The Future of Illusions or the Illusions of the Future: FOMC Economic Projections 2008-2015

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Abstract

Monetary policy is forward looking and, in its pursuit of transparency, it communicates its economic outlook to the public at large. As a result, there is great interest in the FOMC's projections and its determinants. Indeed, do these projections converge to the actual values and at what pace? To what extent predictions for a given year are determined jointly with predictions for other years? To what extent FOMC participants differ in their outlook? Are their differences related to the state of the economy? To the Chair of the FOMC? What information is being used for revising these projections and is it possible to anticipate what the FOMC will anticipate? Is it possible to extract a narrative about the functioning of the economy? And is that narrative consistent with existing theories? To address these questions, we assemble FOMC forecasts from 2008 to 2015, examine their statistical properties, and assess the extent to which these forecasts can be predicted using publicly available data at the time the forecasts are made.

1 Introduction

That anticipating monetary policies involves understanding FOMC projections is clear:

> "*The Federal Open Market Committee (FOMC) announced on Wednesday that, as part of its ongoing commitment to improve the accountability and public understanding of monetary policy making, it will increase the frequency and expand the content of the economic projections that are made by Federal Reserve Board members and Reserve Bank presidents and released to the public.*"[1]

What is not clear is whether these projections have enhanced the public's understanding of monetary policy: FOMC's projections since 2008 show errors that are large, one-sided, and persistent. Further, the FOMC does not provide a mapping from projections to decisions. Without such a mapping, how can those decisions be understood? Taken together, these findings could be construed as a failure of the FOMC to enhance the public's understanding of monetary policy. We argue, however, against reaching such a conclusion without further analysis.

Two reasons justify extending the benefit of the doubt. First, forecasts from alternative sources over this period were not any better than those of the FOMC. Second, FOMC participants are not impartial observers of their own forecasts but rather must influence the economy so as to meet their dual mandate. In other words, because the FOMC exerts a strong influence on the economy it forecasts, a narrow interpretation of forecast accuracy is not useful if that accuracy means high inflation and high unemployment.

But not everyone is willing to extend the benefit of the doubt. Indeed, there is pending legislation in the U.S. Congress that would require the FOMC to provide details about its decision process

> "$\cdots$ *The FORM Act allows the Fed to choose any monetary policy, strategy or rule it prefers and it has the power to amend or depart from that rule whenever the Fed decides economic circumstances so warrant. Whether the Fed chooses to conduct monetary policy based upon the Taylor Rule, developed by Stanford economist John Taylor, or whether they choose to conduct monetary policy based on a rousing game of rock, paper, scissors, or any other rule or method, the Fed will retain the unfettered discretion to do so. The FORM Act simply requires the Fed to report and explain its rule and its deviations from a standard benchmark to the rest of us.* $\cdots$ " *Press Release by U.S. Representative Hensarling Washington, Nov 18, 2015*"[2]

Under these circumstances, we argue that FOMC projections can enhance the public's understanding if they are, at a minimum, replicable by the public. Finding that projections are replicable by the public means that both the FOMC and the public share an understanding of both the goals of monetary policy and the functioning of economy. Otherwise, these forecasts do not enhance understanding, even in provided daily. Section 2 documents the historical record of FOMC projections from 2008 to 2015. Section 3 develops the notion of replicability and shows our results; section 4 shows the long list of objections to our results. The rest of the paper documents the details of our replication of FOMC forecasts and relates our findings to previous questions: whether the forecast heterogeneity of FOMC participants is consistent with the Taylor rule (Fendel and Rulke, 2011); whether the voting status of FOMC participants matters for the distribution of forecasts (Tillman, 2011; Nakazono, 2013); and whether FOMC participants exhibit herd behavior (Rulke and Tillman, 2011).

[1] Press Release Nov. 14, 2007 http://www.federalreserve.gov/newsevents/press/monetary/20071114a.htm

[2] FORM stands for Fed Oversight and Reform and Modernization Act (FORM Act). See http://financialservices.house.gov/news/documentsingle.aspx?DocumentID=399933

2 The Historical Record

Since 2012, the FOMC has been releasing individual participants' projections for the federal funds rate; figure 1 shows the range of these projections along with the mean across participants:

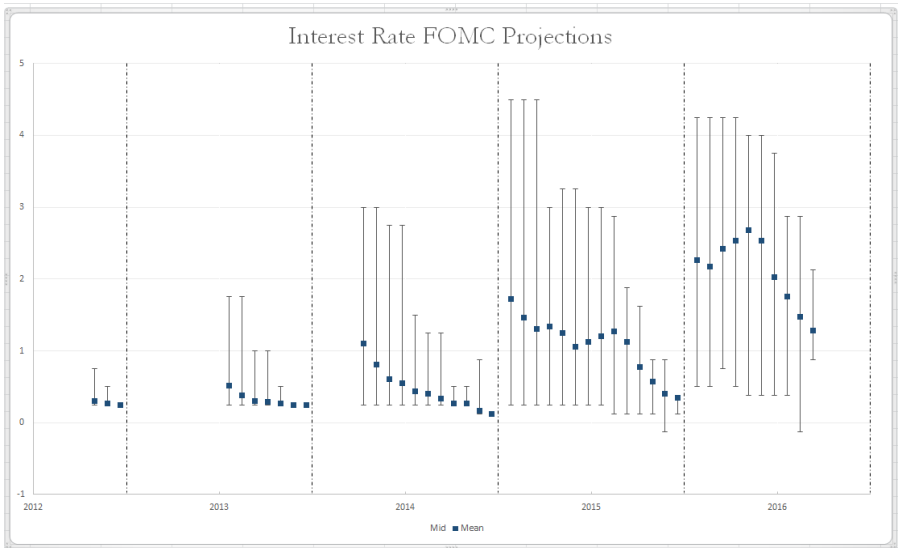


Figure 1 (the horizontal axis shows the projections for the year shown)

The figure shows several features of interest. First, there is a substantial dispersion of projections during each meeting suggesting that participants differ greatly in their interpretation of the appropriate monetary policy. Second, projections for a given year show a tendency to decline, not gradually, as the forecast date approaches the date of the forecast. [3]

FOMC projections for unemployment show significant and persistent underprediction of unemployment through 2012 and systematic over prediction since then (figure 2). For inflation, the gap between projection and actual is quite pronounced (figure 3). Indeed, projections for inflation nearly always include the inflation target of 2 percent, even though the inflation rate has been lower than the target for several years.

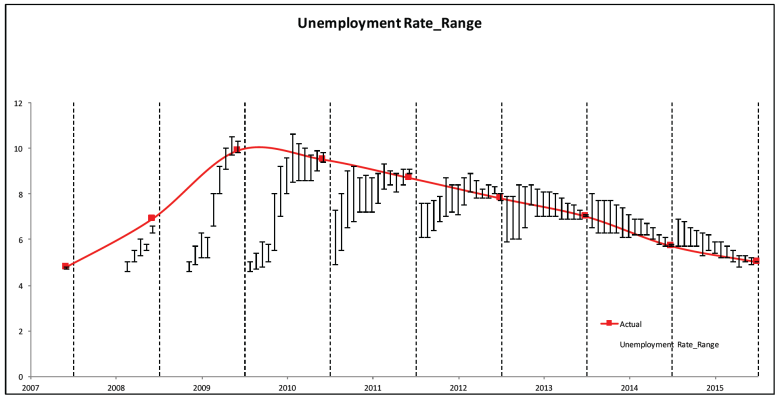


Figure 2: FOMC Forecasts for Unemployment (the horizontal axis shows the projections for the year shown)

[3] Finally, note that FOMC participants are not picking just any value of the federal funds rate they deem appropriate. Rather, their values vary in steps of 0.125 percentage points; the steps might vary from meeting to meeting. So their interpretation of the appropriate monetary policy is not unconstrained.

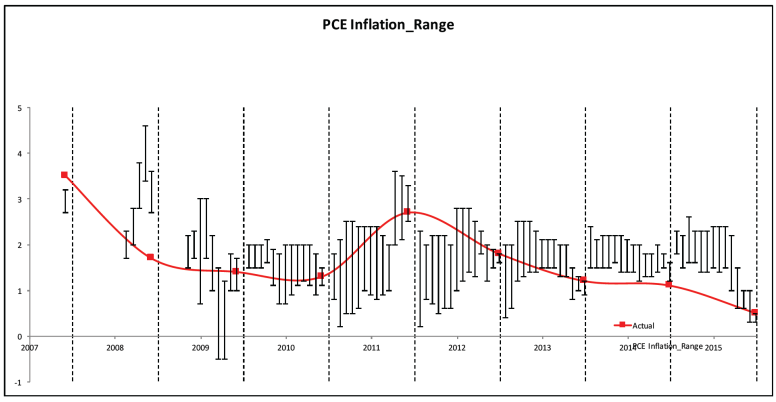


Figure 3: FOMC Forecasts for PCE Inflation (the horizontal axis shows the projections for the year shown)

In brief, these projections show that the FOMC is slow in incorporating changes in unemployment and that it adheres to the hope that inflation rate will reach their target rate. Considering that the federal funds rate was close to zero from 2008 to 2015, how can one map these projections for inflation and unemployment into the projections for the federal funds rate?

If one were unwilling to extend the benefit of the doubt, these errors could be interpreted as reflecting as either dogmatic views or a reliance on faulty frameworks. To argue that this period was unusual in U.S. history is of no comfort: it is precisely during unusual periods when guidance is needed.

3 What is Meant by Replication?

Replicating a process that by design is both secretive and deliberative is not obvious: There are no agreed upn equations (if any) because otherwise there would be no need for deliberations. So asking if FOMC projections are replicable amounts to asking whether it is possible to extract a narrative of the FOMC's views of the economy's functioning. We want a narrative that is quantitative in nature, that is consistent with the FOMC record, that can be rejected by the data, and that allows mapping publicly available data into FOMC projections. To this end, we postulate that

$$
\begin{aligned}
i &= f(\pi, u) && (1)\\
\pi &= g(i|\pi^{spf}, \pi^{a}, u^{spf}, u^{a}) && (2)\\
u &= j(i|\pi^{spf}, \pi^{a}, u^{spf}, u^{a}), && (3)
\end{aligned}
$$

where i is the FOMC projection of the federal funds rate; π and u are the FOMC's projections forecast for inflation and unemployment. This model treats FOMC projections as jointly determined while being influenced by facts and judgements. The facts are the actual values of inflation and unemployment (denoted with a superscript a) and the judgments are the values from the Survey of Professional Forecasters for inflation and unemployment (denoted with a superscript spf).

Treating FOMC projections as jointly determined is important because FOMC participants' projections rely on their assessments of the *appropriate* monetary:

Appropriate monetary policy is defined as the future policy most likely to foster outcomes for economic activity and inflation that best satisfy the participant's interpretation of the Federal Reserve's dual objectives of maximum employment and price stability.[4]

Though we do not have access to the solutions of the participants' optimization problems, we assume that their projections are jointly determined.

For this framework to yield a useful narrative, it must meet two conditions: Transparency and Consistency. Transparency means that one can map publicly available data into FOMC projections. Thus a useful narrative of FOMC behavior entails $\frac{\partial i}{\partial u^{spf}} < 0$ and $\frac{\partial i}{\partial \pi^{spf}} > 0$. Consistency means that an increase in the FOMC forecast for inflation raises the FOMC forecast for the federal funds rate and that an increase in the FOMC forecast for the unemployment rate lowers the FOMC forecast for the federal funds rate. Meeting these conditions only confers eligibility to our narrative: it does not ensure its uniqueness, much less its superiority.

The empirical work applies several econometric estimators and, using Sims words (Sims 1996), *compresses* the FOMC process into a single equation explaining interest-rate forecasts in terms of SPF forecasts:

$$\begin{aligned} i &= 1.23 \cdot \pi^{spf} - 0.53 \cdot u^{spf} + 2.40, \\ &\quad (0.20) \qquad (0.09) \qquad (0.59) \end{aligned}$$

where the entries in parentheses are the standard errors. The resemblance of this equation to the Taylor rule is remarkable, which is surprising given that the FOMC has not claimed that it follows that rule but consistent with Fendel and Rulke (2011).

Combining this equation with hypothetical values of π^{spf} and u^{spf} yields a mapping from publicly available data to projections of the federal funds rate:

Table 1: Mapping of π^{spf} and u^{spf} to Interest-rate Forecasts

		u^{spf}						
		4	5	6	7	8	9	10
π^{spf}	-1	-0.95	-1.48	-2.01	-2.54	-3.07	-3.6	-4.13
	0	0.28	-0.25	-0.78	-1.31	-1.84	-2.37	-2.9
	1	1.51	0.98	0.45	-0.08	-0.61	-1.14	-1.67
	2	2.74	2.21	1.68	1.15	0.62	0.09	-0.44
	3	3.97	3.44	2.91	2.38	1.85	1.32	0.79

For a given π^{spf}, a one percentage point increase in u^{spf} lowers the interest-rate forecast by about 50 basis points. Similarly, for a given u^{spf}, a one percentage point increase in π^{spf} raises the interest-rate forecast by 1.2 percentage point. Another way of mapping public data into interest-rate forecasts involves computing the combinations of u^{spf} and π^{spf} associated with a given federal funds rate projection; figure 4 shows these combinations for alternative values of the interest-rate forecast:

[4] See http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20071031.pdf.
See also Page 3 of http://www.federalreserve.gov/mediacenter/files/FOMCpresconf20151216.pdf

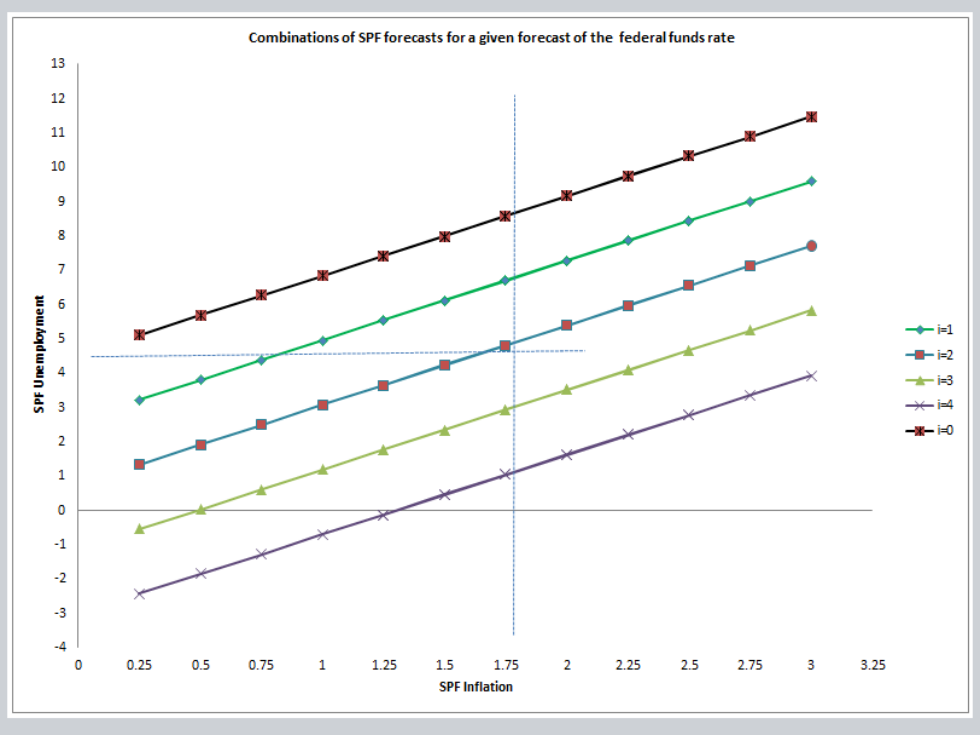


Figure 4: Iso Interest-Rate Forecasts

Given the interest-rate forecast, the upward pressure on the forecast of the federal funds rate from a one percent increase in π^{spf} needs to be offset by an increase in u^{spf}. This intuitive is result is known; our contribution is quantifying the tradeoff:

$$di = 0 \Longrightarrow \frac{du^{spf}}{d\pi^{spf}} = -\frac{(-0.53)}{1.23} = 0.43.$$

So an interest-rate forecast remains unchanged if an increase in π^{spf} is accompanied by an increase in u^{spf} of 0.43 percentage points.[5] The dashed lines in figure 4 are the values of the SPF forecasts as of March 2016.[6] The implied interest-rate forecast is about 2 percent; if one allows for uncertainty in the intercept of the mapping equation, then the 66% confidence interval for the interest-rate forecast ranges from 1.4 percent to 2.6 percent.

Before documenting the details of how we arrive at this mapping, we highlight the objections to these findings.

4 Objections to Our Findings

There are many objections to our findings. First, just like Supreme Court's decisions are based on the Justices' interpretation of the Constitution, FOMC participants' projections rely on their assessments of the *appropriate* monetary policy. We do not have access to the solutions of participants' optimization problem, much less the aggregate of such solutions. Second, there is no guarantee that a replicable, but unknown, process even exists. Indeed, our work is subject to the criticism that we are testing a joint hypothesis:

[5] The 95 percent critical values for this estimate are 0.26 and 0.71, which are based on Monte-carlo simulations of section 6.3.

[6] See https://www.philadelphiafed.org/research-and-data/real-time-center/survey-of-professional-forecasters/2016/survq116

that the mapping exists and that our approach offers a characterization of it. Third, even a casual reading of FOMC transcripts reveals that the FOMC considers many variables in their decision-making process: term structures (foreign and domestic), exchange rates, interest rates (foreign and domestic), among others. Fourth, the current format of FOMC data releases creates complications that lack a neat workaround. Specifically, the FOMC reports only the bounds of the distribution of participants' projections for inflation and unemployment whereas the projections for the federal funds rate are for each participant.[7] Our approach to bypass this gap in data structure need not be of general applicability. Fifth, from a modeling standpoint, our mapping treats SPF forecasts as given. Finally, we have not undertaken an exhaustive sensitivity analysis of our econometric results. Taken as whole, these limitations underscore the undeniably tentative character of our results: Being able to replicate FOMC's forecast is one thing; being able to find a reliable replication is another.

5 FOMC Projections

5.1 Protocol

Since October 2007, FOMC participants (voting and non-voting) submit quarterly projections for inflation, unemployment, and the federal funds rate among other variables. There are at most 19 participant submissions for each of these meetings: 12 from the Federal Reserve Bank presidents and 7 from the Board of Governors of the Federal Reserve System; to maintain confidentiality, names of FOMC participants are not identified in these projections. Rather, participants are assigned a number randomly and the number may change from meeting to meeting.

The projections' horizon includes the current year and two additional years.[8] During the last two meetings of each year, participants extend their projections by one year. The multi-year character of this protocol yields as many as 14 forecasts for a given year (table 2).[9]

[7] Starting in December 2015, the FOMC projections include the median of the distribution.

[8] Prior to October 2007, FOMC's projections were released twice a year, focused on the current year and the next, provided a range of the projections of FOMC participants; see http://www.federalreserve.gov/boarddocs/hh/2006/july/ReportSection1.htm

[9] The projections also include a long-run horizon (not shown in the table) defined as "$\cdots$each participant's assessment of the rate to which each variable would be expected to converge under appropriate monetary policy and in the absence of further shocks to the economy." See http://www.federalreserve.gov/monetarypolicy/files/fomcprojtabl20151216.pdf

Table 2: Protocol of FOMC Projections

	Forecast Horizon						
Forecast Date	2010	2011	2012	2013	2014	2015	2016
2010:Q1	•	•	•				
2010:Q2	•	•	•				
2010:Q3	•	•	•	•			
2010:Q4	•	•	•	•			
2011:Q1		•	•	•			
2011:Q2		•	•	•			
2011:Q3		•	•	•	•		
2011:Q4		•	•	•	•		
2012:Q1			•	•	•		
2012:Q2			•	•	•		
2012:Q3			•	•	•	•	
2012:Q4			•	•	•	•	
2013:Q1				•	•	•	
2013:Q2				•	•	•	
2013:Q3				•	•	•	•
2013:Q4				•	•	•	•

Participants' projections are revised in response to economic developments. Further,the revisions use information available *through the conclusion* of the meeting, on each participant's assumptions regarding a range of factors likely to affect economic outcomes, and on his or her assessment of *appropriate* monetary policy.[10] Importantly, forecasts revisions cannot be unambiguously interpreted as reactions to news. As indicated earlier, FOMC participants' projections depend on their assessments of the *appropriate* monetary policy. Thus as participants' terms expire, new participants will bring their own assessment which then means different forecasts, even in the absence of economic news.

5.2 Varieties of Releases

Since 2012, the FOMC has been releasing participants' projections for the federal funds rate. For inflation and unemployment, the FOMC has been releasing since 2007 the Ranges and Central Tendencies of these projections.[11] The FOMC also releases with a five year delay the individual participants' projections for inflation and unemployment; figure 5 shows the varieties of FOMC data releases:

[10] http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20071031.pdf.
See also Page 3 of http://www.federalreserve.gov/mediacenter/files/FOMCpresconf20151216.pdf
[11] Starting in December 2015, the FOMC projections include the median of the distribution.

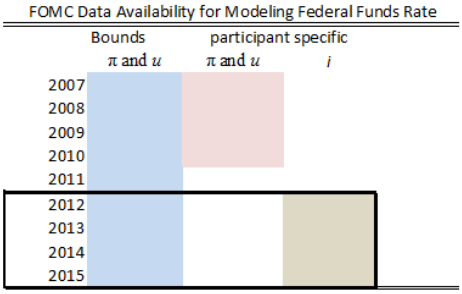


Figure 5: Structure of FOMC Release of Projections

This peculiarity in FOMC data releases means that the period with interest-rate forecasts from individual participants does not overlap with the period of inflation and unemployment forecasts from individual participants. Given the simultaneity of the model, we combine data from two types of releases from the FOMC for meetings over the period 2012-2015 (enclosed area): participant-specific projections for the federal funds rate and bounds of projections for inflation and the unemployment rate.

5.3 Data for Replication

Figure 6 shows the mean across participants of interest-rate projections for each release:

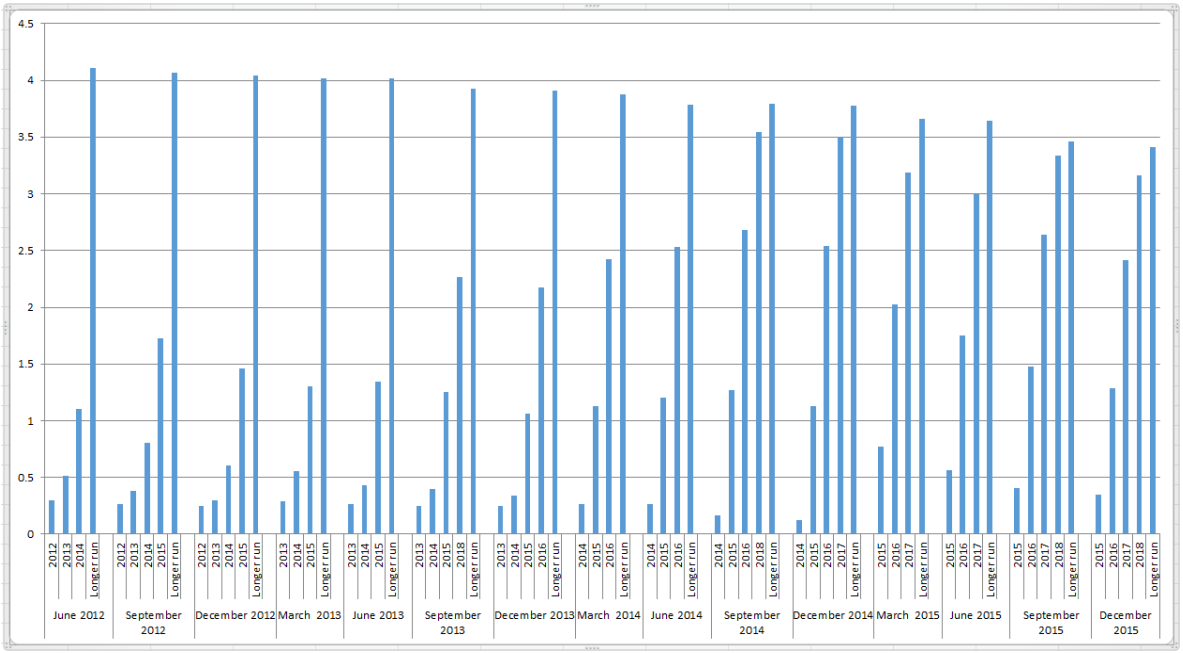


Figure 6: Average Interest Rate Forecasts Across FOMC Meetings

For each meeting, the longer-run interest-rate projection increases with the horizon. Across meetings, however, the longer-run interest-rate projection has decline from 4 in June 2012 to percent to 3 percent in December 2015.

Figures 7 and 8 show the projections for unemployment and inflation:

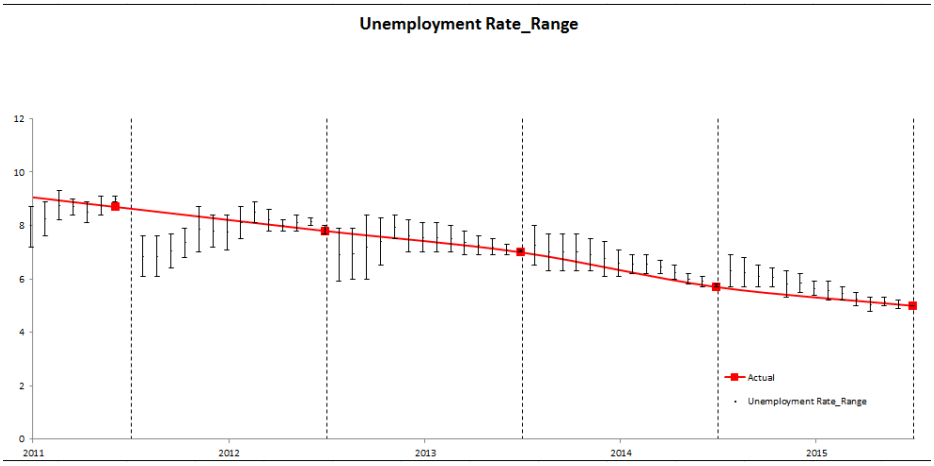


Figure 7 (the horizontal axis shows the projections for the year shown)

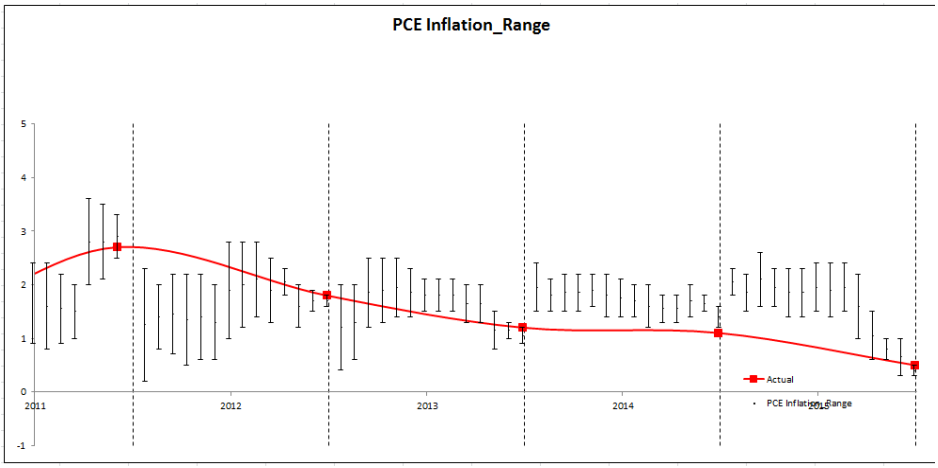


Figure 8 (the horizontal axis shows the projections for the year shown)

The figures show that the gap between the upper and lower bounds of these projections diminishes as the meeting date approaches the year that is being forecasted. However, the gap is not always eliminated. This pattern raises two questions: Do these projections converge to the actual value and at what pace? Figure 9 answers these questions by comparing the bounds of the projections to the associated actual values:

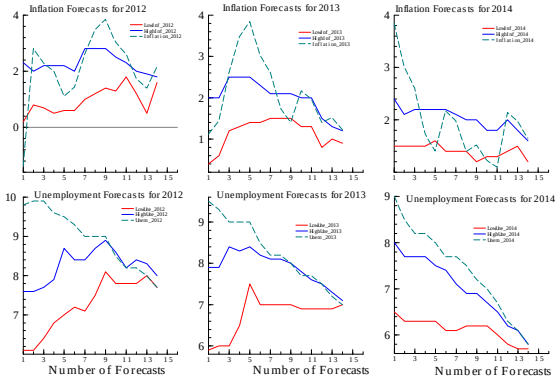


Figure 9: Bounds of FOMC Projections and Actual Values

We find that the upper bound of the distribution of inflation and unemployment forecasts converge to their actual values fairly promptly. The lower bounds of these distributions seems disconnected from actual values.

6 A Simple Model for FOMC Projections

6.1 Data Assembly

6.1.1 Federal Funds Rate

For analytical purposes, we denote $i_{t,j,y}$ as the federal funds rate projection at time t (the date of the FOMC meeting) by the jth FOMC participant ($j = 1...n_t$) for the yth year ($y = 2012 \cdots 2018$). Note that the number of FOMC forecasts submitted at date t, n_t, might vary from meeting to meeting. The mean of the participants' projections for i in year y and meeting t is

$$i_{t,y} = \frac{1}{n_t} \sum_{j=1}^{n_t} i_{t,j,y};\ n_t \leq 19$$

Table 3 shows how we assemble the data for projections of the federal funds rate:

Table 3

	Forecast Horizon						
Forecast Date	2012	2013	2014	2015	2016	2017	Long run
2012June	$i_{june2012,2012}$	$i_{june2012,2013}$	$i_{june2012,2014}$				$i_{june2012,lr}$
2012Sep	$i_{sep2012,2012}$	$i_{sep2012,2013}$	$i_{sep2012,2014}$				$i_{sep2012,lr}$
2012Dec	$i_{dec2012,2012}$	$i_{dec2012,2013}$	$i_{dec2012,2014}$	$i_{dec2012,2015}$			$i_{nov2012,lr}$
2013Mar		$i_{mar2013,2013}$	$i_{mar2013,2014}$	$i_{mar2013,2015}$			$i_{mar2013,lr}$
2013Jun		$i_{june2013,2013}$	$i_{june2013,2014}$	$i_{june2013,2015}$			$i_{june2013,lr}$
2013Sep		$i_{sep2013,2013}$	$i_{sep2013,2014}$	$i_{sep2013,2015}$	$i_{sep2013,2016}$		$i_{sep2013,lr}$
2013Dec		$i_{dec2013,2013}$	$i_{dec2013,2014}$	$i_{dec2013,2015}$	$i_{dec2013,2016}$		$i_{dec2013,lr}$
2014Mar			$i_{mar2014,2014}$	$i_{mar2014,2015}$	$i_{mar2014,2016}$		$i_{mar2014,lr}$
2014Jun			$i_{june2014,2014}$	$i_{june2014,2015}$	$i_{june2014,2016}$		$i_{june2014,lr}$
2014Sep			$i_{sep2014,2014}$	$i_{sep2014,2015}$	$i_{sep2014,2016}$	$i_{sep2014,2017}$	$i_{sep2014,lr}$
2014Dec			$i_{dec2014,2014}$	$i_{dec2014,2015}$	$i_{dec2014,2016}$	$i_{dec2014,2017}$	$i_{dec2014,lr}$

The vector of projections of the average federal funds rate in 2014 is

$$i_{2014} = [i_{june2012,2014}; \cdots ; i_{dec2014,2014}]' .$$

This vector has 11 entries because there were 11 meetings from June 2012 to December 2014 that included a projection for 2014; these observations are enclosed in a rectangle. Stacking the vector of forecasts of average fed funds rate across all FOMC meetings yields

$$i = [i_{2012}, i_{2013}, i_{2014}, \cdots]'.$$

6.1.2 Inflation and Unemployment

For analytical purposes, we adopt the following notation:

$\pi^h_{t,y}$: upper bound of the range of inflation forecasts in year y made during FOMC date t

$\pi^l_{t,y}$: lower bound of the range of inflation forecasts in year y made during FOMC date t

$u^h_{t,y}$: upper bound of the range of unemployment forecasts in year y made during FOMC date t

$u^l_{t,y}$: lower bound of the range of unemployment forecasts in year y made during FOMC date t

π^a_{t-1} actual inflation one month prior to the FOMC meeting $(t-1)$

u^a_{t-1} actual unemployment one month prior to the FOMC meeting $(t-1)$

$\pi^{spf}_{t-1,y}$ SPF inflation forecast in year y made at time $t-1$

$u^{spf}_{t-1,y}$ SPF unemployment forecast in year y made at time $t-1$

Table 4 below illustrates the alignment of forecasts and conditioning variables for π^h_{2012} and π^h_{2013}:

Table 4

Date of forecast (t)	π^h_{2012}	π^a_{2012}	π^{spf}_{2012}	π^h_{2013}	π^a_{2013}	π^{spf}_{2013}
(1)	(2)	(3)	(4)	(5)	(6)	(7)
Nov09	$\pi^h_{nov09,12}$	π_{oct09}	$\pi^{spf}_{oct09,12}$			
Jan10	$\pi^h_{jan10,12}$	π_{dec09}	$\pi^{spf}_{dec10,12}$			
April10	$\pi^h_{apr10,12}$	π_{mar10}	$\pi^{spf}_{mar10,12}$			
Jun10	$\pi^h_{jun10,12}$	π_{may10}	$\pi^{spf}_{may10,12}$			
Nov10	$\pi^h_{nov10,12}$	π_{oct10}	$\pi^{spf}_{oct10,12}$	$\pi^h_{nov10,13}$	π_{oct10}	$\pi^{spf}_{oct10,12}$
Jan11	$\pi^h_{jan11,12}$	π_{dec10}	$\pi^{spf}_{dec10,12}$	$\pi^h_{jan11,13}$	π_{dec10}	$\pi^{spf}_{dec10,12}$
Apr11	$\pi^h_{apr11,12}$	π_{mar11}	$\pi^{spf}_{mar11,12}$	$\pi^h_{apr11,13}$	π_{mar11}	$\pi^{spf}_{mar11,12}$
Jun11	$\pi^h_{jun11,12}$	π_{may11}	$\pi^{spf}_{may11,12}$	$\pi^h_{jun11,13}$	π_{may11}	$\pi^{spf}_{may11,12}$
Nov11	$\pi^h_{nov11,12}$	π_{oct11}	$\pi^{spf}_{octv11,12}$	$\pi^h_{nov11,13}$	π_{oct11}	$\pi^{spf}_{octv11,12}$
Jan12	$\pi^h_{jan12,12}$	π_{dec11}	$\pi^{spf}_{dec12,12}$	$\pi^h_{jan12,13}$	π_{dec11}	$\pi^{spf}_{dec12,12}$
Apr12	$\pi^h_{apr12,12}$	π_{mar12}	$\pi^{spf}_{mar12,12}$	$\pi^h_{apr12,13}$	π_{mar12}	$\pi^{spf}_{mar12,12}$
Jun12	$\pi^h_{jun12,12}$	π_{may12}	$\pi^{spf}_{may12,12}$	$\pi^h_{jun12,13}$	π_{may12}	$\pi^{spf}_{may12,12}$
Sep12	$\pi^h_{nov12,12}$	π_{oct12}	$\pi^{spf}_{oct12,12}$	$\pi^h_{nov12,13}$	π_{oct12}	$\pi^{spf}_{oct12,12}$
Dec12	$\pi^h_{dec12,12}$	π_{nov12}	$\pi^{spf}_{nov12,12}$	$\pi^h_{dec12,13}$	π_{nov12}	$\pi^{spf}_{nov12,12}$
Mar13				$\pi^h_{mar13,13}$	π_{feb13}	$\pi^{spf}_{feb13,13}$
Jun13				$\pi^h_{jun13,13}$	π_{may13}	$\pi^{spf}_{may13,13}$
Sep13				$\pi^h_{nov13,13}$	π_{oct13}	$\pi^{spf}_{oct13,13}$
Dec13				$\pi^h_{dec13,13}$	π_{nov13}	$\pi^{spf}_{nov13,13}$

The observations enclosed by the rectangle emphasize the role of current information in conditioning forecasts at different horizons. For example, the actual inflation rate as of October 2010 is being used in the November 2010 meeting as information to forecast the inflation for 2012 and 2013.

The vector of projections of the upper bound of the forecast for inflation in 2012 is

$$\pi^h_{2012} = \left[\pi^h_{nov09,2012}; \cdots ; \pi^h_{dec12,2012}\right]'$$

The number of entries of this vector is 14 because there were 14 meetings from November 2009 to December 2012 that included a projection for 2012; other years will differ somewhat in the number of FOMC meetings. The resulting vector of forecasts of the upper bound of inflation across all FOMC meetings is

$$\pi^h = [\pi^h_{2012}, \pi^h_{2013}, \pi^h_{2014}, \cdots, \pi^h_{2018}]'.$$

Following the format of the table, we now express columns (3)-(4) in vector format

$$\begin{aligned} \pi^a_{2012} &= (\pi_{oct09} \cdots \pi_{nov12})', \\ \pi^{spf}_{2012} &= (\pi^{spf}_{oct09,2012} \cdots \pi^{spf}_{nov12,2012})'. \end{aligned}$$

The vector of projections across all FOMC meetings for the actual and the SPF forecasts are

$$\begin{aligned} \pi^a &= (\pi^a_{2008}, \pi^a_{2009}, \pi^a_{2010}, \pi^a_{2011}, \pi^a_{2012}, \pi^a_{2013}, \pi^a_{2014}, \pi^a_{2015})', \\ \pi^{spf} &= (\pi^{spf}_{2008}, \pi^{spf}_{2009}, \pi^{spf}_{2010}, \pi^{spf}_{2011}, \pi^{spf}_{2012}, \pi^{spf}_{2013}, \pi^{spf}_{2014}, \pi^{spf}_{2015})'. \end{aligned}$$

The vectors for π^l, u^h, and u^l are constructed analogously.

6.2 Empirical Analysis

6.2.1 A-Priori Formulation

The estimation model we postulate is

$$i = \alpha_{10} + \alpha_{11} \cdot \pi^h + \alpha_{12} \cdot \pi^l + \alpha_{13} \cdot u^h + \alpha_{14} \cdot u^l + \alpha_{15} \cdot \mathbb{C} + \kappa_i + e^i \tag{4}$$

$$\pi^h = \alpha_{21} \cdot i + \alpha_{22} \cdot \pi^{spf} + \alpha_{23} \cdot \pi^a + \alpha_{24} \cdot u^{spf} + \alpha_{25} \cdot u^a + \kappa_{\pi^h} + e^{\pi^h} \tag{5}$$

$$\pi^l = \alpha_{31} \cdot i + \alpha_{32} \cdot \pi^{spf} + \alpha_{33} \cdot \pi^a + \alpha_{34} \cdot u^{spf} + \alpha_{35} \cdot u^a + \kappa_{\pi^l} + e^{\pi^l} \tag{6}$$

$$u^h = \alpha_{41} \cdot i + \alpha_{42} \cdot \pi^{spf} + \alpha_{43} \cdot \pi^a + \alpha_{44} \cdot u^{spf} + \alpha_{45} \cdot u^a + \kappa_{u^h} + e^{u^h} \tag{7}$$

$$u^l = \alpha_{51} \cdot i + \alpha_{52} \cdot \pi^{spf} + \alpha_{53} \cdot \pi^a + \alpha_{54} \cdot u^{spf} + \alpha_{55} \cdot u^a + \kappa_{u^l} + e^{u^l} \tag{8}$$

where

$$e = (e^i, e^{\pi^h}, e^{\pi^l}, e^{u^h}, e^{u^l}) \tilde{} N(0, \Sigma)$$

Equation (4) assumes that the interest-rate forecasts depends on the bounds of the forecast distributions of inflation and unemployment forecasts. Ideally, we would like to use the means of the distributions of participants' projections for inflation and unemployment but the FOMC has not released participant specific projections; we revisit this limitation shortly. The choice of inflation and unemployment forecasts rests on the history of press releases of FOMC decisions and *Bluebooks* documenting the alternative options over which

FOMC members vote.[12] This record indicates that the outlook for economic activity (*i.e.* unemployment) and inflation are the most important considerations for determining the outlook for interest rates. To examine if differences in FOMC governance matter, the equation includes an auxiliary variable $\mathbb{C}$ equal to 1 for FOMC meetings chaired by Yellen.

A faithful modeling FOMC projections of inflation and unemployment (equations (5) to (8)) would benefit from having access to the type of information used by the FOMC. But these deliberations are not available to the public at the time of the meeting. And even if they were, those deliberations take place precisely because there are no explicit, or agreed upon, equations (if any) to determine their forecasts. So, to be sure, we are not arguing that the FOMC determines their projections using these equations as such. Instead we are arguing that the actual values of inflation and unemployment (π^a and u^a) and SPF projections for inflation and unemployment (π^{spf} and u^{spf}) are highly correlated with the variables used by the FOMC. Thus these equations are the ones that the public could use to replicate projections of the FOMC.

For this formulation to be eligible as a potentially useful narrative, the parameter estimates need to meet both Consistency and Transparency. Assessing whether Consistency is met involves reading out the coefficients of equation (5): an increase in the inflation forecast raises the interest-rate forecast ($\alpha_{11}+\alpha_{12}>0$) and an increase in the unemployment forecast lowers the interest rate forecast ($\alpha_{13}+\alpha_{14}<0$).

Transparency to the public is met if $\frac{\partial i}{\partial u^{spf}}<0$ and $\frac{\partial i}{\partial \pi^{spf}}>0$. Assessing whether Transparency holds, however, cannot be read off directly from the parameters of equations (4) to (8) because of the simultaneous nature of the model. The reduced-form coefficients associated with the solution of the model can be used to to that end. To obtain the reduced form, we re-write the model as[13]

$$\underbrace{\begin{bmatrix} 1 & -\alpha_{11} & -\alpha_{12} & -\alpha_{13} & -\alpha_{14} \\ -\alpha_{21} & 1 & 0 & 0 & 0 \\ -\alpha_{31} & 0 & 1 & 0 & 0 \\ -\alpha_{41} & 0 & 0 & 1 & 0 \\ -\alpha_{51} & 0 & 0 & 0 & 0 \end{bmatrix}}_{A} \cdot \begin{bmatrix} i \\ \pi^h \\ \pi^l \\ u^h \\ u^l \end{bmatrix} = \underbrace{\begin{bmatrix} 0 & 0 & 0 & 0 & \alpha_{15} & \kappa_i \\ \alpha_{22} & \alpha_{23} & \alpha_{24} & \alpha_{25} & 0 & \kappa_{\pi^h} \\ \alpha_{32} & \alpha_{33} & \alpha_{34} & \alpha_{35} & 0 & \kappa_{\pi^l} \\ \alpha_{42} & \alpha_{43} & \alpha_{44} & \alpha_{45} & 0 & \kappa_{u^h} \\ \alpha_{52} & \alpha_{53} & \alpha_{54} & \alpha_{55} & 0 & \kappa_{u^l} \end{bmatrix}}_{B} \cdot \begin{bmatrix} \pi^{spf} \\ \pi^a \\ u^{spf} \\ u^a \\ \mathbb{C} \\ 1 \end{bmatrix} + \underbrace{\begin{bmatrix} e^i \\ e^{\pi^h} \\ e^{\pi^l} \\ e^{u^h} \\ e^{u^l} \end{bmatrix}}_{e}$$

The solution to of the model is

$$\begin{bmatrix} i \\ \pi^h \\ \pi^l \\ u^h \\ u^l \end{bmatrix} = \underbrace{\begin{bmatrix} \delta_{11} & \delta_{12} & \delta_{13} & \delta_{14} & \delta_{15} & \delta_{16} \\ \vdots & \vdots & \vdots & \vdots & \vdots & \vdots \\ \delta_{61} & \delta_{62} & \delta_{63} & \delta_{64} & \delta_{65} & \delta_{66} \end{bmatrix}}_{A^{-1}\cdot B} \cdot \begin{bmatrix} \pi^{spf} \\ \pi^a \\ u^{spf} \\ u^a \\ \mathbb{C} \\ 1 \end{bmatrix} + \underbrace{v}_{A^{-1}\cdot e} \tag{9}$$

So Transparency is met if both $\frac{\partial i}{\partial \pi^{spf}}=\delta_{11}>0$ and $\frac{\partial i}{\partial u^{spf}}=\delta_{13}<0$.

6.2.2 Econometric Results

Recall that our model relates the mean forecast of the federal funds rate to the bounds of the distribution of inflation and unemployment over 2008 to 2010. Inferences based on the bounds of the distributions might be

[12] For an example of the Bluebook, see http://www.federalreserve.gov/monetarypolicy/files/FOMC20100127bluebook20100121.pdf

[13] Note that the order conditions for identification are met.

construed as unreliable because they do not provide information about individual participants' projections. Ideally, we would like to replicate the FOMC process using the mean of the forecast distributions for inflation and unemployment but the FOMC has not released associated data. Thus an important question is whether using the bounds of the forecast distribution entails a loss of information for the questions we raise here. To that end, we argue that if there is a fixed relation between the bounds of the distribution and the its mean, then relying on these bounds would not carry a loss of information. To examine this question, we use the individual participants data from 2007 to 2010 because these data include the bounds and the mean; figure 10 shows the association between bounds and both the mean and median of the distributions:

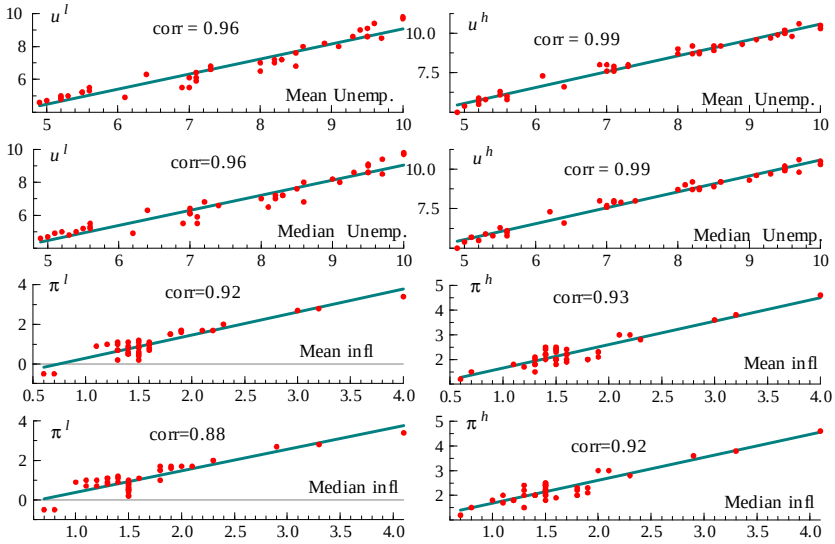


Figure 10

For unemployment forecasts across all meetings, the correlation between the mean and u^h is 0.99; the correlation between the mean and u^l is 0.96. For inflation forecasts across all meetings, the correlation between the mean and the π^h is 0.93; the correlation between the mean and π^l is 0.92. The correlations using the median instead of the mean are comparable. Overall, these high correlations suggest that the loss of information from using the bounds is small. There is no guarantee, however, that the loss of information is also minimal for the period 2012-2015.

To be sure, modeling the bounds of the distribution of inflation and unemployment is a limitation of our work. Nevertheless, this limitation stems from the FOMC not releasing data that are available and it applies with the same force to any work trying to characterize empirically the relation between i and both π and u.

With these considerations in mind, we estimate A and B using FIML; the results are in table 5. Reliance on FIML yields estimates that flat out reject the usefulness of a narrative based on our model: Virtually every coefficient is insignificant. Two explanations for this result are possible. First, our formulation is just not suitable. Second, the formulation might be suitable but reliance on FIML involves estimating too many parameters relative to the number of observations. Hence, to avoid confusing suitability with imprecision, we assume that Σ is diagonal, treat i as predetermined, and re-estimate the parameters with OLS. The resulting parameter estimates meet the Consistency requirement: A one percentage point increase in the inflation forecast raises the interest forecast by 1.1 percentage points (=1.65-0.52). Further, a one percentage point increase in the unemployment forecast lowers the interest-rate forecast by 0.64 percentage points (=-0.83+0.19).

Table 5: FIML and OLS Coefficient Estimates

Structural Coefficients

	FIML		OLS	
i				
	Coefficient	Std.Error	Coefficient	Std.Error
π^k	-3.34	5.62	-0.52	0.35
π^l	3.21	5.16	**1.65**	0.39
u^k	3.48	3.53	0.19	0.35
u^l	-4.08	3.51	**-0.83**	0.34
Yellen	0.66	1.01	-0.08	0.29
Constant	4.16	3.77	**3.44**	1.11
π^k				
	Coefficient	Std.Error	Coefficient	Std.Error
u^{spf}	-0.31	2.77	**-0.28**	0.11
π^{spf}	1.09	1.91	**1.07**	0.11
π^a	-0.01	0.34	-0.01	0.05
u^a	0.17	1.62	0.15	0.10
i	-0.13	2.48	-0.10	0.06
Constant	1.04	6.48	**0.96**	0.28
π^l				
	Coefficient	Std.Error	Coefficient	Std.Error
u^{spf}	-1.82	12.75	0.18	0.10
π^{spf}	2.22	8.81	**0.84**	0.10
π^a	-0.25	1.58	0.00	0.05
u^a	0.98	7.46	**-0.19**	0.09
i	-1.66	11.41	**0.13**	0.06
Constant	4.50	29.83	-0.16	0.25
u^k				
	Coefficient	Std.Error	Coefficient	Std.Error
u^{spf}	-1.05	14.58	**1.18**	0.17
π^{spf}	2.00	10.08	**0.47**	0.17
π^a	-0.45	1.81	**-0.18**	0.08
u^a	1.12	8.54	-0.18	0.16
i	-1.89	13.06	0.10	0.09
Constant	4.63	34.14	-0.59	0.42
u^l				
	Coefficient	Std.Error	Coefficient	Std.Error
u^{spf}	-5.64	45.03	**1.52**	0.15
π^{spf}	4.98	31.10	0.04	0.14
π^a	-0.98	5.58	-0.10	0.06
u^a	3.61	26.37	**-0.58**	0.13
i	-6.22	40.31	**0.20**	0.08
Constant	16.51	105.40	-0.26	0.36

To assess the whether the estimates meet the Transparency condition we report the reduced form coefficients in table 6.

Table 6: Reduced Form Coefficients Implied by FIML and OLS Estimates

Reduced-form Coefficient Estimates

FIML

Estimates	u^{spf}	π^{spf}	π^{a}	u^{a}	yellen	Constant	SER	Normality†	Homoskedasticity†	Correlation of Fit & FOMC
i	-1.13	0.77	-0.13	0.64	-0.05	2.80	0.97	0.00	0.04	0.87
π^{k}	-0.16	0.99	0.01	0.09	0.01	0.67	0.18	0.72	0.20	0.91
π^{l}	0.06	0.94	-0.03	-0.09	0.08	-0.14	0.81	0.52	0.15	0.89
u^{k}	1.08	0.55	-0.21	-0.09	0.10	-0.67	0.93	0.01	0.08	0.96
u^{l}	1.38	0.21	-0.18	-0.37	0.32	-0.89	2.88	0.92	0.30	-0.68
Std. Errors										
i	0.24	0.26	0.13	0.25	0.32	1.28				
π^{k}	0.10	0.10	0.05	0.10	0.13	0.52				
π^{l}	0.09	0.10	0.05	0.10	0.12	0.49				
u^{k}	0.15	0.16	0.08	0.15	0.19	0.78				
u^{l}	0.13	0.13	0.07	0.13	0.17	0.67				

OLS

Estimates	u^{spf}	π^{spf}	π^{a}	u^{a}	yellen	Constant	SER	Normality†	Homoskedasticity†	Correlation of Fit & FOMC
i	-0.68	1.00	0.05	0.06	-0.09	3.14	0.49	0.47	0.00	0.85
π^{k}	-0.21	0.97	-0.01	0.14	0.01	0.64	0.18	0.30	0.23	0.91
π^{l}	0.09	0.96	0.00	-0.18	-0.01	0.23	0.16	0.34	0.36	0.89
u^{k}	1.11	0.57	-0.17	-0.18	-0.01	-0.26	0.27	0.00	0.05	0.96
u^{l}	1.39	0.23	-0.09	-0.57	-0.02	0.35	0.23	0.71	0.27	-0.86
Std. Errors										
i	0.29	0.32	0.12	0.28	0.33	1.34				
π^{k}	0.10	0.11	0.05	0.11	0.03	0.27				
π^{l}	0.11	0.12	0.06	0.12	0.04	0.30				
u^{k}	0.15	0.16	0.08	0.16	0.04	0.38				
u^{l}	0.11	0.12	0.06	0.12	0.07	0.35				

Coefficients in red have |t-statistic| less than 2

† Significance level needed to reject the associated null hypothesis o the residuals of the equation

The OLS results indicate that a one-percent increase in u^{spf} lowers i by 0.7 percentage points and that one percent increase in π^{spf} raises i by one percentage point. Though these two estimates are statistically significant, they are not reliable: the correlation between FOMC forecasts and our fitted value for u^{l} is large and negative. Moreover, most of the estimate are not significant which raises the question of whether excluding these insignificant coefficients would raise the reliability of the remaining estimates.

Indeed, one may argue that there are gains in precision of the estimates if one were to exclude insignificant variables from the model. But to avoid the statistical pitfalls associated with the joint nature of model specification and parameter estimation, we rely on a computer-automated algorithm, developed by Hendry and Krolzig (2001) and Hendry and Doornik (2014).[14] Their algorithm combines least squares with a selection criteria that excludes insignificant coefficients and tests for both parameter constancy and white-noise residuals; the critical values for rejection are not fixed in advance but, rather, are calculated sequentially. Specifically, we use a conservative strategy in which the probability of retaining irrelevant variables is one-hundredth of one percent. We apply this algorithm to the reduced-form expression and the results are shown in table 7:

[14] For a discussion of the issues raised by automated specification, see Hendry and Krolzig (2003), Granger and Hendry (2004), Phillips (2004), and Ericsson (2016).

Table 7: Reduced Form Coefficients from Automated Search

Reduced Form Coefficients with Autometrics

Autometrics

Estimates	u^{spf}	π^{spf}	π^{a}	u^{a}	yellen	Constant	SER	Normality†	Homoskedasticity†	Correlation of Fit & FOMC
i	-0.53	1.23	-0.14	0e	0e	2.40	0.47	0.33	0.07	0.85
π^{k}	-0.09	1.05	0.01	0e	0e	0.67	0.18	0.61	0.24	0.91
π^{l}	-0.06	0.86	-0.02	0e	0e	0.20	0.17	0.73	0.01	0.89
u^{k}	0.96	0.46	-0.19	0e	0e	-0.28	0.27	0.00	0.12	0.97
u^{l}	0.90	-0.13	-0.12	0e	0e	0.39	0.27	0.47	0.19	0.96
Std. Errors										
i	0.09	0.20	0.13	0e	0e	0.59				
π^{k}	0.03	0.08	0.05	0e	0e	0.22				
π^{l}	0.03	0.07	0.05	0e	0e	0.21				
u^{k}	0.05	0.12	0.07	0e	0e	0.34				
u^{l}	0.05	0.12	0.08	0e	0e	0.34				

Target size 0.0001

0e means that the algorithm excluded the variable

Coefficients in red have |t-statistic| less than 2

† Significance level needed to reject the associated null hypothesis o the residuals of the equation

First, in terms of Transparency, the results indicate that an increase of one percentage point in u^{spf} lowers the projected federal funds rate by 50 basis points. An increase of one percentage point in π^{spf} raises the projected federal funds rate by 1.2 percentage points. Second, SPF forecasts are the best leading indicators: an increase of one percent in the SPF forecasts raises FOMC forecasts in the same proportion. In other words, changes in recorded unemployment or inflation do not serve as signals of further changes in the FOMC forecasts for these variables. Third, recognizing who is the Chair of the FOMC does not matter for these results. In terms of model fit, the correlations between FOMC projections and the fitted values range from 0.85 for the federal funds rate to 0.97 for the upper bound of the unemployment rate. Overall, these results suggest that our framework is helpful in crafting a narrative of FOMC projections.

6.3 FOMC Mapping

We now use the results of table 7 to generate mapping from publicly available data to FOMC interest-rate forecasts. The top row of table gives uses the mapping equation for the FOMC forecast of the federal funds rate:

$$\begin{aligned} i &= 1.23 \cdot \pi^{spf} - 0.53 \cdot u^{spf} + 2.40 \\ &\quad (0.20) \qquad (0.09) \qquad (0.59) \end{aligned}$$

where the entries in parentheses are the standard errors; the resemblance of this equation to the Taylor rule is remarkable. Table 8 shows values of the interest-rate forecast for alternative values π^{spf} and u^{spf} :

Table 8: Mapping of π^{spf} and u^{spf} to Interest-rate Forecasts

		u^{spf}						
		4	5	6	7	8	9	10
π^{spf}	-1	-0.95	-1.48	-2.01	-2.54	-3.07	-3.6	-4.13
	0	0.28	-0.25	-0.78	-1.31	-1.84	-2.37	-2.9
	1	1.51	0.98	0.45	-0.08	-0.61	-1.14	-1.67
	2	2.74	2.21	1.68	1.15	0.62	0.09	-0.44
	3	3.97	3.44	2.91	2.38	1.85	1.32	0.79

For a given π^{spf}, an increase in u^{spf} lowers the interest-rate forecast. Similarly, for a given u^{spf}, an increase in π^{spf}. This much can be presumed known. Our contribution is to provide a quantitative estimate of the response of the interest-rate forecast.

Another way of mapping public data into interest-rate forecasts involves computing combinations of SPF forecasts for unemployment and inflation for a given federal funds rate projection. Figure 11 below shows those combinations for selected values of the interest-rate forecast:

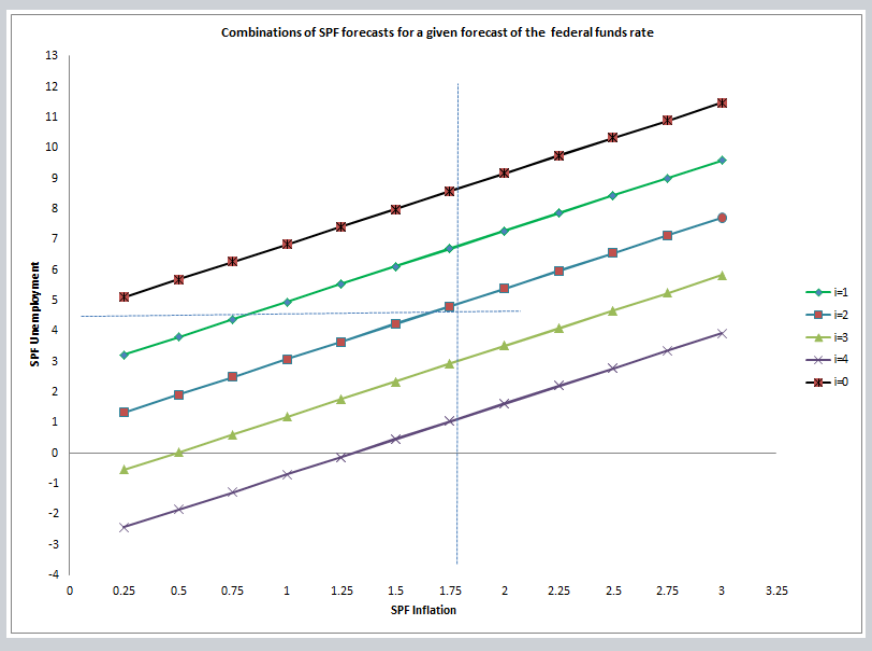


Figure 11: Iso Interest-Rate Forecasts

The figure shows that, for a given interest-rate forecast, an increase in the SPF unemployment forecast needs to be offset by an increase in the SPF inflation forecast. Again, this much can be presumed known. Our contribution is in quantifying the tradeoff as

$$\begin{aligned} di &= \frac{\partial i}{\partial u^{spf}} \cdot du^{spf} + \frac{\partial i}{\partial \pi^{spf}} \cdot d\pi^{spf} \\ &= \widehat{\delta}_{11} \cdot d\pi^{spf} + \widehat{\delta}_{13} \cdot du^{spf} \\ di &= 0 \Longrightarrow \frac{du^{spf}}{d\pi^{spf}} = -\frac{\widehat{\delta_{11}}}{\widehat{\delta_{13}}} = -\frac{(-0.53)}{1.23} = 0.43 \end{aligned}$$

So a given interest-rate forecast remains unchanged if a one percent increase in π^{spf} is accompanied by an increase in u^{spf} of 0.43 percentage points. To get a sense of the range of values of this derivative, we generate one-thousand random replications of this ratio recognizing the normality of the numerator and the denominator. The distribution of these replications is shown in figure 12

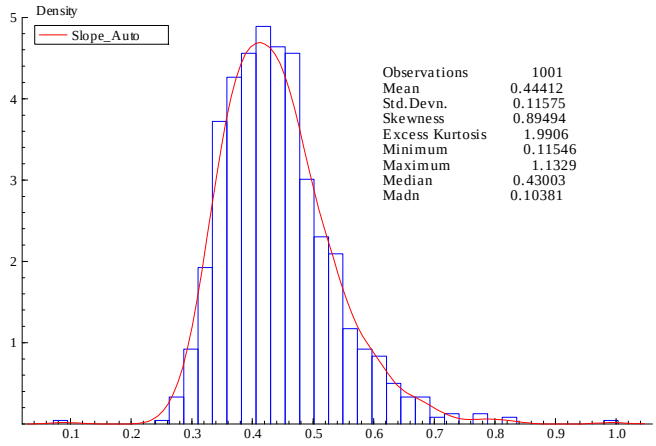


Figure 12: Empirical Distribution of Slope of Iso Interest-Rate Forecast

The critical values associated with a five percent significance are 0.26 and 0.71; we use these values because of the asymmetry of the empirical distribution.

7 Individual Participants' Projections: 2008-2010

We now examine the participant-specific projections for inflation and unemployment from 2007 to 2010 in detail. This level of detail allows a finer characterization of FOMC forecasts because there is no need to assume that the bounds of the distributions embody everything that there is to know about these distributions. As far as we know, these data have not been studied before. To be sure, the data assembled by Romer (2010) contains participant-specific projections for the period of the Great Moderation only. In contrast, we use data for the Great Recession and thus offer the first characterization of FOMC forecasts during the financial crisis: What are the mean and variance of the distribution of forecasts for each year? To what extent developments over 2008-2010 heightened the level of uncertainty by FOMC participants? To what extent are the predictions of inflation for a given FOMC meeting correlated with predictions for unemployment? We find that participants were slow to adjust their projections to economic developments; that disagreements among participants regarding the outlook for unemployment increased but not for inflation; and that projections embody an inverse and weak association between inflation and unemployment.

7.1 Raw Data

Figures 13 to 20 show the distributions of participant-specific projections during the financial crisis of 2008. We use these data to examine whether the findings of previous work are robust to developments during the financial crisis.

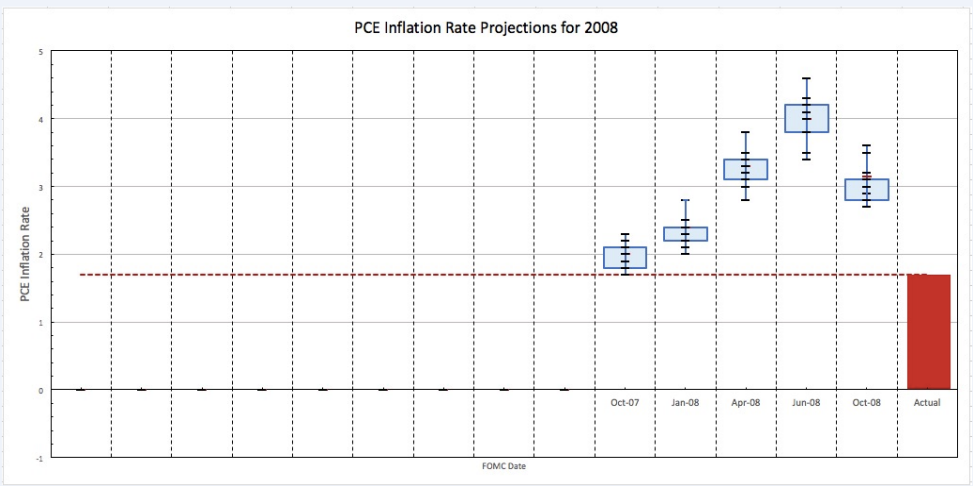


Figure 13

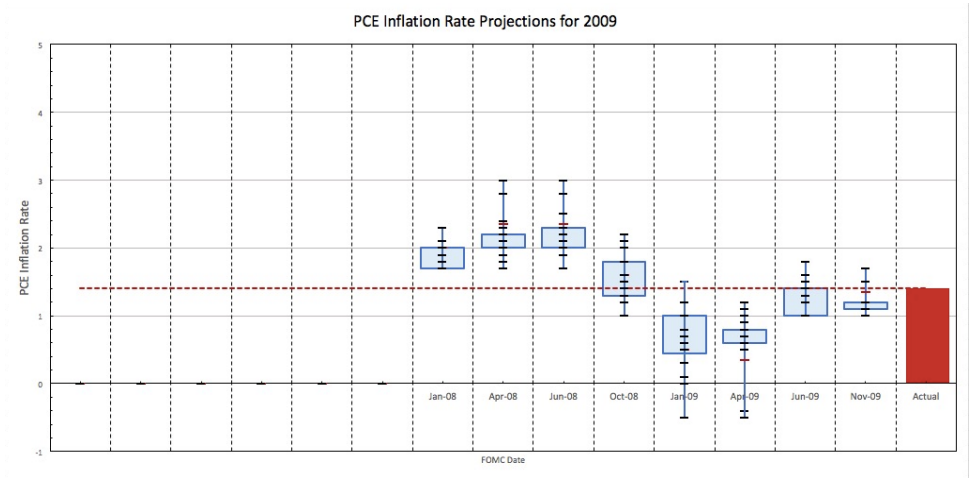


Figure 14

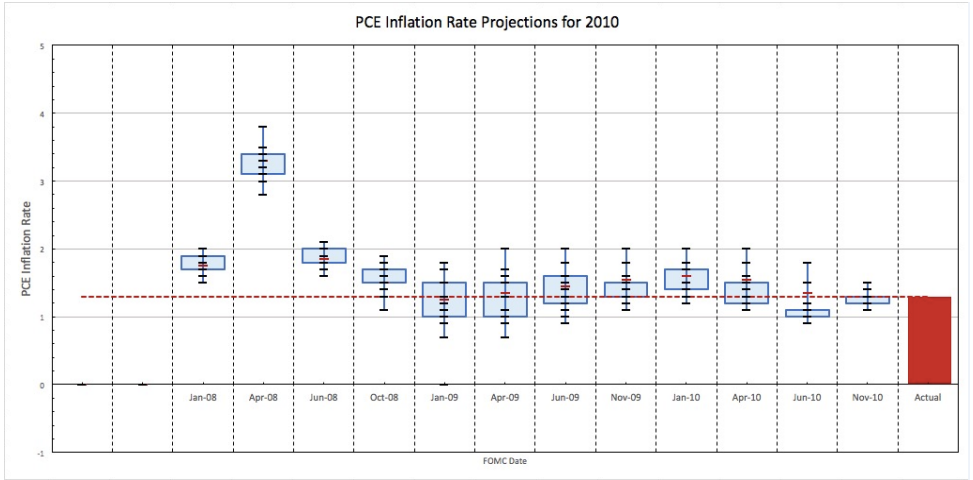


Figure 15

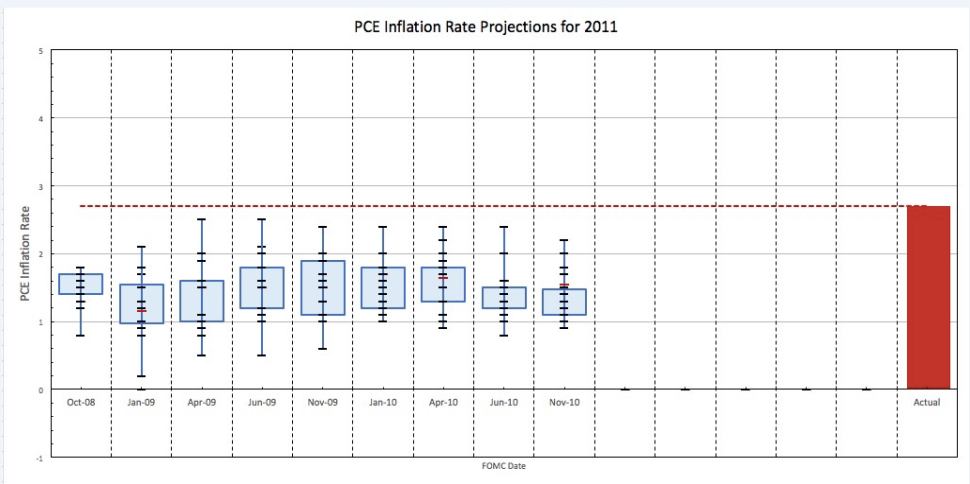
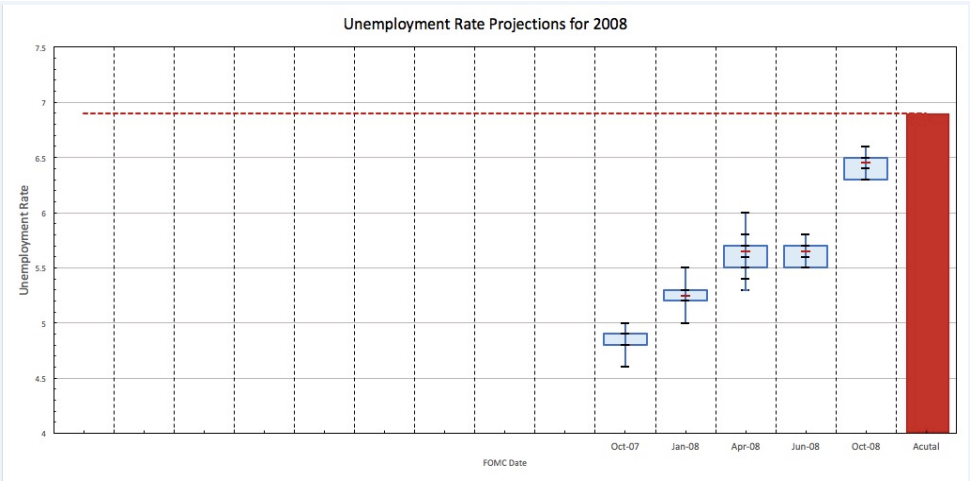


Figure 16



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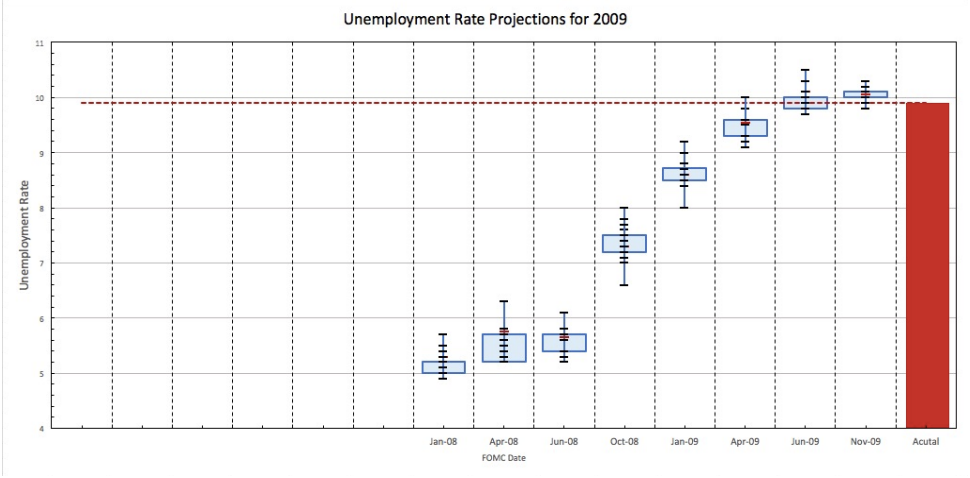

Figure 18

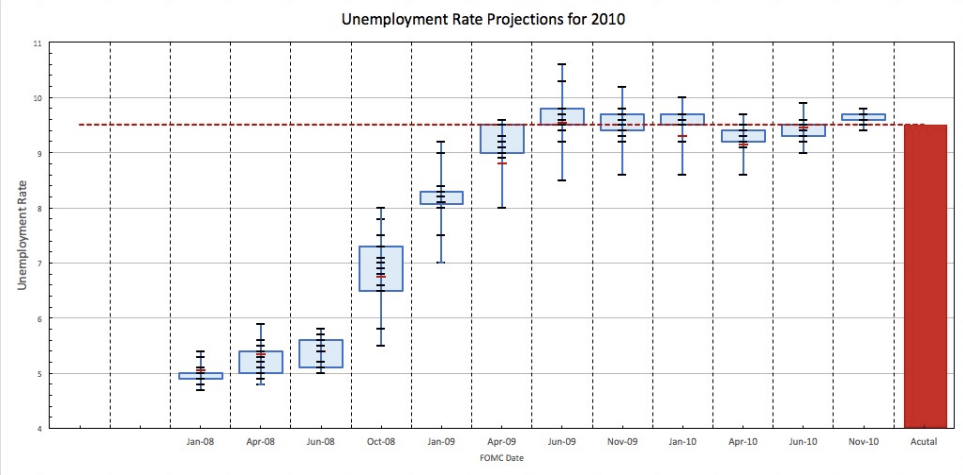

Figure 19

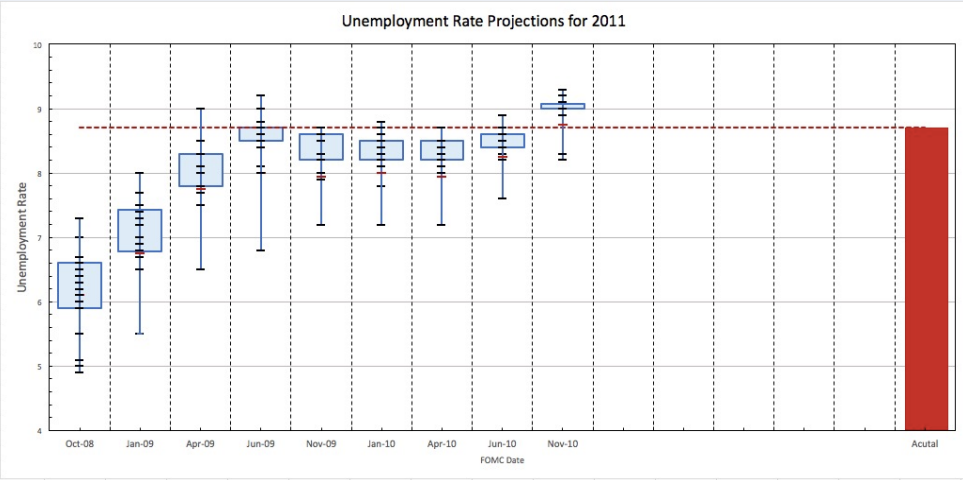

Figure 20

7.2 Unconditional Moments

Figures 21 and 22 show the means for the distributions of unemployment and inflation forecasts from FOMC meetings during 2008- 2010. For the first three meetings during 2008, the average of participants' projections was about 5 percent for the unemployment rate and 2 percent for the inflation rate. In the aftermath of Lehman's bankruptcy, the average of the projections for unemployment rose noticeably but the longer term outlook was always optimistic for unemployment: forecasts decline throughout the forecast horizon. For inflation, the range of FOMC's forecasts nearly always include the inflation target of 2 percent, even though the inflation rate has been lower than the target for several years.

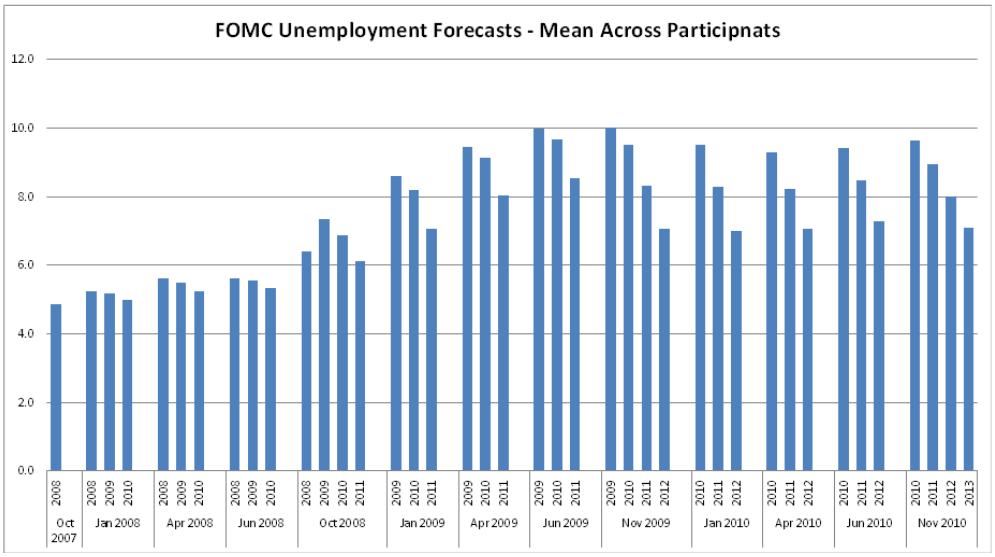

Figure 21

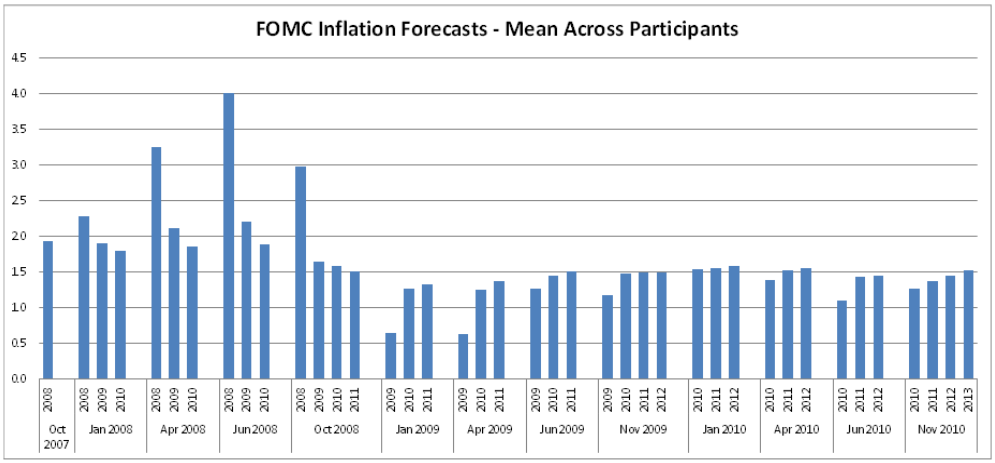

Figure 22

These data also reveal that as the economic situation worsened during the crisis, the mean of unemployment forecasts increased considerably more than the decline in the mean of inflation forecasts. This pattern is reflected in an inverse correlation of between inflation forecasts and unemployment forecasts (figure 23):

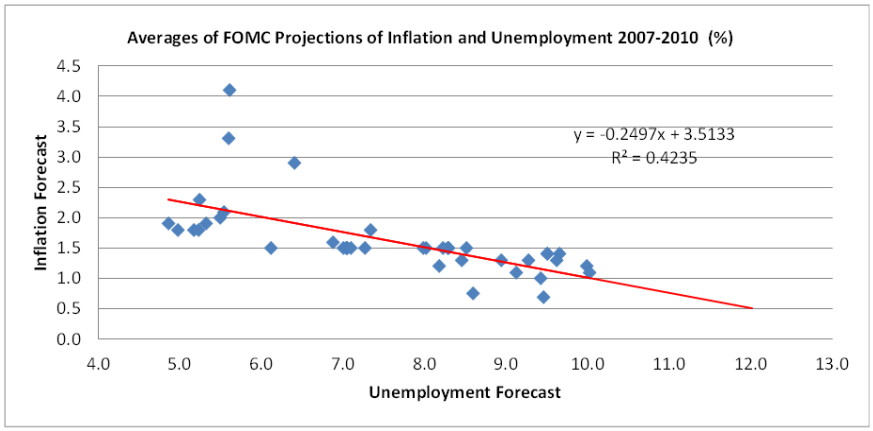

Figure 23

That forecasting during the financial crisis proved to be truly challenging amounts to stating the obvious. What is not obvious is how the degree to disagreement among participants' projection evolved over the this period. One estimate of this disagreement is the standard deviation of the forecasts (figure 24). As one might expect, disagreements about the unemployment outlook for 2010 made during October 2008 were noticeably larger than previous values. Disagreements about the outlook for both inflation also rose considerably relative to historical values.

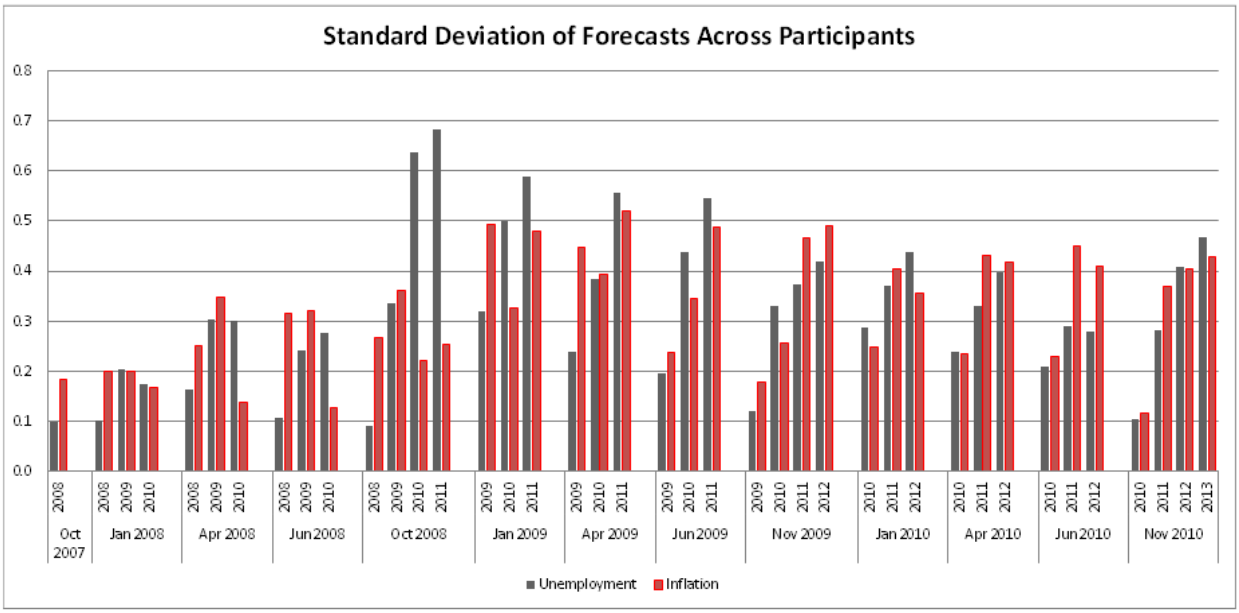

Figure 24

One feature of the FOMC's protocol is that participants release projections for several years ahead in each forecast meeting. This protocol suggests the possibility of an intertemporal correlations of forecasts from each meeting. Figures 25 and 26 document the strength of this correlation:

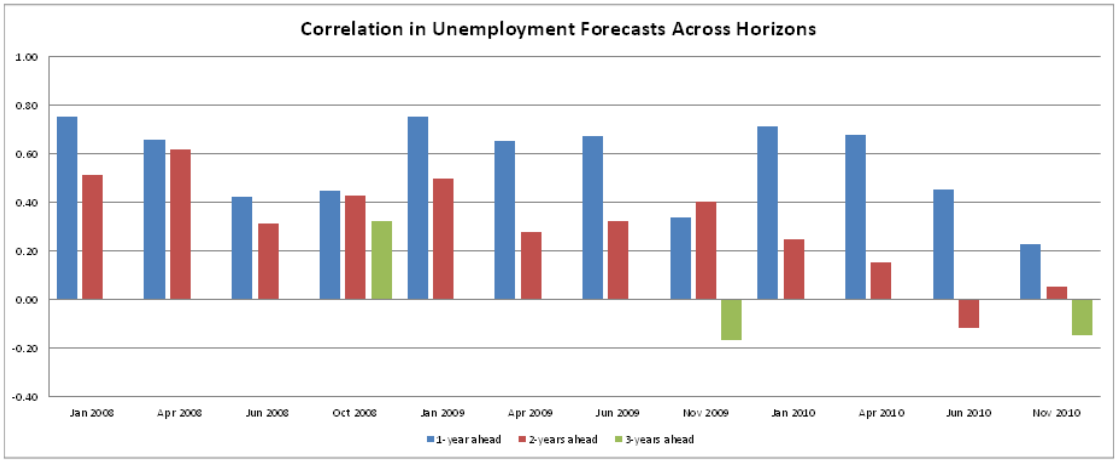

Figure 25

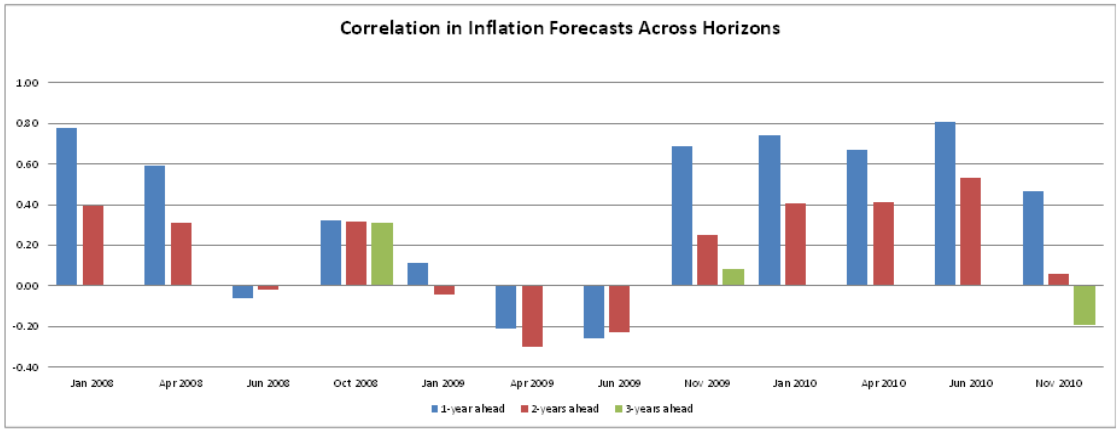

Figure 26

For unemployment, the correlation of forecasts one year ahead is important but it varies from meeting to meeting. For inflation, the calculations reveal that the correlations varies in magnitude and sign.

7.3 Relation to Previous Work

7.3.1 Herd Behavior

Inspection of the data reveals that developments over 2008-2010 induced significant realignments of the distribution of projections of FOMC participants (figures 19 and 20). These observations fit the views Rulke and Tillman (2011) who examine whether FOMC participants exhibit herd behavior. Further work is needed, however, before classifying the FOMC as exhibiting herd behavior. Specifically, drawing inferences about collective behavior based on a small group is tricky: members may become aware of their herding behavior and thus alter it. In addition, herds lack a final known destination whereas FOMC participants generate their forecasts based on policies to attain the FOMC dual's mandate. Finally, recall that even though the entire distribution of unemployment forecasts shifted as the recession worsened, the distribution of forecasts for the inflation rate remained largely unchanged - such behavior does not seem to be consistent with herd behavior.

7.3.2 Extreme Values and Disagreements

The forecasts also exhibit instances of seemingly extreme values. Indeed, forecasts for unemployment in 2010 made during the April 2009 meeting (figure 19) might be construed as extreme. Tillman (2011) and Nakazono (2013) have noted such instances and they attribute them to the differential behavior of FOMC participants who are not voting during the meeting. Indeed, they argue that these participants might submit "extreme" forecasts as a way of registering their disagreements. Again, further work is needed because declaring a forecast as extreme involves two considerations: First one needs a benchmark to judge whether the forecast is extreme. Second, one needs a method to differentiate between mood swings and interpretations of an appropriate policies, which is beyond our scope.

7.3.3 Forecast Revisions

Finally, Arai (2015)'s revisions of the midpoints of the forecast ranges need not informative about forecast revisions. A fair amount of work is needed before the nature of these revisions is satisfactorily understood. First, FOMC participants are not impartial observers of their own forecasts but, rather, can and must influence the economy so as to meet their dual mandate. In other words, they exert strong influence on the subject of their forecasts, especially if the forecasts are not consistent with the dual mandate. Second, forecast bounds might remain unchanged, along with heir mid-point, even though forecasts are being revised. To emphasize this drawback, figure shows the distribution of interest rate forecasts for 2015; the horizontal axis indicates the date of the FOMC meeting when the forecast was made.

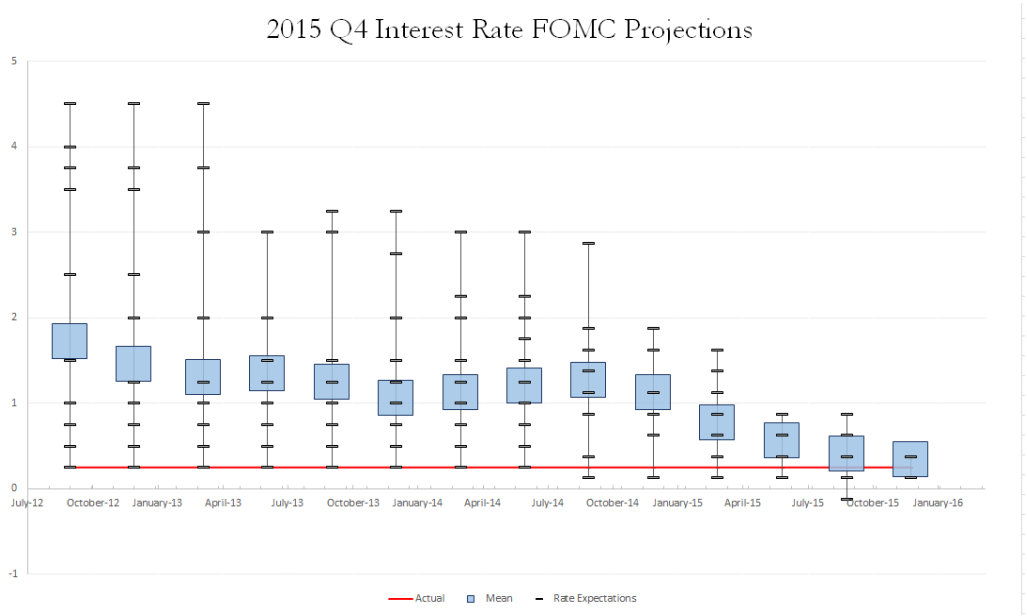

Figure 27

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