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A Proposal to Clarify the Objectives and Strategy of Monetary Policy

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Abstract: Academic economists have perennially made arguments for the conduct of monetary policy constrained by an explicit rule. These arguments have gone nowhere. This paper advances a proposal to clarify Fed objectives and strategy in order to facilitate discussion leading to consensus over a desirable rule. Economists are likely to have more success in their quest for a rule if they follow the indirect strategy of pushing the Fed for more transparency about the systematic character of policy.

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The rules versus discretion debate over how to discipline the formulation of monetary policy has generated enormous amounts of discussion over the years with no clear outcome. In early 2012, the FOMC did adopt an inflation target but without articulation of a strategy for achieving it. The Great Recession has even challenged this step toward explicitness by the criticism that “inflation targeting” contributed to the Great Recession through downgrading concerns for financial stability (Curdia and Woodford 2009; Woodford 2012). The goal of a monetary policy conducted by a rule seems farther out of reach than ever.

Although written many years earlier, Lucas (1980 [1981], 255) still summarizes the chasm between monetary policymakers and mainstream academic economists:

[O]ur ability as economists to predict the responses of agents rests, in situations where expectations about the future matter, on our understanding of the stochastic environment agents believe themselves to be operating in. In practice, this limits the class of policies the consequences of which we can hope to assess in advance to policies generated by fixed, well understood, relatively permanent rules (or functions relating policy actions taken to the state of the economy) . . . [A]nalysis of policy which utilizes economics in a scientific way necessarily involves choice among alternative stable, predictable policy rules, infrequently changed and then only after extensive professional and general discussion, minimizing (though, of course, never entirely eliminating) the role of discretionary economic management.

Lucas (1980 [1981], 255) also noted, however:

I have been impressed with how noncontroversial it [the above argument for rules] seems to be at a general level and with how widely ignored it continues to be at what some view as a “practical” level.

The proposal here attempts to bridge the gap between monetary policymakers and mainstream academic economists as well as critics who are concerned about Fed accountability. On the one side, academics want an arithmetical rule that prescribes individual changes in the funds rate. On the other side, policymakers contend that they do not and cannot follow an arithmetical rule. The proposal here accepts the latter view. However, the FOMC can be more explicit about its objectives and the strategy for achieving them. The proposal here makes explicit what can be made explicit. Also, policymakers are conservative in the sense of Edmund Burke in that they are not going to change the monetary regime in a discrete, dramatic way. The advantage of the proposal here is that it is not a break from existing procedures. Instead, it promotes progress toward transparency of existing procedures.¹

Section 1 elucidates how explicitness about the systematic character of monetary policy is required in order to identify the shocks that cause recessions. Section 2 highlights the deficiencies in

¹ The proposal does not deal with arguments that the Fed should include financial stability as an additional goal beyond “maximum employment” and “price stability.” The proposal clarifies discussion by treating monetary policy and credit policy as separate and by first reaching consensus over desirable monetary policy. With that foundation, debate can continue over the desirability of giving central banks an additional set of ad hoc tools in order to intervene in credit markets in a way that extends beyond the long-standing availability of the discount window.

current FOMC procedures for communicating the strategy of monetary policy. Section 3 makes a proposal that would clarify the systematic behavior of monetary policy (the strategy) by making explicit FOMC objectives and procedures. Section 4 provides details on the implementation of the proposal. Section 5 explains how the proposal renders explicit the communication with markets that is now implicit and that is an integral part of the implementation of monetary policy. The proposal does not change current practice. Instead, it is a natural extension of the efforts the FOMC has made since 1994 to be more transparent.

Section 6 illustrates how the proposal would elicit from the FOMC what is systematic about its procedures by conjecturing how it would have worked in the Great Recession. Section 7 places the proposal in the context of rules advanced in the past for the conduct of monetary policy. Section 8 makes the argument that the Fed would protect its independence by clarifying the rule-like behavior of monetary policy. In sum, the proposal is in the spirit of the research agenda laid out by John Taylor (1993) of adopting a rule by building on what is already systematic in the behavior of the FOMC—evolution not revolution.

1. Identification of shocks that cause recessions requires explicitness about the strategy

Traditionally, as Lucas pointed out above, monetary policymakers have used the language of discretion rather than rules. The implicit assumption is that if each period the policy action chosen is optimal in light of the economy's most pressing problem then the concatenation of such optimal "point in time actions" will yield a long-run optimal policy. With Kydland and Prescott (1977), the profession rejected this argument. Apart from their critique, a problem with the language of discretion is that without knowledge of the systematic character of policy that generates the individual policy actions one cannot identify departures. It follows that one cannot evaluate whether those departures are stabilizing or destabilizing. The answer to that issue addresses a fundamental issue of what causes recessions.

Recessions are infrequent events. Consequently, the price system must work well most of the time in order to keep real output moving around potential. It also follows that the FOMC must have a baseline monetary policy, a rule, which allows the price system to work to keep output moving around potential while maintaining nominal expectational stability. Whether departures from the rule regularly precede recessions and destabilize the economy or whether they instead occur with the onset of recession and stabilize the economy addresses a fundamental divide in macroeconomics. In the popular language of economics, monetarists and Keynesians differ over whether economic disorder derives from the behavior of central banks or the private sector.

Economists on the monetarist side of the divide believe that periodically central banks interfere with the operation of the price system. Especially, they create a negative output gap in order to lower inflation (at earlier times also to maintain an overvalued exchange rate). However, the "long and variable lags" highlighted by Milton Friedman subvert the hoped for "soft landing" in which inflation declines in a moderate fashion while slack in the economy remains moderate.

Economists on the Keynesian side of the divide believe that periodically market forces overwhelm the stabilizing forces of the price system. The default explanation of recessions in this spirit points to speculative excess accompanied by excessive accumulation of debt the collapse of which requires a prolonged, painful deleveraging. The purging of the imbalances accumulated during the period of irrational exuberance overwhelms the stabilizing properties of the price system while offering the opportunity for expansionary monetary policy to aid recovery. Without an

understanding of the baseline monetary policy, it is difficult to identify departures and judge whether they are stabilizing or destabilizing.

2. Building on and extending FOMC transparency

At present, the FOMC as a committee has four ways of communicating with financial markets. First, the FOMC votes on a statement for release after FOMC meetings. The statement of course records whether the FOMC has changed the funds rate target. While the statement explains the specific policy action or inaction, it serves equally to shape the perception of financial markets about future policy actions. The first two paragraphs of the statement are critical. Publicly available transcripts of FOMC meetings, which are available after five full calendar years, demonstrate that the Committee exerts an enormous amount of effort on crafting these paragraphs. The first paragraph of the statement summarizes the current state of the economy relative to its state at the last FOMC meeting. The second paragraph summarizes the Committee's consensus on the near-term evolution of the economy. Financial markets use this information to forecast the future behavior of the funds rate. "Monetary policy" then is not only the decision regarding the funds rate but also the communication by the FOMC that shapes the behavior of the term structure of interest rates.

In addition to the statement, the FOMC chair holds a press conference after FOMC meetings four times a year in which (s)he summarizes consensus views of the Committee. Also, Minutes of the meetings, which are more a compilation of various views with information on the relative prevalence of the views than actual minutes, appear with a lag of several weeks. Finally, with the Minutes of four of the eight meetings that include a press conference, there is a compilation of forecasts made by FOMC participants.² This Summary of Economic Projections (SEP) includes forecasts of four-quarter real GDP ending in the final quarter for the current year for the two future years and for a "longer run." There are similar forecasts for headline and core PCE inflation, for the level of the unemployment rate, and for the level of the funds rate range. These forecasts are presented both as ranges and as histograms.

Of particular interest to financial markets is the "dot plot," which for the same yearly forecast horizons shows with a dot each participant's assumed year-end funds rate range. For example, the downshift in the mass of dots from the March 2016 FOMC meeting to the June 2016 FOMC meeting moved down the interest-rate term structure. For the March meeting, all but one of the participants desired two *or more* funds rate increases by 2016 year-end. For the June meeting, all but two of the participants desired two *or just one* increase by year-end.

While offering information to professional Fed watchers on the predilections of the FOMC, the current SEP forecasts obscure the nature of the monetary policy desired by the FOMC consensus. First, the SEP forecasts are not forecasts based on what individual participants believe will be actual policy. The instructions that participants receive ask for forecasts based on "appropriate" policy. Both hawks and doves will then likely forecast inflation at target over medium and longer horizons even though the former will assume a higher path for the funds rate.

² FOMC "members" are the governors and the regional Bank presidents who vote. "Participants" include the members and also regional Bank presidents who are not currently voting members.

Second, the individual forecasts are ambiguous because of the lack of association with the funds rate path on which they are based. The current forecasts would possess more substance if the forecasts for the macroeconomic variables along with the funds rate path were presented separately for each participant. In that way, one would know the path for policy (the funds rate) that conditions the forecasts as well as the common complex of variables forecast (output, unemployment, and inflation). Even then, the forecasts would lack relevance in that what counts is the FOMC consensus over the desirable path for the funds rate and the associated forecasts for the economy. The proposal here entails a common FOMC forecast based on a common assumed funds rate path. By removing the ambiguities inherent in the current SEP forecasts concerning the FOMC's desired influence on the term structure of interest rates, it clarifies the monetary policy of the FOMC. For this reason, the term "FOMC SEP" is used to refer to the proposal.

3. The proposal: a graphical framework for clarifying strategy

The proposal advances transparency through an FOMC forecast organized around three graphs displaying forecasted values. First, since January 2012, the FOMC has set a two-percent inflation target. Graph 1 shows a benchmark (solid) line growing at 2 percent per annum from the current base of the price level (the PCE or personal consumption expenditures deflator). It also shows a path for the price level forecasted by the FOMC (dashed line). The assumption in the graph is that inflation is growing below target so that the price level falls away from the benchmark line but that over time inflation will return to 2 percent so that the forecasted path of the price level will grow parallel to the benchmark line.³

Second, Graph 2 shows a path for the estimated level of potential real GDP extending several years into the future. The dashed line shows real GDP forecasted by the FOMC. It is drawn based on the assumption that there exists some slack in the economy, that is, a negative output gap.⁴ The underlying assumption is that the FOMC conducts monetary policy with the intention of causing real GDP over the "long-run" to move around the potential path. The relationship between the forecasted paths in Graph 1 and Graph 2 relative to their benchmark levels reveals information about the strategy of monetary policy.

Graph 2 shows two alternative paths from point A to point F, which lies on the potential path. One path is A-B-D-E-F. That is, in order to correct the shortfall in inflation from target, the FOMC intends to engineer a positive output gap.⁵ The other path is A-B-C-E-F. That is, in order to return

³ Because the target is for inflation, there is base drift in the price level. With each SEP forecast, drift is forgiven and the two lines will coincide at the current date. Graph 1 would also be accompanied by a Graph 1a showing forecasts for core PCE as a way of removing noise in headline PCE.

⁴ Graph 2 would also be accompanied by a Graph 2a showing forecasts for real final sales to private domestic purchasers as a measure of underlying demand. This measure omits noise from transitory movements in changes in inventories and in net exports.

⁵ Comments by San Francisco Fed president John Williams suggested that as of August 2016 the FOMC favors this strategy. Jon Hilsenrath (2009) reported the following exchange at a meeting of Fed officials with representatives of Fed Up held before the start of the Jackson Hole Conference:

"I don't want to be sacrificed for a war against an inflation enemy that isn't here," said Rod Adams, an African American Fed Up activist.... Fed officials weren't arguing.... John

inflation to target, the FOMC intends to rely on maintaining expected inflation equal to target. The first policy works off exploiting a Phillips curve relationship between inflation and output. In terms of New Keynesian models, the second policy relies on a credible rule that shapes the price-setting behavior of firms in the “sticky-price” sector (firms that set prices for multiple periods). Within that environment of nominal expectational stability, the FOMC follows a rule that effectively allows the price system to set the real rate of interest in order to keep output growing at potential.

Graph 3 shows the path for the funds rate that supports the forecast. In this way, the FOMC clarifies its monetary policy by revealing how it desires to influence the term structure of interest rates. In order to implement monetary policy, the FOMC has to reach a consensus over how it desires to influence the term structure. The proposal here elucidates that consensus and the forecasts of the economy that condition it.

Graph 3 also shows the funds rate path observed in futures markets.⁶ In that way, it clarifies the debate required to formulate monetary policy. For example, if the FOMC were missing on the upside both its inflation and output objectives and the funds rate path inferred from futures markets lay below the FOMC consensus path, how should the FOMC respond? Should it accept the market judgment or communicate its belief that markets are underestimating strength in the economy?

4. Implementation of the proposal

The long-run objectives of policy are fixed. Those objectives are to keep output growing along the path for potential output while maintaining expected inflation and actual inflation equal to the inflation target. The implementation of monetary policy then requires an ongoing evaluation of whether the economy is growing faster or slower than potential and whether output lies above or below the potential path. Based on those estimates, the FOMC must evaluate the appropriateness of the term structure of interest rates for achieving its objectives. That is, it has to decide whether to validate or to shift the term structure. If it chooses the former, it moves the funds rate as expected by markets. If it chooses the latter, it moves the funds rate more aggressively than expected by markets and communicates its concerns through the statement, Minutes, and speeches.

Implementation of the FOMC SEP proposal would build upon current procedures. Because of the extended discussion that would be required, the FOMC SEP would occur four times a year. Prior to FOMC meetings, the Board staff would circulate its judgmental forecast of the economy as done in the publicly available document, “Current Economic and Financial Conditions: Summary

Williams, president of the Federal Reserve Bank of San Francisco, [replied] “We’re going to run it [the economy] hot, get the unemployment rate down lower.”

What counts, however, are comments by the chair speaking for the FOMC. The proposal here would clarify the ambiguity inherent in President Williams’ statement of strategy.

⁶ Graph 3 would be accompanied by commentary on the estimated term premia in the market forecast. Term premia, which offer insurance, create a divergence between the forward rates observed in futures markets and the actual funds rates expected by markets. See for example, Adrian et al (2013).

and Outlook.”⁷ Also as done in the publically-available Greenbooks, the staff would provide a more pessimistic and a more optimistic forecast. The Greenbook would show then three sets of graphs with each set corresponding to an associated set of the Graphs 1, 2, and 3 proposed above. Also as done in 2010 and earlier years, the document “Monetary Policy Alternatives” would contain language for the end-of-meeting FOMC statement appropriate for each of the three alternatives.⁸

As shown in the publicly-available documents, the forecasts contained in the Greenbook are summarized in several tables, especially, “Changes in Real Gross Domestic Product and Related Items” and “Changes in Prices and Costs.” Historically, the Board staff has given weekly briefings to the governors and circulates these briefings to the economics staffs of the regional Banks. These briefings update the forecasts in the Greenbook from the previous FOMC meeting. As part of this weekly update, the Board staff would circulate updated summary versions of the above tables along with current commentary. Staff at the regional banks would be encouraged to offer input so that by the time of the issue of the Greenbook prior to the FOMC meeting all the regional Banks would have had an opportunity to engage in dialogue with the Board staff. In that way, prior consultation would help to assure that the A, B, and C alternatives of the Greenbook span the views of FOMC participants.

Part of the proposal includes reorganization of the format for debate at the four FOMC SEP meetings. Based on transcripts available through 2010, FOMC meetings follow the practice of staff presentations from the New York Desk on financial markets and from the Board staff on the domestic and foreign economies. A go-around on the economy that includes all FOMC participants follows. There is then a staff presentation on the policy options. A go-around on policy follows. Participants read prepared statements prior to each go-around with the regional Bank presidents reviewing the state of their district economies. For the four FOMC SEP meetings, FOMC participants would write out these statements and distribute them prior to the meeting but not present them at the meeting.

For the four FOMC SEP meetings, FOMC discussion would concentrate on the choice of the three alternative sets of three graphs of forecasted inflation, output, and the conditioning funds rate path. The Board staff would start with a summary presentation of the Greenbook alternatives. Discussion would then center on an exchange of views between Board Staff and FOMC participants. The heads of the Division of Monetary Affairs and Research and Statistics would represent the Board staff at the table. The role of the FOMC chair would be to form a consensus over the choice among Greenbook alternatives, A, B, or C and the associated language in the Bluebook.

The Greenbook forecasts are judgmental and could be adjusted but they are internally consistent and cannot be changed piecemeal. If the FOMC decided to adjust the Greenbook alternative it chose, the chair could sketch an outline of the changes. The staff would then prepare a consistent set of output and inflation tables in time for the release of the FOMC SEP graphs with the Minutes. FOMC members would retain the right to dissent. The FOMC is arguably the world’s most civil debating society. Members work hard to achieve consensus and do not dissent lightly. It is likely that dissents would be no more common than at present. However, each FOMC participant

⁷ In the materials from FOMC meetings available now (2010), this document was referred to as the Greenbook. I use that term here.

⁸ As of 2010, this document was called the Bluebook.

would have the opportunity to write under his (her) own name a public comment on the alternative chosen indicating areas of agreement and disagreement.

Opposition to the proposal could arise from fear that it would reveal wide differences among FOMC participants about their objectives, strategy, and forecasts of the evolution of the economy. Diversity of views among FOMC participants, however, always exists. Lack of clarity about how the FOMC reaches consensus and how it communicates that consensus to financial markets can only limit the quality of the required debate.

The proposal could raise the concern that it would create a false sense of precision about the ability of the FOMC to forecast the future and about its knowledge of the key benchmark path for potential output. Legitimately, monetary policymakers will argue that they possess very little confidence in their knowledge of the path of potential output and of the funds rate trajectory that will move output along that path while keeping inflation in line with its target. However, that lack of knowledge only reflects the inherent uncertainty over the evolution of the economy. Moreover, policy is not conditioned by a structural model of the economy that reveals the “natural” values of real variables. Inevitably, policy actions, which are made in real time, are judgmental. Although the FOMC objectives of keeping output moving along potential over the longer run and of maintaining inflation at two percent remain constant, achieving them requires a continual updating about the path of potential output and about the course of the economy relative to that path. It also requires continual checking that expected inflation remains anchored at two percent.

Even though the implementation of monetary policy is relentlessly data dependent, the success of monetary policy depends upon a consistent strategy—rule-like behavior. That consistency causes financial markets to update constantly the term structure of interest rates in response to incoming information in a way that keeps output moving around its potential path. The success of monetary policy also depends upon the expectational environment that maintains the expectation of longer-run inflation by financial markets and firms at the two percent target. Implicitly, FOMC procedures acknowledge the requirement of shaping the expectations of markets in order to ensure this behavior through consistent, rule-like behavior. As explained below, the proposal here only clarifies for a wide public audience how the FOMC disciplines the term structure of interest rates to respond to incoming information in a way that stabilizes the economy.

5. The proposal clarifies actual FOMC strategy

With the binding of the zero-lower-bound (ZLB) constraint after December 2008, the FOMC advanced transparency on two tracks. First, with the SEP, the range of forecasts of the economy of individual FOMC participants has become clearer. Second, the statement released after FOMC meetings offers a qualitative consensus of the current state of the economy and its near-term evolution. Both forms of communication constitute monetary policy actions through their influence on the term structure of interest rates. The proposal offered here would combine these two separate forms of communication into a single statement of monetary policy. Hopefully, over time, the FOMC would become more comfortable with explicit articulation of the now implicit consensus over the way in which it intends to shape the evolution of the economy through its influence on the term structure of interest rates. It will then move toward fuller articulation of the systematic way in which it sets the funds rate, that is, its strategy.

An understanding of the strategy underlying monetary policy starts from the fact that the FOMC uses as its policy instrument the funds rate, an overnight rate, which by itself possesses no

significance. What is relevant is the entire term structure of interest rates. The problem the FOMC must solve is how to cause the term structure of interest rates to respond in a stabilizing way in response to the behavior of the economy. When “news” arrives, say, that the economy is growing faster than previously anticipated, the term structure should rise with the entire rise being in expected real forward rates rather than in inflation premia.⁹ It follows that the FOMC must move the funds rate in a systematic way that conditions such a response. The FOMC must follow a rule that determines not only the level of the funds rate but that also communicates how it will move the funds rate in response to incoming information. Effectively, the FOMC must conduct policy in a way that forecasting the path of the funds rate causes markets to forecast a real term structure of interest rates that keeps output growing along its potential path and that stabilizes expected inflation (inflation term premia).¹⁰

Explicitness about objectives, strategy, and the term structure of interest rates considered optimal, however, does not lead to an arithmetical rule that determines individual funds rate changes. In order to maintain output growing at potential, the FOMC must track the “natural” rate of interest. The reality, unfortunately, is that there exists no structural model of the economy that reliably estimates the natural rate of interest. As a result, policy has to discover it through an ongoing process of testing (*tâtonnement*) with continuous monitoring of “news” about the economy and how the term structure of interest rates reacts to that news.

The funds rate and communication about its anticipated path are the proximate instrument while the term structure of interest rates and its response to incoming information are the ultimate instrument. In its deliberations, the FOMC assesses the strength of the economy and reaches an implicit judgment over whether the term structure of interest rates is appropriate. If the output gap is not zero, will the term structure cause output to follow a glide path that leads to movement along the path of potential output? In making that assessment, the FOMC implicitly forms a consensus over the sign of the growth gap and the output gap.

For example, the growth gap is positive if the unemployment rate is declining persistently. In assessing whether a positive growth gap will be associated with “inflationary pressures,” the FOMC has to have a sense of the cyclical state of the economy. For example, it must have some sense of whether the positive growth gap will cause output to overshoot potential output turning a negative output gap into a positive one. The decision is judgmental and imprecise but what is important is that the policy process is one of continual revision.

⁹ Before TIPS offered a measure of the real term structure of interest rates, the rule of thumb was that unanticipated cyclical strength in the economy should raise the short end of the term structure (near-term forward rates) significantly more than the long end (far off forward rates).

¹⁰ In the stop-go era, the FOMC put considerable cyclical inertia into movements in the funds rate. In an attempt to hasten a decline in a negative output gap, it delayed raising rates after cyclical troughs. In an attempt to lower inflation by creating a negative output gap, it delayed lowering rates after cyclical peaks. It did so while allowing inflation to rise across business cycles. These procedures made it difficult for markets to set the term structure of interest rates based on a forecast of the path of forward rates that would keep output growing at potential. In general, the FOMC needs for markets to assess the strength of the economy as accurately as possible. Monetarists argue for that to occur, the FOMC needs to avoid attempts to manipulate output gaps.

In the event that the FOMC believes that the term structure needs to rise in order to contain inflationary pressures, it has several options. It could raise the funds rate by $\frac{1}{2}$ of a percentage point when the market was expecting instead a $\frac{1}{4}$ percentage point increase. Before the FOMC tied the discount rate to the funds rate, it could implement the “gong effect” by accompanying a funds rate increase with an increase in the discount rate. It can convey a sense of urgency through an intermeeting increase in the funds rate. The chair can give public speeches that highlight the FOMC’s concerns. The markets will then anticipate significant persistence in funds rate increases and the term structure of interest rates will rise accordingly.

The FOMC also communicates its commitment to low, stable inflation. In the Volcker-Greenspan era, the FOMC communicated credibility for the control of inflation through signals that it was committed to continuing funds rate increases to whatever extent necessary in order to prevent unsustainable strength in the economy from generating an increase in trend inflation. Moreover, during “inflation scares” when long-term bond yields exhibited large, discrete jumps, the FOMC raised the funds rate regardless of the amount of slack in the economy (Goodfriend 1993; Hetzel 2008, ch. 13). A “whatever it takes” commitment to keeping real output growing at potential in an environment of stable expected inflation causes the term structure of interest rates to respond to “news” about the economy in a stabilizing way with all the movement in real forward rates and none in inflation premia. Effectively, the FOMC conditions markets to forecast the path of forward rates that will keep the economy growing at potential.

In addition, the FOMC listens to financial markets.¹¹ It compares its implicit forecast of the future path of the funds rate with the market path measured by the Fed funds futures and the euro-dollar market. If the two differ, then the FOMC must determine the reason. One possibility is that market participants differ in their assessment of the strength of the economy and in the level of interest rates required in order to keep output growing at potential. If the market path lies above the FOMC’s implicit path, the FOMC must consider whether it is “behind the curve.” The alternative interpretation is that markets attribute a different reaction function to the FOMC than the FOMC attributes to itself. The FOMC must then find a credible way to communicate its intentions. In the ZLB period, when the FOMC had to maintain confidence that it would ensure a steady recovery, it turned to quantitative easing.

FOMC procedures have always been constrained by a desire to avoid unnecessary volatility in bond markets. That desire appears as an ideal that markets move the term structure of interest rates ahead of funds rate changes.¹² Although the appearance is one of the FOMC following the

¹¹ Bernanke (2005, 7) wrote:

[M]arket prices on actively-traded futures contracts on the funds rate or on the Eurodollar rate tell us a great deal about the funds rate that market participants expect to prevail at various dates in the future.... By watching financial markets and listening to the views of market participants, FOMC members are able to know with considerable accuracy what the markets expect for monetary policy. This information helps Committee members deduce how their own actions and statements are likely to affect asset prices and yields.

¹² Instances in which an action by the FOMC surprises markets are unusual and highly newsworthy. The discipline imposed on the FOMC to behave systematically in order not to surprise markets began after the Treasury-Fed Accord of 1951 with William McChesney Martin’s policy of “even keel.”

market, the reality is that the FOMC must respond consistently to the economy in order that markets can forecast its behavior. The movement toward increased transparency that began with the announcement of the funds rate target at the February 1994 FOMC meeting has involved making explicit communication that had previously occurred through signals sent to the financial markets about how new information on the economy affects the future path of the funds rate.

The FOMC SEP proposal makes explicit the information that the FOMC now conveys implicitly to markets. Former FOMC chairman Ben Bernanke (2005, 6) wrote:

The Fed controls very short-term interest rates quite effectively, but the long-term rates that really matter for the economy depend not on the current short-term rate but on the whole trajectory of future short-term rates expected by market participants. Thus, to affect long-term rates, the FOMC must somehow signal to the financial markets its plans for setting future short-term rates. [T]he FOMC has two general ways to help financial market participants divine the long-run course of policy. First, to the extent practical, the FOMC strives to be consistent in how it responds to particular configurations of economic conditions and transparent in explaining the reasons for its response. ... Second ... comments by FOMC officials about the Committee's general policy framework ... help the public deduce how policy is likely to respond to future economic circumstances.

6. An illustration using 2008

Discussion of the actions of the Fed in the 2007-2009 recession (the Great Recession) has focused on the Fed's credit market interventions in fall 2008. An advantage of the FOMC SEP proposal offered here is the sharp distinction drawn between monetary policy (the reaction function that summarizes the systematic procedures of the FOMC for influencing the term structure of interest rates) and credit policy. It is interesting to conjecture how the proposal here would have elucidated the strategy of monetary policy in the Great Recession. Although this exercise indicates a particular strategy for monetary policy in 2008, the intention is not to argue for the validity of that characterization of policy. The point is rather that individuals have to infer the strategy *ex post* because the FOMC does not articulate it *ex ante*.

Figure 1 shows the behavior of the headline personal consumption expenditures (PCE) deflator and its core counterpart normalized using 2005Q4 as a base. These series are compared to a benchmark level rising at an annualized rate of two percent. As shown by the two actual inflation series, relative to the benchmark both grew at rates in excess of two percent until mid-summer 2008. The headline PCE deflator exhibited the greatest excess as a result of the worldwide commodity price shock that began in summer 2004. It likely that to some extent the high rate of growth of the headline PCE deflator due to commodity prices passed through to the core deflator.

Starting with the June 2004 meeting, the FOMC raised the funds rate from a cyclical low of 1 percent to a cyclical high at the June 2006 meeting of 5.25 percent. By summer 2007, the high rate of inflation due to the extended commodity price shock had depressed real disposable income and

The FOMC would not change its interest-rate target during Treasury refundings when broker/dealers were holding significant inventories of Treasuries for sale.

growth in consumption weakened correspondingly (Hetzel 2012, Fig. 12.6). The peak of the business cycle occurred in December 2007. The FOMC had started lowering the funds rate from its cyclical peak of 5.25 percent at its September 2007 meeting out of concern that a disruption to the flow of credit to mortgage markets would weaken growth. Following its lean-against-the-wind procedures, it lowered the funds rate to 2 percent at its April 2008 meeting. However, at that meeting, the FOMC signaled an end to the easing cycle.

One reason for this signaling was that economy appeared to stabilize in 2008Q2. Temporary factors made it appear that the economy was reviving. A decline in net exports boosted GDP. The enormous boost to disposable income provided by the Bush tax cuts temporarily halted the decline in real personal consumption expenditures that had begun in December 2007 (Hetzel 2012, 213).¹³ Most important, the FOMC became concerned about the persistent overshoot in its inflation target and also about depreciation of the dollar. Its communication delivered the message that the easing cycle was over so that the next move in the funds rate was likely to be upward.¹⁴

For observations the day following an FOMC meeting, Figure 2 plots the difference between the 3-month (6-month) Treasury bill rate and the funds rate target. The difference is positive when markets expect the FOMC to raise the funds rate. In this situation, markets believe that the FOMC wants to restrain growth. Conversely, a negative difference indicates a market belief that the FOMC wants to boost growth through funds rate reductions. The series declined after the May 9, 2007 FOMC meeting and declined significantly after the September 18, 2007 FOMC meeting. At the April 30, 2008 meeting, the FOMC lowered the funds rate from 2.25 percent to 2 percent. However, in line with the messages sent by the FOMC about the likely direction of the next move in the funds rate, as shown in Figure 2, the yield curve jumped after April 2008 FOMC meeting.

This evidence suggests that the FOMC attempted to create a negative output gap in order to lower headline inflation. That view receives support from Figures 3 and 4. Consider Figure 3. The solid line comprises two components. First, it uses a measure of the path of potential real output starting from a base for real GDP in 2005Q4. Each quarter that base value is updated using estimates of potential real GDP growth from the Greenbook. That updating yields an estimated path for

¹³ The following figures are for annualized growth rates of monthly real PCE:

12/2007 – 2/2008: -1.9%
 3/2008 – 5/2008: 1.7%
 6/2008 – 9/2008: -3.8%
 10/2008 – 12/2008: -4.5%

There is a pause to these negative growth rates in the months of March, April, and May. That pause came from the boost to income from the Bush tax cut, which President Bush signed into law on February 12, 2008. The actual rebates arrived in the month of May, but households anticipated their arrival. Real personal disposable income increased at an average monthly rate of \$12.1 billion over the months January 2007 through September 2007; at the average rate of \$6.6 billion over the months October 2007 through April 2008; and then jumped by \$562.1 billion in May 2008.

¹⁴ See Hetzel (2012, pp. 217-219) and the Appendix: Communicating an end to the easing cycle.

potential real GDP.¹⁵ The potential nominal GDP path of Figure 3 adds growth at an annualized rate of two percentage points (the assumed inflation target) to the potential real path.

As shown in Figure 3, after 2005Q4, nominal GDP moves along the benchmark path. It first began to fall below path in 2008Q4, which corresponds to the falling away shown for 2009Q1. (The observations for actual GDP are measured with a one-quarter lag.) At the same time, as shown in Figure 4, real GDP began to fall below path in a sustained way in 2008Q1, which corresponds to the falling away shown for 2008Q2. As shown in footnote 10, real PCE growth became negative in December 2007. That is, the FOMC attempted to keep nominal GDP growing at a stable rate as a way of mitigating high headline inflation through producing slack in the economy.

Monetary policy in 2008 falls into the general pattern that accompanies recessions in the post-World War II era. Policy entails continually-updating estimates about how the economy is moving relative to its potential path combined with moving the funds rate in a “lean-against-the-wind” (LAW) manner that reflects the *tâtonnement* process of discovering the natural rate of interest. The FOMC does not operate with knowledge of a benchmark interest rate in the form of a “neutral” or “natural” rate of interest. The FOMC moves the funds rate away from its prevailing value in small but persistent unidirectional steps with widely spaced inflection points. In the event of unsustainable strength in the economy (sustained increases in the rate of resource utilization), the FOMC raises the funds rate in a measured, persistent way. Converse statements hold, of course, for weakness.

Consider the process of raising the funds rate as the economy recovers from a recession. After a trough, when the FOMC becomes convinced that economic recovery possesses sufficient momentum in order to handle a succession of funds rate increases, it begins the process of raising the funds rate in a measured but persistent fashion until the economy weakens. At that point, if the FOMC is not concerned with inflation, it begins the process of ratcheting down the funds rate. However, if it is concerned with inflation, it imparts downward inertia to the funds rate with the intention of developing a negative output gap. In these instances, recession follows (Hetzel 2008, Chs. 23, 24; Hetzel 2012, Chs. 7, 8; Hetzel 2015).

It appears as though in 2008 the FOMC attempted to allow a negative output gap to develop in order to lower headline inflation. The main purpose here, however, is not to argue whether such a policy was optimal or not. The purpose is to make the point that an understanding of the strategy of monetary policy is left to those outside the FOMC to ferret out.

¹⁵ Econometricians make joint estimates of NAIRU (the unemployment rate consistent with maintaining inflation unchanged), which provides an estimate of the unemployment gap, and potential output, which provides an estimate of the output gap. For example, the unemployment rate fell rapidly in 2011 while output grew only moderately. As a result, econometricians reduced their estimate of potential output growth. Econometricians also go from an unemployment gap to an output gap using an Okun’s law relationship. Adjustments to this relationship can change the level of estimated potential output, in the 2011 case lowering it. The graphs are illustrative in that they do not allow for level adjustments in potential output.

7. What about rules yielding numerical values for the funds rate?

Since money demand became highly interest sensitive with the deregulation of interest rates in the early 1980s, the proposal of Milton Friedman (1960) for a rule based on money growth has become infeasible. The reason is that when the economy weakens and interest rates need to decline, money demand increases. The resulting increased money growth then would send an inappropriate signal that interest rates should rise. During periods of financial distress, the flight to quality and to liquid assets also increases the demand for demand deposits. Again, rapid money growth is a misleading guide to monetary policy. As a result, Friedman's k -percent money growth rule has been displaced. However, the reasons for abandoning it do not bear on his underlying supposition about what a central bank can and cannot control. Friedman's rule for steady money growth would have supplied a stable nominal anchor in terms of domestic prices while turning over to the price system the determination of real variables, such as the real interest rate and the unemployment rate.

Friedman's underlying assumption is that central banks can control trend inflation, no more and no less. A negative way to put the Friedman assumption is that central banks lack the ability to successfully implement a monetary policy that manipulates Phillips curve trade-offs between unemployment and inflation. Any attempt to control real variables in a systematic fashion founders on the problem of "long and variable lags," that is, ignorance about the structure of the economy (Friedman 1960, 88). In this spirit, a monetarist interpretation of the success of monetary policy in the period known as the Great Moderation came from a credible rule that conditioned price setting by firms that set prices for multiple periods (firms in the sticky-price sector) and as a result freed up monetary policy to follow procedures that allowed market forces to determine real variables (Hetzel 2008, chs. 13, 14, and 21).

Evaluation of the alternatives to the Friedman money rule requires a stand on his assumption that the powers of a central bank are limited to controlling trend inflation. The critique here accepts that assumption. That acceptance is implicit in the argument in section 5 that although the objectives of monetary policy are fixed and discipline policy actions over time the search for the natural rate of interest is one of trial and error in the absence of a structural model of the economy. Economists who believe that the central bank can control the behavior of real variables through the manipulation of Phillips curve relationships will reach a different conclusion. The two chief contestants for a rule to guide monetary policy that have emerged are nominal GDP targeting and Taylor rules.

Consider first the proposal for nominal GDP targeting advanced by Bennett McCallum (1987 and 1988) in which the central bank would vary its instrument (the monetary base or the funds rate) based on a simple feedback rule intended to correct misses. Consider also two sorts of shocks that push nominal GDP above target. One is a sustained increase in productivity such as occurred in the last half of the 1990s and the early 2000s. The other is a sustained inflation (commodity price) shock such as occurred from mid-2004 through mid-2008. In both instances, in order to maintain nominal GDP on its path, the central bank must create and maintain a negative output gap. Evidence from the stop-go era when manipulation of output gaps was a central element of policy casts doubt on the FOMC's ability to exercise this degree of control over real variables (Hetzel 2008, chs. 23-25; 2012, ch. 8).¹⁶ At least until 2008, the hallmark of monetary policy in the Volcker post-disinflation era was

¹⁶ Market monetarists like Scott Sumner (2014 and 2015) argue for nominal GDP targeting but not based on a simple feedback rule running from misses in target to the FOMC's instrument. Instead, they argue that the FOMC should respond to market measures of the expected path for nominal GDP.

a rejection of attempts to exploit Phillips curve trade-offs. It is then unclear whether nominal GDP targeting would successfully overcome the problems that arose in the stop-go era.

John Taylor (1993, 1999, and 2015) reinvigorated interest in rules to guide monetary policy with a formula for setting the funds rate now known as a “Taylor rule.” Specifically, the FOMC sets the funds rate based on a formula that assumes a known, constant benchmark rate of interest. It then moves the funds rate relative to that benchmark based on a measure of lagged inflation plus deviations of inflation from a target of 2 percent and on deviations of output from trend. As shown in Figure 5, for the period 1987 through 2008, the Taylor-rule formula does predict the level of the funds rate.¹⁷ In estimated models of the U. S. economy, it has therefore become standard to include a functional form like the Taylor rule to capture the behavior of the Fed.

At the same time, it is important to keep in mind two caveats in using the Taylor rule as a guide to monetary policy. First, the fact that the formula allows estimated models to predict the behavior of the funds rate does not mean that monetary policy is optimal. In the Great Recession, when instability in financial markets likely caused a sharp decline in the natural rate of interest, inertial Taylor rules seem particularly suspect. As shown in Figure 5, going into recessions, the Taylor rule predicts levels of the funds rate near cyclical highs. If monetary policy were countercyclical, the funds rate would decline prior to cyclical peaks as the economy weakens (Hetzel 2012, 2015, and 2016).

While the fit of the Taylor rule over the period 1987 through 2008 is impressive, it probably reflects a non-representative period of exceptional economic stability. As shown in Figure 6, long-run real GDP growth was quite stable over this period. However, a reduction in labor force growth and productivity growth in the second half of the first decade of the 2000s, popularly referred to as secular stagnation, probably lowered the benchmark interest rate of 2 percent assumed in the estimation of Taylor rules. A decline in the benchmark rate would put the funds rate prescribed by the Taylor rule plotted in Figure 5 below the actual funds rate in 2008.

Second, when estimated as part of a model, unless the model is a true structural model of the economy, the Taylor rule has the properties of a reduced form. Its measure of slack (an output or unemployment gap) provides a measure of the cyclical state of the economy and thus predicts the relationship of the funds rate to the cycle average. While the coefficient on the output gap picks up cyclical movements, the coefficient on the inflation term picks up low frequency (trend) movements between inflation and interest rates. As would be expected if inflation is only capturing the trend in the funds rate, the relationship between inflation and the funds rate would disappear when the series are first-differenced (Granger and Newbold 1974).

The formula that generates the Taylor rule predictions in Figure 5 is shown in (1). The estimated coefficients in a level-form regression approximate the “a” (inflation miss) and “b” (unemployment gap) coefficients. In a level-form regression from 1987 through 2008 using the

Market monetarists express the monetarist critique that just as procyclical money growth indicated non-optimal monetary policy so does procyclical nominal GDP growth.

¹⁷ In correspondence with the author, Taylor wrote, “[T]he rule was derived from looking at many simulations which were done as part of research searching for an optimal rule using my multi-country model and many other models.”

series referenced in Figure 5, the estimated value of a is .8 (13.3), which is close to the coefficient of .5 assumed in Figure 5 while the estimated value of b is -1.9 (-25.7), which is close to the coefficient of -2 assumed in Figure 5 (t-statistics in parentheses). When the regression is estimated in first differences, the estimated value of “ a ” is -.8 (-9.2), which is of the opposite sign from the coefficient of .5 assumed in Figure 5. The estimated value of b is -.7 (-6.2), which differs from the coefficient of -2.

$$(1) \quad FFR = r^* + \pi + a(\pi - 2) + b(u - u^*)$$

Taylor rules estimated as part of a model that is not the true structural model may predict the funds rate without being structural. That is, they do not explain how the FOMC controls inflation.¹⁸ During normal periods, when credibility shapes the expectations of firms, the Fed does not respond directly to measured inflation. At the end of a tightening cycle, however, when the economy begins to weaken, if the Fed is concerned that inflation is too high, it then responds directly to observed inflation and as a result imparts inertia to downward movements in short-term interest rates. It does so in an attempt to create a negative output gap in order to lower inflation. From the monetarist perspective, that interference with the price system is the initiating factor in recessions.

8. Rules and independence

Central bankers emphasize the need for independence. Public support for that independence rests on a sense of legitimacy, which in turns comes from a belief that policymakers are accountable. For that to happen, policymakers need clarity about their objectives and their strategy for achieving those objectives.

The Constitution of the United States assigns to Congress the power “to coin money and regulate the value thereof.” Originally, that meant the Congress could establish a mint that would provide dollars in specie in return for a specified weight in gold or silver. That assignment of powers came out of the British system of government in which Parliament had control of the mint. In the United States, this assignment of powers assures that Congress retains control over fiscal policy through the control of the seigniorage that comes from money creation.

Congress, however, lacks the capacity to direct the operation of monetary policy. It has delegated that responsibility to the Federal Reserve. At the same time, it has also effectively delegated to the Fed the responsibility for determining the nature of the monetary standard not just responsibility to run it. This delegation is awesome and debate over accountability is natural. A currently popular strand is to advocate limiting the regional character of the Fed, especially, by either removing the regional Reserve Bank presidents from the FOMC or requiring their appointment by

¹⁸ The fundamental issue is the realism of a model that offers to the central bank a Phillips curve trade-off in which the central bank can manage an output gap as part of the control of inflation. In contrast, in the divine coincidence version of the New Keynesian model, the monetary policy rule provides for price stability (more generally, stable trend inflation) while allowing the price system to operate to determine all real variables (Goodfriend and King 1997). In the monetarist spirit of allowing the price system to work unhindered to determine real variables, the control of inflation occurs through a credible rule that shapes the way in which firms that set prices for multiple periods set their dollar prices.

the President. Given the short tenures of most governors and the four-year terms of the chair and vice chair of the Board of Governors, the practical result could be to increase the influence over monetary policy of the administration relative to Congress. To date, Congress has maintained its constitutional prerogatives by not removing the checks and balances of a regional system.

Another strand of reform is the attempt to make the Fed a part of the constitutional framework through imposition of an explicit rule (Friedman 1962). Fed spokespersons have protested that the rules proposed entail an arithmetical formula for the determination of the funds rate. They are correct in asserting that setting the funds rate involves ongoing judgment—a process of trial and error with continual feedback from financial markets and the economy. However, when successful, that process is disciplined by a fixed north star in terms of maintaining expected inflation equal to target and of maintaining growth of output along its potential path. The proposal here makes that discipline explicit and provides for the formulation of monetary policy in the spirit of a rule.

9. Concluding comment

Monetary policy is complicated because it emerges out of the interaction of the behavior of the FOMC and the financial markets. It is inherently complex.

The proximate objective of monetary policy is the level and slope of the term structure of interest rates. The strategy of monetary policy deals with the procedures the FOMC uses in order to cause the term structure of interest rates to behave in a way that stabilizes economic activity. The stance of monetary policy emerges out of the relationship between the real term structure of interest rates and the operation of the price system represented by the “natural” term structure, which is the behavior of the real term structure with no nominal price rigidities. That is, the natural term structure is the pattern of real interest rates that would emerge in a perfectly competitive market economy. It forms the benchmark for policy.

The complexity of monetary policy renders accountability difficult. By providing a framework that makes explicit FOMC objectives and its forecasts both of the economy and of the path of the funds rate, the proposal here would facilitate the communication with the public required for accountability.

Appendix: Communicating an end to the easing cycle

The message communicated to markets shifted between the March 18, 2008 FOMC meeting and the April 29-30, 2008 meeting. In the March 13, 2008 Greenbook, estimated growth in real final sales to private domestic purchasers for the entire year 2008 turned negative (-1.6 percent). At the March meeting, the Minutes (Board 3/18/2008, 7) recorded a primary concern for recession:

[M]ost members judged that a substantial easing in the stance of monetary policy was warranted at this meeting. The outlook for economic activity had weakened considerably since the January meeting, and members viewed the downside risks to economic growth as having increased. Indeed, some believed that a prolonged and severe economic downturn could not be ruled out. . . . [T]hey noted that, through a range of channels, lower short-term real interest rates should help buoy economic activity. . . . Even with a substantial easing at this meeting, most members saw overall inflation as likely to moderate in coming months. . . .

The end-of-meeting statement for the March FOMC meeting (Board 3/18/2008, 7) read:

Inflation has been elevated, and some indicators of inflation expectations have risen. The Committee expects inflation to moderate in coming quarters, reflecting a projected leveling-out of energy and other commodity prices and an easing of pressures on resource utilization.

Going forward through the summer, contrary to the expectation for “inflation to moderate” due to a “levelling-out of energy and other commodity prices,” inflation rose. Year-over-year headline PCE inflation rose from 2.4 percent in July 2007 to 4.4 percent in July 2008 while the comparable figures for core PCE inflation were 2.2 percent and 2.5 percent, respectively. The Minutes (Board 4/29-30/2008, 9) for the April 29-30 FOMC meetings sent a message to markets that the easing cycle was likely at an end:

[A]lthough downside risks to growth remained, members were also concerned about the upside risks to the inflation outlook, given the continued increases in oil and commodity prices and the fact that some indicators suggested that inflation expectations had risen in recent months. . . . [R]isks to growth were now thought to be more closely balanced by the risks to inflation. Accordingly, the Committee felt that it was no longer appropriate for the statement to emphasize the downside risks to growth. . . . In that regard, several members noted that it was unlikely to be appropriate to ease policy in response to information suggesting that the economy was slowing further or even contracting slightly in the near term, unless economic and financial developments indicated a significant weakening of the economic outlook.

The end-of-meeting statement repeated the language from the prior statement about the expectation for “inflation to moderate” but added the qualification: “[U]ncertainty about the inflation outlook remains high. It will be necessary to continue to monitor inflation developments carefully.”

Chairman Bernanke (2008) stated:

Another significant upside risk to inflation is that high headline inflation, if sustained, might lead the public to expect higher long-term inflation rates, an expectation that could ultimately become self-confirming. . . . We are attentive to the implications of changes in the value of the dollar for inflation and inflation expectations and will continue to formulate policy to guard against risks to both parts of our dual mandate, including the risk of an erosion in longer-term

inflation expectations.

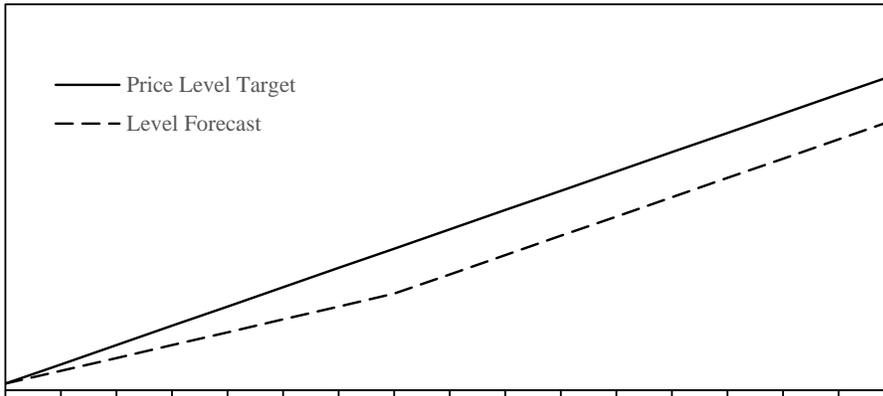
By the time of the August 2008 meeting, the Greenbook contained the following commentary, “Considering the totality of the evidence, we continue to think that a significant weakening of activity is in train” (p. I-1). Nevertheless, the Board staff assumed that the next change in the funds rate would be an increase. “As before, we assume that the federal funds rate will remain at 2 percent over the rest of 2008 and be raised to 2 ¾% over the first half of 2009” (p. I-2). As part of the long-term outlook, the staff forecast that “the federal funds rate continues to climb to just above 4 percent by the end of 2012” (p. I-15).

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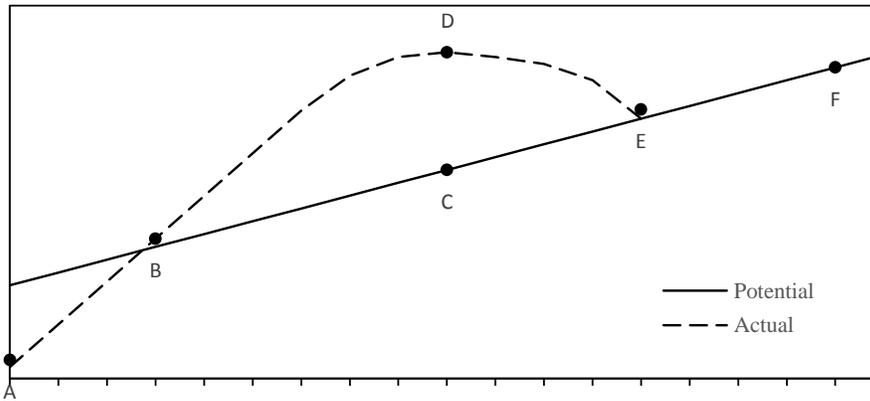
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Graph 1
Target Path for Price Level and Forecasted Path



Notes: Target path for price level with no base drift given an inflation target of two percent and normalized to one at time t.

Graph 2
Forecast Path for Potential Real Output and Actual Real Output



Notes: Graph shows two hypothetical paths for real output: ABCEF and ABDEF.

Graph 3
Funds Rate Path Forecasted by FOMC and Market

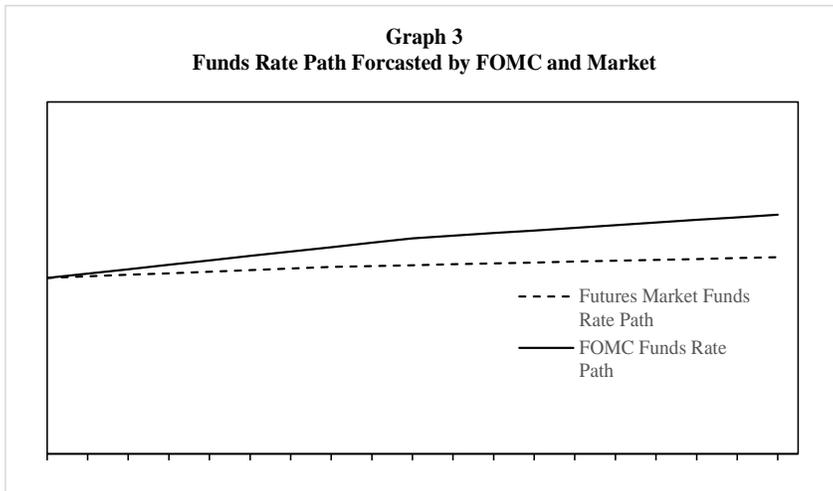
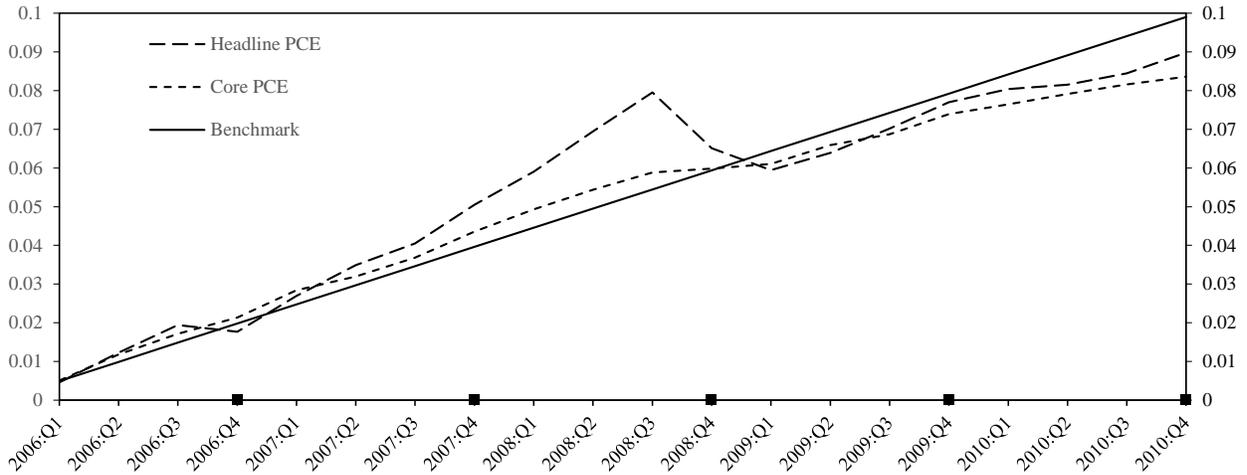
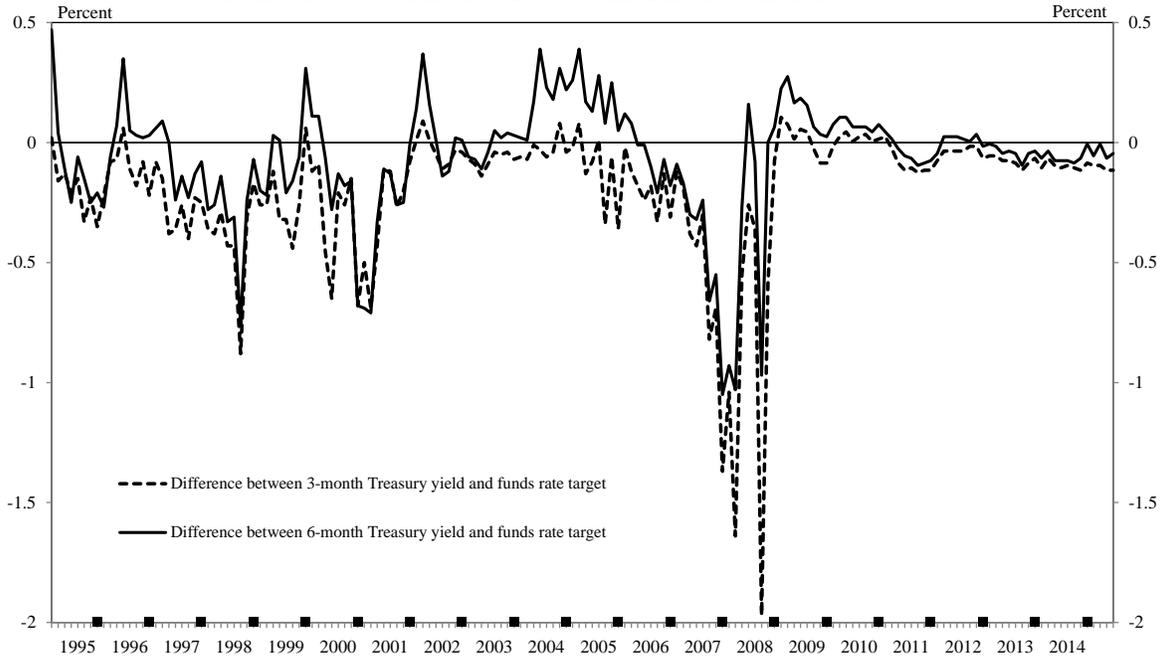


Figure 1
Headline and Core PCE Deflator with 2% Benchmark



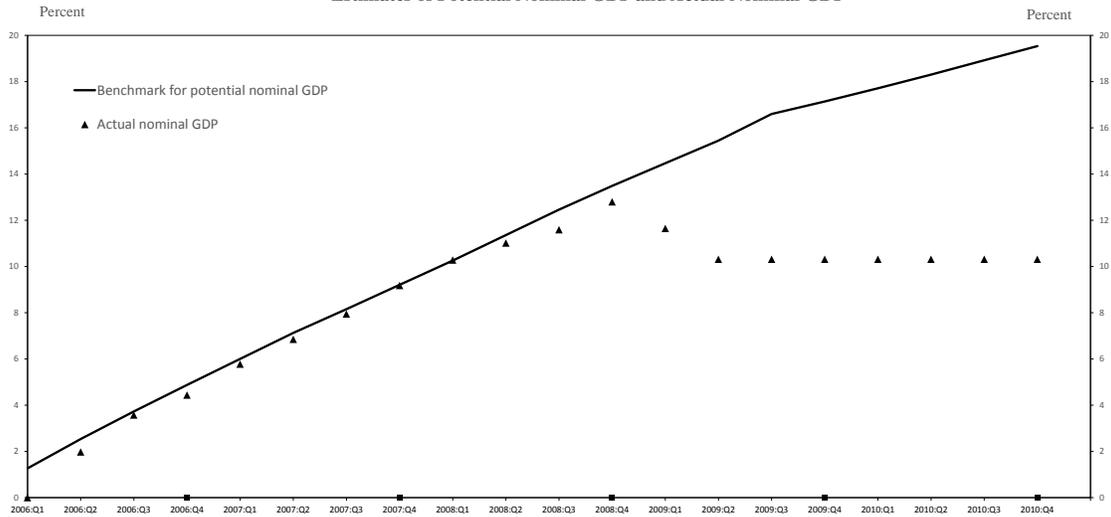
Notes: The benchmark grows at an annualized rate of 2 percent. The other lines show the level of the headline and core PCE deflator. Series are normalized to equal 1 in 2005 Q4. Values expressed as natural logarithms. Data from Haver analytics. Heavy tick marks indicate fourth quarter.

Figure 2
Term Structure of Interest Rates: 3-month and 6-month



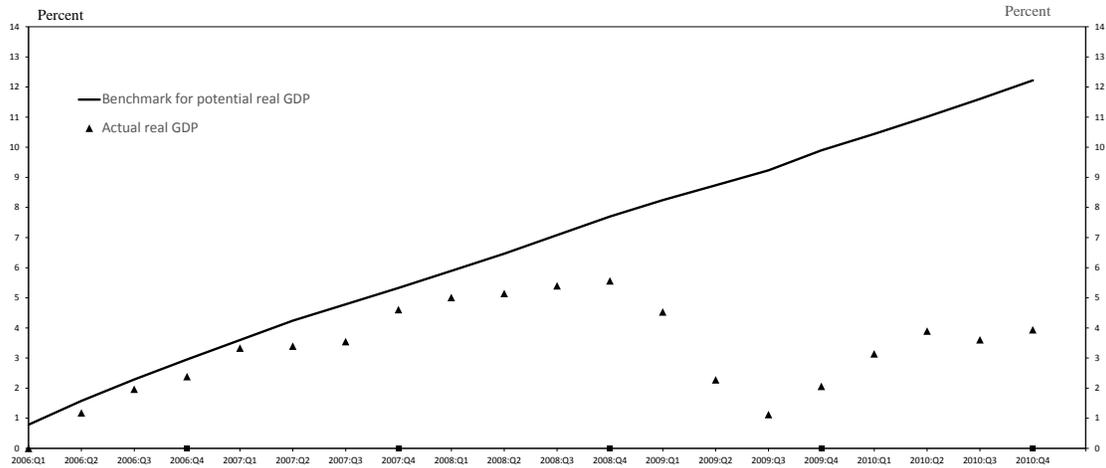
Notes: The series are the difference between three-month and six-month Treasury yields and the funds rate target. Treasury yields are from Board of Governors statistical release H.15 starting January 7, 2002 and from G.13 before. Starting October 2, 2001, yields are constant maturity. Before, they are the three-month and six-month yields. Observations are for the day after an FOMC meeting. Heavy tick marks indicate December.

Figure 3
Estimates of Potential Nominal GDP and Actual Nominal GDP



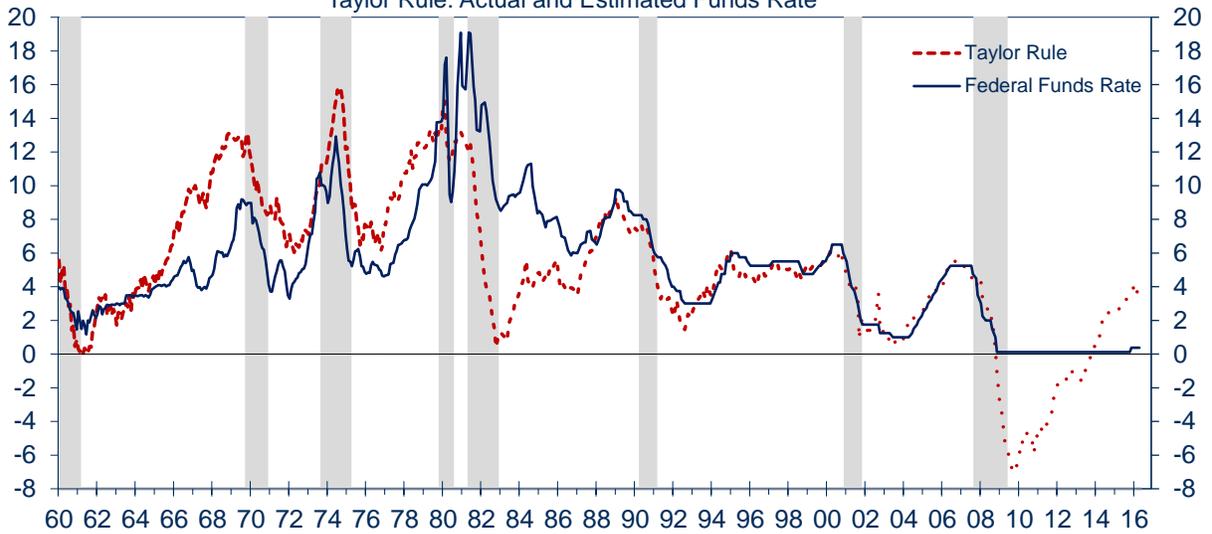
Notes: The contemporaneously available values for nominal GDP are for the quarters prior to the dates shown and are from the Philadelphia Fed real-time data set. The path of potential nominal GDP uses as its base the contemporaneously available value of nominal GDP for 2005Q4. Initially, this value is subject to quarterly revisions. For each quarter, the Tealbook from the first FOMC meeting of the quarter is used and the estimate of potential real GDP growth for the year recorded (from the table "Decomposition of Structural Labor productivity" initially and then the table "Decomposition of Potential GDP"). Through successive quarters starting in 2006Q1, the quarterly values of these potential annual growth rates are used to update the path for potential real GDP. The potential nominal path is the potential real path plus two percentage points. No allowance is made for drift in the level. Because values are normalized using the base quarter 2005Q4 and expressed as natural logarithms, the vertical scale measures the percentage increase from the base quarter.

Figure 4
Estimates of Potential Real GDP and Actual Real GDP



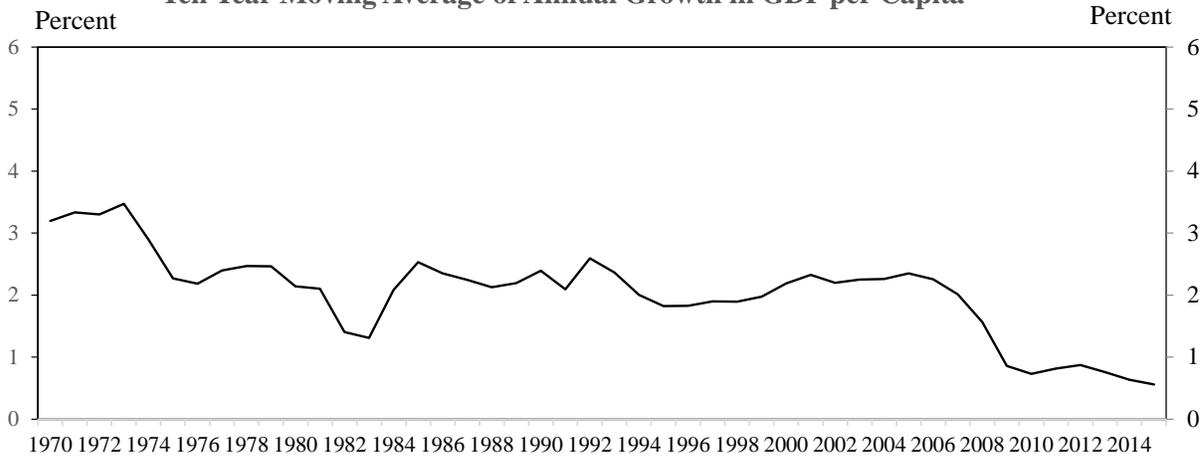
Notes: The graph is constructed similarly to the one for nominal GDP without the addition of two percentage points to the potential path.

Figure 5
Taylor Rule: Actual and Estimated Funds Rate



Notes: The Taylor Rule is $FFR = r^* + \pi + a(\pi - 2) + b(u - u^*)$. Observations correspond to FOMC meetings. FFR is the funds rate. The "neutral" interest rate r^* is 2. π is the 12-month percentage change in the core personal consumption expenditures price index (PCEPI) in the month prior to each FOMC meeting. Starting August 2000, core PCEPI is measured from the real-time data release archived in Alfred maintained by the St. Louis Fed. Before August 2000, when the real time figures are no longer archived, core PCEPI is measured from the currently-available data series. The inflation target is 2. u is the real-time unemployment rate as reported in the month prior to each FOMC meeting taken from Alfred. Before 1987, u^* is the current CBO estimate of the natural rate of unemployment. From 1987 to 2010, u^* is the natural rate of unemployment (NAIRU) estimated by the staff of the Board of Governors taken from the Philadelphia Fed Real Time Data Research Center. Thereafter, u^* is the midpoint of the range of the FOMC Survey of Economic Projections (SEP) for the longer run unemployment rate. FFR is from Haver Analytics. The inflation gap coefficient "a" is 0.5 and the unemployment gap coefficient "b" is -2 and is taken from Yellen (4/11/2012), fn. 15. The form of the modified Taylor rule is from Taylor (1999).

Figure 6
Ten Year Moving Average of Annual Growth in GDP per Capita



Notes: The series plots a ten-year moving average of annual percentage changes in real GDP per capita. Source Haver Analytics.