The Forecasts of Individual FOMC Members:

New Evidence after Ten Years

Jaime Marquez and S Yanki Kalfa[1]

Johns Hopkins SAIS and University of California San Diego

draft as of

February 22, 2021

[1]The calculations in this paper are carried out with OxMetrics (8.03). We are grateful to Gordon Bodnar, Neil Ericsson, David Hendry, Fred Joutz, Davifd Romer. Contact author: Jaime Marquez at jmarque1@jhu.edu. For data requests, contact Kalfa at Yanki.Kalfa@rady.ucsd.edu.

Abstract

A central tenet of Macroeconomics is that monetary policy is forward looking. But Romer (2010) uses the forecasts of the participants of the U.S. Federal Open Market Committee's (FOMC) and shows a remarkable heterogeneity in these participants' outlooks. What accounts for this forecast heterogeneity? And how can one reconcile the tension between the need for a single monetary and the heterogeneity of forecasts that are steering it? To study these two questions, we continue the line of work initiated by Romer (2010). We find that forecast revisions are large and remarkably heterogenous across participants. Specifically, the FOMC's forecast heterogeneity is systematically related to differences in participants' education, voting status, and regional affiliation, as Romer anticipated. These results should not be surprising: heterogeneity is a built-in feature of the functioning of the Federal Reserve System and the role of the FOMC is to reconcile the differences. The reconciliation of private and public interests, and the implied heterogeneity of courses of action, involves a conversation in which the Chair gets the benefit of the doubt.

Contents

1 Introduction **2**

2 Extending Romer's FOMC Forecasts **4**

3 Replication **6**

4 Institutional Heterogeneity **8**

5 Dynamic Heterogeneirty **14**

5.1 Forecast Levels 14

5.2 Forecast Errors 16

5.3 Forecast Revisions 18

6 Previous Work **22**

6.1 Herd Behavior 22

6.2 Extreme Values and Disagreements 22

6.3 Forecast Revisions 23

7 Federalism **23**

8 FOMC Dissents **24**

9 Courage, Heterogeneity, and History: The 2008 Financial Crisis **27**

10 Conclusions **29**

A Detailed Data Description **34**

A.1 Participant Specific with FR attribution: 34

A.1.1 Monetary Policy Report 34

A.1.2 Summary of Economic Projections 34

A.2 Participant Specific without FR attribution: 34

B FOMC Forecasts Across Districts **36**

> The dictum "If you must forecast, forecast often," is neither a joke nor a confession of impotence. It is a recognition of the primacy of brute fact over pretty theory. Samuelson [1]

1 Introduction

A central tenet of Macroeconomics is that monetary policy is forward looking. Yet, using the forecasts of the participants of the U.S. Federal Open Market Committee's (FOMC) from 1992 to 1998, Romer reports sharp differences in participants' outlook that are delinked from macroeconomic theory:

> *"... there is no clear relationship between forecasts of real variables and inflation. None of the correlations between either real GDP growth or unemployment and either of the inflation measures is close to statistically significant." Romer (2010, p. 953).*

One could argue that Romer's findings are not surprising. That, as shown by Faust (1992), the design of the FOMC embodies a federalism seeking to reconcile differences between the interests of the private sector, as represented Federal Reserve Bank Presidents, and the public's interest, as represented by the Federal Reserve Board. That, furthermore, participants differ in their experience, educational backgrounds, institutional affiliation, and in their forecast protocols (e.g., models, assumptions for exogenous variables). In short, heterogeneity of forecasts is a built-in feature of U.S. monetary policy.

However, comparing the forecasts of Romer's sample to those reported afterwards (figure 1) reveals an increased in forecast heterogeneity for both inflation and unemployment. Thus, if the built-in federalism of U.S. monetary policy justifies forecast heterogeneity, then what factors account for its increase since 2000?

This paper answers that question by quantifying the relative importance of the factors raised by Romer. He asks whether FOMC forecasts show a systematic relation between inflation and economic activity? Are there systematic differences in forecast accuracy across FOMC participants in terms of educational background, professional affiliation, and voting status? Do these forecasts pass standard tests of forecast rationality? What are the characteristics of forecast revisions? What do the forecasts reveal about specific episodes?[2]

Not surprisingly, Romer's questions have received attention in the literature. But the analyses do not take into account developments since 1998: the change of FOMC chair from Greenspan to Bernanke, the 2008 Financial Crisis along with the introduction of Unconventional Monetary Policy after 2008 (large scale asset purchases and forward guidance), the change in the FOMC forecast protocol after 2007 which introduced the notion of appropriate policy.

[1] February 1985, in William Breit and Roger W. Spencer (ed.) Lives of the laureates.

[2] See Romer (2010), page 954 for the exact wording of these questions.

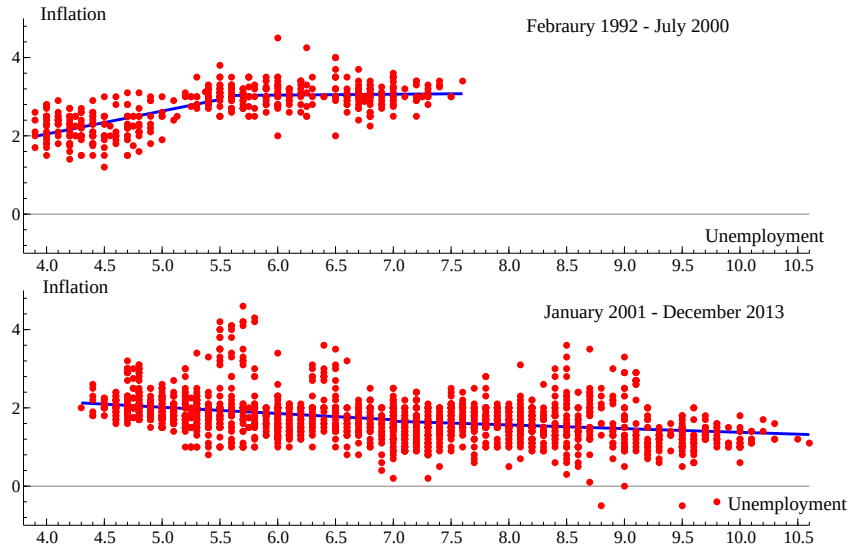

Figure 1: FOMC Forecasts for Unemployment (Horizontal axis) and for Inflation (Vertical axis). Romer's sample (1992-2000) in the top panel and for the Post Romer sample (2001-2013) in the bottom panel. Each panel shows two regression lines: one for each half of the sample. Section 2 documents the data sources.

The analysis begins in Section 2 by extending Romer's forecast database for inflation and unemployment through 2013. The paper focuses on these two variables for several reasons. First, the Press Releases of FOMC decisions focus on them. Second, policy documents, such as the Bluebook (released with a delay), show that the alternatives over which FOMC members vote focus on unemployment and inflation.[3]

With an extended sample, Section 3 examines the robustness of Romer's findings to sample period and to the associated changes in FOMC practices. Section 4 examines the importance of *Institutional Heterogeneity* – namely, differences in participants' education, voting status, and regional affiliation – and the associated implications for forecast rationality. Section 5 documents the nature of *Dynamic Heterogeneity* due to herd behavior, extreme forecasts, temporal aggregation, and macroeconomic shocks. These factors emphasize that forecast heterogeneity is not a given constant but rather, it changes in response to the alignment between private and social interests of the FOMC. We relate these findings to the literature in Section 6. Sections 7-8 address two questions that are important for monetary policy: Federalism and Dissents. Section 8 examines the heterogeneity of FOMC unemployment forecasts during the 2008 financial crisis and offers a tentative approach to resolve the differences in participants views.

Extending Romer's sample through 2013 reveals an inverse association between inflation and unemployment FOMC forecasts. Further, institutional factors are statistically relevant for explaining both the dispersion of participants forecasts and the absence of forecast rationality. Dynamic considerations reveal that forecast revisions are large, remarkably heterogenous across participants, and sensitive to the phase of

[3] The Bluebook and other historical documents are available at https://www.federalreserve.gov/monetarypolicy/fomc_historical.htm

the business cycle. Finally, the response to the financial crisis of 2008 shows how the FOMC Chair reconciles sharp differences in participants' views of the economy to adopt a single course of action. Section 10 offers our conclusions and lists the limitations of the analysis.

2 Extending Romer's FOMC Forecasts

The FOMC consists of 19 participants: 12 Presidents from the Federal Reserve Banks and 7 Governors from the Board of Governors of the Federal Reserve System; only 12 participants vote in a given FOMC meeting. The voting participants, known as *members*, are the seven governors of the Federal Reserve Board, the President of the New York Federal Reserve Bank, and four presidents on a rotating basis.

The FOMC meets eights times per year but it does not release macroeconomic forecasts after each meeting. From 1992 to 2007, forecasts were released twice per year (February and July) in the *Monetary Policy Report (MPR)*. Meetings in February reported projections for current year; meetings in July reported projections for the current and one-year ahead (table 1).

Table 1: MPR Target Year

year(t)→	1995	1996	1997	1998
Period (p)↓				
February 1995	•			
July 1995	•	•		
February 1996		•		
July 1996		•	•	
February 1997			•	
July 1997			•	•

Since 2007, forecasts are released four times per year in the *Summary of Economic Projections (SEP)*. Participants offer forecasts for the current and two years ahead; during the last two meetings of each year, participants extend their projections by one year (table 2).

Table 2: SEP Target Year

year(t)→	2010	2011	2012	2013	2014	2015	···	Long-run[4]
Period (p)↓								
2010:Q1	•	•	•				···	•
2010:Q2	•	•	•				···	•
2010:Q3	•	•	•	•			···	•
2010:Q4	•	•	•	•			···	•
2011:Q1		•	•	•			···	•
2011:Q2		•	•	•			···	•
2011:Q3		•	•	•	•		···	•
2011:Q4		•	•	•	•		···	•
2012:Q1			•	•	•		···	•
2012:Q2			•	•	•		···	•
2012:Q3			•	•	•	•	···	•
2012:Q4			•	•	•	•	···	•

These releases, however, only provide forecasts for the FOMC as a whole (*e.g.*, range and median) and not the individual participants' forecasts, which are needed to study the associated heterogeneity. The FOMC releases participants' forecasts in two phases. The first phase occurs five years after the associated FOMC meeting; this phase releases participants' forecasts without attribution.[5] The second phase occurs ten years after the associated FOMC meeting; this second phase releases participants' forecasts with attribution. Attribution means that the name and institutional affiliation of the FOMC participant associated with a given forecast is public information. This is the type of information needed to characterize heterogeneity.

A key change in the FOMC protocol is the adoption of the FOMC directive that forecasts should be geared towards the *Appropriate* monetary policy "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."[6]

Table 3 summarizes this paper's extension of Romer's forecast database: Inclusion of forecasts with attribution through 2009 and inclusion of forecasts without attribution through 2013.

[4] The long-run horizon is defined as "···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."

[5] Participants are identified by a number (from 1 to 19) which changes from meeting to meeting.

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

Table 3: Attributes of FOMC Forecasts

	Romer	This Paper's Extension		
Sample Period	1992-2000	2001-2007	2008-2009	2010-2013
FOMC Document	MPR	MPR	SEP	SEP
Release Frequency	Half year	Half year	Quarterly	Quarterly
Forecast Horizon (years)	current+1	current+1	current+2	current+2
Attribution	Available	Available	Available	Not Available Yet
Appropriate Policy	Absent	Absent	Present	Present

3 Replication

The model used by Romer is

$$\begin{pmatrix} \pi_{i,p,t} \\ u_{i,p,t} \end{pmatrix} = \Gamma \cdot D_t + \begin{pmatrix} e^{\pi}_{i,p,t} \\ e^{u}_{i,p,t} \end{pmatrix} \tilde{} N(0, \Sigma) \tag{1}$$

where

$\pi_{i,p,t}$: inflation forecast of the i^{th} participant made in the p^{th} meeting for the t^{th} target year

$u_{i,p,t}$: unemployment forecast of the i^{th} participant made in the p^{th} meeting for the t^{th} target year

D_t is a dummy variable equal to one for the date of the p^{th} meeting and zero otherwise

$\left(e^{\pi}_{i,p,t}\ e^{u}_{i,p,t}\right)' \tilde{} N(0, \Sigma)$.

We generalize Romer's model equation (1) to include forecast horizon, FOMC Chair, and the measure of inflation. The resulting estimating equation is

$$\begin{pmatrix} \pi_{i,p,t} \\ u_{i,p,t} \end{pmatrix} = \underbrace{\Gamma \cdot D_t}_{Romer} + \overbrace{\Phi \cdot X_{i,p,t}}^{Extension} + \begin{pmatrix} e^{\pi}_{i,p,t} \\ e^{u}_{i,p,t} \end{pmatrix} \tilde{} N(0, \Sigma) \tag{2}$$

where $X_{i,p,t}$ is a vector of dummy variables for the target year, FOMC Chair, and inflation measure

- Target Year (column heading of Tables 1 and 2):
  - with a value of one if the forecast horizon is for one year after the current target year
  - with a value of one if the forecast horizon is for two years after the current target year
  - with a value of one if the forecast horizon is for three years after the current target year
- FOMC Chair:

– with a value of one for Greenspan's tenure

– with a value of one for Bernanke's tenure

- Inflation Measure

  – with a value of one if the inflation target is measured as CPI

  – with a value of one if the inflation target is measured as PCE

  – with a value of one if the inflation target is measured as core PCE

To examine the generality of Romer's results, parameter estimation uses all the participants forecasts with and without attribution. We use three samples (1992-1998, 1999-2013, and 1992-2013) and three formulations: Romer's original ($\Phi = 0$), Romer augmented ($\Phi \neq 0$) and Romer augmented excluding outliers as implemented by Romer. Following his procedure, we estimate the correlation between $\widehat{e}^{\pi}_{i,p,t}$ and $\widehat{e}^{u}_{i,p,t}$ for each configuration of sample period and econometric estimation.

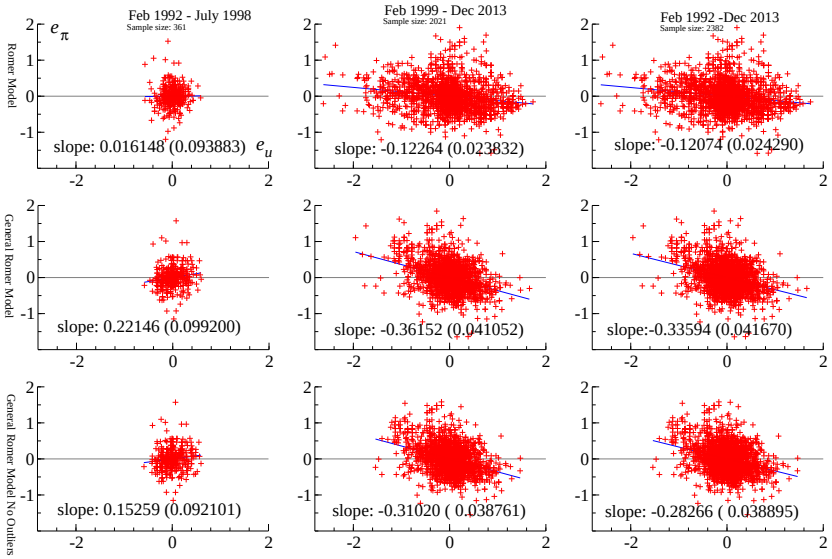

Figure 2: Correlation of Estimation Residuals from Romer's Formulation: Alternative Dates and Specifications

The results reveal that for Romer's sample (left-most column in figure 2), the inclusion of additional controls in the regression or excluding outliers leaves his conclusion intact. But including forecasts through 2013 changes Romer's conclusions: there is a negative and significant correlation between FOMC forecasts for inflation and unemployment; the strength of this correlation is sensitive to the econometric details.

4 Institutional Heterogeneity

Note that the heterogeneity in the residuals of figure 2 remains significant even after accounting for technical factors associated with the FOMC protocol. To examine whether FOMC participants embody idiosyncratic attributes relevant for accounting the heterogeneity of forecasts, we expand equation (2) to control for participants' Education, Voting Status, and District association. As before, we also control for technical factors: forecast horizon, measure of inflation forecasted, and FOMC Chair. Thus the formulation we use is

$$\begin{pmatrix} \pi_{i,p,t} \\ u_{i,p,t} \end{pmatrix} = \begin{pmatrix} \alpha_\pi \\ \alpha_u \end{pmatrix} + \underbrace{\Gamma \cdot D_t}_{Romer} + \overbrace{\Phi \cdot X_{i,p,t}}^{Extension} + \begin{pmatrix} e^\pi_{i,p,t} \\ e^u_{i,p,t} \end{pmatrix} \tag{3}$$

where

X_{i1} equals one if the i^{th} participant has a PhD in either economics or business;

X_{i2} equals one if the i^{th} participant is a voting member during the t^{th} FOMC meeting;

X_{i3} equals one if the forecast horizon is one-year ahead;

X_{i4} equals one if the forecast target inflation is the PCE;

X_{i5} equals one if the forecast target inflation is Core PCE;

X_{i6} equal one if the ith FOMC participant is from the i^{th} District;

X_{i7} equals one for Bernanke's tenure;

$\left(e^\pi_{i,p,t}\ e^u_{i,p,t}\right)' \tilde{}\ N(0, \Sigma)$.

The intercepts (α_π and α_u) measure the current-year forecast of a member of the Board without a PhD, forecasting the CPI under Greenspan's tenure; we denote these intercepts as the base forecasts. The coefficients on the PCE and Core PCE measure the differential effect with respect to the CPI; the coefficient on PhD measure the effect relative to not having a PhD; the coefficient on the District measures the effect relative to the Board; the coefficient on the one-year ahead measures the effect relative to the current-period forecast; the coefficient on voting measures the effect relative to FOMC participants that are not FOMC members.

Because equation (3) uses forecasts with attribution, the estimation sample excludes forecasts without attribution. Parameter estimation uses FIML and the estimation results reveal several features of interest (table 4).

First, the estimate of the base inflation forecast ($\widehat{\alpha}_\pi$) is 3.1 percent and the base unemployment forecast ($\widehat{\alpha}_u$) is almost 7 percent; both estimates are significant.

Second, the coefficient for education (X_{i1}) is negative and significant for inflation, positive and not significant for unemployment. This finding suggests that participants with PhD tend to forecast inflation below the base forecast but the unemployment forecast is not influenced by training.

Third, the coefficient for voting status (X_{i2}) is not significant indicating that the forecast from a District eligible to vote is not different from the base forecast.[7]

Fourth, the coefficient for the horizon (X_{i3}) is negative and significant meaning that one-year ahead forecasts embody an optimistic outlook in which inflation and unemployment are lower than in the associated typical forecasts.

Fifth, the coefficients for the measure of inflation (X_{i4} and X_{i5}) are negative and significant meaning that the targeting the CPI involves an upward bias.

Sixth, in terms of differences between the Board and Districts' Presidents (X_{i6}), the estimation results point to significantly higher inflation forecasts for Richmond, Atlanta, St. Louis, Dallas, and Minneapolis; for significantly lower unemployment forecasts Cleveland, Atlanta, St. Louis, and Dallas.

Seventh, the effect of Bernanke's tenure (X_{i7}) on inflation differ little from those during the Greenspan tenure but are significantly lower in unemployment (50 basis points).[8]

[7] This result does not support Tillman (2011) and Nakazono (2013) who argue a differential behavior of FOMC participants who are not voting during the meeting.

[8] Greenspan did not report his forecasts. So in effect, the coefficient for Bernanke is not measuring the effect relative to Greenspan as such but to his tenure.

Table 4: FOMC Heterogeneity - FIML

	Inflation		Unemployment	
	coeff	stderr	coeff	stderr
Constant	3.110	0.066	6.985	0.044
T+1	-0.039	0.019	-0.051	0.013
Bernanke	-0.034	0.021	-0.481	0.014
Core	-0.966	0.049	-1.563	0.033
PCE	-1.256	0.055	-1.612	0.037
PHD	-0.053	0.025	0.021	0.017
Voting	0.018	0.021	0.012	0.014
Boston	0.052	0.044	0.056	0.030
NewYork	0.044	0.041	-0.008	0.028
Philadelphia	0.007	0.039	-0.003	0.026
Cleveland	-0.098	0.039	-0.054	0.026
Richmond	0.090	0.040	-0.039	0.027
Atlanta	0.108	0.044	-0.092	0.029
Chicago	0.032	0.040	-0.032	0.026
StLouis	0.246	0.039	-0.082	0.026
Minneapolis	0.244	0.040	-0.028	0.027
Kansas	0.010	0.044	-0.011	0.030
Dallas	-0.040	0.040	-0.116	0.027
SanFrisco	-0.028	0.039	0.025	0.026
Std. Err Reg	0.247		0.167	
Std Deviation	0.652		0.838	
N=865	July 1992-July 2007		MPRs=32	

Thus the answer to Romer's question is that, yes, systematic factors help explaining the dispersion of forecasts. Note that though the standard error of the regression is well below the standard deviation of the variables, we have not accounted for the all factors capable generating forecast heterogeneity. The remaining factors could include differences in forecast protocols among participants such as models, parameter estimates, path for other exogenous variables (fiscal policy and oil prices) and so it is outside the scope of this paper.

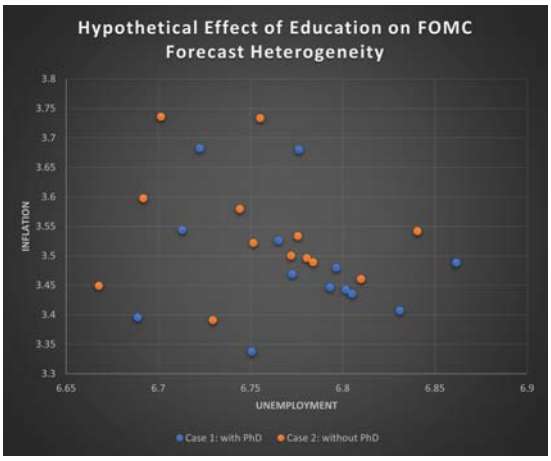

Figure 3: Effects of Education on Forecast Heterogeneity

We now use these estimates to study the role of Educational differences in generating forecast heterogeneity; to this end we use two hypothetical scenarios. The first one assumes that the FOMC Chair is Bernanke, that the FOMC forecasts the CPI, that the ith District is a voting member of the FOMC, and that the ith participant holds a PhD. For the second scenario, the ith participant does not have a PhD. Given these assumptions, the estimates of the participants' forecasts are given by

$$\begin{aligned}
\widehat{\pi}^{1}_{i,p,t} &= \widehat{\alpha}_{\pi} + \widehat{\Phi}_{i\pi 1} + \widehat{\Phi}_{i\pi 2} + 0 + 0 + 0 + \widehat{\Phi}_{i\pi 6} + \widehat{\Phi}_{i\pi 7} \\
\widehat{u}^{1}_{i,p,t} &= \widehat{\alpha}_{u} + \widehat{\Phi}_{iu1} + \widehat{\Phi}_{iu2} + 0 + 0 + 0 + \widehat{\Phi}_{iu6} + \widehat{\Phi}_{iu7}
\end{aligned}$$

$$\begin{aligned}
\widehat{\pi}^{2}_{i,p,t} &= \widehat{\alpha}_{\pi} + 0 + \widehat{\Phi}_{i\pi 2} + 0 + 0 + 0 + \widehat{\Phi}_{i\pi 6} + \widehat{\Phi}_{i\pi 7} \\
\widehat{u}^{2}_{i,p,t} &= \widehat{\alpha}_{u} + 0 + \widehat{\Phi}_{iu2} + 0 + 0 + 0 + \widehat{\Phi}_{iu6} + \widehat{\Phi}_{iu7}
\end{aligned}$$

Figure 3 shows that inflation forecasts from participants with a PhD form an envelope from below whereas inflation forecasts from participants without a PhD form an upper envelope. In terms of magnitudes, the ranges of these forecast estimates match the unconditional standard deviations of figure 5, shown below, as well as the range of FOMC forecasts shown in figure 4.

A relevant issue to raise is whether participants' heterogeneity affects the extent to which their forecasts pass conventional tests of rationality. To examine that question, the paper uses

$$\pi_{i,p,t} = \alpha_{\pi} + \beta_{\pi} \cdot \pi_{t} + \upsilon_{\pi} \cdot X_{i,t} + \omega_{\pi} \cdot W_{i,p} + e^{\pi}_{i,p,t} \tag{4}$$

$$u_{i,p,t} = \alpha_{u} + \beta_{u} \cdot u_{t} + \upsilon_{u} \cdot X_{i,t} + \omega_{u} \cdot W_{i,p} + e^{u}_{i,p,t} \tag{5}$$

where parameter estimation is implemented district by district but recognizing the voting status of the participant and their educational background with two additional controls:

X_{it} is a dummy variable if the ith participant is a voting member during the th FOMC meeting;

W_{i1} is a dummy variable if the participant at the th FOMC meeting has a PhD.

The null hypothesis of conventional tests of rationality is $\alpha_u = \alpha_\pi = 0$ *and* $\beta_\pi = \beta_u = 1$. Assuming that $\left(e^{\pi}_{i,t,t}\ e^{u}_{i,t,t}\right)' \tilde{} N(0, \Sigma)$, we use a χ^2 test with four degrees of freedom to test this hypothesis. We implement these rationality tests for each District separately. Further, we do not include rationality tests for the 2008-2009 period because the parametric specification leaves only three degrees of freedom.

In general, FOMC forecasts do no pass standard tests of rationality (table 5). Specifically, the evidence rejects rationality for Atlanta, Boston, Dallas, Kansas, and St. Louis. The role of having a PhD is not an important consideration except for Boston and St. Louis.

Table 5: Test of Rationality of FOMC Forecasts – 1992-2007

		Unemployment				Inflation				pval for H_0
		β_u	α_u	Vote	PhD	β_π	α_π	Vote	PhD	
Atlanta	Coeff	0.956	0.202	0.213	-0.048	0.904	0.356	-0.132	-0.145	0.000
	SE	0.080	0.452	0.146	0.290	0.141	0.341	0.153	0.304	
Board†	Coeff	0.908	0.626	–	–	0.880	0.272	–	–	0.110
	SE	0.072	0.387	–	–	0.134	0.312	–	–	
Boston	Coeff	0.875	0.850	-0.378	0.528	0.944	0.109	0.210	0.336	0.000
	SE	0.088	0.442	0.116	0.206	0.182	0.413	0.164	0.248	
Chic	Coeff	0.931	0.545	-0.130	–	0.835	0.435	-0.035	–	0.300
	SE	0.077	0.420	0.139	–	0.155	0.374	0.161	–	
Clev	Coeff	0.931	0.349	0.219	–	0.658	0.806	-0.072	–	0.172
	SE	0.081	0.447	0.140	–	0.146	0.351	0.147	–	
Dallas	Coeff	0.924	0.246	0.151	0.200	0.876	0.141	-0.130	0.133	0.000
	SE	0.078	0.405	0.153	0.197	0.175	0.449	0.207	0.254	
Kansas	Coeff	0.930	0.589	-0.320	–	1.109	-0.297	0.209	–	0.015
	SE	0.072	0.379	0.136	–	0.137	0.323	0.151	–	
Minn.	Coeff	0.917	0.472	0.212	–	0.788	0.741	-0.161	–	0.066
	SE	0.077	0.411	0.146	–	0.176	0.405	0.194	–	
NYork	Coeff	0.855	0.821	–	0.306	0.709	0.691	–	0.414	0.181
	SE	0.115	0.590	–	0.303	0.165	0.368	–	0.252	
Phil	Coeff	0.900	0.626	0.072	–	0.974	0.042	-0.061	–	0.588
	SE	0.084	0.450	0.159	–	0.154	0.355	0.168	–	
Rich.	Coeff	1.017	-0.074	0.283	–	0.917	0.233	0.254	–	0.967
	SE	0.075	0.416	0.149	–	0.174	0.405	0.201	–	
San Fran	Coeff	0.955	0.300	0.252	–	0.936	0.156	-0.124	–	0.870
	SE	0.066	0.367	0.125	–	0.152	0.361	0.166	–	
St. Louis	Coeff	0.808	1.496	-0.356	-0.468	0.246	2.517	0.111	-1.052	0.000
	SE	0.064	0.373	0.103	0.111	0.170	0.467	0.136	0.175	

† We use the average across Board members.

5 Dynamic Heterogeneirty

As Romer notes, characterizing the heterogeneity of FOMC forecasts needs to avoid reliance on summary measures because of the distortions induced by temporal aggregation. To illustrate the distortions from summary measures, table 6 shows the mean and standard deviation of current-year forecasts for unemployment and inflation across FOMC participants with attribution for two periods: 1992-2007 (semiannual) and 2008-2009 (quarterly). The similarity of these moments across institutions is remarkable. Further, the similarity in outlooks across institutions did not change with the onset of the 2008 financial crisis even though the moments themselves did change. But this similarity across participants owes to the canceling of their high and low forecast values over time.

Table 6 FOMC Forecasts for Unemployment and Inflation: Differences Across Institutions – 1992-2009

	Unemployment				Inflation			
	Mean		StdDev		Mean		StdDev	
	1992-2007	2008-09	1992-2007	2008-09	1992-2007	2008-09	1992-2007	2008-09
Atlanta	5.34	7.31	0.90	2.24	2.34	2.02	0.63	1.26
Board†	5.43	7.30	0.88	2.21	2.26	2.06	0.60	1.21
Boston	5.43	7.29	0.94	2.31	2.38	2.08	0.69	1.17
Chicago	5.40	7.27	0.90	2.15	2.31	2.04	0.63	0.90
Clev	5.38	7.33	0.89	2.24	2.26	1.71	0.51	1.60
Dallas	5.35	7.31	0.94	2.27	2.20	2.03	0.70	1.43
Kansas	5.40	7.30	0.90	2.26	2.28	1.97	0.72	1.28
Minn	5.39	7.23	0.91	2.11	2.48	2.02	0.64	1.19
NewYork	5.38	7.47	0.91	2.32	2.35	1.92	0.61	1.09
Phil	5.41	7.14	0.90	2.10	2.23	2.14	0.66	0.99
Rich	5.38	7.26	0.91	2.03	2.37	2.26	0.67	1.22
SanFran	5.44	7.27	0.88	2.24	2.23	1.97	0.67	1.17
StLouis	5.36	7.25	0.86	2.17	2.46	1.94	0.70	1.38

The seeming forecast homogeneity disappears by examining the evolution of forecasts from three angles: their level, the associated errors, and the revisions.

5.1 Forecast Levels

Figure 4 shows current-year forecasts for unemployment and inflation across FOMC participants with attribution for two periods: 1992-2007 (semiannual) and 2008-2009 (quarterly). FOMC's inflation forecasts differ markedly among participants for a given date, which is surprising given the stability of the recorded

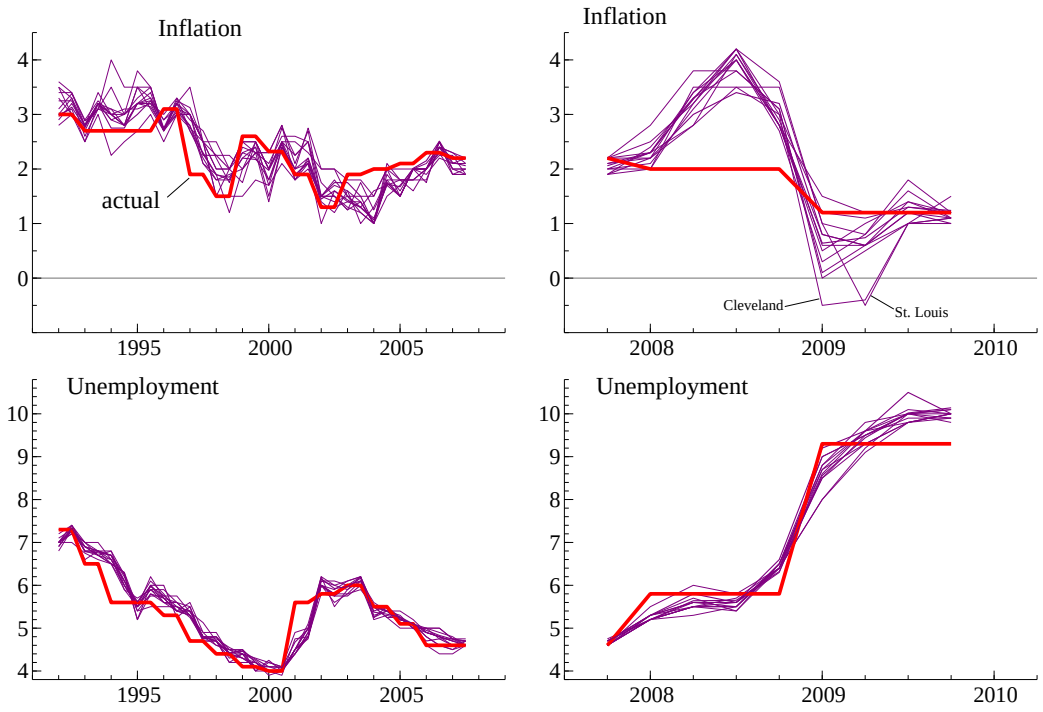

Figure 4: Top Panels: FOMC Forecasts for Inflation. Bottom Panels: FOMC Forecasts for Unemployment. For the Federal Reserve Board, we use the average across Board members.

inflation. Further, forecasts for inflation made during the January and April 2009 meeting (figure 4) might be construed as extreme.

To be sure, the dispersion of forecasts during this period was not typical.[9] Figure 5 shows that for 1992-2007, the standard deviation for inflation has a negative (but gentle) trend whereas the standard deviation for unemployment is roughly constant.[10] This is the type of result one expects for the period known as the Great Moderation. But the advent of the financial crisis in 2008 raised these standard deviations to historical peaks; the standard deviations returned to the levels seen during the Great Moderation once the economy recovered. Thus this evidence suggests that heterogeneity is related to economic activity. The associated implications for the realignment of private and social interests is examined below.

[9] To be sure, the distribution of FOMC forecasts comes from a small sample of at most 19 FOMC participants; hence the measure of the variance of the distribution is influenced by forecasts from one or two participants.

[10]

$$\mu_{t,mpr} = \frac{1}{13}\sum_{i=1}^{13}\pi_{i,t};\ t = 1992-2007; \sigma_{t,mpr} = \frac{1}{13}\sqrt{\sum_{i=1}^{13}(\pi_{i,t}-\mu_{t,mpr})^2};\ t = 1992-2007$$

$$\mu_{t,sep} = \frac{1}{13}\sum_{i=1}^{13}\pi_{i,t};\ t = 2008Q1-2009Q4; \sigma_{t,sep} = \frac{1}{13}\sqrt{\sum_{i=1}^{13}(\pi_{i,t}-\mu_{t,sep})^2};\ t = 2008Q1-2009Q4$$

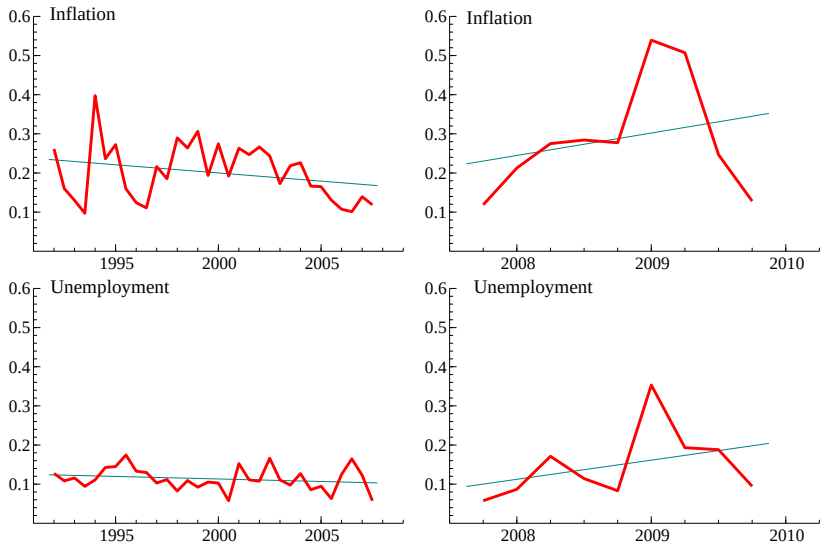

Figure 5: Standard deviations for inflation and unemployment forecasts across FOMC participants for each date

5.2 Forecast Errors

FOMC forecasts errors for inflation and unemployment are one-sided and persistent (figure 6). Further, forecast errors for the 2008-2009 periods are larger than those during the Great Moderation. Regardless of sample, forecast errors exhibit serial correlation (figure 7).

This serial correlation raises the question of whether the forecast errors are stationary. If they are, then the protocol of FOMC meetings generates, "somehow," an error-correction process that prevents forecast errors from becoming permanent. If the errors are not stationary, then that evidence would suggest that forecast participants are, in Samuelson's words, adhering to pretty theories.

We study the stationarity of forecast errors using a simple Augmented Dickey Fuller test, which is implemented District by District; the simplicity owes to the small sample.[11] The results for 1992-2007 indicate that one cannot reject the hypothesis that the forecast errors are stationary (table 8). In other words, the FOMC protocol embodies an error-correction mechanism. The results for 2008-2009 are less compelling: there is a handful of cases in which the forecast errors appear non-stationary and three possible explanations are available. First, the number of observations is small. Second, the sample period is unique. Third, the participants did not heed Samuelson's words and stuck to pretty theories. Future extensions of our sample will help discriminating among these hypotheses.

[11] The equation we use is $\Delta y_t = \alpha + \mu \cdot y_{t-1} + \delta \cdot \Delta y_{t-1} + e_t$

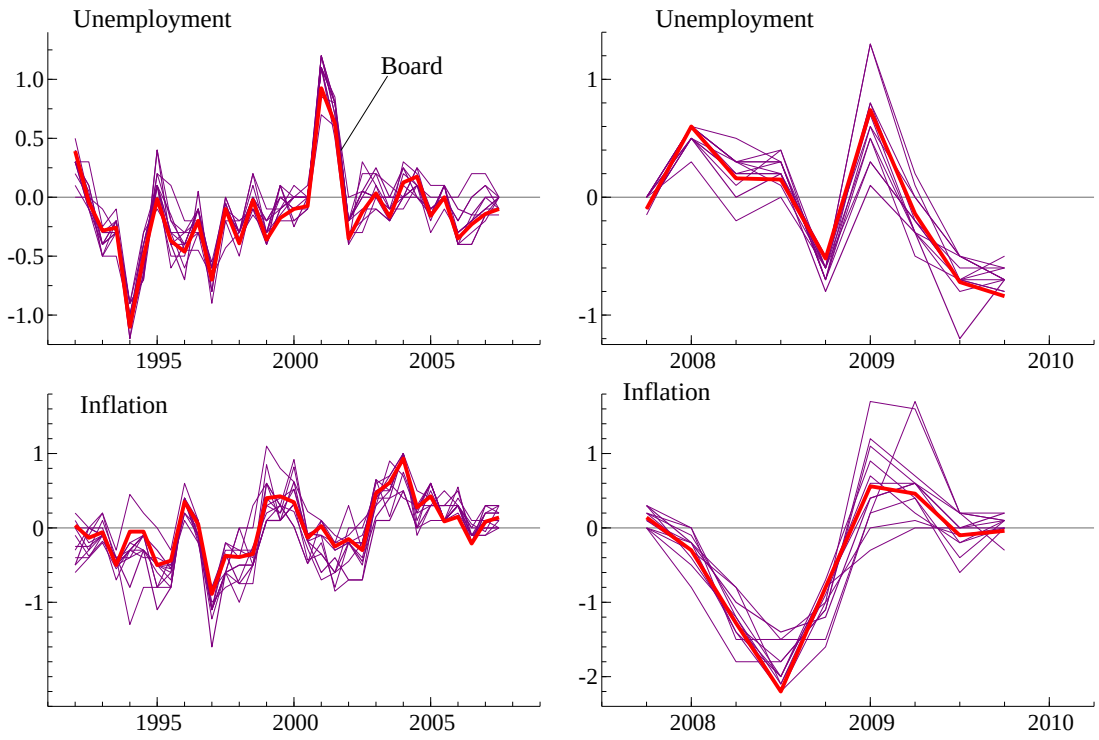

Figure 6: Top Panel: FOMC Forecast Errors for Unemployment. Bottom Panel: FOMC Forecast Errors for Inflation. For the Federal Reserve Board, we use the average across Board members.

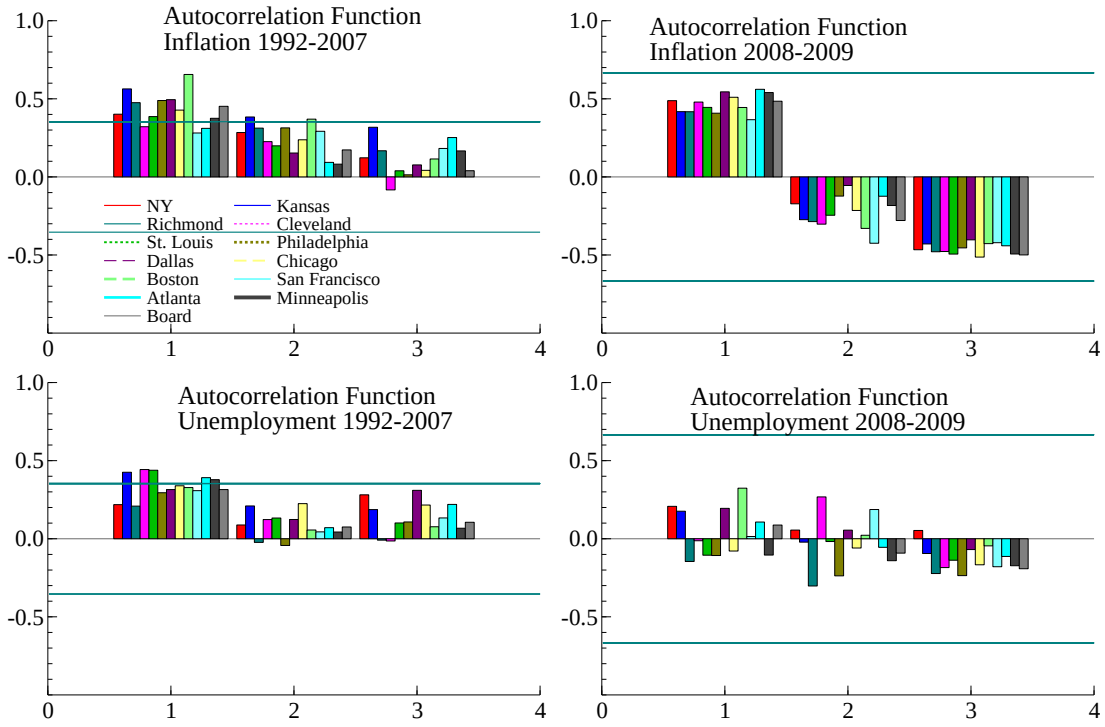

Figure 7: Autocorrelation Function of Order 3 for Forecast Errors of FOMC Participants. For the Federal Reserve Board, we use the average across Board members.

Table 8: Augmented Dickey-Fuller Tests: ADF Values

		1992-2007 ; 5% = -1.95		2008-2009 ; 5% = -2.00	
Participant	Lags	Unemployment	Inflation	Unemployment	Inflation
NY	1	-2.969**	-2.357*	-0.308	-1.877
	0	-4.068**	-3.406**	-1.562	-1.200
KS	1	-2.544*	-2.302*	-1.016	-2.050*
	0	-3.202**	-2.863**	-1.827	-1.386
Rich	1	-3.301**	-2.266*	-2.482*	-1.642
	0	-4.017**	-3.059**	-2.795*	-1.131
Clevld	1	-2.909**	-2.656**	-0.464	-2.686*
	0	-3.185**	-3.807**	-2.284*	-1.436
St.Louis	1	-2.967**	-2.456*	-1.464	-1.977
	0	-3.347**	-3.272**	-2.673*	-1.413
Phialdelphia	1	-3.303**	-2.428*	-1.988	-1.134
	0	-3.697**	-3.172**	-2.601*	-1.135
Dallas	1	-2.928**	-2.963**	-0.856	-1.782
	0	-3.817**	-3.089**	-1.813	-1.259
Chicago	1	-2.466*	-2.626*	-1.447	-1.669
	0	-3.476**	-3.368**	-2.463*	-0.996
Boston	1	-2.892**	-2.442*	-0.911	-1.934
	0	-3.492**	-2.474*	-1.401	-1.258
SanFran	1	-2.719**	-2.458*	-0.856	-2.333*
	0	-3.333**	-4.000**	-2.333*	-1.464
Atlanta	1	-3.156**	-3.140**	-1.112	-1.988
	0	-3.453**	-3.913**	-1.911	-1.164
Minneapolis	1	-3.081**	-2.698**	-1.801	-2.070*
	0	-3.411**	-3.185**	-2.621*	-1.14
Board	1	-2.704**	-2.871**	-1.195	-2.069*
	0	-3.354**	-3.293**	-1.928	-1.216

5.3 Forecast Revisions

Revisions in FOMC forecasts reflect several factors: First, news about economic developments. Second, changes in the composition of the FOMC participants. Thus, new participants will bring their own appropriate policies which bring different forecasts, even in the absence of economic news. Third, participants'

assessment of *appropriate* monetary policy may change. Finally, participants revise their projections in response to 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. But these interim revisions are not observed by the public. What we observe are the revisions from one meeting to the next. Parsing out the separate contribution of these factors is beyond the scope of this paper.[12]

With these considerations in mid, figure 8 shows revisions for current-year forecast, denoted as $\Delta\pi_{i,t,t}$ and $\Delta u_{i,t,t}$. Forecast revisions during the Great Moderation were small, seemingly uncorrelated over time, and seemingly uncoordinated across FOMC participants. For the Great Recession, however, forecast revisions are large and seemingly coordinated among participants. Note, furthermore, that in terms of magnitudes, the forecast revisions during the Great Recession dwarf revisions during the Great Moderation. 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: members may become aware of their herding behavior and thus alter it. Finally, herds lack a final destination known in advance whereas FOMC participants generate their forecasts based on policies to attain the FOMC dual's mandate.

To study the character of these revisions further, we examine the unconditional correlations of forecast revisions between inflation and unemployment for each District. Figure 9 shows that during the Great Moderation, forecast revisions to inflation were unrelated to forecast revisions of unemployment of the same participant; this finding is consistent with those of Romer. But the character of these revisions changed sharply during the 2008 financial crisis and the change was shared across FOMC participants: forecast revisions of inflation are inversely correlated to forecast revisions of unemployment for the same participant (figure 10).

To examine the extent to which forecast revisions are correlated across FOMC participants, table 9 shows the unconditional correlations between the forecast revision for inflation and the forecast revision for unemployment for 1992-2007. The unconditional correlations are generally negative and small (below $|0.4|$). Carrying out the same calculations for the period 2008-2009 reveals a sharply different pattern: all the correlations are negative and large (table 10).

[12] For more details, see http://www.federalreserve.gov/monetarypolicy/files/fomcminutes20071031.pdf. See also Page 3 of http://www.federalreserve.gov/mediacenter/files/FOMCpresconf20151216.pdf

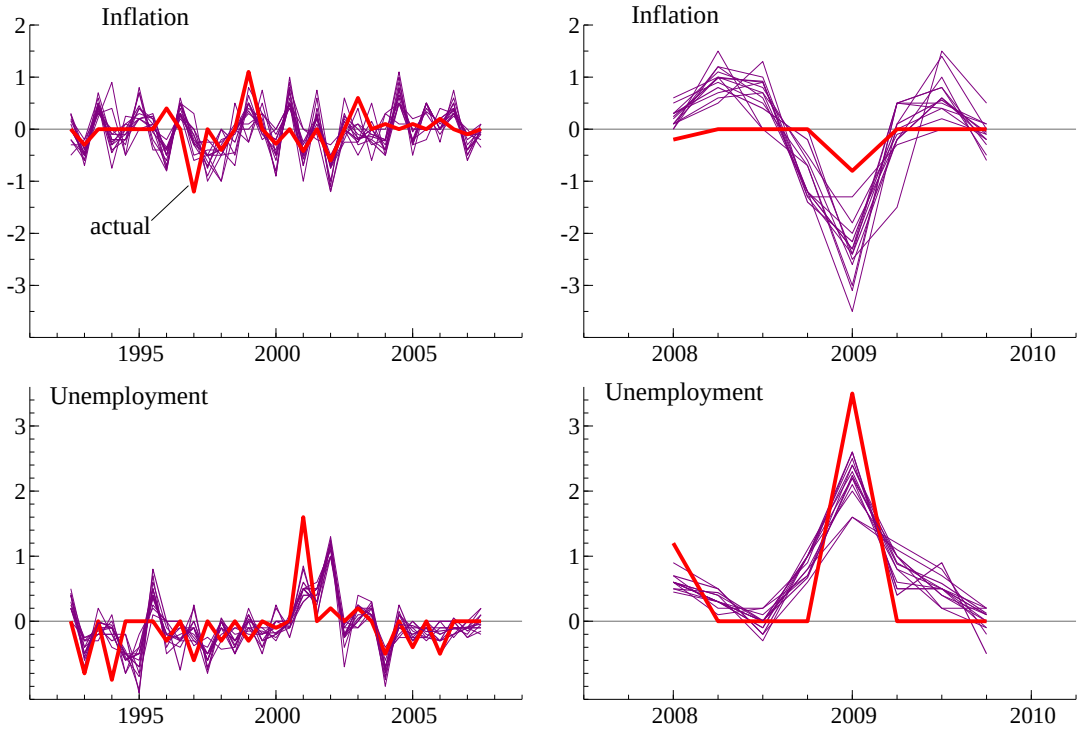

Figure 8: Top Panels: FOMC Forecast Revisions for Inflation. Bottom Panels: FOMC Forecasts Revisions for Unemployment

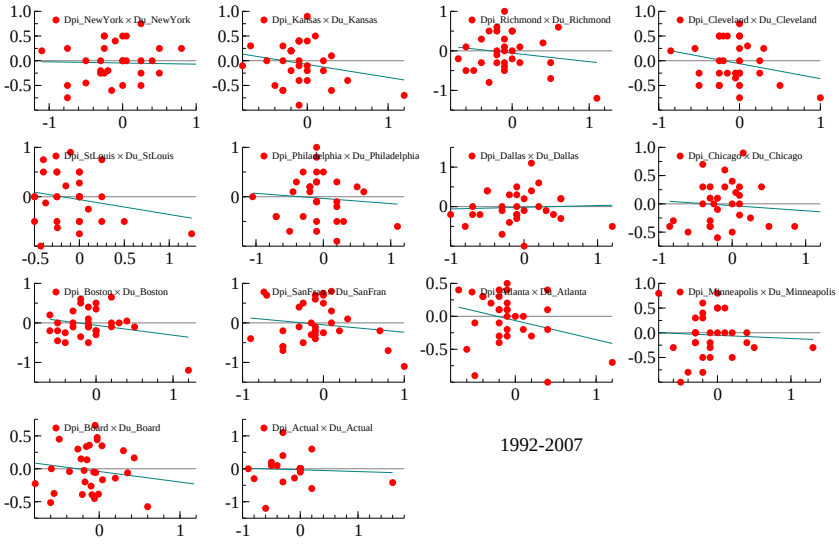

Figure 9: Scatter Plots for FOMC Forecast Revisions by FOMC Participant – 1992-2007. Horizontal Axis corresponds to Unemployment, Vertical Axis Corresponds to Inflation

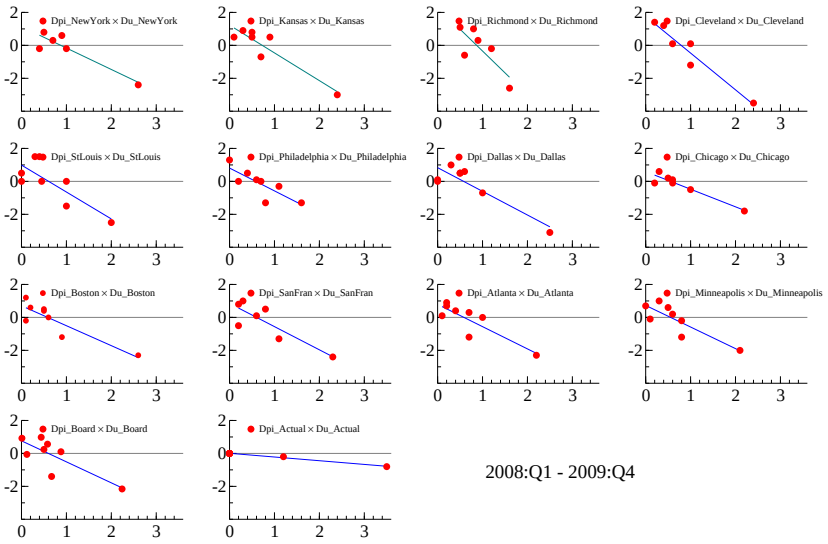

Figure 10: Scatter Plots for FOMC Forecast Revisions by FOMC Participant – 2008:Q1-2009:Q4. Horizontal Axis corresponds to Unemployment, Vertical Axis Corresponds to Inflation

Table 9: Unconditional Correlation between forecast revisions for unemployment and inflation 1992-2007

							$\leftarrow \Delta\pi \rightarrow$						
$\downarrow \Delta u$	NY	Ks	Rich	Clev	StL	Phil	Dall	Chic	Bost	SnFr	Atla	Minn	Board
NY	**-0.03**	-0.30	-0.16	-0.13	-0.16	-0.11	-0.09	-0.23	-0.22	-0.22	-0.27	-0.20	-0.20
Ks	-0.08	**-0.23**	-0.22	-0.12	-0.12	-0.04	-0.05	-0.07	-0.25	-0.17	-0.34	0.01	-0.20
Rich	-0.01	-0.14	**-0.17**	-0.06	0.00	0.07	0.01	-0.08	-0.22	-0.15	-0.21	0.00	-0.14
Clev	-0.15	-0.15	-0.34	**-0.24**	-0.05	-0.05	-0.18	-0.27	-0.35	-0.30	-0.33	-0.10	-0.30
StL	-0.23	-0.20	-0.28	-0.24	**-0.21**	-0.07	-0.12	-0.26	-0.26	-0.33	-0.40	-0.11	-0.29
Phila	-0.07	-0.24	-0.20	-0.11	-0.04	**-0.09**	-0.05	-0.21	-0.26	-0.23	-0.21	-0.13	-0.20
Dall	0.07	-0.03	-0.04	0.09	0.01	0.12	**0.05**	-0.01	-0.12	-0.07	-0.18	0.11	-0.08
Chic	0.00	-0.21	-0.21	-0.20	-0.11	-0.04	-0.07	**-0.10**	-0.19	-0.19	-0.40	0.07	-0.23
Bost	-0.06	-0.22	-0.19	-0.11	-0.13	0.03	-0.07	-0.18	**-0.25**	-0.17	-0.18	-0.06	-0.15
SnFr	0.05	-0.14	-0.15	-0.05	-0.03	0.04	0.05	-0.12	-0.12	**-0.15**	-0.29	0.02	-0.15
Atla	-0.15	-0.19	-0.25	-0.13	-0.02	-0.06	-0.06	-0.21	-0.31	-0.27	**-0.28**	-0.13	-0.24
Minn	-0.05	-0.19	-0.14	-0.08	-0.07	0.07	-0.03	-0.18	-0.24	-0.18	-0.27	**-0.05**	-0.17
Board	-0.03	-0.18	-0.23	-0.10	-0.05	0.05	-0.05	-0.09	-0.22	-0.16	-0.29	0.01	**-0.17**

Table 10:Unconditional Correlation between forecast revisions for unemployment and inflation 2008-2009

						$\leftarrow \Delta\pi \rightarrow$							
$\downarrow \Delta u$	NY	Ks	Rich	Clev	StL	Phil	Dall	Chic	Bost	SnFr	Atla	Minn	Board
NY	**-0.72**	-0.88	-0.57	-0.85	-0.85	-0.77	-0.88	-0.89	-0.92	-0.91	-0.90	-0.88	-0.88
Ks	-0.73	**-0.82**	-0.46	-0.80	-0.80	-0.67	-0.88	-0.88	-0.91	-0.89	-0.83	-0.84	-0.82
Rich	-0.64	-0.79	**-0.50**	-0.81	-0.81	-0.72	-0.82	-0.85	-0.85	-0.89	-0.83	-0.83	-0.80
Clev	-0.75	-0.85	-0.57	**-0.88**	-0.87	-0.76	-0.90	-0.92	-0.92	-0.95	-0.88	-0.88	-0.84
StL	-0.55	-0.79	-0.60	-0.77	**-0.80**	-0.73	-0.70	-0.71	-0.75	-0.79	-0.87	-0.77	-0.75
Phila	-0.71	-0.70	-0.65	-0.81	-0.82	**-0.81**	-0.78	-0.84	-0.73	-0.84	-0.71	-0.79	-0.73
Dall	-0.76	-0.84	-0.46	-0.79	-0.81	-0.67	**-0.89**	-0.87	-0.93	-0.87	-0.84	-0.84	-0.83
Chic	-0.81	-0.89	-0.66	-0.90	-0.90	-0.84	-0.93	**-0.95**	-0.93	-0.95	-0.90	-0.93	-0.90
Bost	-0.73	-0.76	-0.47	-0.77	-0.78	-0.67	-0.86	-0.88	**-0.88**	-0.87	-0.78	-0.81	-0.75
SnFr	-0.68	-0.72	-0.43	-0.77	-0.77	-0.65	-0.83	-0.86	-0.84	**-0.87**	-0.75	-0.79	-0.73
Atla	-0.81	-0.86	-0.62	-0.90	-0.91	-0.82	-0.92	-0.95	-0.91	-0.95	**-0.86**	-0.90	-0.86
Minn	-0.71	-0.80	-0.55	-0.85	-0.86	-0.77	-0.85	-0.89	-0.86	-0.92	-0.83	**-0.85**	-0.79
Board	-0.74	-0.79	-0.54	-0.84	-0.85	-0.75	-0.87	-0.90	-0.87	-0.91	-0.80	-0.84	**-0.79**

6 Previous Work

6.1 Herd Behavior

Inspection of the data reveals that developments over 2008-2010 induced significant realignments of the distribution of projections of FOMC participants. 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.

6.2 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 4) 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. Nevertheless, their view is supported by the forecast from Cleveland, which was not an FOMC **member** in the 2009:Q1 meeting. But the seemingly extreme forecast from St. Louis does not support their view because St. Louis was an FOMC member in 2009:Q2.[13]

6.3 Forecast Revisions

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.

7 Federalism

As noted earlier, the FOMC seeks to reconcile differences between the interests of the private sector, as represented Federal Reserve Bank Presidents, and the public's interest, as represented by the Federal Reserve Board. Arguably, this federalism means that forecast heterogeneity is not an exogenously given attribute but, rather, an endogenous outcome of the conduct of monetary policy. That these two interests need not be aligned is made clear in Hoenig's remarks during the June 2009 FOMC:

> "MR. HOENIG. On the national front, our outlook isn't a whole lot different from that of the Greenbook, except in one important way, and that is that we have a more aggressive policy path for interest rates. They increase almost a year sooner than some outlined in the Greenbook. ...[14]

Other than offering a gallery of FOMC statements supporting different positions, answering Romer's question requires forecasts from the Districts for their own regions, which are not available.[15] One might, however, provide an approximate answer to Romer's question if one assumes that the forecasts from the Board are driven solely by national concerns whereas, as Hoenig suggests, forecasts from districts are influenced from

[13] Another contributing factor is that FOMC participants disagree sharply on the relevant economic theory and statistical methods used to generate their forecasts. We do not study this possibility in this paper.

[14] Pages 132-133 of https://www.federalreserve.gov/monetarypolicy/files/FOMC20090624meeting.pdf

[15] What is available is the Beige Book which is a "Summary of Commentary on Current Economic Conditions by Federal Reserve District, which is produced by Reserve Bank staff and released to the public approximately two weeks prior to each regularly scheduled FOMC meeting." In this summary "Each Federal Reserve Bank collects anecdotal information on current economic conditions in its District through reports from Bank and Branch directors and interviews with key business contacts, economists, market experts, and other sources. In addition to summaries of this information organized by District, the Beige Book presents a national summary of the information."

both local and national developments. To be sure, this separability would, if correct, that the Board's forecast neglect Districts' conditions which is not consistent with the Board's forecasting practice.[16]

With these considerations in mind, Table 11 shows the correlation between unemployment and inflation among FOMC participants.[17] For the period of the Great Moderation, the correlations between the Board's forecasts and District's forecasts are positive and small. But for the period of the Great Recession, these correlations turn negative and increase in absolute value. Again, the onset of the financial crisis induced an alignment between private and public interests that translated into a greater agreement about the outlook.

Table 11: Board and Districts Forecast Correlations

	Corr (u_B, π_i)		Corr (u_i, π_B)	
	1992-2007	2008-2009	1992-2007	2008-2009
Atlanta	0.41	-0.80	0.38	-0.74
Boston	0.32	-0.74	0.36	-0.77
Chicago	0.34	-0.79	0.39	-0.76
Cleveland	0.22	-0.71	0.37	-0.77
Dallas	0.47	-0.80	0.39	-0.76
Kansas	0.46	-0.72	0.39	-0.75
Minneapolis	0.46	-0.78	0.34	-0.75
NewYork	0.39	-0.77	0.39	-0.75
Philadelphia	0.48	-0.77	0.35	-0.71
Richmond	0.25	-0.68	0.31	-0.69
SanFran	0.36	-0.69	0.38	-0.77
StLouis	0.50	-0.70	0.37	-0.75

For additional work, see Banternghansa (2009), Eichler et al. (2017) López-Moctezuma (2015) Malmendier (2014) Rulke (2011) Tillmann (2011b).

8 FOMC Dissents

For our sample of 32 meetings, there are 10 meetings in which a dissent was recorded. Romer's question is whether knowledge of FOMC forecasts helps predicting these dissents. Addressing this question is difficult

[16] To motivate the potential for interdependency we use a simple formulation in which the unemployment forecast from the Board is $u_{B,t,t} = u_{us,t-1}$ and the inflation forecast from the ith District is $\pi_{i,t,t} = \theta_t \cdot u_{us,t-1} + (1-\theta_t) \cdot u_{i,t-1}$. Then the correlation between $u_{B,t,t}$ and $\pi_{i,t,t}$ depends on θ_t and on the covariance between $u_{us,t-1}$ and $u_{i,t-1}$. If the District's inflation forecasts are driven solely by regional concerns ($\theta_t = 0$), then their correlation to the Board's unemployment forecasts depends on cov($u_{us,t-1}$, $u_{i,t-1}$). If only national concerns are relevant to the District, ($\theta_t = 1$), then one might expect a non-negligible correlation between Districts's forecast revisions and the Board's forecast revisions.

[17] We are not focusing on the correlations between the Board's inflation forecast and the Districts' inflation forecasts because those correlations are evident from figure 8.

for several reasons. First, FOMC members do not vote over the reasonableness of their forecasts. Instead, the votes are over the adoption of a specific Policy Directive, which are crafted by the Federal Reserve Board, submitted to the FOMC, and reported in the "Bluebooks."[18] Second, because FOMC participants report forecasts for several variables and horizons, one cannot identify which of these forecasts is responsible for a dissent. Third, personalities of FOMC members play a key role in their willingness to dissent. As Blinder notes,

> "that being on the FOMC is a repeated game, and, in the atmosphere at the time, taking on Alan Greenspan would have, I believe, diminished my ability to persuade anyone else on the FOMC for a long time. Rightly or wrongly, I believe that."

Blinder contines by noting that

> " ... I wouldn't dissent against Alan Greenspan on a tactical judgment, even though I thought he was wrong. After the fact, I thought he was right, which is why you don't dissent on tactics. That case was November 1994. ... He had a very good feel for market reactions like that, which is one of the reasons I wouldn't dissent on tactics."[19]

Blinder's views are confirmed by Greenspan who notes that "...unless there are important dissents, the rest of the Board and, indeed, the rest of the FOMC tries to accommodate the Chairman as best they can."

With these caveats in mind, we regress the residuals $\widehat{e}^{\pi}_{i,t,t+h}$ and $\widehat{e}^{u}_{i,t,t+h}$ associated with equation (4) on dummy variables, one for each participant and FOMC meeting. Because this strategy leaves no degrees of freedoms for least squares, we use the impulse saturation technique developed by Doornik and Hendry (2013).[20] Using a 0.01 percent, out of the ten dissents, we correctly identified 2 of them; there are no false positive results (table 12):

Table 12: Predicting Dissents

		Record[21]	
		Yes	No
Algorithm	Yes	2	0
0.01%	No	8	22

The results correctly identified dissents corresponding to the forecast for Melzer made in 1992 for 1993 and to Angell made in 1993 for 1994:

[18] As an example, see https://www.federalreserve.gov/monetarypolicy/files/FOMC20090128bluebook20090122.pdf

[19] https://www.federalreserve.gov/aboutthefed/centennial/federal-reserve-oral-history-interviews.htm

[20] Their method applies least squares to blocks of variables and then iterates over all the possible blocks until they have the same list of explanatory variables. For a discussion of the issues raised by automated specification, see Hendry and Krolzig (2003), Granger and Hendry (2004), and Phillips (2004).

[21] Source: FOMC Dissent Data Appendix to "Making Sense of Dissents: A History of FOMC Dissents." Federal Reserve Bank of St. Louis Review, Third Quarter 2014 Vol. 96, No. 3

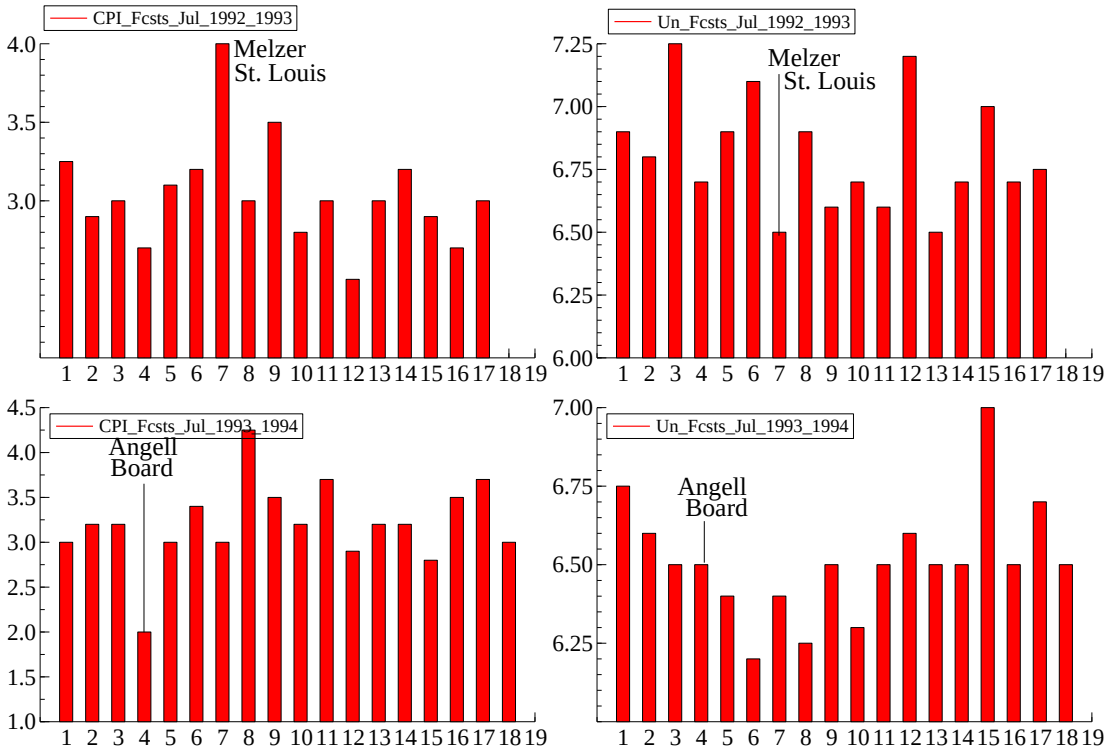

Figure 11: Inflation and Unemployment Forecasts 1992-1994

"With Messrs. LaWare and Melzer dissenting from the **operational paragraph on policy implementation** in the period immediately ahead, and Ms. Phillips and Mr. Jordan dissenting from the decision relating to the monetary growth ranges for 1993, the Federal Reserve Bank of New York was authorized and directed, until otherwise directed by the Committee." emphasis added.[22]

"Mr. Angell dissented because he favored a prompt move to tighten policy. In his view, monetary policy was overly expansive at this point as evidenced by what he viewed as excessive liquidity in financial markets, the negative level of real short-term interest rates, and the disappointing lack of progress toward lower inflation this year."[23]

Figure 11 shows the forecasts for all participants for these two meetings: In short, it is possible to use forecasts for predicting dissents but our approach does not have a compelling predictive power. Further work is needed to assess whether this lack of predictability owes to the nature of dissents or to the method we have used.

[22] https://www.federalreserve.gov/monetarypolicy/files/fomcmoa19920701.pdf

[23] https://www.federalreserve.gov/fomc/MINUTES/1993/19930707min.htm

9 Courage, Heterogeneity, and History: The 2008 Financial Crisis

The FOMC introduced Unconventional Monetary Policy in March 2009. This decision involved instructing the Federal Reserve Bank of New York to carry out large scale purchases of commercial securities.[24] Further, the FOMC statement reveals that, for the first time in the Fed's history, *purchases* of securities exceeded the total assets of the Federal Reserve in October 25, 2007 $886 billion.[25]

One would expect that such an unprecedented policy would reflect a consensus among FOMC participants about the implications of not acting. But that is not what the record shows: Meetings during 2008 show dissents from Fisher in January and June; Fisher and Plosser in March, April, and August. Lacker from the Richmond Fed dissented in the January 2009 meeting. To be sure, the minutes from March 2009 meeting record no dissents

In addition to these dissents, distributions of unemployment forecasts show an increase in the standard deviation and a reversal of skewness from positive to negative values. Specifically, figure 12 shows the distribution of one-year ahead forecasts for unemployment from October 2007 to January 2009.[26] The flattening of the distributions and their rightward shifts are unmistakable: the mean of forecasts evolves from 4.9 percent during the October 2007 meeting to 8.6 by the January 2009 meeting; these increases follow the news from financial disruption: BNP Paribas in August 2007, Bear Sterns in March 2008, and Lehman Brother in September 2008. These developments raised both the mean and the standard deviations of the forecasts. Despite the increase in forecasts' dispersion, the target for the federal funds rate declined from 4.5 percent in October 2007 to 1 percent in October 2008.[27] By January of 2009, the FOMC was forecasting a level of the unemployment rate that would not be consistent with the dual mandate. And not surprisingly, the FOMC moved to targeting a range for the federal funds rate between 0 and 0.25 percent.[28]

An examination of the FOMC Transcripts of 2008 and 2009 reveal that FOMC participants disagreed on whether this crisis was a financial panic and on whether an FOMC decision would be misconstrued as validating suspicious of a panic that they are trying to avoid.[29] Furthermore, Bullard states that

> The FRB/US model is probably not a good guide for policymaking in this environment. I base this on the brilliant figure provided in the memo by Robert Tetlow and Peter Tulip. It is their figure 1, which

[24] The one adopted here is Alternative B; see https://www.federalreserve.gov/newsevents/pressreleases/monetary20090318a.htm Again, see Bernanke (2015) and Gagnon et al. (2011).

[25] https://www.federalreserve.gov/releases/h41/20071025/

[26] Note that for each date, the FOMC distribution of forecasts is joint distribution including other macroeconomic variables and several forecast horizons. This figure abstracts from these considerations.

[27] We are reporting the changes to the federal funds rate associated with the meetings of the Summary of Economic Projections. There were reductions to the target federal funds rate for the meetings in between.

[28] Finally, even 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 (figure 1) - such behavior does not seem to be consistent with herd behavior.

[29] See Bernanke (2015, chapter 19) and Gagnon et al. (2011) for extensive discussions of the March 2019 decision. Meetings during 2008 show dissents from Fisher in January and June; Fisher and Plosser in March, April, and August.

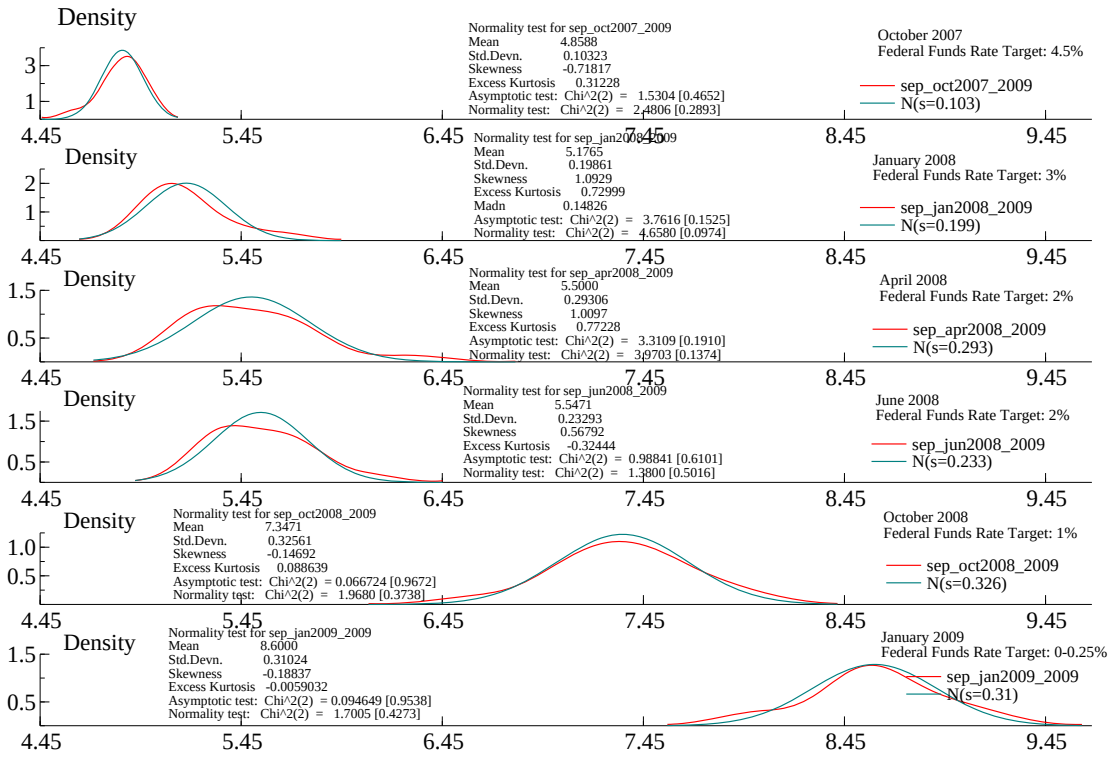

Figure 12: One-year Ahead FOMC Unemployment Forecasts: 2007-2009

shows 90 percent confidence intervals for key forecast variables as of June 2007. No doubt, many of you read it. Actual events have far outstripped these measures of uncertainty, so we are way outside the confidence bands that were put around forecasts at that April 28–29, 2009 65 of 201 time except for inflation, and my interpretation of that is that we are quasi-inflation targeting and inflation stays close to the target. [30]

Bernanke ended these disagreements ended on January 28, 2009:

Let me say something about these frictions and **why we can affect them**. There are two frictions that I think are important. One of them relates to the friction of illiquidity. It is a tradition of central banking that we lend against illiquid assets when there is a panic run, and we know that panic runs are equilibrium phenomena and they can occur even though the assets are worth more than the liabilities. **I would argue that that kind of phenomenon has generalized into a lot of aspects of our economy**—emphasis added.[31]

Our tentative explanation relies on two considerations. The first one is that 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. As a result, a narrow interpretation of forecast accuracy is not useful if that accuracy

[30] https://www.federalreserve.gov/monetarypolicy/files/FOMC20090429meeting.pdf
[31] https://www.federalreserve.gov/monetarypolicy/files/FOMC20090128meeting.pdf

means high inflation and high unemployment.appeals to the power of words. Also notice that Bernanke's view "why we can affect them" is a forceful way of saying that the FOMC participants are not impartial observers of their own forecasts and that they must influence the economy they forecast so long as those forecasts are not consistent with the FOMC's dual mandate. Forecast errors over this period are small (see figure 6) but accuracy is not the point of FOMC forecasts but the attainment of the dual mandate. And this goal prompted the FOMC

The second one is that FOMC participants seek to avoid repeating past errors. Thus, when celebrating Friedman's 90th birthdate in 2002, Bernanke made a reference to the role of the Federal Reserve during the Great Depression:

> Let me end my talk by abusing slightly my status as an official representative of the Federal Reserve. I would like to say to Milton and Anna: Regarding the Great Depression. You're right, we did it. We're very sorry. But thanks to you, **we won't do it again**.[32] —emphasis added

The development of the 2008 financial crisis offered the FOMC an opportunity to apply, in real time with real consequences, the lesson learned from Friedman and Schwartz. And in doing so, they confirmed Samuelson's other dictum – namely,

> Always look back. You may learn something from your residuals. Usually one's forecasts are not so good as one remembers them; the difference may be instructive." Samuelson[33]

10 Conclusions

Several of the empirical findings reported here are likely to change with the removal of the two most limiting factors of this work: scant observations and ill-suited statistical techniques. But there are four findings that, we believe, will stand the test of time. First, FOMC participants are not impartial observers of their own forecasts: Their reaction to their forecasts influence the economy that they are forecasting. As a result, conventional analyses of forecasts are not ideally suited to assessing FOMC forecasts. Second, the degree of heterogeneity changes in response to the alignment between private and social interests. Third, based on the Transcripts from the FOMC meetings and from the Oral Interview of Board Officials, the FOMC reconciles differences in outlook via a conversation in which the persuasive power of the FOMC chair plays a key role. Bernanke's "why we can affect them" is one instance. Another is,

> And the question is, are we ever going to converge? I would feel my job is to get everybody to see that off-white is not a bad alternative. (Laughter) As brilliant as your choice was, maybe you could live with

[32] https://www.federalreserve.gov/BOARDDOCS/SPEECHES/2002/20021108/default.htm
In 2002 Bernanke was a Governor and Greenspan was the FOMC Chair.

[33] February 1985, in William Breit and Roger W. Spencer (ed.) Lives of the laureates.

off-white, and it's not so bad. And we can converge on that and it's going to function just fine and maybe we can agree. Yellen (2018)[34]

References

[1] Arai, N. (2016). Evaluating the Efficiency of the FOMC's New Economic Projections. *Journal of Money, Credit and Banking*, 48(5), 1019-1049.

[2] Banternghansa, C., and McCracken, M. W. (2009). Forecast disagreement among FOMC members.

[3] Bennani, H. (2016). Measuring Monetary Policy Stress for Fed District Representatives. *Scottish Journal of Political Economy*, 63(2), 156-176.

[4] Bhattacharjee, A., and Gelain, P. (2011). Monetary policy under model uncertainty: a Bayesian analysis of FOMC forecasts. Working paper, University of Dundee. https://www.researchgate.net/publication/267723991_Monetary_Policy_under_Model_Uncertainty_A_Bayesian_Analysis_of_FOMC_Forecasts

[5] Capehart, K. W. (2013). What'S So Funny About Making Monetary Policy?. *Economic Inquiry*, 51(4), 2125-2130.

[6] Claussen, C. A., and Røisland, Ø. (2014). The Discursive Dilemma in Monetary Policy. *The Scandinavian Journal of Economics*, 116(3), 702-733.

[7] Coibion, O., and Gorodnichenko, Y. (2012). What can survey forecasts tell us about information rigidities?. *Journal of Political Economy*, 120(1), 116-159.

[8] Eichler, S., and Lähner, T. (2014). Forecast dispersion, dissenting votes, and monetary policy preferences of FOMC members: the role of individual career characteristics and political aspects. *Public Choice*, 160(3-4), 429-453.

[9] Eichler, S., and Lähner, T. (2018). Regional, individual and political determinants of FOMC members' key macroeconomic forecasts. Journal of Forecasting, 37(1), 119-132.

[10] Ellis, M. A., and Liu, D. (2013). Do FOMC forecasts add value to staff forecasts?. *European Journal of Political Economy*, 32, 332-340.

[11] Ellis, M. A., and Liu, D. (2016). FOMC forecasts and monetary policy deliberations. *Economics Letters*, 147, 131-134.

[12] Ellison, M., and Sargent, T. J. (2012). A Defense of the FOMC. *International Economic Review*, 53(4), 1047-1065.

[34] See https://www.brookings.edu/wp-content/uploads/2018/03/es_20180227_yellen_bernanke_transcript.pdf

[13] El-Shagi, M., and Jung, A. (2015). Does the Greenspan era provide evidence on leadership in the FOMC?. *Journal of Macroeconomics*, 43, 173-190.

[14] Faust,J., (1992) "Whom Can We Trust to Run the Fed? Theoretical Support for the Founders' Views" International Finance Discussion Paper No. 429, Federal Reserve Board.

[15] Fendel, R., and Rülke, J. C. (2012). Are heterogeneous FOMC forecasts consistent with the Fed's monetary policy?. *Economics Letters*, 116(1), 5-7.

[16] Fischer, H., García-Bárzana, M., Tillmann, P., and Winker, P. (2014). Evaluating FOMC forecast ranges: an interval data approach. *Empirical Economics*, 47(1), 365-388.

[17] Gagnon, J., Raskin, M., Remache, J., and Sack, B.. (2011). The Financial Market Effects of the Federal Reserve's Large-Scale Asset Purchases. *International Journal of Central Banking*, March. Special Issue: Monetary Policy Lessons from the Global Crisis.

[18] Gamber, E. N., Liebner, J. P., and Smith, J. K. (2015). The distribution of inflation forecast errors. *Journal of Policy Modeling*, 37(1), 47-64.

[19] Gourevitch, P. A. (2013). Yet more hard times, in Miles Kahler; David A Lake (eds.) *Politics in the new hard times: The great recession in comparative perspective*, 253-274. Cornell University Press, 2013.

[20] Granger, C. and D. F. Hendry, 2004, "A Dialogue Concerning a New Instrument for Econometric Modeling," *Econometric Theory*, 21, 278-297.

[21] Hayo, B., and Neuenkirch, M. (2013). Do Federal Reserve presidents communicate with a regional bias?. *Journal of Macroeconomics*, 35, 62-72.

[22] Hendry, D. F. and J. Doornik, 1999, *Empirical Econometric Modelling Using PcGive*, London: Timberlake.

[23] Hendry, D. F. and H. Krolzig, 2001, *Automatic Econometric Model Selection Using PcGets*, London: Timberlake.

[24] Hendry, D. F. and H. Krolzig, 2003, "New Developments in Automatic General-to-Specific Modeling," in B. Stigum (ed.), *Econometrics and the Philosophy of Economics*, Princeton: Princeton University Press.

[25] Jung, A. (2013). Policymakers' interest rate preferences: recent evidence for three monetary policy committees. *International Journal of Central Banking*, 9(3), 150-197.

[26] Jung, A., and Latsos, S. (2015). Do federal reserve bank presidents have a regional bias?. *European Journal of Political Economy*, 40, 173-183.

[27] Katzenstein, P. J., and Nelson, S. (2011). Worlds in collision: uncertainty and risk in hard times. Stato e mercato, 31(3), 369-394.

[28] López-Moctezuma, G. (2016). Sequential Deliberation in Collective Decision-Making: The Case of the FOMC. Working Paper. https://authors.library.caltech.edu/84490/1/sequential.pdf

[29] Malmendier, U., Nagel, S., and Yan, Z. (2017). The Making of Hawks and Doves: Inflation Experiences on the FOMC (No. w23228). National Bureau of Economic Research.

[30] Nakazono, Y. (2012). Strategic Behavior of Federal Open Market Committee Board Members: Evidence from Members' Forecasts. *Journal of Behavioral Economics and Finance*, 5, 239-242.

[31] Nakazono, Y. (2013) "Strategic Behavior of Federal Open Market Committee board Members: Evidence from Member's Forecasts," *Journal of Economic Behavior and Organization*, 93, 62-70.

[32] Nelson, S. C., and Katzenstein, P. J. (2014). Uncertainty, risk, and the financial crisis of 2008. International Organization, 68(2), 361-392.

[33] Nunes, R. (2013). Do Central Banks' Forecasts Take Into Account Public Opinion and Views?. Federal Reserve Board. https://www.federalreserve.gov/pubs/ifdp/2013/1080/ifdp1080.pdf

[34] Phillips, P., 2004, "Automated Discovery in Econometrics," *Cowles Foundation Discussion Paper* No. 1469, Yale University.

[35] Pierdzioch, C., Rülke, J. C., and Tillmann, P. (2016). Using Forecasts To Uncover The Loss Function Of Federal Open Market Committee Members. *Macroeconomic Dynamics*, 20(3), 791-818.

[36] Pruitt, S. (2012). Uncertainty over models and data: The rise and fall of American inflation. *Journal of Money, Credit and Banking*, 44(2-3), 341-365.

[37] Romer, D. (2010) "A New Data Set on Monetary Policy : The Economic Forecasts of Individual Members of the FOMC," *Journal of Money, Credit, and Banking*, 42, 951-957.

[38] Rülke, J. C., and Tillmann, P. (2011). Do FOMC members herd?. *Economics Letters*, 113(2), 176-179.

[39] Sheng, X. S. (2015). Evaluating the economic forecasts of FOMC members. *International Journal of Forecasting*, 31(1), 165-175.

[40] Thornton, D. and David C. Wheelock (2014) "Making Sense of Dissents: A History of FOMC Dissents" Third Quarter 2014, Vol. 96, No. 3

[41] Tillmann, P. (2010a). The Fed's perceived Phillips curve: Evidence from individual FOMC forecasts. *Journal of Macroeconomics*, 32(4), 1008-1013.

[42] Tillmann, P. (2010b). Do FOMC members believe in Okun's Law. *Economics Bulletin*, 30(3), 2398-2404.

[43] Tillmann, P. (2011a). Reputation and forecast revisions: Evidence from the FOMC (No. 28-2011). Joint discussion paper series in economics.

[44] Tillmann, P. (2011b). Strategic forecasting on the FOMC. *European Journal of Political Economy*, 27(3), 547-553.

A Detailed Data Description

A.1 Participant Specific with FR attribution:

A.1.1 Monetary Policy Report

- Period covered is from 1992 to July 2006.
- Data are semi-annual and is published on February and July.
- Only January forecasts only have t end-of-period forecasts until January 2005. On January 2005 and 2006, the MPR had end-of-period and one-period-ahead forecasts.
- All July forecasts have end-of-period and one-period-ahead forecasts.
- Participants forecasted CPI from January 1992 to July 1999.
- Between January 2000 and January 2004 the inflation measure forecasted is the PCE.
- Starting in July 2004 the measure of inflation forecasted is Core PCE.
- Primary source: The Federal Reserve Bank of Philadelphia.

A.1.2 Summary of Economic Projections

Source: The Board of Governors of the Federal Reserve System

- In January 2017, the FOMC made the participant list for the October 2007 SEP available, which has a nowcast, one-period-ahead, two-period-ahead, and three-period ahead forecasts. The inflation measure chosen is the PCE.

A.2 Participant Specific without FR attribution:

Summary of Economic Projections

Source: The Board of Governors of the Federal Reserve System

SEP is released quarterly.

In 2008 publication months were January, April, June, and October.

From 2009 through 2011 publication months were January, April, June, and November.

In 2012 publication months were January, April, June, September, and December. Therefore the data range is 2008-2012.

Starting in April 2009, SEP participants also forecasted the "Long-Run".

From 2008 until 2012, participants made three forecasts: end-of-period, one-period-ahead, and two-periods-ahead.

On the fourth quarter individuals added a three-periods-ahead forecast. In 2012, participants made an end-of-period, one-period-ahead, and two-periods-ahead forecasts for the January, April, and June SEP.

The SEP included a three-periods-ahead forecast for the September and December meetings.

Starting in 2013, the SEP includes end-of-period, one-period ahead, and two-periods-ahead forecasts for the March and June meetings and includes end-of-period, one-period ahead, two-periods-ahead, three-periods-ahead forecasts for September and December publications.

B FOMC Forecasts Across Districts

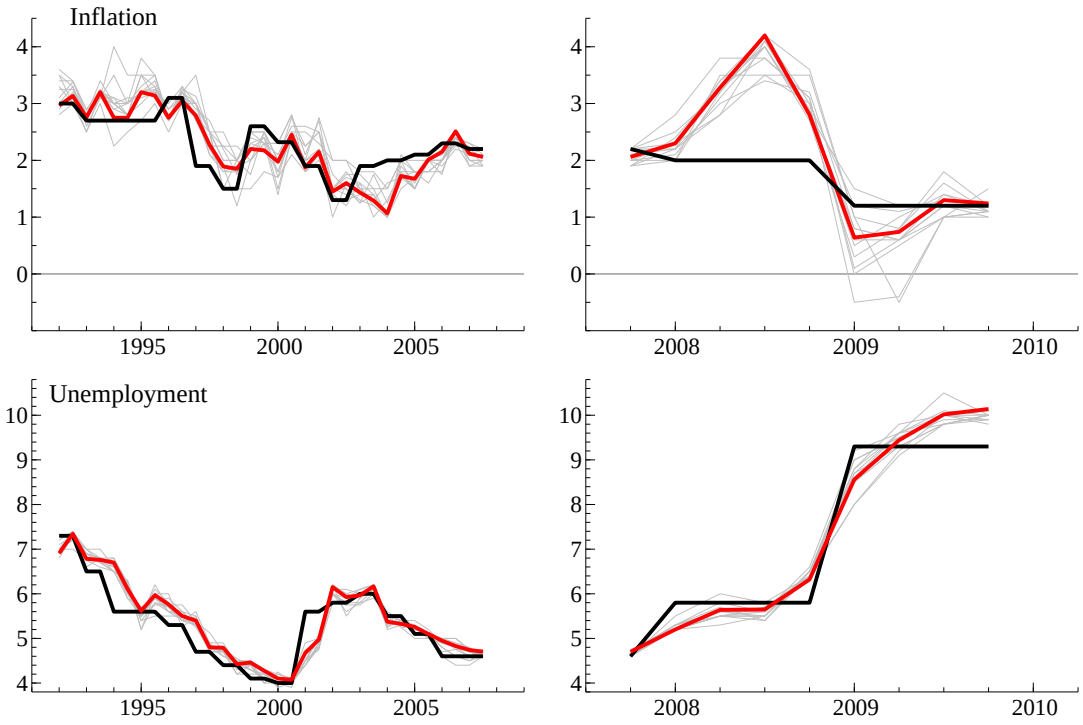

Figure 13: **Federal Reserve Board** Read line represents the Board; the black line represents the Actual.

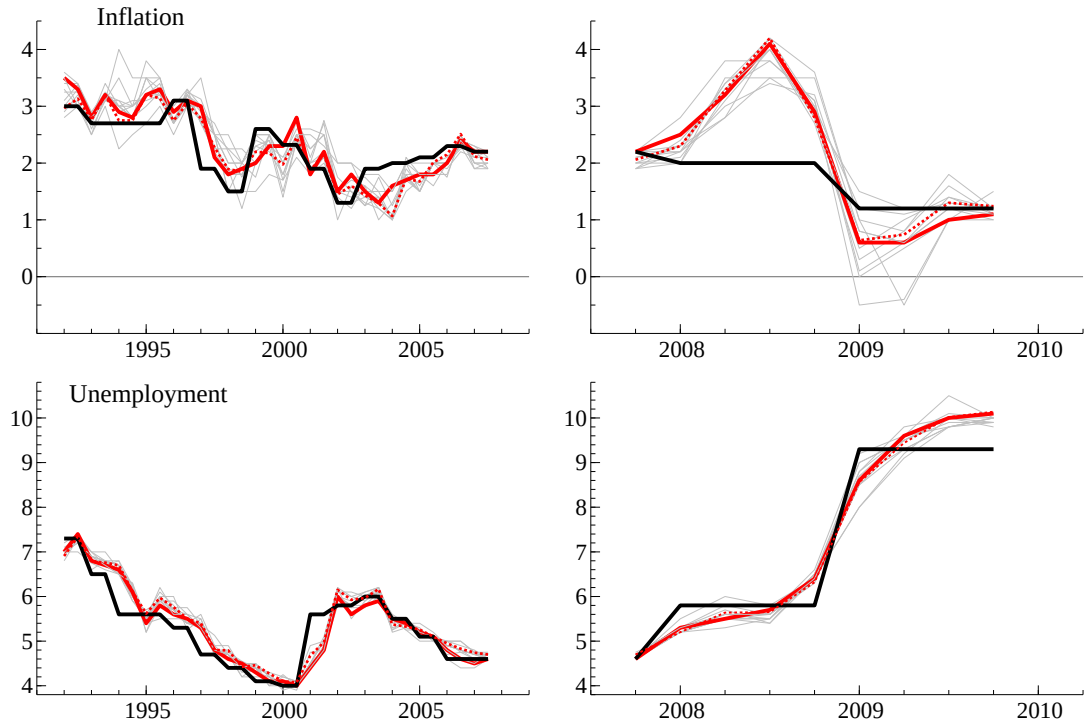

Figure 14: **F.R. Atlanta** Red-dash line represents the Board; the black line represents the Actual; red line represents Atlanta.

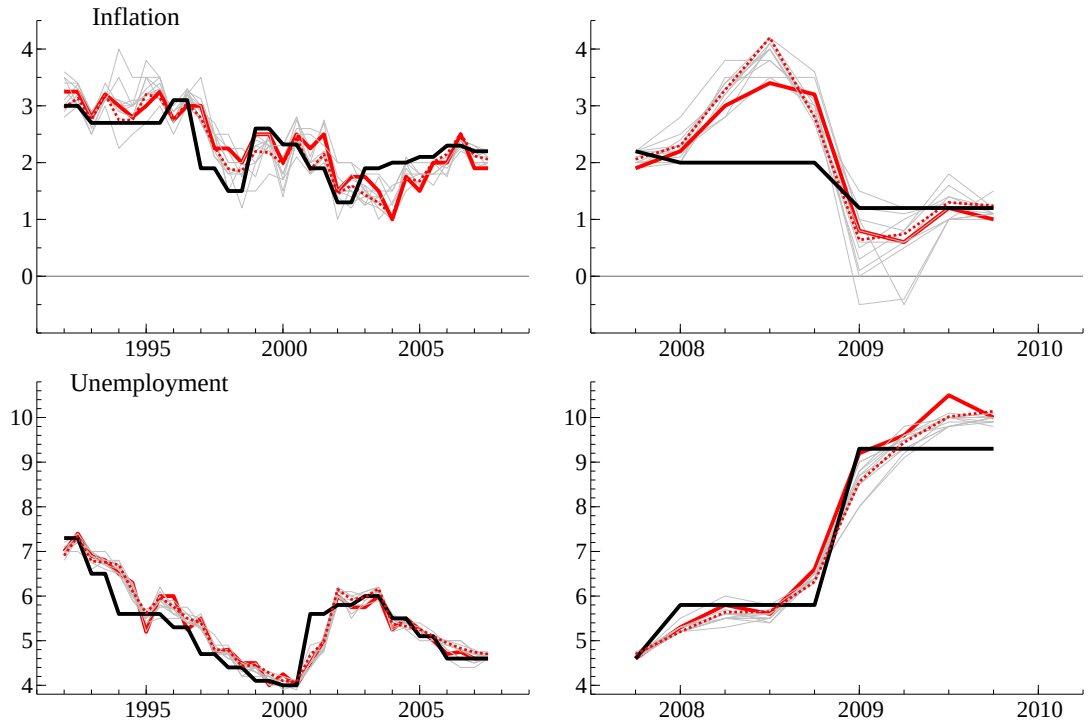

Figure 15: **F. R. New York** Red-dash line represents the Board; the black line represents the Actual; red line represents **New York**

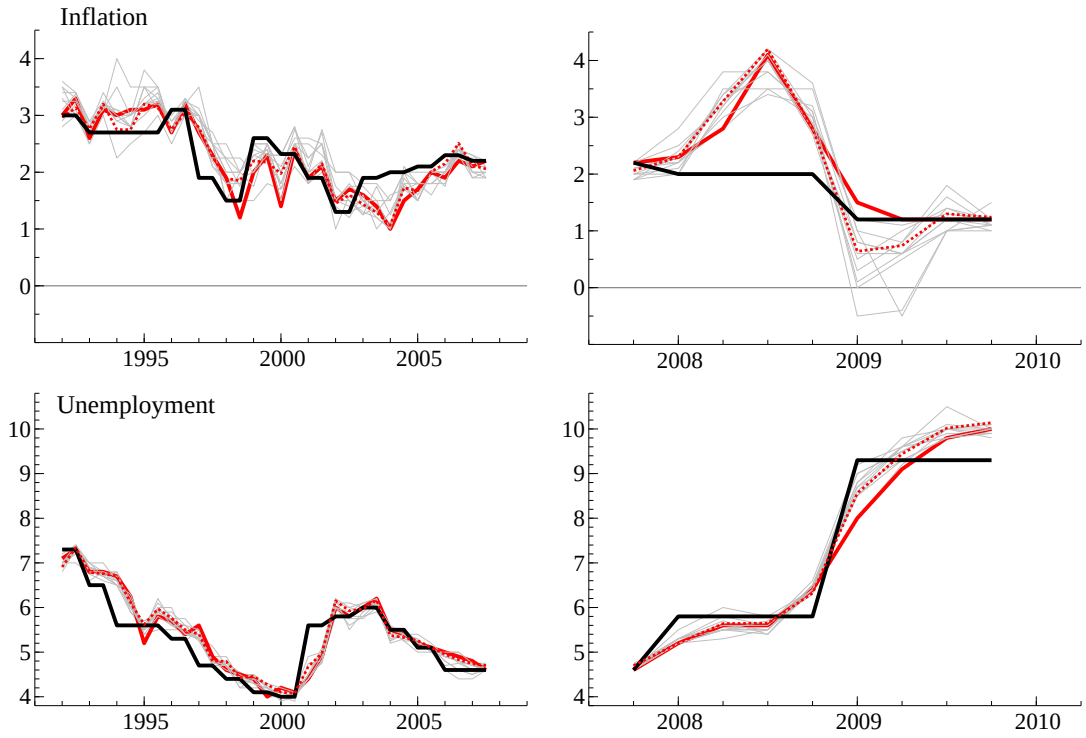

Figure 16: **F. R. Philadelphia** Red-dash line represents the Board; the black line represents the Actual; red line represents Philadelphia

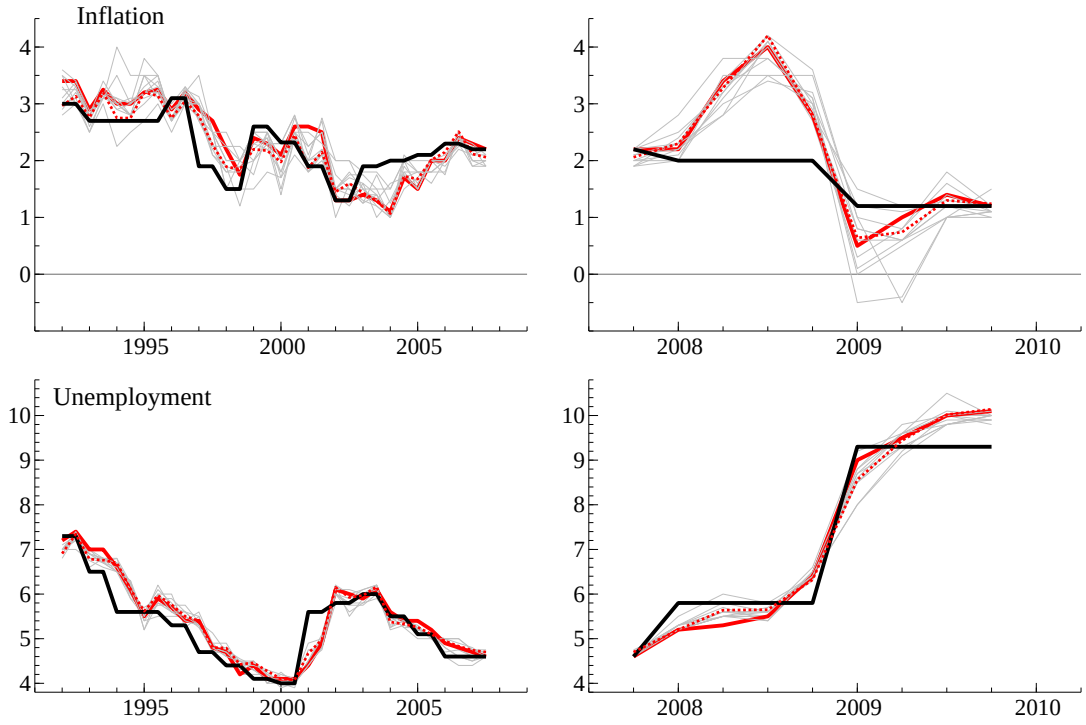

Figure 17: **F.R. Boston** Red-dash line represents the Board; the black line represents the Actual; red line represents **Boston**

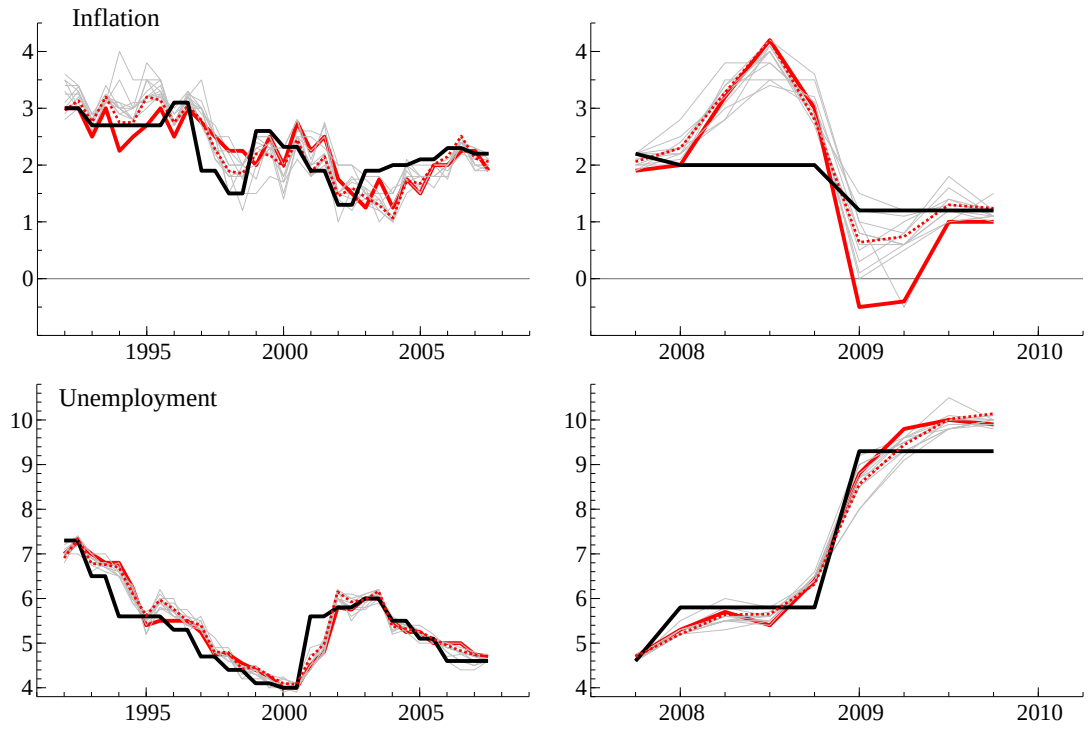

Figure 18: **F.R. Cleveland** Red-dash line represents the Board; the black line represents the Actual; red line represents **Cleveland.**

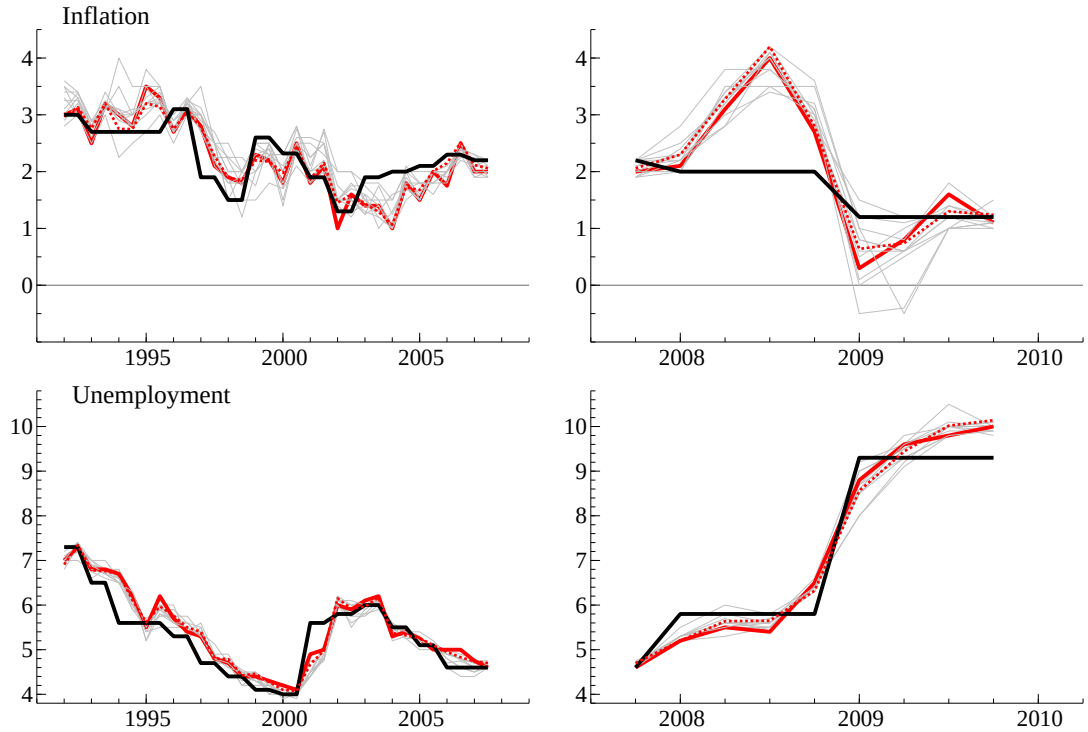

Figure 19: **F.R. San Francisco** Red-dash line represents the Board; the black line represents the Actual; red line represents **San Francisco**

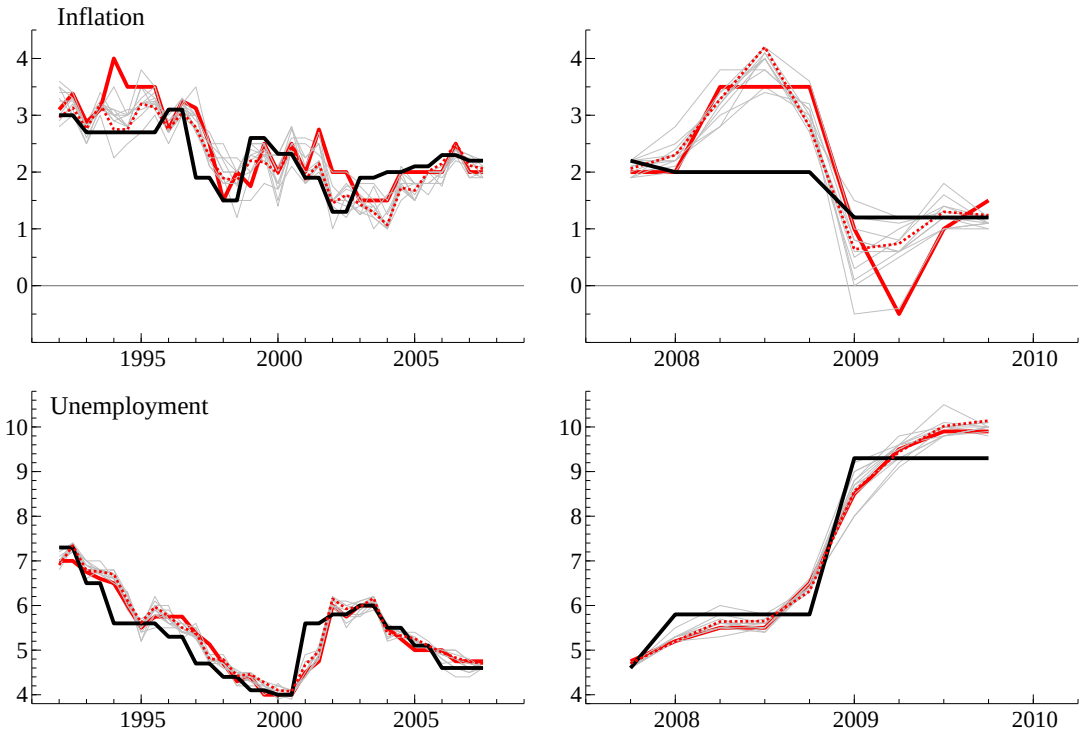

Figure 20: **F.R. St. Louis** Red-dash line represents the Board; the black line represents the Actual; red line represents **St. Louis**

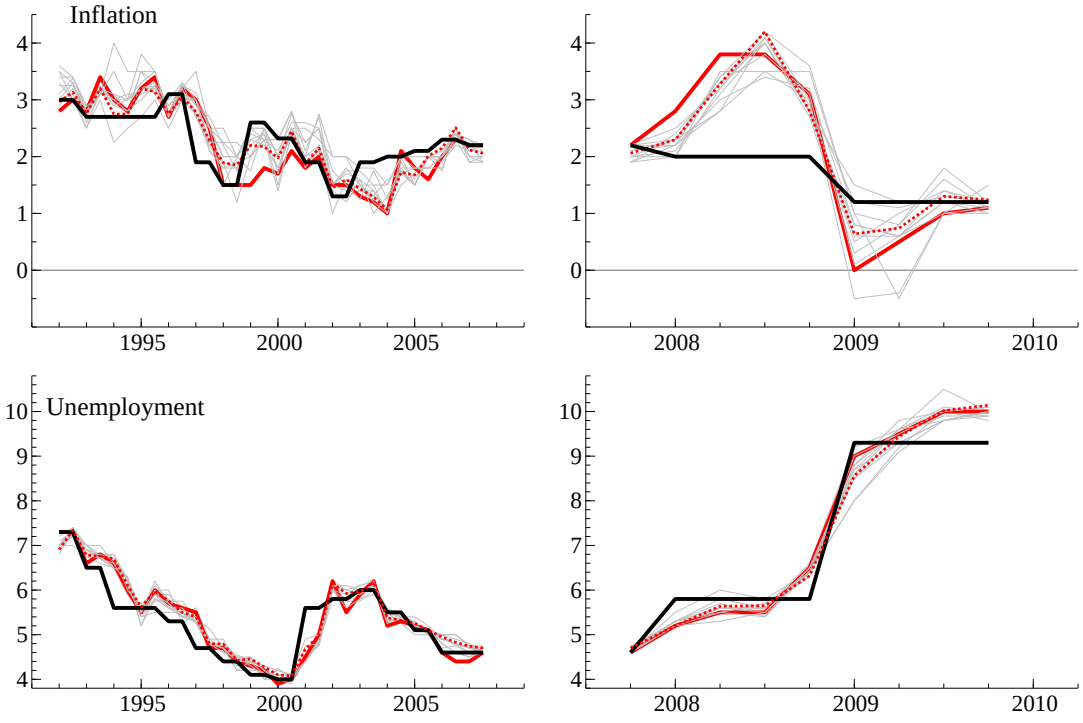

Figure 21: **F.R. Dallas** Red-dash line represents the Board; the black line represents the Actual; red line represents **Dallas**

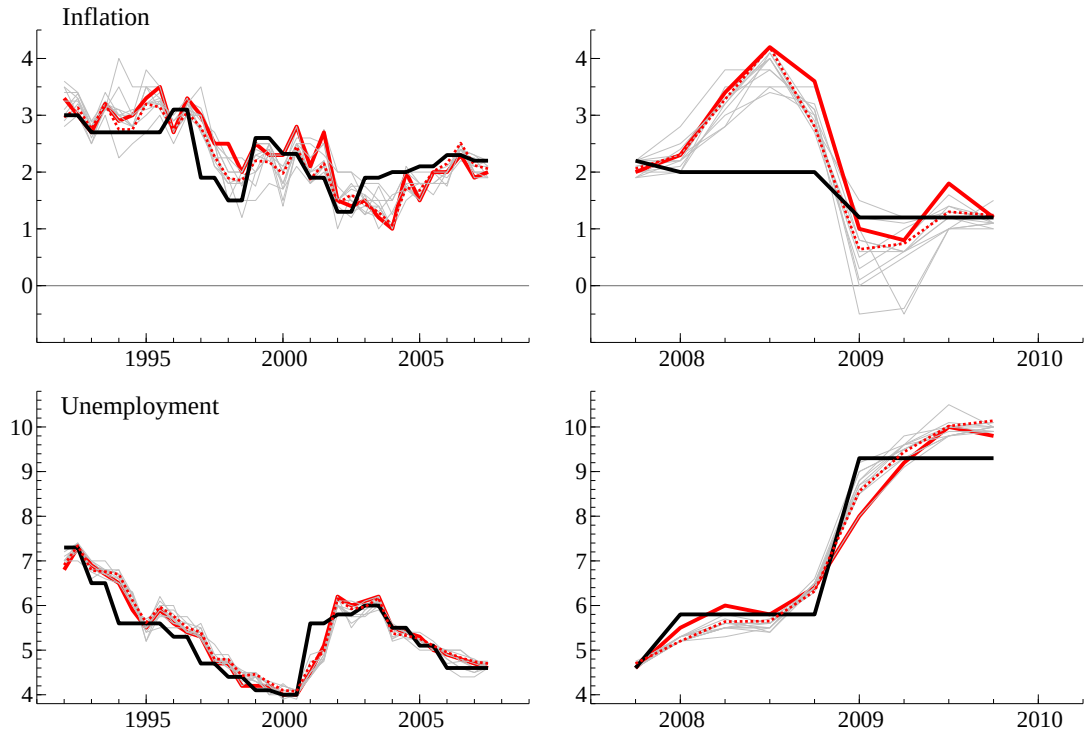

Figure 22: **F.R. Richmond** Red-dash line represents the Board; the black line represents the Actual; red line represents **Richmond**

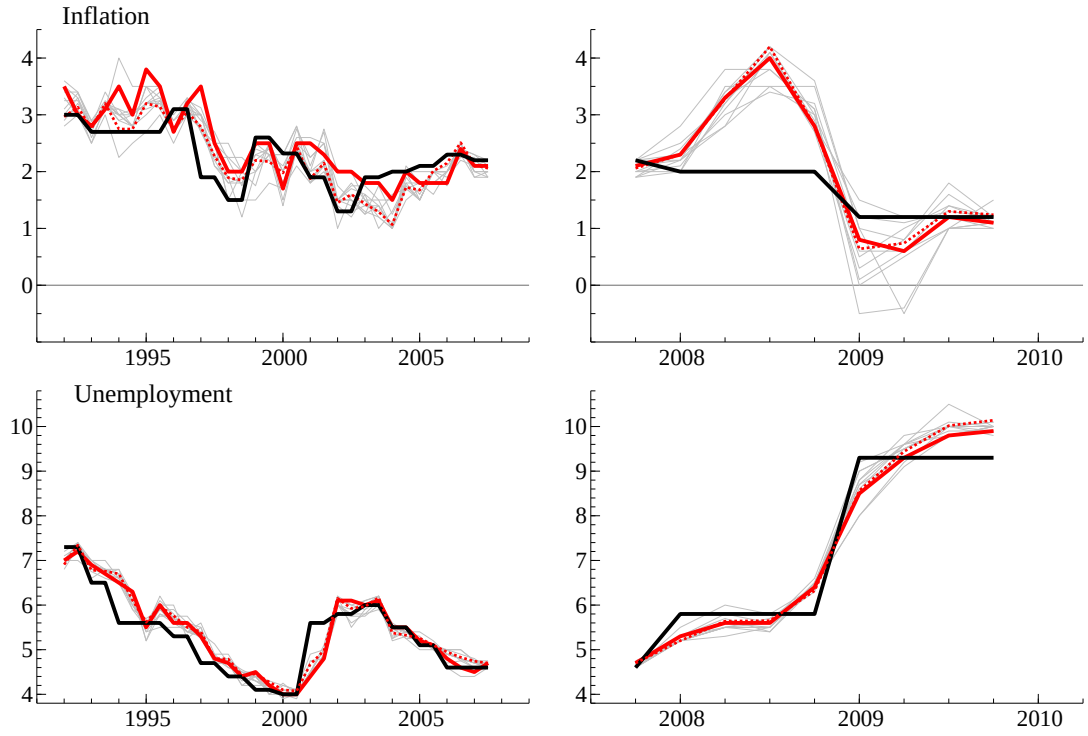

Figure 23: **F.R. Minneapolis** Red-dash line represents the Board; the black line represents the Actual; red line represents **Minneapolis**

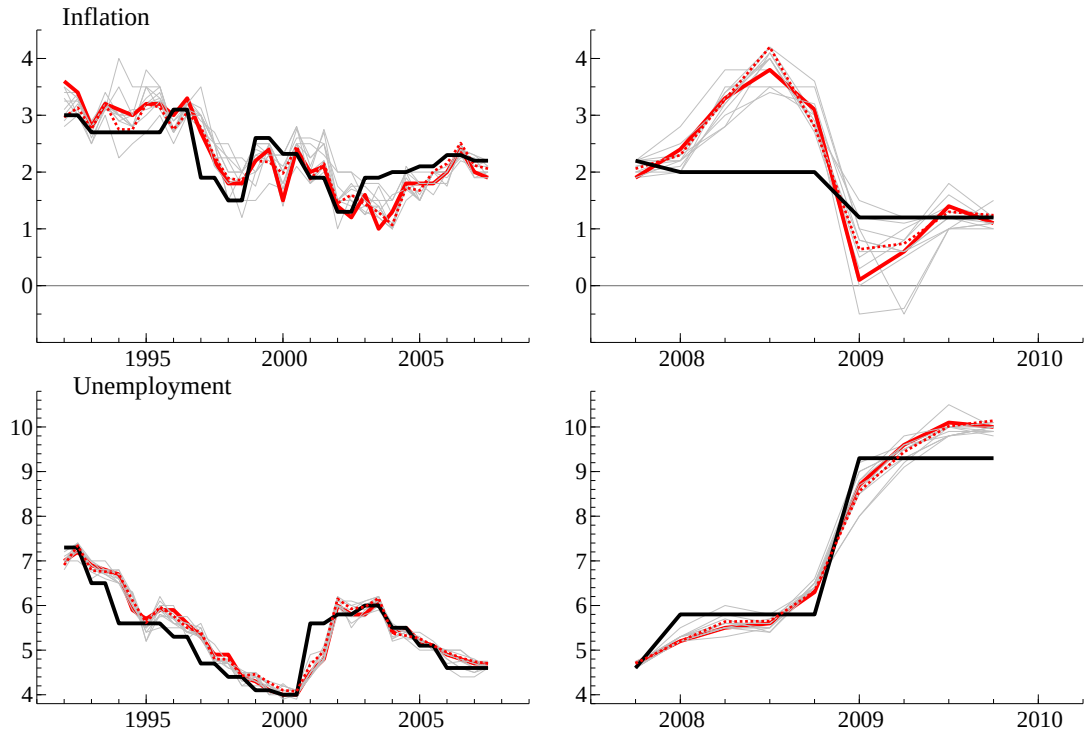

Figure 24: **F.R. Kansas** Red-dash line represents the Board; the black line represents the Actual; red line represents **Kansas**

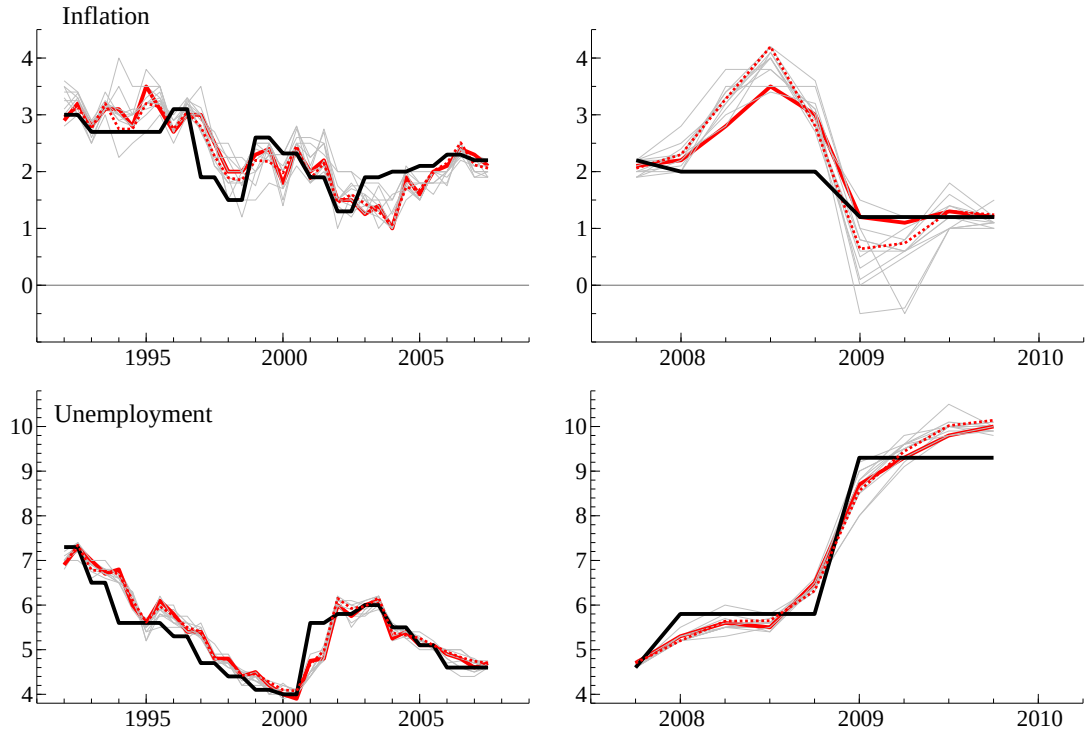

Figure 25: **F.R. Chicago** Red-dash line represents the Board; the black line represents the Actual; red line represents **Chicago**