

Making the Systematic Part of Monetary Policy Transparent

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Since the 1990s, central banks have made monetary policy increasingly transparent. In February 1994, in a statement released after the Federal Open Market Committee (FOMC) meeting, the FOMC began to announce whether it had changed its funds rate target. In August 1997, the FOMC began to announce a quantitative target for the funds rate. In May 1999, it began to offer information about the likely near-term behavior of the funds rate. However, the FOMC's ability to continue down this route is limited. Signaling the future behavior of the funds rate is limited by the difficulty of forecasting economic activity.

Continued significant progress toward broader transparency will require the FOMC to explain funds rate behavior using state-contingent language. That is, apart from forecasting the future behavior of the funds rate, the FOMC will need to explain how it varies the funds rate in response to incoming data. A description by the FOMC of its behavior in terms of state-contingent language would emerge as a by-product of explicitness about objectives and the strategy for achieving those objectives. Such explicitness would also require the FOMC to flag publicly departures from standard procedures for changing the funds rate. Although nothing in an attempt by the FOMC to clarify the underlying consistency in its behavior requires commitment, the attempt does imply a high degree of public communication and dialogue.

■ The views in this article are the author's own, not those of the Federal Reserve Bank of Richmond. Specifically, the characterizations of FOMC behavior contained in the article do not represent an official view of the Federal Reserve System but are inferences drawn by the author. The author's manuscript, *The Monetary Policy of the Federal Reserve System: An Analytical History*, provides an overview of the evolution of the monetary policy procedures summarized in this article. I thank Andreas Hornstein, Yash Mehra, Pierre Sarte, and Alexander Wolman for critical comments and Christopher Herrington and Brian Minton for research assistance.

All the issues raised by the perennial rules versus discretion debate would be on the table. Is Lucas (1981) correct that the consistent behavior required to influence expectations reliably is a prerequisite for predicting the effect of monetary policy actions and thus for a stabilizing monetary policy? In contrast, is the flexibility to depart from established procedures in response to unusual events a prerequisite for a stabilizing monetary policy? Would state-contingent language be a desirable move toward rules or an undesirable move away from discretion?

Section 1 reviews how the desire of Volcker's and Greenspan's FOMCs to reshape the inflationary expectations inherited from the prior period of stop-go monetary policy imposed an underlying consistency on monetary policy. Empirical support for the conduct of monetary policy by a rule derives from the overall consistency of policy in this period.¹ Section 2 offers an empirical overview of monetary policy in the Volcker-Greenspan (V-G) era. Section 3 reviews the argument for transparency about the systematic part of policy. Of course, articulating a state-contingent approach would require a common understanding of that approach by members of the committee. I propose that the FOMC organize its discussion to elucidate the systematic part of policy. Section 4 suggests a policy rule intended to capture the systematic way in which the FOMC sets the funds rate and discusses the ongoing monitoring necessary to assess the credibility of the rule. Section 5 uses a model to understand how the rule would work. Section 6 discusses the feasibility of incorporating asset prices into a simple rule.

1. AN EXPECTATIONS-FOCUSED MONETARY POLICY

A persistent attempt to change the inflationary expectations conditioned by the stop-go era defined the V-G era. Documentary evidence attests to the importance that Volcker and Greenspan attached to restoring nominal expectational stability. Specifically, they wanted to 1) lower the inflation premium in long-term interest rates, 2) eliminate the positive correlation between above-trend real growth and expected trend inflation, and 3) eliminate the positive correlation between inflation shocks and expected trend inflation. As a result of this emphasis upon restoring expectational stability, Volcker and Greenspan largely behaved in a consistent way over their tenure. Taken together with the reduced variability in both inflation and real output relative to the stop-go period, this consistency favors a policy rule rather than a discretionary policy undisciplined by explicit objectives and strategy.

Formula (1) summarizes the article's hypothesis about what constitutes the consistent part of the V-G monetary policy procedures:

¹ Consistency does not imply commitment the way a rule does.

$$i_t = i_{t-1} + \alpha(\pi_t^e - \pi^*) + \beta \Delta R_t^{RU} \quad \alpha, \beta > 0, \quad (1)$$

where i_t is the funds rate, π_t^e is expected inflation, π^* is the inflation target, and ΔR_t^{RU} is an estimate of persistence in the change in the rate of resource utilization. The variable ΔR_t^{RU} measures the extent to which output is growing faster than potential output in a sustained way, that is, $(\Delta y_t^S - \Delta y_t^P) > 0$, where (the log of) real output is y_t . The superscript “s” indicates “smoothed” real output, that is, output purged of transitory factors. The superscript “p” indicates potential output and the first-difference operator is Δ .

The definition of potential output requires a model. With the New Keynesian model used in Section 5, potential output is the output that would obtain with perfectly flexible prices. However, that definition lacks operational content. The hypothesis here is that the FOMC does not work off estimates of the level of or change in potential output, but rather looks for evidence of a sustained change in the rate of resource utilization. Although macroeconomic shocks cause changes in the optimal degree of resource utilization, the working assumption of policy is that rates of resource utilization cannot indefinitely increase or decrease. With (1), the funds rate moved in response to evidence of sustained changes in the degree of resource utilization. Also, it raised the funds rate above its prevailing value if evidence from the bond market indicated that expected inflation exceeded its implicit target.

The importance Volcker and Greenspan attached to expectations showed in their description of a Kydland-Prescott (1977) world where expectations frustrate the effect of stimulative policy on output.² Volcker (1980) observed

[T]he idea of a sustainable “trade off” between inflation and prosperity. . . broke down as businessmen and individuals learned to anticipate inflation, and to act in this anticipation. . . . The result is that orthodox monetary or fiscal measures designed to stimulate could potentially be thwarted by the self-protective instincts of financial and other markets. Quite specifically, when financial markets jump to anticipate inflationary consequences, and workers and businesses act on the same assumption, there is room for grave doubt that the traditional measures of purely demand stimulus can succeed in their avowed purpose of enhancing real growth.

Greenspan (Senate 1993, 55–6) made the same point:

The effects of policy on the economy depend critically on how market participants react to actions taken by the Federal Reserve, as well as on expectations of our future actions. . . . [T]he huge losses suffered by bondholders during the 1970s and early 1980s sensitized them to the

² See also Goodfriend and King (2004) and Lindsey, Orphanides, and Rasche (2005).

slightest sign...of rising inflation... An overly expansionary monetary policy, or even its anticipation, is embedded fairly soon in higher inflationary expectations and nominal bond yields. Producers incorporate expected cost increases quickly into their own prices, and eventually any increase in output disappears as inflation rises.

In commenting on the slow recovery from the 1990 recession, Greenspan (Senate 1993) attested to the sensitivity of policy to expected inflation:

[S]ome have argued that monetary policy has been too cautious, that short-term rates should have been lowered more sharply... [T]hese arguments miss the crucial features of our current experience: the sensitivity of inflation expectations... Lower inflation and intermediate- and long-term interest rates are essential to the needed structural adjustments in our economy, and monetary policy thus has given considerable weight to encouraging the downtrend of such rates.

In building credibility, the FOMC was sensitive to how a positive growth gap could exacerbate inflationary expectations.³ For that reason, it behaved preemptively with respect to inflation. Greenspan (House 1994, 11) testified,

[C]ritics of our latest policy actions have noted that we tightened policy even though inflation had not yet picked up. That observation is accurate, but is not relevant... [T]hrough much of this nation's history, we had periods of tightened labor and product markets with only transitory effects on the general price level. In these periods the discipline on credit expansion provided by the gold standard...limited the potential for prices to spiral upward and thus kept long-term inflation expectations from rising. After World War II, however, with those disciplines no longer in place, tightened markets became increasingly associated with rising inflation expectations... There remains a significant inflation premium embodied in long-term interest rates, reflecting a still skeptical world financial market view that American fiscal and monetary policies retain some inflation bias.

In 1994, the association of a positive growth gap with expected inflation motivated the decisive increase in the funds rate. Greenspan (House 1994, 44–45, 49) testified after the first 25-basis-point increase,

[M]arkets appear to be concerned that a strengthening economy is sowing the seeds of an acceleration in prices... [A] clear lesson we have learned

³The reduction in inflation in the last half of the 1990s followed the generally restrictive policy followed from 1989 through 1995. That is, it followed the continuation of the soft-landing strategy that kept real interest rates unusually high during the recovery from the 1990 recession (the “jobless recovery”) and the sharp rise in rates in 1994 and early 1995.

over the decades since World War II is the key role of inflation expectations in the inflation process. . . . The test of successful monetary policy in such a business-cycle phase is our ability to limit the upward movement of long-term rates. . . . When we take credible steps to head off inflation before it can begin to intensify, the effects on long-term rates are muted. By contrast, when Federal Reserve action is seen as lagging behind the need to counter a buildup of inflation pressures, long rates have tended to move sharply higher. . . . Failure to tighten in a timely manner will lead to higher than necessary nominal long-term rates as inflation expectations intensify.

The testimony of former FOMC Chairman Greenspan in defense of preemptive interest rate increases is consistent with the view that the FOMC raises the funds rate in response to a persistent positive growth gap. However, it does not assign significance to particular measures of the level of excess capacity, output gap, or unemployment rate as predictors of inflation. The emphasis on changing measures of resource utilization, evidenced by the use of terms like “stress” and “imbalances,” eliminates the need to make a numerical assessment of the level and growth rate of potential output or growth gap.

A “flexible” relationship between measures of excess capacity and inflation makes such measures unreliable indicators of inflation.⁴ Greenspan (Senate 1995, 4–5) explained the interest rate increases in 1994 as a response to the *increase* in resource utilization rates.⁵

It is possible for the economy to exceed so-called “potential” for a time without adverse consequences by extending work hours, by deferring maintenance, and by forgoing longer-term projects. . . . History shows clearly that given levels of resource utilization can be associated with a wide range of inflation rates. Accordingly, policymakers must monitor developments on an ongoing basis to gauge when economic potential is actually beginning to become strained, irrespective of where current unemployment rates and capacity utilization rates may lie.

Greenspan then listed various indicators of increased resource utilization such as purchasing managers’ reports of slower supplier deliveries, shortages of workers, and anticipatory inventory building that produced increases in raw materials prices accompanied by anecdotal reports of firms’ markup of final

⁴ The word is Greenspan’s (see the following Greenspan references). See Orphanides (2001, 2003a, 2003b, 2003c, 2004), and Orphanides and van Norden (2002, 2004) for discussion of the problems raised by use of an output gap as a monetary policy indicator.

⁵ See also Greenspan (House 1999, 57) and his reply to Rep. Frank’s (p. 19) question, “What is the potential output growth rate of the economy?” “We cannot tell at any particular point in time what the actual potential is. . . . But it shouldn’t be our concern. Our concern should be the imbalances that emerge.”

goods prices over these increased costs. In other testimony, he mentioned average weekly hours worked.⁶

Employment growth that exceeds labor force growth is a commonly referenced indicator of a positive growth gap. Greenspan (Senate 2000, 14) explained to Sen. Bunning:

The question of how fast this economy grows is not something the central bank should be involved in. . . . What we are looking at is basically the indications that demand chronically exceeds supply. . . . The best way to measure that is to look at what is happening to the total number of people who, one, are unemployed or, two, are not in the labor force but want a job, from which we are getting increased production. . . . [W]hat it is that we are concerned about is not the rate of increase in demand or the rate of increase in supply, but only the difference between the two. . . . The difference between the two is measurable by. . . the amount of goods that are produced as a consequence of the unemployment rate falling. . . .

2. AN EMPIRICAL SUMMARY OF THE VOLCKER-GREENSPAN ERA

The policy summarized by formula (1) implies a positive relationship between funds rate changes and two variables: (1) a growth gap, which is the difference between “actual” and “sustainable” real growth, and 2) a credibility gap, which is the difference between expected inflation and an implicit inflation target. I constructed proxies for these variables. For the growth gap, the “actual” variable used Greenbook GDP forecasts.⁷ The “sustainable” variable expresses the path for real growth that the FOMC believed would bring actual growth in line with trend real growth. Hence, this notion of sustainability allows for growth to be faster or slower when an output gap is being closed, but represents growth that does not close the gap “too fast.” To proxy for sustainable growth, I used the midpoint of the “central tendency” range of forecasts of real output growth that the FOMC chairman presents in biannual congressional oversight hearings (see “Appendix: FOMC Data”). Because FOMC members make these forecasts based on an assumption of “appropriate” monetary policy, they implicitly assume a funds rate path estimated to

⁶ See Greenspan (Senate 1995, 18; House 1994, 12).

⁷ If an FOMC meeting was in the first or second month of the quarter, I used the forecast of growth for the contemporaneous quarter. If the meeting was in the last month of the quarter, I used the forecast for the succeeding quarter. Greenbook data are confidential for five full calendar years after an FOMC meeting. See “Appendix C: FOMC Data” for a discussion of the Greenbook and the data.

bring real output growth in line with trend growth.⁸ The forecasts thus proxy for the growth considered compatible with a path moving to trend.⁹

In Figure 1, the diamonds mark episodes (derived from visual examination) of funds rate behavior unexplained by the growth gaps. In each case, the behavior of the bond rate offers an explanation. The diamonds on the graph of the bond rate in Figure 2 correspond to those on Figure 1. Of the ten episodes marked, eight correspond to instances when the FOMC raised the funds rate in the absence of predicted strength in economic activity. As shown in Figure 2, they correspond to “inflation scares,” discrete increases in the bond rate (Goodfriend 1993). In the remaining two episodes, the FOMC failed to lower the funds rate despite projected weakness in economic activity. They correspond to bond rates indicating relatively high levels of expected inflation.¹⁰ The diamonds thus mark FOMC policy actions taken to bring the public’s expectation of inflation into line with the FOMC’s implicit inflation target.¹¹

The episodes marked by diamonds illustrate the FOMC’s concern with inflationary expectations. FOMC procedures were preemptive in that the FOMC responded to expected inflation, not to realized inflation. For example, when the funds rate rose dramatically in 1984, CPI inflation had already fallen to 4 percent. In 1994, when the FOMC also raised the funds rate dramatically, CPI inflation was falling to around 2.5 percent from the prior 3 percent level. Greenspan (House 1998, 12) likened responding to realized inflation (“what inflation is now”) to “looking in a rearview mirror.” I therefore used changes in bond rates as a proxy for the behavior of the credibility gap.¹²

The Taylor rule offers a different summary of monetary policy than formula (1). The latter is less demanding in its assumption that the FOMC needed

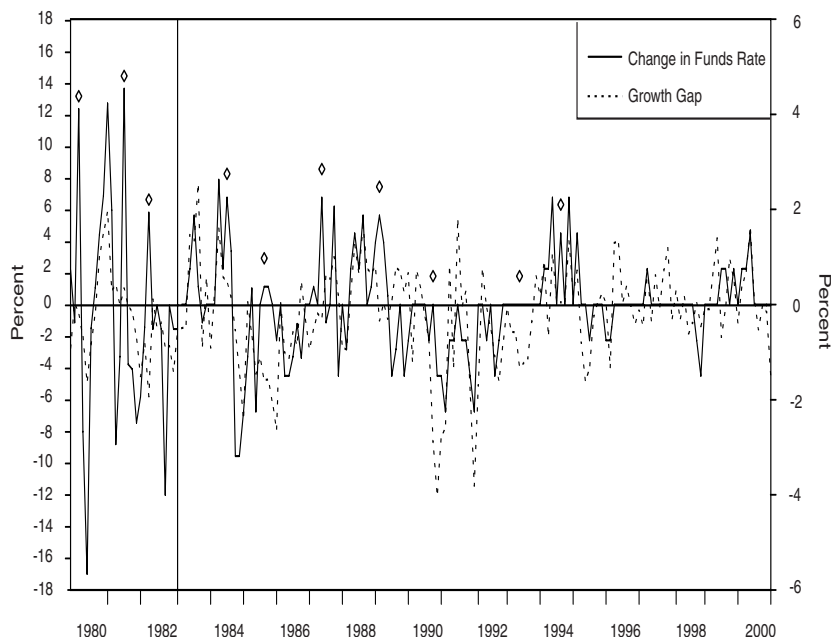
⁸The word “appropriate” is contained in the instructions sent by the FOMC secretary to FOMC members. Volcker (7/28/83, 283) commented: “[T]hose projections reflect a view as to what outcome should be both feasible and acceptable...otherwise monetary policy targets would presumably be changed.”

⁹For the FOMC meetings in the first five months of the year, I used the central tendency range from the February oversight hearings. For the remainder of the meetings, the range came from the July oversight hearings. These predictions are for the calendar year. The proxy for sustainable growth for the last half of the year is the midpoint of the central tendency range for the year divided by the annualized growth rate predicted in the Greenbook for the first half.

¹⁰These two episodes relate to the FOMC’s “soft-landing” strategy to restore price stability. The FOMC had brought inflation down to 4 percent in 1983. In 1988, it decided to continue with the restoration of price stability. See the Greenspan (Senate 1993) quote above. The sharp funds rate reduction in August 1982 reflected the onset of the LDC debt crisis. The funds rate reductions in the last half of 1989, which do not correspond to economic weakness, reflected the problems, which came to a head at this time with the S&Ls and some large regional banks.

¹¹The “implicit” language is from former Board Governor Laurence Meyer. For example, Meyer (2004, 201) wrote, “[I]n the second half of the 1990s, inflation was above the FOMC’s implicit target. . . . Core inflation (measured by the 12-month inflation rate for the core CPI) declined from 2.5 percent in late 2002. This was still at or above the FOMC’s implicit target.”

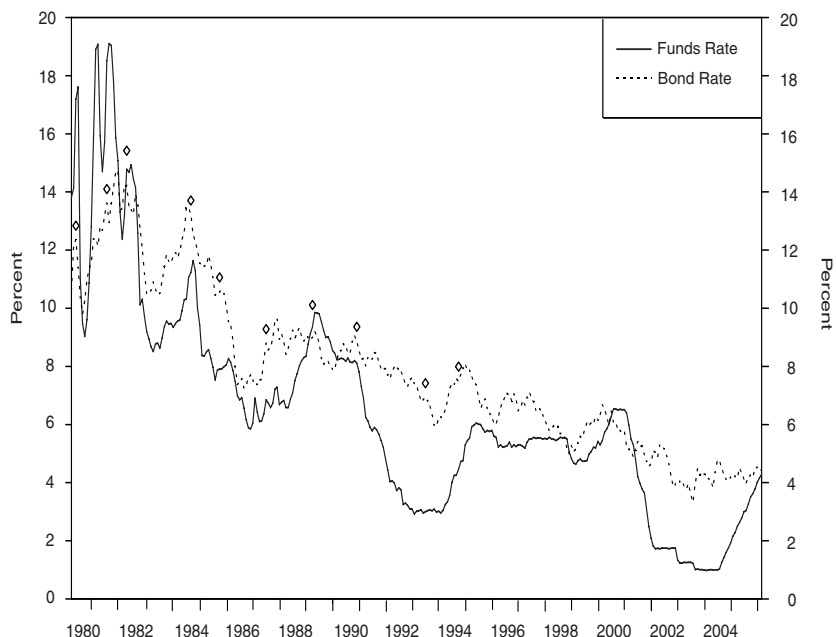
¹²Specifically, I used inter-meeting changes in the bond rate (30-year through 1999 and 10-year thereafter).

Figure 1 Growth Gap and Funds Rate Changes

Notes: Observations are for FOMC meetings. The growth gap is the difference between contemporaneously available forecasts of real growth from the Greenbook and sustainable growth proxied for by the midpoint of the central tendency figure for real growth presented by the FOMC chairman in the prior February or July congressional oversight (Humphrey-Hawkins) hearings. Left scale is for the 1980–1982 period and right scale is for the subsequent period. The funds rate is the “target” set at FOMC meetings (see footnote 12). Changes in the funds rate are multiplied by three. Diamonds mark the following dates: March 1980, May 1981, February 1982, July 1984, August 1985, May 1987, February 1989, October 1990, May 1993, and August 1994. Tick marks indicate December FOMC meetings.

only make a decision about the change in resource utilization rather than decide upon the extent of idle resources (an output gap). Also the Taylor rule implies that the FOMC controlled inflation in the V-G era through a willingness to increase the funds rate more than increases in inflation. However, the Taylor rule does not express the preemptive way in which the FOMC raised the funds rate in response to increases in expected inflation, even when actual inflation remained quiescent.¹³ As a test of the Taylor rule, I included an infla-

¹³ Hetzel (2000) argues that empirically estimated Taylor rules are not identified. That is, they fit primarily because of common trends in inflation and the funds rate.

Figure 2 The Funds and Bond Rate

Notes: Monthly observations of the funds rate and the bond rate. Prior to 2000, the bond rate is the 30-year Treasury constant maturity series; thereafter, it is the 10-year series. Diamonds mark the following dates: March 1980, May 1981, February 1982, July 1984, August 1985, May 1987, February 1989, October 1990, May 1993, and August 1994. Tick marks indicate December meetings.

tion gap variable: the gap between actual inflation and the FOMC's implicit "interim" target for inflation, where "interim" is analogous to "sustainable" real growth. The interim target keeps inflation on a path compatible with a longer-run target.

Because the FOMC controls inflation (apart from transitory fluctuations), forecasting inflation for FOMC members is not like forecasting the weather. A forecast of a high or rising inflation rate would imply inappropriate monetary policy (as long as inflation was not *lower* than desired). In congressional testimony, Greenspan (U.S. Congress, February 24, 1998, p. 266) commented, "[T]he policymakers' forecasts also reflect their determination to hold the line on inflation."¹⁴ As a proxy for an interim inflation target, I, therefore, used

¹⁴ In 2000, the European Central Bank (ECB) debated public release of the inflation forecasts that its own and member bank staffs make biannually. That debate raised the obvious problem with a central bank making a "forecast" of inflation when inflation is the variable that it targets

Table 1 Funds Rate Correlations

$$\Delta FR = .11 GG + .03 MISSI + .32 \Delta BR + .14 \Delta BRL1 + \hat{u}$$

(5.5) (2.3) (5.3) (2.4)

$$CRSQ = .41 \quad SEE = .25 \quad DW=1.6 \quad DF = 144 \quad \text{date: } 2/83 \text{ to } 12/00$$

Notes: ΔFR is the change in the funds rate following FOMC meetings. GG is the growth gap, the difference between actual and sustainable real output growth. $MISSI$ is the difference between actual and targeted inflation. ΔBR is the change in the bond rate observed the day prior to FOMC meetings (30-year through 1999 and 10-year thereafter) and is set equal to zero after 1994. $\Delta BRL1$ is the lagged value of the change in the bond rate.

$CRSQ$ is the corrected R-squared; SEE , the standard error of estimate; DW , the Durbin-Watson statistic; and DF , degrees of freedom. Absolute value of t-statistics is in parentheses.

the midpoint of the central tendency figure given by the chairman in biannual congressional oversight hearings (analogously to the proxy for sustainable real output growth). I constructed the proxy for actual inflation in the same way as the proxy for actual output growth.

In the regression of Table 1, the dependent variable is changes in the funds rate between FOMC meetings, and the independent variables are the proxies for the growth gap, the inflation miss, and the credibility gap. Because the bond rate variable loses explanatory power after 1995, it is set to zero from 1996 onward. The credibility the FOMC gained in 1994 and 1995 apparently meant that the FOMC did not need to look to bond rates as a measure of expected inflation. The regression also includes misses of actual inflation from target, where the actual and targeted values are calculated analogously to the growth gap.¹⁵

The regression runs from February 1983, when the FOMC abandoned its nonborrowed reserves procedures, through December 2000, after which Greenbook forecasts are confidential. A statistically significant relationship exists between changes in the funds rate target and the independent variables.¹⁶ However, the F-statistic from an F-test of the significance of the inflation-miss term is barely significant at the 5 percent level, while the growth gap and bond

and controls. The central bank cannot forecast an inflation rate that is different from its target, explicit in the case of the ECB. A forecast of an inflation rate higher than the central bank's target could make labor unions or bond holders set prices inappropriately (*Financial Times* 2000).

¹⁵ We are hence modelling behavior as if the FOMC was following the rule (1) with sustainable output growth and targeted inflation calculated from semi-annual forecasts.

¹⁶ Problems with the proxy for the growth gap lower its correlation with changes in the funds rate. For example, the Greenbook forecast of real output growth may incorporate transitory factors to which the FOMC does not respond. The FOMC need not accept the Board staff forecast. Many factors involving the timing of funds rate changes introduce noise. At an inflection point in the funds rate, the FOMC changes the funds rate only after enough data have accumulated that a near-term reversal is highly unlikely.

rate terms are highly significant.¹⁷ Figure 3 shows within-sample simulated values from the regression. The growth gap is the dominant independent variable. Simulated values are largely unchanged with omission of the bond-rate and inflation-miss terms.

The continuity in FOMC procedures is evident in recent funds rate increases. Although the recovery from recession began in November 2001, the FOMC started moving away from its 1 percent funds rate target only in May 2004 when it became clear that real output growth was exceeding potential.¹⁸ In March 2004, at 5.7 percent, the unemployment rate was still near its cyclical 6 percent peak. However, the release of strong payroll employment data in April and May made it seem likely that the economy was growing faster than potential.

Moreover, the FOMC faced a small inflation scare. Core PCE inflation (the PCE deflator excluding food and energy) had averaged an annualized .8 percent over the first eight months of 2003. Over the six months from October 2003 through March 2004, it jumped to 2.1 percent. In response, the inflation compensation number calculated from the ten-year nominal and inflation-indexed Treasury yield spread, which had been as low as 1.6 percent in June 2003, began to rise and reached 2.6 percent by May 2004. The FOMC advertised its commitment to control inflation through the steady stream of increases in the funds rate, despite episodes of apparent developing weakness in economic activity in summer and fall 2004 and in spring 2005 (Appendix A: Fluctuations in Economic Activity).

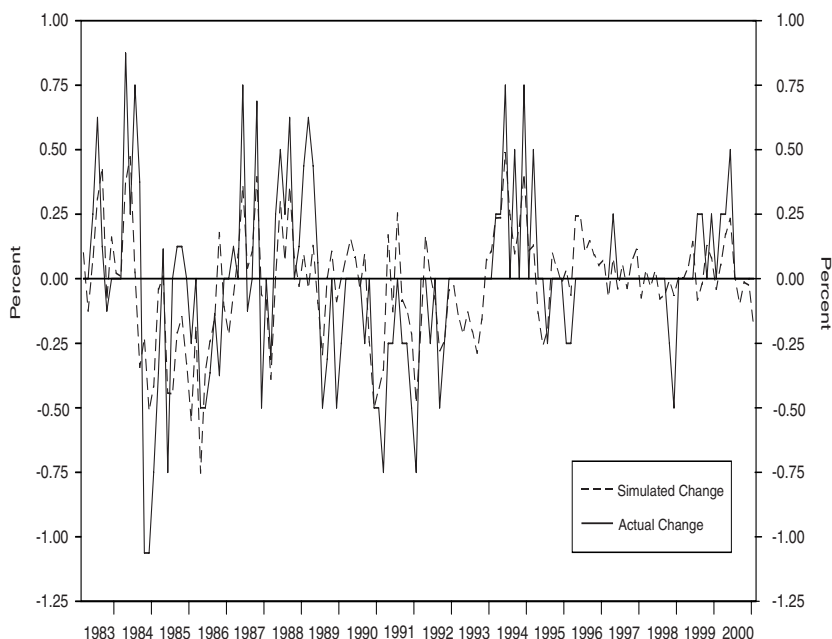
3. MAKING THE CONSISTENCY IN FOMC BEHAVIOR EXPLICIT

Transparency refers to the clarity with which central banks state their objectives and their strategy for achieving those objectives. State-contingent language would represent the practical working out of explicit transparent procedures. Woodford (2005) summarizes the professional consensus for explicitness about the systematic part of monetary policy:

Because the key decision-makers in an economy are forward-looking, central banks affect the economy as much through their influence on *expectations* as through any direct, mechanical effects of central bank trading in the market for overnight cash. As a consequence, there is good reason for a central bank to commit itself to a systematic approach to

¹⁷The F-statistic for the 5 percent level of significance is 3.8. The F-statistic for the growth gap is 30.0 and for the bond rate 16.1. For the inflation-miss term, it is 5.4.

¹⁸It changed the directive language from “[T]he Committee believes that it can be patient in removing its policy accommodation” to “[T]he Committee believes that policy accommodation can be removed at a pace that is likely to be measured.”

Figure 3 Actual and Simulated Funds Rate Change

Notes: Predicted values are within sample simulations. Tick marks indicate December FOMC meetings.

policy that not only provides an explicit framework for decision-making within the bank, but that is also used to explain the bank's decisions to the public. The signals that have been given thus far through the post-meeting [FOMC] statements all attempt to say something about the likely path of the funds rate for the next several months; . . . they do not speak of the way in which future policy should be *contingent* on circumstances that are not already evident. If the statements are interpreted as *commitments* to particular non-state-contingent paths for the funds rate. . . then they are likely to constrain policy in ways that are not fully ideal. For while an optimal policy commitment will generally imply that policy should be *history-dependent*. . . , it will also generally imply the policy should be *state-contingent* as well. [italics in original]

Woodford distinguishes between two kinds of transparency. With the first—policy-rule transparency—the central bank articulates the consistent part of its procedures and commits to maintaining that consistency. With the second—forward policy-action transparency—it forecasts the funds rate.

There are inherent limitations to the latter.¹⁹ The ability of the FOMC to forecast funds rate changes requires an ability to forecast the economy, and the difficulties associated with forecasting are well known.²⁰ Policy-rule transparency, on the other hand, complements the market's forecasts of the economy. In order for the yield curve to move in a stabilizing way in response to incoming information, financial markets must understand the way that the central bank responds to that information. Because systematic errors in predicting funds rate behavior impose costs, market participants will base funds rate forecasts on their understanding of the consistent part of central bank behavior. The clearer that the central bank is about the systematic part of its policy, the more stabilizing will be the behavior of the yield curve.

Adopting a format at FOMC meetings that elucidates how policy actions emerge out of new information about the economy could aid in developing a consensus among FOMC members about the systematic part of policy. Under Chairman Greenspan, FOMC meetings began with a discussion of the economy. Greenspan then initiated a policy go-around focused on acceptance or rejection of his proposal for the funds rate target.²¹ This format did not elucidate whether the funds rate decision represented a consistent response over time to new information or a departure from past behavior.

As a practical way of moving toward thinking about policy strategically, that is, as a consistent way of responding to new information to achieve given objectives, the FOMC could maintain a record of its discussions designed to facilitate generalization about the consistency of policy. The Board staff

¹⁹ Paul Volcker (Senate 1982), former FOMC chairman, criticized Fed interest-rate forecasts on two grounds. First, they would reduce the information about the economy contained in market interest rates. Second, they would create the temptation to move the yield curve opportunistically, that is, in a "desirable" way that avoids actually having to change the funds rate target.

I do strongly resist the idea of the Federal Reserve as an institution forecasting interest rates. No institution or individual is capable of judging accurately the myriad of forces working on market interest rates over time. Expectational elements play a role—fundamentally expectations about the course of economic activity and inflation, but also, in the short run, expectations about Federal Reserve action. We could not escape the fact that a central bank forecast of interest rates would be itself a market factor. To some degree, therefore, in looking to interest rates and other market developments for information bearing on our policy decisions, we would be looking into a mirror. Moreover, the temptation would always be present to breach the thin line between a forecast and a desire or policy intention, with the result that operational policy decisions could be distorted.

²⁰ The recent tightening cycle, which began with a slightly negative short-term real rate, is unusual in that the real funds rate clearly had to rise when the economic recovery became established.

Also, the ability of the FOMC to forecast future funds rate changes depends upon the smoothing constraints it imposes upon those changes. If the FOMC always moved the funds rate to a level that it believed made the next funds rate change equally likely to be an increase or a decrease, it would always forecast no change in the funds rate. The bond market would remain unaffected by this lack of rate smoothing. The only difference would be additional volatility in short-term interest rates.

²¹ See Meyer (2004, Ch. 2) for a discussion of FOMC meetings.

and FOMC members could submit to the FOMC secretary suggested reaction functions summarizing FOMC behavior. These functions would distill past behavior and embody desirable theoretical properties. In the initial part of the policy go-around, the FOMC chairman could lead a discussion organized around the suggested reaction functions. Are any of them useful for summarizing the evidence for changing the funds rate? Can the FOMC reach a consensus over the values of the indicators employed in these reaction functions? For example, is the output gap an operational concept in that the FOMC can reach a consensus over its sign and magnitude? If not, can the FOMC agree over the sign of the growth gap, that is, whether the degree of resource utilization is increasing, steady, or falling?

The FOMC secretary would maintain an account assessing the usefulness of the various reaction functions for organizing discussion and explaining the actual funds rate action. In particular, is it possible to summarize the information used by the FOMC in its funds rate decision with a small number of indicators? Is there some acknowledged ranking in order of importance of the economic variables used by the FOMC to construct these indicators? Are outside observers likely to be able to reproduce the FOMC decision? Just as important, the FOMC secretary would assess how often special factors, such as asset price volatility, prompted a departure from the benchmark reaction functions.

4. A PROPOSED POLICY RULE AND ITS MONITORING

In Section 1, I argue that the focus on changing the character of the inflationary expectations inherited from the stop-go era endowed the Volcker-Greenspan era with an overall consistency summarized in Formula (1). Based on (1), I propose a (prescriptive) monetary policy rule (2):²²

$$i_t = i_{t-1} + .125(\pi_t^{TR} - \pi^*) + .25I_t^{RU}, \quad (2)$$

where now trend inflation π_t^{TR} replaces expected inflation π_t^e .

With rule (2), the FOMC would respond to discrepancies between estimated trend inflation and the target for trend inflation.²³ At an individual

²² I reserve the term “policy rule” for a reaction function that assumes credibility rather than the Volcker-Greenspan reaction function that restored credibility. With a credible rule and rational expectations, expectations are an equilibrium outcome based on the policy rule, the structure of the economy, and shocks. With (2), the policymaker does not control expectations by making them arguments in a rule.

²³ Inflation in the flexible price sector, which includes commodities, such as oil, minerals, and food, varies with cyclical strength in the world economy. With (2), the FOMC would respond

meeting, the FOMC need not respond in a quantitatively strong way to the emergence of a gap between actual and targeted inflation. What is important to assure stabilizing behavior of the yield curve is that financial markets believe that the FOMC will raise the funds rate in a persistent way as long as a positive miss of the inflation gap exists and conversely for a negative gap.

In rule (2), the terms $i_t = i_{t-1} + .25I_t^{RU}$ capture the lean-against-the-wind part of policy where the FOMC raises the funds rate above its prevailing value in a measured, persistent way as long as the rate of resource utilization is rising. I_t^{RU} is an indicator variable showing whether resource utilization is increasing or decreasing in a sustained way.²⁴ It takes on the value 1 if the resource utilization rate is increasing, -1 if it is decreasing, and zero otherwise. In the first case, output is growing faster than potential output in a sustained way.²⁵ The coefficient on I_t^{RU} of .25 is the standard size of funds rate changes. As with the inflation-miss term, what is important is the public's belief that the FOMC will raise the funds rate in a persistent way as long as the growth gap is positive, and conversely for a negative gap.²⁶

Even though with rule (2) the FOMC would not respond to expectations, it would monitor them to ascertain the rule's credibility. The remainder of this section discusses the kind of behavior the FOMC would expect with a credible rule. Credibility implies that the yield curve responds in a stabilizing way in response to macroeconomic shocks. Although the proposed rule is simple, its implementation and the ongoing monitoring involved in assessing its credibility would require considerable sophistication in reading the economy and in following financial markets.

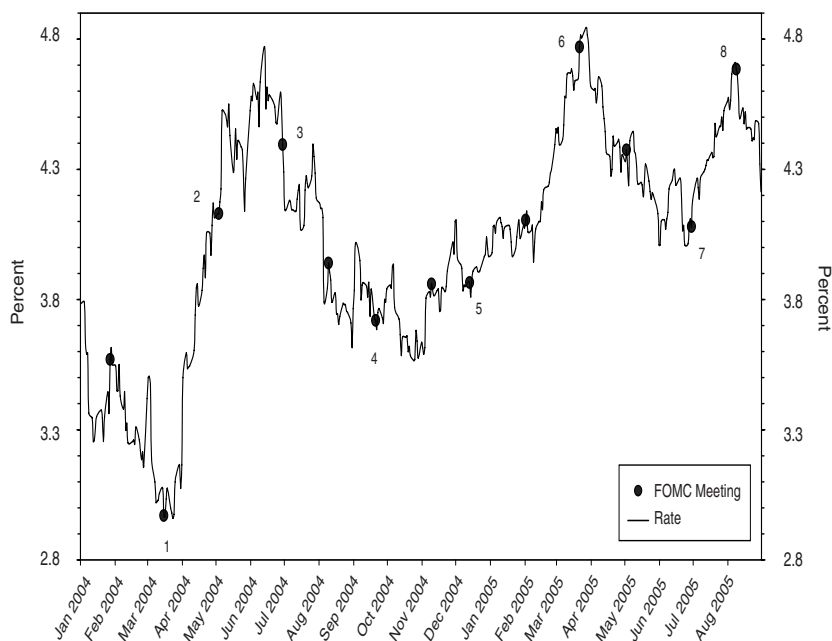
The ability of the economy to return to a balanced growth path after a macroeconomic shock rests on the ability of markets to move the yield curve in a stabilizing fashion in response to such shocks. That ability, in turn, rests on a credible rule, where credibility is the belief by markets that the central

to that inflation (as opposed to inflation in the sticky-price sector) only if it passes through to trend inflation. Core PCE deflator inflation removes energy and food prices, which are volatile and contain a cyclical component. The core measure is usually considered a better measure of trend inflation than the broader measure because trend inflation excludes transitory and cyclical components.

²⁴ FOMC discussion does not produce an explicit numerical estimate for the rate of change of resource utilization. There are no clearly satisfactory proxies. A simple proxy would be payroll employment growth (purged of transitory factors) in excess of the trend given by demographics. Of course, the FOMC looks at an extensive array of statistics. A forward-looking measure would be desirable. However, the difficulty of forecasting would render difficult formation of a consensus around a forward-looking measure of resource utilization.

²⁵ See the discussion of ΔR_t^{RU} in formula (1), Section 1.

²⁶ If a rule is to condition expectations, the market must be able to infer the values of its arguments. In Section 2, I used Greenbook forecasts, which are not publicly available, in construction of a proxy for a growth gap. What is important, however, is whether Fed watchers, who have available basically the same information as policymakers in the form of data releases and Beige Book surveys of regional economic conditions, make the same inferences about the economy as the FOMC.

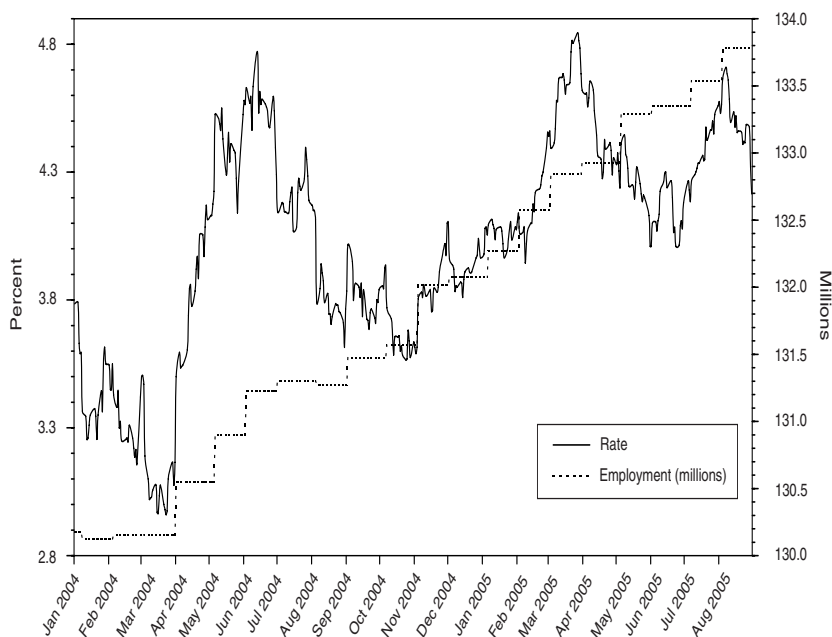
Figure 4 Rates Implied by Eurodollar Futures

Notes: Eurodollar-implied rates are calculated from the two-year exchange-traded options on three-month futures contracts. The daily data are from Bloomberg.

bank will maintain an unchanged, low inflation rate.²⁷ With credibility, all the change in forward rates that occurs in response to shocks is real. In effect, after a shock, markets forecast the cumulative change in the funds rate required to align actual with potential output growth, where again this balanced growth appears as the absence of persistent change in resource utilization.

What does a credible central bank see in response to a real shock? It sees a stabilizing movement in the yield curve comprising movement exclusively in forward real rates. Figure 4 and the commentary in Appendix A (Fluctuations in Economic Activity) suggest how a credible rule allows the price system to offset macroeconomic shocks. Figure 4 shows the interest rate on the three-month Eurodollar futures contract 24 months in the future. Because of the close relationship between Libor and the funds rate, it is a forecast of the funds

²⁷ Alternatively, a credible central bank possesses instrument independence in that markets believe that the political system will allow it to raise the funds rate in response to shocks to whatever extent is required to maintain unchanged trend inflation.

Figure 5 Eurodollar-Futures-Implied Rates and Employment Levels

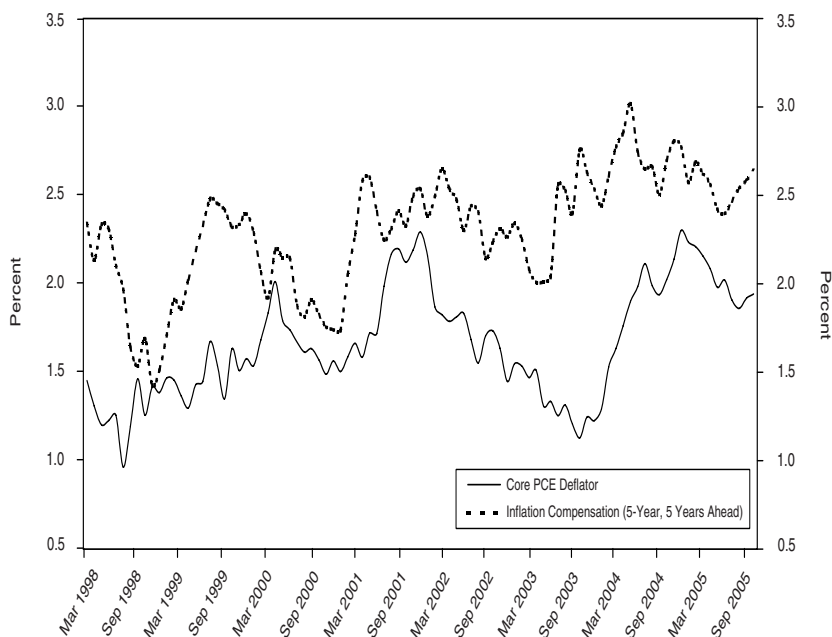
Notes: Eurodollar-implied rates are calculated from the two-year exchange-traded options on three-month futures contracts. The daily data are from Bloomberg. Observations on employment are the civilian payroll employment numbers initially released by the BLS. The steps correspond to the release dates.

rate two years in the future. When the economy strengthened (given that the FOMC constrains the magnitude of individual funds rate changes), the slope of the yield curve increased, and conversely. Figure 5 shows Eurodollar futures rates and the contemporaneously available level of payroll employment. When employment rose slowly, forward rates fell; and when it rose quickly, they rose.

Figure 4 also shows the dates of FOMC meetings, after which the FOMC announces the funds rate target, along with a statement containing forward-looking information about future funds rates. Variation in the expected future funds rate depends mostly upon incoming information on the economy rather than upon information provided in Fed announcements. For the latter, the standard deviation of the change in the two-year Eurodollar rate for the interval shown on the graph is only ten basis points, half the value associated with release of payroll employment numbers.²⁸

²⁸ Changes are from close of business (COB) the day before the announcement to COB the day of the announcement. The major change in the expected funds rate associated with an FOMC

Figure 6 Core PCE Deflator Inflation and Inflation Compensation (Five-Year, Five Years Ahead)



Notes: Inflation compensation data are monthly numbers from the Division of Monetary Affairs of the Board of Governors of the Federal Reserve System. The core personal consumption expenditures data are from Haver Analytics. Observations for the core personal consumption expenditures (PCE) deflator are lagged two months. Inflation is annualized percentage changes in the monthly core PCE deflator. The five-year, five-year-ahead inflation compensation observations are implied by the five-year and ten-year inflation compensation numbers.

The existence of Treasury Inflation Protected Securities (TIPS) makes possible ongoing assessment of FOMC credibility. The difference (“inflation compensation”) between the yield on nominal Treasury securities and the real yield on TIPS of the same maturity provides a good measure of expected inflation (Appendix B: Are TIPS Inflation Compensation Numbers Biased?). A market assessment of Fed credibility is the degree of stability in the inflation compensation figure for the five-year period starting five years in the future

statement occurred at the May 4, 2004, FOMC meeting when the FOMC warned the markets that it would begin to raise the funds rate from its 1 percent level. Because the FOMC attempts to avoid closely spaced funds rate reversals, it moves the funds rate up after a cyclical low only when it is largely convinced that economic recovery is persistent. The market apparently has difficulty predicting the timing of such inflection points in the funds rate.

inferred from the yield gap between nominal Treasury and TIPS yields. Figure 6 shows this series along with core PCE inflation. Since early 2000, the inflation compensation figure has been stable at approximately 2.5 percent. This stability reflects the high degree of credibility enjoyed by the FOMC, despite the existence of a positive growth gap and an inflation shock that raised headline inflation numbers.²⁹

The scatter diagrams of Figures 7, 8, and 9 (following Appendix C) illustrate how the FOMC can monitor whether the rule conditions the public's expectations in a stabilizing way. They plot the surprise in payroll employment numbers on the x-axis for the two-year period, August 2003 through September 2005. Figure 7 shows the associated change in the yield on the six-month fed funds futures contract. When the economy turns out to be stronger than anticipated, the yield curve rises.³⁰

With credibility, the change in forward rates that occurs in response to shocks is all real. Investors, who make decisions based on real interest rates, need not guess about the extent to which yield curve changes reflect changes in expected inflation or changing uncertainty about future inflation rather than in real forward rates. Figure 8 exhibits a positive correlation between changes in the five-year real TIPS yield and the employment surprise. Figure 9 plots the change in inflation compensation for the five-year, five-year-ahead period. There is some positive correlation, although the slope of the regression line is smaller by a factor of 3 than that shown in Figure 8.³¹ These results suggest near, but not complete, credibility.

Policymakers can routinely monitor the credibility of policy by observing the reaction of markets to "surprises" in the economic data releases. For a variety of data releases, they possess the median expectation of a sample of business forecasters. They can observe the reactions of the five-year TIPS yield and of the five-year inflation compensation number to the announcement surprises. For example, in response to the September 2, 2005, announcement of August payroll employment, the TIPS yield rose 5.3 basis points. Although

²⁹ The price of oil rose from \$34 per barrel West Texas Intermediate (WTI) in early 2004 to around \$65 per barrel in September 2005 (a relative price rise comparable to the 1973–1974 and 1979–1980 oil price increases). Over the 12 months through September 2005, CPI inflation was 4.7 percent, while CPI inflation excluding energy was only 2 percent over this latter period.

³⁰ If the FOMC possesses neither economic data nor a forecasting ability superior to the market's, it should ratify the market's expectation for the change in the funds rate at its meetings.

³¹ A perception that the FOMC is willing to allow some drift in trend inflation could account for the positive slope of the regression line in Figure 9, as well as the fluctuations in inflation compensation in Figure 6 (Gurkaynak, Sack, and Swenson 2003). For example, consider the imprecision about the inflation rate the FOMC finds acceptable in the response by former Governor Ferguson (2006) to a question: "[I]f inflation threatens to fall much below 1 percent, the Fed clearly responds to that.... [I]f inflation rises much above 2, 2½ percent—let's say 2 percent—on the core measures, the Fed finds that to be outside of the range of stable prices."

the figure came in somewhat below expectations, an upward revision in the prior month's numbers turned the release into a positive surprise.³² Evidence of credibility appeared in the slight fall in the inflation compensation number while the TIPS yield rose.

5. PREDICTING HOW THE RULE WOULD WORK

A prediction of how rule (2) would work to control inflation requires a model. I use the New Keynesian sticky-price model.³³ Three elements of the model summarize the discipline imposed on the monetary policy process: one from price theory, one from monetary theory, and one from rational expectations. First, the real interest rate is a price. As summarized by the real business cycle core of the model, the real rate varies to smooth aggregate demand intertemporally. The price system works in that "moderate" changes in the real interest rate, say, in the range of 6 percentage points, are sufficient to reconcile aggregate demand with available resources. The central bank must respect the working of the price system.

Second, in a fiat money regime, the central bank, not the public, determines trend (steady-state) inflation. More generally, only the central bank can give money (nominal variables) a well-defined (determinate) value. It does so by providing a nominal anchor that stabilizes inflationary expectations.

Third, firms (price-setters) are "rational." Firms, which possess some monopoly power, set their prices to maintain an optimal markup (price over marginal cost). Because firms can change their dollar prices only infrequently, they set nominal prices to maintain this markup (a real variable) on average. They are forward-looking in their price-setting and use information efficiently. An implication is that firms set their dollar prices based on a forecast of inflation that reflects the consistent part of the central bank's behavior. Even though historically the erratic evolution of the monetary standard has made learning extremely difficult, the public does learn to conform its expectations of inflation to the consistent behavior of policy. As a result, the central bank cannot manipulate the markup in a predictable way. More broadly, it cannot raise the inflation rate to lower the unemployment rate in a sustained, significant way or increase its variability to reduce the variability of the unemployment rate (King and Wolman 1999).

The experiment yielded by the monetary policy of stop-go followed by the monetary policy of inflationary expectational discipline yielded results consistent with these implications of the New Keynesian model. First, the premise

³² The 3-month annualized growth rate of payroll employment went from 1.5 percent for the July release to 1.8 percent for the September release.

³³ For an exposition, see Goodfriend and King (1997), Hetzel (2005), and Wolman (1997, 1998, 1999, and 2001).

of stop-go monetary policy was that government had to manage aggregate demand to offset the chronic failure of the price system to maintain full employment. As long as the unemployment rate exceeded the full employment rate, assumed to be 4 percent, stimulative monetary policy would supposedly raise output and lower unemployment without creating inflation.

In contrast, the discipline imposed in the V-G era by the desire to restore expectational stability for inflation precluded persistent intervals of stimulative policy. The FOMC had to raise the funds rate promptly in response to emerging positive growth gaps. Rather than attempting to manipulate the unemployment rate, the FOMC used *changes* in the unemployment rate as an *indicator* of changes of the degree of resource utilization useful for inferring the behavior of the markup. By allowing the price system to work rather than superseding it, the FOMC produced more, not less, economic stability.

Second, the control of inflation required central banks imbued with a mission to control inflation through monetary policy. Inflation is a monetary phenomenon in that central banks determine trend inflation. Fiscal policy and a plethora of programs involving direct intervention in price-setting all failed to control inflation (Hetzel 2004).

Third, the trade-offs predicted by Keynesian Phillips curves failed. With the high trend inflation of the 1970s, the negative relationship between the level of inflation and unemployment disappeared. In the 1980s and 1990s, not only did the reduced variability of inflation not require increased variability of unemployment, but also the variability of both fell. As predicted by the New Keynesian model, maintenance of low, stable inflation did not impose real resource costs.

As implied by the New Keynesian model, to maintain price stability, the FOMC must follow a rule for moving the funds rate, which keeps the real interest rate at whatever level is necessary to prevent increases in aggregate demand from compressing firms' markups (relative to the optimal value) and thus creating a general incentive to raise prices (Broadus and Goodfriend 2004; Goodfriend 2004). The rule (2) achieves this prerequisite, but in a way that reflects the availability of information.³⁴ The FOMC knows that markup compression must occur if the growth rate of real output exceeds the growth rate of potential output. Determination of whether a positive growth gap exists

³⁴ The central bank does not possess sufficient information to solve the model of the economy under the assumption of flexible prices. If it did, it could set the real interest rate equal to the natural rate (the flexible-price real interest rate determined along with expected consumption growth). Another deficiency in the data is that observable measures of the markup are biased by the unobservable behavior of labor force utilization rates. As a result, direct measures of the markup can be misleading for policy. One measure of the change in the markup is the difference between inflation and the change in unit labor costs. After 1964, for example, expansionary monetary policy (measured by an increased M1 growth rate) apparently initially led to increased rates of labor force utilization. Because productivity rose while price and wage inflation remained unchanged, the markup increased. Only later with sustained expansionary monetary policy did unit labor costs rise, the markup fall, and inflation rise.

starts with observation of whether employment growth exceeds growth in the working age population. In this event, the FOMC looks for agreement in a wide variety of additional measures of changes in resource utilization such as the behavior of supplier delivery times and the prices of raw materials. The rule calls for an increase in the funds rate if this assessment implies an increase in resource utilization that is persistent.

Greenspan (House 1999, 6) observed,

[W]hen productivity is accelerating, it is very difficult to gauge when an economy is in the process of overheating. In such circumstances, assessing conditions in the labor market can be helpful. . . . Employment growth has exceeded the growth in working-age population this past year by almost $\frac{1}{2}$ percentage point. . . . [T]his excess is...large enough to continue the further tightening of labor markets. It implies that real GDP is growing faster than its potential. . . . There can be little doubt that, if the pool of job seekers shrinks sufficiently, upward pressures on wage costs are inevitable, short...of a repeal of the law of supply and demand.

Shocks change the optimal degree of resource utilization, and the FOMC does not attempt to hold it constant. However, the basis of the rule is the fact that increases in resource utilization (markup compression) cannot persist indefinitely.

The rule rests on the assumption of how rational expectations condition the relationship between real and nominal variables (Hetzel 2004, 2005). Consider a macroeconomic shock in the form of a persistent increase in productivity. At the original real interest rate, real aggregate demand exceeds potential (flexible-price) output. Because individuals feel wealthier and want to smooth their consumption over time, contemporaneous demand for output exceeds the increase in supply. With sticky prices, output grows above potential and firms' markups are compressed below their profit-maximizing values.³⁵ As resource utilization rates rise, the central bank raises the (nominal and real) funds rate to restrain real aggregate demand. Credibility implies not only that firms believe that the markup compression is transitory, but also that they do not associate it with a sustained increase in inflation. Stated alternatively, when a real shock pushes output away from potential, firms do not associate that departure with a change in inflation.

When firms change their dollar prices, they do so to set the relative price of their product. Because of the central bank's credibility, the shock does not lead firms to believe that they need to raise their dollar prices to preserve their relative prices. With a credible inflation-targeting rule, real shocks can introduce fluctuations in the price level but not in trend inflation. The central bank never gets into the Kydland-Prescott (1977) or Barro-Gordon (1983)

³⁵ See the similar discussion of monetary policy in Broadus and Goodfriend (2004).

predicament of having to shock the real economy to control expected and actual trend inflation. As long as the rule is credible (expectations are stable), there are no real costs to controlling trend inflation.

6. SHOULD A RULE INCLUDE ASSET PRICES?

Alan Greenspan (2004, 39) acknowledged the consistency in monetary policy: “In practice, most central banks...behave in roughly the same way. They seek price stability as their long-term goal. . . . All banks ease when economic conditions ease and tighten when economic conditions tighten.” However, Greenspan then raised the issue of “the appropriate role of asset prices in policy.”

In principle, the central bank should use the information contained in asset prices to set the funds rate. For example, a funds rate such that the real funds rate lies below the natural rate given by the flexible-price working of the price system results in excess money creation, which leads to portfolio rebalancing (Hetzel 2004, 2005). Although instability in money demand may hide this monetary stimulus, asset prices such as equities rise. However, the complexity of the forces affecting asset prices makes discerning this effect problematic and militates against an explicit state-contingent rule that contains asset prices. Rather than attempting to assess whether the level of equity prices is too high, the central bank is better off relying on the fact that a wealth effect will stimulate real output growth and increase resource utilization rates.

An answer to the question of whether asset prices offer useful information will depend upon assessment of the historical record. For example, at the time of the Asia crisis, the world suddenly appeared riskier and the risk premiums required for holding risky assets, especially emerging market debt, increased sharply. The FOMC made the judgment that the increase in risk premiums was large enough to become a source of economic instability without counteracting monetary stimulus. Such a judgment was necessarily subjective and not easily captured by a rule.³⁶

From mid-1997 through mid-1999, the FOMC gave significant weight to financial market instability. (For a discussion of this period, see Greenspan in U.S. Congress, June 17, 1999.) Beginning in mid-1997, the FOMC stopped raising the funds rate in response to positive growth gaps. In fall 1998, it lowered the funds rate $\frac{3}{4}$ of a percentage point despite an essentially zero

³⁶ A commitment to lower the funds rate, say, in response to a sharp fall in some class of asset prices would also create moral hazard problems. A different issue is whether a rule would constrain the ability of the FOMC to control the short-term timing of funds rate changes. In particular, when the funds rate is at a cyclical low in the early stages of economic recovery, the FOMC waits until recovery is clearly established before raising the funds rate. In this way, it limits the possibility of an increase followed by a closely spaced reversal because of a faltering recovery.

growth gap. In 1998, the absence of a positive growth gap as measured in Figure 1 reflected Greenbook forecasts of moderate real growth. Forecasts of moderate real growth in turn depended significantly upon the repeated Board staff assumption of a decline in the stock market with an attendant reduction in consumption because of a decline in wealth.

However, real growth consistently exceeded predicted growth in the Greenbook. The steady decline in the unemployment rate suggests that the growth gap was positive throughout this period. In March 1997, when the FOMC raised the funds rate to 5.5 percent, the available figure for the unemployment rate was 5.3 percent (February 1997). In June 1999, when it raised the funds rate from 4.75 percent to 5 percent, the available figure for the unemployment rate was 4.2 percent (May 1999). Not until early 2000 and the passage of concerns over Y2K-related computer failures did the FOMC push the funds rate above the level prevailing before the reductions made in fall 1998.

The FOMC acted on the assumption that high rates of productivity growth would restrain inflation at least transitorily by lowering the growth rate of unit labor costs (Greenspan in House 1999; Hetzel 2006, Ch. 16–19; Meyer 2004, Ch. 4). Richmond Fed president, J. Alfred Broaddus (2004), challenged the consensus view that an increase in trend productivity growth made increases in the funds rate in response to rising resource utilization rates at least temporarily unnecessary. Beginning with the May 1997 FOMC meeting, he argued that increased productivity growth that made individuals feel wealthier required a higher real interest rate. The real interest rate would have to rise to restrain the extent to which individuals attempted to smooth consumption intertemporally through increases in contemporaneous consumption.

The failure of inflation to rise as the unemployment rate fell is consistent with the Friedman (1974) generalization that the extent to which stimulative monetary policy initially impacts real growth rather than inflation depends upon the behavior of expected inflation. Stock prices rose strongly over this period, but fell starting in 2000. Also, inflation drifted upward from 1999 through 2001. This assumption appeared to explain the combination of “low” unemployment and low inflation. However, these facts are consistent with the hypothesis that expansionary monetary policy exacerbated the rise in asset prices and strength in economic activity.

7. THE DESIRABILITY OF AN EXPLICIT RULE

A rule embodies a perceived commitment to consistent behavior that shapes expectations in a predictable way. Commitment to a rule makes monetary policy a source of stability in an uncertain world. For the economy to respond resiliently to large shocks, individuals must believe that government will allow the price system to reallocate resources. With regard to monetary policy, they must believe that, in response to shocks, the central bank will allow the real

interest rate to vary sufficiently to maintain aggregate demand for resources equal to available supply. As a result, the yield curve will respond in a stabilizing way, that is, in a way that makes the change in forward rates entirely real. The belief that the central bank will move the funds rate by whatever amount is required for macroeconomic stability comes from a credible commitment to price stability.

The United States has received benefits from the rule-like behavior that has characterized most of the Volcker-Greenspan era. Those benefits have occurred without explicitness about monetary policy procedures. Nevertheless, there are reasons for explicitness and for commitment. In a constitutional democracy like the United States, the long-term viability of a rule depends upon the existence of a public consensus in its favor. Such consensus can arise only with a widespread understanding made possible by explicitness.

APPENDIX A: FLUCTUATIONS IN ECONOMIC ACTIVITY

The fluctuations in the market's estimate of future spot rates shown in Figure 4 and thus in the slope of the yield curve derive from fluctuations in the strength of economic activity. The Board staff's summary of the economy contained in FOMC minutes provides a useful assessment of economic activity. Dots mark FOMC meetings.

The slope of the yield curve rose between the March 16, 2004, and May 4, 2004, FOMC meetings (observations [obs.] 1 and 2). The March 16, 2004, minutes summarized prior relative weakness in economic activity: "[T]he increases in economic activity [in early 2004] had not yet generated sizable gains in employment." But, the May 4, 2004, minutes reported additional strength:

[T]he economy expanded at a rapid pace in the first quarter. . . . The labor market displayed further signs of improvement during the quarter, capped by a significant increase in private payrolls in March.

The slope of the yield curve fell between the June 30, 2004, and September 21, 2004, FOMC meetings (obs. 3 and 4). The September 21, 2004, minutes (obs. 4) reported only moderate growth for this interval:

[E]conomic growth regained some vigor in recent months after having slowed in late spring. The August labor market report showed a moderate gain in payrolls. After contracting in June, industrial production strengthened modestly on average in July and August.

The minutes of the December 14, 2004, meeting (obs. 5) reported continued moderate growth:

[T]he economy expanded at a moderate pace over the third quarter and into the current quarter. . . . Manufacturing production increased at a modest pace, and employment gains in October and November indicated that the labor market continued to improve gradually.

The slope of the yield curve then rose between the December 14, 2004, and March 22, 2005, FOMC meetings (obs. 5 and 6). The March 22, 2005, minutes (obs. 6) reported relative strength for this interval:

The information reviewed at this meeting suggested that the economy was expanding at a solid pace in the first quarter of the year. . . . Consumer spending still appeared to be growing briskly, and residential construction expenditures continued to move higher. Business spending on equipment and software showed notable gains early in the quarter. . . . Private nonfarm payrolls grew at a solid pace, and these gains were widespread across industries.

The slope of the yield curve then fell between the March 22, 2005, and June 30, 2005, FOMC meetings (obs. 6 and 7). The June 30, 2005, minutes (obs. 7) reported only moderate growth for this interval:

The information received at this meeting suggested that the economy was expanding at a moderate pace in the second quarter.

But, the slope of the yield curve rose between the June 30, 2005, and August 9, 2005, FOMC meetings (obs. 7 and 8). The August 9, 2005, minutes (obs. 8) reported relative strength for this interval:

The information received at this meeting suggested that final demand had expanded at a solid pace in the second quarter, led by a surge in net exports and another robust gain in residential investment.

APPENDIX B: ARE TIPS INFLATION COMPENSATION NUMBERS BIASED?

Two factors potentially bias the measure of expected inflation provided by TIPS inflation compensation numbers. First, investors may demand a risk premium to compensate for expected volatility in future inflation that renders uncertain the ex post real return from holding nominal bonds. If so, the measure of expected inflation offered by the inflation compensation numbers is biased upward. Given the low levels reached by yields on ten-year Treasury securities in recent years, at times below 4 percent, this source of bias cannot be large. The last time such low yields appeared on Treasury bonds was the first half of the 1960s, when an expectation of price stability prevailed. If this bias exists, the FOMC lacks credibility. Regardless of whether an inflation compensation number in excess of the FOMC's implicit inflation target arises from an expectation of inflation that lies above the target or from a lack of confidence in the FOMC's willingness to maintain stable trend inflation, the FOMC needs to reinforce its credibility.

The second source of possible bias works the other way, that is, to cause the inflation compensation number to underestimate expected inflation. A lack of liquidity could raise the real rate on TIPS relative to nominal securities and bias downward the inflation compensation numbers as a measure of expected inflation. In Figure 6, the inflation compensation numbers do rise to a higher trend level after June 2001. Plausibly, that rise reflects a decrease in the liquidity premium incorporated into TIPS yields. In any event, the low level of TIPS yields leaves little room for a liquidity premium.³⁷ If a small bias does remain, it will dissipate over time as the TIPS market grows.³⁸

Survey data reinforce the view that the inflation compensation numbers offer a good approximation to expected inflation. The quarterly Survey of Professional Forecasters offers a ten-year forecast of CPI inflation. For 2005Q4, the survey comprised 51 economists who routinely forecast economic activity. They come from large commercial banks, brokerage houses, private corporations, and universities. There is no reason to believe that their inflation forecasts differ systematically from the forecasts implicit in nominal bond yields. Over the period since June 2001, the ten-year forecasts of CPI inflation from this survey have remained at 2.5 percent. Similarly, since December 2001, the Livingston Survey of business economists has reported a consensus estimate of 2.5 percent for CPI inflation over the succeeding ten years. This 2.5 percent number is basically the same as the average number for the

³⁷ On January 5, 2006, the ten-year TIPS yield was 2.07 percent.

³⁸ In 2005, there were about \$200 billion in TIPS outstanding (Kwan 2005).

five-year, five-year-ahead inflation compensation numbers shown in Figure 6. This similarity indicates that the inflation compensation numbers are good measures of expected trend inflation.³⁹

APPENDIX C: FOMC DATA

This Appendix discusses the data used in Figure 1. In his semiannual (February and July) congressional oversight hearings (formerly known as the “Humphrey-Hawkins” hearings), the FOMC chairman provides Congress with forecasts for the growth rate of nominal GDP, real GDP, and prices from the fourth quarter of the preceding year to the fourth quarter of the current year. Members of the FOMC make individual forecasts. The chairman presents these forecasts as a range that encompasses the majority of the forecasts submitted by the members. Since 1983, he has also presented a smaller range called the “central tendency.” I use the midpoint of this “central tendency” for real output growth and inflation as proxies for potential real growth and the FOMC’s inflation target.

The observations in the figures and regressions correspond to FOMC meeting dates. Starting in 1981, there have been eight FOMC meetings a year. FOMC meetings are usually held on a Tuesday. Forecasts of growth rates for real output and inflation are from the Greenbook, which is available as of an FOMC meeting. The Greenbook (“Current Economic and Financial Conditions”) is prepared by the staff of the Board of Governors and is circulated prior to FOMC meetings. Part 1, “Summary and Outlook,” contains quarterly forecasts for nominal and real output (GNP before 1992, GDP thereafter) as well as forecasts of many other series such as the unemployment rate. Greenbooks remain confidential for five full calendar years after the year in which they were published.

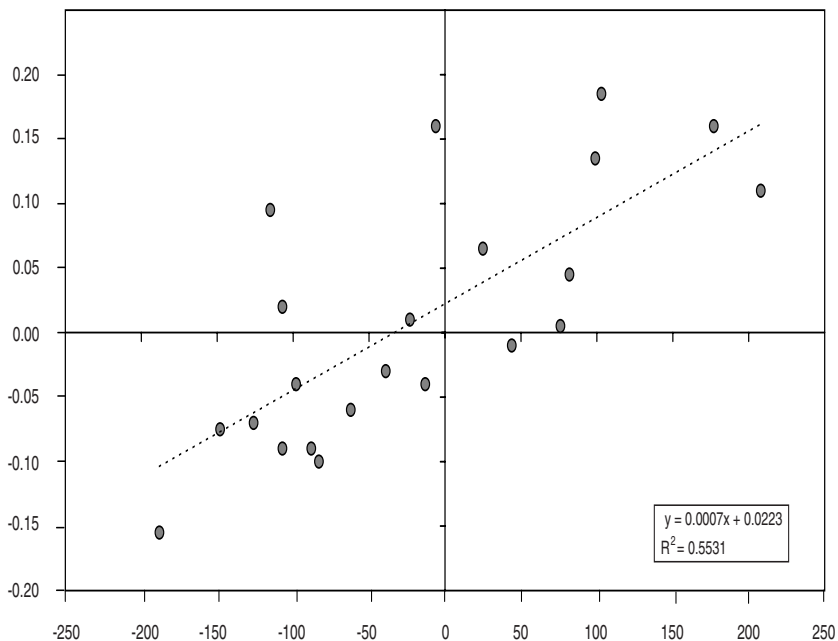
³⁹ It is possible that the Survey of Professional Forecasters’ number is not a good measure of expected trend inflation because it incorporates the special factors affecting near-term inflation. However, the questionnaires for the last three quarters of 2005 asked about expected inflation for the coming five-year interval as well as the coming ten-year interval. The implied numbers for expected inflation for the five-year interval five years ahead were, respectively, 2.5 percent, 2.5 percent, and 2.4 percent, basically the same as the numbers for the entire ten-year period.

These quarterly surveys also asked for forecasts of inflation over the subsequent two-year interval as well as the subsequent one-year interval. Based on these numbers, the special factors that affect expected inflation one year out do not affect expected inflation much beyond this interval. The ten-year forecasts in the Survey of Professional Forecasters are, therefore, basically measures of expected trend inflation.

The inflation predictions from the Greenbook used in the regression are for the implicit GNP deflator prior to 1988, CPI excluding food and energy from 1989 through May 2000, and the PCE excluding food and energy chain-weighted price index thereafter. At FOMC meetings from June 1988 through March 1989, the FOMC had available forecasts of GNP growth adjusted for the effects of the 1988 drought. The details of the drought adjustment are found in the Greenbooks. The Commerce Department estimates of the differences between drought-adjusted GNP growth and actual GNP growth are 0.7 (1988Q2), 0.5 (1988Q3), 1.0 (1988Q4), and -2.2 (1989Q1) percentage points. For these meetings, to obtain predictions of drought-adjusted levels of GNP, the Board staff applied drought-adjusted growth rates to the initial 1988Q1 GNP figure, which was unaffected by the subsequent drought. The regression uses the drought-adjusted forecasts.

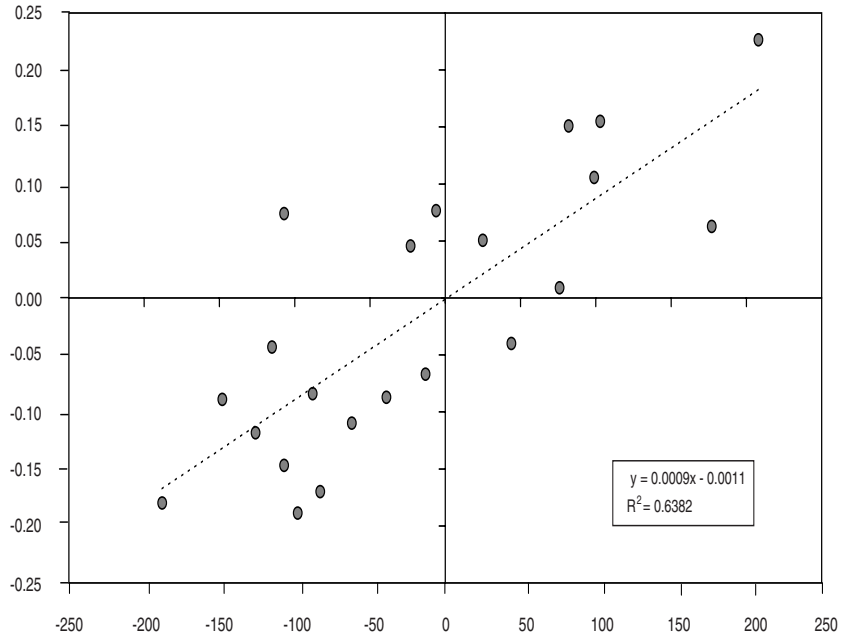
For the November 1970 through September 1979 meetings, the funds rate is the initial value set by the FOMC as reported in the Board staff document called the Bluebook ("Monetary Policy Alternatives"). For the last two meetings in 1979, 1980, 1981, and the first half of 1982, the funds rate is the actual funds rate prevailing in the first full statement week following an FOMC meeting. (For January 1980, May 1980, May and July 1981, and November 1981, it is possible to obtain a value expected to prevail by the Desk.) From the last half of 1982 through 1993, the funds rate is the value the New York Desk expected to prevail in the first full statement week after an FOMC meeting as reported in "Open Market Operations and Securities Market Developments," published biweekly by the New York Fed. Starting in 1994, the funds rate is the announced target. Actual funds rate data for the average funds rate that prevailed in the first full reserve settlement week ending Wednesday following an FOMC meeting along with other interest rates are reported in the Board of Governor's statistical release, G.13, "Selected Interest Rates." (The December 1980 meeting was held on a Thursday and Friday, so the funds rate figure used is the average of the daily-average values for the following Monday, Tuesday, and Wednesday. For the occasional meetings held on a Wednesday and Thursday, if the actual funds rate is used, it is the average of the daily-average values for the week beginning that Thursday.)

Figure 7 Daily Change in Fed Funds Futures (Six-Month) in Response to Employment Surprise



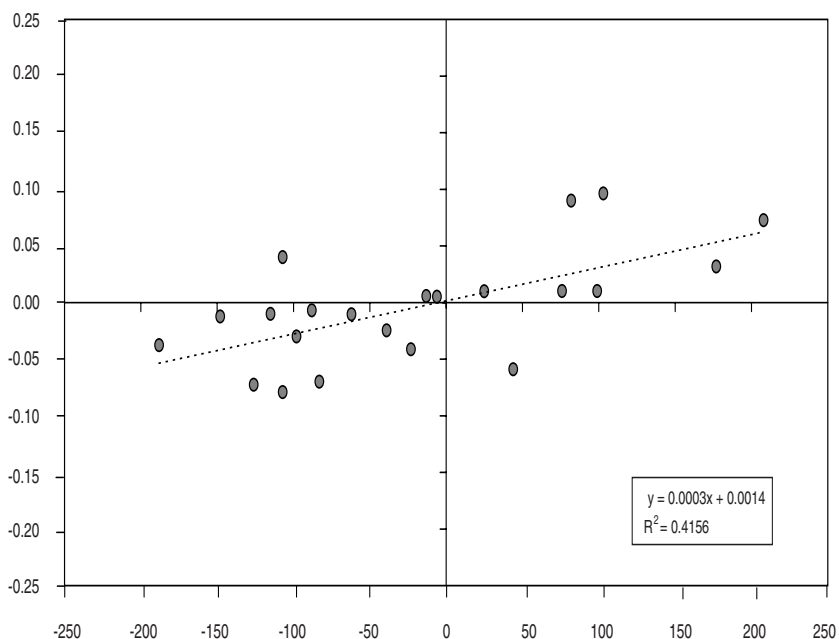
Notes: Observations on employment (horizontal axis) are for civilian nonfarm payrolls from the BLS. The surprise is the difference between the actual number released and the median expectation of surveyed business economists reported by the Federal Reserve Bank of St. Louis on the cover sheet of its release, *U.S. Financial Data*. The change in the interest rate (vertical axis) on the generic six-month Fed funds futures contract is from close of business on the day before the release to the close of business on the day of the release, as reported by the Bloomberg (Code: FF6 <index> HP).

Figure 8 Daily Change in TIPS (Five-Year) in Response to Employment Surprise



Notes: Observations on employment (horizontal axis) are for civilian nonfarm payrolls from the BLS. The surprise is the difference between the actual number released and the median expectation of surveyed business economists reported by the Federal Reserve Bank of St. Louis on the cover sheet of its release, *U.S. Financial Data*. The change in the five-year TIPS yield (vertical axis) is from the close of business on the day before the release to the close of business on the day of the release, as reported by Bloomberg.

Figure 9 Daily Change in Inflation Compensation (Five-Year, Five Years Ahead) in Response to Employment Surprise



Notes: Observations on employment (horizontal axis) are for civilian nonfarm payrolls from the BLS. The surprise is the difference between the actual number released and the median expectation of surveyed business economists reported by the Federal Reserve Bank of St. Louis on the cover sheet of its release, *U.S. Financial Data*. The change in the five-year, five-year-ahead inflation compensation (vertical axis) is from the close of business on the day before the release to the close of business on the day of the release. Data are from the Division of Monetary Affairs of the Board of Governors of the Federal Reserve System.

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