Discussion of “Anchoring Inflation Expectations in Unconventional Times: Micro Evidence for the Euro Area”
by
Jonas Dovern and Geoff Kenny

Robert Rich
Federal Reserve Bank of New York

May 17, 2018

The views expressed here are those of the presenter and do not necessarily represent those of the Federal Reserve Bank of New York or the Federal Reserve System
Discussion Outline

1) Review paper and main findings

2) Point forecasts versus density forecasts

3) Inflation anchoring: concept and measurement
   - Changes in the distribution of long-term inflation expectations
   - Properties of individual ECB-SPF density forecasts of inflation
     o Heterogeneity and persistence in forecast behavior
     o Unbalanced panel and composition effects
   - Some other related work
     o A metric to assess/compare different configurations of the aggregate density forecast
     o Economic versus statistical significance
   - Making further use of information from the individual density forecasts

4) Minor comments
   - Alternative measures for some density moments

5) Conclusions
Focus of the Paper

Look at the behavior of long-term inflation expectations in the euro area before and after the Great Recession

- Investigate the stability of the distribution of long-term inflation expectations
  - Central to the data analysis is the construct of aggregate density moments
  - Application of structural break tests to identify shifts in density moments
- Examine the co-movement of key moments of this distribution with other variables
  - Use regression analysis to examine the relationship between the first two moments of the aggregate density forecast of inflation and other economic variables/events
Empirical Results

Compared to the period preceding the Great Recession, forecast behavior during the period after the Great Recession displays the following features:

- There is evidence of some decline in mean expectations, although they remained fairly well anchored to the ECB’s price stability objective.

- In contrast to the behavior of mean expectations, there was an increase in long-term inflation uncertainty and the aggregate density forecast became more negatively skewed.

- While the degree of co-movement of mean expectations with other variables did not increase noticeably, there is evidence that the increase in long-term uncertainty has been associated with announcement dates for non-standard monetary policy measures.

I will focus most of my comments on the first part of the paper that investigates the stability of the distribution of long-term inflation expectations.
There is one important takeaway for me that I continue to think about and look forward to discussing further:

- The conditions defining inflation anchoring may not be as straightforward as we think
  - To paraphrase a famous saying: “I may not be able to tell you exactly what it is, but I’ll know it when I see it.”
Inflation Anchoring

To analyze the anchoring of (inflation) expectations, point forecasts from surveys are insufficient to address this issue and instead require the use of density forecasts.

The European Central Bank (ECB) Survey of Professional Forecasters (SPF) is among a small group of surveys providing density forecasts.

Advantages of ECB – SPF density forecasts compared to US – SPF:

- Short- and more medium- and longer-term horizons surveyed (including rolling and calendar year horizons)
- Constant width of interior intervals for density forecasts
- Some data allow for analysis of density forecasts with constant forecast horizons
- Survey has been better maintained and larger survey response size
Measuring Inflation Anchoring

Some of the following comments/graphs are from Rich and Tracy (2017) “The Behavior of Uncertainty and Disagreement, and their Roles in Economic Prediction: A Panel Analysis”

1) To construct the density moments of the aggregate distribution, the authors construct the cross-sectional average of estimated density moments at the individual level

   - It isn’t clear to me what you gain from this approach versus simply deriving the moments from the aggregate density forecast
   - Subsequent comments will suggest that (in the case of estimating the aggregate variance) there is an advantage to working from the aggregate density forecast

2) A critical aspect of the analysis concerns identifying changes in the distribution of long-term inflation expectations in the euro area

   - Authors initially apply structural break tests to 5 subjectively selected individual probability intervals
Why not test initially/directly for evidence of shifts in the aggregate density forecast rather than separate intervals?

- Metric to convey the degree of divergence between two histograms based on cumulative density functions
- Example to illustrate one approach:
  - Close off both open intervals using twice the width of interior intervals
  - Measures constructed from density forecasts will assume probability mass is distributed uniformly within intervals (can accommodate alternative assumptions or approaches)

Wasserstein distance (WD) measure for two aggregate histograms:

\[
WD_{t+1,t} = \int_0^1 |F_t^{-1}(z) - F_{t+1}^{-1}(z)| dz
\]

where \(F_t^{-1}\) and \(F_{t+1}^{-1}\) denotes the inverse CDF for the aggregate density forecasts for the survey at date \(t\) and at date \(t+1\), respectively
- WD measure uses the absolute value norm (the Mallows measure provides an analogue based on a squared norm) and can be calculated using intervals originally specified by the ECB (or modified if necessary)
- Time series of WD values can be accumulated and used for visual and statistical evaluation of a shift in the aggregate density forecast
- Compared to tests on separate segments, test on aggregate density forecast seems to have the advantage of being more powerful
  - Small changes in individual bins may mask magnitude and timing of an overall shift in the aggregate density forecast

3) If I observe a change in a density moment, how should I interpret the event/development?

- Concern about compositional effects and their bearing on estimated density moments
- Forecasters’ uncertainty display substantial heterogeneity and as well as a high degree of persistence
Distribution of Individual 1-Year-Ahead Inflation Uncertainty (IQR) over Time
Persistence of Individual Uncertainty (IQR) as Measured by Transition Probabilities

a) Inflation

<table>
<thead>
<tr>
<th>Quartile t</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.66***</td>
<td>0.25</td>
<td>0.08***</td>
<td>0.01***</td>
</tr>
<tr>
<td>2</td>
<td>0.28</td>
<td>0.46***</td>
<td>0.23</td>
<td>0.03</td>
</tr>
<tr>
<td>3</td>
<td>0.08***</td>
<td>0.21***</td>
<td>0.56***</td>
<td>0.16***</td>
</tr>
<tr>
<td>4</td>
<td>0.02***</td>
<td>0.05***</td>
<td>0.17***</td>
<td>0.77***</td>
</tr>
</tbody>
</table>

Chi-square(16)=2,310, p-value=0.000

b) GDP growth

<table>
<thead>
<tr>
<th>Quartile t</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.66***</td>
<td>0.26</td>
<td>0.06***</td>
<td>0.02***</td>
</tr>
<tr>
<td>2</td>
<td>0.30</td>
<td>0.46***</td>
<td>0.20</td>
<td>0.03</td>
</tr>
<tr>
<td>3</td>
<td>0.06***</td>
<td>0.20**</td>
<td>0.55***</td>
<td>0.19***</td>
</tr>
<tr>
<td>4</td>
<td>0.01***</td>
<td>0.04***</td>
<td>0.20***</td>
<td>0.75***</td>
</tr>
</tbody>
</table>

Chi-square(16)=2,140, p-value=0.000

c) Unemployment

<table>
<thead>
<tr>
<th>Quartile t</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>0.62***</td>
<td>0.28</td>
<td>0.08***</td>
<td>0.02***</td>
</tr>
<tr>
<td>2</td>
<td>0.31</td>
<td>0.44***</td>
<td>0.20</td>
<td>0.04</td>
</tr>
<tr>
<td>3</td>
<td>0.09***</td>
<td>0.21**</td>
<td>0.52**</td>
<td>0.18**</td>
</tr>
<tr>
<td>4</td>
<td>0.02***</td>
<td>0.06***</td>
<td>0.18***</td>
<td>0.74***</td>
</tr>
</tbody>
</table>

Chi-square(16)=1,801, p-value=0.000

Notes: One-tailed tests for diagonal (off-diagonal) elements > (<) 0.25

*** significant at the 1% level
**  significant at the 5% level
*   significant at the 10% level
The previous results lead me to ask the following questions:

- If there is heterogeneity and persistence across forecast density moments, then movements in the cross-sectional average could reflect shifts in the moments of individual forecast densities, a shift in the mix of respondents, or a combination of both

4) Returning to an earlier discussion point, it would be useful to derive a measure of the anchoring of long-term inflation expectations

- How do I differentiate/compare a scenario in which long-term inflation expectations display low uncertainty but are far from target to a scenario in which long-term inflation expectations display high uncertainty but are close to the target?

- Such a metric could also prove useful for the purpose of differentiating between changes in the extent of inflation anchoring that are economically significant versus statistically significant

- Use a host of surveys to estimate a dynamic factor model with time-varying uncertainty and compute the probability of future inflation being in a certain range consistent with inflation targets.

5) Related to the above point, I think there is an opportunity to incorporate more information at the individual level to bear upon the assessment and quantification of the extent of inflation anchoring.

- How do I think about changes in distributional moments when they result from a subset of respondents versus being uniform across respondents?
- Is it worth further differentiating between or defining two concepts of inflation anchoring:
  - ‘Absolute’ inflation anchoring – A situation in which individual density forecasts are unchanged.
  - ‘Relative’ inflation anchoring – A situation in which the aggregate density forecast is unchanged, but individual density forecasts display changes.
Miscellaneous Comments

Point forecasts: Mean, median or mode?

- In a special autumn 2008 questionnaire, 75% of respondents revealed their point estimate corresponds to the mean of their density forecast.

How are the open intervals closed off?

Related to above point, uncertainty measures can be sensitive to the treatment of the open intervals of the density forecast, with the sensitivity being increased by the use of a squared norm. Consequently, it might be useful to consider alternative measures:

- Wallis (2005) variance decomposition approach
- Inner quartile range (or some other percentile differential) has advantage that uncertainty value will be unaffected as long as 25th and 75th percentiles fall in an interior interval
  - Most, but not all, respondents only assign probabilities to the interior closed intervals
  - Number of respondents assigning probability to open intervals can, however, be notable
  - Respondents rarely place more than 25 percent probability in an open interval
Concluding Thoughts

I really enjoyed reading this paper and found the topic and analysis to be extremely interesting.

The paper made me think a lot about defining and deriving metrics associated with the concept of “well-anchored” long-term inflation expectations.

My thanks again to the authors and I hope they find my comments useful.