed range for short-term forecast revisions in figure 12 is relatively narrow until the end of 2007, but after the Lehman Brothers collapse it widened and the range moved clearly downwards (in 2008Q4 the lower bound was -0.88 and upper bound -0.24). In 2009Q3, when expectations were very heterogeneous, the lower bound was clearly negative (-0.42) and the upper bound clearly positive (0.58).

The range for aggregated long-term forecast revisions is exceptionally wide downwards in the middle of the crisis (see figure 13). In 2009 the lower bound was temporarily very low (under -0.6 percentage points) for three quarters. This means that some survey respondents lowered their long-term inflation forecasts quite dramatically at that time. Relatively wide range was also measured in the end of 2004.

Appendix 4 shows that the range for short-term inflation uncertainty has been quite narrow, with a few exceptions. In 2002 the range widened temporarily in both directions and in 2009-

[20] The weights of the largest and smallest forecast revisions in the lower and upper bounds are the larger, the larger the shares of missing observations is in groups $N_t(1,0)$ and $N_t(0,1)$.

2011 it widened first upwards and then downwards. Compared to the short-term uncertainty, bounds for long-term inflation uncertainty have been somewhat wider and notable peaks have occurred.

All in all, the aggregated forecast revisions in the two panel data sets are very closely related although, due to heterogeneity across individual forecasters, the constructed the ranges for short and long-term forecast revisions are relatively wide.

Varying composition in the ECB SPF has been considered by Abel et al. (2016) and López-Péres (2014) and in the US SPF by Engelberg et al. (2011) and Jain (2013). Abel et al. (2016) examine real GDP growth, inflation and unemployment expectations in the ECB SPF. They provide evidence that measures of forecast uncertainty based on individual histograms display countercyclical behaviour and that forecast uncertainty has increased across all forecast horizons since 2007. Abel et al. (2016) argue that forecast uncertainty cannot be reliably measured using forecast dispersion and forecast accuracy. They show that their results are robust to changes in panel composition over time.

López-Péres (2014) focuses on short-term expectations of real GDP growth, inflation and unemployment in the ECB SPF. He constructs an aggregate measure of uncertainty, which is based on a sub-panel of fixed composition. He pays attention to differences in forecasting accuracy across survey respondents and therefore uses performance-based weights in aggregating the measure of uncertainty. López-Péres (2014) argues that variation in the panel of forecasters may contribute to bias in the evolution of aggregated expectations.

Aggregated forecast revisions of short-term US SPF inflation expectations are analysed in Engelberg et al. (2011). In that that study, expectations are measured by percentage changes in the GDP price index. Engelberg et al. (2011) argue that US forecasters are persistently quite heterogeneous and that changes in aggregated expectations may be misleading due to changing panel composition.

Jain (2013) examines quarterly forecasts for the CPI inflation rate in the US SPF. She proposes a new method for extracting measures of perceived inflation persistence, which is based on implied autocorrelation functions and forecaster-specific state-space models. Jain (2013) provides evidence that perceived inflation persistence has declined over time in the US and that

forecasters have viewed unexpected inflation shocks as transitory, especially since the mid-1990s. Then main analysis in Jain (2013) is based on an unbalanced panel of 80 forecasters, but she also considers separately 13 forecasters who participated in the survey for both in the pre-1995Q2 period and post-1995Q2 periods. She concludes that the results are not driven by the unbalanced panel and therefore the changing panel composition does not distort the empirical results.

6 Conclusions

This paper has analysed aggregated inflation expectations in the ECB SPF by focusing on the heterogeneity of short and long-term inflation expectations and varying composition of the unbalanced panel. We have examined separate groups of forecasters and aggregated forecast revisions for 1999Q1-21015Q3. Our analyses indicate that, due to heterogeneity of professional forecasters, the unbalanced ECB SPF panel does not necessarily truly represent the whole forecaster population. Therefore, we must also analyse dispersion of forecasters' views on a micro level.

The Engelberg et al. (2011) method of analysing aggregated inflation expectations is appealing, but in addition to forecast revisions, we need to focus also on the level of expectations. Especially in the current low inflation regime, the level of inflation expectations is crucial from the monetary policy point of view. It is also worth pointing out that the constructed ranges for aggregated forecast revisions based on the Engelberg et al. (2011) method are relatively large for monetary policy purposes.

Inflation expectations are in the core of euro area monetary policy analysis and they are continuously analysed using aggregated ECB SPF information. Euro area inflation is currently close to zero, and the possible risks of deflation and de-anchoring of long-term expectations are widely monitored. In current low inflation regime, 0.1-0.2 percentage point differences between alternative aggregates of inflation expectations in the ECB SPF suggest that we need to examine inflation expectations also on a micro level.

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TABLES AND FIGURES:

Table 1. Correlation coefficients

	Aggregated short-term point forecasts in the unbalanced panel	Aggregated long-term point forecasts in the unbalanced panel
Accurate forecasters	0.981	0.357
Inaccurate forecasters	0.987	0.937
Regular forecasters	0.997	0.952
Irregular forecasters	0.952	0.626

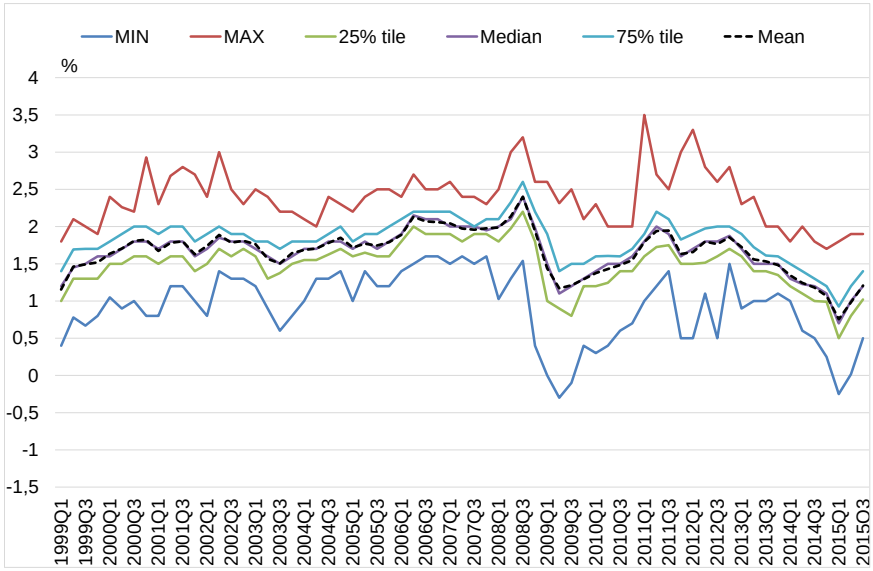
Source: own calculations based on ECB data.

Table 2. The Wilcoxon Rank Sum test results

Aggregated short-term point forecasts	P-value	Aggregated long-term point forecasts	P-value
2009Q2	0.033	2009Q2	0.010
2011Q2	0.028	2010Q3	0.048
2014Q4	0.046	2011Q1	0.046
2015Q3	0.039	2012Q2	0.028
		2012Q4	0.023
		2015Q3	0.023

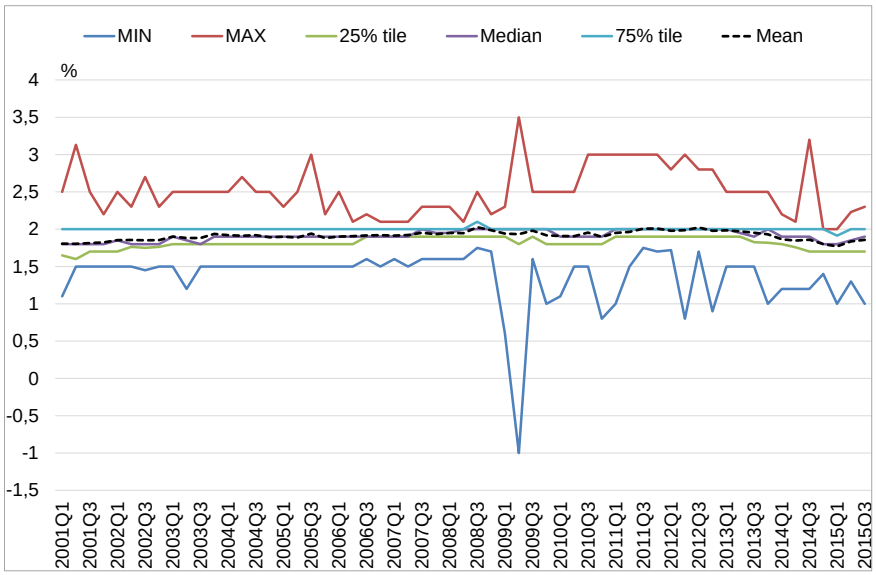
Note: The Wilcoxon Rank Sum test is a non-parametric test for which the null hypothesis is that density distributions of regular and irregular forecasters are identical.
Source: own calculations based on ECB data.

Figure 1. Short-term point forecasts for inflation



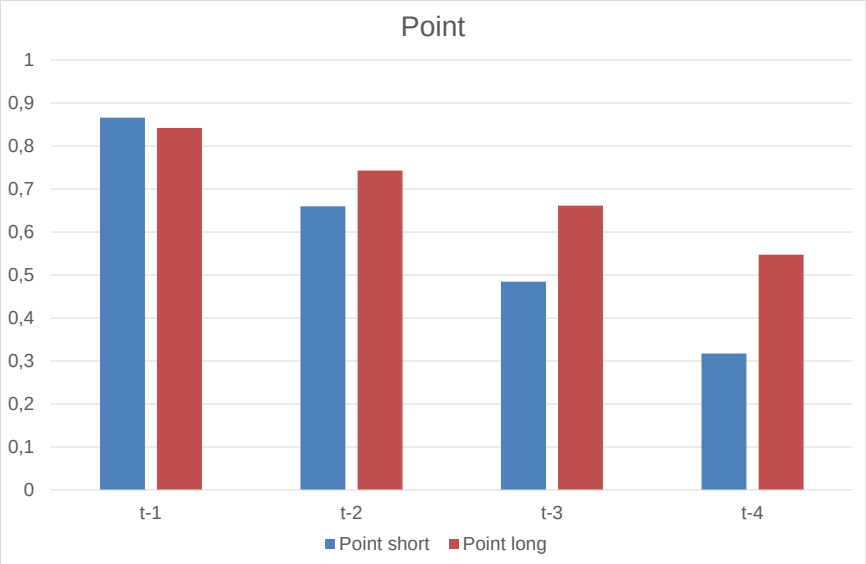
Source: own calculations based on ECB data.

Figure 2. Long-term point forecasts for inflation



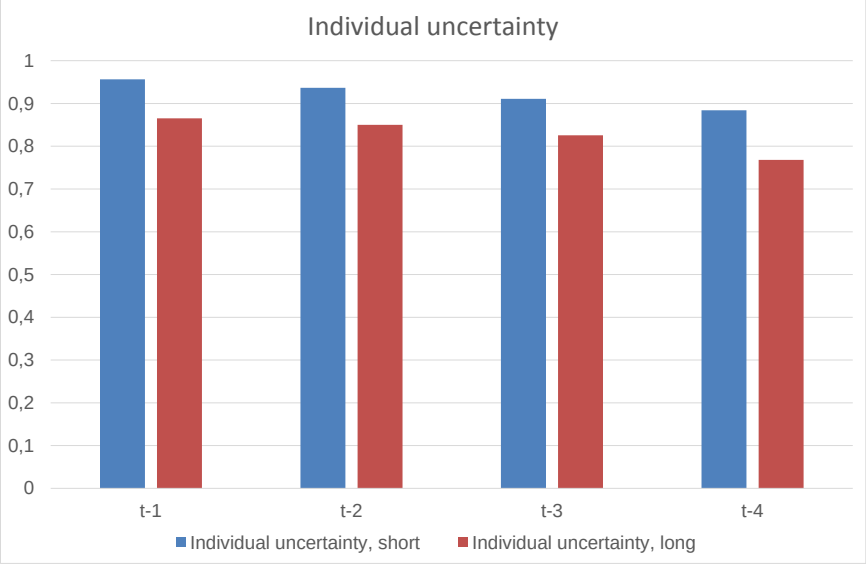
Source: own calculations based on ECB data.

Figure 3. Correlation coefficients for point forecasts



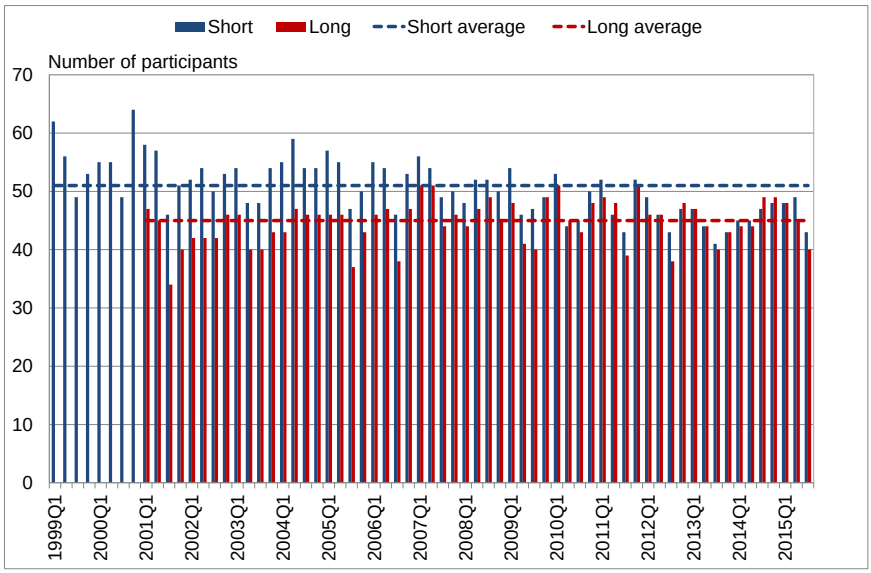
Source: own calculations based on ECB data.

Figure 4. Correlation coefficients for inflation uncertainties



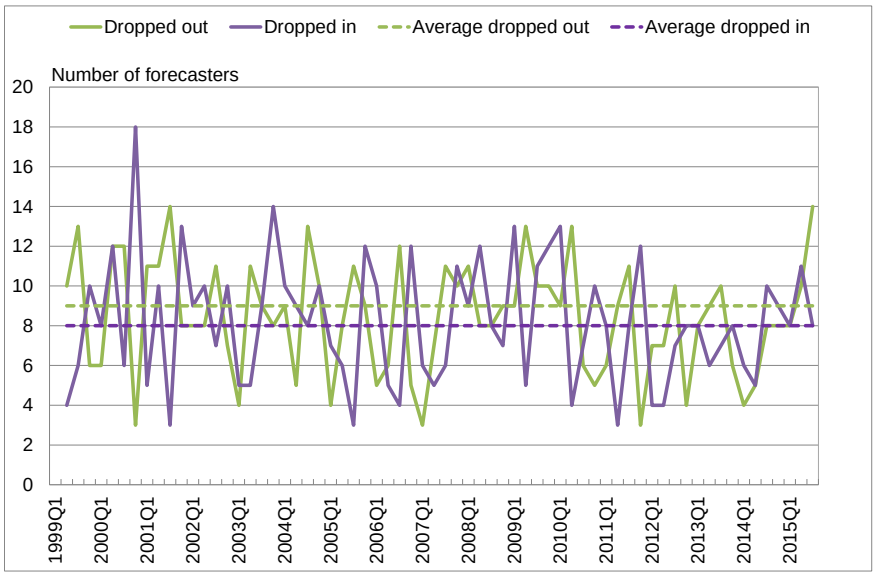
Source: own calculations based on ECB data.

Figure 5. Number of short- and long-term forecasters



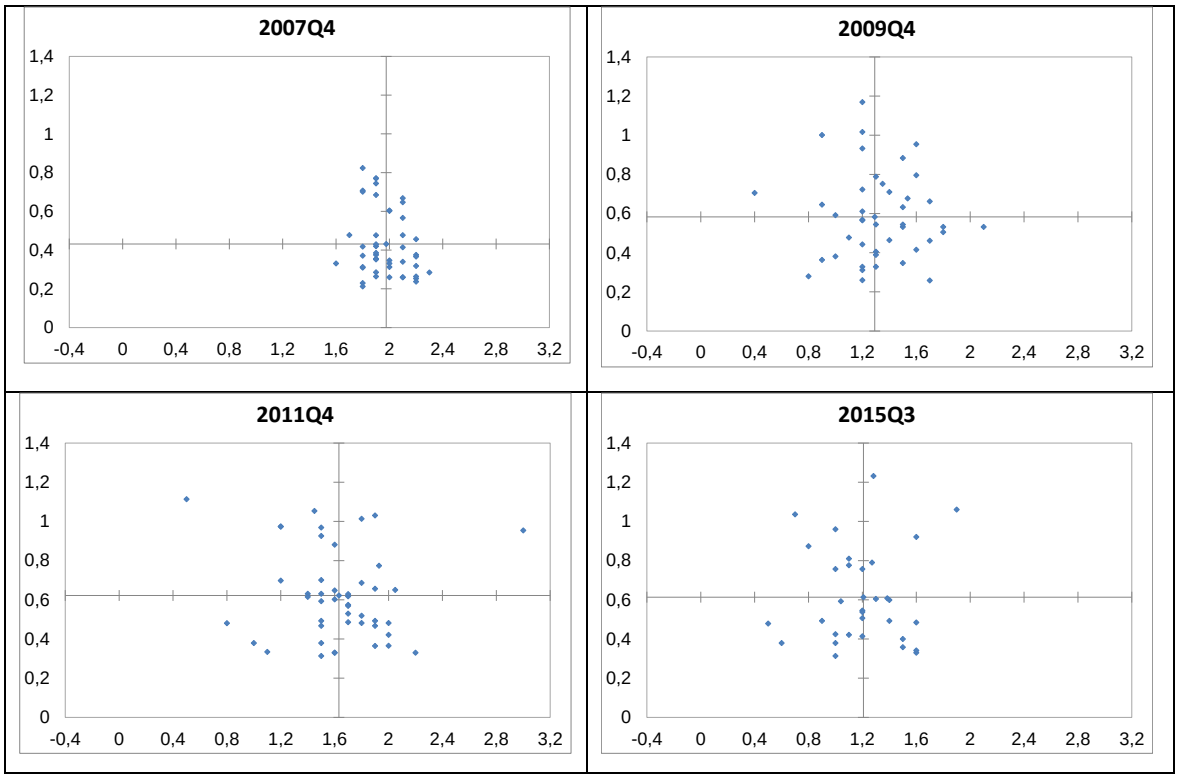
Source: own calculations based on ECB data.

Figure 6. Number of short-term forecasters who join and leave the survey



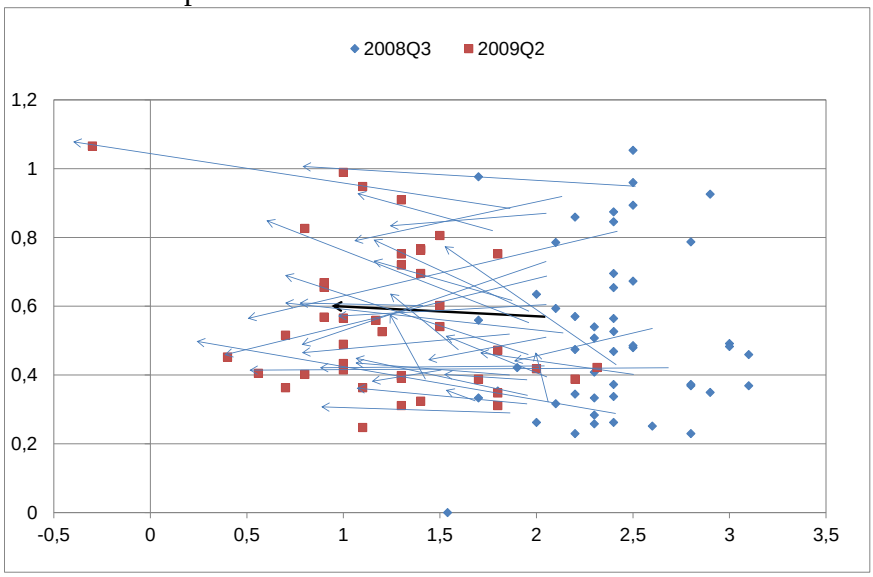
Source: own calculations based on ECB data.

Figure 7. Short-term inflation expectations and inflation uncertainties



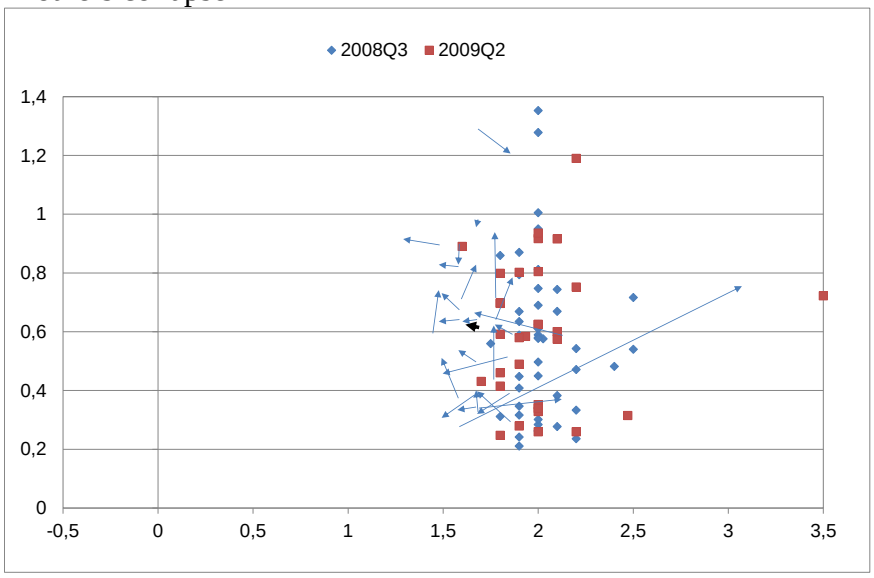
Source: own calculations based on ECB data.

Figure 8. Short-term point forecasts and inflation uncertainties before and after the Lehman Brothers collapse



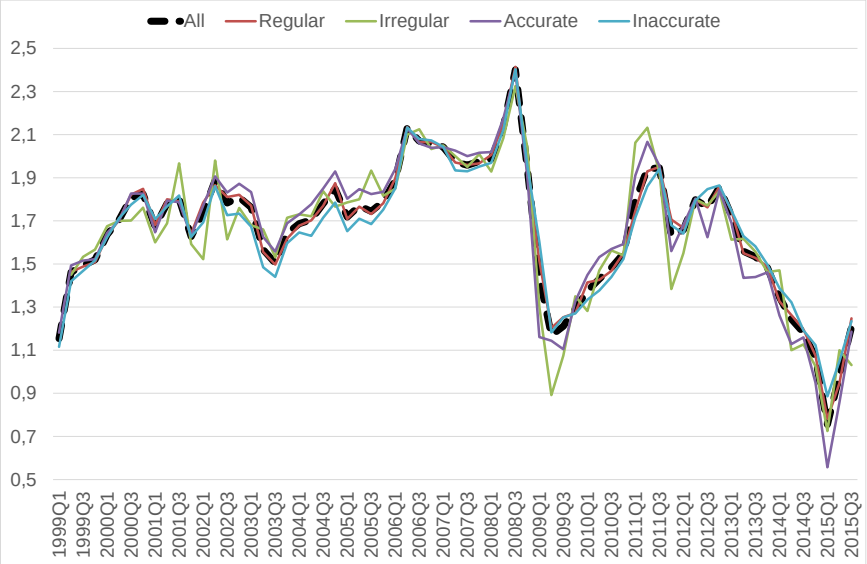
Source: own calculations based on ECB data.

Figure 9. Long-term point forecasts and inflation uncertainties before and after the Lehman Brothers collapse



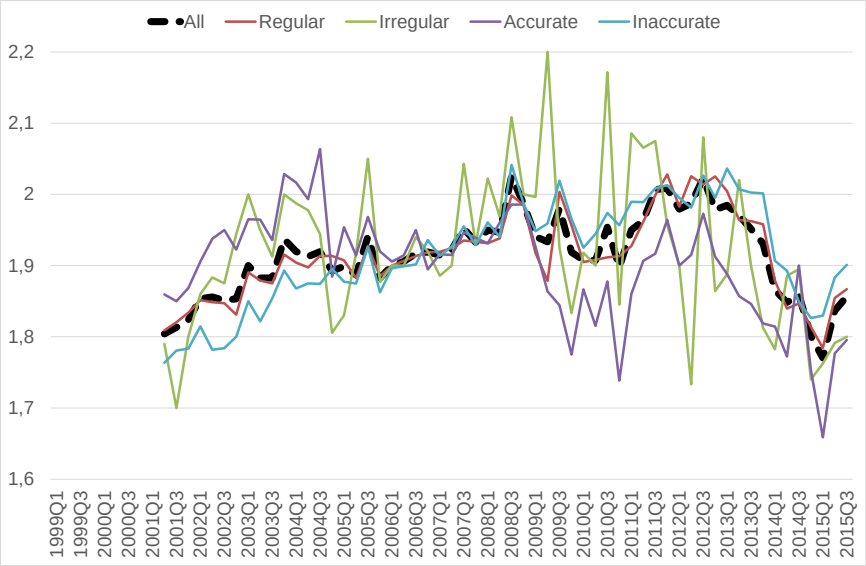
Source: own calculations based on ECB data.

Figure 10. Aggregated short-term inflation forecasts



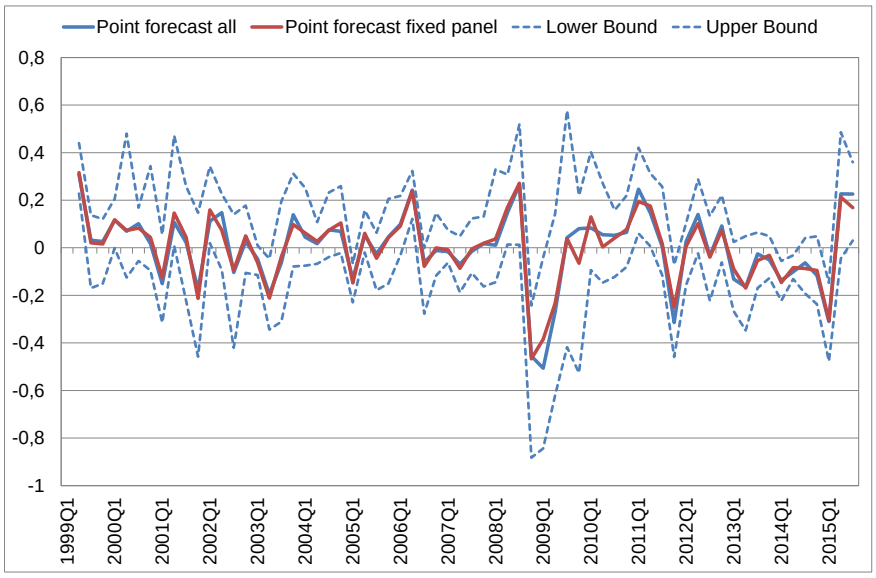
Source: own calculations based on ECB data.

Figure 11. Aggregated long-term inflation forecasts



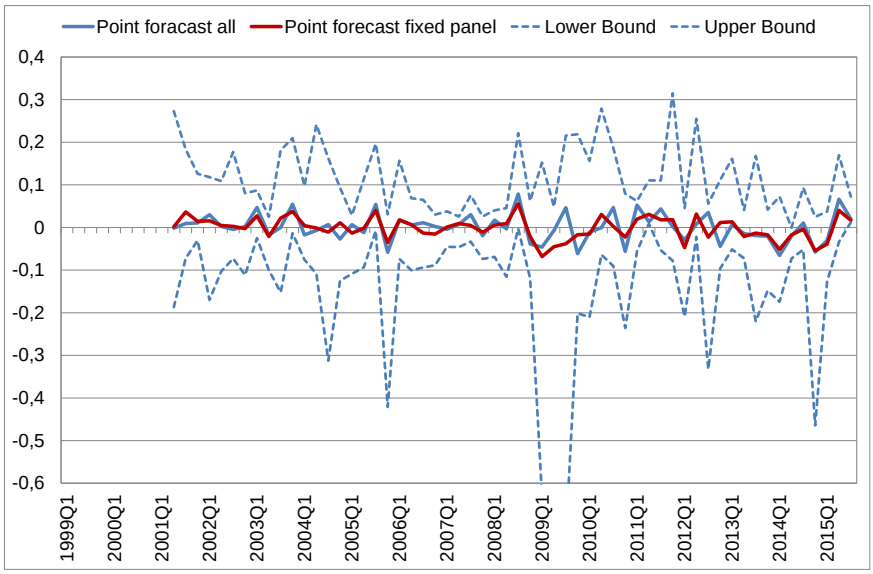
Source: own calculations based on ECB data.

Figure 12 Aggregated forecast revisions for short-term inflation



Source: own calculations based on ECB data.

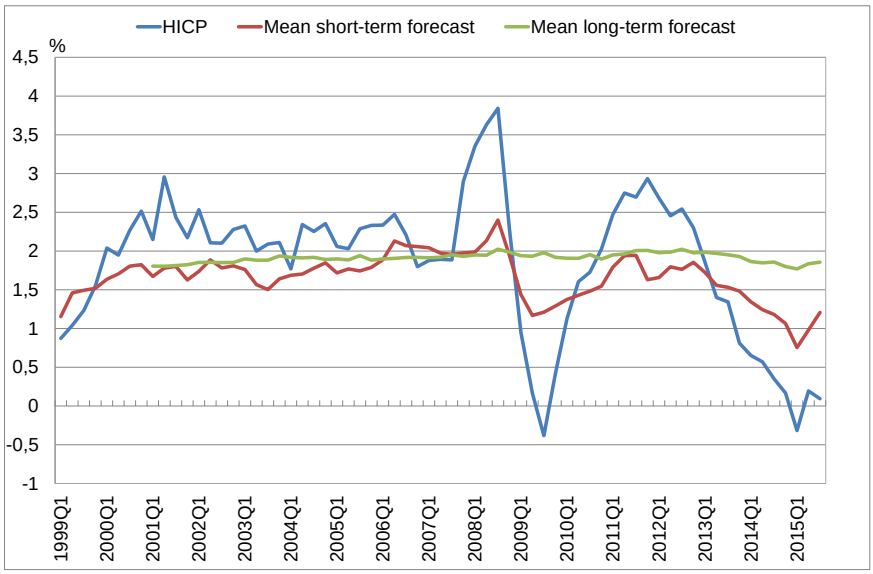
Figure 13. Aggregated forecast revisions for long-term inflation



Source: own calculations based on ECB data.

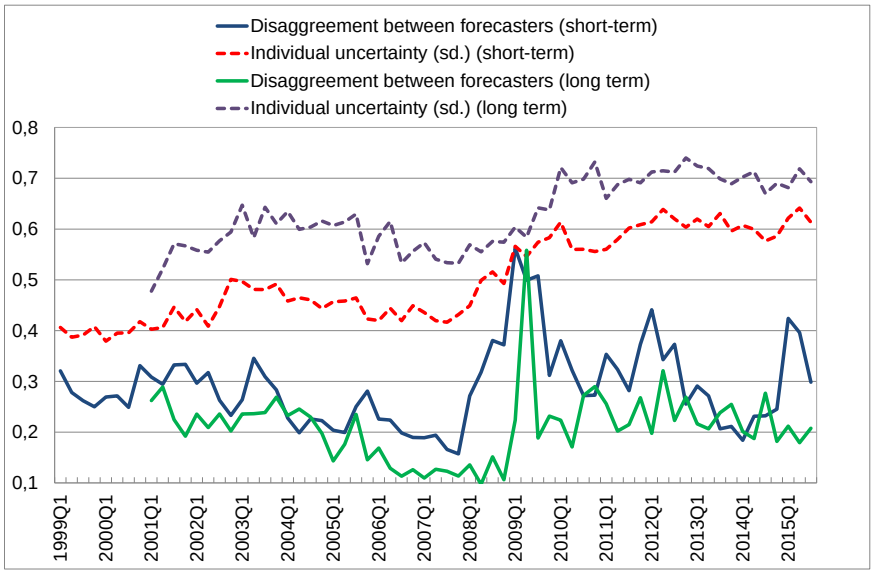
Appendix 1

Figure A1.1 Inflation history and the average inflation forecasts



Source: own calculations based on ECB data.

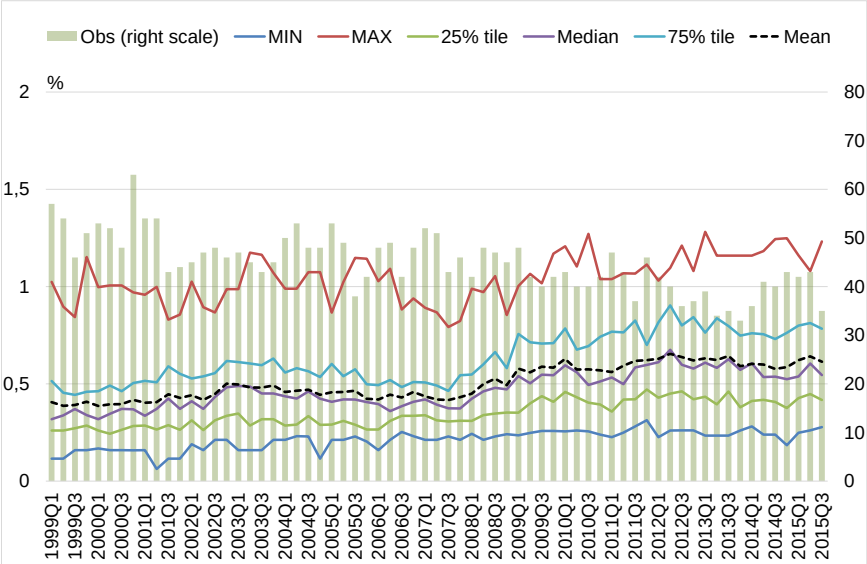
Figure A1.2. Forecast disagreements and the average individual uncertainties



Note: Disagreement refers to standard deviation of point forecasts and individual uncertainty to the average standard deviation of the individual probability distributions.
Source: own calculations based on ECB data.

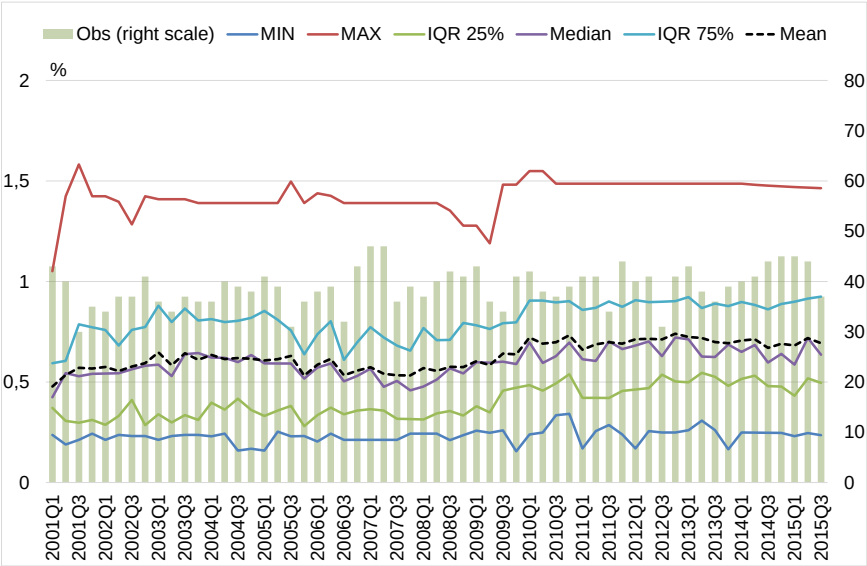
Appendix 2

Figure A2.1. Short-term inflation uncertainty



Source: own calculations based on ECB data.

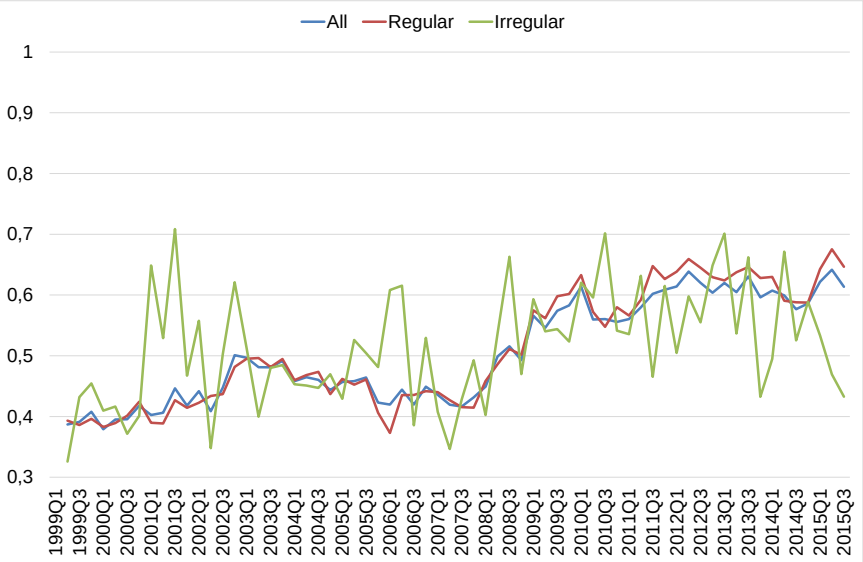
Figure A2.2. Long-term inflation uncertainty



Source: own calculations based on ECB data.

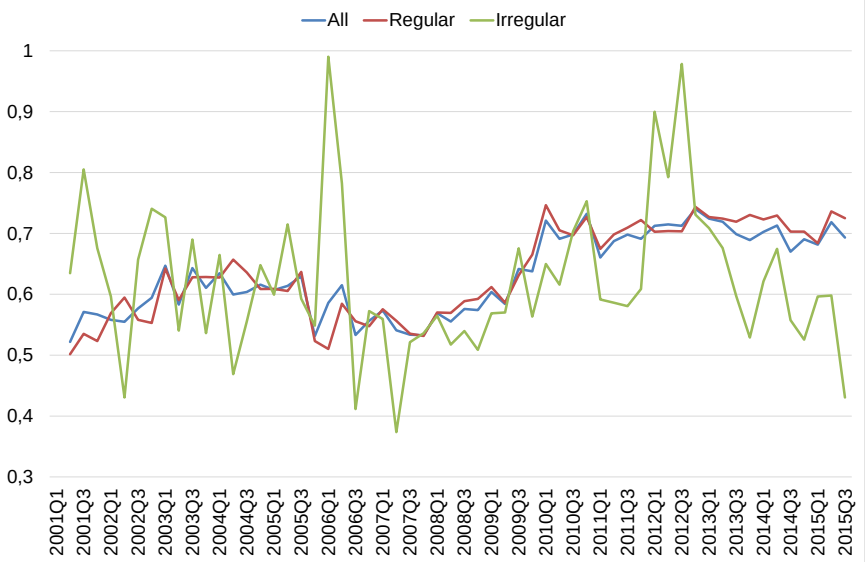
Appendix 3

Figure A3.1. Aggregated short-term inflation uncertainties



Source: own calculations based on ECB data.

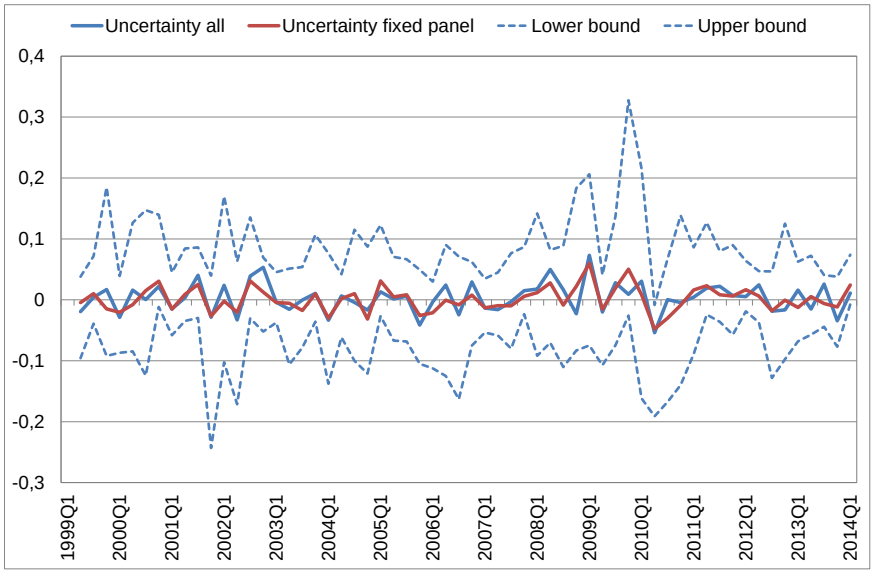
Figure A3.2. Aggregated long-term inflation uncertainties



Source: own calculations based on ECB data.

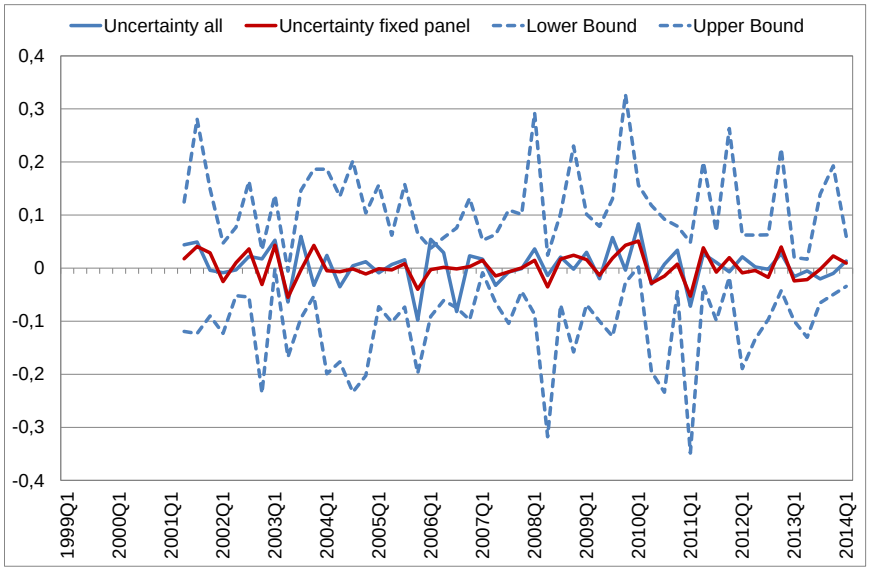
Appendix 4

Figure A4.1. Aggregated forecast revisions for short-term inflation uncertainty



Source: own calculations based on ECB data.

Figure A4.2. Aggregated forecast revisions for long-term inflation uncertainty



Source: own calculations based on ECB data.

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