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Inflation and output growth uncertainty in individual survey expectations

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Abstract

This paper studies uncertainty using the ECB Survey of Professional Forecasters' data. We consider both inflation and real GDP growth forecasts at the micro level and explore forecast uncertainty using two alternative measures, i.e. conventional standard deviation of individual point forecasts and the median values of individual forecasters' uncertainty, which are based on subjective probability distributions of survey respondents. Our analysis indicates that individual inflation uncertainty is closely related to the output growth uncertainty. In forming expectations, individual forecasters seem to behave according to an uncertainty-augmented hybrid specification of the New Keynesian Phillips curve. We also find evidence that inflation uncertainty has a negative impact on economic activity by decreasing output growth and increasing inflation and lowering the price sensitiveness of aggregate supply.

Key words: Forecasting, Survey data, Expectations, Phillips curve

JEL Classification: C53, E37, E31

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1. Introduction

Expectations, which are crucial in price and wage formation and in the monetary policy transmission mechanism, have widely been analyzed using survey data (see Pesaran and Weale (2006) and Sinclair (2010) for basic references of survey-based studies). Since most of the studies have explored survey expectations on an aggregate level, we do not exactly know what happens behind the mean values of (point) forecasts. If, for example, the mean value of inflation forecasts increases, we do not know whether all forecasters increase their expectations by the same amount or whether only low inflation forecasters generally become high-inflation forecasters. Since only one expectations variable (usually the mean of point forecasts) is typically analyzed at a time, internal consistency of individual expectations has not been intensively analyzed. Most of the survey data are in the form of repeated cross-sections rather than genuine panel data, which restricts the analysis of expectations uncertainty.

Quite recently there has been a growing interest in examining the quantitative impact of uncertainty along the lines of e.g. Bloom (2009). Recent and ongoing crises have clearly increased uncertainty and intuitively it sounds obvious that it has some effect on economic activity. It is only that thus far we have not had much hard evidence on this uncertainty – economic activity link. This point was also made by Robert Lucas in a 2011 *Wall Street Journal* interview, where he said he had "plenty of suspicion, but little evidence" that uncertainty was holding back the recovery. This paper tries just to provide more evidence.

Typically, surveys publish only mean values of individual forecasts and corresponding conventional standard deviations as a measure of expectations disagreement. Disagreement measures dispersion (or consensus) across individual forecasters. However, it does not express confidence associated with each individual expectation. It is possible that according to point forecasts inflation expectations are still firmly anchored, although public confidence in the likelihood that the inflation target will be achieved has reduced. Probability distributions of individual survey respondents are alternative measures of forecast uncertainty. They provide useful information about the probability of the future outcome being in the specific range.

This paper studies individual professional forecasts using two alternative data sets. The analysis is

mainly based on the ECB Survey of Professional Forecasts from 1999Q1 to 2012Q3, a period that includes both the pre-crisis years with relatively stable inflation rates and the crisis years with negative inflation rates. For comparison, inflation data for the US Survey of Professional Forecasts (US SPF) is also investigated. Two alternative measures of forecast uncertainty are used. In the empirical analysis, the determinants of inflation and output uncertainty measures are examined and, in particular, the relationship between these two is scrutinized. As for the core analyses, we investigate the impact of inflation uncertainty on price developments within the New Keynesian Phillips curve relationship using a micro-data-based panel approach. As an alternative, and completing approach we use a Lucas-type of supply function in order to evaluate the impact of inflation uncertainty on output growth. Both of these analyses give strong support to the idea that (inflation) uncertainty has a negative and nontrivial effect on inflation and output.

First, we briefly describe the data in section 2. Then we analyze the inflation uncertainty in section 3, and the impact of uncertainty on inflation and output growth in section 4. Finally, some concluding remarks follow in section 5.

2. The data

Since the beginning of 1999 the European Central Bank has conducted a quarterly Survey of Professional Forecasters (ECB SPF). In this survey the ECB asks a panel of approximately 75 forecasters for their short- and long-term views of HICP inflation, real GDP growth and unemployment in the euro area. Respondents represent financial sector, non-financial research institutes and employer or employee organizations in the European Union (EU). Contrary to many other surveys, the ECB SPF survey provides both *fixed event* and *fixed horizon* forecasts for different time horizons (terminology is from Dovern et al 2009). *Fixed event* forecast refers to a certain calendar year (for example, the next calendar year) and *fixed horizon* forecast to horizon a certain time period ahead (like four quarters ahead). In addition to the point estimates, probabilities surrounding point estimates (i.e. density forecasts) for all variables and all horizons are published[2,3]. The data (actual data and four quarter-ahead expectations) are illustrated in Figure 1. Until mid-

[2] The ECB SPF survey is described in detail in Bowles et al (2007).
[3] Kenny et al. (2012) provide some evidence of the usefulness of these data by showing that the distributional information helps to predict future inflation and output developments.

2008 forecasts were quite stable, but after that future prospects of price and output developments worsened sharply and also forecasting errors increased substantially. After 2009 expectations and expectations errors have, however, returned to more or less "normal levels".

For the sake of comparison, the Survey of Professional Forecasts provided by the Federal Reserve Bank of Philadelphia (US SPF) is also analyzed in the paper. In this case, we only analyze inflation (in terms of GDP deflator) because all output numbers are expressed in quarterly levels and hence construction of variables like growth rate uncertainty is quite tedious (see Sill (2012) for recent review of US SPF developments).

3. Analysis of forecast uncertainty

Now, turn to analysis of forecast uncertainty and disagreement. The recent financial crisis clearly highlighted the fact that mean values of survey forecasts do not necessary reveal all relevant information about forecasters' expectations. An analysis of forecast uncertainty may also provide useful information about market participants' behavior. Forecast uncertainty and disagreement in the ECB SPF survey has been analyzed in some recent studies, but not from the point of view of internal consistency of different variables (see for example Bowles et al (2010) and Conflitti (2011)). Uncertainty and disagreement in the Bank of England Survey of External Forecasters has been widely analyzed in Boero et al (2008).

Individual forecast uncertainty is investigated using two alternative measures, i.e. (1) the median values of individual forecasters' subjective uncertainty that is measured by second moment of the distribution of forecast values and (2) conventional standard deviation of point forecasts that indicates disagreement between individual forecasters. Figure 2 represents these two measures for both inflation and output growth expectations four quarters ahead in the ECB SPF survey. Individual uncertainties and corresponding expected values are compared in Figure 3[4]. Figure 4 shows both disagreement and individual uncertainty in the US data.

Figure 2 may be interpreted to indicate that data for individual forecast uncertainty (computed from the distribution of individual responses) is not very informative in terms of different events while the disagreement series seem to be much more sensitive to economic crises, in particular to the

[4] In our data, we found the expected values to be very close to the point forecasts. Thus, we do not separate analyses for these two series.

financial crisis in 2007-2009. This is particularly true for the output growth where the level of disagreement appear to be more than five times higher than normally in the middle of the crisis in 2008/2009. Also in the US disagreement increased clearly in the middle of the crisis[5]. The relationship between these measures is scrutinized in more detail in Table 1. From this table, we can see that that there is quite close relationship between inflation and output growth forecast uncertainties. Thus, the explanatory power of a simple regression model for inflation uncertainty is above 0.6.

Signs of increasing uncertainty during and after the crisis period may have different explanations. We can speculate, for example, that strategic forecasting potentially explains forecast values in the crisis years (forecasters may have wanted to cover also less probable outcomes). On the other hand, since even the sign of future price developments was widely debated (inflation or deflation) at that time, increasing inflation uncertainty seems to be reasonable. Also, growth prospects were very difficult to assess in real time in the middle of the crisis, partly due to huge data revisions. If we have data only on the point estimates and dispersion of inflation expectations, we should perhaps not hasten to conclude that the survey data indicate that inflation expectations have been firmly anchored during and after the crisis as it was done in several occasions[6].

The recent crisis revealed some possible caveats in the surveys. Individual forecasters may react to increasing uncertainty by adopting completely different distribution (with more skewness and kurtosis). Thus we should not focus only on the standard deviation. On the other hand, the crisis may have changed survey response rates (less survey responses are received altogether and/or the distribution is described less accurately). In the US SPF, the distribution of forecasts is particularly crude, since in terms of inflation, the average number of entries per respondent is only 3.5 (see Figure 5). In the ECB SPF things are somewhat better. With inflation, there has been 4.7 entries and with output growth 5.1 entries on an average. Figure 5 also shows the time-variation in the response rate in the US SPF survey. In the ECB survey data these seems to be rather clear increase in the response rate (average number of data points reported for the distribution) over time while in the US data such a change cannot really be detected. The US data on the response rate shows more erratic behavior which obviously sets some question mark to the quality of the data.

[5] This finding is consistent with Döpke and Fritsche (2006), who have analyzed forecast dispersion of German professional forecasts for 1970-2004. They find that forecast dispersion varies over time and is particularly high before and during recessions.

[6] Typically, long-term forecast uncertainty is interpreted using the standard deviation measure. Unfortunately, the sample size with long-term forecasts is so small that it is really hard to make proper statistical analysis.

The disagreement measure works more or less in the same way as in the ECB data showing marked increase in inflation uncertainty in the middle of financial crisis but the subjective uncertainty measures (computed from the reported distributions) show very little sensitivity with respect to economic developments. On the basis of this evidence one might prefer the disagreement measure (standard deviation of individual point forecasts) as a more informative uncertainty indicator. However, it is worth noting that disagreement is a measure of consensus across forecasters, not a measure of confidence of individual forecasters. Increasing disagreement does not reveal, whether confidence of individual respondents has changed. Even so, it is not all clear which one of these is a "better" indicator of uncertainty. Opinions seem to differ quite considerably in this respect and it may be better make the final verdict after more evidence is obtained.

Examination of survey response patterns and survey response rates suggests that one cannot necessarily scrutinize the higher-order moments of the distributions in order to analyze forecast uncertainty. Quite often, responses cover only three or four intervals of the inflation and output growth values. Thus, the respondent may only give some probability to the point forecast value and to the two neighboring values that do not facilitate proper analysis of distributional properties. Even the standard deviations may be on relatively shaky ground[7]. The interpretation problem is aggravated by the fact that the questionnaires have been changed over time. In the ECB survey this has happened in 2008/2009 where more ranges were added to the probability distributions. This is particularly problematic from the point of assessing the impact of financial crisis on uncertainty[8]. With the US survey, there have been several changes but here we cover only the most recent period where the questionnaire has been the same.

4. How does uncertainty affect inflation and output?

The question of how (inflation) uncertainty affects the economy is old and empirical analyses go back to (at least) 1970s. Thus, we may refer to the old analysis Levi and Makin (1980) that considers the role of inflation uncertainty in the Phillips curve relationship. Levi and Makin argue that the slope of the Phillips curve ought to depend on the level of inflation uncertainty (to be more precise, the slope ought to become more steeper). Using U.S data, they found evidence of this effect

[7] We in fact computed the number of respondents that attached a nonzero probability to more than four inflation values (ranges). The average value for the whole data sample was 20, but the minimum was nine.

[8] Scrutiny of the distribution of individual distributions suggests, however, that the new questionnaires did not awfully much affect the reported distributions in the sense that many forecasters would have wanted to produce more gloomy forecasts prior to 2007 but would have been prevented in doing so because of missing values on the scale. This can be

and here we do in fact revisit their test with (more extensive) individual forecasters' panel data. More recently, the case of the uncertainty effect has forcefully been put forward by Bloom (2009) using different data sets. Here we follow a bit different approach due to our micro data setting and our emphasis on expectations altogether. The results seem, however, follow the same logic as with Bloom (2009).

To get started, we estimate first the uncertainty-augmented New Keynesian Phillips curve using the ECB SPF data[9]. For that purpose, we use relationship (1) as the estimating equation. In estimation, we use the survey values (see, e.g., Kortelainen et al 2011)

$$\Delta p^{e}_{it,T} = \alpha \Delta p^{e}_{it-1,T} + \beta \Delta p^{e}_{it,T+1} + \gamma \Delta y^{e}_{it,T} + \theta\, c\delta \Delta p_{it} + \sum Seas_t + u_{it} \qquad (1)$$

where $\Delta y^{e}_{it,T}$ denotes the expected growth rate of output for the current calendar year expected in period t by forecaster i. T denotes the period that is subject to the forecast. The terms $\Delta p^{e}_{it,T}$ and $\Delta y^{e}_{it,T}$ refer to micro-level real-time equivalents of actual inflation and actual output growth. $\delta \Delta p_{it}$ denotes the subjective individual inflation uncertainty. "$Seas_i$" with i =1,2,3,4 denotes a seasonal dummy for quarter i. The equation is also estimated using fixed 4 quarters-ahead expectations.

The results, which are displayed on the last row of Table 2, clearly indicate that forecast uncertainty tends to change to slope of the Phillips curve. The curve both shifts upwards and the slope also becomes (marginally) steeper. In other way round, looking at the supply response to unanticipated inflation, the results suggests – in accordance to Friedman's Nobel lecture (1977) - that higher uncertainty tends to suppress output[10]. Thus, uncertainty is not a trivial thing in terms of economic importance. Although we have dealt with inflation uncertainty it is worthwhile to remember that inflation and output growth uncertainties are highly correlated (the coefficient of correlation being about 0.8). Thus the result for inflation uncertainty may also reflect effect more general economic uncertainty (cf. Baker et al (2012) for more evidence of this). That may affect not only the slope of the Phillips curve but other relevant behavioral relationships as well.

To study the joint effect of inflation and output growth uncertainties, we explore a Lucas-type

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seen by scrutinizing the three-dimensional graph(s) in Figure 10.

[9] Only few studies have analyzed Phillips curves at the micro level (see Fendel et al 2011 and Tillmann 2010).

[10] From the point of view of the Lucas's (1973) supply curve, increased aggregate inflation uncertainty directly affects

supply function where the main ingredient is the variable for unanticipated inflation (the term $\Delta p_{tT} - \Delta p^{e}_{it-1,T}$) . Again we use the ECB SPF data and estimate the supply function in the following form:

$$\Delta y^{e}_{it,-1T} = a + b(\Delta p_{tT} - \Delta p^{e}_{it-1,T)} + c\delta\Delta p_{it} + d\delta\Delta y_{it} + e\Delta y^{e}_{it-1,T} + u_{it} \quad (2)$$

where the notation is the same as in equation (1). The corresponding estimation results with different panel data estimation procedures are reported in Table 3. They clearly show that (1) uncertainty affects output growth, (2) the impact of uncertainty on output growth effects is always negative, (3) inflation uncertainty is far more important than output growth uncertainty and (4) output growth reacts positively to unanticipated inflation as in the basic story of Lucas (1973). The result is not very surprising given the data. Thus when scrutinizing the Figure 7 that illustrates the bivariate relationship between output growth and inflation uncertainty we see a quite clear negative relationship. One may speculate the uncertainty effect just reflects the financial crisis in 2007-2009. This does, however, seem not to be the case. Subsample estimates were quite similar suggesting that the uncertainty effect was present already during the early years of the EMU. In quantitative terms, we may conclude that the uncertainty effects could have cost the Euro economies almost two percent during the financial crisis (in other words, had we had zero inflation and output growth uncertainty that amount of GDP could have saved).

To be sure that the uncertainty effects do not reflect some specific estimating equation we also investigated the impact of uncertainty on output growth in the VAR framework. Thus, we estimated a VAR model from the whole panel data using the following set of variables: inflation uncertainty, expected inflation, inflation and output growth. Identification was based on the Cholesky decomposition, where we always had the uncertainty variable first. This choice may be defended on the grounds that the inflation uncertainty reflects the (credibility of the) underlying policy regime that may not be affected by current inflation and output growth. The VAR was estimated for all respondents from the data sample 1999Q1-2012Q3 using the two lags with all variables. To give some flavor of the estimations results, we just report the impulse response of Δy with respect to the inflation uncertainty shock (Figure 8). The nature and quantitative magnitudes of the negative response of output to inflation uncertainty comes quite close to Leduc and Liu (2012) and Baker et al (2012) again supporting the initial findings of Bloom (2009). It may also be emphasized that the result seems to be very robust in terms of alternative orderings and lag lengths.

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the supply curve coefficient and thus the price sensitiveness of supply.

5. Concluding remarks

This paper has examined individual inflation and real GDP growth expectations using the two professional forecasters' micro data sets, the ECB SPF and US SPF. The analyses have shown that inflation and output growth expectations are positively correlated and also the respective uncertainties are positively related. Moreover, we find evidence that inflation uncertainty is an important element in aggregate supply so that increased uncertainty leads to higher inflation and suppressed economic activity. This finding has important practical implications thinking about the current financial and economic crisis. The crisis raised inflation uncertainty to an unprecedented level in the euro area and uncertainty seems to have strengthened the sharp decrease in output in the middle of the crisis and suppressed recovery after that. If uncertainty remains at this high level it may restrain euro area output growth considerably in the future.

References

Baker, S., Bloom, N. and S. Davis (2012) Has Economic Policy Uncertainty Hampered the Recovery? *Chicago Booth Research Paper N. 12-06.*

Bloom N. (2009), The Impact of Uncertainty Shocks, *Econometrica*, 77(3), 623—685.

Boero. G., Smith J. and Wallis, K. F. (2008) Uncertainty and Disaggreement in Economic Prediction: The Bank of England Survey of External Forecasters, *The Economic Journal*, 118 (July), 1107-1127.

Bowles, C., Friz R., Genre V., Kenny G., Meyler A. and Rautanen, T. (2007) The ECB Survey of Prefessional Forecasters: A Review after Eight Years‟ Experience, *ECB Occasional Paper* 58.

Bowles, C., Friz R., Genre V., Kenny G., Meyler A. and Rautanen, T. (2010) An Evaluation of the Growth and Unemployment Forecasts in the ECB Survey of Professional Forecasters, *OECD Journal: Journal of Business Cycle Measurement and Analysis*, Vol. 2.

Conflitti, C. (2011) Measuring Uncertainty and Disaggreement in the European Survey of Professional Forecasters, *OECD Journal: Journal of Business Cycle Measurement and Analysis*, Vol. 2.

Dovern, J, Fritsch, U. and Slacalek, J. (2009) Disagreement among Forecaster in G7 Countries. *ECB Working Paper 1082.*

Döpke, Jörg, and Ulrich Fritsche (2006), "When Do Forecasters Disagree? An Assessment of German Growth and Inflation Forecast Dispersion," *International Journal of Forecasting*, 22, 125–135.

Fendel, R, E. Lis, and J.C. Rülke (2011) Do professional forecasters believe in the Phillips curve? Evidence from G7 countries. *Journal of Forecasting* 30, 268-287.

Friedman, M. (1977) Nobel Lecture: Inflation and Unemployment. *Journal of Political Economy 85(3),* 451-472.

Kenny, G., Kostka, T. and Masera, F. (2012) How informative are the subjective density forecasts of macroeconomists? *ECB Working Paper*, 1446.

Kortelainen, M, Paloviita, M. and Viren, M. (2011) Observed Inflation Forecasts and the New Keynesian macro Model. *Economics Letters*, 112 (1), 88-90.

Leduc, S. and Z. Liu (2012) Uncertainty, Unemployment, and Inflation. *FRBSF Economic Letter* 28.

Levi, M. and J. Makin (1980) Inflation Uncertainty and the Phillips Curve: Some Empirical Evidence. *American Economic Review 70(5),* 1022-1027.

Lucas (1973) "Some International Evidence on Output-Inflation Trade-offs", *American Economic Review* 63, 326–334.

Pesaran, M. H. and Weale, M. (2006), Survey Expectations, Chapter 14 in *Handbook in Economic Forecasting*, ed. Elliot, G, ed. Granger, C. W. J and ed. Timmermann, A., Elsevier.

Sill, K. (2012) Measuring Economic Uncertainty Using the Survey of Professional Forecasters. Business Review of Philadelphia FED, Q4/2012, 16-27.

Sinclair, P. (2010) Inflation Expectations ed. Peter J. N. Sinclair, Routledge *International Studies in Money and Banking, London.*

Tillmann, P. (2010) The Fed's perceived Phillips curve: Evidence from individual FOMC forecasts. *Journal of Macroeconomics* 32, 1008-1013.

Table 1 Relationship between ECB SPF uncertainty measures

	1	2	3	4
Constant	.150	.199	.131	.167
	(72.26)	(20.34)	(18.02)	(9.45)
disagreement w.r.t. Δy_t	.366			
	(70.89)			
$\delta\Delta y_t$		.552	.684	.669
		(28.00)	(42.95)	(38.76)
Δp_t				-.001
				(0.05)
Δg_t				-.017
				(5.10)
fixed cross section terms		x		
dependent variable	disagreement	$\delta\Delta p_t$	$\delta\Delta p_t$	$\delta\Delta p_t$
R^2	0.604	0.732	0.648	0.649
SEE	0.051	0.112	0.126	0.123

Numbers inside parentheses are corrected t-ratios. The dependent variable is inflation uncertainty, measured by disagreement (standard deviation of point estimates) or individual inflation uncertainty, $\delta\Delta p$ (average standard deviation of individual inflation forecasts based on subjective probability distributions). The term $\delta\Delta y$ refers to individual output growth uncertainty (average standard deviation of individual growth forecasts based on subjective probability distributions).

Table 2 Estimation results of uncertainty augmented Phillips curve (ECB SPF)

	Δy^e_t	Δp^e_{t+1}	$s_1*\Delta^e p_{t+1}$	$s_2*\Delta p^e_{t+1}$	$s_3*\Delta p^e_{t+1}$	$s_4*\Delta p^e_{t+1}$	Δp^e_{t-1}	$\delta\Delta p_t$	R2/SEE
1	.108	1.003							0.508
	(16.84)	(127.11)							0.457
2	.111		.364	.511	.551	.485	.485		0.694
	(17.32)		(17.42)	(25.72)	(26.17)	(22.91)	(22.54)		0.348
3	.130		.268	.411	.450	.401	.524	.183	0.682
	(17.32)		(11.07)	(18.13)	(18.63)	(15.91)	(21.73)	(5.32)	0.352

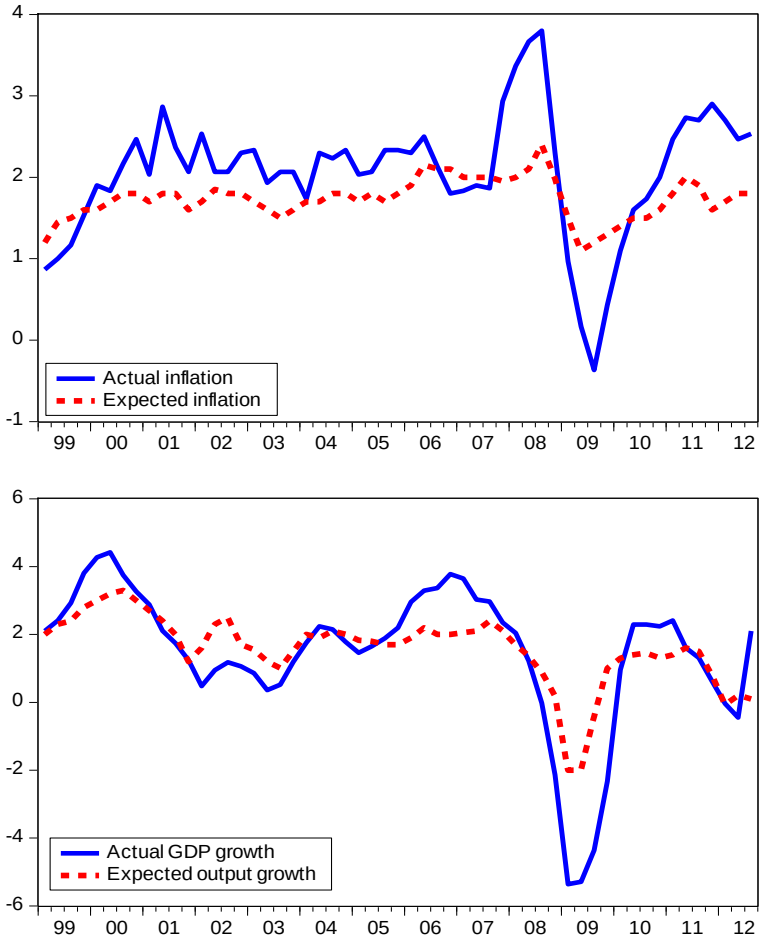
Δp_{t+4} denotes expected inflation for the subsequent four quarters and Δp_{t+1} the corresponding measure for the next calendar year. Δp_{t+L} denotes the long-run inflation expectations. The growth rate of output, Δy^e_t is defined accordingly. In the Phillips curve, the dependent variable Δp^e_t is expected rate of inflation for the current period. In a sense, it is the micro-level real-time equivalent of actual inflation. $\delta\Delta p$ is the standard deviation of individual forecasts. All equations have been estimated by OLS, the simple equations on rows 1-6 also include cross-section fixed effects. s1-s4 denote seasonal dummies. Equations on rows 10-13 are estimated with the first, second, third and fourth quarter data only. The last row represents an uncertainty-augmented hybrid Phillips curve.

Table 3 Estimation results of the uncertainty augmented supply curve (ECB SPF)

	1	2	3	4	5
Constant	1.663	1.705	2.286	1.734	.591
	(23.79)	(24.26)	(24.40)	(26.65)	(6.53)
$\delta\Delta p_t$	-1.394	-1.337	-1.917	-1.494	-.430
	(6.12)	(5.78)	(8.13)	(7.02)	(1.87)
$\delta\Delta y_t$	-.179	-.203	-.885	-.179	-.190
	(0.95)	(1.06)	(4.55)	(0.99)	(1.04)
$\Delta p_t - \Delta p^e_t$	1.221	1.215	1.209	1.205	.525
	(25.55)	(24.26)	(26.74)	(25.66)	(10.72)
lagged Δy					.630
					(15.91)
fixed cross section terms	no	no	yes	no, gls	no
expected inflation	4 quarters ahead	next calendar year	4 quarters ahead	4 quarters ahead	4 quarters ahead
R^2	0.471	0.476	0563	0.471	0.700
SEE	1.140	1.136	1.062	1.139	0.863

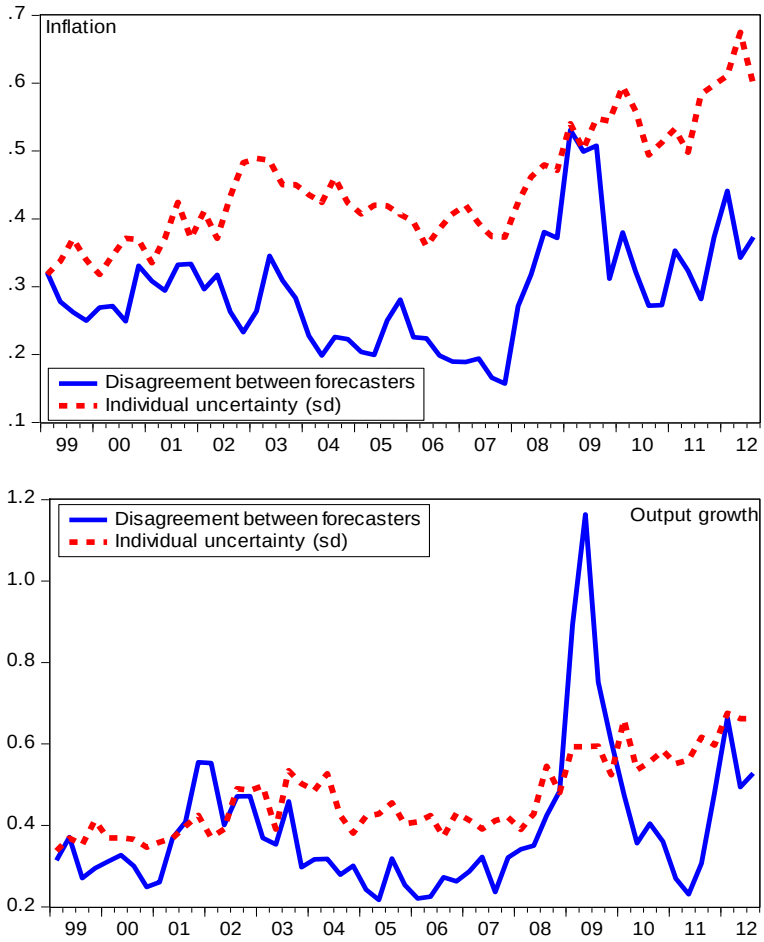
The dependent variable is output growth. $\delta\Delta p$ ($\delta\Delta p$) is the standard deviation of individual inflation (output growth) forecasts based on subjective probability distributions. gls denotes the GLS estimator, otherwise the OLS estimator is used.

Figure 1 Forecasts of inflation and output growth for one year-ahead (ECB SPF)



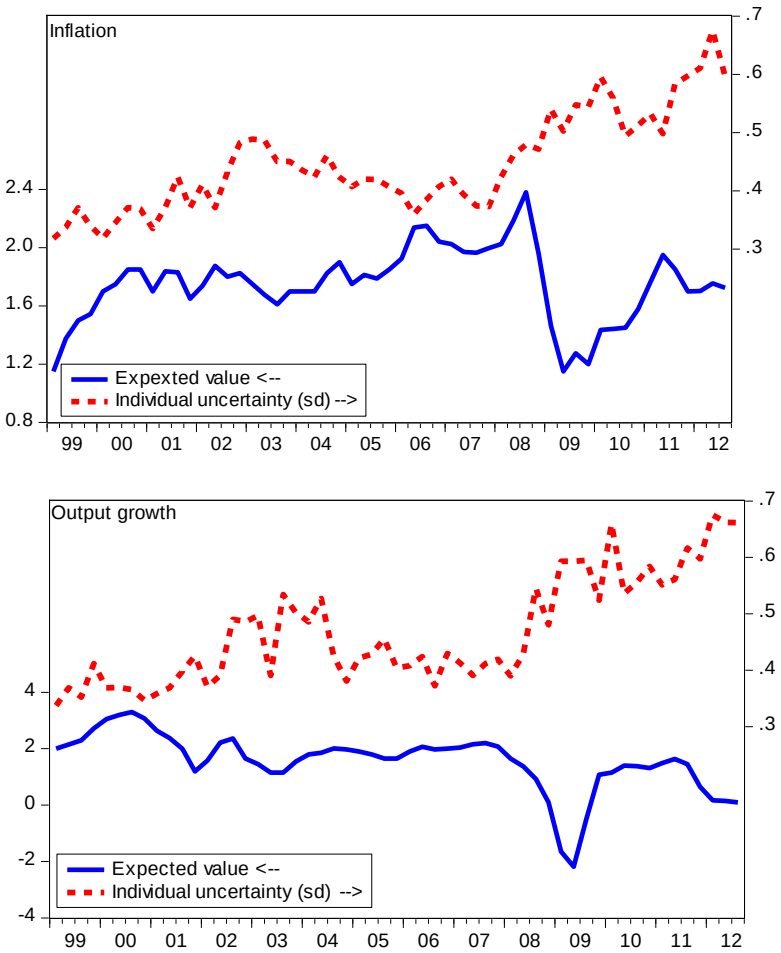
In all graphs, forecasts are dated according to the quarter of publications of the forecast.

Figure 2 Comparison of forecast uncertainties (ECB SPF)



Uncertainty is measured by the standard deviation of point forecasts (disagreement) and the median of the standard deviation of individual forecasts (computed from the individual distributions) in the second graph. Forecast horizon is 4 quarters ahead. Also here, dating corresponds the publications of forecasts.

Figure 3 Expected values vs. individual uncertainty (ECB SPF)



Values are respective medians

Figure 4 Uncertainty and the form of the distribution in the US data (US SPF)

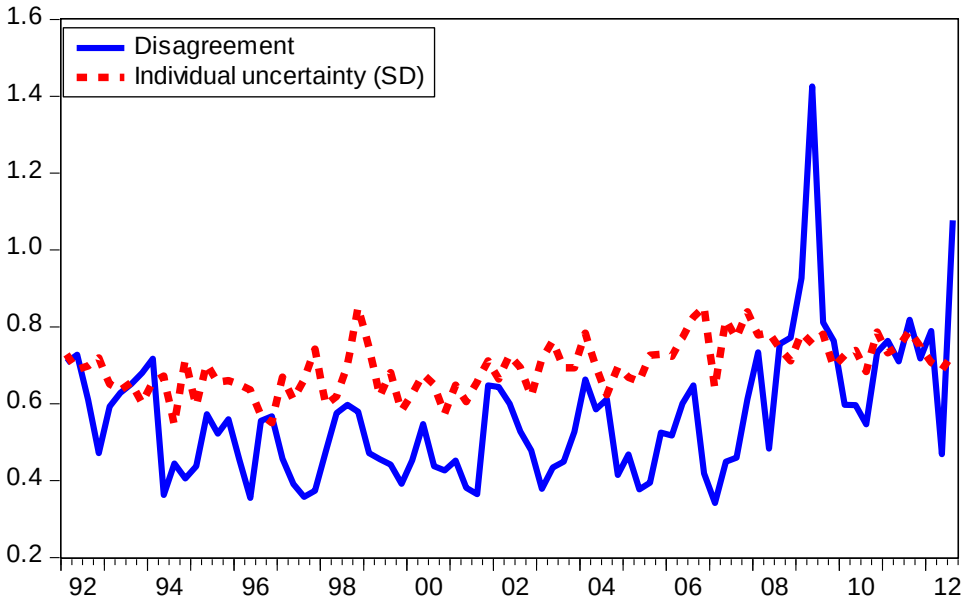
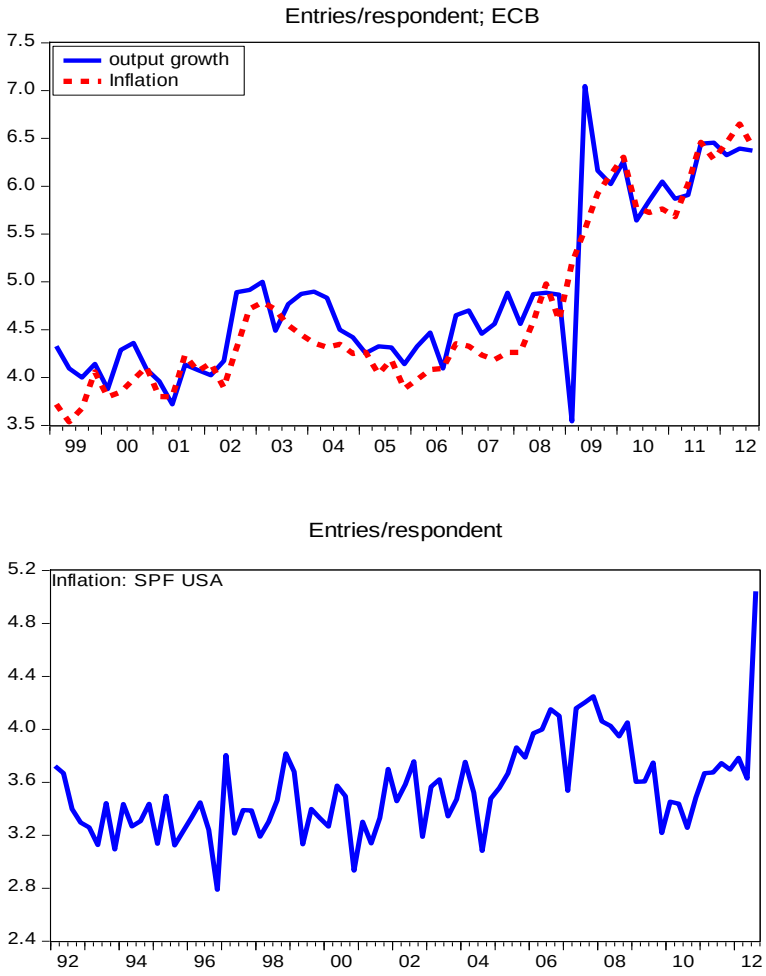
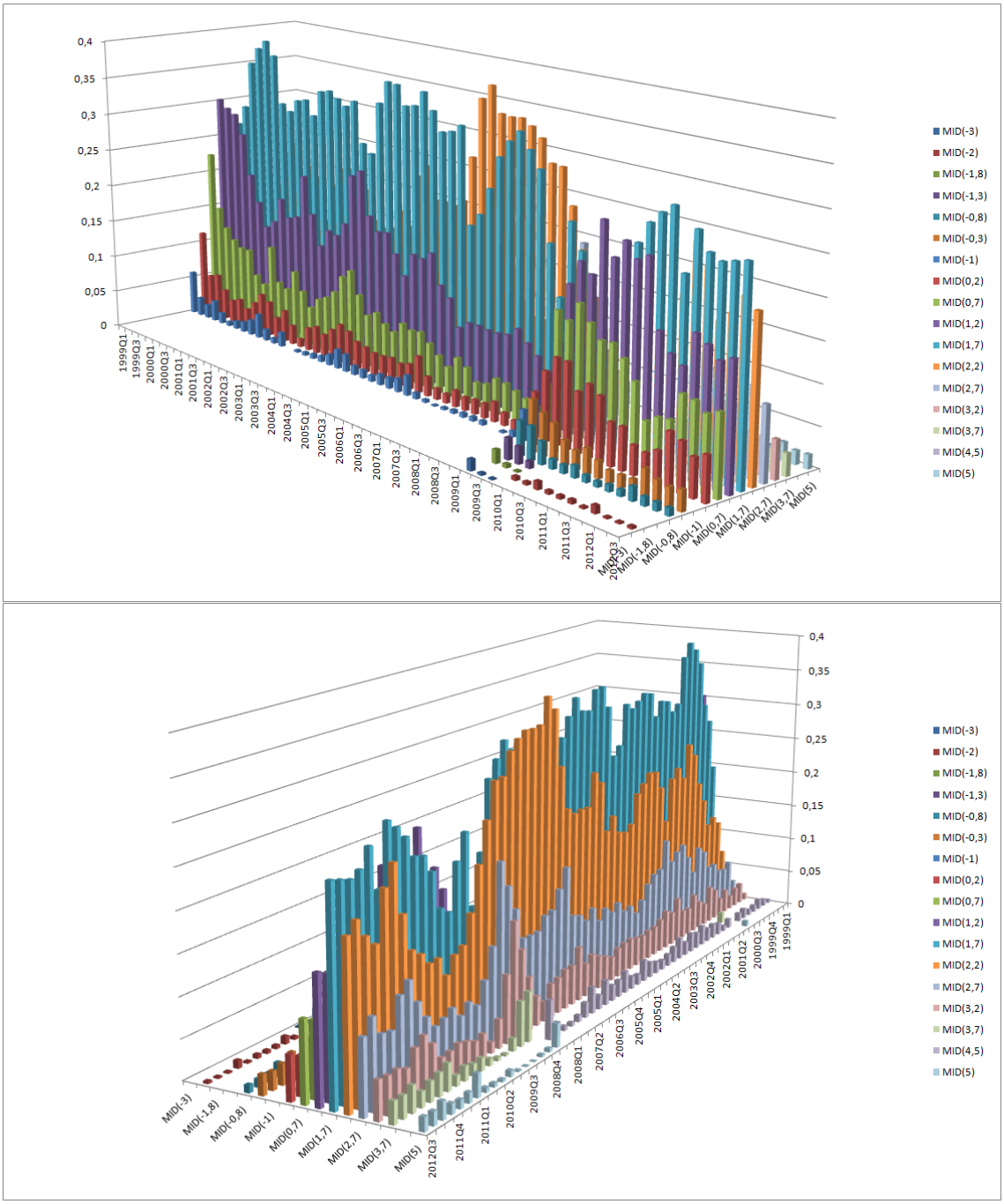


Figure 5 Changes in the response rates



The series "entries/respondent" are derived by dividing the number of entries (=categories in the distribution with nonzero values) by the number of forecasters.

Figure 6 Average values of reported distributions for inflation in the ECB SPF micro data



The upper (lower) graph illustrates the left-hand (right-hand) side of the distribution of the reported values for expected inflation.

Figure 7 Output growth and inflation uncertainty (ECB SPF)

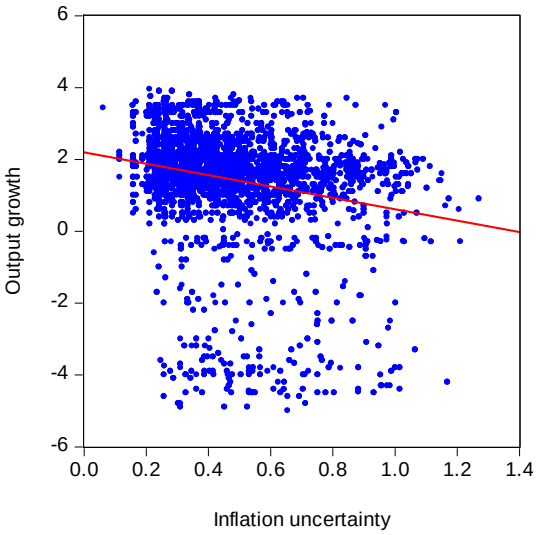
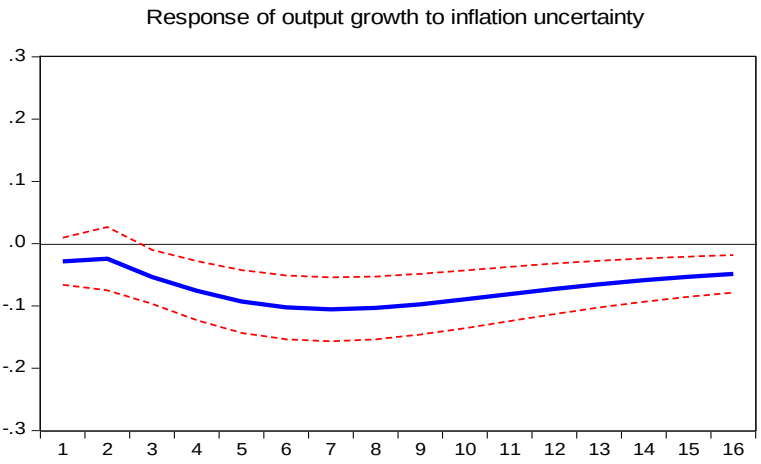


Figure 8 An impulse response from a VAR model (ECB SPF)



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