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The Forecasts of Individual FOMC Members:

New Evidence after Ten Years

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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 study two sources of heterogeneity: Institutional and Dynamic. *Institutional Heterogeneity* is about differences in participants' education, voting status, and regional affiliation – and the associated implications for forecast rationality. *Dynamic Heterogeneity* is about herd behavior, extreme forecasts, temporal aggregation, and macroeconomic shocks. These factors emphasize that forecast heterogeneity is not a given constant but rather, that it changes in response to the alignment between private and social interests of the FOMC. 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

> 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, in addition, 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 by 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: 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.[3] 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, 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.

[3] Two types of analyses have emerged. One asking whether differences in forecasts reflect a tension between the Districts and the Board. If so, is that tension giving rise to dissents and seemingly erratic voting behavior? See Banternghansa (2009), Eichler et al. (2018), López-Moctezuma (2016), Malmendier (2017), Tillmann (2011a,b). Another asks if it is possible to infer from the forecasts the behavior of the economy that is maintained by FOMC participants? Do they forecast using a Taylor rule or a Phillips curve? See Bhattacharjee et al. (2011) Jung (2013) Tillmann (2010a, b).

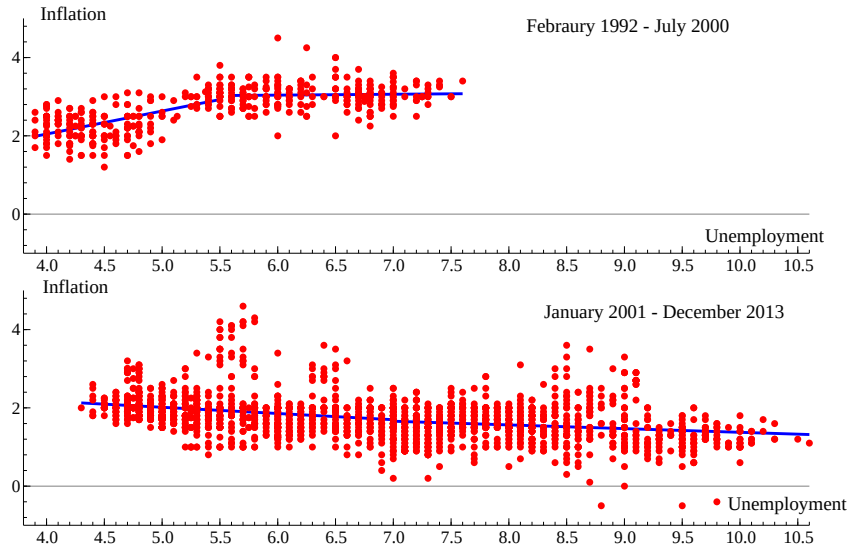

Figure 1: FOMC Forecasts for Unemployment (Horizontal axis) and for Inflation (Vertical axis). Romer's sample (1992-2000) in the top panel and for the Post Romer sample (2001-2013) in the bottom panel. Each panel shows two regression lines: one for each half of the sample. Section 2 documents the data 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.[4]

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, that it changes in response to the alignment between private and social interests of the FOMC. Section 6 addresses the role Federalism and Section 7 examines the heterogeneity of FOMC unemployment forecasts during the 2008-09 financial crisis.

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 the business cycle. Finally, the response to the financial crisis of 2008-09 shows how the FOMC Chair reconciles sharp differences in participants' views of the economy to adopt a single course of action. Section

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

8 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).[5]

[5] The long-run horizon is 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."

Table 2: SEP Target Year

year(t)→	2010	2011	2012	2013	2014	2015	···	Long-run
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.[6] 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 introduced in 2007 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."[7]

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.

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

[7] 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

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

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_p 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

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

where $X_{p,t}$ is a vector of dummy variables for the forecast horizon, the FOMC Chair, and the 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):

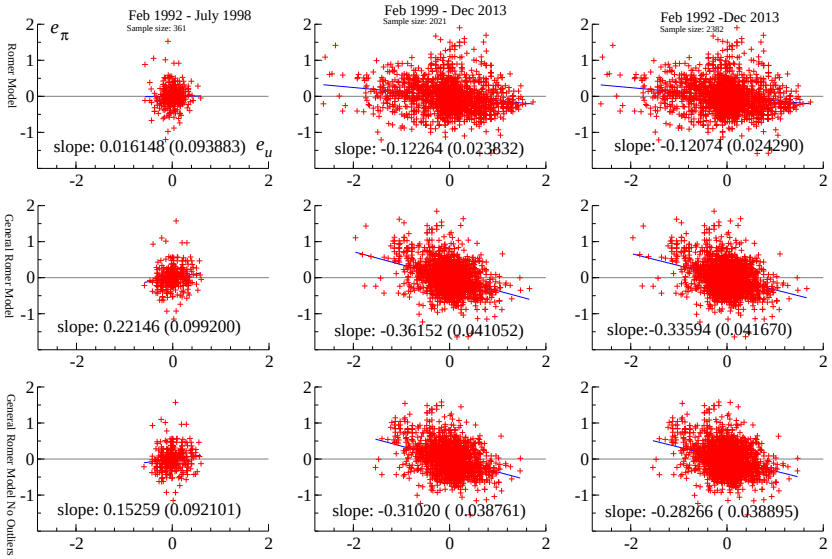

Figure 2: Correlation of Estimation Residuals from Romer's Formulation: Alternative Dates and Specifications

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

$$\begin{pmatrix} \pi_{i,p,t} \\ u_{i,p,t} \end{pmatrix} = \begin{pmatrix} \alpha_\pi \\ \alpha_u \end{pmatrix} + \underbrace{\Gamma \cdot D_{p'}}_{Romer} + \overbrace{\Phi \cdot X_{p,t}}^{Extension} + \begin{pmatrix} e^{\pi}_{i,p,t} \\ e^{u}_{i,p,t} \end{pmatrix} \tag{3}$$

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.[8] The coefficients on the PCE and Core PCE measure the differential effect with respect to the CPI; the coefficient on PhD measures 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.

Parameter estimation uses forecasts with attribution and thus the estimation sample excludes forecasts without attribution. 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.

[8] To allow for the inclusion of intercepts in equation (3), $D_{p'}$ excludes the dummy for the first meeting.

Second, the coefficient for education (PhD) 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 is not significant indicating that the forecast from a District eligible to vote is not different from the base forecast.[9]

Fourth, the coefficient for the horizon ($T+1$) is negative and significant. This finding suggests 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 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, the estimation results point to significantly higher inflation forecasts for Richmond, Atlanta, St. Louis, Dallas, and Minneapolis; for significantly lower unemployment forecasts for Cleveland, Atlanta, St. Louis, and Dallas.

Seventh, the effect of Bernanke's tenure on inflation differ little from those during the Greenspan tenure but are significantly lower in unemployment (50 basis points).[10]

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

[10] 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.

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

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

$$u_{i,p,t} = \alpha_u + \beta_u \cdot u_t + \upsilon_u \cdot X_{i,p,t} + \omega_u \cdot W_{i,p} + e^{u}_{i,p,t} \quad (5)$$

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

$X_{i,p,t}$ is a dummy variable if the ith participant is a voting member during the p^{th} FOMC meeting;

W_{i1} is a dummy variable if the participant at the p^{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 $\left(e^{\pi}_{i,p,t}\ e^{u}_{i,p,t}\right)' \tilde{} N(0, \Sigma)$, 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 Heterogeneity

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 these distortions, 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

† We use the average across Board members.

5.1 Forecast Levels

The seeming forecast homogeneity disappears by examining the evolution of forecasts from three angles: their level, the associated errors, and the revisions. Specifically, figure 3 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 inflation.

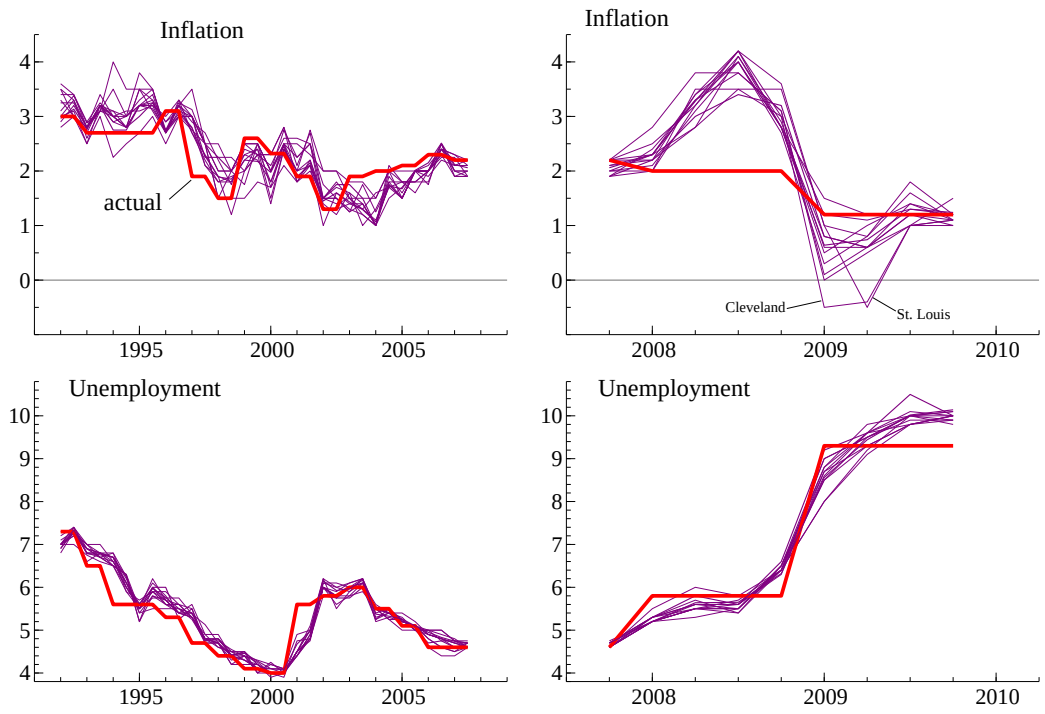

Figure 3: Top Panels: FOMC Forecasts for Inflation. Bottom Panels: FOMC Forecasts for Unemployment. For the Federal Reserve Board, we use the average across Board members.

The forecasts also exhibit instances of seemingly extreme values. Indeed, forecasts for unemployment in 2010 made during the April 2009 meeting (figure 3) might be construed as extreme. Tillman (2011 a,b) 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. We do not explore these possibilities further in this pape.

To be sure, the dispersion of forecasts during this period was not typical.[11] Figure 4 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. 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

[11] Indeed, 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.

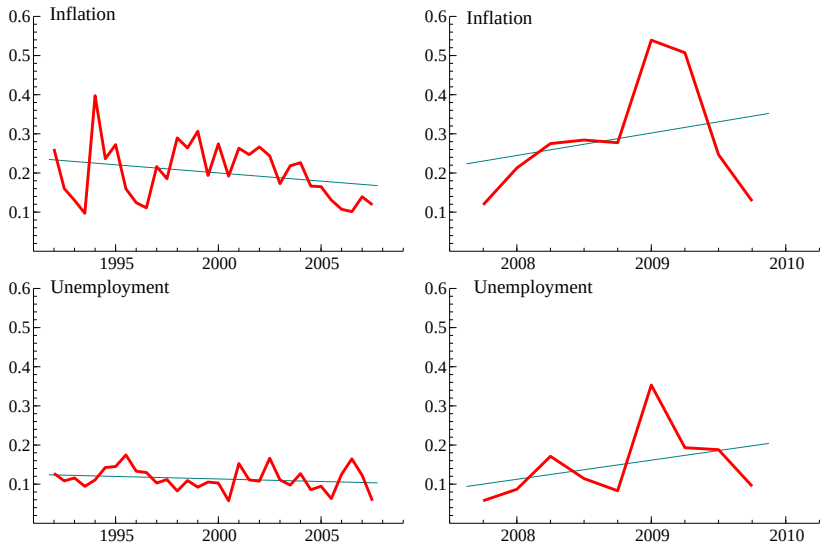

Figure 4: Standard deviations for inflation and unemployment forecasts across FOMC participants for each date

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 are examined in sections 5.3 and 6 below.

5.2 Forecast Errors

FOMC forecasts errors for inflation and unemployment are one-sided and persistent (figure 5). 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 6).

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.[12] 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

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

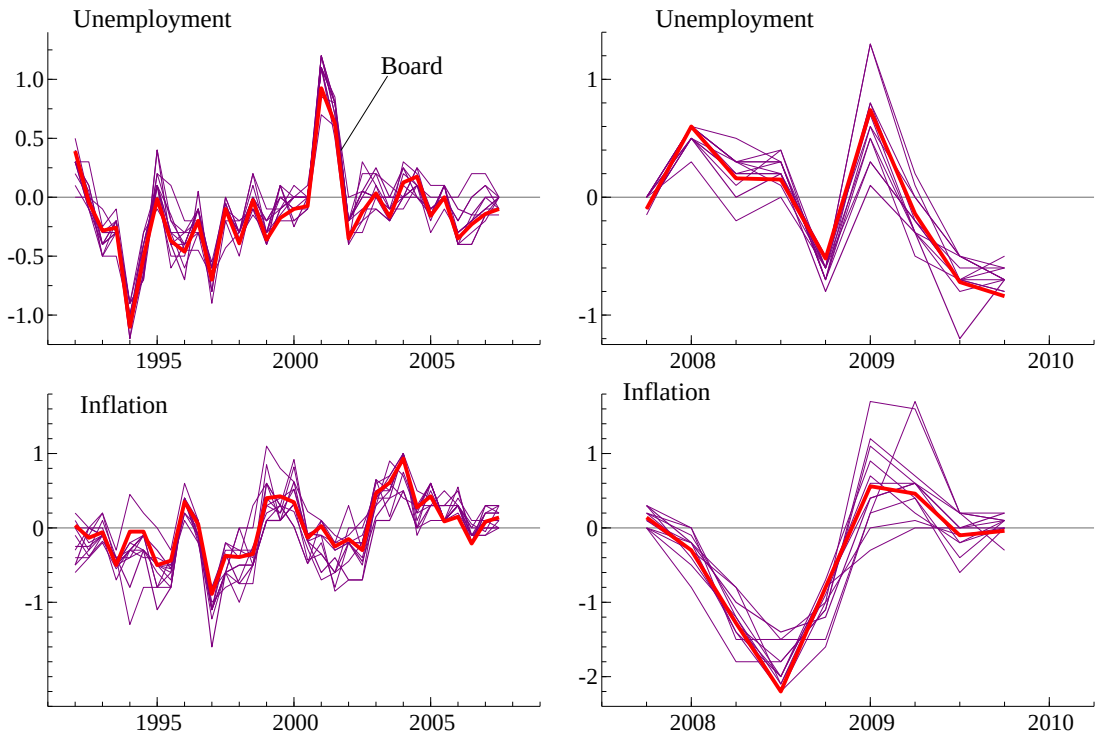

Figure 5: Top Panel: FOMC Forecast Errors for Unemployment. Bottom Panel: FOMC Forecast Errors for Inflation. For the Federal Reserve Board, we use the average across Board members.

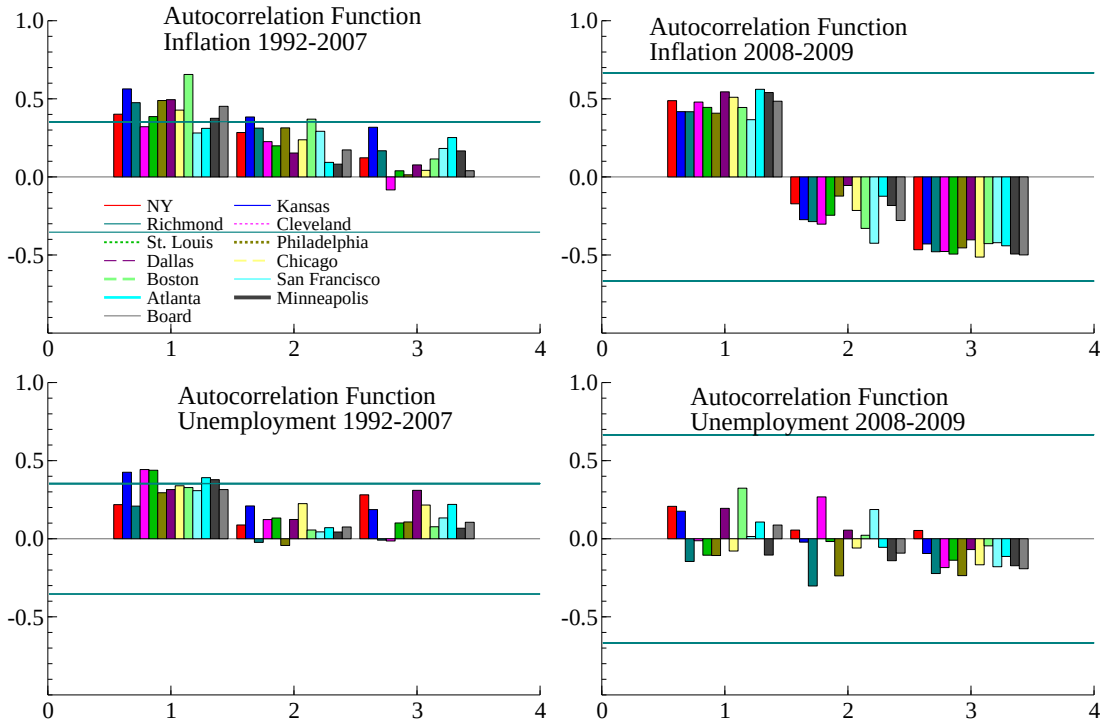

Figure 6: Autocorrelation Function of Order 3 for Forecast Errors of FOMC Participants. For the Federal Reserve Board, we use the average across Board members.

our sample will help discriminating among these hypotheses.

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. Specifically, new participants will bring their own ap-

propriate policies which bring different forecasts, even in the absence of economic news. Third, participants' assessment of *appropriate* monetary policy may change. Finally, participants could 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.[13] 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.

With these considerations in mid, figure 7 shows revisions for current-year forecast, denoted as $\Delta\pi_{i,t,t}$ and $\Delta u_{i,t,t}$.[14] 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 8 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 observed across FOMC participants: forecast revisions of inflation are inversely correlated to forecast revisions of unemployment for the same participant (figure 9).

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).

[13] 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

[14] 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 their mid-point, even though forecasts are being revised.

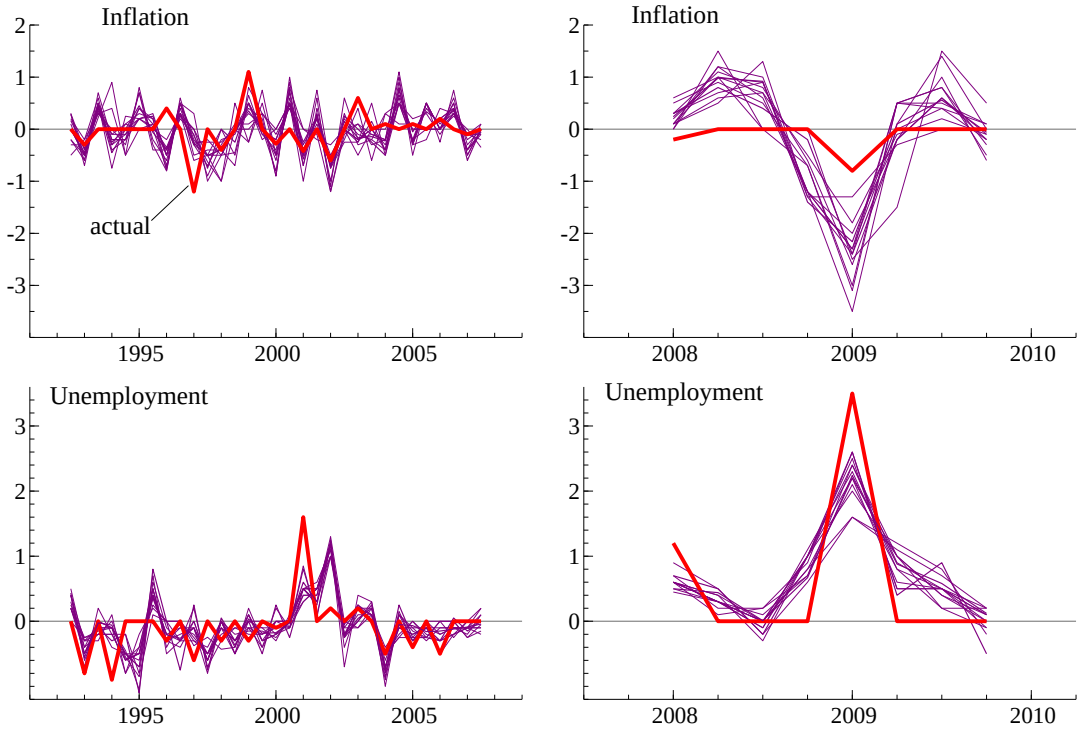

Figure 7: Top Panels: FOMC Forecast Revisions for Inflation. Bottom Panels: FOMC Forecasts Revisions for Unemployment

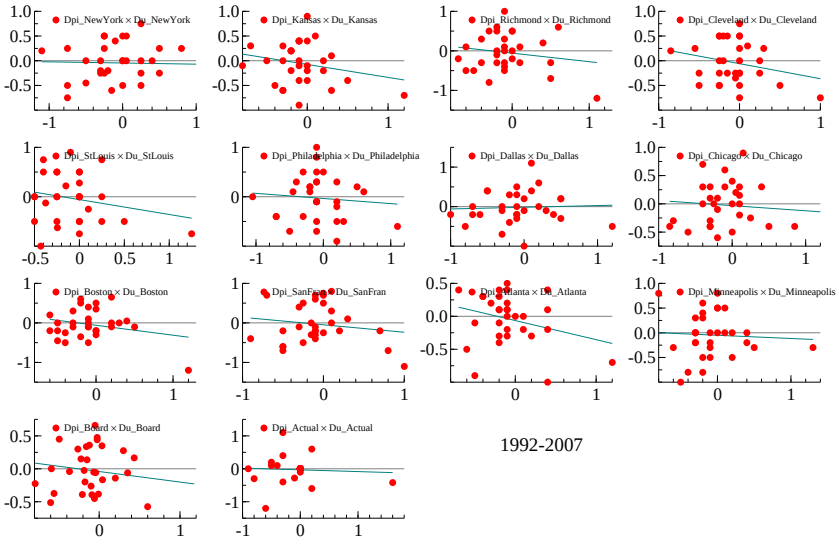

Figure 8: Scatter Plots for FOMC Forecast Revisions by FOMC Participant – 1992-2007. Horizontal Axis corresponds to Unemployment, Vertical Axis Corresponds to Inflation

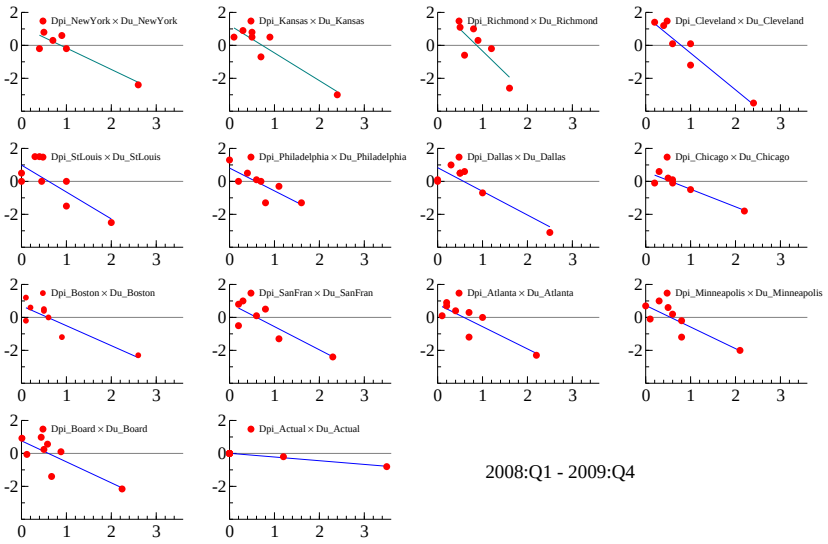

Figure 9: Scatter Plots for FOMC Forecast Revisions by FOMC Participant – 2008:Q1-2009:Q4. Horizontal Axis corresponds to Unemployment, Vertical Axis Corresponds to Inflation

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 Federalism

As noted earlier, the FOMC seeks to reconcile differences between the interests of the private sector, as represented by Federal Reserve Bank Presidents, and the public's interest, as represented by the Federal Reserve Board. 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. ...[15]

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.[16] One might, however, provide an approximate answer to Romer's question if one assumes that the forecasts from the Board for

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

[16] 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."

unemployment and inflation (u_B and π_B) are driven solely by national concerns whereas, as Hoenig suggests, forecasts from Districts (u_i and π_i) are influenced by both regional *and* national developments. To be sure, this separability would, if correct, would imply that the Board's forecast neglect Districts' conditions which is not consistent with the Board's forecasting practice.

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).

7 Heterogeneity, History, and the 2008 Financial Crisis

Figure 10 shows the distribution of forecasts for unemployment in 2009 starting from October 2007 to January 2009.[18] The flattening of the distributions and their rightward shifts are unmistakable: the mean

[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 7.

[18] 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.

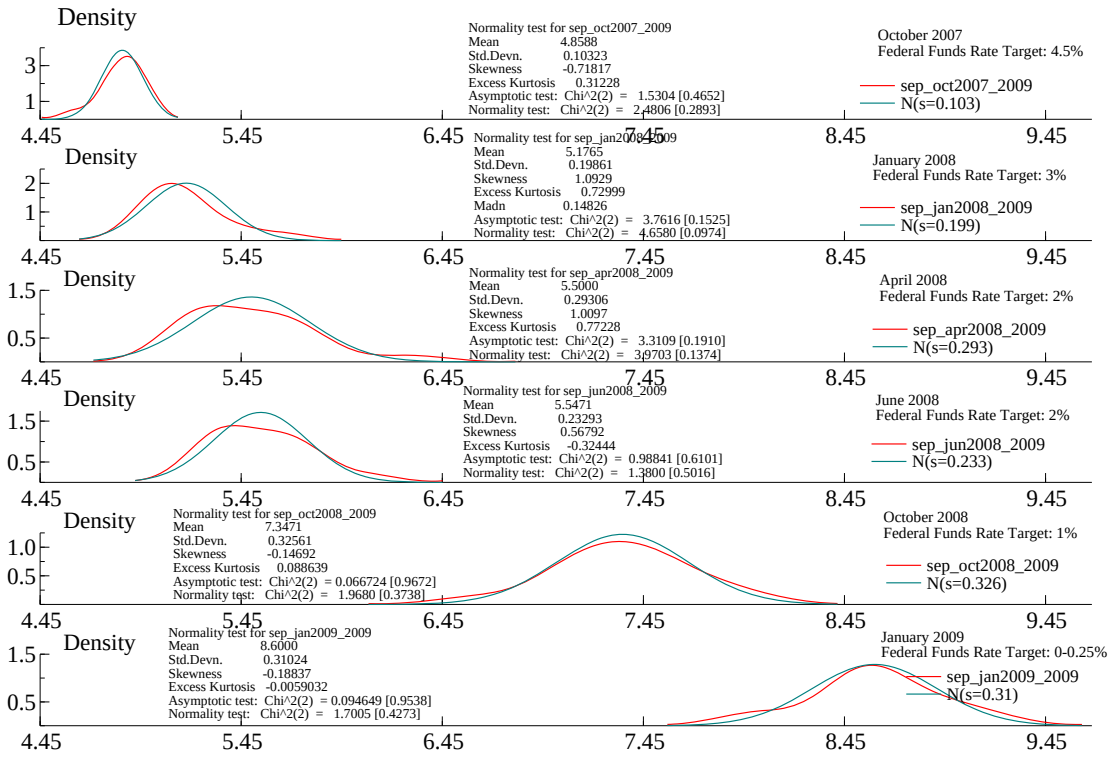

Figure 10: FOMC Unemployment Forecasts for 2009 made from FOMC meetings from October 2007 to January 2009

of forecasts evolves from 4.9 percent during the October 2007 meeting to 8.6 by the January 2009 meeting; the standard deviation increases from 0.10 in October 2007 to 0.31 in January 2009.

The shifts in these distributions follow the news from financial disruptions: BNP Paribas in August 2007, Bear Sterns in March 2008, and Lehman Brothers in September 2008. By January 2009, the mean of the distribution of FOMC forecasts for unemployment in 2009 was 8.6 percent, 3.7 percentage points greater than their October 2007 forecasts and, arguably, above the level consistent with the dual mandate.[19] Not surprisingly, the target for the federal funds rate declined from 4.5 percent in October 2007 to 1 percent in October 2008 and then to a range between zero and 25 basis points by January 2009.[20]

Despite the increased heterogeneity of forecasts and the numerous dissenting votes during these meetings, the FOMC approved unanimously the introduction of Unconventional Monetary Policy in March 2009.[21]

[19] 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.

[20] 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.

[21] The one adopted here is Alternative B; see https://www.federalreserve.gov/newsevents/pressreleases/monetary20090318a.htm See Bernanke (2015, chapter 19) and Gagnon et al. (2011) for extensive discussions of the March 2009 decision. An examination of the FOMC Transcripts of 2008 and 2009 reveal disagreements from FOMC participants: Fisher in January and June of 2008; Fisher and Plosser in March, April, and August of 2008. Lacker dissented in the January 2009 meeting.

Several factors could explain the timing of this decision.[22] First, as Bernanke noted in 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.[23]

Bernanke's view of "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.[24]

Second, the role of monetary history in the United States was in the foreground during Bernanke's tenure. Indeed, 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**.[25] —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[26]

8 Conclusions

Several of the empirical findings reported here are likely to change with the removal of the most limiting factor of this work: scant observations. But there are several findings that, we believe, will stand the test of

[22] Note that by design, the Board has the majority of votes in FOMC decisions and neither the Federal Reserve Bank of New York nor any the Board members dissented.

[23] https://www.federalreserve.gov/monetarypolicy/files/FOMC20090128meeting.pdf

[24] Note that forecast errors over this period are small (see figure 5) but accuracy is not the point of FOMC forecasts but the attainment of the dual mandate.

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

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

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.

> 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 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)

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

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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

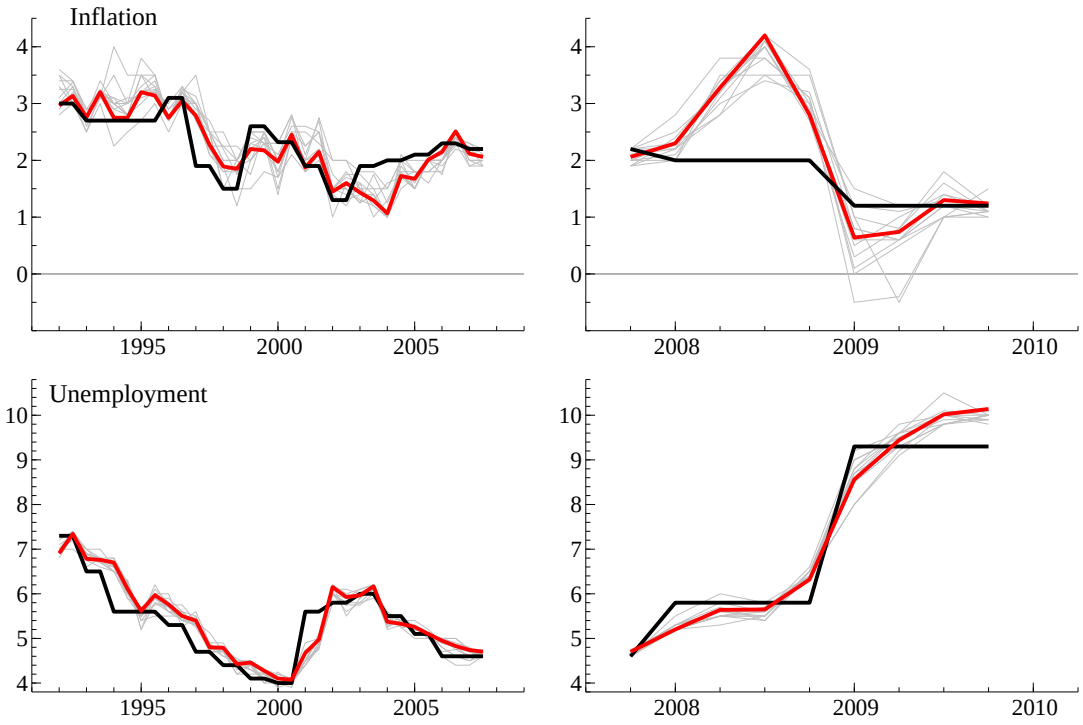

Figure 11: **Federal Reserve Board** Read line represents the Board; the black line represents the Actual.

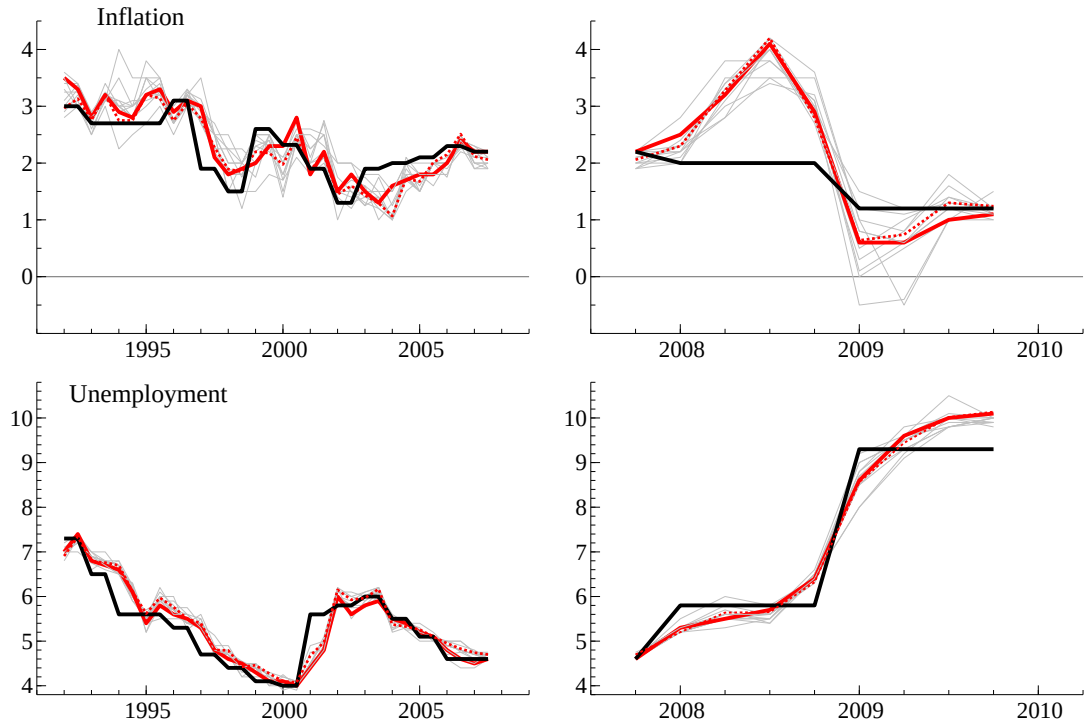

Figure 12: **F.R. Atlanta** Red-dash line represents the Board; the black line represents the Actual; red line represents Atlanta.

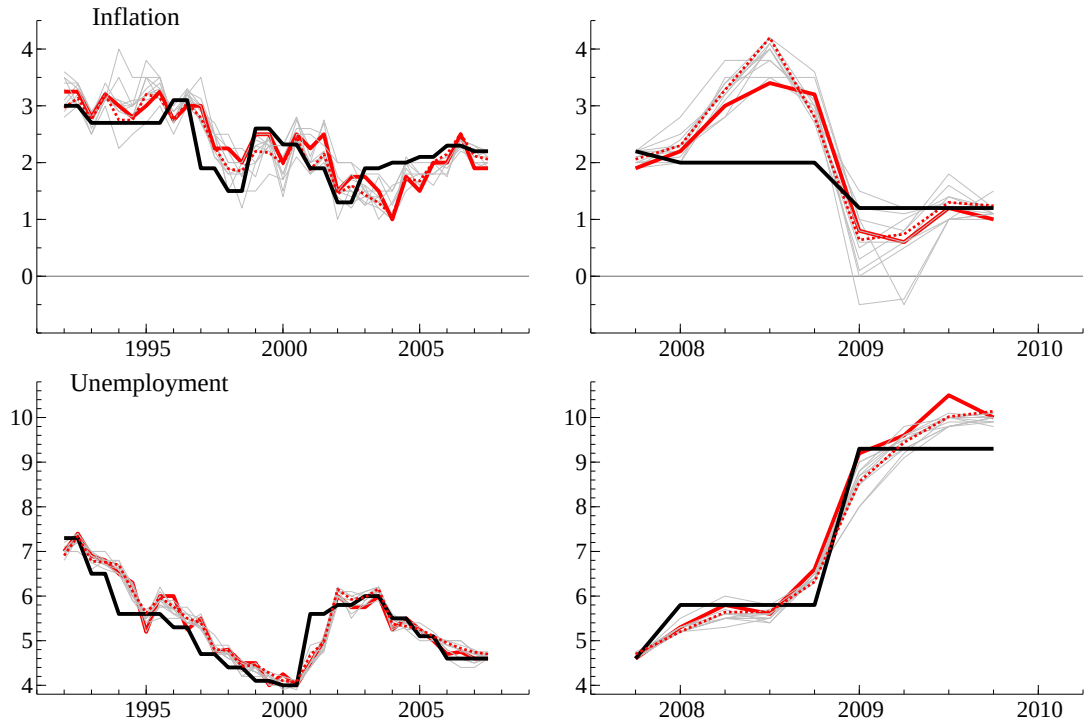

Figure 13: **F. R. New York** Red-dash line represents the Board; the black line represents the Actual; red line represents **New York**

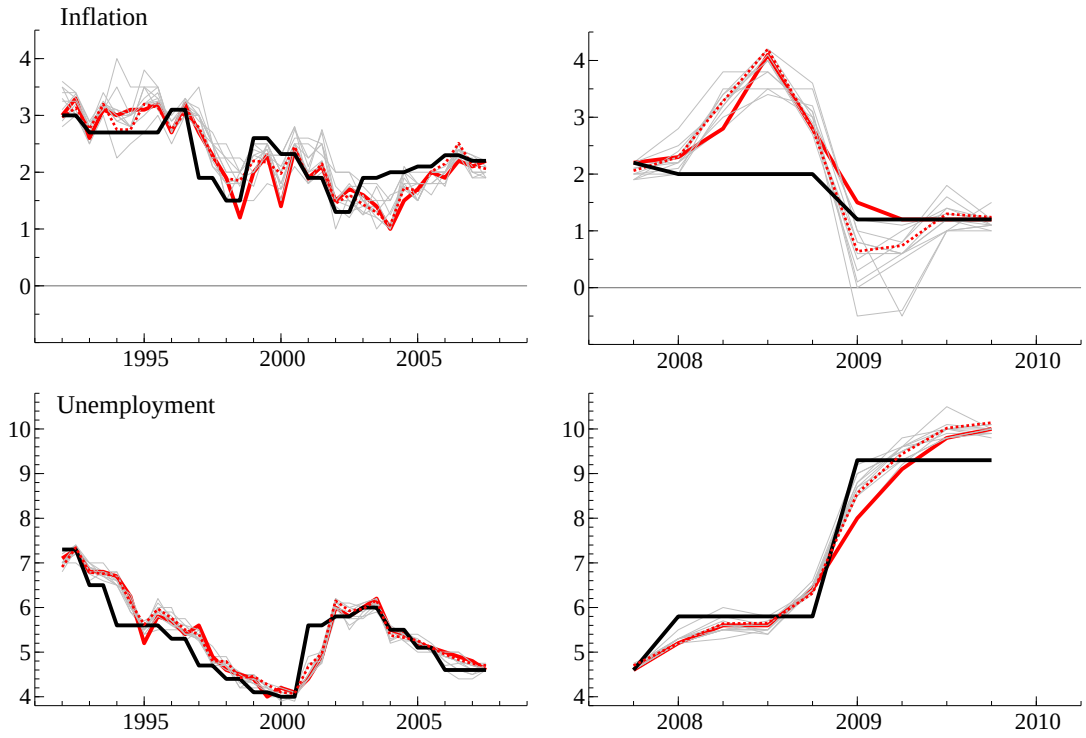

Figure 14: **F. R. Philadelphia** Red-dash line represents the Board; the black line represents the Actual; red line represents Philadelphia

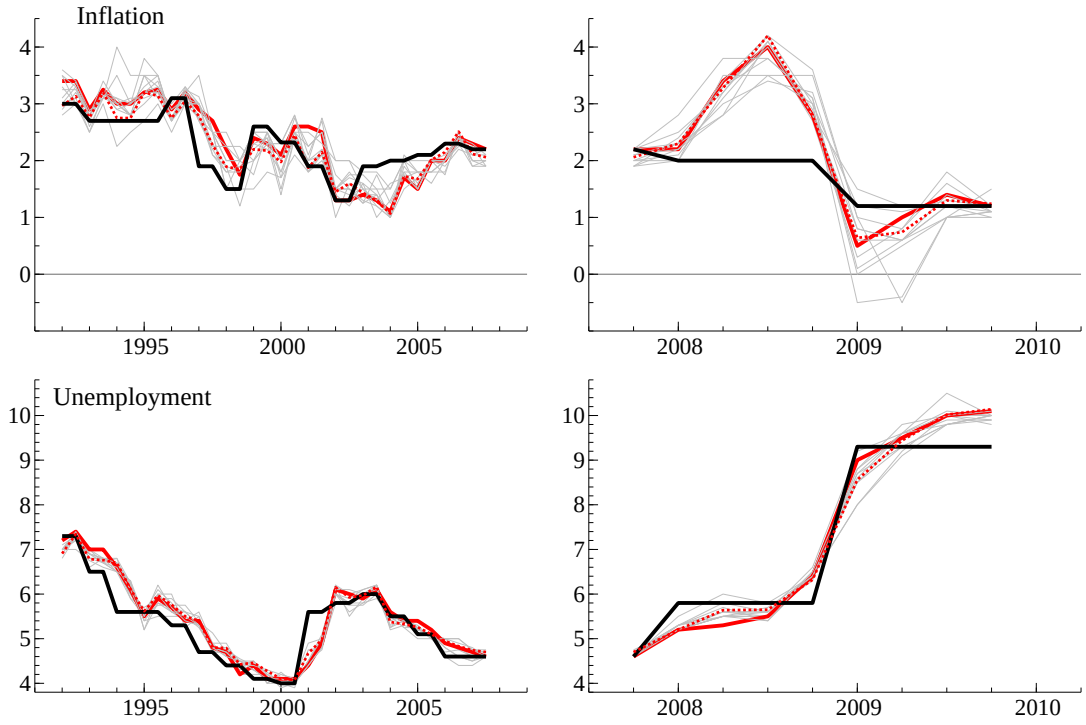

Figure 15: **F.R. Boston** Red-dash line represents the Board; the black line represents the Actual; red line represents **Boston**

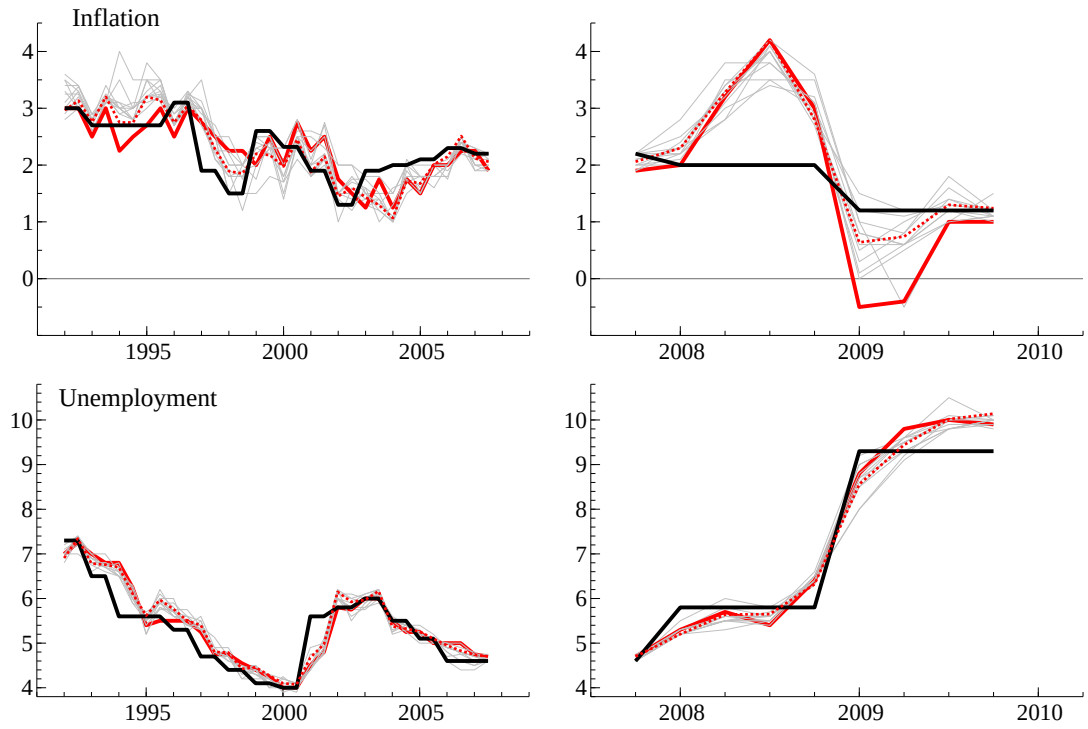

Figure 16: **F.R. Cleveland** Red-dash line represents the Board; the black line represents the Actual; red line represents **Cleveland.**

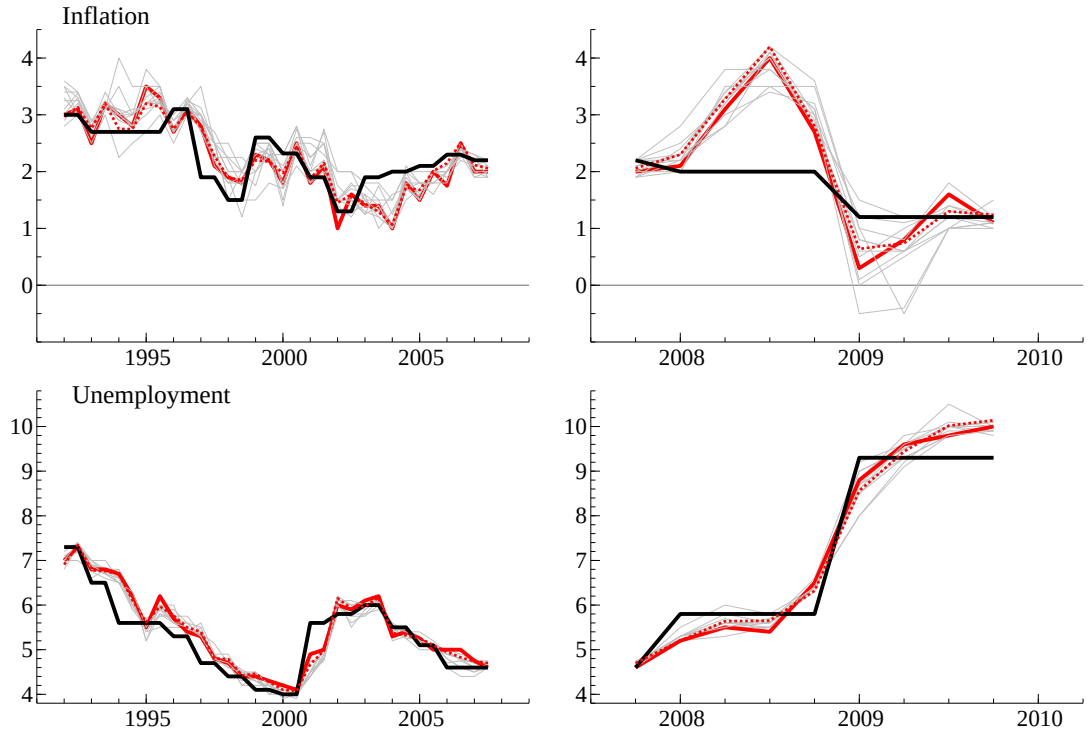

Figure 17: **F.R. San Francisco** Red-dash line represents the Board; the black line represents the Actual; red line represents **San Francisco**

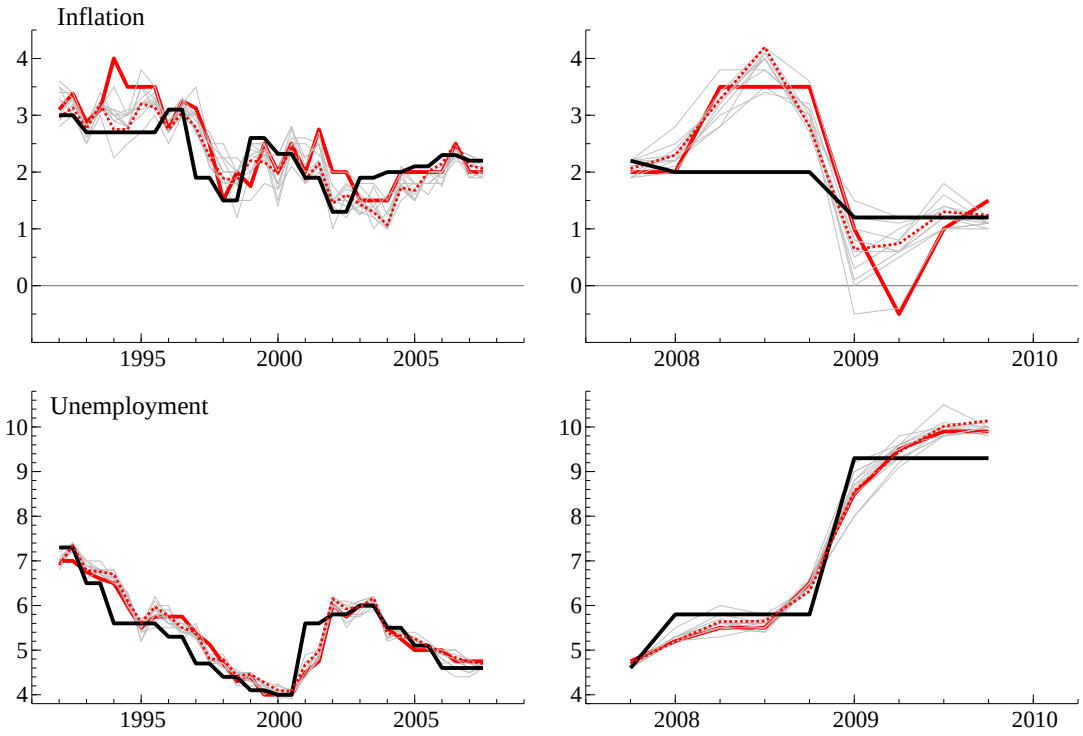

Figure 18: **F.R. St. Louis** Red-dash line represents the Board; the black line represents the Actual; red line represents **St. Louis**

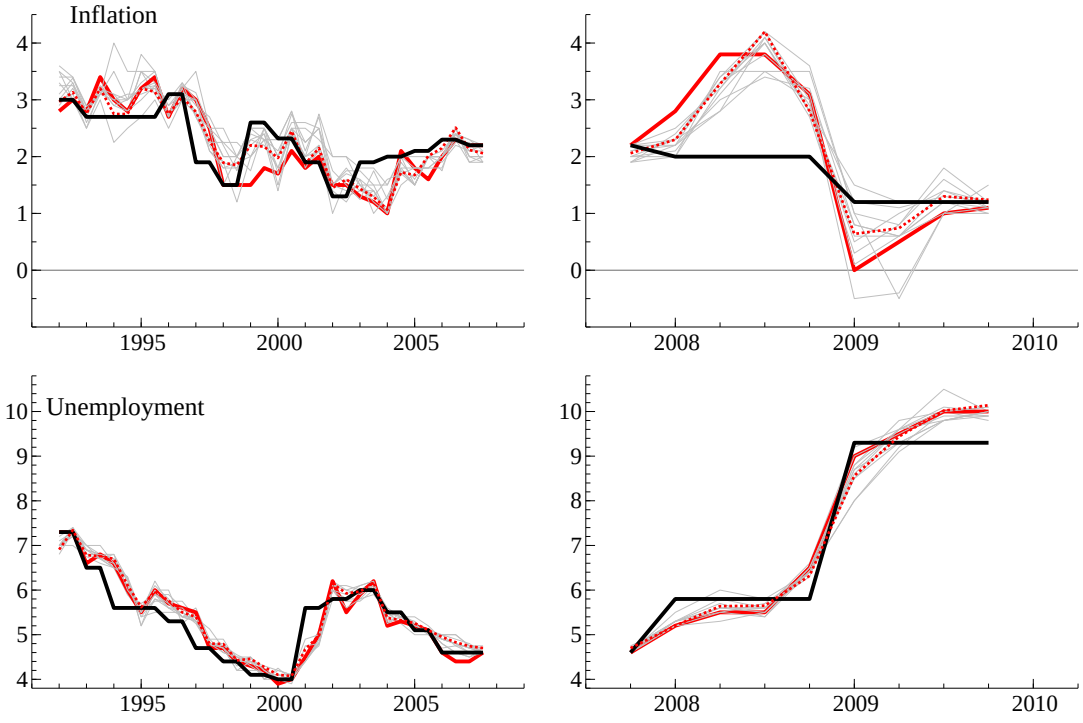

Figure 19: **F.R. Dallas** Red-dash line represents the Board; the black line represents the Actual; red line represents **Dallas**

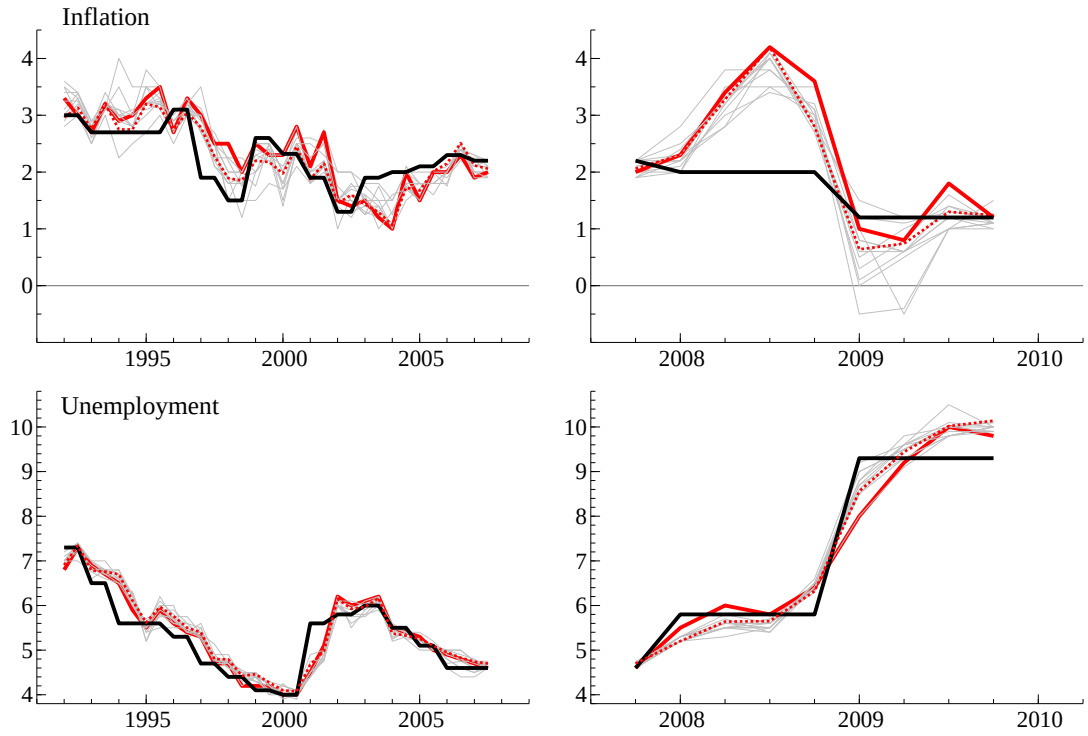

Figure 20: **F.R. Richmond** Red-dash line represents the Board; the black line represents the Actual; red line represents **Richmond**

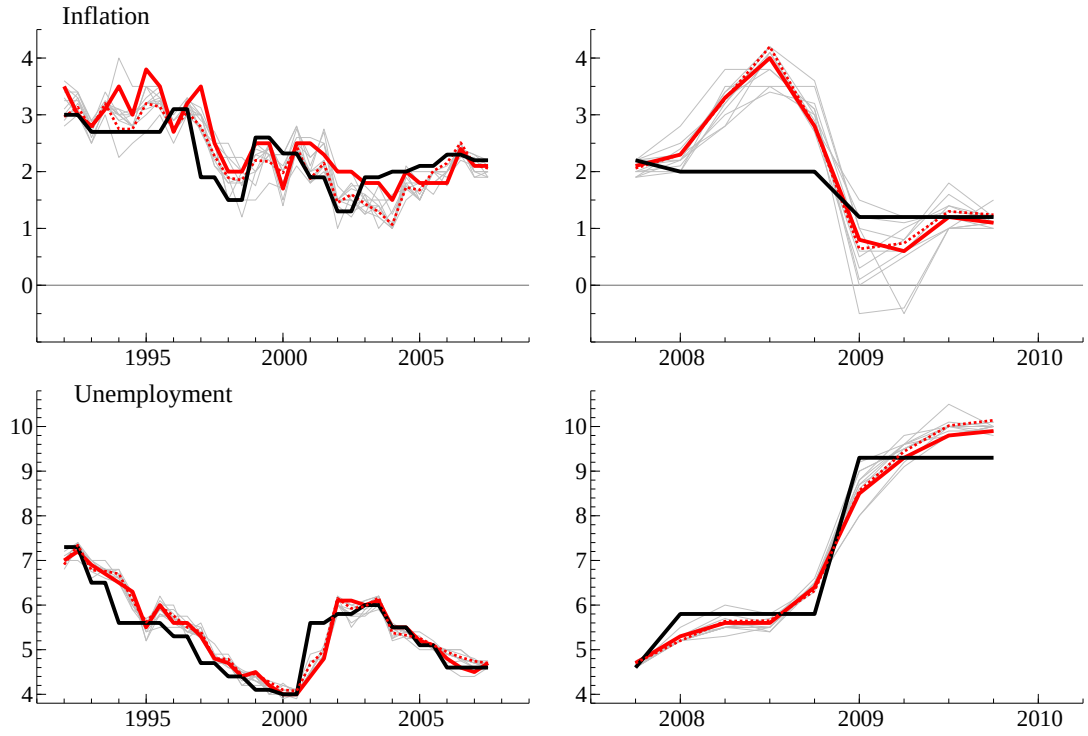

Figure 21: **F.R. Minneapolis** Red-dash line represents the Board; the black line represents the Actual; red line represents **Minneapolis**

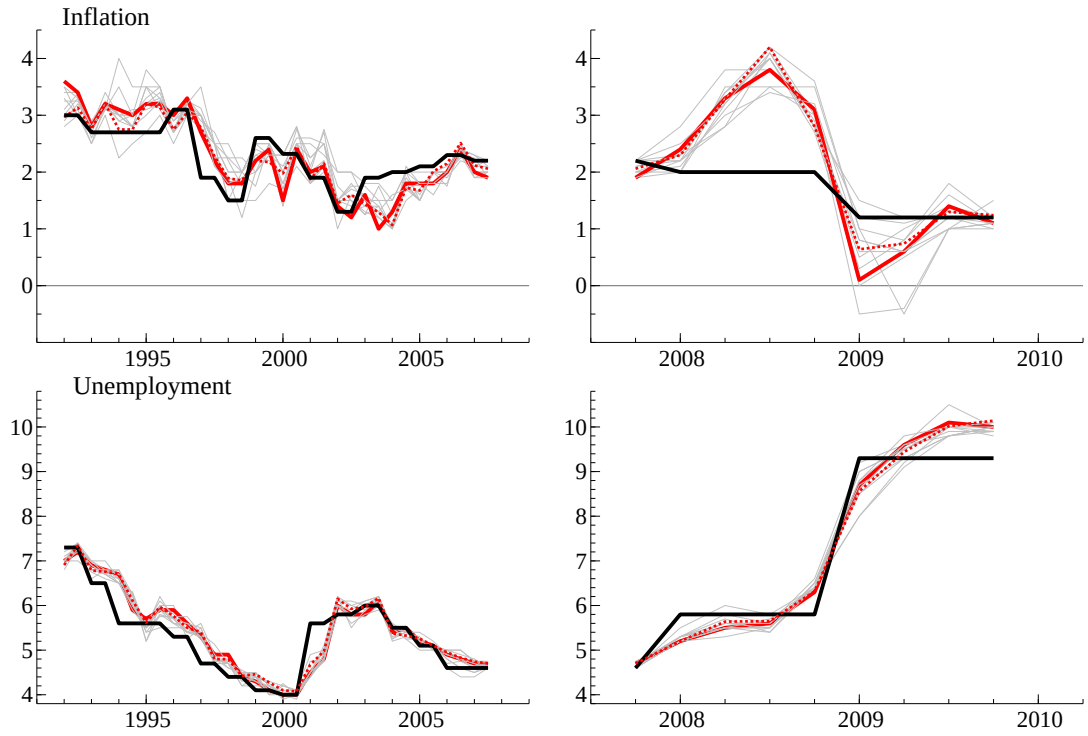

Figure 22: **F.R. Kansas** Red-dash line represents the Board; the black line represents the Actual; red line represents **Kansas**

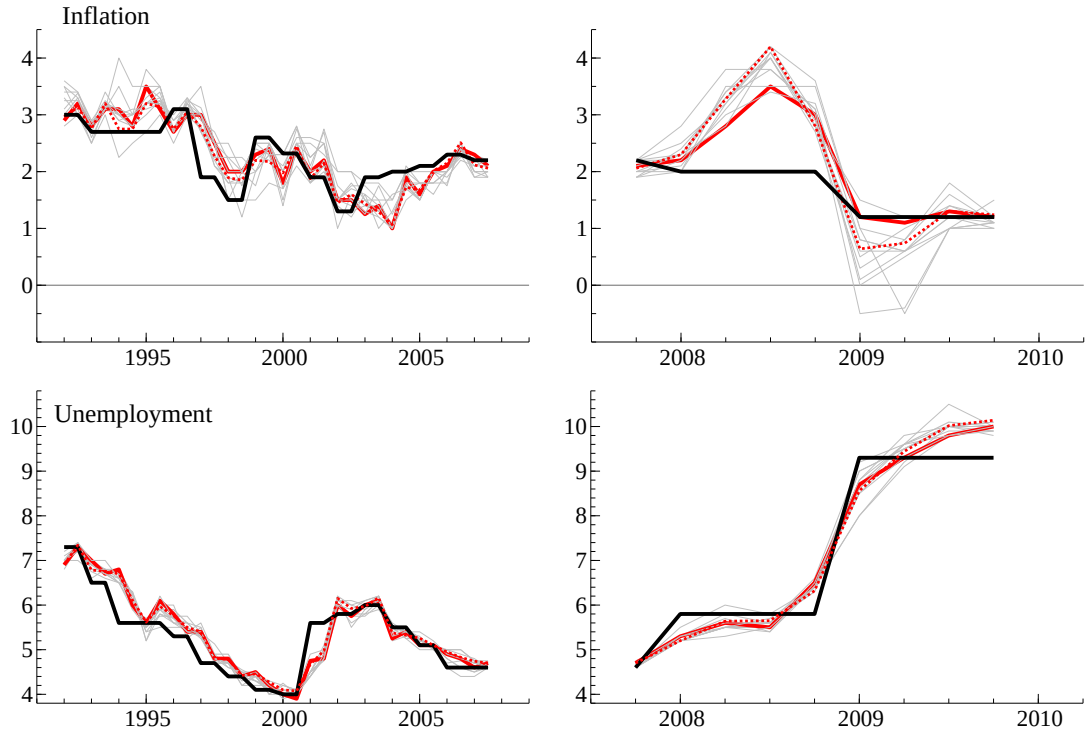

Figure 23: **F.R. Chicago** Red-dash line represents the Board; the black line represents the Actual; red line represents **Chicago**