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The Camp View of Inflation Forecasts

by

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Nr. 320/2009

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December 2009

Abstract

Analyzing sample moments of survey forecasts, we derive disagreement and uncertainty measures for the short- and medium term inflation outlook. The latter provide insights into the development of inflation forecast uncertainty in the context of a changing macroeconomic environment since the beginning of 2008. Motivated by the debate on the role of monetary aggregates and cyclical variables describing a Phillips-curve logic, we develop a macroeconomic indicator spread which is assumed to drive forecasters' judgments. Empirical evidence suggests procyclical dynamics between disagreement *among* forecasters, *individual* forecast uncertainty and the macro-spread. We call this approach the *camp view* of inflation forecasts and show that camps form up whenever the spread widens.

Keywords: monetary policy, survey forecasts, inflation uncertainty, heterogenous beliefs and expectations, monetary aggregates.

JEL classification: E47, E51, E52, E58, E66.

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1 Introduction

Expectations are at the core of monetary economics with monetary policy anticipating future developments and managing market expectations over the stance of the business cycle. In particular, central banks' ability to shape inflation expectations takes center stage for the purpose of providing a nominal anchor and of guaranteeing stable prices (Woodford 2003). Both from an academic and from a policy perspective, it is widely accepted that given the time lags in monetary transmission, expectations provide evidence about the likely future development of economic conditions; they allow monetary policy to react in a forward-looking manner to obtain its political task of price (and output) stability. This holds all the more because expectations can influence current economic outcomes in terms of quantities and prices (ECB 2009b).

For the conduct of monetary policy, measures of expectations can be extracted either from survey forecasts or from financial market data. Thereby, inflation expectations are pivotal instruments which guide interest-rate decisions in board meetings. A jump in inflation expectations might be associated with inflation scares which might call for restrictive monetary policy actions in order to bring expectations down. If the change in expectations represents the majority of forecasters, the signal for monetary policy is clear. If, however, the analysis of inflation forecasts reveals that respondents disagree on their inflation outlook, the mechanical response to the average forecast might even aggravate heterogenous developments within the survey. High volatility in inflation expectations as well as high disagreement among forecasters, thus, can pose great challenges for central banks.

For the US, Leduc et al. (2009) report that disagreement about the future path of inflation has risen substantially since the start of financial turmoil in 2008; similar findings hold for the euro area as documented by Geiger and Sauter (2009). The analysis of surveys reveals that disagreement substantially varies with the forecast horizon. Meanwhile some forecasters expect much lower short-run inflation, others expect much higher long-run

trend inflation. Within this environment, the national central bank has to deal with the conflict of shaping both horizon-dependent inflation forecasts each separately calling for different communication strategies.

Heterogeneity in inflation surveys reflects disagreement and inflation uncertainty. This uncertainty can be associated with *individual* forecast uncertainty and uncertainty *among* forecasters (Giordania and Soederlind 2003). Both measures can be constructed with the help of individual probabilistic distributions of future inflation over different forecast horizons. Though dynamics of inflation uncertainty for the US have been widely discussed in the literature, little evidence can be found for the euro area.

Most importantly, the fact that inflation disagreement and inflation uncertainty change over time raises the question for sources of such dynamics. At an intuitive level, the answer would be to ascribe heterogeneity to different, but correlated information sets as well as to the use of diverging real-time indicators on which survey participants estimate the future path of inflation and other economic variables. Moreover, disagreement might evolve as a reflex of diverging model views about the determination of inflation, in particular, to what extent monetary actions influence consumer price inflation in the short- to medium term. A bulk of research has worked on the driving forces of inflation emphasizing the role of economic indicators and monetary aggregates for inflation determination - the theoretical and empirical evidence is at least ambiguous.[1]

In our paper, we focus on data of the *Survey of Professional Forecasters* (SPF) for the euro area and the US. Our findings provide insights into the evolution of inflation forecast uncertainty in the context of a changing macroeconomic environment since the beginning of 2008. Besides presenting stylized developments of 1-year and 5-year inflation forecasts, the analysis matches disagreement and forecast uncertainty with a changing macroeconomic environment. Against the background of aggravating financial turmoil that agitates economic outlooks, we attribute rising forecast disagreement to heterogeinity within the

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[1]   See Assenmacher-Wesche and Gerlach (2006), Woodford (2008) or McCallum and Nelson (2009) among many other studies.

group of forecasters. In particular, diverging opinions with regard to inflation prospects may stem from a theory-specific weighting of forecast-relevant information. We assign heterogenous beliefs to two different macro-theoretic camps, i.e. the "monetarist camp" and the "Phillips-curve" camp, and develop an indicator spread that mirrors diverging inflation outlooks. We call this approach the *camp view* of inflation forecasts.

The paper is structured as follows: chapter 2 reviews the underlying data set and the applied theoretical measures on heterogeneity. Chapter 3 gives a description of the empirical results for disagreement and uncertainty in survey data. Chapter 4 is dedicated to the camp view of inflation forecasts where rising uncertainty among forecasters is accompanied by decreasing individual uncertainty of forecasters. Finally, chapter 5 concludes.

2   Data Set and Measurement Concepts

In general, inflation expectations can be approximated in two ways: *survey-based* and *financial market-based* measures. Within these two categories, several methods exist that vary with respect to their specific form. For instance, ECB (2006) lists four different surveys for the euro area differing in regard to inquiry frequency, forecast horizon and survey participants as well as two financial market-based measures.

Although surveys deliver *direct* information on inflation expectations compared to financial market data, they have several shortcomings. As mentioned by Giordania and Soederlind (2003) and Croushore (1993), there is no guarantee that the respondents give their *best* estimate. One could also think of *tactical games* or the fear of consequences leading to biased and exaggerated answers. This source of error is tried to be reduced by making the publication of the survey anonymous. Hence, this anonymity reduces the risk of "wrong" forecasts and encourages the respondent to report what she really believes. On the other hand, she can not be held accountable for her predictions eventually leading to less precise forecasts. Due to the low survey frequency ranging from monthly up to

biannually reports, they can not reflect behavioral changes properly. To this end, they suffer from well known problems with the design of questionnaires (Galati et al. 2009).

Inflation expectations derived from financial data are predominantly based on information given by the performance of *inflation-linked bonds* and *swap-rates*. As these data are available in high frequency, changes in behavior can be examined quite well. But those bonds tend to overestimate inflationary risks due to several additional risk-premia and underestimate them because of an inherent liquidity premium. In addition, institutional and technical issues arise, e.g. due to thin markets or tax distortions (ECB 2006).[2]

For our work we use survey data of the euro area and the US. The *European Survey of Professional Forecasters* is provided by the ECB.[3] It was established in early 1999 in order to collect information of private sector forecasts on macroeconomic expectations and captures expectations of HCPI as well as the expected rate of real GDP growth. Within this survey, inflation expectations play a key role in signaling future risk to price stability and provide information how market participants gauge these risks. The data set contains point estimates for different time horizons reaching from the current year to a five-year horizon depending on the evaluation date and is based on a quarterly questionnaire taking place in the first month of the respective quarter, answered by experts affiliated with financial and non-financial institutions rooted within the euro area.

Within the survey, the section of inflation expectations provides point estimates as well as range estimates for different time horizons reaching from the current year to a five-year horizon depending on the evaluation date. Due to the possibility of each participant to provide a precise subjective probability distribution about her forecasts we can also approximate individual uncertainty concerning point estimates (Garcia 2003; Söderlind 2008).

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[2] An extensive analysis on the information content of interest rates is given in ECB (2000).

[3] It is available for mean data on their web page www.ecb.int. We thank the Survey of Professional Forecasters team for kindly providing us the individual data set; the latter being available on request directly from the ECB.

For US data, we base our analysis on the *Survey of Professional Forecasters* as it is provided by the Federal Reserve Bank of Philadelphia.[4] This survey, founded in 1968 by the American Statistical Association and the National Bureau of Economic Research, captures, analogous to the European survey, inflation expectations on different time horizons; unfortunately, long-term expectations (five-year ahead) are provided only since 2005.

Table (1) summarizes the design of our underlying survey data set as it is collected by the ECB. This representation will be useful to illustrate the single steps for constructing different uncertainty measures.

Table 1: Quarterly forecast setup

i	v_i	s_1	s_2	$\ldots$	s_m
1	v_1	p_{11}	p_{12}	$\ldots$	p_{1m}
2	v_2	p_{21}	p_{22}	$\ldots$	p_{2m}
$\ldots$	$\ldots$	$\ldots$	$\ldots$	p_{ij}	$\ldots$
n	v_n	p_{n1}	p_{n2}	$\ldots$	p_{nm}

The first column lists the respondents i ranging from 1 to n. The setup of the survey is divided into two parts: *direct point-forecasts* v_i and individual probability judgments p_{ij}. The former do not contain probabilistic information regarding alternative future outcomes whereas the latter explicitly do. Variable s_j represents midpoints of the proposed inflation-ranges or states within the survey (the number of intervals j ranging from 1 to m)[5]. Each row, beginning with s_1, corresponds to the *empirical distribution of the individual probability judgments* p_{ij} given by forecaster i. Provided consistent forecast judgments, point forecasts should approximately equal the *individually expected value of future inflation* μ_i given by

$$\mu_i = \sum_{j=1}^{m} s_j p_{ij} \approx v_i. \tag{1}$$

As noted in Giordania and Soederlind (2003), typically three ways of representing the data are common: (i) median point forecasts, (ii) dispersion of individual forecasts and (iii) aggregate histograms. While median point forecasts ($m_{0.5}$) as well as the upper and lower quartile ($m_{0.75}$, $m_{0.25}$) are calculated appropriately, *disagreement* (*dis*) among forecasters can be approximated by the *dispersion of individually expected inflation* (Giordania and Soederlind 2003; D'Amico and Orphanides 2008). Therefore, equation (2) provides the standard deviation in each quarter.[6]

$$dis = \sqrt{1/n \sum_{i=1}^{n} (v_i - \overline{v})^2} \qquad (2)$$

Because a high standard deviation signals strong disagreement *among* forecasters[7] we will further refer to this as *dis*. Aggregated histograms (as shown later) are made up of the information derived by previous techniques and give a comprehensive picture.

Hitherto, measures are extracted out of point forecasts v_i. If the additional information, given by the individual probabilistic estimates p_{ij} is taken into account, further proxies of forecast uncertainty can be computed.

Following Giordania and Soederlind (2003) and D'Amico and Orphanides (2008), firstly, we want to capture the (un)certainty of how *individual* forecasters judge inflation scenarios. Technically speaking, this addresses the way probability mass will be assigned to different columns s_j. We will call this *average (individual) forecast uncertainty (afu)*. In general we assume that a forecaster will distribute probability mass more uniform if she is less convinced (faces a higher degree of uncertainty) about a specific state. The *dispersion of future states* assigned by a single forecaster can be estimated by the *individual forecast uncertainty*

$$ifu_i = \sqrt{\sum_{j=1}^{m} (s_j - \mu_i)^2 p_{ij}}. \qquad (3)$$

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6   Here, variable $\overline{v}$ represents the mean point forecast in each quarter.
7   This is because of the dispersion of individual forecasts around the expected value, which takes all estimates into account.

Equation (3) captures the deviation of the midpoint s_j from the point estimate of each participant μ_i, multiplied by the probability p_{ij} given to the state by the respective participant.

To summarize the overall evolution of forecasters' uncertainty regarding their individual scenario choices within each quarter, we average the individual dispersions to get the *average individual forecast uncertainty*

$$afu = 1/n \sum_{i=1}^{n} ifu_i$$
$$= 1/n \sum_{i=1}^{n} \sqrt{\sum_{j=1}^{m} (s_j - \mu_i)^2 p_{ij}} \tag{4}$$

Secondly, we approximate *average state uncertainty* (*asu*) by equation (7) which is derived as follows. Each quarter the averaged probability p_j assessed to a future state s_j is given by

$$p_j = 1/n \sum_{i=1}^{n} p_{ij}. \tag{5}$$

Weighting midpoints s_j with aggregated state probabilities p_j results in the overall aggregated forecast value

$$E_s = \sum_{j=1}^{m} s_j p_j \approx \overline{v}. \tag{6}$$

Equation (6) gives the expected (point) inflation forecast of all participants. The standard deviation of the aggregated expected values of state outcomes *asu* indicates the dispersion of the single state outcomes and can be interpreted as a useful proxy of inflation forecast uncertainty

$$asu = \sqrt{\sum_{j=1}^{m} (s_j - E_s)^2 p_j}. \tag{7}$$

3 Forecast Disagreement and Inflation Uncertainty

3.1 Point Forecasts of the Inflation Outlook

Figure (1) plots basic descriptive statistics on *one-year ahead inflation expectations* for the euro area and the US beginning in 1999. It reports the median and mean point forecasts as well as the upper and lower quartile calculated from the individual responses of the survey. Since 1999, euro area short-term inflation expectations have fluctuated in the bandwidth of 1.2 % to 2.4%. A slight upward trend can be documented beginning in the second quarter of 2006 and peaking in the second quarter of 2008 against the background of rallying commodity and food prices on a global level. With the financial crisis feeding into goods markets, the short-term inflation outlook adjusted to a below 1%-level and the latest available data confirm the overall assessment of low expected annualized inflation for the upcoming year. As regards a first crude look on survey dispersion, the upper and lower quartile are plotted against the respective survey dates. With the exception of the point forecasts for the third quarter 2009, there is no trend of a widening or a shrinking gap of point forecast responses. Only the latest results of the questionnaire reflect a heightened amount of disagreement concerning the future short-term inflation outlook. Indeed, Geiger and Sauter (2009) show that the spread between the maximum and minimum forecasts has soared with the maximum forecasts not outperforming the upper ceiling of previous projections; meanwhile the minimum forecasts are on a historical low including deflationary expectations.

US one-year ahead inflation expectations are considerably stable over the sample period. Median point forecasts range between 1.7% and 2.6% with dips in the first quarter 2004 and the second quarter 2009. The former can be attributed to the debate about deflationary scares in 2003 (Bernanke 2003); the latter event mirrors the same reflex in the euro area, i.e. the real effects of the financial crisis transmitting to goods- and labor markets. In contrast to the findings for the euro area, the distance of the upper and lower quartile is much wider, in particular for the latest quarter in 2009. Still, the mean and

median point estimates do not show signs of a sharp drop as is the case for the consumer price index in the euro area. However, short-term expectations are likewise characterized by a high max-min spread where increased disagreement about the outlook reflects the fact that some forecasters are predicting much lower inflation than before the financial crisis.[8]

Recent developments of *long-term inflation expectations* are displayed in figure (2). In the euro area, the 5-year outlook of inflation has been fluctuating between 1.8% and 2% from 2001 to 2009 and has converged to the officially announced inflation target of maintaining inflation rates below, but close to 2% over the medium term. The upper quartile has been generally stable at 2% with the exception of a small increase in the third quarter of the year 2008. This outcome can be interpreted as a success of the ECB in communicating its explicit inflation target to the public. The lower quartile supports this view since it has progressively adjusted from a low of 1.5% to 1.9% since mid 2006.

Compared to findings of the US, long-term inflation expectations tend to exhibit both a lower level and less volatility across the sample period (note the scaling of the vertical axis for the US in relation to the euro area). The survey measure fluctuates between 2.0% and 2.8% where expectations have rapidly fallen during the financial crisis. The upper quartile has risen in the third quarter 2009, whereas the lower quartile is still below 1.8% which indicates a remarkable disagreement among respondents about the long-term inflation outlook.

We now turn to evidence about the *degree of consensus in beliefs* about inflation dynamics in the short-term and medium-term future. We illustrate disagreement about inflation expectations with two measures, i.e. the standard deviation of point estimates of the respondents and the inter-quartile range of the ranked survey set for a particular survey date. In regard to short-term inflation expectations, the upper left graph of figure (3)

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[8]   See Geiger and Sauter (2009) or Leduc et al. (2009). The latter authors do not calculate max-min spreads, but report evidence about the averages of the highest and lowest quartiles of the forecasts; they come to the same conclusion that the increased disagreement is owed to a bias towards lower expected inflation rather than higher expected inflation.

Figure 1: Short-Term Inflation Expectations in the Euro Area and the USA

1-year Inflation Expectations Euro Area

1-year Inflation Expectations USA
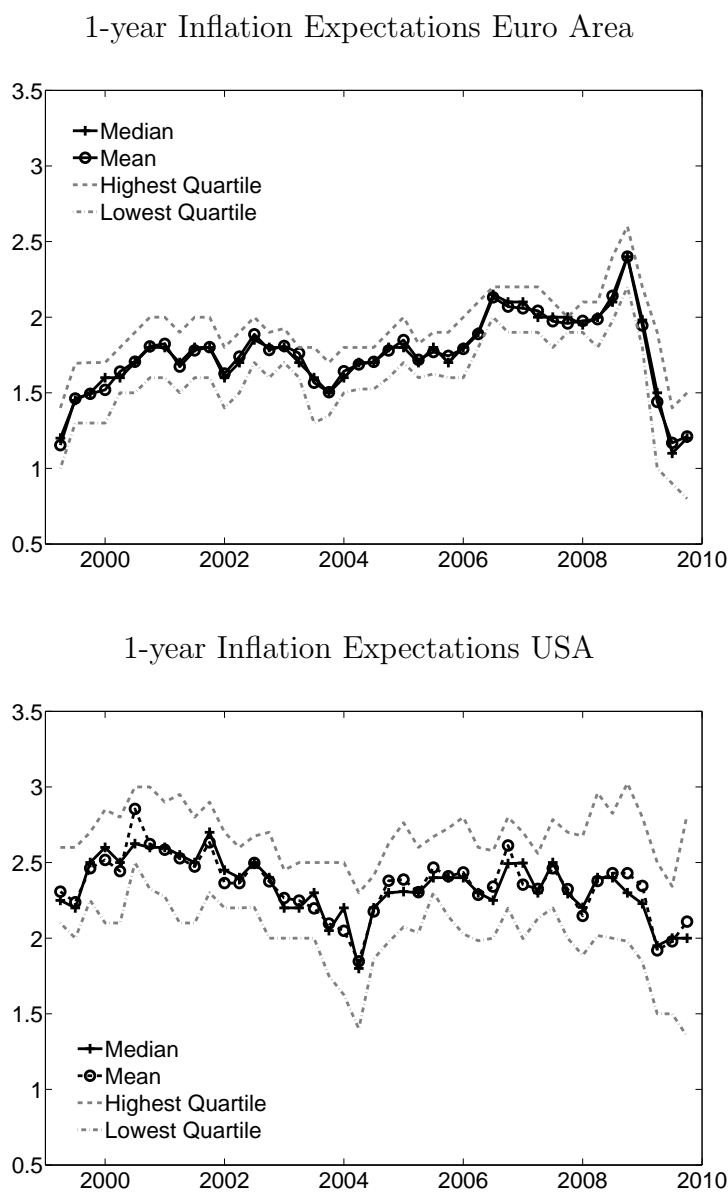
shows the first measure for individual point forecasts. Eye-catching is that disagreement is more distinct for the US than for the euro area across the entire sample. Moreover, for both regions, the dispersion measure more than doubled, as distortions on financial markets sent its first waves on goods- and labour markets in 2007/08. The difference of disagreement between the two surveys is less pronounced when plotting the inter-quartile range (IQR) against the survey dates in the upper right graph. Still, we can observe a

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Figure 2: Long-Term Inflation Expectations in the Euro Area and the US

5-year Inflation Expectations - euro area

5-year Inflation Expectations - US
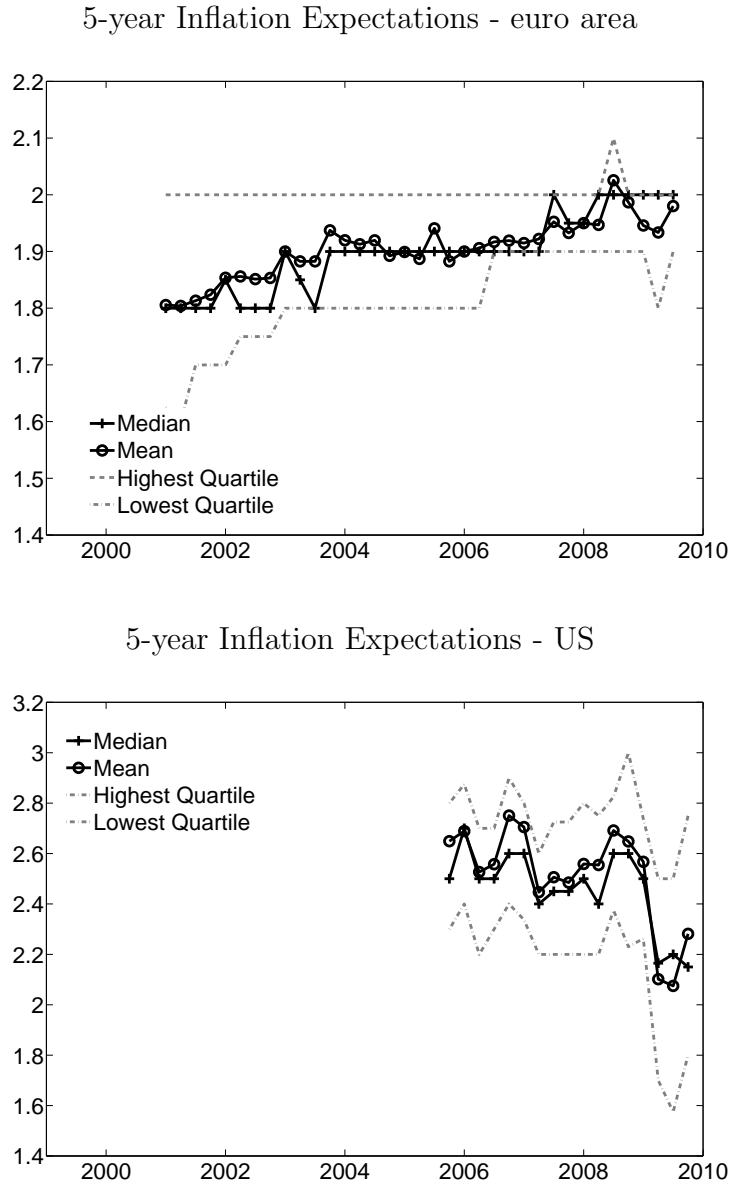
clear upward trend for both IQRs starting in 2007 for the US and in 2008 for the euro area.

Dispersion of 5-year point forecasts as measured by its standard deviation follows a similar pattern as its 1-year counterpart, albeit the latest available survey hints to rather stabilizing developments. In terms of the corresponding IQRs, the data for the US point to ongoing disagreement about long-term inflation expectations with a peak in the third

quarter 2009. The opposite holds for the euro-area survey according to which there is a clear consensus emerging between professional forecasters; form 2001 onwards, its IQR has steadily fallen and reached a low value of 0.1% on average.

Figure 3: Dispersion Measures of Inflation Expectations

Standard Deviation 1-year forecast

Inter-Quartile Range 1-year forecast

Standard Deviation 5-year forecast

Inter-Quartile Range 5-year forecast
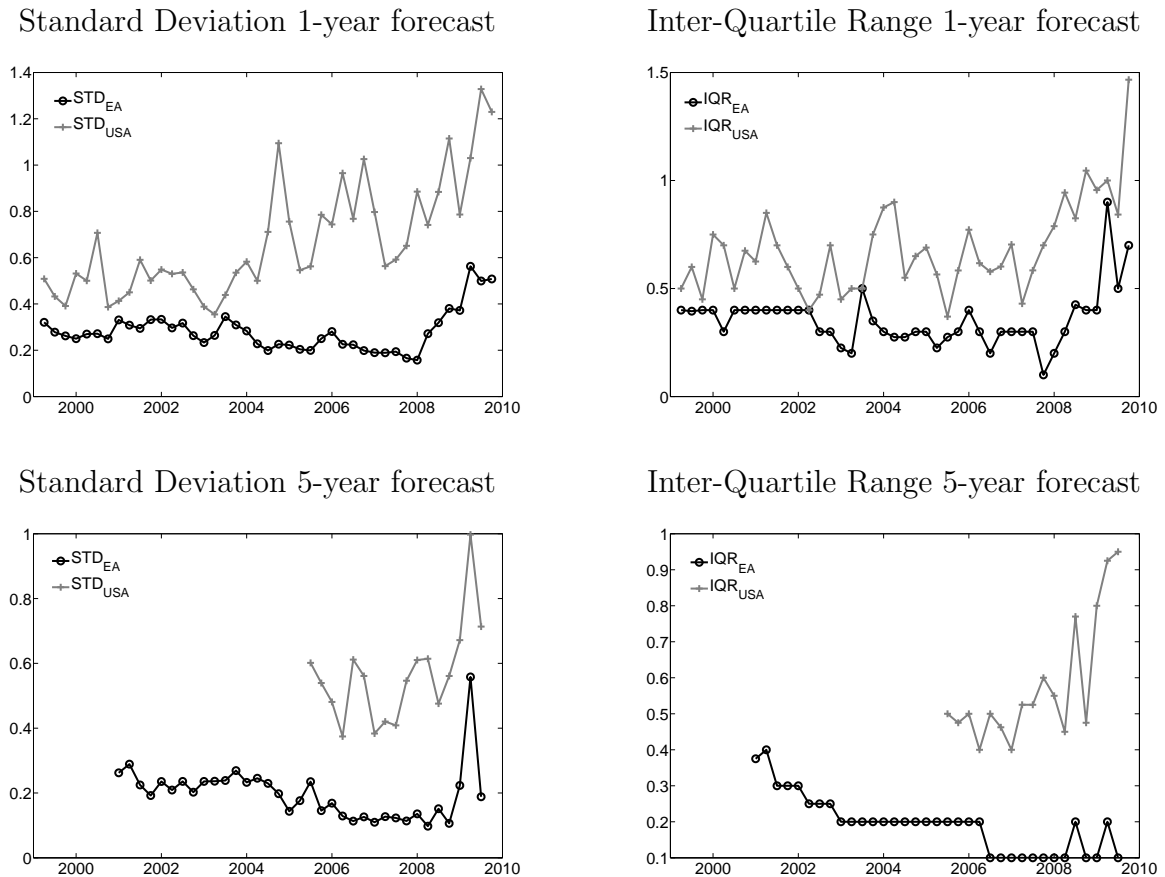
Figure (4) provides a stylized illustration that matches the information of a changing mean and the underlying evolution of disagreement.[9] Against this background, the approximated theoretical normal distributions are plotted for the last four quarters of available surveys. Again, the upper part displays results for one-year ahead estimates and the lower graphs belong to the 5-year counterparts.

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[9] The basic idea is to augment the outcomes of the point forecasts to a "sufficient" large number of respondents by assuming a normal distribution for the point forecasts with given mean and standard deviation. This strategy of simplification allows to draw joint implications for average inflation expectations and its dispersion for particular survey dates.

The stylized probability density functions for the one-year point forecasts reflect the observations of figure (1) with a high variability of the mean response for the euro area. For instance, the bell for the fourth quarter 2008 indicates a mean response of 2% points for annualized inflation with a standard deviation of 0.4. Over time, these estimates have changed by switching to a mean of roughly 1.2% and a standard deviation of 0.5. The widening of the bell can also be documented for the US but the mean forecasts remain rather stable.

Turning to long-term inflation expectations for the euro area, the probability mass centers around the mean of the inflation forecasts. An exception is the second quarter of 2009 where disagreement has manifested itself by a high dispersion. For the US, the location of the approximated density functions varies with a tendency of increasing bells for the latest surveys (note again the different scaling of the figures for both countries).

In sum, the descriptive analysis of point forecasts confirms previous studies with different survey sources and sample periods whereby long-term inflation expectations are more firmly anchored in the euro area than in the US.[10] Although, since the start of EMU in 1999, the participating countries have been hit by a number of consumer price shocks in both directions, it appears that 5-year point expectations are broadly consistent with the numerical inflation target by the ECB. This evidence is supported by the fact that expectations are marginally altered by short-term changes in inflation expectations as documented in figure (1) so that there is no clear relationship between movements in short-term and longer-term inflation expectations (ECB 2009b). Short-term deviations are mainly driven by the business cycle stance and do not alter the long-term inflation outlook. Along similar lines, macroeconomic releases about latest consumer price data or about goods- and labor market indicators have no significant impact on long-term inflation expectations extracted from financial-market based measures - the opposite holds for the US (Gürkaynak et al. 2005; Ehrmann et al. 2007). US long-term treasury securities significantly react to a variety of macroeconomic and monetary policy surprises which

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[10]   Anchoring evidence can be found in Castelnuovo et al. (2003); Beechey et al. (2008).

Figure 4: Theoretical Normal Distribution of Point Forecasts

1-year Point distribution euro area

1-year point distribution US

5-year point distribution euro area

5-year point distribution US
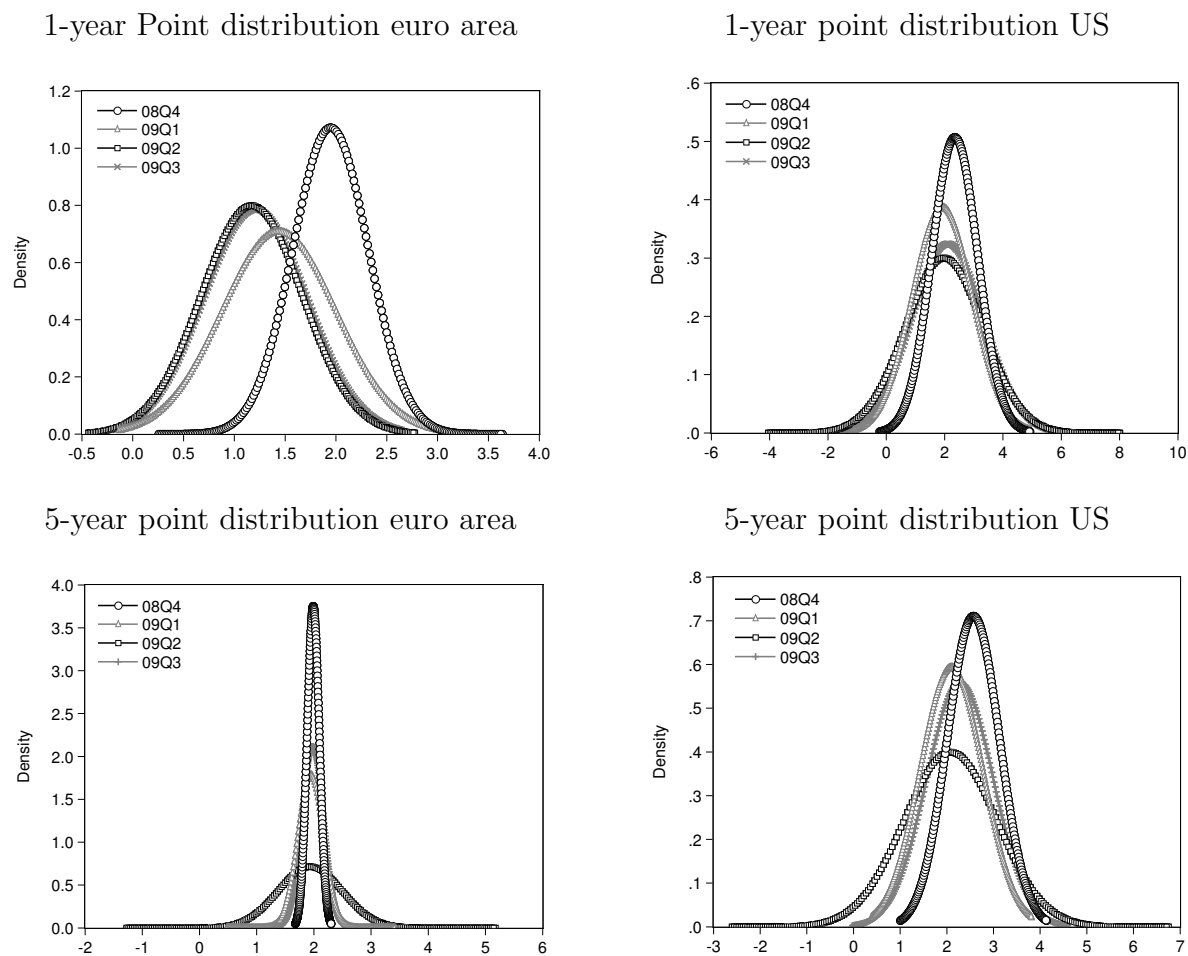
may reflect changing views on part of market participants about long-term inflation in the absence of a communicated numerical inflation target by the FED.

So far, we have analyzed the responds of point forecasts of the inflation outlook for the euro area and the US. In what follows, we concentrate on the individual probability distributions (histograms) for the euro area. For the US, individual data of the survey of consumer price inflation only start at 2005, so that statements about individual dispersion and uncertainty are rather limited. Previous work on US forecast uncertainty has taken GDP deflator inflation as object of investigation and evidence can be found in Giordania and Soederlind (2003) and Söderlind (2009). In order to avoid a possible bias due to different inflation measures, we do not use the US GDP deflator data set. Instead, the

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focus in the preceding section is on the euro area exclusively, in particular, because to our best knowledge we could not find any work that has applied a rigorous analysis of individual histograms for the euro area.

3.2 Heterogeneity and Inflation Uncertainty in Individual Survey Forecasts

This section compares the two measures of inflation uncertainty derived from the individual distributions and the disagreement measure extracted from the point forecasts. The aim is to study how the variables have evolved over the sample period. As documented in figure (5), our state uncertainty measure asu is represented by the grey line and the average individual uncertainty proxy afu by the black line. Starting with the 1-year horizon, the time series of inflation uncertainty asu can be characterized as a stable process until the end of 2007 - with a small significant hump in 2003/04. It has fluctuated between 0.2 and 0.4 % before it has sky-rocked to a sharp increase in 2008. Average individual inflation uncertainty (afu) as well as disagreement (dis) derived from the point forecasts co-move with overall state uncertainty indicating a high correlation between the three variables.[11]

When inspecting 5-year inflation uncertainty, the time series are smoother compared to their 1-year horizon counterparts which represents the conventional view that long-term inflation expectations should be more anchored compared to short-run fluctuations (see the different scaling of axis). Such observation should manifest in lower uncertainty among forecasters. In addition, we can document a small downward trend in inflation uncertainty starting in 2004. This may stem from an enhanced ECB monetary policy strategy with its clarification of price stability.[12]   Again, the uncertainty measures are

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[11]   A comparison of survey forecast uncertainty with financial-based measures of inflation risk premia confirms recent dynamics (ECB 2009a). Volatility of break-even forward inflation rates has soared during the same period in which forecast uncertainty has increased though the findings might have been distorted by technical and liquidity factors.

[12]   Typically, one would expect a positive correlation between inflation uncertainty and the level of inflation expectations (Evans and Wachtel 1993).

strongly positively correlated so that an increase in uncertainty *among* forecasters is associated with an increase in *individual* uncertainty.

Figure 5: Disagreement (*dis*) and forecast uncertainty (*afu, asu*), euro area

1-year forecasts, *dis* right axis   5-year forecasts, *dis* right axis
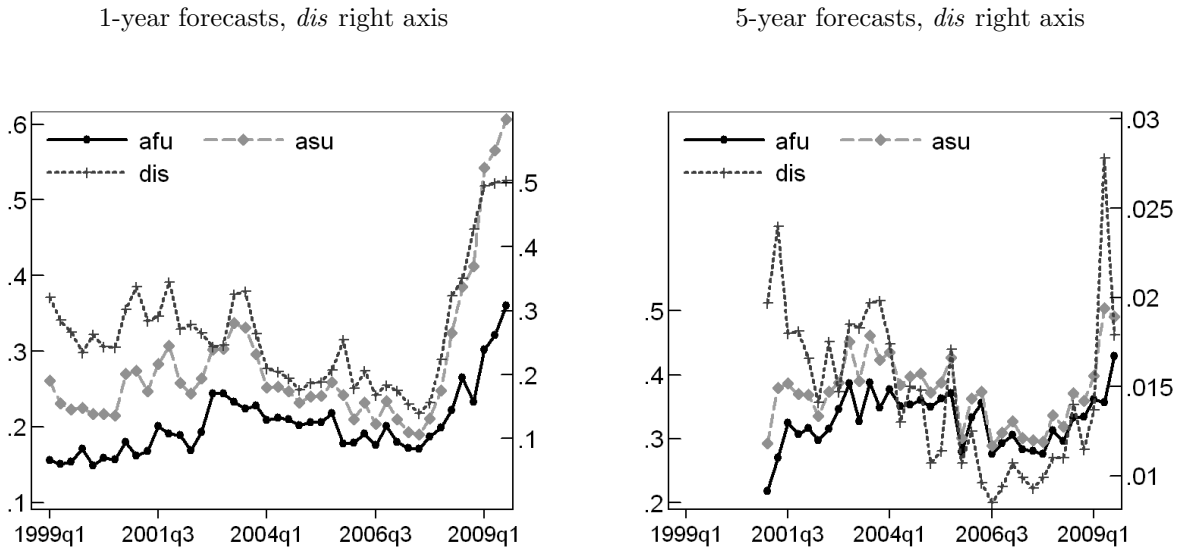
As can be seen, forecast uncertainty shows a significant jump since 2007:Q4 for both survey horizons. This means averaged probability assignments p_{ij} regarding different states s_j have been increasingly varying ever since documenting a rising overall (state) uncertainty (*asu*) with regard to inflation prospects. The latter is highly correlated with the disagreement measure (*dis*) derived from point forecasts ($\rho = 0.90$ for 1-year forecasts and $\rho = 0.70$ for 5-year forecasts).[13]

Average individual forecast uncertainty (*afu*), in turn, increases sharply since 2008:Q2 indicating a distribution of individual probability mass p_i that has become much more wider on average - in other words, has concentrated on more states s_j - compared to the time span before. This fact documents that forecasters have lost confidence in their individual judgements. At the same time disagreement among forecasters has risen.

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[13]   Due to their construction, these indicators show a narrow pro-cyclical co-movement (see also Giordania and Soederlind 2003).

One possible explanation attempt could be that one might think of diverging opinions in regard to the future evolution of inflation. Such views may be attributed to different theoretical perspectives about how inflation is determined. The proportion of forecasters sticking to a specified model view may change over the course of the business cycle depending on the diffusion of information, in particular on the validity of indicators to produce small forecast errors for future inflation. In what follows, we provide a systematization of empirical results on inflation uncertainty and we try to link them to the ongoing debate about the indicator role of monetary and business cycle variables for future inflation.

4   Forming up the "Camps"

What predominantly strikes us is the enormous increase of individual forecast uncertainty (*afu*) since 2008:Q2 for both forecasting maturities as well as the hike for the evolution of disagreement (*dis*) and state uncertainty (*asu*). Matching the types of indicators suggests that the financial crisis aggravates forecast uncertainty. A plausible explanation for this finding might be the existence of diverging opinions with respect to the future evolution of inflation due to opposing model views of inflation determination.

It might reflect different groups of forecasters within the survey that contrast in regard to their theoretical conviction. Different judgements might be based on individual forecasters' theoretical heritage due to their education and their affiliation to scientific camps. Alternatively, the *camp view* can be interpreted in a more pragmatic way mirroring simply the forecasting power of macro-based indicators for future inflation. Stronger signals from the macroeconomic environment may favor a scope of decisions where high uncertainty about the medium-term outlook pushes forecasters to take a firm stand in terms of a model view though individual uncertainty may still be eminent. Such an interpretation implies that forecasters shift their mean estimates within the probability space either to the right or the left but allocate the probability mass to a wider range of states.

Since 2008:Q3, the dispersion of inflation scenarios might have been amplified by the divergence of macroeconomic key indicators that play a central role within specific theoretical interpretations. Meanwhile monetary figures such as the annualized growth of the monetary aggregate M1 experience double digit growth, indicators that mirror business cycle conditions show weak tendencies of a re-bounding economy.

According to the setup of the survey in table (1), figure (6) illustrates the camp view by contrasting two basic concepts of inflation determination. The first view sticks to monetarist beliefs where survey participants build inflation expectations by observing monetary developments. The second camp (PC) derives inflation judgements from a Phillips-curve based logic of inflation determination where inflation expectations are driven by the outlook of real cyclical activity. The representation implies (i) a vertical ranking of forecasters i in regard to their individual theoretical preferences that might reflect their voting and (ii) the PC-group is supposed to assign significantly more probability mass to states s_j that correspond to comparably low future inflation.

Figure 6: Survey Setups and Macro Camps
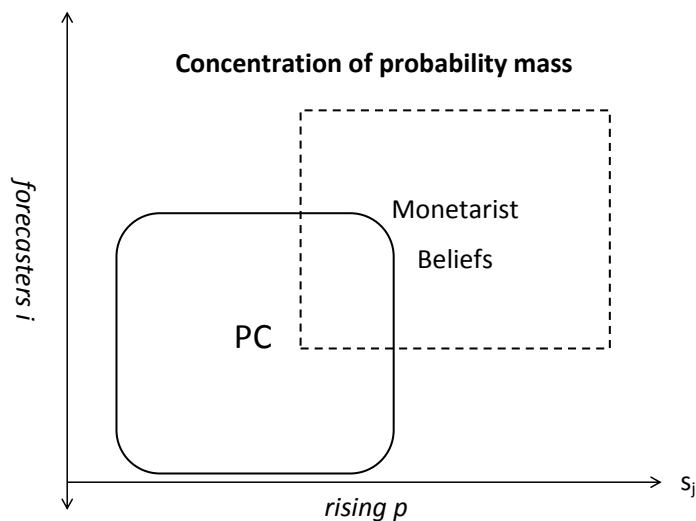
In view of the strong distortions most economies have been hit by since 2008 and the different inflation prospects that have been discussed in the aftermath - reaching

from deflation scares to (hyper-) inflation scenarios - the camp view offers an explanation to the enormous rise in forecast disagreement.[14] While one would expect forecasters that predominantly base their survey-judgements on monetary indicators to support a significant rise in inflation as a medium-term scenario due to extremely expansionary monetary policy and huge fiscal stimulus in many countries, economists focussing on production gaps should tend to anticipate low inflation or - considering the fact of the tremendous global downturn in demand - even tend to vote in favor of deflationary scares.

This interpretation is in line with our empirical results presented above. As illustrated in figure (1), short-term prospects from 2008:Q3 onwards might have been dominated by severe recessionary judgements. Rising inflation disagreement (figure 3) and increasing averaged state uncertainty (figure 5) account for a significant number of forecasters who favor relatively higher expectations. Such a judgement could be justified by medium-term inflation fears and support the assumption of (co-) existing monetary beliefs within the pool of respondents of the *Survey of Professional Forecasters*.

However, our assumptions not only seem to match the developments within the timespan from 2008:1 onwards. As will be illustrated, the data provide further empirical evidence for the basic statements of the camp view over the whole observation period. Within corresponding regression analyses we notice that all signs of the estimated coefficients are consistent with our theoretical considerations.

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[14]   The debate about inflation vs. deflation is (still) on the top agenda of both the financial press and research academia. The main discourse about likely outcomes concentrates on the question whether central banks are willing to withdraw the liquidity they provided in the aftermath of the Lehman Brothers collapse with the scope of stabilizing inter-banking markets. Various 'exit' strategies have been communicated by major monetary authorities in order to guide market participants over the medium-term. ECB president J.-C. Trichet (2009) recently remarked that "[t]he exit strategy, in the end, will need to be invoked at the precise time in which the traditional link between broad money and our provision of liquidity to the banking system will re-establish itself. This calls for a constant and careful monitoring of the conditions at which the Eurosystem supplies central bank credit to banks in view of the evolution of the economy and of markets expectations." Moreover, deficit-driven actions of national fiscal authorities to stimulate effective demand through expenditure programs resemble a huge fiscal stimulus. Some observers call for heightened alertness in terms of central bank independence (Meltzer 2009). Any move on part of central banks to initiate increasing interest rates could provoke the danger of political pressure once increasing interest-rate burdens would constrain the room of future fiscal maneuver.

In order to highlight the mechanism that we suppose to be the major force driving forecast dispersion and uncertainty, we focus on the evolution of macroeconomic aggregates that serve as fundamental indicators for the creation of camp-specific inflation expectations. For this purpose we approximate a spread of macroeconomic signals by

$$isprd_t = ln(M1_t/Y_t) \ - \ y_t^{GAP}. \tag{8}$$

The information reflected by monetary growth relative to the growth of real GDP $ln(M1_t/Y_t)$ on the one hand and the output gap y_t^{GAP} on the other hand is supposed to capture the degree of divergence with regard to the macroeconomic environment from which inflation forecasts evolve.[15]

Explorative regression analysis and the checking of fitted residuals, further supported by formal test evidence, indicate that our time series dis_t, afu_t, asu_t and $isprd_t$ are integrated of order 1. Table (5) in the appendix reports the results of the corresponding unit root tests. We complement the findings of an Augmented Dickey-Fuller-Test (ADF) and a Phillips-Perron-Test (PP) by the results of a Dickey-Fuller Generalized Least Squares analysis (DFGLS, see Elliott et al. (1996)). Note that the results of ADF and PP are not perfectly in line with the DFGLS outcomes. Due to its better performance within small samples we base our analysis on the DFGLS-results and continue by taking first differences (FD) to estimate the relationships via Ordinary Least Squares. In order to improve the model fit we consider additional lags of dependent variables. The absence of serial correlation of the disturbances is checked by a Breusch-Godfrey test. Additional reference regressions based on a Prais-Winsten correction as well as white-noise analysis of the OLS-residuals confirm our findings.

Table (2) summarizes our estimation results for the 1-year forecast data of the euro area. The regression of disagreement Δdis_t on the spread of macro indicators $\Delta isprd_t$ yields a positive sign which is significant on the 5-percent level. Regressing Δafu_t and

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[15]   Data are taken from the ECB and OECD Economic Outlook.

Δasu_t on $\Delta isprd_t$ documents positive coefficient estimates that are significant on the 1-percent level.

Table 2: Regression results: 1-year Forecasts, euro area

1999:1-2009:3	FD: $\Delta dis_t = .609^{**} \Delta isprd_t$	se (.231)
1999:1-2009:3	FD: $\Delta afu_t = .285^{***} \Delta isprd_t$	se (.127)
1999:1-2009:3	FD: $\Delta asu_t = .725^{***} \Delta isprd_t$	se (.179)

Levels of significance: $*** 1\%$ $** 5\%$ $* 10\%$

Table (3) illustrates the corresponding results for the 5-year forecasts of the euro area. The regression of Δdis_t on the quarterly change of the macrospread ($\Delta isprd_t$) indicates a procyclical co-variation that is reported statistically significant on the 5-percent level. The corresponding regressions of Δafu_t and Δafu_t also yield positive coefficient estimates that are significant on the 1-percent and 5-percent levels.[16]

Table 3: Regression results: 5-year Forecasts, euro area

2001:1-2009:3	FD: $\Delta dis_t = .047^{**} \Delta isprd_t$	se (.023)
2001:1-2009:3	FD: $\Delta afu_t = .543^{**} \Delta isprd_t$	se (.193)
2001:1-2009:3	FD: $\Delta asu_t = .681^{***} \Delta isprd_t$	se (.163)

Levels of significance: $*** 1\%$ $** 5\%$ $* 10\%$

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[16]   The regressions of Δdis_t and Δafu_t on $\Delta isprd_t$ include 2 additional lags of the dependent variables. The regression of Δasu_t on $\Delta isprd_t$ includes 1 additional dependent lag and requires a Newey-West correction for serial correlation of 2 lags.

Finally, table (4) illustrates the regression outcomes for 1-year forecast disagreement and the macro-spread within the US. Here we also report a positive coefficient estimate that is significant on the 5-percent level.[17]

Table 4: Regression results: 1-year Forecast, US

1999:2-2009:2	FD: $\Delta dis_t = .659^{**} \Delta isprd_t$ se $(.307)$

Levels of significance: $***\,1\%$ $**\,5\%$ $*\,10\%$

All in all, we conclude that (i) within both areas changes in disagreement among forecasters co-vary significantly with the stylized macroeconomic divergence in a procyclical manner. Moreover, we notice (ii) that for the euro area the quarterly changes of the macrospread is also positively connected to forecast uncertainty. As the quality of the pattern holds for the whole observation period the data support our camp view interpretation of inflation forecast dispersion.

5 Conclusion

Motivated by the debate on the role of monetary aggregates and cyclical variables describing a Phillips-curve logic we analyze disagreement and uncertainty of inflation expectations derived from survey forecasts for the euro area and the US. We find increasing disagreement for the 1-year and 5-year horizon where long-term expectations are more anchored in the euro area than in the US.

Against the background of aggravating financial turmoil that agitates economic outlooks, we attribute the extraordinary rise in disagreement to heterogeneity within the group of forecasters. In particular, diverging opinions with regard to inflation forecasts

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[17] Due to the relatively high volatility of disagreement (dis_t) for the US (see figure 3) we base the regression on a 4-quarter moving average of the basic time series. Since the 5-year point forecast time series for the US only starts in 2005, we cannot include it in the regression analysis.

may stem from a theory-specific weighting of forecast-relevant information observed from the macroeconomic system. We call this explanation the *camp view* of inflation forecasts.

Since each forecast rests on a theoretical conviction of inflation determination, we form up two groups, i.e. the monetarist camp and the PC camp, whereas the latter derives inflation judgments from a Phillips-curve logic. To this end, a macro indicator spread is constructed from a monetary aggregate and real output data. Regression analysis provides further evidence that camps form up whenever the macro indicator spread widens. Since this pattern holds for the entire sample period, inflation forecasts do indicate latent camp-affiliation.

Appendix

Table 5: Unit root tests

euro area		Level			First Differences		
		ADF	PP	DFGLS	ADF	PP	DFGLS
1-year	dis_t	-0.380	-0.887	-0.902	-5.426***	-5.444***	-2.778***
	afu_t	0.302	0.595	-0.801	-7.077***	-7.055***	-3.705**
	asu_t	1.747	0.964	-0.598	-4.634***	-4.730***	-3.050*
5-year	dis_t	-2.952**	-2.863**	-1.268	-8.507***	-8.589***	-3.742**
	afu_t	-3.273	-3.299	-1.278	-8.418***	-8.792***	-3.593**
	asu_t	-2.550	-2.680*	-1.049	-8.608***	-8.607***	-3.336*
	$isprd_t$	-0.376	-1.685	-2.539	-3.411**	-3.624***	-2.068**

US		Level			First Differences		
		ADF	PP	DFGLS	ADF	PP	DFGLS
1-year	dis_t	0.314	-0.244	-2.849	-3.789***	-3.834***	-3.005***
	$isprd_t$	0.695	-0.368	-2.156	-3.416**	-3.450***	-3.581**

Significance levels: $***\,1\%$ $**\,5\%$ $*\,10\%$

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Hohenheimer Diskussionsbeiträge aus dem

INSTITUT FÜR VOLKSWIRTSCHAFTSLEHRE

DER UNIVERSITÄT HOHENHEIM

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