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Marco Buchmann[3]

In 2009 all ECB publications feature a motif taken from the €200 banknote.

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Abstract

The aim of this study is to assess empirically to what extent the degree of heterogeneity of consumers' inflation perceptions and expectations is driven by the flow of information related to current and future price developments in the euro area. We conduct the analysis both on an aggregate level for the euro area as well as for a set of countries using panel techniques. We find that the degree to which consumers' expectations are discordant is negatively related to news intensity. Moreover, the results suggest that the absolute bias in expectations decreases as news become more intense and this effect has become more pronounced since the introduction of the common currency.

Keywords: Inflation Expectations, Heterogeneity, Survey data, Euro Area, News

JEL Classification: D12, D84, E31

Non-technical summary

In this study we aim at capturing empirically the role of news in shaping the view of the general public with respect to past, current and future price developments. The analysis has two dimensions. First, interest lies in the extent to which people *disagree* either in their statements about contemporaneous inflation or in their predictions for likely future price developments. To this end, a measure of heterogeneity is being constructed which is based on survey data from the European Commission's Business and Consumer Survey. It serves the purpose of quantifying disagreement in perceptions and expectations and constitutes one set of dependent variables being used for subsequent econometric analysis. Expectations and perceptions themselves are quantified through a refined method building on the Carlson-Parkin approach. The second question that is then being addressed is to what extent perception and expectation *biases* are influenced by news. The analysis is conducted by means of panel regression techniques for a set of individual euro area countries as well as the euro area as a whole. In our regressions, a new measure of news intensity is employed. It is being constructed by dividing the number of articles which contain a reference to inflation either in their headline or lead paragraph through the total number of articles categorized as containing economy-related information.

We also aim at revealing the importance of the results from the perspective of different theoretical strands that exist in the literature. The subject matters, for instance, for theories that come under the heading of 'epidemiological modelling', which postulate that, analogous to the spread of a disease, news disseminate throughout the economy, thereby 'infecting' people and shaping their beliefs. By assumption, individuals other than professional forecasters do not form expectations by themselves in this framework, nor do they attempt to estimate the current state of the economy, in particular concerning recent and future price developments. The role of news in this context manifests itself in its ability to influence the speed at which typical individuals can update their beliefs. In the context of other theories from the 'imperfect information' field, these assumptions are relaxed along some dimensions; according to the theory, agents have at least some capacity of forming own beliefs and collecting own information. The general conclusion, however, carries over, namely that through the action of news the heterogeneity in beliefs decreases and individuals' forecasts become more precise with respect to later realized price developments.

Our cross-country estimation results suggest that for the period between 2002 and 2008 an increasing rate of price inflation is generally associated with more agreement both in perceptions and expectations. The role of news is in line with what theory predicts. More news related to current and future price developments generate more agreement, i.e. less heterogeneous beliefs. As concerns the second dimension of the analysis, namely the deviations of perceived and expected inflation from realized price inflation, results suggest that more news help reduce the expectation error on average. The sample is being extended back to 1985 when using area wide instead of

cross-country data, with the results broadly confirming the findings from the panel context.

Overall, evidence is being adduced in favour of news having a strong impact on the dispersion of beliefs as they are able to densify both perceptions and expectations. Evidence concerning its role in explaining perception and expectation biases remains mixed. We also test for structural changes taking place after the introduction of the euro as a common currency and report evidence for this indeed being the case.

1 Introduction

Modern macroeconomics recognizes the role of information as one of the main driving forces behind aggregate fluctuations and business cycles. Especially since the Lucas (1973) distinction between anticipated and unanticipated shocks, it is a widely accepted fact that information processing influences expectation formation at micro level and thus has far-reaching effects on the macroeconomy, determining ultimately the effectiveness of policy interventions. However, one dimension of the expectation formation process has not found until recently its place in macro modeling and even less so in empirical research: the intrinsically heterogeneous nature of individual forecasts and the determinants thereof.

Influenced by the assertion of Sims (2008) that the heterogeneity in beliefs about inflation can be viewed by itself as a policy instrument and by the Carroll (2003) epidemiological framework, we intend in this paper to focus on one of these determinants, namely news. Our working hypothesis is that through the effect of professional economic media, information reaches more people and thus determines them to agree more on one side (thus decreasing cross-sectional forecast heterogeneity), while it also induces them to make more precise forecasts (thus reducing perception and expectation biases) on the other.

An early strand of the literature in this regard is concerned with the agenda-setting function of media. The idea is that media can have a marked impact upon people's awareness of certain topics, where one assumption is that concentration on salient issues leads the population to perceive this issue as more relevant. Importantly, the theory rests also on the assumption that media can shape news in a way that may distort reality to some extent. One of the first contributions to this area of research is work by McCombs and Shaw (1972). As most of the related work that has appeared since then, they explore the theory in a political context and find a positive relation between news intensity and what voters found most relevant in political campaigns. Recent work by Eife and Coombs (2007) analyze the role of media and communication in shaping the public's perception of current price developments. They argue that increasing inflation misperceptions following the euro cash changeover could possibly have been avoided if policy makers had made the public more aware of the fact that its perception of current inflation was unreasonably high.

From a policy perspective, anchoring perceptions and expectations via improved means of communication is essential as changes in perceptions and expectations will eventually cause changes in people's behavior. The findings in the present empirical study substantiate the plausibility of the agenda-setting theory since more news related in inflation turn out to densify people's perceptions and expectations. Increased awareness eventually also helps to perceive actual inflation more correctly.

In the following, various theoretical approaches that are relevant in the context of this study are being discussed briefly. They are grouped according to the prevailing modeling paradigm.

Asymmetric preferences Capistran and Timmermann (2009) use a model which includes heterogeneous asymmetries in the forecasters' costs of over- and under-predicting inflation. They show that in this setup forecasts are biased even in the long run and inflation uncertainty, as captured by the short-term volatility, substantially influences the cross-sectional dispersion of beliefs. Their theoretical framework constitutes an important benchmark case for our study.

Self-control theories Compared to standard behavioral economics frameworks, Brunnermeier and Parker (2004) go a step further in formalizing biases in perceptions and expectations. In their model, agents care also about expected future utility flows, so they derive higher current felicity if they believe that better outcomes are more likely in the future. They then form optimal expectations by weighing the felicity gains from optimism against the losses incurred due to poor decisions and worse than expected realized outcomes. What the authors conjecture based on this framework is that agents tend to (optimally) overestimate the return on their investments; on aggregate forecasts tend to exhibit overconfidence and overoptimism. A similar line of reasoning is put forth by Amonlirdviman (2007), which comes however to a strikingly different conclusion: becoming defensively pessimistic serves as an (optimal) self-regulation device to counteract the lack of self-control in decision making. From whichever perspective one looks at self-control issues it remains clear that what ultimately determines the expectation formation process is the form and type of utility function assumed, such that the discussion bounces back to the behavioral side.

Sticky information Perhaps the most widely cited study regarding the role of information in macroeconomic fluctuations is the one by Mankiw and Reis (2001). Their main assumption - a significant departure from more standard frameworks used in modern theoretical macroeconomics - is that information disseminates slowly throughout the population. This then implies that the response of decision makers to new information is staggered, while, more importantly, aggregate variables reflect not only forward-looking expectations formed contemporaneously, but also the whole series of expectations formed in the past. The role of news in this context is then implicit: media has the power to determine the rate at which information arrives to people, thus determining the cross-sectional dispersion of expectations and perceptions.

Bayesian learning In a recent paper, Maag and Lamla (2009) adopt a Bayesian learning model in which media coverage of inflation affects forecast disagreement by influencing both the information sets and the predictor choice. In their model setup, agents update prior expectations about

inflation by absorbing news transmitted by television and newspapers, while these media reports are known even by the public to contain quite noisy signals about future inflation. In this sense then, the problem of a typical household amounts to a signal extraction issue, which is solved through Bayesian updating. Moreover, they allow for heterogeneous forecasting models, along the lines of Kandel and Zilberfarb (1999). The approach is innovative particularly with respect to the analytical differentiation between the *volume* of news and their *content*: more news induce the agent to put less weight on prior beliefs, but it is the specific content which determines heterogeneity and disagreement at aggregate level. So in terms of testable implications the model delivers clear results: (1) both a higher volume of media reporting and a lower heterogeneity (information entropy) of the statements about inflation lead to lower forecast disagreement, as agents converge more and more to the same information set and (2) if all media reports contain the identical message, the variance of the noise component collapses to zero, agents end up choosing identical predictors and at aggregate level the cross-sectional dispersion of expectations decreases.

Rational inattention Sims (2005) and Mackowiak and Wiederholt (2009) adopt a different perspective on the issue, in an attempt to provide coherent and complete micro-foundations to the expectation formation process. The main idea is that market players have limited capacities to process information, so they then receive only noisy signals of actual shocks hitting the economy. However, compared for instance to the Bayesian learning approach mentioned above or to other behavioral specifications, the advantage of the rational inattention framework is that the form of the observational errors is itself predicted by the theory and can be derived from the structure of the individuals' optimization problems. In his seminal paper on the issue, Chris Sims mentions that: "If there are enough other semi-public filterers of monetary news (TV, newspapers, investment clubs, lunch table conversation), the signal processing noise [...] may partially cancel out at the aggregate level." This issue is taken up in the present study when we assess empirically to what extent news intensity affects the absolute forecast and perception biases of consumers.

Epidemiology The idea that information spreads in an epidemiological way from a core such as a statistical body or a cluster of experts (professional forecasters) to be absorbed gradually by the large body of economic agents has also gained prominence in recent years, as most prominently exemplified in Carroll (2003). Analogous to the spread of a disease, perceptions and expectations are considered to be transmitted throughout the social networks. Then, at an aggregate level, the time paths of variables mirror closely a sticky-information framework: the infinite series of previously formed expectations determine the outcome at each step. News play a very important role in this context since the only way in which information can flow from the narrow cluster of experts to the broad public is through the intermediation of a mass communication device. It follows then that depending on the access or use of mass information media, agents differ in their

expectations and perceptions.

On the empirical side, a steady stream of new approaches is also emerging, but until now the literature is not too rich. For the case of the United States, the most prominent study of inflation expectations in recent years is Mankiw et al. (2003). Their starting point is that disagreement about inflation expectations is itself an interesting variable for monetary policy research and practice. Along various dimensions, our study and Mankiw et al. (2003) have a similar orientation, and we refer to it whenever parallels arise.

For the euro area, a number of different studies have analyzed inflation perception and expectation data, with differing focus: Brachinger (2006) analyzes the effects of the euro cash changeover on inflation perceptions and finds a significant positive bias versus actual inflation; Forsells and Kenny (2002) consider the usefulness of survey-derived measures for predicting actual inflation - they also show that expectations have become more rational since the 1990s, a fact that we explore further in Section 3; Aucremanne et al. (2007) estimate the gap between observed and perceived inflation and find evidence on behavioral biases due to the introduction of the Euro, but no persistent perception errors; Dias et al. (2008) assess the rationality of inflation expectations and report significant departures therefrom. They report the presence of positive long-run expectation errors.

To our knowledge, until now it were only Maag and Lamla (2009) to handle explicitly the role of the media in this context. We have been referring to their theoretical model above. Regarding their empirical contribution, the present work differs in that the sample covers a number of different countries as well as aggregated data for the euro area as a whole. Also, they restrict their focus to assessing forecast disagreement, while the present study also examines the role of news in determining absolute perception and expectation errors.

The paper proceeds as follows. In Section 2, we describe in detail the data sources and methodology used for quantifying inflation expectations, perceptions and their respective measures of cross-sectional heterogeneity. We then summarize our main results in Section 3 and present some robustness checks in Section 4. Section 5 concludes and proposes several ways in which research could proceed further.

2 Empirical Methodology

2.1 Quantifying Perceptions and Expectations

Before conducting the empirical analysis we need to address three issues; The first one is related to the *quantification* of consumers' perceptions and expectations, the second one is concerned with the measurement of *disagreement* and the third is related to the measurement of *news intensity*. We discuss these issues in the following.

The need for a method that quantifies perceptions and expectations arises because in a survey on expectations (perceptions, respectively) respondents are usually not asked to give a precise estimate of how much they expect a particular variable, say a price or price index, to change in the future. Instead, individuals are merely asked to indicate whether they expect prices to go up, go down, or to remain where they are within a prespecified period of time. This is what makes survey data *qualitative* in the sense that only the expected *direction of change* in prices is captured.

The survey which is the basis for this study is the European Commission's Business and Consumer Survey. The survey provides information on economic developments and monitors the perception of consumers with respect to past, current, as well as expected future conditions in Europe. Five subsurveys, addressing the manufacturing industry, construction, consumers, retail trade and services are currently conducted on a monthly basis. In the following, only survey data taken from consumers is relevant and therein only a subset of questions will in fact be taken into consideration, namely Questions 5 and 6. They read as follows.

> Question 5: *How do you think that consumer prices have developed over the past 12 months? They have...*
>
> ++ *risen a lot*
> \+ *risen moderately*
> = *risen slightly*
> – *stayed about the same*
> – – *fallen*
> N *don't know*

> Question 5: *By comparison with the past 12 months, how do you expect that consumer prices will develop in the next 12 months? They will...*

++ *increase more rapidly*
\+ *increase at the same rate*
= *increase at a slower rate*
– *stay about the same*
– – *fall*
N *don't know*

From the raw sample proportions, i.e. the relative frequency of answers in respective categories for each question one can derive a balance. The European Commission is providing such balance which aggregates the percentages of answers by weighing them in the following way.

$$B = (PP + 1/2P) - (1/2M + MM)$$

where PP refers to '++', P to '+', M to '-', and MM to '- -'. The balance can thereby range from -100, when all respondents expect (perceive) prices to fall, to +100, when all respondents expect (perceive) them to increase rapidly. For more detailed methodological notes on the EC Consumer Survey, we refer to the EC User Guide, EC (2007).

For later use in the model we will refer to the balance B computed from Question 5 as s_t^p (the *perception score*), and the balance B from Question 6 as s_t^e (the *expectation score*).

In order to derive a quantitative estimate that has the same dimension as inflation itself, a number of methods have been developed, among them the Balance-Disconformity approach (henceforth BA approach) proposed by Theil (1952) and the Carlson-Parkin technique (referred to as the CP approach), named after the two authors proposing the method in Carlson and Parkin (1975). By and large, the two techniques differ in terms of how restrictive they are in imposing assumptions on the expectation distribution and response function of individuals. Batchelor (1986) summarizes the theory underlying these approaches. In the following, we refrain from presenting the theory and rather direct the reader to the original papers by Theil, Carlson and Parkin. In principal, both methods rely on the assumption that each individual forms an expectation about future prices. It is a subjective distribution from which one can compute a mean and variance and by aggregating these moments across individuals one obtains an average expected mean and variance estimate of prices. In the literature, this distribution is usually referred to as the *expectation distribution*. A second assumption that is necessary to operationalize such quantification schemes is the *response function*. Depending on the expected mean price change, an individual is supposed to indicate only the expected direction of change. Thus, one needs a rule that indicates whether an individual perceives an expected increase (decrease) in prices sufficiently large to report prices to go up or to go down. Since the variable in question is continuous, i.e. the ex ante probability of expecting exactly zero inflation goes to zero, both the BA and the CP method introduce a threshold inflation

rate so as to rationalize why a certain proportion of individuals report 'no change' in perceived or expected prices. As long as mean expectations lie inside the interval that is bounded by the threshold, respondents will report 'no change'. This indifference interval can be seen as a *range of imperceptibility*; synonyms used in the literature, e.g. by Seitz (1988),are *no-change interval* and *difference limen*.

Denoting the perception score observed at time t by s_t^p and the year-on-year percentage change in observed prices by π_t (where $\pi_t = \ln(p_t/p_{t-12}) \cdot 100$ and p_t is the price index), the correspondence between the perception score s_t^p and inflation π_t is assumed to be of the following form.

$$\pi_t = \alpha_o + \alpha_1 s_t^p + \epsilon_t \tag{1}$$

This equation is estimated recursively (i.e. parameters vary through time), to generate fitted values, that is:

$$\pi_{t|t}^p = \widehat{\alpha}_o + \widehat{\alpha}_1 s_t^p \tag{2}$$

For the sake of parsimony we refrain from making the recursive estimation scheme explicit in notation. At every point in time only past observations of π_t and s_t^p are used. We refer to the resulting fit, $\pi_{t|t}^p$, as the consumers' *quantified perception* of inflation[1].

To quantify also consumers' expectations, we follow the conventional CP type approach. Let $\{s_t^{e1}, s_t^{e2}, s_t^{e3}, s_t^{e4}, s_t^{e5}\}$ denote the shares in each of the five response categories in the question referring to consumers' expectations[2]. The conditional expectation of inflation is made a function of these scores, that is:

$$\pi_{t+12|t}^e = -\pi_{t|t}^p \left[\frac{\left(Z_t^3 + Z_t^4\right)}{\left(Z_t^1 + Z_t^2 - Z_t^3 - Z_t^4\right)} \right] \tag{3}$$

where $Z_t^1 = N^{-1}\left[1 - s_t^{e1}\right]$, $Z_t^2 = N^{-1}\left[1 - s_t^{e1} - s_t^{e2}\right]$, $Z_t^3 = N^{-1}\left[1 - s_t^{e1} - s_t^{e2} - s_t^{e3}\right]$, $Z_t^4 = N^{-1}\left[s_t^{e5}\right]$ and $N^{-1}[\cdot]$ denotes the inverse of the standard normal distribution function. We refer to Berk (1999) for a derivation of this set of equations. The perceived inflation rate, $\pi_{t|t}^p$, that has been derived previously, now scales the quantified measure of expected inflation, thus one does not, in fact, has to impose an assumption that would stipulate *unbiasedness* in expectations. We shall later assess to what extent quantified expectations as well as perceptions of inflation are biased relative to actual inflation.

A final remark concerns the volatility measure of inflation that is being incorporated into the analysis. As in Mankiw et al. (2003), we proxy for inflation variability with the square of the first

[1] A *rolling* sampling scheme has been chosen, where the length of the window has been set to 36 months.

[2] The sixth category ('don't know') has been excluded and the remaining five categories rescaled so that they sum up to 1.

difference of inflation, denoted as $(\Delta\pi_t)^2$.

2.2 Measuring Disagreement in Perceptions and Expectations

To measure the degree of heterogeneity in beliefs (yet again concerning current as well as future conditions), the following measure is being employed.

$$\sigma_t^p = \sum_{i=1}^{4} F_t^{p,i}\left(1 - F_t^{p,i}\right) \text{ and } \sigma_t^e = \sum_{i=1}^{4} F_t^{e,i}\left(1 - F_t^{e,i}\right) \tag{4}$$

where $F_t^{p,i}$ and $F_t^{e,i}$ are the cumulative relative frequencies for the i-th category at time t from question A and B. This measure has been proposed by Lacy (2006). For further details see also Blair and Lacy (2000) and references therein. Note that the 5th category from the survey questions has been excluded because $F_5^{p/e}$ equals one and therefore does not contain additional information on the distribution of the response shares. Importantly, this measure is *ordinal* in nature, i.e. it does not require one to presume that the distance between categories be equal. Other statistics such as plain standard deviation measures should not be applied in the current context because one would have to have a variable measured at *interval* scale. The distances between response categories cannot be quantified, nor should one assume that they are equally far from one another. One can easily show that when considering 4 categories, the maximum $\sigma_t^{p/e}$ is 1, characterizing a fully *polarized* distribution (as Lacy (2006) refers to this case) in which all responses fall into two response categories to equal shares. The other extreme is when all responses fall into a single category (full agreement); the measure will attain its minimum at 0 in this case.

2.3 Measuring News Intensity

To construct the measure of inflation news intensity we use the professional news platform *Factiva* and proceed as follows: a search engine serves to count the number of news articles containing the term *inflation* (plus equivalent translations to local languages) in their headlines or lead paragraphs which is then divided by the total number of news contained in the specific parent category (see below for a detailed overview of the selected categories). In this way, one obtains a ratio that can be interpreted as a percentage of inflation-related news in overall economic news. News are retrieved for each month throughout the sample period. The search is allowed to comprise print articles as well as online news.

Our aim is to also differentiate between general and more factual inflation related news. To this end, two parallel searches are being conducted. First, a search is run within the *Economic News* category, which includes as sub-categories *Economic Performance/Indicators*, *Economic/Monetary*

Policy, *Euro Zone/Currency*, *Government Finance* and *Trade/External Payments*. The derived measure of news intensity will be referred to as n_t. A second, somewhat more constricted, search is then run which comprises the categories *Calendar of Events*, *Dow Jones/Reuters Top Wire News*, *Economic Predictions/Forecasts*, *News Agency Material*, *News Digest*, *Press Release*, *Routine Market/Financial News*, *Statistics*, *Survey/Poll* and *Table*. We interpret this group of categories as containing more factual news and denote the derived intensity measure as n_t^f. To the news series from search 1 we refer to as *baseline*, to those from search 2 as *factual*.

By following the above outlined procedure we obtain baseline and factual news series for all countries for the period between January 2002 and December 2008. For the euro area, the baseline news ratio series starts in January 1990 and the factual one in January 2001, for reasons of data availability.

Figures 3 and 6 in the Appendix illustrate how all news series evolve over time.

2.4 Data and Preliminary Analysis

The source of raw survey data is the European Commission's Business and Consumer Survey. Inflation in our models is the year-on-year percentage change computed from monthly price level index series, all of which have been seasonally adjusted. Euro area and all country-specific inflation series are taken from the ECB's statistical data warehouse. The reference area is of changing composition in the case of HICP for the euro area and has been computed using fixed conversion rates as of 1990. As regards the selection of countries to be included in the cross-country analysis, we decided to incorporate twelve countries, namely Austria, Belgium, Spain, Finland, France, Greece, Ireland, Italy, Germany, the United Kingdom, Sweden, and The Netherlands[3]. It should be noted, though, that whenever imposing coefficient homogeneity, as is the case in all panel regressions, only the 10 euro area countries are being included.

The raw data series that are needed for quantifying perceptions and expectations start in 1985 and end in December 2008; all series are used at monthly frequency. The regression method that is employed to quantify perceptions needs a number of observations in order to yield reliable estimates and this is why the first five years of derived perception and expectation data is being excluded. In the sequel, the euro area sample will effectively start in January 1990 and the panel sample in January 2002.

The reader is referred to the Appendix where graphs of all relevant time series are presented. As regards the measure of dispersion in expectations (which can lie between 0 and 1), one can observe

[3]The Gesellschaft fuer Konsumforschung (GfK) has kindly provided us with data (detailed response shares) for Germany. Other European countries could unfortunately not be taken on board due to missing survey data.

intermediate levels thereof, ranging from 0.43 (for the euro area e.g. in the summer of 1985) to 0.62 (towards the end of the sample in winter 2008). Figures 1 and 4 in the Appendix illustrate how disagreement in perceptions and expectations have evolved over time (Figure 1 for the total population of all euro area countries separately; Figure 4 for the euro area). On an area wide level, the two measures are positively correlated (correlation coefficient at 0.26 for the full sample starting in 1985). One can also see that for most countries there was somewhat more agreement in perceptions around 2002, with a cross-sectional average of 0.53, than in later parts of the sample. As regards the euro area, in June 2008 we observe a significant fall from the previous year's average of 0.55 to 0.39, i.e. one also observes more agreement on recent price developments at that time; thereafter, consumers in the euro area increasingly disagree as far as perceptions are concerned. Regarding variation in expectations one can see that disagreement has risen since the beginning of the financial turmoil in fall 2007 and seems to rise even further with the ongoing crisis.

Concerning quantified expectations of inflation on an area wide level, one can observe that on average between 1990 and 2008 expectations are below realised inflation; the mean difference equals -0.38 percentage points. Interestingly enough, following the euro cash changeover in January 2002 expectations fall off well below 1.5%, whereas actual inflation rises to an average of about 2.1% (2003-2005). Towards the end of the sample we observe a sharp decline in actual inflation down to 1.6% in December 2008.

Turning to the baseline measure of news intensity, we refer to Figures 3 and 6 in the Appendix. For the countries as well as the euro area the news ratio looks quite balanced in the sense that no noticeable jumps or outliers occur throughout the sample period. One can observe a marked upward movement around August 2000 when the ratio exceeds 8%. From August 2000 until the end of the sample the average news ratio equals 4.3%. The baseline news ratio reaches another high of about 9.2% in June 2008. When considering the later part of the sample (from 2002 onwards), unit root test results, as reported in Table 6, suggest that the news ratio is stationary at a 2 percent significance level. Area wide and panel unit root test results are entirely consistent in this regard.

3 Results

Our benchmark empirical exercises consist of panel fixed effects and aggregate euro area estimations, with disagreement measures and absolute biases as dependent variables. Obvious controls in these regressions are the level of inflation and its short-term variance, since they capture the uncertainty involved in the individual forecasting processes, but also behavioral effects. All variables, including the baseline news measure, are used with a lag of one period. This is so because data collection of survey data is done during a particular month and so we cannot assume that either the inflation rate or news have contemporaneous impact on disagreement or the absolute biases. Also, it is possible

that at the time of the response none of the aggregate macro variables were actually realized. Lagging the right-hand side terms should also help mitigate any reverse causality possibly present in the model.

Both panel and aggregate estimation results that are presented in the following will be based on four benchmark equations. The first two relate to *disagreement* in perceptions and expectations, the other two to perception and expectation *biases*.

With i indexing countries, t referring to the respective month and ξ_i and χ_i denoting country-specific fixed effects, the first two equations, referring to disagreement in expectations and perceptions, read as follows:

$$\sigma^e_{i,t} = \alpha_0 + \alpha_1 n_{i,t-1} + \alpha_2 \pi_{i,t-1} + \alpha_3 \pi^2_{i,t-1} + \alpha_4 (\Delta\pi_{i,t-1})^2 + \xi_i + \varepsilon^p_{i,t} \quad (5)$$

$$\sigma^p_{i,t} = \beta_0 + \beta_1 n_{i,t-1} + \beta_2 \pi_{i,t-1} + \beta_3 \pi^2_{i,t-1} + \beta_4 (\Delta\pi_{i,t-1})^2 + \chi_i + \varepsilon^e_{i,t} \quad (6)$$

Analogous to the disagreement regressions, with i indexing countries, t referring to the respective month and ω_i and ν_i denoting country-specific fixed effects, the third and forth equation read as follows:

$$|\pi^e_{i,t+12|t} - \pi_{i,t+12}| = \delta_0 + \delta_1 n_{i,t-1} + \delta_2 \pi_{i,t-1} + \delta_3 \pi^2_{i,t-1} + \delta_4 (\Delta\pi_{i,t-1})^2 + \omega_i + \epsilon^e_{i,t} \quad (7)$$

$$|\pi^p_{i,t|t} - \pi_{i,t}| = \gamma_0 + \gamma_1 n_{i,t-1} + \gamma_2 \pi_{i,t-1} + \gamma_3 \pi^2_{i,t-1} + \gamma_4 (\Delta\pi_{i,t-1})^2 + \nu_i + \epsilon^p_{i,t} \quad (8)$$

The aggregate euro area econometric model specifications are simple time series versions of these equations.

3.1 Impact of News on Disagreement

The estimation results (see Table 1) confirm the findings in Maag and Lamla (2009). First, inflation enters negatively in the expectations regression, with the squared term being positive. With price inflation equalling 2%, its marginal impact on disagreement in expectations is between -1.3 and -1.5 percentage points (depending on whether the inflation volatility term is being included or not).

Second, the volatility measure enters positively and its coefficient is highly statistically significant. A marginal 1 percentage point increase in the volatility increases disagreement in expectations by around 1.5 percentage points and disagreement in perceptions by 2.3 percentage points. These results are very much in line with implications from both the theoretical side as well as with related empirical work.

Regarding perceptions, the estimation results suggest that level inflation has a positive impact on disagreement in perceived inflation only when not allowing for the quadratic term. A 1 percentage point increase in level inflation entails a reduction in disagreement on perceived price inflation of about 3.3 percentage points.

Essentially all macro models that were briefly mentioned in the introduction predict a negative relationship between the amount of news and the cross-sectional dispersion of inflation expectations and perceptions. Our results show that, indeed, an increase in news intensity is associated with more agreement both on the perception and the expectation side. Under all specifications the effect is significant at least at the 2 percent level. A 1 percentage point increase in inflation-related news entails a 0.35 percentage point reduction in disagreement in expectations. Dispersion in perceived inflation reacts somewhat stronger with an associated reduction in disagreement of about 0.66 percentage points. Overall, these figures tell an interesting story: empirical research has focused predominantly on assessing disagreement in expectations, while at least in the particular case under study here, it is actually the effect of news on *perceptions* which seems to be more pronounced. This would then imply that the role of *general economic* news media as a tool in signal processing is much more important than its role in generating opinions about the likely future path of prices. As is briefly discussed in Section 4.1, a key determinant of both disagreement in expectations and the absolute forecast error is actually the intensity of *factual* news reporting.

In a second estimation step, regressions are run using aggregate euro area data. Table 2 shows the results. We follow this route primarily in order to assess whether our conclusions from the cross-country analysis can be generalized to the area as a whole and, most importantly, to the years before the introduction of the Euro.

The negative effect of inflation carries over only as far as disagreement in expectations is concerned. When considering only the later part of the sample 2002-2008, however, the relationship turns out to lose its statistical significance altogether. Regarding disagreement in perceptions, full sample estimates and those for the time before 2002 suggest that level inflation has a positive impact on disagreement in perceptions, which is somewhat conflictive with panel regression results.

Inflation volatility measured on an area wide level seems to have very little impact on disagreement; only in the later part of the sample 2002-2008 disagreement in expectations rises with increasing volatility in inflation.

Concerning the role of news on the heterogeneity of beliefs, results at euro area level confirm only partially the significant negative relationship found in a panel context. On one side, disagreement in perceptions responds strongly to news, but the response of disagreement in expectations is not found to be statistically different from zero. Corroborated with results from regressions with factual news (as reported in Table 5), where it was apparent that expectations are driven chiefly by factual

and only to a lesser extent by general economic news, the finding is then not too surprising.

3.2 Impact of News on Absolute Bias

In this section, the role of news is explored in light of the *precision* of perceived and expected rates of inflation. Table 3 contains both panel and area wide estimates.

An immediate conclusion, which confirms results from previous work such as Kenny and Forsells (2002) is that consumer expectations are positively biased, on average by 1.7 percentage points in absolute values when considering the full sample (1990-2008) and after controlling for all relevant variables. Across all model specifications and samples, this result is robust. Concerning the effect of the level of inflation on the precision of forecasts, the estimates reveal a negative relationship, which is statistically significant in all sub-samples. At higher levels of inflation people's expectations turn out to be more precise. When looking at the sample that excludes the years after 2002, inflation volatility contributes positively to variation in expectation biases. Increasing volatility is reflective of higher uncertainty in the inflation process, and the positive relation found in the data confirms that higher uncertainty does indeed lower the precision of consumers' forecasts. For the time following the cash-changeover, however, both area wide and panel estimates then suggest that inflation volatility plays no role in explaining absolute expectation biases. This result may partly be due to the general fall in inflation volatility.

As regards the role of news, we find significantly negative effects on expectation errors at euro area level, but not so at cross-country level. What seems surprising is that for the part of the sample since 2002, news seem to play a more prominent role in lowering the absolute forecast error at euro area than at country level. We could cautiously interpret this result as reflecting more euro-area related content in the inflation-related news of the last decade. If we put this result in relation to the fact that disagreement in expectations also responds strongly to news, we could conclude that indeed one significant portion of the social transmission of expectations is done through mass media, which, at least since 2002, may have been concerned more with area wide developments.

In the case of perceptions, some of the above-mentioned results are actually reversed. Level inflation seems to play no significant role in explaining perception biases when looking at area wide estimates. Only panel estimates suggest a negative relation: a 1 percentage point increase in actual inflation, say from 2% to 2.1% is associated with a decrease in the absolute perception errors of about 0.22 percentage points. The role of news is also mixed: a marginal increase in inflation-related news is associated with an increase in precision of perceived rates of about 2.8 percentage points, while after 2002 the impact of news seems to vanish altogether. Overall, it seems that news have a strong and very robust contribution to densifying perceptions around some point, but our analysis is not able to illuminate what this point really is.

Finally, expected inflation volatility affects strongly the absolute bias. A 1 percentage point increase in volatility generates between a .2 and 1.0 percentage point increase in absolute perception errors, but has no significant impact on expectation errors. This fact would e.g. be consistent with a story of inflation affecting gradually different product groups, such that when inflation volatility rises *ceteris paribus*, it seems easier for consumers to estimate the price level in twelve months time (also influenced by media reports) than to understand what is actually happening contemporaneously to product groups they do not consume.

3.3 Country-Level Estimation

In this section, additional estimates for the exact same four benchmark equations are being presented, which are based on the so-called Mean-Group (MG) procedure (see Pesaran and Smith (1995) and references therein for details). The theoretical foundation of this approach can be found in Kao (1997) and Phillips and Moon (1999). Regression estimates are obtained for all countries in the panel separately in the first place and then averaged. Results are summarizes in Table 4 in the Appendix.

Concerning disagreement, previous findings are confirmed in that more news help improve agreement on perceived and expected inflation rates. In either case, the effect is significantly negative at least at a 3 percent level. As in the pooled OLS case, the absolute bias in expectations is not driven significantly by the amount of (general economic) news, whereas the absolute bias in perceptions is affected positively by increasing news intensity.

The level of inflation plays a significant role only in the context of disagreement in perceptions and bias in expectations. In either case, its effect is negative. Increasing volatility is associated with a significant increase in disagreement in perceptions and a decreasing absolute bias in expectations. The latter effect, however, is only border-line significant with its associated p-value equaling 0.13.

In order to assess the importance of news in countries outside the euro zone, separate estimates are also reported for the UK and Sweden (see Table 4). In the UK, more news help consumers agree more both with respect to perceived and expected price inflation, as well as to reduce biases in expectations. Along all three dimensions, associated p-values are virtually zero and thereby indicate a very strong role for news. Absolute biases in perceptions turn out not to be affected by the intensity of news related to inflation. For Sweden, results are broadly consistent will all other estimation outcomes.

Overall, MG estimates confirm that the role of news is more pronounced as far as disagreement in both expectations and perceptions is concerned. They substantiate the hypothesis that more news help consumers agree more both on perceived and expected future price changes.

4 Robustness Checks

4.1 The Role of Factual News

As mentioned in the methodological section, two measures of inflation news intensity are being employed; a *baseline* measure of inflation news in general economic articles and a *factual* measure reflecting inflation-related content in publications such as press releases, calendars of events, or statistical tables.

As a first robustness exercise we aim at establishing whether the main results concerning the impact of general economic news upon disagreement and absolute biases carry over to a context in which one explicitly controls for the effect of factual media reporting (see Table 5). The results suggest that along all dimensions and for both the cross-country panel and the euro area the coefficient on the baseline news variable retains its sign, with significance levels having changed only very little in almost all cases. In terms of magnitudes at country level, the effect of a 1 percentage point increase in the news rate is of decreasing disagreement in expectations by 0.3 percentage points and disagreement in perceptions by 0.6 percentage points. General economic news do not seem to exert a significant influence on absolute bias (except that at euro area level where 1 percentage point more news decrease expectation bias by 0.15 percentage points), a result that is substantiating all baseline estimation results.

Since factual news are causally independent of all our dependent variables (at least to a much higher degree than general economic news), we hope to also provide a robustness check to establish whether reverse causality may have been a problem in our benchmark regressions. We interpret the results as providing evidence against the regressions having been subject to reverse causality; a 1 percentage point increase in factual inflation-related news decrease disagreement in expectations by 1.25 percentage points, disagreement in perceptions by 0.5 percentage points and the absolute bias by 0.08 percentage points, all of which are close to the effects reported for baseline news.

Overall, this part of the analysis shows that perceptions are highly influenced by general economic news (in terms of cross-sectional heterogeneity in beliefs, but also in terms of absolute biases), while expectations seem much more responsive to factual news, as captured in press releases and statistical tables.

4.2 Structural Breaks

Perhaps the most important empirical issue in a dataset comprising inflation perceptions and expectations for the euro area is the presence of structural breaks either in January 1999 when the

European Central Bank introduced the common currency or in January 2002 when the common currency replaced the national currencies as cash.

We test this with a tool commonly used in the literature, namely the Chow test. The test is conducted recursively by dividing the sample in two parts, at each point in time between May 1992 and October 2005. These two endpoints are chosen rather *ad hoc*, simply out of the need to have enough observations in both subsamples such that statistical inference is reliable. Then, for each point in this space of time and for each of the four model specifications, a statistic of the following form is being computed.

$$C_t^m = \frac{\frac{RSS_t^m - RSS_{1t}^m - RSS_{2t}^m}{k}}{\frac{RSS_{1t}^m + RSS_{2t}^m}{N_1 + N_2 - 2k}} \sim F_{k, N_1+N_2-2k}, \tag{9}$$

where RSS_t^m is the residual sum of squares from the model estimated for the whole sample, RSS_{1t}^m corresponds to the first subsample and RSS_{2t}^m corresponds to the second subsample, k is the number of regressors and equal to 4 (a constant, lagged inflation, lagged news and inflation volatility), N_1 and N_2 are the numbers of observations corresponding to each of the two subsamples and m is a model identifier for the four dependent variables: disagreement in perceptions and expectations and absolute error in perceptions and expectations.

Figure 5 shows the test results. Especially concerning disagreement in perceptions the test results are suggestive of the euro cash changeover having had significant impact. The Chow statistic attains its peak at about 48.0 in February 2002. Regarding the forecasting errors, one can observe a peak in the Chow statistic of 17.97 in November 1998. This timing difference is interesting since on the expectations side little happens after the euro cash changeover, a finding one could attribute to the intrinsically forward-looking nature of the expectation formation process about inflation, such that the introduction of the common currency even parallel to national ones produced a change in the way people thought about monetary phenomena.

4.3 Stationarity

A final step will in the following be to ask whether stationarity may be an issue in the data. The integration properties of the actual, perceived and expected inflation series are summarized in the Appendix in Table 6. The Null hypotheses of non-stationarity cannot be rejected for the euro area perceived and expected inflation series. There is strong evidence against the Null, however, when looking at realized annual price changes throughout the sample period; it seems not to possess a unit root. Panel unit root test results are somewhat conflictive with area wide test results in the case of the expectations series. Corresponding p-values suggest that based on the panel of countries one should reject the null of nonstationarity of the expectation series at conventional significance

levels. For the area wide expectations series the p-value turns out to be 0.45, indicating only weak evidence against the Null of nonstationarity. Concerning perceptions, results from panel and area wide tests are in line with each other. P-values indicate only weak evidence against the null both in panel and area wide data.

So overall, at least some of the results might be subject to problems inherent in non-stationary data, such as spurious effects. In order to check if this may be the case, all baseline regressions are being reestimated, now by using first-differences of both dependent and independent variables. The results are reported in Table 7 and they confirm the robustness of previous estimation outcomes. First, coefficients on both inflation levels and news intensity retain their signs and statistical significance remains almost unchanged at cross-country level. In the euro area regressions, the magnitudes of the coefficients are somewhat diminished and their statistical significance exceeds the 10% level; for most variables, however, the signs of the effects remain unchanged.

5 Conclusions

In recent years, the field of macroeconomics has seen a revived interest in the role of information. Research efforts are organized along two dimensions in the area: on one side, clarifications are sought as to what type of changes incomplete information and departures from rational expectations bring about in standard models and how these features materialize for example in different policy implications; on the other, it is seen to be equally essential to understand the underlying driving forces of perceptions and expectations themselves, at household and firm level. In more specific terms regarding inflation, we have on one side an assessment as to the *effects* of individual inflation perceptions and expectations on aggregate variables such as output, unemployment and asset prices, while on the other we search for the *determinants* of perceptions and expectations for each agent in isolation.

In this paper, a set of empirical exercises has been aimed at shedding light on one such determinant, namely the intensity of reports about inflation in economic news media. The sample covers a number of different countries, as well as aggregated data for the euro area and the results are highly suggestive of the fact that news have a significant impact upon both the expectation formation process and the perception of current inflation by typical households.

Similar to the results from previous studies, we find a significant impact of inflation volatility: a 1 percentage point increase in volatility increases disagreement by around 1.5 percentage points on the expectations side and by 2.3 percentage points on the perceptions side. The effects of the measure of news intensity are also in line with theoretical predictions and existing empirical evidence: 1 percentage point more news regarding inflation (relative to the control group of total economic

news) reduces disagreement in expectations by around 0.4 percentage points and disagreement in perceptions by close to 0.7 percentage points. Further, we find that an increase in inflation-related news intensity generates a significant decrease in the absolute prediction error, but an increase in the absolute perception error.

For an enlarged sample going back to 1985 at euro area level, most of the effects mentioned above carry over, however with somewhat diminished magnitudes and less statistical significance. For this reason, we have been testing for structural breaks using a recursive Chow procedure and we find, inter alia, strong evidence in favour of a break in the process driving perceptions that occurs around the time of the euro cash changeover.

Overall, we think our results are conclusive in themselves but we regard them as only a first step towards more refined empirical attempts at uncovering the effects of media reporting. An immediate extension would entail e.g. the specification of a detailed macroeconometric model for household expectations, with structural shocks to the levels and volatility of output, asset prices, interest rates and news as exogenous and thus with the possibility of structural variance decompositions. Also, a more disaggregated view of inflation may be appropriate in order to uncover how much of the biases in perceptions and expectations can be attributed to factors such as oil or house prices. Finally, another interesting extension would be to account for media content explicitly. That is, one could account for media content as in Maag and Lamla (2009) or seek to establish the backward- versus forward-looking nature of inflation-related statements.

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Appendix

TABLE 1
Panel Data Estimation Results

σ_t^e	Disagreement in Expectations					
const	0.574	(0.00)	0.590	(0.00)	0.591	(0.00)
n_{t-1}	-0.351	(0.02)	-0.378	(0.02)	-0.366	(0.02)
π_{t-1}	-0.005	(0.18)	-0.019	(0.07)	-0.021	(0.05)
π_{t-1}^2			0.003	(0.11)	0.003	(0.10)
$(\Delta\pi_{t-1})^2$					0.015	(0.00)
obs.	822		822		812	
R^2	0.41		0.41		0.42	

σ_t^p	Disagreement in Perceptions					
const	0.600	(0.00)	0.607	(0.00)	0.605	(0.00)
n_{t-1}	-0.666	(0.02)	-0.676	(0.01)	-0.662	(0.01)
π_{t-1}	-0.033	(0.06)	-0.038	(0.29)	-0.038	(0.30)
π_{t-1}^2			0.001	(0.80)	0.001	(0.82)
$(\Delta\pi_{t-1})^2$					0.023	(0.01)
obs.	822		822		812	
R^2	0.57		0.57		0.57	

Note: The results are based on monthly panel data for 10 countries for the period 2002-2008. The estimation procedure includes fixed effects along the unit dimension and White period heteroskedasticity and autocorrelation consistent (HAC) standard errors. P-values are reported in parentheses.

TABLE 2
Euro Area Estimation Results

	Disagreement in Expectations σ_t^e						Disagreement in Perceptions σ_t^p					
	1990-2008		1990-2001		2002-2008		1990-2008		1990-2001		2002-2008	
const	0.627	(0.00)	0.645	(0.00)	0.480	(0.00)	0.534	(0.00)	0.494	(0.00)	0.571	(0.00)
n_{t-1}	0.069	(0.69)	-0.012	(0.95)	0.217	(0.32)	-0.600	(0.17)	-0.182	(0.36)	-2.145	(0.01)
π_{t-1}	-0.023	(0.02)	-0.032	(0.00)	0.075	(0.20)	0.047	(0.01)	0.072	(0.00)	0.069	(0.44)
π_{t-1}^2	-0.002	(0.14)	-0.001	(0.68)	-0.018	(0.08)	-0.009	(0.01)	-0.014	(0.00)	-0.017	(0.32)
$(\Delta\pi_{t-1})^2$	0.015	(0.53)	-0.053	(0.14)	0.038	(0.01)	-0.005	(0.87)	0.022	(0.58)	0.005	(0.84)
obs.	228		144		84		288		144		84	
R^2	0.72		0.85		0.25		0.13		0.49		0.56	

Note: The results are based on time-series estimation by OLS for a sample ranging from 1990 to 2008. P-values based on HAC standard errors are reported in parentheses.

TABLE 3
Estimation Results: Absolute Biases

	Bias in Expectations $\lvert\pi_{t+12\lvert t} - \pi_t\rvert$						Panel data	
	1990-2008		1990-2001		2002-2008		2002-2008	
const	1.719	(0.00)	1.396	(0.00)	9.049	(0.02)	1.016	(0.05)
n_{t-1}	-7.735	(0.07)	0.153	(0.97)	-16.574	(0.02)	0.152	(0.95)
π_{t-1}	-0.679	(0.01)	-0.837	(0.01)	-6.214	(0.06)	0.105	(0.79)
π_{t-1}^2	0.131	(0.01)	0.163	(0.01)	1.222	(0.09)	-0.058	(0.46)
$(\Delta\pi_{t-1})^2$	0.800	(0.12)	1.197	(0.05)	-1.074	(0.21)	-0.197	(0.39)
obs.	216		144		72		700	
R^2	0.13		0.27		0.36		0.12	

	Bias in Perceptions $\lvert\pi_{t\lvert t} - \pi_t\rvert$						Panel data	
	1990-2008		1990-2001		2002-2008		2002-2008	
const	0.135	(0.17)	0.071	(0.53)	0.785	(0.05)	0.869	(0.00)
n_{t-1}	-2.781	(0.02)	-4.994	(0.01)	2.703	(0.51)	1.427	(0.35)
π_{t-1}	0.114	(0.24)	0.246	(0.09)	-0.443	(0.15)	-0.339	(0.01)
π_{t-1}^2	-0.009	(0.56)	-0.032	(0.20)	0.060	(0.32)	0.058	(0.02)
$(\Delta\pi_{t-1})^2$	0.609	(0.00)	1.039	(0.00)	0.601	(0.00)	0.218	(0.01)
obs.	228		144		84		812	
R^2	0.15		0.23		0.18		0.21	

Note: The estimation is carried out by OLS. The left part of the table shows estimation results based on aggregate euro area data. The right part reports panel data estimation results. P-values based on HAC standard errors are reported in parentheses.

TABLE 4
Estimation Results: Country-by-Country Regressions

	Disagreement in Expectations						Disagreement in Perceptions					
	n_{t-1}		π_{t-1}		$(\Delta\pi_{t-1})^2$		n_{t-1}		π_{t-1}		$(\Delta\pi_{t-1})^2$	
Austria	0.687	(0.01)	-0.038	(0.00)	0.052	(0.07)	-0.986	(0.00)	-0.033	(0.00)	0.047	(0.04)
Belgium	-0.233	(0.06)	0.005	(0.10)	0.006	(0.44)	-1.629	(0.00)	-0.019	(0.00)	0.011	(0.52)
Spain	0.267	(0.23)	0.001	(0.79)	0.042	(0.01)	0.976	(0.00)	-0.018	(0.00)	0.035	(0.01)
Finland	-1.621	(0.00)	0.009	(0.17)	-0.006	(0.76)	0.172	(0.52)	0.003	(0.58)	0.017	(0.27)
France	-0.138	(0.64)	-0.003	(0.67)	0.020	(0.35)	-1.573	(0.00)	-0.044	(0.00)	0.024	(0.42)
Greece	-0.564	(0.04)	-0.001	(0.94)	0.012	(0.71)	-0.516	(0.03)	-0.018	(0.18)	0.034	(0.21)
Ireland	-0.020	(0.89)	-0.011	(0.00)	-0.001	(0.98)	-0.095	(0.45)	-0.024	(0.00)	-0.007	(0.68)
Italy	-0.067	(0.76)	0.026	(0.03)	0.135	(0.06)	-0.655	(0.00)	-0.079	(0.00)	0.044	(0.53)
Netherlands	-1.270	(0.00)	-0.031	(0.00)	0.022	(0.74)	0.260	(0.64)	-0.164	(0.00)	-0.014	(0.89)
Germany	-1.006	(0.00)	-0.009	(0.08)	-0.015	(0.48)	-4.004	(0.00)	-0.001	(0.94)	-0.029	(0.52)
MG-EA	**-0.396**	**(0.03)**	**-0.005**	**(0.28)**	**0.027**	**(0.02)**	**-0.805**	**(0.03)**	**-0.040**	**(0.00)**	**0.016**	**(0.02)**
UK	-1.127	(0.00)	0.010	(0.00)	0.039	(0.21)	-2.590	(0.00)	0.036	(0.00)	-0.154	(0.01)
Sweden	-0.454	(0.17)	-0.050	(0.00)	0.003	(0.88)	-0.006	(0.98)	0.018	(0.00)	0.041	(0.01)

	Bias in Expectations						Bias in Perceptions					
	n_{t-1}		π_{t-1}		$(\Delta\pi_{t-1})^2$		n_{t-1}		π_{t-1}		$(\Delta\pi_{t-1})^2$	
Austria	4.879	(0.24)	-0.051	(0.71)	-0.450	(0.32)	-1.538	(0.45)	-0.051	(0.45)	0.406	(0.07)
Belgium	-13.385	(0.14)	-0.467	(0.03)	0.454	(0.52)	12.902	(0.00)	-0.041	(0.41)	-0.091	(0.54)
Spain	13.197	(0.01)	-1.019	(0.00)	-0.299	(0.54)	1.964	(0.49)	-0.137	(0.04)	0.594	(0.00)
Finland	18.995	(0.06)	0.203	(0.28)	-0.828	(0.30)	-1.371	(0.69)	-0.145	(0.03)	0.147	(0.44)
France	-0.944	(0.88)	-0.892	(0.00)	-0.965	(0.08)	6.350	(0.00)	-0.183	(0.00)	0.205	(0.17)
Greece	1.189	(0.54)	-0.720	(0.00)	0.879	(0.00)	4.586	(0.00)	0.039	(0.55)	0.167	(0.19)
Ireland	1.585	(0.60)	-0.114	(0.16)	-0.392	(0.33)	-2.152	(0.46)	-0.117	(0.13)	0.050	(0.90)
Italy	-0.985	(0.65)	-0.929	(0.00)	0.106	(0.90)	-0.937	(0.17)	0.076	(0.04)	0.113	(0.61)
Netherlands	4.342	(0.29)	-0.038	(0.57)	-0.240	(0.67)	-3.189	(0.54)	0.527	(0.00)	-0.782	(0.42)
Germany	-15.153	(0.01)	0.080	(0.47)	-0.476	(0.34)	7.395	(0.00)	-0.200	(0.00)	0.543	(0.01)
MG-EA	**1.372**	**(0.61)**	**-0.394**	**(0.00)**	**-0.221**	**(0.13)**	**2.401**	**(0.08)**	**-0.023**	**(0.68)**	**0.135**	**(0.18)**
UK	-16.622	(0.00)	0.372	(0.00)	1.707	(0.17)	0.220	(0.91)	0.192	(0.00)	0.054	(0.87)
Sweden	-1.936	(0.69)	-0.020	(0.87)	0.505	(0.13)	5.019	(0.04)	-0.067	(0.14)	0.680	(0.00)

Note: The results are based on country-by-country time-series regressions estimated by OLS. The sample covers the period 2002-2008 for 10 euro area countries and two non-euro zone countries, Sweden and the United Kingdom. P-values based on HAC standard errors are reported in parentheses.

TABLE 5
The Role of Factual News

Panel data	Disagreement in Expectations				Disagreement in Perceptions			
const	0.592	(0.00)	0.598	(0.00)	0.594	(0.00)	0.608	(0.00)
n^f_{t-1}	-1.459	(0.00)	-1.246	(0.00)	-1.018	(0.19)	-0.529	(0.47)
n_{t-1}			-0.271	(0.11)			-0.623	(0.02)
π_{t-1}	-0.023	(0.03)	-0.023	(0.03)	-0.039	(0.29)	-0.039	(0.30)
π^2_{t-1}	0.002	(0.23)	0.003	(0.09)	-0.001	(0.87)	0.001	(0.82)
$(\Delta\pi_{t-1})^2$	0.012	(0.03)	0.012	(0.02)	0.020	(0.05)	0.021	(0.01)
obs.	812		812		812		812	
R^2	0.42		0.43		0.56		0.57	

	Absolute Bias in Expectations				Absolute Bias in Perceptions			
const	1.093	(0.02)	1.067	(0.03)	0.891	(0.00)	0.862	(0.00)
n^f_{t-1}	-7.902	(0.11)	-8.583	(0.12)	2.359	(0.68)	1.325	(0.84)
n_{t-1}			0.937	(0.71)			1.317	(0.47)
π_{t-1}	0.084	(0.83)	0.085	(0.83)	-0.335	(0.01)	-0.337	(0.01)
π^2_{t-1}	-0.054	(0.48)	-0.056	(0.48)	0.061	(0.02)	0.058	(0.02)
$(\Delta\pi_{t-1})^2$	-0.223	(0.34)	-0.227	(0.34)	0.224	(0.00)	0.221	(0.00)
obs.	700		700		812		812	
R^2	0.12		0.12		0.21		0.21	

Euro Area	Disagreement in Expectations				Disagreement in Perceptions			
const	0.493	(0.00)	0.479	(0.00)	0.458	(0.00)	0.566	(0.00)
n^f_{t-1}	-0.324	(0.61)	-0.441	(0.50)	-2.562	(0.04)	-1.650	(0.16)
n_{t-1}			0.256	(0.38)			-1.996	(0.00)
π_{t-1}	0.071	(0.05)	0.078	(0.03)	0.130	(0.06)	0.078	(0.22)
π^2_{t-1}	-0.016	(0.01)	-0.018	(0.01)	-0.037	(0.00)	-0.020	(0.10)
$(\Delta\pi_{t-1})^2$	0.036	(0.04)	0.038	(0.03)	0.015	(0.64)	0.002	(0.94)
obs.	84		84		84		84	
R^2	0.25		0.26		0.5		0.58	

	Absolute Bias in Expectations				Absolute Bias in Perceptions			
const	8.723	(0.02)	8.788	(0.02)	0.907	(0.02)	0.813	(0.04)
n^f_{t-1}	-15.241	(0.54)	-8.928	(0.71)	11.688	(0.30)	10.900	(0.30)
n_{t-1}			-15.619	(0.01)			1.723	(0.63)
π_{t-1}	-6.262	(0.06)	-5.946	(0.07)	-0.547	(0.05)	-0.501	(0.07)
π^2_{t-1}	1.189	(0.10)	1.156	(0.11)	0.092	(0.06)	0.078	(0.12)
$(\Delta\pi_{t-1})^2$	-0.854	(0.31)	-1.020	(0.24)	0.611	(0.00)	0.622	(0.00)
obs.	72		72		84		84	
R^2	0.33		0.36		0.21		0.22	

Note: The estimation is carried out by OLS. Both panel as well as aggregate euro area regressions are based on a sample ranging from 2002-2008. P-values based on HAC standard errors are reported in parentheses.

TABLE 6
Unit Root Test Results

	Panel		Euro Area
	IPS	LLC	ADF
n	0.00	0.00	0.02
σ^e	0.00	0.00	0.06
σ^p	0.01	0.59	0.00
π^e	0.00	0.08	0.45
π^p	0.46	0.92	0.36
π	0.03	0.45	0.00

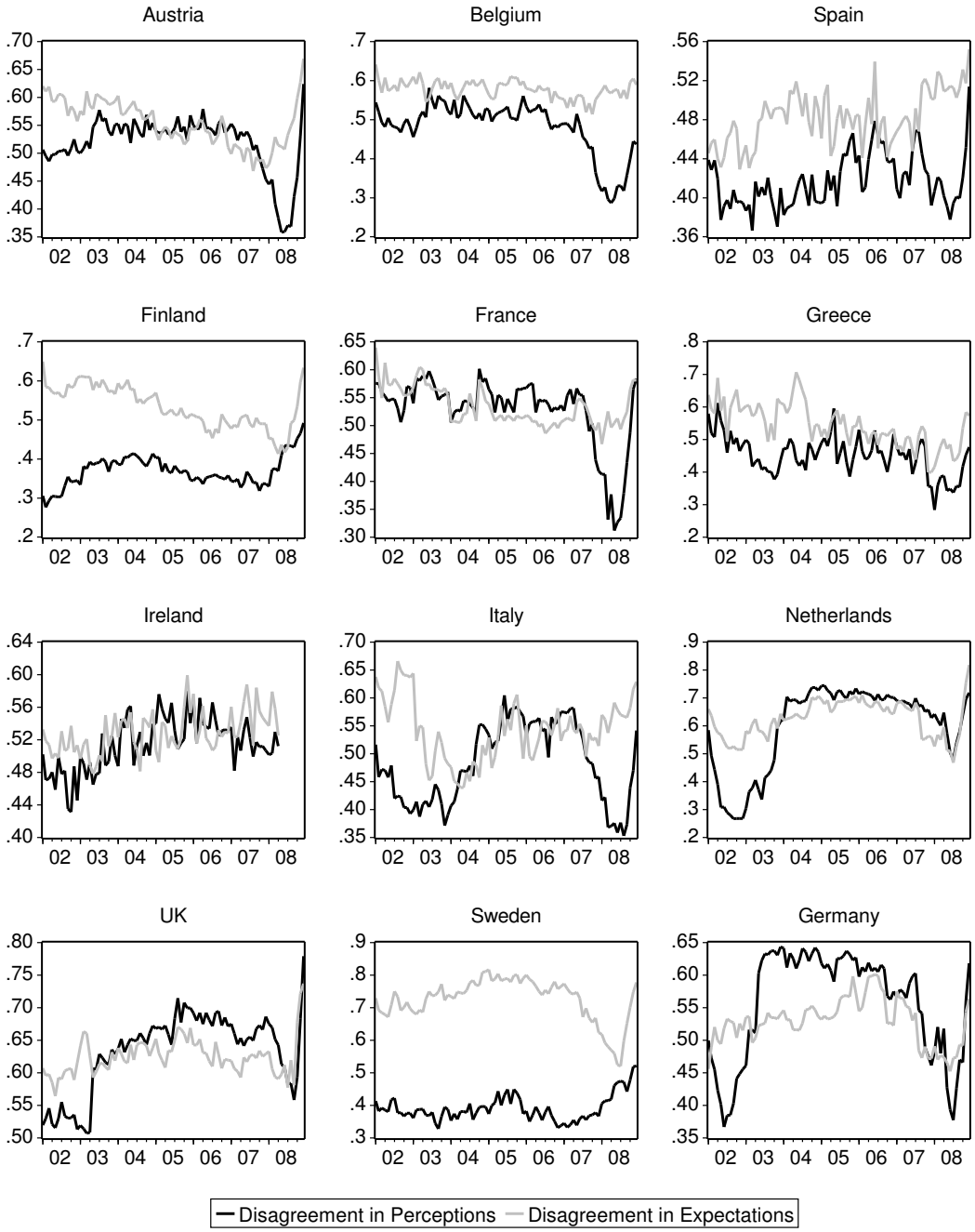
Note: We report p-values of three unit root tests in parentheses. IPS corresponds to the Im-Pesaran-Shin test for individual unit roots and LLC corresponds to the Levin-Lin-Chu test for a common unit root in panel data. The panel sample covers monthly data for the period from 2002-2008 for 10 countries. The ADF (Augmented Dickey-Fuller test) is applied to aggregate euro area data that ranges from 1990-2008. The Null hypothesis for all tests is that a unit root is present in respective variables.

TABLE 7
Regressions with First-Differenced Variables

Panel	$\Delta\sigma^e_t$		$\Delta\sigma^p_t$		$\Delta\lvert\pi^e_{t+12\lvert t} - \pi_{t+12}\rvert$		$\Delta\lvert\pi^p_{t\lvert t} - \pi_t\rvert$	
c	0.001	(0.00)	0.001	(0.00)	0.003	(0.00)	-0.001	(0.00)
Δn_{t-1}	-0.164	(0.00)	-0.213	(0.00)	0.627	(0.34)	1.314	(0.05)
$\Delta\pi_{t-1}$	-0.004	(0.50)	-0.012	(0.09)	-0.441	(0.02)	0.160	(0.03)
$\Delta\pi^2_{t-1}$)	0.001	(0.33)	0.000	(0.69)	0.078	(0.03)	-0.045	(0.00)
obs.	812		812		700		812	
R^2	0.01		0.03		0.02		0.02	
Euro Area								
c	0.001	(0.62)	0.001	(0.79)	0.007	(0.83)	0.006	(0.67)
Δn_{t-1}	-0.055	(0.66)	-0.208	(0.34)	1.376	(0.67)	0.742	(0.68)
$\Delta\pi_{t-1}$	0.079	(0.00)	0.026	(0.72)	-2.956	(0.01)	0.509	(0.23)
$\Delta\pi^2_{t-1}$	-0.017	(0.00)	-0.009	(0.57)	0.625	(0.01)	-0.128	(0.15)
obs.	84		84		72		84	
R^2	0.2		0.13		0.09		0.07	

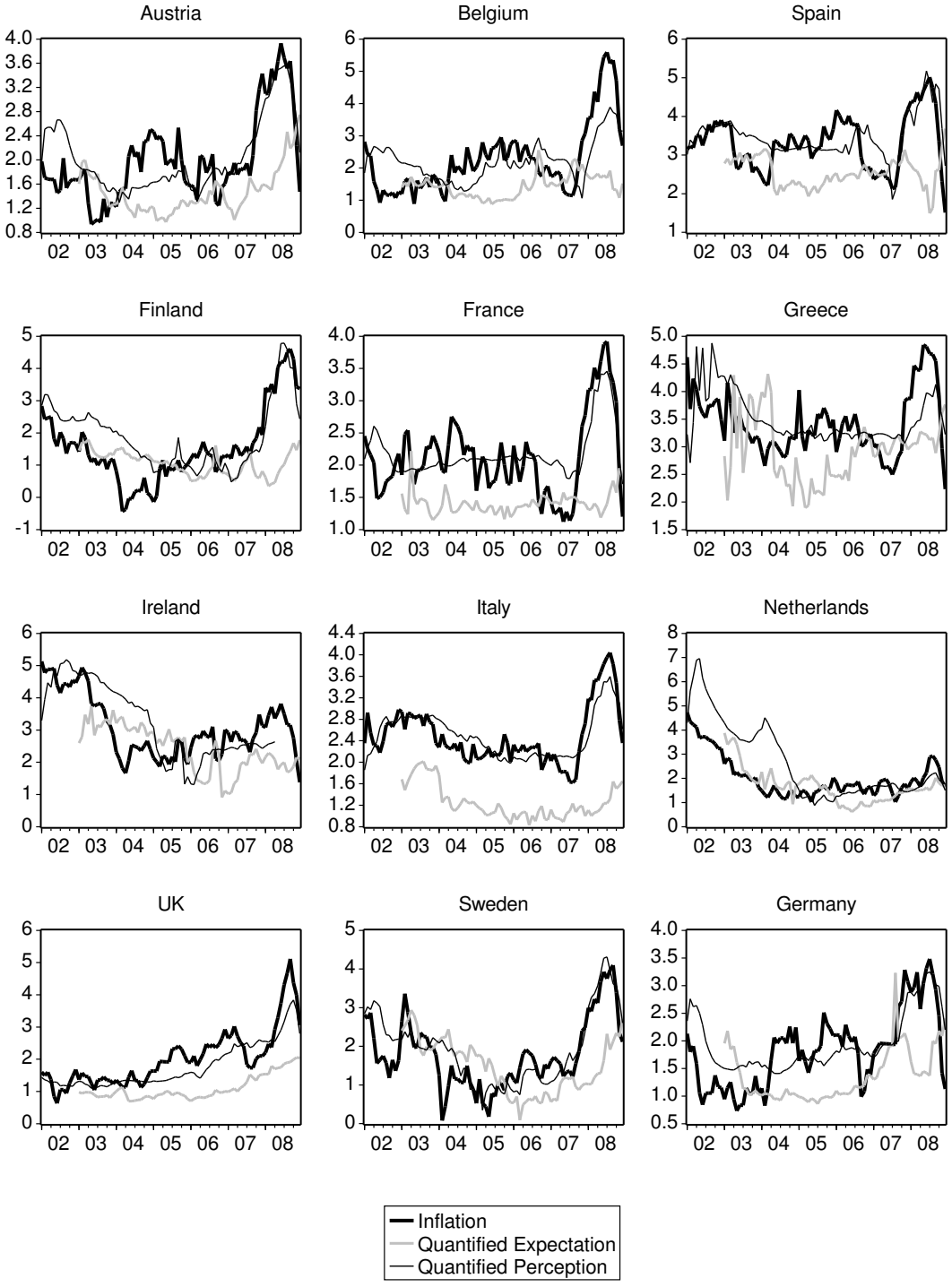
Note: The underlying sample ranges from 2002-2008 and all estimations are carried out by OLS. P-values based on HAC standard errors are reported in parentheses.

FIGURE 1
Disagreement at Country Level



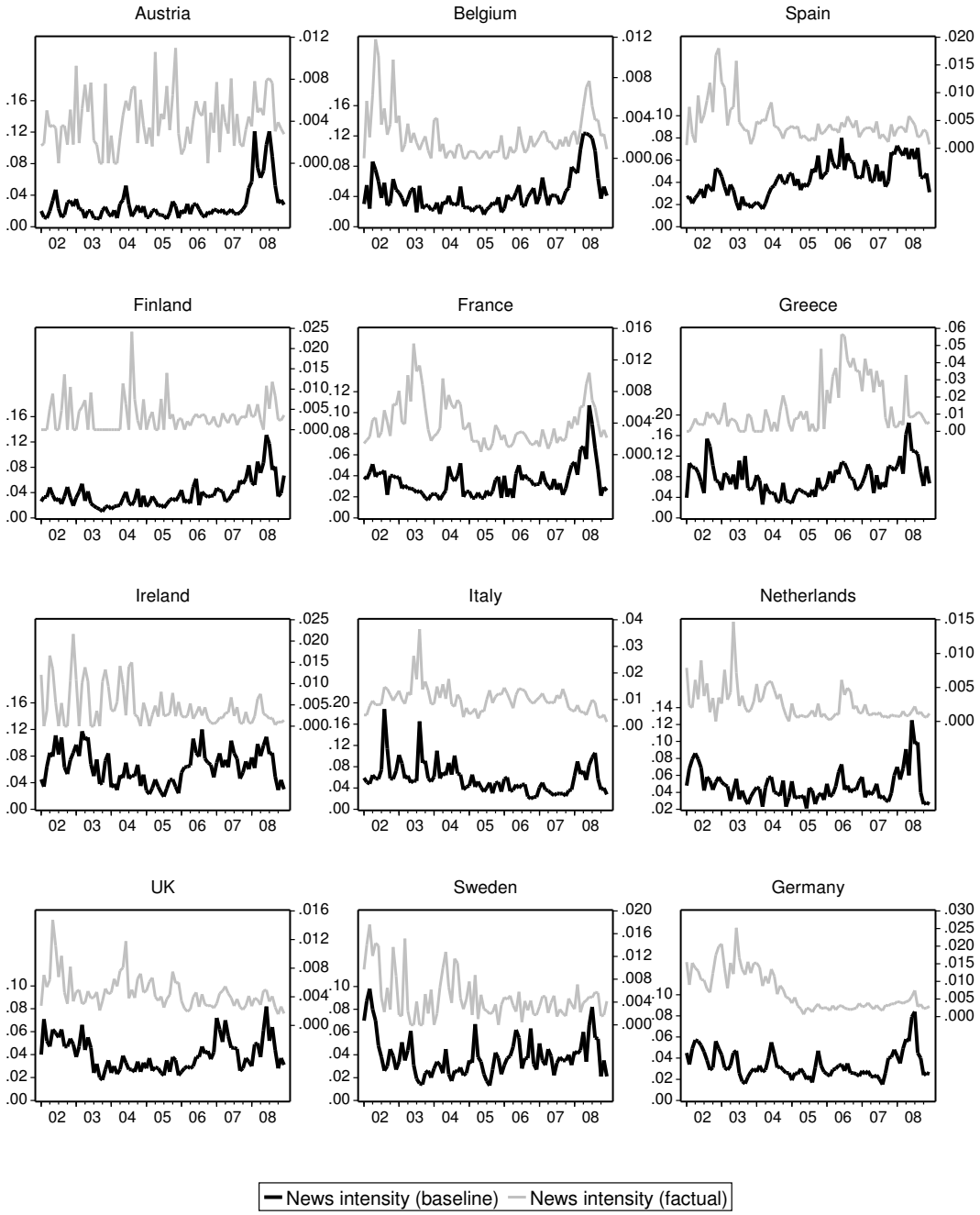
Note: For details concerning the measure of disagreement in perceptions and expectations see Section 2.2.

FIGURE 2
Quantified Perceptions and Expectations at Country Level



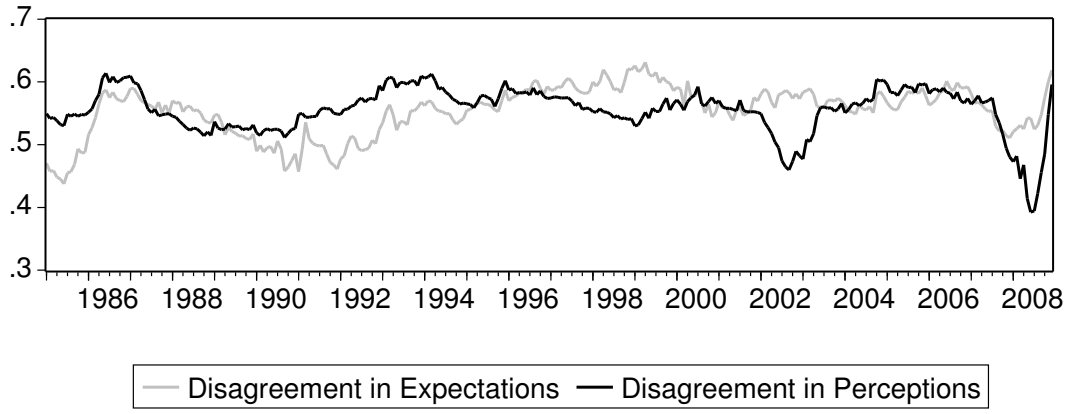
Note: For details concerning the procedure to quantify perceptions and expectations see Section 2.1.

FIGURE 3
News Intensity at Country Level



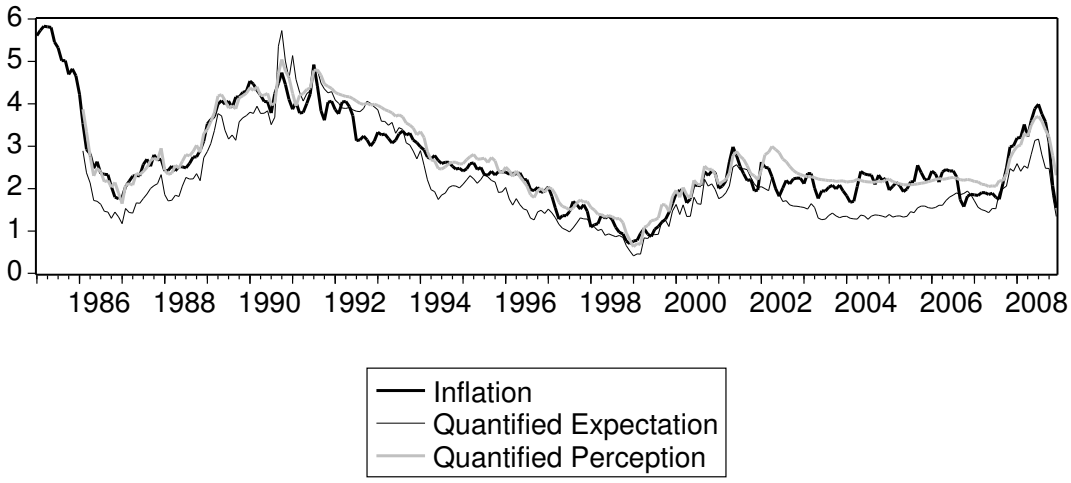
Note: For detailes concerning the construction of baseline and factual news series see Section 2.3.

FIGURE 4
Disagreement at Euro Area Level



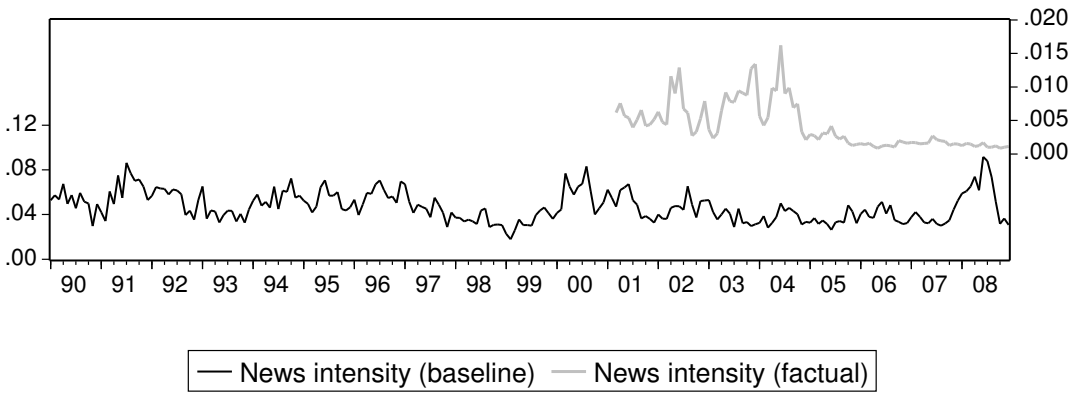
Note: For details concerning the measure of disagreement in perceptions and expectations see Section 2.2.

FIGURE 5
Perceptions and Expectations at Euro Area Level



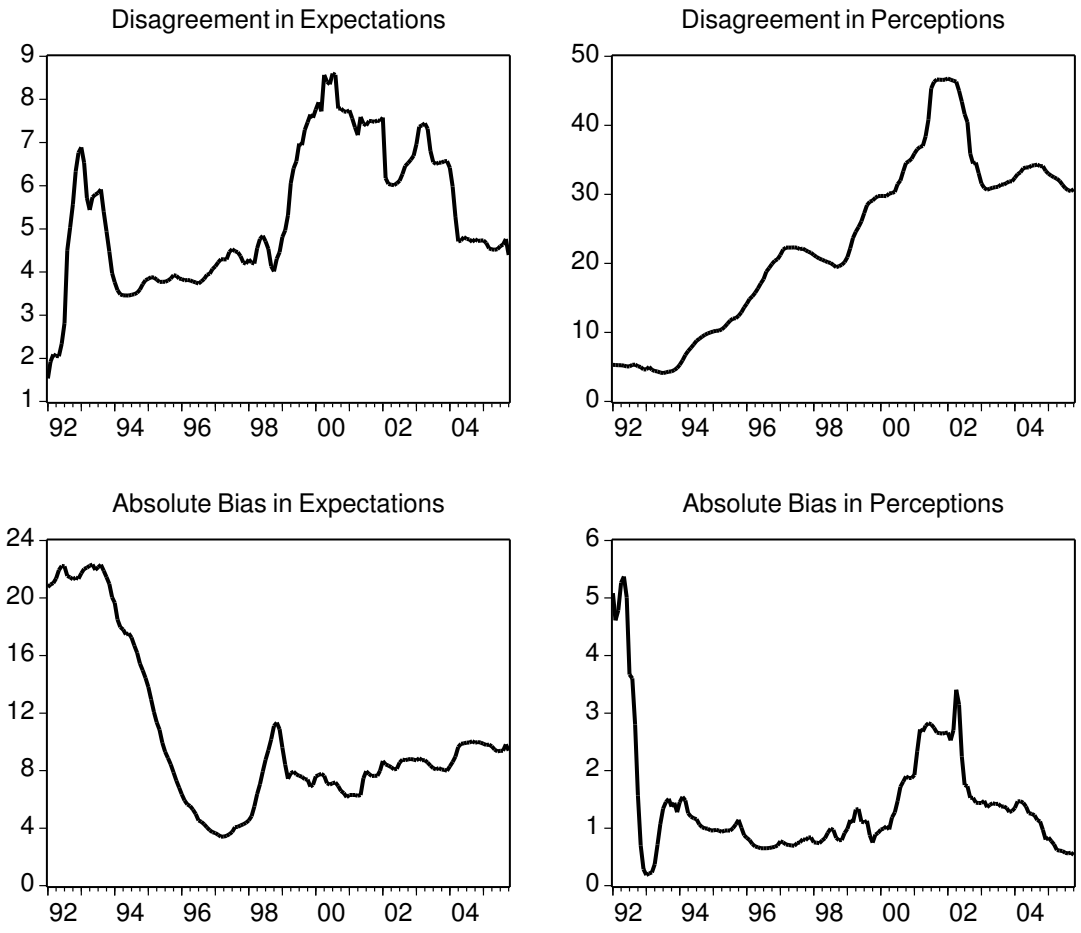
Note: For details concerning the procedure to quantify perceptions and expectations see Section 2.1.

FIGURE 6
News Intensity at Euro Area Level



Note: For detailes concerning the construction of baseline and factual news series see Section 2.3.

FIGURE 7
Chow Statistic Across Time at Euro Area Level



Note: A Chow Test is being conducted recursively. For details see Section 4.2.

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