DISAGREEMENT ON INFLATION EXPECTATIONS IN G7-COUNTRIES

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ABSTRACT. We investigate a new *Consensus Economics* data set with disaggregate expert inflation forecasts from G7 countries. We find that the precision of forecasts has risen in the late 1990s as inflation became more stable. The central tendency of inflation forecasts are found to be biased for about half of the countries in the study and in general – with the notable exception of Germany – rationality has to be rejected. The forecasts can still be systematically improved with information from the past variables (including inflation, unemployment and interest rates). All in all the results call for a rejection of the efficiency hypothesis. There is some evidence that the cross-sectional dispersion of forecasts (disagreement) rises with inflation rate and during recessions – which is in line with theories of different information sets and the possibility that forecasters have different views on the strength of propagation mechanisms.

Keywords: inflation expectations, survey data, professional forecasters, disagreement

JEL Classification: E31, E32, E37, C53

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1. Introduction

As Carroll (2003) and Hommes (2006) state at the beginning of their respective papers, the role of expectation formation in macroeconomics has been stressed regularly since Pigou (1927) and Keynes (1936). Kenneth Arrow's sentences from an interview published in Colander et al., eds (2004) are worthwhile to be repeat:

> "One of the things that microeconomics teaches you is that individuals are not alike. There is heterogeneity, and probably the most important heterogeneity here is heterogeneity of expectations. If we didn't have heterogeneity, there would be no trade."[1]

This paper adds to the literature on the theory and empirics of inflation expectation formation by investigating disagreement among professional forecasters in G 7 countries by means of survey data and testing selected hypothesis.

Several studies have documented that professional forecasters sometimes disagree to a surprisingly large degree. Therefore, the question arises, whether forecaster disagreement can be justified theoretically. Second, it is natural to ask how these models can be tested empirically. A literature survey reveals the following possible explanations for differing forecasts across a given set of professional forecasters:

Diverging information sets. The forecasting institutions may rely on different information sets. In particular, an individual forecaster may have specific information other forecasters have not or may have information more timely than its competitors. Differing information sets are a well-known topic in explaining diverging expectations at least since Lucas (1973) justified his aggregate supply function with the so-called "island parable". According to this line of reasoning agents are better informed over the circumstances of the market they act on and less good informed over the development of the aggregate price level. The producers are specialized in producing a certain good. They are assumed to be well informed about the circumstances in their own market, but can be surprised by macro policy. In other words, the agents live on their own, separate island, which represent the respective market. If the price of the product changes the agents, have to gauge whether this is due to idiosyncratic shocks or due to the course of monetary policy. A version of this model was presented by Cukierman and Wachtel (1979) who give an explanation for a positive relation between the divergence in beliefs and the variance of aggregate demand shocks/the variance of inflation. The extension of the model in Cukierman and Wachtel (1982) delivers an explanation for the correlation between the variance of relative price changes and the variance of inflation expectations/the variance of inflation (Parks, 1978). The recent models by Mankiw and Reis (2002), Mankiw et al. (2003) and Carroll (2003) also follow the line of argumentation laid out by the assumption of diverging information sets. In particular, Carroll (2003) proposes a micro-founded model of transmission of inflation expectations between professional forecasters and households (see Roberts (1997) and Branch (2004), among others, for related work). Carroll argues that the dynamics of aggregate household expectations is adequately captured by a model in which households choose to update their expectations sporadically rather than instantaneously. Information about inflation spreads slowly across households in the following "epidemiological" way. Although the model is build explicitly to explain the behavior of non-professional observers of the economic environment, one could argue that a similar process causes some professional forecasters to adjust only sluggishly to the new available "best" forecast. Explanations could be production costs for each revision of a forecast, production lags caused by hierarchical structures in larger institution, or simply fixed publication dates that do not allow to react immediately to any new information at each point in time. In addition, one might argue that some forecasters rely their forecasts on some information that is not publicly available; think, for example, of the results of the several business tendency surveys undertaken for example by the ifo institute, the ZEW institute, the IWH institute, the

[1] Colander et al., eds (2004), p. 301, cited in Hommes (2006), p. 1.

OECD, the EU commission, or the employers organizations. The information from these surveys is more timely available to the institutions that undertake the survey and may have, therefore, a larger impact on the forecast than on the forecasts of other institutions.

Diverging assumptions. Practically all real-life forecasts are conditional forecasts. While one might argue that this fact demands a richer model to make the crucial variables also endogenous to the model, this advice runs into practical limits since economic forecasts rely on non-economic conditions like the political environment. To the extent that forecasters have different settings regarding these exogenous variables their forecasts differ.

Diverging models and theories. Economists generally have no consensus over "the" macro-economic model. In particular, issues probably relevant for macro-forecasting seem to be under ongoing debate. For example, Fuller and Geide-Stevenson (2003)) report that the members of the American Economic Association reach no consensus whether a economy in a short-run equilibrium at a real gross domestic product (GDP) below potential GDP has a self-correcting mechanism that will eventually return it to potential. Admittedly, not all forecasters belong to academic societies and not all academic economists are involved in forecasting. Unfortunately, there is little systematic direct evidence on forecasters preferred models and theories. The study of Batchelor and Dua (1990) documents considerable differences among forecasters as it comes the their ideological point of view and forecasting methods. However, they find no systematic differences in forecasting quality. In particular, following a Keynesian or Monetarist ideology is of no importance for the accuracy of the published forecasts. Döpke and Fritsche (2007) seek to establish indirect evidence regarding the question whether forecasters share a common belief. Relying on an analysis of inflation and growth forecast errors they conclude that there is no common model in forecasters mind.

Diverging incentives. Forecast accuracy might not be the only aim of the forecasters. Rather, they might seek public attention for their institution. If this is the case, an unbiased forecast is not the optimal anymore, since the utility of the forecaster depends on more than one argument (Laster et al., 1999, Ehrbeck and Waldmann, 1996). In other words, forecasts might diverge, because the individual forecasters give more or less weight to publicity of the forecast relative to its accuracy. Diverging incentives might boil down to a diverge interaction between the consensus forecast and individual forecasts. For example, forecasters may follow an opportunistic strategy and stick to some kind of consensus forecast to preserve reputation even in the case that the own predictions are wrong. In an investigation of the behavior of American forecasters, McNees (1992) reports that professional forecasters heavily rely on some kind of consensus forecast. This idea has been particularly successful in explaining forecaster' behavior with respect to the development in financial markets (Löffler, 1999). Finally, forecasters often are found to be too conservative; i.e. not all forecasters do change forecasts enough when the underlying assumptions have altered (McNees, 1992).

Policy influence and rent-seeking behavior. A related source of forecaster disagreement might be seen in forecasting as part of the policy advice process. In particular, Stege (1989) finds some ate least anecdotal evidence of so-called "intentional" forecast errors, i.e., e.g., the forecaster predicts something to prevent it. Insofar the forecasters represent diverging political and ideological viewpoints the forecasts will differ accordingly. Furthermore, Kirchgässner (1999) argues that under standard assumptions of rent-seeking behavior economic advisers will try to promote their political clients. Consequently, the forecasts will differ as the clients interests differ.

Diverging loss functions. Forecasters might also disagree, because they have different loss functions. This explanation is emphasized by Capistran and Timmermann (2006) who assume that the individual forecasters have different weights concerning a possible over- or underestimation of the inflation rate. Their model with an asymmetric loss function implies a biased forecast with serial correlation and a cross-sectional dispersion that rises with the level of inflation variance. This might be the case because (i) costs/benefits ratios of different actors might

be differently distributed across forecasters, (ii) forecasters might have an incentive to behave strategically (Laster et al., 1999), or (iii) due to psychological factors which can be explained by "prospect theory" (in this case the loss function is kinked, see Kahneman and Tversky (1979)).

Uncertainty. A last interpretation of forecaster disagreement, i.e. of a cross-sectional dispersion of forecasts is the notion that dispersion reflects forecast uncertainty. If dispersion is high, so is the uncertainty of the forecast (Rich and Tracy, 2003, Bomberger, 1996). This interpretation, however, in a sense simply summarizes all the aspects that have been mentioned so far. Moreover, there seems to be no empirical link between forecast dispersion in t and the forecast error in t+1 (Döpke and Fritsche, 2006).

This list of possible explanations of the dispersion phenomenon defines a whole research program. In this paper, we will focus on some aspects and base our conclusions on the results of selected tests but also on own preparatory work in other papers. In a recent paper (Döpke et al., 2005), we tested the sticky information model of Carroll (2003). In a nutshell, we found evidence for the "epidemiological" model – which implies heterogeneity across different types of agents – to hold empirically in European countries. Furthermore, using the model of Mankiw and Reis (2002), we estimated and confirmed parameter values for the "sticky information Phillips curve" (Döpke et al., 2006). In both papers, however, we only used the the central tendency of professional forecasters' inflation expectations at quarterly frequency.

In the course of this study, we focus on both, the central tendency as well as the cross-section dimension of our data set by using monthly data for all G7-countries. We analyze bias, rationality, and efficiency of the central tendency along the lines of reasoning suggested in Mankiw et al. (2003). We then proceed by testing for a positive correlation between level of inflation/inflation variance and cross-section dispersion in beliefs which would give support to theories of divergent information sets (Cukierman and Wachtel, 1979). We implicitly test for the divergent beliefs on the propagation on inflationary shocks on the economy by testing for the relationship between the business cycle and the dispersion and we report that the reasons for most of the periods, where we find "dissent" is due to skewed distribution – which points to the often-reported tendency of the majority of forecasters to adjust towards consensus, whereas a minority might find it worthwhile to differ from the consensus (Lamont, 2002).

The plan of the paper is as follows: Section 2 explains the data and presents some basic descriptive statistics, section 3 summarizes the tests on bias and efficiency, and section 4 discusses our preliminary findings for the relationships between disagreement inflation variance and presents an classification scheme based on Kolb and Stekler (1996) to distinguish consensus regimes from regimes of dissent. Finally, section 5 concludes the paper.

2. Data and Summary Statistics

2.1. **The Consensus Economics Data Set.** In this study, we rely on data from the surveys conducted by *Consensus Economics*, a London-based firm.[2] Each month, starting in October 1989, *Consensus Economics* polls institutions like investment banks or research institutes for economics about their predictions for the most common macroeconomic variables.[3] Since most of the panelists are located in the country they are forecasting upon, country-specific expertise is guaranteed. The largest sample is available for the G7 countries, on which we concentrate in this paper. A big advantage of the data set is that estimates are comparable across countries as well as across panelists. This is assured through the procedure the surveys are conducted; *Consensus Economics* publishes its survey for all countries in the second week of each month based on a foregoing survey period of two weeks.

[2]The company's web page is available under http://www.consensuseconomics.com. See Dovern and Weisser (2007) for a detailed information on the data set and some basic summary statistics. The manuscript is available from both of the authors upon request.

[3]Variables in the survey include real growth of the gross domestic product, real growth of industrial production, consumer price inflation, the short-term interest rate, the long-term interest rate, changes in the real effective exchange rate, real growth of fixed investment, the unemployment rate and the current account balance.

The participating institutions are asked to state their predictions for the current and the subsequent calender year, i.e. the survey data set provides series of *fixed event* forecasts. Once a quarter there are special questions included in the survey that asks for the predictions on a selected subset of variables for the following quarters, i.e. for *fixed horizon* forecasts. For these special questions, however, only the *consensus forecasts* are published. Since we are mainly interested in the cross-section dispersion of forecasts in this study, unfortunately we have to start from the *fixed event* forecast data set for which the disaggregated data are available (Dovern and Weisser, 2007).

The approach taken in the subsequent analysis, however, requires the transformation of *fixed event* forecasts into time series of approximations of the underlying *fixed horizon* forecasts. We use this approach for two reasons. First, we want to avoid any problems resulting from seasonality in disagreement measures for *fixed event* forecasts. And second, we would like our results to be directly comparable to the findings presented in Mankiw et al. (2003).

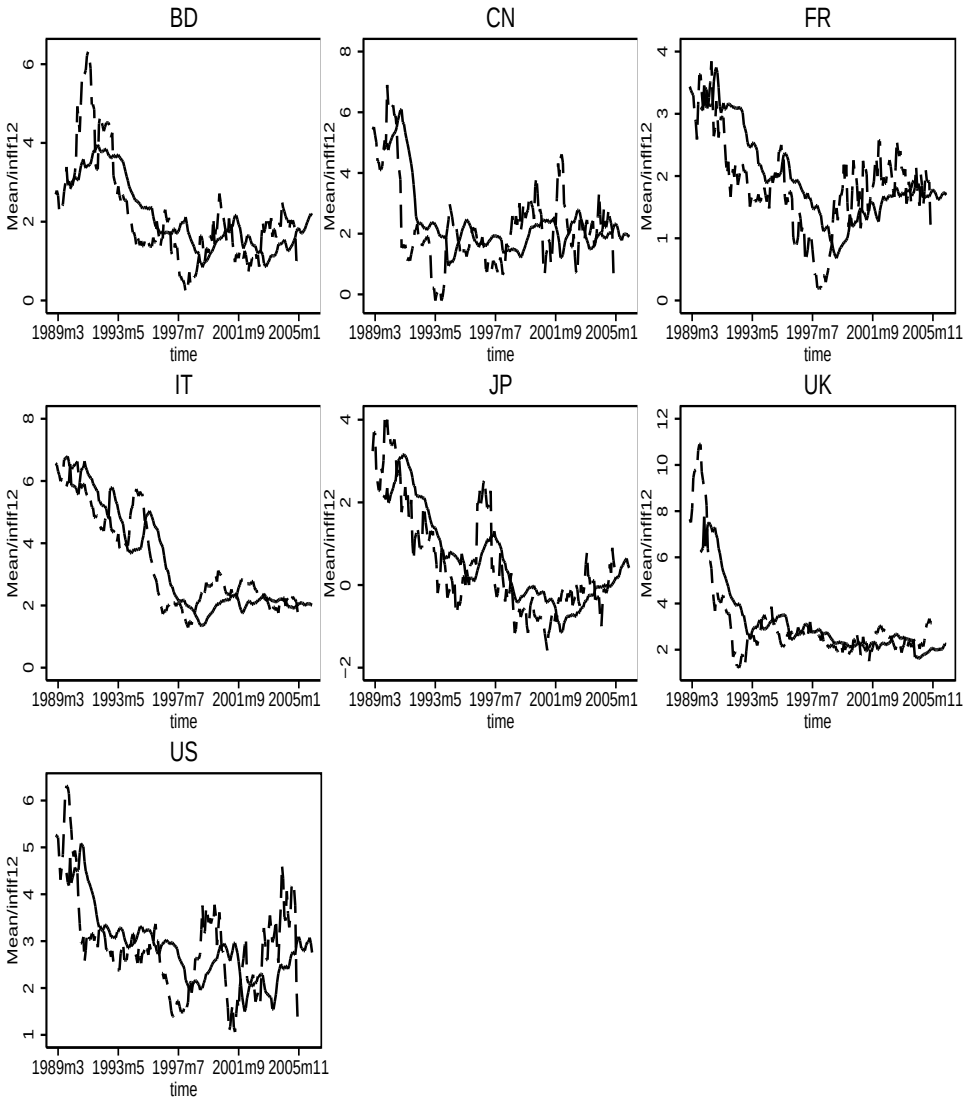
We use a simple transformation rule. Denoting a *fixed event* forecast for the development of a target variable V in year s made in month m of year y by $F^{fe}_{y,m,s}(V)$ and a *fixed horizon* forecast with a horizon of twelve months made at the same time for the same target variable by $F^{fh}_{y,m,12}(V)$, our transformation from *fixed event* to *fixed horizon* forecasts is given by

$$F^{fh}_{y,m,12}(V) \quad = \quad \frac{12-m+1}{12} F^{fe}_{y,m,y}(V) + \frac{m-1}{12} F^{fe}_{y,m,y+1}(V) \quad . \tag{1}$$

That is, we compute the *fixed horizon* forecasts for the next twelve months as a simple weighted average of the forecasts made for the current and the subsequent calendar year that are reported in the data set. For example, the forecast from May in year y for the inflation rate between May in year y and May in year $y+1$ is approximated by the sum of $F^{fe}_{y,5,y}(\pi)$ weighted by $\frac{8}{12}$ and $F^{fe}_{y,5,y+1}(\pi)$ weighted by $\frac{4}{12}$. The approximation error of this method depends on how smooth inflation expectations are: If the price development is relatively stable, the approximation should coincide very closely with the true underlying *fixed-horizon* expectations. Exceptional one-time shocks to prices (such as the recent VAT increase in Germany, which, however, came into effect after our sample end at the beginning of 2007) would lead to larger errors. Such one-time shocks are arguably relatively rare.

2.2. **Descriptive Statistics.** Figure 2 displays the individual forecasts, $E_t\pi_{t,t+12}$ and actual inflation $\pi_{t,t+12}$. The forecasts typically—except when inflation is temporarily high, such as in Germany around 1991—lie within ± 1 percent of the inflation rate over the *past* year. As actual inflation has tended to fall since the late 1980s this implies that the forecast errors are on average positive (see Table 2 below for formal evidence). This sluggishness may be an artifact of the relatively short sample: If the predicted variable follows a drift-less random walk process, it is of course optimal for forecasters to use the most recent observed value as their preferred predictor. While the successful monetary policy and increased central bank credibility have probably caused inflation rates to become lose persistence (see e.g. Cecchetti et al., 2007), inflation in countries like Germany and the US has remained to be sensitive to the current rates. This suggests that forecasters continue to believe that over the short horizons inflation can move a bit away from the (explicit or implicit) inflation target.

While inflation expectations are largely determined by current inflation rates, Figure 2 documents that forecasters do not agree. How much they disagree, measured by the cross-sectional average interquartile range, varies across countries between 0.21 percent (France) and 0.38 percent (United Kingdom). Figure 2 illustrates that there is not much of a trend in disagreement except for its reduction in Italy, Japan and the United Kingdom after 1993. This may result from relatively little variability of inflation (and inflation expectations) in our sample. Table 1 shows the two most widely used measures for forecast accuracy, the *mean absolute error* (MAE) and the *root mean squared error* (RMSE), for each of the countries. In addition, we show both



— consensus, – – actual inflation

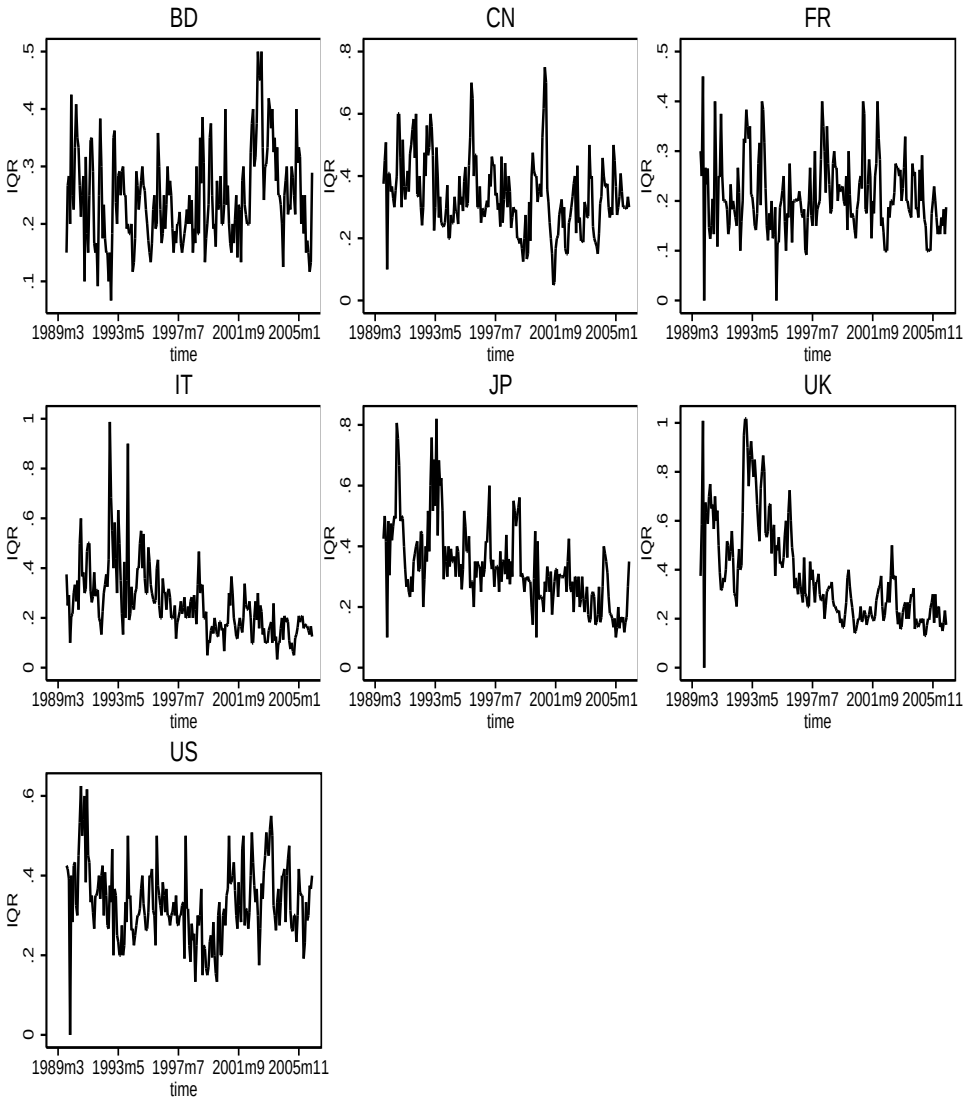
Note: Inflation and inflation expectations at time t are $\pi_{t,t+12}$ and $E_t\pi_{t,t+12}$, respectively.

FIGURE 1. Consensus Expectations (Mean) and Actual Inflation

statistics computed for the post-1999 period only since at his point the Euro area came into existence and also for the other countries the inflation regime is not stable over the sample period. The numbers here refer to the forecast performance of the *consensus forecast* computed as the mean over the cross-section each month, respectively.[4]

The figures tell the following story. Forecast precision is highest in France and lowest in Canada. When comparing the post-1999 sample to the pre-1999 sample, forecast errors in general are much smaller during the recent sub-sample. The only exception are the US where both the MAE and the RMSE are higher in the post-1999 sample relative to the full sample period. This might be explained by the fact that in the other countries inflation rates came down considerably over the sample whereas this development is less pronounced in the US. Since a higher level of inflation generally goes along with higher prediction errors of inflation forecasts, these results are not very surprising.

[4]Given very few outliers, the cross-sectional mean is practically identical to the corresponding median.



Note: Disagreement is measured by the cross-sectional interquartile range.

FIGURE 2. Disagreement about Inflation Expectations

	Germany	Canada	France	Italy	Japan	UK	US
Total sample							
RMSE	0.90	1.37	0.66	0.87	0.81	1.09	0.96
MAE	0.73	1.02	0.55	0.69	0.69	0.74	0.79
Post 1999							
RMSE	0.61	1.14	0.56	0.59	0.57	0.52	1.09
MAE	0.53	0.89	0.46	0.46	0.50	0.42	0.96

TABLE 1. Performance of consensus forecasts

3. EFFICIENCY

Most literature on survey data investigates whether the publicly available forecasts are consistent with the notion of rational expectations (see e.g., Keane and Runkle (1990) or Davies and Lahiri (1995)). The rational expectation hypothesis of Muth (1961) implies demanding time series properties for series of sequential forecasts. Although we are not particularly interested in efficiency properties of forecasts in this study, we want to present some tests on the central tendency of the *consensus forecasts* in our data set. In what follows, we assess whether the *consensus forecasts* can be said to be unbiased and efficient.

We start with a test on bias to test whether the forecast errors on average are zero. The test requires regressing the prediction errors on a constant. Results are presented in Table 2. The tests indicate that for four of the countries inflation forecasts are biased. Whereas we find unbiased inflation forecasts for Germany, Italy, and the US, the average forecast errors for Canada, France, Japan, and the UK are significantly positive. This means that in those countries forecasters tend to predict too high inflation rates on average.

	Germany	Canada	France	Italy	Japan	UK	US
Constant	−0.01	0.21	0.15	0.04	0.14	0.28	0.05
t-Statistic	−0.12	2.19**	3.32***	0.57	2.52**	3.70***	0.78

Notes: *,**,*** denote significance at the 10%, 5%, and 1% level, respectively.

TABLE 2. Tests for Bias

A second test assesses whether the *consensus forecasts* themselves contain information about the forecast error and, hence, could improve forecasts. Table 3 shows the results. Under the Null hypothesis of rational forecasts, we should find a zero constant, β_1, and a zero marginal effect of the *consensus forecast*, β_2. The estimates indicates that the central tendency of the forecasts could be improved by simply using information of the forecasts themselves, i.e. the forecasts themselves can be used to predict the forecast errors. Again, we find some differences across countries. Only for Germany we can't reject the hypothesis that both coefficients are zero. The regression for the forecast errors for Japanese inflation shows a zero constant but positive correlation between the forecasts and the forecast errors. For all other countries both coefficients are estimated significantly different from zero.

	Germany	Canada	France	Italy	Japan	UK	US
Constant	0.20	−1.04	−0.66	−0.66	0.06	−0.57	−1.51
t-Statistic	1.18	−5.27***	−5.55***	−4.96***	0.97	−3.30***	−6.25***
Forecast	−0.09	0.53	0.42	0.21	0.14	0.27	0.54
t-Statistic	−1.34	7.09***	7.28***	5.79***	2.71***	5.39***	6.70***

Notes: *,**,*** denote significance at the 10%, 5%, and 1% level, respectively.

TABLE 3. Is Information of forecasts fully exploited?

Another implication of the rational expectation hypothesis is that forecast errors should be independently distributed without any sign of autocorrelation. To test this implication we regress the forecast errors on a constant and lagged forecast errors. The estimates are given in Table 4.[5] Once more, the evidence is mixed. Whereas the results for Italy, Japan, the UK, and the US show no sign of autocorrelated forecast errors at all, the picture for the remaining three countries differs. For Germany and France there is strong evidence for positive autocorrelation, i.e. positive forecast errors tend to be followed by positive forecast errors and negative forecast errors tend to be followed by negative forecast errors. This is a pattern one would expect if forecasters adjust only sluggishly to permanent shocks. For Canada the results indicate some degree of negatively autocorrelated forecast errors, i.e. positive forecast errors are likely to be followed by negative errors and vice versa.

Finally, we assess whether information contained in other macroeconomic data that is available at the time the forecasts are made is fully exploited in the *consensus forecasts*. To proxy the available information we include the inflation rate, the real change in industrial production, the change of the real effective exchange rate, the unemployment rate, as well as the short term interest rate. We think that assuming a maximum publication lag of one month is reasonable for the variables included in the regression so that information about last month's developments

[5]Robustness checks including further lags of the forecast errors lead to the same conclusions.

	Germany	Canada	France	Italy	Japan	UK	US
Constant	0.02	0.34	0.11	0.08	0.24	0.32	0.10
t-Statistic	0.23	3.49***	2.38**	1.17	4.31***	4.71***	1.42
Lagged Error	0.19	−0.28	0.39	0.01	−0.04	0.01	−0.03
t-Statistic	2.56***	−3.99***	5.69***	0.19	−0.53	0.09	−0.35

Notes: *,**,*** denote significance at the 10%, 5%, and 1% level, respectively.

TABLE 4. Are Forecast Errors Persistent?

should have been available when making the forecasts in all cases. It is well known that the figures for some macroeconomic variables undergo heavy revisions following the initial publication of the statistical offices (see e.g. Croushore and Stark (2001) for an exemplary demonstration and Croushore and Stark (2003) for a discussion of the consequences). And of course, only the initial publication is available to the forecaster at the time the prediction is made. For this reason, one should use real time data whenever possible to assess the efficiency of macroeconomic forecasts. In the case of the variables chosen here this might apply to the real change of industrial production only since all other variables are either instantaneously observable or usually not heavily revised. Therefore, we choose to work with ex-post data rather than real time data sets. The results are given in Table 5. Now, all regressions show non zero estimates for the constant term. The forecasts for Italy are remarkably efficient with respect to the additional information we include in this test. We find only a significant predictive power of the real change of industrial production whereas all other marginal effects are estimated to be not different from zero. For the other countries the picture is not as clear. In all cases we find two or more significantly non-zero coefficients. There is, however, no clear picture about information of which variables is neglected when forming the forecasts. The sub-sets of variables that are significant in the regressions varies from country to country. There are, however, some results about the significant effects that are worth reporting. First, with the exception of Germany high inflation is followed by more positive forecast errors, i.e. forecasters overstate the persistence of inflation rates. One can also argue that this follows from the fact that on average forecasters did not anticipate the disinflation processes that can be observed over the sample period for most of the included countries. Second, a high unemployment rate is associated with subsequent positive forecast errors in all cases. This means that forecasters tend to overestimate the inflation dampening effects of high unemployment rates. Third, all significant coefficients for the short term interest rate are negative. This leads us to conclude that forecasters tend to overestimate the short run effects of monetary policy decisions for the price development. Alternatively one could argue that forecasters misjudge to what extend higher short term interest rates are an indication for higher inflation pressure in the short term.

The results presented in this section resemble the outcomes of other studies that analyze the efficiency of *consensus forecasts*; the forecasts in our data set seem to exhibit similar characteristics as are usually attributed to survey data on forecasts for price developments. This makes us quite confident that the following analysis of the dispersion of the forecasts is not flawed by a totaly non-representative data sample.

4. DISAGREEMENT

4.1. **Tests for Consensus among Forecasters.**

Methodology. According to Zarnowitz and Lambros (1987) a consensus can be defined by a "unimodal, symmetrical and sufficiently tight" (Zarnowitz and Lambros, 1987, p. 592) distribution. However, the question is, under which circumstances can we reject a consensus? Kolb and Stekler (1996) propose a reasonable multi-step procedure, which is based on statistical tests of uniformity, skewness and kurtosis.

Starting with the uniformity assumption, the authors argue, that "(a) set of forecasts can be said to generate a consensus only if the uniform distribution is rejected and normality is

	Germany	Canada	France	Italy	Japan	UK	US
Constant	−4.287***	−6.268***	−4.033***	−1.610**	−0.745*	−1.775***	−2.924***
	(0.992)	(0.407)	(0.371)	(0.697)	(0.439)	(0.256)	(0.484)
$Forecast_t$	1.031***	0.997***	0.790***	−0.016	0.624***	−0.534***	0.214
	(0.279)	(0.178)	(0.152)	(0.229)	(0.183)	(0.192)	(0.316)
π_{t-1}	−0.238**	0.485***	−0.052	0.087	−0.021	0.538***	0.434***
	(0.107)	(0.093)	(0.101)	(0.159)	(0.079)	(0.117)	(0.147)
IP_{t-1}	−0.033*	0.108***	−0.013	−0.077***	−0.025**	−0.063**	0.054**
	(0.017)	(0.017)	(0.012)	(0.018)	(0.010)	(0.031)	(0.021)
XR_{t-1}	−0.030*	−0.021	−0.050***	0.005	0.050***	0.028***	0.119***
	(0.017)	(0.013)	(0.011)	(0.010)	(0.004)	(0.010)	(0.015)
U_{t-1}	0.414***	0.566***	0.301***	0.101	0.209**	0.349***	0.230**
	(0.097)	(0.044)	(0.033)	(0.066)	(0.103)	(0.048)	(0.116)
$R3m_{t-1}$	−0.114	−0.398***	−0.048**	0.066	−0.128***	−0.057	−0.082
	(0.123)	(0.046)	(0.022)	(0.050)	(0.045)	(0.058)	(0.078)
$\bar{R}^2$	0.31	0.68	0.55	0.23	0.44	0.33	0.40
N	193	193	193	193	193	193	193

Notes: *,**,*** denote significance at the 10%, 5%, and 1% level, respectively.
Numbers in parenthesis denote standard errors.

TABLE 5. Are forecasts efficient with respect to other information?

not rejected (...)" (Kolb and Stekler, 1996, p. 458). However, the authors argue further, that even if the hypothesis of normality is rejected statistically, a consensus is still possible, since the forecasters may even be closer together than normality implies. To exclude this possibility, the results of tests for skewness and kurtosis are calculated. If the distribution is skewed, a consensus is rejected. If the distribution is not skewed, a significant kurtosis indicates that the forecasters are very close to each other. Thus, this case is also counted as a consensus.[6]

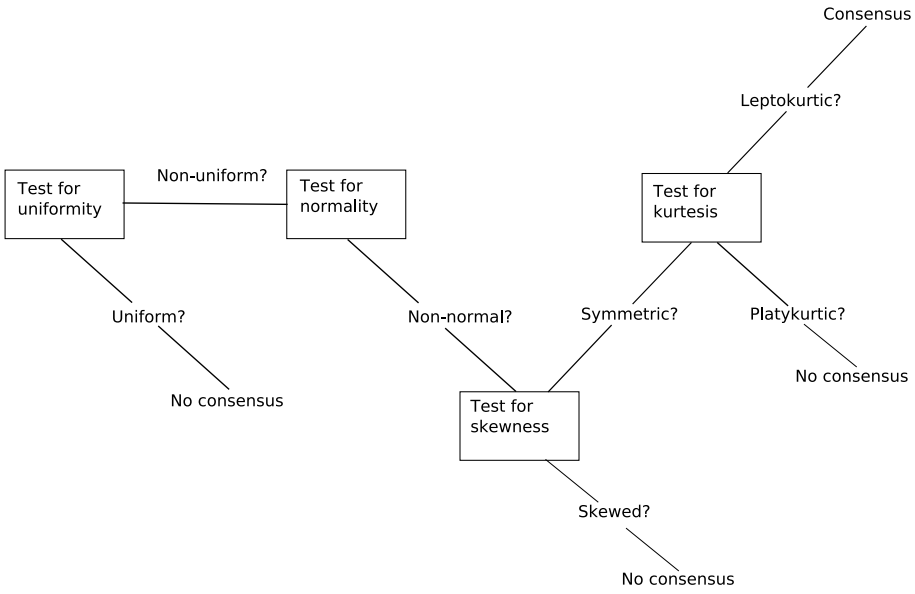


FIGURE 3. Test procedure by Kolb and Stekler (1996)

Results. Using the relevant cross-section we run the Kolb–Steckler filter for consensus on our data set for each month and country.[7] The results are summarized in Table 6; the numbers shown are percentages. The most striking result is that in general there seems to exist a consensus (according to the definition taken on here) among the professional forecasters in the majority

[6]The tests are: a Komolgorov test of the hypothesis that all forecasts are from a uniform distribution between ranges defined below, a Shapiro–Silk test for normality, skewness, and kurtosis, respectively.

[7]As bounds for the test on uniform distribution we choose the minimum and maximum observation that is reported for a specific month, respectively. In this way, we automatically account for shifts in mean inflation rates during the sample period for most of the countries included in the data set.

	Consensus	No Consensus		
		Uniform	Skewed	Platykurtic
Germany	88.3	0.0	9.8	2.0
pre-99	87.4	0.0	11.7	0.9
post-99	89.4	0.0	7.4	3.2
Canada	94.1	0.0	5.9	0.0
France	91.2	0.0	8.8	0.0
pre-99	91.9	0.0	8.1	0.0
post-99	90.4	0.0	9.6	0.0
Italy	87.3	0.0	12.2	0.5
pre-99	87.4	0.0	11.7	0.9
post-99	87.2	0.0	12.8	0.0
Japan	90.2	0.0	9.3	0.5
UK	76.1	0.0	22.4	1.5
pre-93	33.3	0.0	61.5	5.1
post-93	86.1	0.0	13.3	0.6
US	86.3	0.0	12.7	1.0

TABLE 6. Frequency of *consensus categories* according to Kolb–Steckler approach

of cases. The fraction of periods in which the distribution of forecasts showed a consensus view reaches from 76.1% in case of the UK to not less than 94.1% for Canada. The reasons why there is no consensus view during some periods are also very similar across countries. We find that for no single case in the sample the first hypothesis that the forecasts follow a uniform distribution is not rejected, i.e. in all cases forecasts tend to be clustered to some extend around some value rather than spread uniformly across a specific range of values. This result is in line with the findings of Kolb and Stekler (1996) for financial forecasts. In the wide majority of cases where a consensus view is rejected this is due to a skewed distribution of forecasts. In contrast a platykurtic distribution of forecasts accounts for only a tiny fraction of rejections of a consensus view in all countries.

Since changes in the monetary policy regime are likely to influence behaviors and beliefs of inflation forecasters, we present sub-sample statistics for the relevant cases. For those countries from the sample that are today members of the Euro are, the monetary policy environment changed at the beginning of 1999 when the European Central Bank (ECB) took over the responsibility for monetary policy from the national central banks. The results listed in the table suggest, however, that this change had no significant influence on the cross-sectional characteristics of the inflation forecasts made with respect to the consensus issue analyzed in this section. Only for Germany there seem to be some effects. The figures indicate a higher unconditional probability of a consensus view in the post-1999 period. Furthermore, platykurtic distributions of the forecasts became relatively more important for rejecting the hypothesis of a consensus among forecasters while the fraction of skewed cross-section distribution decreased from 11.7% to 7.4%.

The second case for which we perform a comparison between two sub-samples are the UK where an inflation targeting strategy for the Bank of England was introduced towards the end of 1992. Here, a comparison of the high inflation pre-1993 sample to the inflation targeting post-1993 sample reveals an interesting difference. After the introduction of inflation targeting the fraction of month in which there is a consensus among inflation forecasters increased considerably from not less than 33.3% to 86.1%. This indicates that the inflation target serves as an anchor for inflation expectations and influences also professional forecasters who cluster around the target whereas the distribution had been more diffuse during the pre-1993 period.

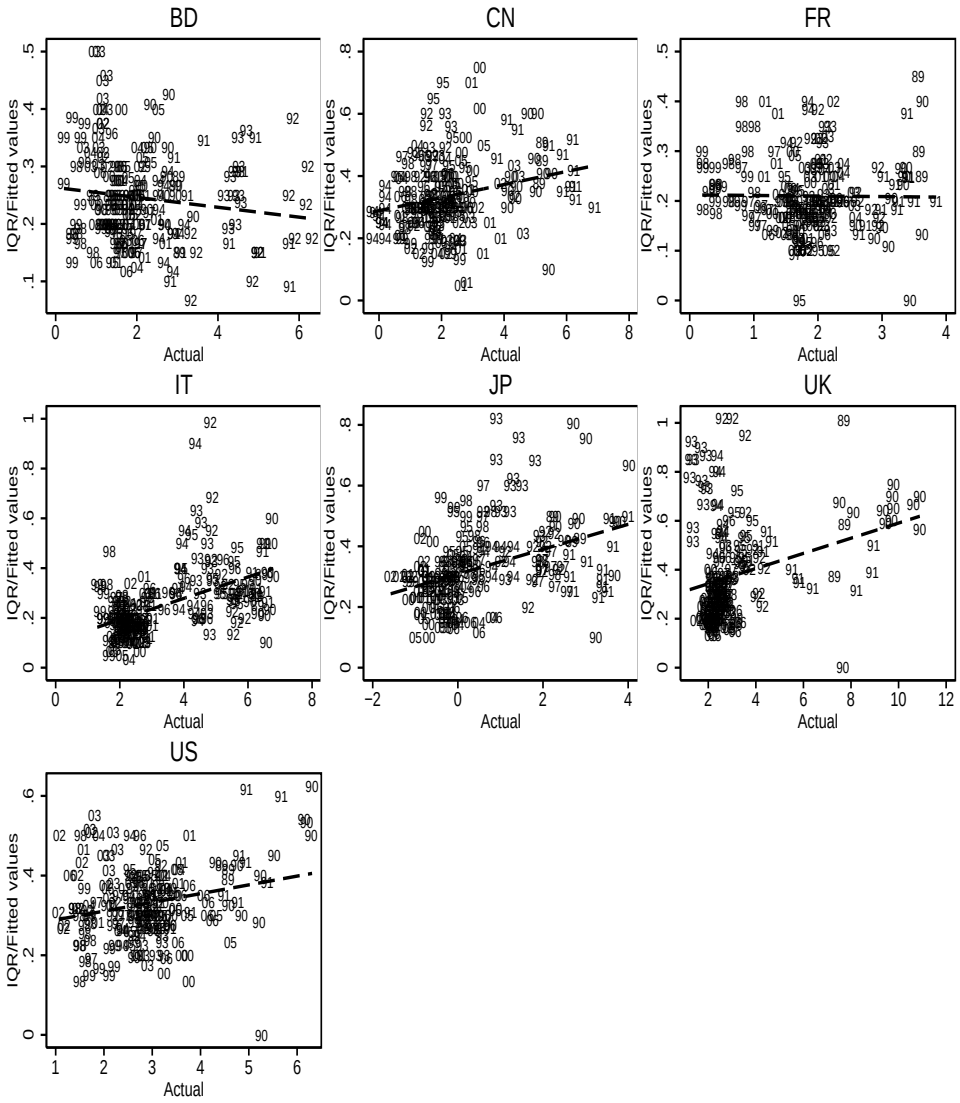


FIGURE 4. Disagreement about Inflation Expectations and Actual Inflation

4.2. **Disagreement and the Business Cycle.** Figure 4 and Table 7 inspired by Mankiw et al. (2003) (see (Mankiw and Reis, 2002) table 6 and figure 9) investigate the determinants of disagreement on inflation expectations. Mankiw et al. (2003) document a robust relationship between disagreement on one hand and inflation and inflation uncertainty on the other in the US data over the past five decades. As figure 4 suggests such relationship is less clear-cut in our sample: Disagreement tends to increase with inflation in five countries but appears to be unrelated in Germany and France.

Table 7 reports the results of regressions in which disagreement is explained with the level of inflation, inflation uncertainty (proxied with squared inflation change) and GDP. Each cell of the top panel displays estimates from a regression with only one explanatory variable. In the middle panel cells report the estimates from the disagreement regressions on the given variable and inflation rate. Finally, the bottom panel shows multivariate regressions on all three variables. The findings are as follows:

- Regressions in table 7 confirm the positive dependence of disagreement on inflation rate in Canada, Italy, Japan, the UK and the US (which mostly remains significant even in multivariate regressions).

	Germany	Canada	France	Italy	Japan	UK	US
Panel A: Univariate regressions							
Inflation	-0.009^{**}	0.021^{***}	-0.001	0.043^{***}	0.041^{***}	0.031^{***}	0.022^{***}
	(0.004)	(0.006)	(0.007)	(0.005)	(0.006)	(0.007)	(0.006)
Δ Infl^2	-0.006^{**}	0.003^{*}	-0.003	0.007	0.012^{**}	0.007^{***}	0.004
	(0.003)	(0.002)	(0.009)	(0.006)	(0.006)	(0.002)	(0.003)
GDP	-0.006^{**}	-0.016^{***}	-0.003	-0.012^{*}	-0.001	-0.029^{***}	-0.022^{***}
	(0.003)	(0.004)	(0.004)	(0.007)	(0.005)	(0.010)	(0.004)
Panel B: Regression controlling for inflation rate							
Δ Infl^2	-0.004	0.003^{**}	-0.004	0.007	0.004	0.005^{**}	0.005
	(0.004)	(0.002)	(0.009)	(0.005)	(0.006)	(0.002)	(0.003)
GDP	-0.006^{*}	-0.011^{**}	-0.003	-0.016^{***}	-0.012^{**}	-0.005	-0.018^{***}
	(0.003)	(0.005)	(0.004)	(0.006)	(0.005)	(0.012)	(0.005)
Panel C: Multivariate regressions							
Inflation	-0.004	0.014^{*}	-0.010	0.045^{***}	0.046^{***}	0.029^{***}	0.012^{*}
	(0.005)	(0.008)	(0.007)	(0.005)	(0.007)	(0.009)	(0.007)
Δ Infl^2	-0.005	0.003	-0.002	0.006	-0.001	0.006^{**}	0.001
	(0.004)	(0.002)	(0.009)	(0.005)	(0.006)	(0.002)	(0.003)
GDP	-0.006^{**}	-0.009^{*}	-0.008^{*}	-0.015^{**}	-0.014^{**}	0.015	-0.017^{***}
	(0.003)	(0.005)	(0.004)	(0.006)	(0.005)	(0.015)	(0.005)

Notes: *,**,*** denote significance at the 10%, 5%, and 1% level, respectively.
Numbers in parenthesis denote standard errors.

TABLE 7. Disagreement and Business Cycle

- The relationship between disagreement and inflation uncertainty is often unclear.
- Inflation uncertainty depends negatively on GDP: It rises during recession. This seems intuitive, forecasters agree more under normal circumstances (expansions). However, their opinions about the future course of inflation seem to vary during recessions, when the inflation rate itself is probably less predictable.

The weak econometric evidence for the positive link between disagreement and inflation uncertainty may result from the lack of high inflation periods in our sample. This suggests the fact that the only country with statistically significant dependence between the two variables, the UK, is also the only country in which inflation expectations exceeded 7%.

5. Conclusion

In this paper we have presented a consistent and comprehensive analysis of the dispersion patterns of inflation forecasts for all G7-countries.

Our results differs somewhat from the outcomes of the study by Mankiw et al. (2003) on US survey data. We belief, however, that most of the conflicting results can be attributed to the different sample periods. First, unlike Mankiw et al. we find a robust and significantly positive correlation between the level of inflation uncertainty measured by the squared change in inflation and the degree of disagreement between forecasters only for the UK. A second key finding of Mankiw et al., the positive dependence of disagreement on the level of inflation, can be established for four of the seven countries on basis of the employed data set. Third, in general disagreement about the future inflation rates tends to increase during periods of weak economic growth. These facts suggest that most of the findings presented by Mankiw et al. (2003) result from the difference of disagreement levels across different inflation regimes. Whereas their samples in some cases reach back as far as to the mid 1950‘s, our data set includes the last 16 years only. Thus, we do not cover high inflation periods like the late 1970‘s and early 1980‘s in the

US.[8] And it seems to be the case that the stylized facts that Mankiw et al. (2003) present are not equally clear-cut within the low inflation regimes of our sample.[9]

For monetary policy these results have the following implications. First, we can infer that during the most recent decade the central banks of the large industrialized countries have been very successful in anchoring inflation expectations. This has made forecast uncertainty and disagreement among forecasters more independent from temporary changes in the inflation rate.[10] In the long-run this advantage can, of course, only be sustained if actual inflation outcomes are broadly in line with the announced targets that function as fix points for inflation expectations. Second, the switch towards low inflation regimes itself seems to have lowered uncertainty about future inflation. As higher uncertainty about inflation rates is usually thought to adversely affect economic activity (see e.g. Friedman, 1977, Wilson, 2006), both points imply that central banks should keep inflation rates low since - among other good reasons - this leads to positive welfare effects due to reduced inflation uncertainty.

In the future we intend to make the results more robust by testing bias, rationality and efficiency using the full panel data structure as in Keane and Runkle (1990) or Davies and Lahiri (1995). We would like to shed more light on the reasons for dissent by e.g. using probit models to estimate conditional rather then simply unconditional probabilities to find a consensus or dissent among forecasters for a particular month. Furthermore, we intend to test other hypothesis like e.g. asymmetric loss functions as in Capistran and Timmermann (2006). In addition, we intend to collect information for the institutional affiliation of forecasters, to investigate to what extent the results are driven by differing incentive structures (Batchelor and Dua, 1990).

References

Batchelor, R. and P. Dua, "Forecaster Ideology, Forecasting Technique, and the Accuracy of Economic Forecasts," *International Journal of Forecasting*, 1990, *6*, 3–10.

Bomberger, W. A., "Disagreement as a Measure of Uncertainty," *Journal of Money, Credit, and Banking*, 1996, *28*, 318–392.

Bowles, Carlos, Roberta Friz, Veronique Genre, Geoff Kenny, Aidan Meyler, and Tuomas Rautanen, "The ECB survey of professional forecasters (SPF). Review after eight years' experience," Occasional paper series 59, European Central Bank 2007.

Branch, William A., "The theory of rationally heterogeneous expectations: Evidence from survey data on inflation expectations," *The Economic Journal*, 2004, *114*, 592–621.

Capistran, C. and A. Timmermann, "Disagreement and Biases in Inflation Expectations," October 2006. mimeo.

Carroll, Christopher D., "Macroeconomic Expectations of Households and Professional Forecasters," *Quarterly Journal of Economics*, 2003, *118* (1), 269–298.

Cecchetti, Stephen G., Peter Hooper, Bruce C. Kasman, Kermit L. Schoenholtz, and Mark W. Watson, "Understanding the Evolving Inflation Process," report, U.S. Monetary Policy Forum 2007. available at http://research.chicagogsb.edu/gfm/events/conferences/2007-usmonetaryforum.aspx.

Colander, D., R.P.F. Holt, and J. Barkley Rosser, eds, *The Changing Face of Economics. Conversations with Cutting Edge Economists*, Ann Arbor: The University of Michigan Press, 2004.

Croushore, Dean and Tom Stark, "A Real-Time Data Set for Macroeconomists," *Journal of Econometrics*, 2001, *105*, 111–130.

[8]The disinflation periods in some of the countries cover only a small first part of the respective samples. And the case in which our results are most similar to the findings of Mankiw et al. (2003) is the UK, which shows at the same time the most sever disinflation coming from the highest inflation rates at the beginning of our sample period.

[9]Reassessing the data set used by Mankiw et al. (2003) for the post-1990 sub-sample only yields a similar picture.

[10]Especially for long-term forecasts this is the case. See Bowles et al. (2007) for the case of the Euro zone inflation expectations.

_____ **and** _____, "A Real-Time Data Set for Macroeconomists: Does the Data Vintage Matter?," *Review of Economics and Statistics*, 2003, *85*, 605–617.

Cukierman, A. and P. Wachtel, "Differential inflationary expectations and the variability of the rate of inflation: theory and evidence," *American Economic Review*, 1979, *69*, 595–609.

_____ **and** _____, "Relative Price Variability and Nonuniform Inflationary Expectations," *The Journal of Political Economy*, 1982, *90* (1), 146–157.

Davies, Anthony and Kajal Lahiri, "A new framework for analysing survey forecasts using three-dimensional panel data," *Journal of Econometrics*, 1995, *68*, 205–227.

Döpke, Jörg and Ulrich Fritsche, "When do forecasters disagree? An assessment of German growth and inflation forecast dispersion," *International Journal of Forecasting*, 2006, *22*, 125–135.

_____ **and** _____, "Shocking! Do Forecaster Share a Common Belief?," *Applied Economics Letters*, 2007, p. forthcoming.

Döpke, Jörg, Jonas Dovern, Ulrich Fritsche, and Jirka Slacalek, "European Inflation Expectation Dynamics," Deutsche Bundesbank Discussion Paper Series 1: Economic Studies 37, Deutsche Bundesbank 2005.

_____, _____, _____, **and** _____, "Sticky Information Phillips Curves: European Evidence," Discussion Paper 615, DIW 2006.

Dovern, Jonas and Johannes Weisser, "Survey Expectations in G7-Countries. Professional Forecasts of Macroeconomic Variables from the Consensus Data Set," mimeo, The Kiel Institut for the World Economy 2007.

Ehrbeck, Tilman and Robert J. Waldmann, "Why are professional forecasters biased? Agency versus behavioral explanations," *Quarterly Journal of Economics*, 1996, *111* (1), 21–40.

Friedman, Milton, "Nobel Lecture: Inflation and Unemployment," *The Journal of Political Economy*, 1977, *85*, 451–472.

Fuller, D. and D. Geide-Stevenson, "Consensus among Economists: Revisited," *The Journal of Economic Education*, 2003, *34*, 369–387.

Hommes, C. H., "Heterogenous agent models in economics and finance," in "Handbbok of Computational Economics. Vol. 2: Agent-Based Computational Economics," Amsterdam: North-Holland, 2006.

Kahneman, D. and A. Tversky, "Prospect Theory: An Analysis of Decision under Risk," *Econometrica*, 1979, *47* (2), 263–292.

Keane, Michael P. and David E. Runkle, "Testing the rationality of price forecasts: new ecidence from panel data," *American Economic Review*, 1990, *80*, 714–735.

Keynes, J. M., *The General Theory of Employment, Interest and Money*, London: Macmillan, 1936.

Kirchgässner, G., "On the Political Economy of Economic Policy Advice," in E. Mohr, ed., *The Transfer of Economic Knowledge*, Cheltenham: Edward Elgar, 1999.

Kolb, R.A. and H.O. Stekler, "Is there a consensus among financial forecasters?," *International Journal of Forecasting*, 1996, *12*, 455–464.

Lamont, Owen A., "Macroeconomic forecasts and microeconomic forecasters," *Journal of Economic Behavior & Organization*, 2002, *48*, 265–280.

Laster, David, Paul Bennett, and In Sun Geoum, "Rational bias in macroeconomic forecasts," *The Quaterley Journal of Economics*, 1999, pp. 293–318.

Löffler, G., "Bias in Analyst Forecasts: Cognitive, Strategic or Second Best?," *International Journal of Forecasting*, 1999, *14*, 261–275.

Lucas, R. J. E., "Some International Evidence on Inflation-Output Tradeoffs," *American Economic Review*, 1973, *63*, 326–334.

Mankiw, N. Gregory and Ricardo Reis, "Sticky Information Versus Sticky Prices: A Proposal to Replace the New Keynesian Phillips Curve," *Quarterly Journal of Economics*, 2002, *117*, 1295–1328.

_____, _____, **and Justin Wolfers**, "Disagreement on Inflation Expectations," *NBER Macroeconomics Annual*, 2003, pp. 209–248.

McNees, S. K., "The Uses and Abuses of 'Consensus' Forecasts," *Journal of Forecasting*, 1992, *11*, 703–710.

Muth, John F., "Rational Expectations and the Theory of Price Movements," *Econometrica*, 1961, *29*, 315–335.

Parks, R. W., "Inflation and Relative Price Variability," *The Journal of Political Economy*, 1978, *86* (1), 79–95.

Pigou, A. C., *Industrial Fluctuations*, London: Macmillan, 1927.

Rich, R. and J. Tracy, "Modelling Uncertainty: Predictive Accuracy as a Proxy for Predictive Confidence," Federal Reserve Bank of New York Staff Reports 161, Federal Reserve Bank of New York, New York 2003.

Roberts, J., "Is Inflation Sticky?," *Journal of Monetary Economics*, 1997, (2), 173–196.

Stege, C., *Zur Beurteilung der Prognosetätigkeit der "führenden Wirtschaftswissenschaftlichen Forschungsinstitute" in der Bundesrepublik Deutschland.*, Verlag Dr. Kovac, 1989.

Wilson, Bradley Kemp, "The links between inflation, inflation uncertainty, and output growth: New time series evidence from Japan," *Journal of Macroeconomics*, 2006, *28*, 609–620.

Zarnowitz, Victor and Louis A. Lambros, "Consensus and uncertainty in economic prediction," *Journal of Political Economy*, 1987, *95*, 591–621.