Anchoring Inflation Expectations in Unconventional Times: Micro Evidence for the Euro Area

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Abstract

We exploit micro data from professional forecasters to examine the stability of the distribution of long-term inflation expectations in the euro area following the Great Recession. Although mean expectations declined somewhat, they remained quite well anchored to the ECBs price stability objective. Also, their degree of co-movement with other variables did not increase noticeably following the Great Recession. In contrast, we document an increase in long-term inflation uncertainty and a clear shift toward a more negatively skewed distribution. Such findings are in line with the predictions of theoretical models emphasizing the impact of the lower bound on policy rates and uncertainty about monetary transmission. For example, controlling for other factors, announcement dates for non-standard monetary policy measures are shown to be associated with an increase in long-term inflation uncertainty.

Motivation

- Anchoring of long-term inflation expectations crucial for steering inflation without substantial economic cost.
- Period of low inflation and binding ZLB raised concerns about possible de-anchoring of expectations in the euro area (EA).
- Existing research has focused on point forecasts or the first moment of distribution of long-term inflation expectations (e.g., Gürkaynak et al., 2010; Beechey et al., 2011; Łyziak and Paloviita, 2017).
- Theoretical models suggest that also higher moments might reveal information about the degree of expectation anchoring (e.g., Hills et al., 2016).

Research Questions

- Did anchoring of inflation expectations in the EA become looser after the Great Recession or the subsequent euro crisis?
- Which moments of the full distribution of expectations were affected?
- Can we identify other economic factors that co-move with changes in long-term inflation expectations and inflation uncertainty?

Main Contributions

- New microevidence about the anchoring of inflation expectations in the EA.
- Focus on the entire distribution of density forecasts:
  – Analysis of mean expectations, inflation uncertainty, skewness, and kurtosis.
- Panel analysis of co-movement with other variables.

Data

We use **individual density forecasts** as provided (in the form of histograms) by the ECB's Survey of Professional Forecasters (SPF):

- Focus on long-term expectations with horizon of roughly 5 years.
- Unbalanced sample from 1999Q1 to 2017Q1 (long-term expectations only available for Q1 in 1999 and 2000).
- Avg. number of respondents is equal to 39.1

We need to **compute the moments of the predictive densities** underlying the reported histograms:

- Denote by $p^j_{i,t+h|t}$ the probability that forecaster i at time t attaches to the event that inflation will fall into a certain interval j with midpoint μ_j in period $t+h$.
- We assume that all probability mass of a certain interval is compressed at its midpoint and compute the moments of the predictive density as follows

$$\pi_{i,t+h|t} = \sum_{j=1}^{J} p^j_{i,t+h|t} \cdot \mu_j \qquad s_{i,t+h|t} = \sum_{j=1}^{J} p^j_{i,t+h|t} \left(\mu_j - \pi_{i,t+h|t}\right)^3 / \sigma^3_{i,t+h|t}$$

$$\sigma^2_{i,t+h|t} = \sum_{j=1}^{J} p^j_{i,t+h|t} \left(\mu_j - \pi_{i,t+h|t}\right)^2 \qquad k_{i,t+h|t} = \sum_{j=1}^{J} p^j_{i,t+h|t} \left(\mu_j - \pi_{i,t+h|t}\right)^4 / \sigma^4_{i,t+h|t} - 3$$

- We compute cross-sectional averages of moments as $\overline{m}_{t+h|t} = 1/N_{t+h|t} \sum_{i=1}^{N_{t+h|t}} m_{i,t+h|t}$ for $m = \{\pi, \sigma^2, s, k\}$.
- In addition, density forecasts allow us to also look at modal expectation.

Detecting Breaks in Moments of Density Forecasts

Well-anchored inflation expectations imply a **stable expected distribution of inflation**. We use the **method of Bai and Perron (1998, 2003)** to test whether the (average) moments of that distribution exhibits significant breaks over time:

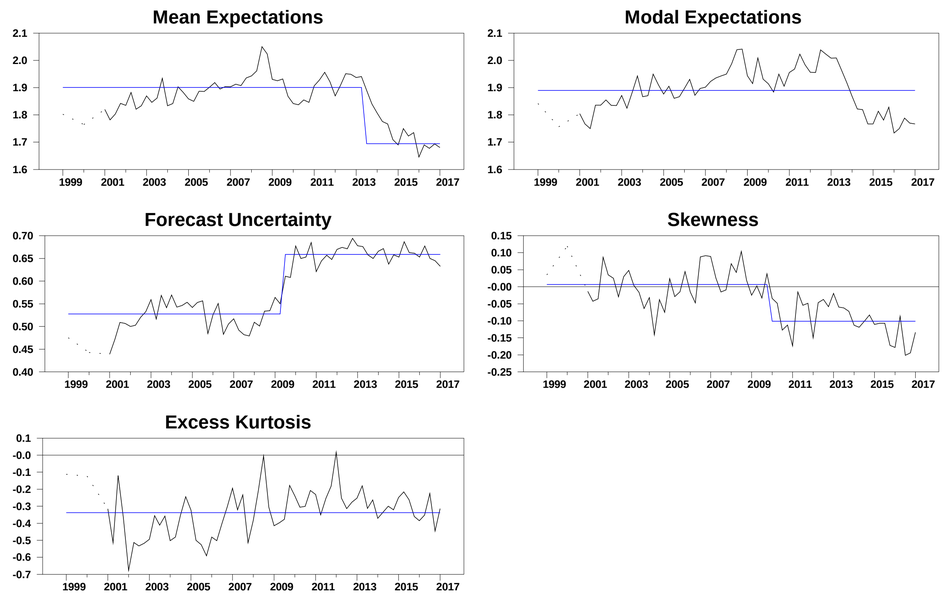
- To account for the high persistence, we model each moment as an AR(1) process:

$$\overline{m}_{t+h|t} = \alpha_{m,r} + \beta_{m,r} \overline{m}_{t+h-1|t-1} + \varepsilon^m_{t+h|t},$$

  where $r = \{1, \ldots, R\}$ are the different regimes (separated by structural breaks) whose number and location is unknown.
- Unconditional mean for each regime is given by $\alpha_{m,r}/(1-\beta_{m,r})$.
- When testing for breaks, we require each regime to last at least 8 quarters to avoid overfitting.

We find the following significant breaks in the different moments (and the corresponding unconditional means in the different regimes, see also Figure on top right):

- Strong and persistent increase in inflation uncertainty around 2009.
- Decline of mean expectations from 1.9% to 1.7% in 2013 which is not matched by development of modal expectations.
- Shift towards negatively skewed long-term expectations in 2010.



Co-movement of Long-term Expectations with Other Variables

Well-anchored **long-term inflation expectations should not co-move with other factors** when there is no uncertainty about the inflation target. In other situations, the degree of co-movement indicates the degree of anchoring.

We consider correlations of changes in individual long-term mean expectations and inflation uncertainty with the following groups of variables:

- Short- and medium-term inflation expectations
- Recent forecast errors for inflation
- Trend inflation performance gap ($TIPG$)
- Long-term expectations about real variables (GDP growth, unemployment rate) (to measure potential expectations of "secular stagnation" equilibria)
- Observed inflation
- Size of ECB's balance sheet and dummies capturing important MP announcements and the hitting of the ZLB for different interest rates

When looking at inflation uncertainty, covariates are suitably transformed (absolute values) and forecast variances instead of mean expectations are used, respectively.

Note that data does not allow for a causal interpretation of the estimates.

	Mean Expectations		
	FS	<2007Q4	≥2007Q4
$\Delta\pi_{i,t+4\|t}$	0.015	0.005	0.024
$\Delta\pi_{i,t+8\|t}$	0.174***	0.189***	0.151***
$TIPG_{t-1}$	0.149***	0.199***	0.152***
$\pi_{t-1} - \pi_{t-1\|t-5}$	−0.007	0.002	−0.004
$\pi_{t-1} - \pi_{t-1\|t-9}$	0.006	0.04	0.002
$\Delta y_{i,t+20\|t}$	0.012	0.024	0.011
$\Delta u_{i,t+20\|t}$	−0.014	−0.008	−0.020*
$\Delta\pi_{t-1}$	0.030**	0.027	0.028
$\Delta CBBS_{t-1}$	−0.147**	−1.157***	−0.115*
MPA	−0.010	-	−0.012
ZLB	0.006	-	0.007
$Constant$	0.000	0.006	0.006
$Obs.$	1,180	1,180	
R^2	0.19	0.20	
$Ftest(pval)$	-	0.17	

	Inflation Uncertainty		
	FS	<2007Q4	≥2007Q4
$\Delta\sigma^2_{i,t+4\|t}$	0.065	−0.015	0.120**
$\Delta\sigma^2_{i,t+8\|t}$	0.268***	0.409***	0.193***
$\lvert TIPG_{t-1}\rvert$	0.007	−0.008	0.013
$\lvert\pi_{t-1} - \pi_{t-1\|t-5}\rvert$	0.003	0.005	0.005
$\lvert\pi_{t-1} - \pi_{t-1\|t-9}\rvert$	−0.003	−0.008	−0.001
$\Delta\sigma^2(y)_{i,t+20\|t}$	0.248***	0.273***	0.210***
$\Delta\sigma^2(u)_{i,t+20\|t}$	0.110***	0.098***	0.120***
$\lvert\Delta\pi_{t-1}\rvert$	0.021***	0.028**	0.018**
$\lvert\Delta CBBS_{t-1}\rvert$	−0.084**	−0.278	−0.037
MPA	0.023***	-	0.025***
ZLB	−0.003	-	0.000
$Constant$	−0.001	−0.004	−0.004
$Obs.$	1,180	1,180	
R^2	0.39	0.40	
$Ftest(pval)$	-	0.19	

Notes: Dependent variables are the change in long-term inflation expectations and the change in long-term inflation uncertainty, respectively. All models include fixed effects for each forecaster. The constant is identified by restricting the average of the fixed-effects to equal 0. Standard errors are computed using the method by Driscoll and Kraay (1998) and are robust against general forms of spatial and temporal dependence. *, **, and *** denote significance at the 10%, 5%, and 1% level, respectively. The last row states the p-value of an F-test of the hypothesis that none of the coefficients change from the first to the second sub-sample.

Conclusions

- Significant breaks in first three moments of distribution; most pronounced for inflation uncertainty.
- Mean expectations still consistent with inflation target, but less tightly anchored.
- Substantial co-movement of long-term expectations/uncertainty with other variables indicate that agents update their beliefs about long-term inflation in response to certain shocks.
- Association of MPA with increasing uncertainty indicates challenges for monetary policy communication.
- Overall, focus on entire predictive density gives more complete picture than point forecasts alone.

Main References

Bai, J., Perron, P., 1998. Estimating and testing linear models with multiple structural changes. Econometrica 66 (1), 47–78.

Bai, J., Perron, P., 2003. Computation and analysis of multiple structural change models. Journal of Applied Econometrics 18 (1), 1–22.

Beechey, M. J., Johannsen, B. K., Levin, A. T., 2011. Are long-run inflation expectations anchored more firmly in the euro area than in the United States? American Economic Journal: Macroeconomics 3 (2), 104–129.

Gürkaynak, R. S., Levin, A., Swanson, E., 2010. Does inflation targeting anchor long-run inflation expectations? Evidence from the U.S., UK, and sweden. Journal of the European Economic Association 8 (6), 1208–1242.

Hills, T., Nakata, T., Schmidt, S., 2016. The risky steady state and the interest rate lower bound. Working Paper Series 1913, European Central Bank.

Łyziak, T., Paloviita, M., 2017. Anchoring of inflation expectations in the euro area: Recent evidence based on survey data. European Journal of Political Economy 46 (C), 52–73.

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