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EXPECTATIONS AND THE EFFECTS OF MONETARY POLICY

Laurence Ball
Economics Department
Johns Hopkins University

Dean Croushore
Federal Reserve Bank of Philadelphia

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FEDERAL RESERVE BANK OF PHILADELPHIA
Ten Independence Mall, Philadelphia, PA 19106-1574• (215) 574-6428• www.phil.frb.org

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EXPECTATIONS AND THE EFFECTS OF MONETARY POLICY

ABSTRACT

This paper examines the predictive power of shifts in monetary policy, as measured by changes in the real federal funds rate, for output, inflation, and survey expectations of these variables. We find that policy shifts have larger effects on actual output than on expected output; thus policy predicts errors in output expectations, a violation of rational expectations. Policy shifts do *not* predict errors in inflation expectations. We explain these results with a model in which agents systematically underestimate the effects of policy on aggregate demand. This model helps to explain the real effects of policy.

EXPECTATIONS AND THE EFFECTS OF MONETARY POLICY

I. INTRODUCTION

There is a growing consensus, based on both historical analysis and econometric evidence, that monetary policy has strong effects on real output. There is not, however, any consensus about how to explain this fact. This paper explores the idea that the non-neutrality of policy arises from a failure of rational expectations. Specifically, we present evidence that agents systematically underestimate the effects of policy on aggregate demand.

Our central results concern the predictive power of policy shifts for real output and for expectations of output. We measure policy shifts with changes in the real federal funds rate; expectations are taken from the Survey of Professional Forecasters. Like previous researchers, we find that increases in the funds rate reduce output at a horizon of roughly a year. A higher funds rate also causes survey respondents to <u>expect</u> lower output, but the effect on expected output is substantially smaller than the effect on actual output. Thus increases in the funds rate lead systematically to negative errors in output expectations, a violation of rational expectations.

We also examine the predictive power of policy shifts for inflation and for expectations of inflation. Here, we cannot reject rationality. A rise in the real funds rate leads to a fall in inflation at a horizon of two years, and a roughly equal fall in expected inflation. Thus policy shifts do <u>not</u> predict errors in inflation expectations.

Our results add new evidence to the general debate about the rationality of expectations. Most important, we find that rationality fails in a particular direction, one that helps explain the effects of monetary policy. To make this point, we analyze a simple macroeconomic model with sticky prices. In the model, policy is neutral under rational expectations. We show, however, that policy is non-neutral if agents systematically underestimate the effects of policy on aggregate demand. Crucially, this assumption about expectations also produces results that match our empirical findings: policy shifts predict surprises in real output but not surprises in inflation. Thus our empirical results support our explanation for non-neutrality.

The remainder of this paper contains four sections. Section II describes our empirical methodology and Section III presents the results. Section IV interprets the results using our model, and Section V concludes.

II. METHODOLOGY

We explore the predictive power of shifts in monetary policy for three output variables: actual output, survey expectations of output, and the difference between the two. We perform a similar procedure for inflation. Here we describe the details of our approach.

A. The Basic Regressions

We measure output by real GNP (or GDP starting in 1992), and inflation by the GNP (GDP) deflator. For both variables, expectations are given by the mean forecast from the Survey of Professional Forecasters (SPF). In an earlier version of this paper (Ball and Croushore, 1995), we also examine expectations from the Livingston survey of business economists and the Michigan survey of consumers. One might expect the behavior of expectations to vary across the surveys, because of the different levels of sophistication of forecasters, general economists, and consumers. It turns out, however, that our results are similar for all three surveys.

In studying both actual and expected variables, we examine deviations from the forecasts of univariate statistical models. That is, we ask whether policy causes inflation and output to deviate from the paths that one would forecast based on their usual dynamics, and whether survey respondents expect these deviations. Our univariate model for quarterly output growth is an AR(1) process with a mean that shifts in 1973:2. Our model for inflation is an IMA(1,1) process. Given these models, we compute statistical forecasts using rolling regressions.[1]

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[1]Our choices of statistical models are based on previous work and our own diagnostic tests. Our choice of an inflation process is based on Barsky (1987) and Ball and Cecchetti (1990). Our choice of an AR(1) process for output growth is based on Beveridge and Nelson (1981) and Campbell and Mankiw (1987); Perron (1989) proposes a shift in the mean in 1973:2. For both

Letting y denote output, y^e denote survey expectations of output, and y^f denote statistical forecasts, we ask whether policy shifts predict $y - y^f$ and whether they predict $y^e - y^f$. We also examine the difference between these two variables to see whether policy shifts lead systematically to expectational errors. Note that this difference is simply $y - y^e$, and thus is not affected by our choice of statistical models. For inflation, we define π, π^e, and π^f similarly and examine the analogous combinations of variables.[2]

We measure policy shifts with changes in the real federal funds rate. This choice reflects the growing consensus among researchers that the real funds rate captures the stance of policy (e.g., Taylor, 1993). We define the real funds rate as the nominal rate minus the mean of expected inflation from the SPF.

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output and inflation, our ARIMA models are the smallest ones that pass tests for autocorrelation (the Durbin-Watson and Q tests) and the tests on forecast residuals suggested by Diebold and Lopez (1996).

[2]Expected output growth is calculated using the mean forecast for the level of output four quarters ahead and the mean forecast for the current quarter. Similarly, expected inflation is constructed from forecasts of the GNP deflator four quarters ahead and in the current quarter. Actual output growth and inflation are calculated from the data available three months after the end of each quarter; this avoids problems arising from rebenchmarking of data and changing base years. (The results are similar, however, if we use final revised data.) For further details about the Survey of Professional Forecasters, see Croushore (1993).

B. Timing

Our data are quarterly. We examine overlapping observations of expected and actual variables over periods of one year. For an observation dated at quarter *t*, actual inflation is inflation from *t* to *t*+4. Our output variable is output growth from *t* to *t*+4. Expected inflation and growth from *t* to *t*+4 are reported by survey respondents during quarter *t*. Finally, our statistical forecasts of inflation and output growth are based on quarterly models estimated through *t* - 1 (the last quarter for which data are available during quarter *t*).

We measure changes in the broad stance of policy with changes in the real federal funds rate over periods of a year. For observation *t*, *FF*1 is the difference between the real funds rate in quarter *t*-1 (the last quarter completed before expectations are formed) and the rate four quarters earlier, during *t*-5. *FF*2 is the difference between the real funds rates at *t*-5 and at *t*-9, and *FF*3 is the difference between *t*-9 and *t*-13. These annual changes in the funds rate are the regressors in our equations for actual and expected inflation and output.[3]

Our data begin in 1968:4, the first quarter of the SPF, and end in 1995:2.

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[3]The nominal federal funds rate is the quarterly average of the daily rate. Note that the data on current inflation expectations are published near the mid-point of each quarter. Therefore π^e at *t*-1, and hence the real funds rate at *t*-1, are known when agents form expectations at *t*.

III. RESULTS

A. Output: Basic Results

Table 1 reports the results of regressing our output variables, $y - y^f$, $y^e - y^f$, and $y - y^e$, on the federal-funds variables. We report results with *FF*1 as the only regressor and with both *FF*1 and *FF*2; longer lags are never significant. We compute standard errors using the Newey-West procedure with eight lags. (OLS standard errors are inconsistent because our use of overlapping observations induces serial correlation.) For each regression, we present the significance level of the χ^2 statistic for the null hypothesis that all coefficients on the *FF* variables are zero.

Not surprisingly, *FF*1 has a negative and highly significant effect on $y - y^f$. That is, output growth falls below the level predicted by a univariate forecast if the real federal funds rate rose in the previous year. When *FF*2 is included, it has a smaller negative effect, with borderline significance (t=1.8). The sum of the coefficients on *FF*1 and *FF*2 is approximately -1.1. That is, a one-percentage-point rise in the real funds rate reduces output growth by 1.1 percentage points over two years.

The *FF* variables also have negative effects on $y^e - y^f$: rises in the real funds rate lead survey respondents to expect lower output. However, the effects on expected output are smaller than the effects on actual output: the sum of the coefficients on *FF*1 and *FF*2 is about -0.5. The effects of the *FF* variables on $y - y^e$, the expectational error, are the differences between their effects on actual and expected output. Thus a one-point rise in the funds rate reduces $y - y^e$ by a total of 1.1 - 0.5 = 0.6 percent. These effects of the funds rate are highly significant (p-value < .01).[4]

Figure 1 plots time series for $y - y^e$ and $FF1$. $FF1$ is plotted on an inverted scale to capture the negative relationship between the variables. The relationship between $FF1$ and $y - y^e$ is consistent over the sample, and does not depend on a few outliers. The relationship is clearest, however, in episodes of large policy shifts. The largest increases in $FF1$ occur in 1973:4 and 1981:4, which correspond to major tightenings by the Federal Reserve to fight inflation. (Recall that $FF1$ for quarter t is the change in the real funds rate from t-5 to t-1.) The largest decreases in $FF1$ occur in 1971:2, 1975:3, and 1983:3, which correspond to loosenings aimed at ending recessions. In all these episodes, $y - y^e$ moves sharply around the same time as $FF1$.[5]

The significant effect of the FF variables on $y - y^e$ is a violation of rational expectations, because survey respondents observe these variables when they form expectations. Rationality

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[4]Note that, in Table 1, each coefficient in the equation for $y - y^e$ is exactly the difference of the corresponding coefficients in the equations for $y - y^f$ and $y^e - y^f$. This fact follows algebraically from the properties of OLS.

[5]See Romer and Romer (1989, 1994) for discussions of Federal Reserve policy during the 1970s and 1980s.

is rejected because respondents systematically underestimate the effects of policy shifts, both tightenings and easings.[6]

B. Output: Robustness

Here we investigate the robustness of our findings by varying the specification in Table 1. We focus on our central result that lagged changes in monetary policy predict the expectational error $y - y^e$.

A More General Lag Structure: We first generalize the lag structure in our regressions for $y - y^e$. Rather than include *FF*1 and *FF*2, which are changes in the real funds rate over four-quarter periods, we enter quarterly changes in the rate from t-1 through t-9. That is, we allow each of the eight quarterly changes to have a different effect on $y - y^e$. With this specification, the first five lags of the change in the funds rate have coefficients ranging from -0.4 to -0.6, and all are significant at the five percent level. The coefficients on longer lags are below 0.05 in absolute value and highly insignificant. The significance of the first five lags confirms

[6] Some tests of rational expectations require micro data on the expectations of individual forecasters. Tests based on the mean forecast can be biased if different individuals have different information (Keane and Runkle, 1990). However, the particular tests that we perform with mean forecasts are valid. The reason is that we examine the predictive power of aggregate variables, *FF*1 and *FF*2, that are observed by all individuals (see note 3). Since everyone observes *FF*1 and *FF*2, rationality implies that these variables are uncorrelated with each individual's expectational error. Averaging across individuals, *FF*1 and *FF*2 must be uncorrelated with the mean expectational error under rationality.

our finding that policy shifts predict $y - y^e$, although the timing is slightly different than before.

Regime Shifts: So far we have treated the period from 1968 through 1995 as one monetary regime with a stable relationship between output and the federal funds rate. However, changes in the behavior of monetary policy could have caused this relationship to shift. To check this possibility, we examine the predictive power of our *FF* variables for $y - y^e$ in different subsamples. We break our sample at two points: 1979:4, when Paul Volcker announced his change in operating procedures, and 1986:1, when Taylor’s (1993) interest-rate rule begins to fit the data.

Table 2 presents regressions of $y - y^e$ on *FF*1 and *FF*2 for each of the three subsamples. The results for the first two periods are similar to those for the entire sample. The results for the post-1986 period are somewhat different: the sum of coefficients is close to that for the full sample, but it is *FF*2 rather than *FF*1 that is significantly negative. It appears that the lag between interest-rate changes and output surprises increased in the last period. A Chow test rejects stability across the three subsamples at the one percent level.

This finding does not, however, affect our central conclusions. In each of the three subsamples, the sum of coefficients on the two *FF* variables is significantly negative at the five percent level. Thus our finding that rises in the funds rate lead to negative output surprises is robust, although the timing differs across periods.

Controlling for Output Innovations: *FF*1 and *FF*2 are endogenous variables: policymakers adjust the real interest rate in response to developments in the economy. A natural question to ask is whether the predictable movements in $y - y^e$ that we detect are caused by the *FF* variables themselves, or by the variables to which the Fed is reacting -- in particular, past output movements.[7] To address this question, we add lags of output innovations to the equation for $y - y^e$ and examine whether the *FF* variables are still significant. Specifically, we include the average values of the innovation in actual output, $y - y^f$, over the periods from t-5 to t-1 and t-9 to t-5 (the periods used to measure *FF*1 and *FF*2).

The results of this exercise are anti-climactic. The effects of past output innovations on $y - y^e$ are highly insignificant. In addition, including these variables has little effect on the coefficients on *FF*1 and *FF*2: these are still jointly significant at the one percent level, with magnitudes close to those in Table 1 (-0.43 and -0.22).

Changes in the Nominal Federal Funds Rate: So far we have measured the stance of monetary policy with the real federal funds rate. However, the variable that the Fed controls directly is the nominal funds rate. In principle, the movements in real rates that predict $y - y^e$ might come from shifts in expected inflation rather than decisions by the Fed to shift the nominal

[7]We thank one of our referees for suggesting that we answer this question.

rate. Therefore, as a final robustness check, we regress $y - y^e$ on lagged changes in nominal rather than real rates.

Specifically, we construct nominal versions of the *FF* variables in our basic regressions. *FF*1 becomes the change in the nominal funds rate from t-5 to t-1, and *FF*2 is the nominal change from t-9 to t-5. When $y - y^e$ is regressed on these variables, the coefficients are -0.40 for *FF*1 and -0.10 for *FF*2. These coefficients are close to those for the real versions of *FF*1 and *FF*2, and they are jointly significant at the one percent level. Thus our conclusions again appear robust.[8]

C. Inflation

We now turn to our inflation variables, $\pi - \pi^f$, $\pi^e - \pi^f$, and $\pi - \pi^e$. Table 3 reports regressions of these variables on various combinations of *FF*1, *FF*2, and *FF*3, defined again as the changes in the real federal funds rate from t-5 to t-1, t-9 to t-5, and t-13 to t-9.

In the $\pi - \pi^f$ equations, *FF*1 has an insignificant coefficient and *FF*2 and *FF*3 have significantly negative coefficients. That is, a policy tightening reduces actual inflation with a two- to three-year lag, compared to a one-year lag for its effects on output. These results confirm previous findings about lags in the effects of policy (e.g., Christiano and Eichenbaum, 1992).

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[8] We have also experimented with real FF variables based on alternative measures of expected inflation, such as Livingston expectations over short horizons and lags of actual inflation. The results are always similar to those in Table 1.

The effects of policy on expected inflation are similar to the effects on actual inflation: in the equation for $\pi^e - \pi^f$, *FF*1 has an insignificant coefficient and *FF*2 and *FF*3 have significantly negative coefficients. Most important, in contrast to the results for output, the effects on actual and expected inflation are close quantitatively. The sum of coefficients when all three *FF* variables are included is -0.54 in the $\pi - \pi^f$ equation and -0.49 in the $\pi^e - \pi^f$ equation. Because of these similar results, one cannot reject the hypothesis that the *FF* variables have no effect on the expectational error $\pi - \pi^e$. The χ^2 statistics for this hypothesis have *p*-values ranging from 0.13 to 0.28, depending on the number of *FF* variables included. Thus there is little evidence against rationality of inflation expectations.[9]

As with our output regressions, we have varied our inflation equation in a number of ways, and generally find that our conclusions are robust.

IV. INTERPRETATION

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[9]The SPF provides expectations of nominal income as well as output and inflation. When we regress errors in nominal-income expectations on the *FF* variables, the coefficients are negative; when *FF*1, *FF*2, and *FF*3 are included, the sum of coefficients is -0.48. The negative nominal-income surprise after a tightening is consistent with the negative surprise in real output and near-zero surprise in inflation. However, the standard errors in our nominal-income equations are large, and so the effects of the *FF* variables on nominal-income surprises are not statistically significant.

A. Background

The behavior of expectations is crucial to the effects of monetary policy on real output. Recent research suggests that these effects are difficult to explain under the assumption of rational expectations, even using models with frictions in wage- and price-setting. In particular, models of staggered price adjustment such as Taylor (1979) do not capture the inertia that makes it costly to reduce inflation. With rational expectations, tight monetary policy can reduce inflation in these models without any loss of output (Ball, 1991; Fuhrer and Moore, 1995). This result conflicts with the empirical evidence that disinflations almost always cause recessions (e.g., Ball, 1994).

It is easier to explain the effects of monetary policy if expectations are less than fully rational (e.g., Roberts, 1997). Motivated by this idea, a large literature has tested the rationality of expectations in surveys such as the SPF. The results are mixed, and authors who survey the literature differ in their interpretations of the evidence (e.g., Lovell, 1986; Croushore, 1998; Roberts). Our results concerning output expectations are a new piece of negative evidence on the validity of rational expectations.[10]

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[10] Most previous papers that test rationality focus on expectations of inflation. Only a few examine output expectations, and most of these yield inconclusive results because the sample periods are short. Mild evidence against rationality is reported by Zarnowitz (1985), Swidler and Ketcher (1990), and Batchelor and Dua (1991).

Most important, we determine a particular direction in which rationality fails: output expectations underreact to shifts in monetary policy. This particular failure of rationality helps explain why policy is non-neutral. To demonstrate this point, the rest of this section analyzes a simple macroeconomic model with sticky prices. In this model, policy is neutral under rational expectations, but non-neutral if agents underestimate the effects of policy on aggregate demand. With this deviation from rationality, the model also fits our empirical results: policy shifts predict errors in output expectations but not inflation expectations.

B. Assumptions

We consider an economy with an aggregate-demand curve--a negative relation between the price level and aggregate spending:

$$(1) \qquad y = x - sp, \qquad s > 0,$$

where y is real output, p is the price level, and x is a term capturing shifts in demand (all variables are in logs). The shift term x is determined by lagged monetary policy:

$$(2) \qquad x = q_{-1},$$

where q_{-1} measures the stance of monetary policy in the previous period. In comparing our empirical results to the model, we interpret a rise in the real federal funds rate as a fall in q.

For simplicity, we ignore non-monetary shocks that shift aggregate demand.

The supply side of the economy is given by a simple sticky-price model. A firm's desired nominal price, p^*, is given by

$$(3) \qquad p^* = p + vy, \qquad v > 0,$$

which follows from the canonical macroeconomic model with monopolistic competition. Intuitively, an increase in aggregate spending shifts out a firm's demand curve, raising its desired relative price. (See Romer, 1996, Chapter 6.) A firm must set its price a period in advance. It chooses a price equal to its expected optimal price, $p^e + vy^e$, where a superscript e denotes expectations in the previous period. All firms are identical, so this expression gives the aggregate price level as well as individual prices:

$$(4) \qquad p = p^e + vy^e.$$

Most authors who study models such as ours assume rational expectations (see Romer, for example). We are interested, however, in the idea that agents underestimate the effects of policy shifts on aggregate demand. A simple version of this behavior is static expectations about the demand-shifter x: $x^e = x_{-1}$. Under this assumption, price setters believe that demand is the same as in the previous period. Since $x = q_{-1}$, this is equivalent to believing that q_{-1} equals q_{-2}: price setters ignore the most recent shift in policy. Our assumption of static demand expectations is, of course, extreme; future work could consider cases in which expectations react partially to policy shifts.

Aside from ignoring the most recent policy shift, firms behave rationally. In particular, they form rational expectations of p and y conditional on their beliefs about x, and the knowledge that other firms have the same beliefs.

C. The Effects of Policy

We now examine the effects of policy in our model. We assume that the policy stance q shifts over time and derive the behavior of actual and expected inflation and output. The nature of the process driving q is not important for our purposes.

As a benchmark, we first consider the case in which expectations are fully rational. In our model, current variables are determined entirely by q_{-1}, which is known when prices are set. Thus rational expectations is equivalent to perfect foresight: $p^e = p$ and $y^e = y$. Substituting these results into (1) and (4) yields $y = 0$ and $p = x/s = q_{-1}/s$. Note that output is not affected by the path of policy.

We now assume static expectations about x: $x^e = x_{-1}$. Taking expectations of equation (1) yields $y^e = x^e - sp^e$, and hence $y^e = x_{-1} - sp^e$. Taking expectations of equation (4) yields $p^e = p^e + vy^e$, and hence $y^e = 0$. Combining these results and using (4) again yields $p = p^e = x_{-1}/s$. Finally, substituting the solution for p into (1) yields $y = x - x_{-1} = q_{-1} - q_{-2}$. Combining these results, we obtain[11]

$$y - y^e = x - x_{-1} = q_{-1} - q_{-2}; \tag{5}$$

$$p - p^e = 0. \tag{6}$$

With static demand expectations, a shift in the policy stance affects actual output: y depends on $q_{-1} - q_{-2}$. In addition, equations (5) and (6) match our empirical findings about expectations: a policy loosening leads to a positive output surprise, but it does not cause an inflation surprise. Thus our model produces an explanation for monetary non-neutrality, and the model's empirical predictions are supported by the data.

Results (5) and (6) reflect the assumption that prices are set before demand is determined. A change in demand, which is a surprise under static expectations, produces a contemporaneous surprise in output. In contrast, prices adjust to demand with a lag. Thus price changes are anticipated even if agents ignore the current shift in demand.

D. An Alternative Interpretation

In our model, the behavior of expectations is in one way naive: agents ignore public information about monetary policy.

[11]These derivations use our assumption that price setters form rational expectations conditional on their beliefs about demand. After setting $x^e = x_{-1}$, we derive the behavior of y and p through standard rational-expectations arguments.

At the same time, we have followed rational-expectations models in assuming that agents know the true structure of the economy, equations (1)-(3). This degree of sophistication may seem odd for agents who ignore key data. We will therefore mention a different interpretation of our model that may seem more natural.

In this interpretation, we follow Sargent (1999) in viewing agents as "econometricians." They do <u>not</u> know the structure of the economy. However, they can determine reduced-form relations between macroeconomic variables by running regressions with historical data. They use their reduced-form equations to make atheoretical forecasts of output and inflation.

In many models, including ours, atheoretical forecasting based on all information converges in equilibrium to rational expectations. To break this equivalence, we introduce an imperfection in the forecasting process. Agents make forecasts based on correct reduced-form equations, but their data are not up to date. Specifically, as assumed above, they ignore the most recent shift in monetary policy -- they believe that q_{-1} equals q_{-2}. We can interpret this imperfection as arising from costs of gathering and processing information, which lead agents to update their data with a lag (see Mankiw and Reis, 2001).

Our earlier theoretical results are consistent with this interpretation of expectations. To see this, recall that equilibrium output in our model is given by $q_{-1} - q_{-2}$ and the price level is given by $x_{-1}/s = q_{-2}/s$. Suppose that agents know these reduced-form equations, but set q_{-1} equal to q_{-2} in forecasting. In this case, their expectation of output is zero. Their expectation of the price level equals the true price level, because the most recent change in policy is irrelevant. These solutions for expected output and inflation are the same as those derived above. Thus we can interpret the agents in our equilibrium as econometricians with imperfect data sets.

V. CONCLUSION

This paper presents new evidence against the rational expectations hypothesis: shifts in the real federal funds rate predict errors in output expectations in the Survey of Professional Forecasters. We explain our results with a model in which agents systematically underestimate the effects of policy shifts on aggregate demand. This deviation from rationality helps explain the real effects of monetary policy.

Why are expectations less than fully rational? We have mentioned the idea that agents do not gather the most recent data on all relevant variables, because it costly to do so. However, this story may not fit the individuals in the SPF, who as professional forecasters have strong incentives to use all information. Lamont (1995) suggests that forecasters violate rationality because they have objectives other than minimizing forecast errors, such as building their reputations. But similar violations of rationality occur in surveys of consumers, who do not have such objectives (Ball and Croushore, 1995). Explaining the behavior of expectations is a crucial open area for research.

Table 1
Output Expectations
Survey of Professional Forecasters
1968Q4 to 1995Q2 (N = 107)

	$y - y^f$		$y^e - y^f$		$y - y^e$	
FF1	-0.878 (0.208)	-0.880 (0.223)	-0.413 (0.188)	-0.414 (0.193)	-0.464 (0.143)	-0.466 (0.155)
FF2	-	-0.243 (0.135)	-	-0.105 (0.157)	-	-0.138 (0.085)
χ^2 sig.	<.01	<.01	.03	.09	<.01	<.01
$\bar{R}^2$	.40	.42	-.02	-.05	.20	.21

Notes: This table reports results from regressing the column variable on the *FF* variable(s) listed in the rows. The regression coefficients are listed, with standard errors in parentheses. χ^2 sig. is the significance level for the test that the coefficients on all the *FF* variables are zero.

Table 2
Output Expectations in Subsamples
Survey of Professional Forecasters
(Dependent variable: $y - y^e$)

	1968Q4 to 1995Q2		1968Q4 to 1979Q3		1979Q4 to 1985Q4		1986Q1 to 1995Q2	
FF1	-0.464	-0.466	-0.619	-0.634	-0.416	-0.425	-0.049	0.141
	(0.143)	(0.155)	(0.254)	(0.269)	(0.150)	(0.161)	(0.140)	(0.194)
FF2	-	-0.138	-	-0.089	-	-0.087	-	-0.637
		(0.085)		(0.126)		(0.112)		(0.152)

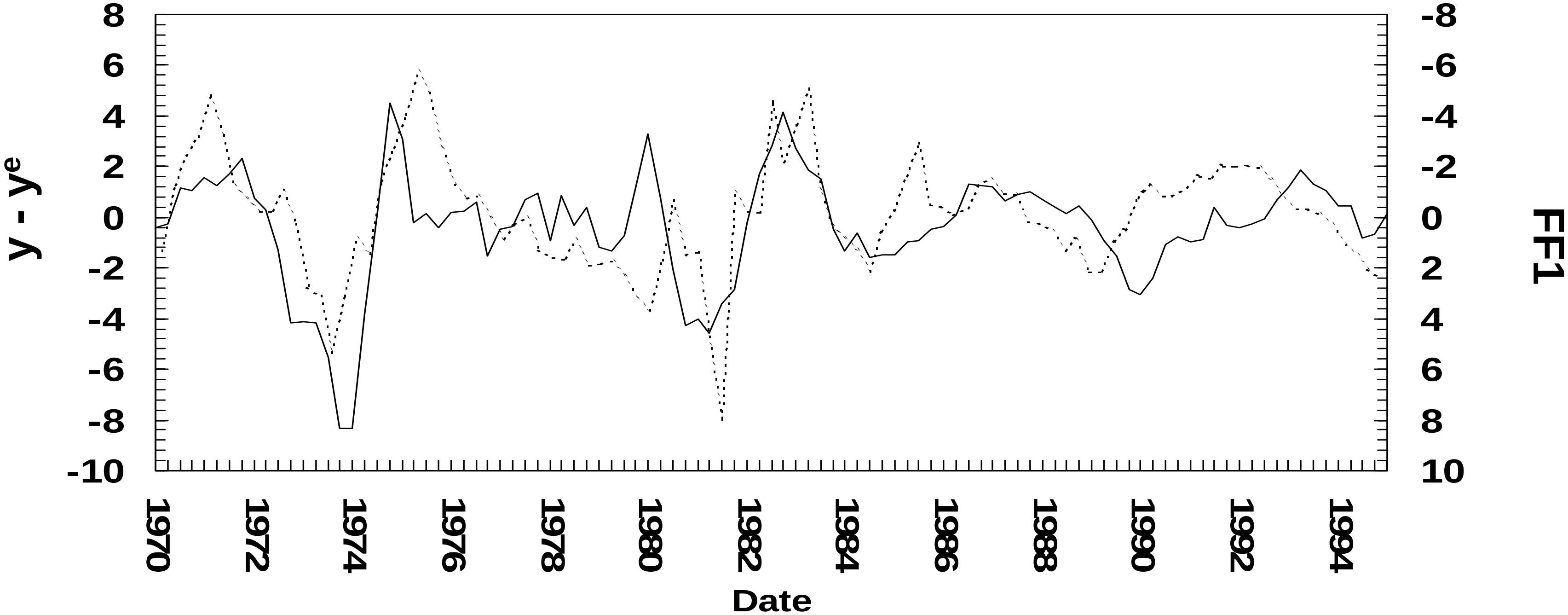
Notes: This table reports results from regressing $y - y^e$ on the *FF* variable(s) listed in the rows. The regression coefficients are listed, with standard errors in parentheses.

Table 3
Inflation Expectations
Survey of Professional Forecasters
1968Q4 to 1995Q2 (N = 107)

	$\pi - \pi^f$			$\pi^e - \pi^f$			$\pi - \pi^e$		
FF1	0.272	0.278	0.155	-0.010	-0.005	-0.081	0.282	0.283	0.236
	(0.215)	(0.222)	(0.211)	(0.108)	(0.110)	(0.102)	(0.184)	(0.189)	(0.184)
FF2	-	-0.340	-0.339	-	-0.305	-0.302	-	-0.035	-0.037
		(0.126)	(0.122)		(0.114)	(0.117)		(0.078)	(0.070)
FF3	-	-	-0.355	-	-	-0.105	-	-	-0.250
			(0.153)			(0.047)			(0.150)
χ^2 sig.	.21	.03	.02	.93	.01	<.01	.13	.28	.13
$\bar{R}^2$	.07	.19	.31	-.05	.17	.21	.12	.12	.21

Notes: This table reports results from regressing the column variable on the *FF* variable(s) listed in the rows. The regression coefficients are listed, with standard errors in parentheses. χ^2 sig. is the significance level for the test that the coefficients on all the *FF* variables are zero.

Figure 1
Policy Shifts and Errors in Output Expectations



$y - y^e$: solid line FF1: dashed line

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