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Alternative Monetary Policy Frameworks[1]

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1. Introduction and summary

The FOMC may wish to consider a shift in its monetary policy strategy to provide additional stimulus and to better stabilize employment and inflation in the event of further adverse shocks. This memo focuses on three alternative strategies that would involve making conditional commitments about how the policy rate will be adjusted going forward: enhanced forward guidance, price level targeting, and nominal income targeting. Simulations across a range of models are used to assess the macroeconomic performance delivered by alternative monetary policy strategies under different scenarios for the evolution of real activity and inflation.

As discussed in this memo, these commitment strategies are broadly consistent with *flexible inflation targeting*—that is, with a policy framework in which the goals include price stability and maximum sustainable employment and where policy actions aim to return inflation and economic activity to their desired levels over the forecast horizon. While the policy goals remain the same across the strategies we consider, these commitment strategies attempt to improve current outcomes through pledges about future behavior that are more extensive than the conditional forward guidance already provided by the Committee. Our main conclusions are:

- Certain strategies that involve conditional commitments about how policy rates will be adjusted going forward may perform considerably better than the existing strategy of constrained discretion.

- One potentially appealing "commitment" strategy involves using enhanced forward guidance to markedly alter the public's views about the timing and pace at which accommodation is likely to be removed (as discussed in the forward guidance memo sent to the Committee in September). Model simulations suggest that this type of forward guidance could bring about a noticeably faster fall in unemployment than under the baseline outlook, while keeping inflation in the neighborhood of 2 percent. Under some alternative scenarios for the economic outlook, however, this strategy performs somewhat less well. Moreover, forward guidance that merely clarifies the Committee's existing strategy without materially changing market expectations would not provide much stimulus.

- A nominal income target also has desirable features. Model simulations suggest that nominal income targeting would provide considerable stimulus under the modal outlook and would also perform well in a severe downturn or in response to an unexpected sustained rise in inflationary pressures. However, there could be difficulties in explaining

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such a distinct break from the Committee's current policy strategy, and there could be communication challenges in explaining periodic revisions to the target path.

- A price level target (strictly interpreted) would likely generate less desirable outcomes for unemployment than nominal income targeting because monetary policy would not respond directly to resource utilization.

A potential difficulty with commitment-based strategies is that their effectiveness depends on influencing the public's beliefs about the policy strategy likely to prevail five or more years ahead. Accordingly, the ability to influence expectations hinges on the public's belief that the Committee will continue to adhere to the strategy for many years, including well after the point at which the unemployment rate has returned to a level consistent with full employment. But the public may doubt such long-horizon commitments. The benefits of these strategies are front-loaded while the costs are incurred later, providing an incentive to renege. Moreover, the adoption of one of these strategies might not be seen as credible because the Committee cannot really bind its successors.

Although these commitment strategies would perform less well if their credibility was significantly questioned, they still may improve upon the current strategy of constrained discretion: Even imperfectly credible commitments may have some favorable effect on expectations, financial conditions, and confidence. These favorable effects would seem most likely to occur if the motivation for and expected effects of the strategy were clearly laid out in supporting communications. Even so, the adoption of a new strategy carries the risk of adversely affecting confidence because the public might view such a move as a signal that the Committee was more pessimistic about its ability to achieve its long-run objectives for employment and inflation. Such an adverse outcome would be more likely still if the Committee's support for the strategy was perceived as tenuous.

There would be significant challenges involved in implementing any of these commitment-based strategies. However, the enhanced forward guidance strategy could build on the refinements that the Committee has made to its communication practices over the last decade. Communication challenges might be particularly formidable in the case of adopting an intermediate target, because the public would be unfamiliar with this approach. Even so, it is plausible that an intermediate target could eventually facilitate communication and boost credibility as a supporting pillar of a flexible inflation targeting framework. In this role, it could provide a clear and transparent indicator of the economic conditions affecting the policy outlook, and play a constructive role in guiding expectations.

One potential concern with adopting price level or nominal income targeting is the risk that either of these strategies could bring about a significant rise in inflation. Although our analysis is somewhat preliminary and certainly requires further work, our results across a wide range of models and scenarios suggest that inflation would be likely to average a little above 2 percent under these policies. As a result, the risks of higher inflation, and the potentially adverse effects of such an increase on term premiums or the economy more generally, do not appear outsized under these strategies.

A more general caveat is that the models we use in our analysis cannot be expected to capture some of the channels through which a major change in strategy could affect the economy. Our

models have important limitations even when applied to questions for which there is a wealth of historical experience. Given that the strategies we consider lack historical precedent, and even the tools used to implement the strategies are relatively unconventional, there is a considerable risk that our model results may prove faulty in some respect. Indeed, any policy outside the range of historical experience—ranging from the strategies considered here to balance sheet adjustments and macroprudential regulation—could have unintended consequences for economic welfare, for the better or for the worse.

The next section discusses policymaker goals, strategies, and insights from the monetary policy literature. Section 3 analyzes various forms of forward guidance, price-level targeting, and nominal income targeting under the modal outlook, a recession scenario, and an inflationary scenario. Section 4 discusses some risks, and Section 5 highlights additional issues related to communications and balance sheet management.

2. Goals, tradeoffs, and strategies

Monetary policy is generally conducted within a policy framework that can be viewed as consisting of the following components:

(1) the long-run goals that the central bank seeks to attain;
(2) the strategy used to achieve those goals, including an approach to disclosing judgments about the economic outlook and resulting monetary policy stance to the public; and
(3) the tools used to implement the strategy.[2]

Here, our primary focus is on alternative strategies to promote the Committee's long-run goals that might be useful in light of current and prospective circumstances, with particular focus on the central role played by forward guidance in their execution. These alternatives range from incremental changes to the FOMC's recent strategy to a more discrete shift in the framework. We begin our discussion with a summary of policymaker goals and the basic contours of the policy strategy currently in place; in this overview, we highlight parallels and distinctions between actual practice and the arrangements generally ascribed to flexible inflation targeting in the monetary policy literature. We then consider how insights from "optimal" policy simulations and monetary policy research can inform aspects of desirable strategies. While much of this section focuses on the modal outlook, some of the arguments for a change in strategy would acquire more force in the event of a further deterioration of the economic situation; we highlight these considerations and discuss them in more detail in the next section.

Policymaker goals and the characteristics of flexible inflation targeting

The FOMC has a statutory mandate to promote maximum employment and price stability. This legislative mandate could be interpreted in different ways. To focus our discussion, we assume that price stability corresponds to a mandate-consistent inflation rate of 2 percent, consistent with the majority of longer-run projections from the Summary of Economic Projections (SEP) and other communications by the Committee. We further assume that observed departures from this

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[2] For a longer discussion of these elements, see the October 2010 memo to the Committee from Michael Kiley, Andrew Levin, Steve Meyer, and Edward Nelson (2010).

price stability criterion are viewed as equally costly irrespective of their sign—that is, that inflation moderately above 2 percent is as costly as inflation moderately below 2 percent. As our analysis will demonstrate, this assumption is important, because strategies likely to provide additional stimulus may entail accepting, or perhaps actively seeking, inflation somewhat in excess of 2 percent for a time. Alternative assumptions about preferences, such as a view that the mandate-consistent rate of inflation is "2 percent or a bit less," or that the costs of inflation escalate rapidly above 2 percent while modest shortfalls below this rate are less problematic, would be inconsistent with the strategies discussed below.

We assume that the maximum employment goal corresponds to an aim to bring unemployment as close as possible over time to its longer-run equilibrium rate, which we assume is in the range of 5 to 6 percent, consistent with the majority of longer-run projections from the SEP. Our focus on this longer-run concept as the objective of policymakers does not imply that the FOMC seeks to achieve this objective quickly, as doing so may be infeasible and may potentially involve substantial costs from higher inflation. Rather, it simply reflects the notion that unemployment above its longer-run natural rate would imply substantial losses both to the aggregate economy and to those individuals without jobs. Furthermore, this assumption is common to most accounts of how monetary policy operates under flexible inflation targeting, in which policymakers act to bring inflation toward its goal level while taking the outlook for economic activity into account.[3]

While most of the analysis in the remainder of this memo takes these objectives as given, alternative interpretations of the goals may have different implications for policy strategies. Some of the costs of rising nominal prices likely reflect the costs associated with uncertainty about the future price level: For example, households and firms concerned about long-run plans—such as those concerning retirement income and investment in the capital stock—may view uncertainty about the long-run *price level,* rather than the rate of inflation, as costly.[4] Such costs would directly imply that strategies which target the level of prices or, potentially, nominal income are desirable; we instead focus on the potential gains (and costs) from such strategies when inflation is the primary policy objective. Likewise, some policymakers may view persistently high unemployment (which could contribute to a loss of skills and reduced attachment to the labor force) as more costly than embedded in our policymaker objectives.

These assumptions regarding goals have direct implications for possible strategies. In particular, both the staff and private sector forecasters expect unemployment to remain persistently above its longer-run sustainable rate of 5 to 6 percent, and inflation to remain either relatively close to its mandate-consistent rate of 2 percent or somewhat below. In other words, under the baseline outlook, the Federal Reserve would not meet its employment goal for a very long time and may be at risk of undershooting its inflation goal as well. Under such conditions, strategies designed to lower unemployment and raise inflation moderately would seem appropriate. For example, the Deputy Governor of the Norges Bank has put forward an intuitive criterion for policy—the forecasts for inflation and resource utilization should not both be too low, because more accommodative policy would result in better outcomes for both objectives. This concern for

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[3] For a discussion of a flexible inflation targeting framework, see Lars Svensson (2011).
[4] A discussion of the relative merits of the price level and inflation as the policymaker objective can be found in Michael Kiley, Eileen Mauskopf, and David Wilcox (2007).

seeking policy settings that bring both inflation and resource utilization back toward their objectives in the medium term is the hallmark of the flexible inflation targeting approach.[5]

Lessons for simulations of staff models and the research literature

Given the zero lower bound, policymakers face constraints when considering strategies to provide additional stimulus or mitigate tail risks, if desired. "Optimal" policy simulations of macroeconomic models can provide some insight into strategies that may be desirable—as in the simulations reported in the Tealbook. Of course, the exercises reported in the Tealbook Part B present "optimal" policies conditional on the FRB/US model and policymakers may have different views concerning how the economy operates—that is, policymakers may have concerns that the particular lessons from those exercises are not robust to alternative models of the economy. To address this concern, the analysis below will also examine simulations from other models.

Figure 1 (page 9) presents the September Tealbook projections for the federal funds rate, the unemployment rate, and the headline PCE inflation rate, along with the projected paths for these variables under two different types of "optimal" policy. In the "discretion" case, policymakers follow an optimal policy on a period-by-period basis and are unwilling to promise future accommodation. In the "commitment" case, policymakers are willing to commit (conditional on economic outcomes) to future policies that are potentially more expansionary than usual in order to stimulate activity today.[6]

These simulations illustrate the role of committing to remain unusually accommodative given the current outlook. In the "discretion" case, policy is only slightly more accommodative and outcomes for goal variables are only modestly better than in the Tealbook baseline. In contrast, under the "commitment" case, policymakers plan to maintain the federal funds rate near zero until the end of 2015. Under the modal outlook, this accommodation brings about a persistent fall in the unemployment rate below its natural rate beginning in early 2016 and a sustained rise in inflation to a little over 2 percent. These outcomes illustrate some of the costs related to commitment that would influence future Committee deliberations. In particular, future policymakers will be tempted to renege on the accommodative policy stance promised in future years given the tight labor market and slightly above-target rate of inflation. Under discretion the funds rate begins to increase in 2014 even though unemployment is well above the natural rate and inflation is below 2 percent.

Relative to the baseline rule, the promise of future accommodation under the "commitment" policy provides additional near-term stimulus through several channels. First, real interest rates faced by firms and households are lower at all maturities, both because nominal policy rates are expected to remain low for a longer period and because expected inflation is higher under the commitment strategy. These lower real interest rates boost investment and consumption demand through a cost-of-capital channel. As seen in Figure 2 (page 10), lower nominal Treasury yields and higher expected inflation contribute about equally to the decline in real 5-10

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[5] See Jan Qvigstad (2005). Lars Svensson (2011) discusses this view in some detail.
[6] Policymakers are assumed to place equal weight on keeping headline PCE inflation close to a 2 percent inflation goal, on keeping unemployment close to the staff's estimate of the natural rate of unemployment, and on minimizing changes in the federal funds rate.

year yields under the commitment policy. Lower real interest rates also boost equity prices and hence household wealth, thereby spurring consumption expenditures. The exchange value of the dollar also falls with lower real interest rates, stimulating exports and reducing imports. Finally, accelerator effects amplify the response of consumption and investment to the more accommodative policy. For example, liquidity-constrained households boost their consumption as the economy recovers, even though the real wage under the optimal policy is initially a touch lower than under the baseline rule. In addition, stronger current and expected output growth provides a strong catalyst for business fixed investment and inventory accumulation.

Putting these channels together (and as shown in the upper-right panel of Figure 2), real GDP advances at a rate about ¾ percentage point higher on average under the commitment strategy than under the baseline rule over the 2012-2015 period. Household expenditures and business investment contribute nearly equally to the stronger pace of demand; residential investment, despite its sensitivity to interest rates, is only a very modest contributor to the increase in aggregate demand because it currently accounts for such a small share of nominal output. Importantly, despite the weaker dollar, real net exports are actually a slight drag on the economy under the commitment policy, reflecting that stronger U.S. activity boosts imports enough to more-than-offset the effects of a weaker dollar. Thus, at least from the perspective of the FRB/US model, the optimal policy has fairly benign effects on U.S. trading partners.

The previous analysis has focused on simulations using the FRB/US model. It is important to also consider whether alternative views of how the economy operates have similar lessons for policy strategies. Figure 3 (page 11) presents optimal policy simulations under commitment generated using two different models—a *small model* that is similar to the Fuhrer-Moore model, and the staff's dynamic general equilibrium model, EDO; as discussed below, the staff's open economy SIGMA model has implications very similar to the EDO model.[7] Both EDO and the small model embed forward-looking behavior and common specifications of the factors influencing firm and household decisions, including wage and price setting. Nevertheless, the two models exhibit notable differences that span (some of) the range of views concerning structural aspects of the economy, with the small model displaying substantially more inertia in inflation and the EDO model showing less structural persistence. As Figures 1 and 3 demonstrate, several aspects of an "optimal" strategy are robust across these models.

- First, each model suggests that an "optimal" commitment policy would involve a nominal federal funds rate near its lower bound well into a projected economic recovery. In particular, the funds rate is maintained near-zero until the unemployment rate has fallen to around 6 percent in EDO, 5½ percent in FRB/US, and 5 percent in the small model; in each model, the inflation rate is fairly close to 2 percent when the funds rate starts to rise. These outcomes suggest that forward guidance intended to provide a degree of stimulus consistent with the "optimal" policies from these models could involve highlighting that the FOMC will keep policy accommodative until the unemployment rate has reached a value close to the estimate of its natural rate.

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[7] The appendix summarizes the main features of the small model and presents some basic properties of that model, EDO, FRB/US, and SIGMA under the calibrations of these models used in this memo. Importantly, the models used in this analysis have broadly similar sensitivities of real economic activity with respect to the path of the nominal policy rate, but somewhat different inflation dynamics.

- Second, the eventual cost associated with the commitment to remain unusually accommodative is that the unemployment rate falls persistently below the natural rate (most notably in FRB/US) and inflation rises above its long-run objective (especially in EDO, but also to a lesser extent in FRB/US and the small model). "Discretionary" optimal policies, which do not constrain future actions, prescribe a considerably more rapid pace of tightening as the economy recovers; although this minimizes overshooting, it results in substantially poorer economic performance on net.

- Third, while the EDO model simulation shows inflation temporarily in the neighborhood of 3 percent, none of the "optimal" policy simulations show inflation substantially above the long-run objective of 2 percent for a protracted period—at least under the modal outlook. This suggests that, according to these models, and given the zero lower bound constraint, a price-level target that involved inflation significantly above 2 percent would not be consistent with "optimal" commitment policies.

Other features of "optimal" strategies, implicit in the figures above, can be gleaned from the research literature.[8] First, the "optimal" commitment policy is history dependent, so that the extent and duration of policy stimulus in the period after the economy exits the zero-lower bound period depends on the evolution of output and prices during the period in which policy was constrained. Intuitively, as an economy facing a zero bound constraint becomes mired in a deeper recession, an "optimal" commitment policy would promise even more stimulus in the future in order to reduce long-term real interest rates. This type of policy framework, which conditions heavily on past outcomes, contrasts with the familiar maxim that central banks should let "bygones be bygones" (as in the "discretionary" case). As we will discuss below, adoption of an intermediate target for nominal income or the price level could help communicate a commitment strategy.

Because the benefits of the "optimal" commitment policy are front-loaded in the form of near-term stimulus, while the costs (in terms of higher than desired inflation and lower-than-desired unemployment) are paid later, policymakers may have a strong incentive to renege on their commitments, as we highlighted in discussing the "discretionary" policy. Thus, the credibility of the central bank's commitment is a critical question. The stimulus provided by forward guidance would have less effect on interest rates, inflation, and asset prices if the public had significant doubts about the central bank's commitment to adhere to the policy. Because our simulations assume full credibility, they may overestimate the effects of a shift toward an optimal strategy. However, our models may also understate the importance of channels that could deliver more stimulus: For example, expectations about future inflation and future income are a much less important determinant of current aggregate demand in FRB/US or the small model than in EDO or SIGMA, and even imperfectly credible actions would provide stimulus in the latter models. Moreover, a shift toward the optimal commitment policy might induce a larger fall in private credit spreads than implied by our models, or a more significant improvement in risk aversion or confidence (channels largely ignored in our models). And even imperfectly credible policies might perform better than discretion. This possibility may be especially applicable under

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[8] Erceg, Kiley, and Levin (2008) summarized some of this literature for the Committee. Eggertsson and Woodfood (2003) provide excellent discussions of the optimal policy under commitment in the presence of a zero bound constraint. Woodford (2011) provides a more general overview.

recessionary scenarios, in which a discretionary policy may be unable to prevent inflation and inflation expectations from drifting down, causing a progressively deeper economic contraction and postponing the liftoff date.

Despite broad similarities in the optimal commitment responses across the three models considered, optimal strategies in general are model-dependent. In models in which inflation is highly persistent and the short-term interest-elasticity of demand relatively low—such as FRB/US—optimal policy calls for keeping inflation fairly close to its target of 2 percent. Because inflation inertia is high it is difficult to bring inflation back down, and even a credible promise of a future boom will not raise current output much because aggregate demand is relatively unresponsive to real interest rates. In contrast, the EDO and SIGMA models have a somewhat lower degree of inflation persistence, even though—as shown in the appendix— the short-run interest sensitivity of demand is fairly similar. Because it is less costly to boost inflation temporarily in the model, the optimal policy involves a noticeable front-loaded rise in inflation above target.

Figure 1
Economic Outlook Under Optimal Policies With and Without Commitment
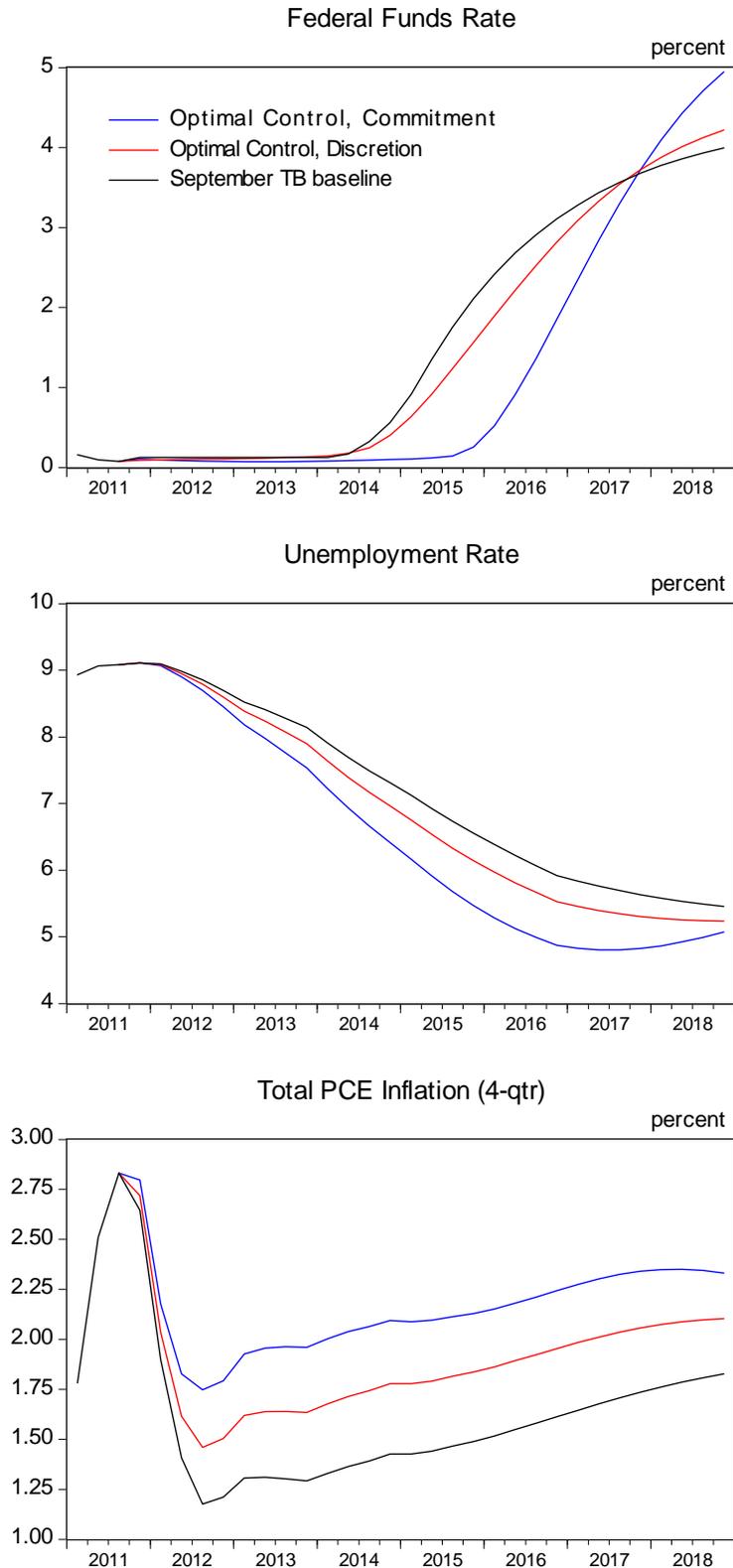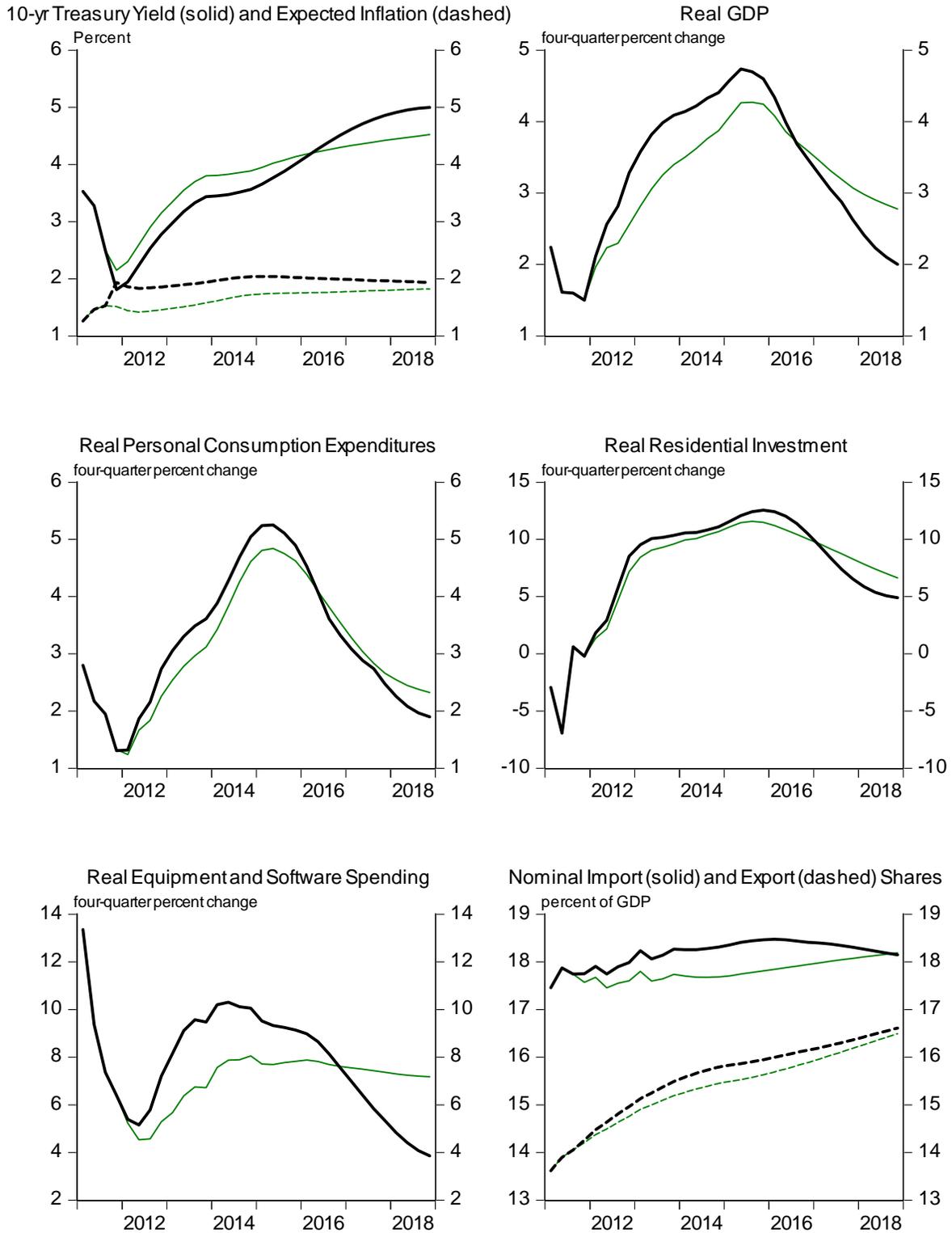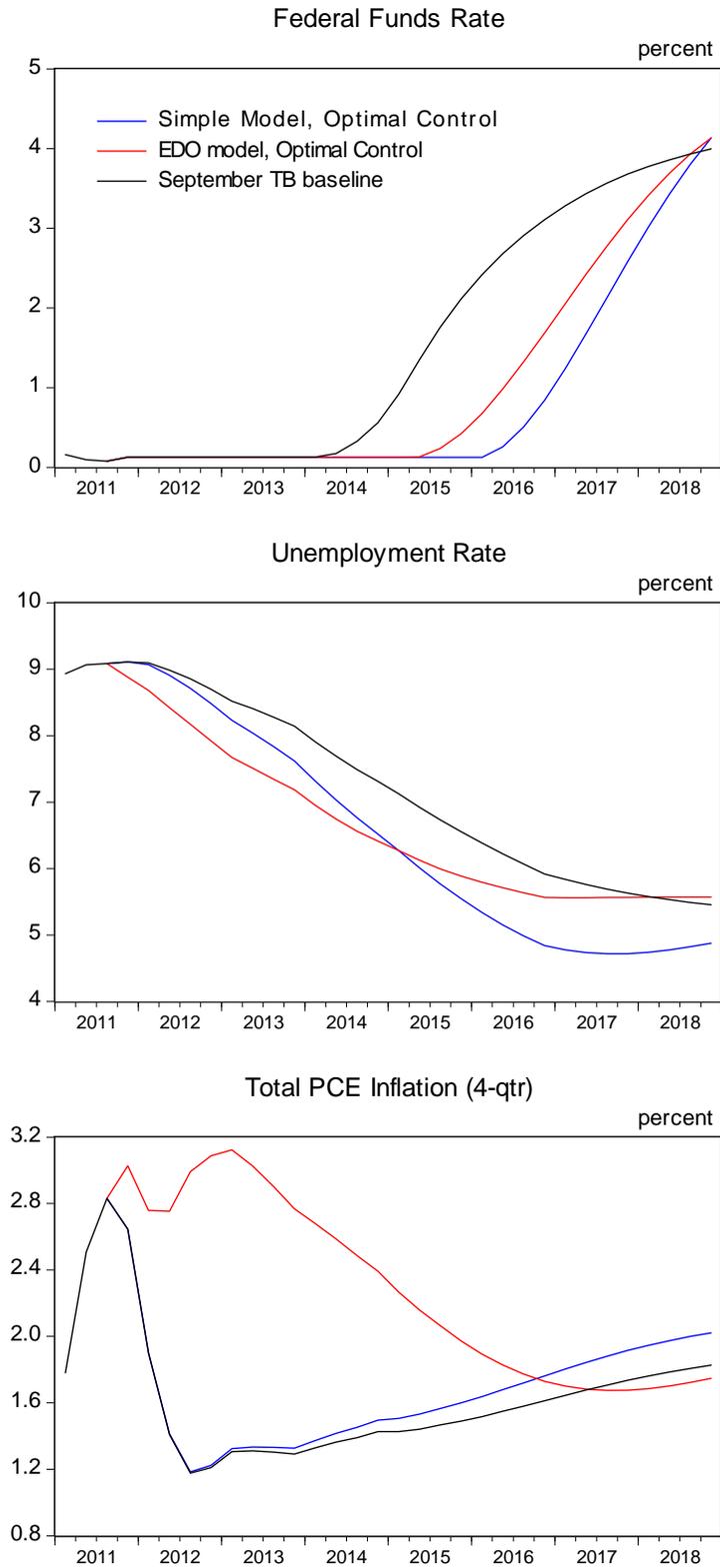FRB\US Model

Federal Funds Rate

Unemployment Rate

Total PCE Inflation (4-qtr)

Figure 2
Key Aspects of Transmission in FRB/US Optimal Control Simulation

10-yr Treasury Yield (solid) and Expected Inflation (dashed)

Real GDP

Real Personal Consumption Expenditures

Real Residential Investment

Real Equipment and Software Spending

Nominal Import (solid) and Export (dashed) Shares

thick, optimal-control
green, September Tealbook

Figure 3
Economic Outlook Under Optimal Policies
in a Small Model and the EDO Model

Federal Funds Rate

percent

- Simple Model, Optimal Control
- EDO model, Optimal Control
- September TB baseline

Unemployment Rate

percent

Total PCE Inflation (4-qtr)

percent

3. Alternative Strategies

The discussion in the previous section suggests that, given the current outlook, strategies to provide additional stimulus would be consistent with achieving outcomes better aligned with the assumed long-run policy goals. Nevertheless, such "optimal" policies are of limited usefulness in FOMC communications, because they are both complex and model-dependent, and because they do not reveal how the Committee would respond to changes in the economic outlook.

In this section, we consider four strategies that the Committee could potentially implement as a practical matter; these range from a modest clarification of the FOMC's current strategy (with few implications for the public's expectations and the economy), to the adoption of intermediate targets as part of a plan designed to provide considerable additional stimulus. Specifically, the first two strategies consist of enhanced forward guidance—in one case to clarify the factors influencing monetary policy without stating an intention of providing more stimulus, and in the other to signal that policymakers expect to remain accommodative over time to a degree not currently anticipated by the private sector, thereby providing some additional stimulus. The second two strategies entail adoption of an intermediate target for, respectively, the price level and nominal income; in each case, we focus on implications of these strategies for economic outcomes over the next decade. The first subsection outlines the characteristics of each strategy, and the following subsections discuss their performance under several scenarios.

Characteristics of each strategy

Forward guidance to clarify the policy strategy: The Committee could use forward guidance primarily to clarify the public's understanding of the existing policy strategy. This strategy might be described as "flexible inflation targeting under discretion" and can be regarded as loosely characterizing the Committee's strategy during the past few decades. Broadly speaking, the Committee aims to help minimize fluctuations in employment in an environment that keeps inflation low and stable, but does not restrict the latitude of future Committees to pursue the strategy they deem appropriate (unlike the "history dependent" strategies described in the optimal control simulations).

Following this strategy, the Committee could communicate that it expects to continue to provide accommodation in line with its historical practice, roughly as embedded (for example) in the outcome-based rule used to set the extended path of the federal funds rate in the Tealbook. As discussed in the September memo, the Committee might choose to specify thresholds for the inflation rate and unemployment rate to clarify conditions governing the onset of tightening. Conditional on the most recent staff projection, such behavior would imply that the funds rate would be held near zero until mid-2014, at which point the unemployment rate is projected to have fallen to 7½ percent and inflation to be running somewhat below 2 percent. In addition, forward guidance could be used to clarify the strategy the Committee intends to follow after it initiates tightening; for example, behavior along the lines of that implied by the outcome-based rule would imply that the funds rate would rise with the projected improvement in activity, bringing the real federal funds rate to 1½ percent in 2016 while inflation, according to the staff projection, lies near 1½ percent. To the extent that the private sector seems to have a reasonable understanding of the historical strategy and expects such behavior to continue, forward guidance

designed to simply clarify the current policy stance probably would not provide much stimulus.[9] Nonetheless, it could facilitate clearer communication with the public, particularly if it were used to illustrate how the Committee might respond to changes in the outlook.

Forward guidance to signal additional accommodation over an extended period: Forward guidance could also potentially serve as a tool to provide additional accommodation. One way in which such accommodation could be provided is through specifying a low threshold for the unemployment rate to indicate the Committee's desire to follow an accommodative policy. However, as discussed in the staff's forward guidance memo, setting a low threshold for the unemployment rate before raising the funds rate would of itself provide only modest stimulus. The Committee could provide more accommodation by using forward guidance to signal that it intends to conduct a more accommodative policy after liftoff from the ZLB than would be implied by historical behavior. In this vein, the Committee might emphasize that its intended exit strategy embeds key features of the optimal control simulations; hence such guidance could be interpreted as consistent with "flexible inflation targeting under commitment." Specifically, the Committee could indicate that it would:

- Allow the unemployment rate to decline below the estimated natural rate as the economic recovery progressed, at least in the absence of supply shocks;
- Permit inflation to rise modestly, but persistently, above its 2 percent mandate, on the grounds that the higher inflation would bring real interest rates down and hence stimulate demand; and
- Respond to adverse demand shocks by conveying an even higher tolerance for inflation in the future, and undershooting of unemployment.

For the purposes of this memo, we assume an inertial version of the Taylor (1999) rule, which responds strongly to the *level* of resource utilization, but not to the *change* (as does the outcome-based rule), captures these features qualitatively. As highlighted in the September forward guidance memo, such a rule would represent a persistently more accommodative stance than expected by markets and could provide stimulus.

An attractive feature of forward guidance from the perspective of providing more stimulus is that it represents an incremental step in the Committee's approach, and can be handled largely within the existing communications framework. But since the main channel for providing stimulus is through moving the public's expectations of future strategy in the direction of much greater accommodation and somewhat more tolerance of inflation a bit above 2 percent, it is imperative that the public come to a reasonably clear understanding of at least the qualitative features of the reaction function, including whether policy will aim to reverse past falls in inflation below target, and more generally, the extent to which past weakness in nominal demand is likely to influence future policy. A major challenge involves communicating the timing of eventual policy tightening to the public in a manner that is transparent and perceived as credible.

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[9] The outcome-based rule performs well in accounting for the observed variation of the federal funds rate over past three decades. Even so, the voluminous literature that has attempted to characterize the Federal Reserve's reaction function suggests a considerable range of estimates of the response of policy rates to key variables. Forward guidance aimed at clarifying the strategy would be more beneficial to the extent that the public's views about the Federal Reserve's strategy are relatively diffuse (though achieving heightened clarity might present greater communication challenges).

An intermediate target for the price level: The Committee may also consider making a more dramatic shift away from the current framework by adopting a formal intermediate target for the price level. Under this approach, the Committee would choose an intermediate target path for the price level ($p*$), and commit to using available instruments to minimize the gap between the price level and its target. The price level might be specified either in terms of the current price level, or a near-term forecast (such as a one-year–ahead projection). The first choice in implementing price level targeting involves specifying the appropriate index: The Committee has emphasized the overall PCE price index in its communications, but the high degree of volatility of food and energy prices might point to alternative measures such as the core PCE index. A second key choice would involve choosing the target path, which entails the specification of an initial condition and the desired growth rate of the targeted series. One possibility is to allow the target to grow at 2 percent per year, and to specify the initial condition as the price level observation just before the recession, in the fourth quarter of 2007; Figure 4 (page 19) shows how the target price path would evolve under this specification, and compares it to the projected evolution of the price level (here taken to be the PCE deflator) from the September Tealbook baseline. As inflation has remained fairly close to 2 percent during most of the financial crisis, the desired target path would not be very sensitive to different choices of initial conditions that were based on recent price level data.

The modest size of the current price-level gap under this approach—less than 2 percent if the target path were extrapolated from the level of prices immediately prior to the financial crisis—would serve to underscore a key feature of price-level targeting: This framework aims to help keep inflation stable and to guard against deflation risk. As this strategy would effectively rule out higher inflation under the modal outlook, it might be perceived as likely to hold steady or even reduce inflation risk premiums in bond yields (for example, , by limiting price level drift). However, it is not likely to provide additional stimulus unless the price level gap were to be interpreted by the public as implying a greater tolerance by the FOMC for inflation above 2 percent.

An intermediate target for nominal income: An alternative, but equally significant, change in the Committee's framework would involve specification of an intermediate target for nominal income. Under this approach, the Committee would choose a target path for nominal income y_N*, and commit to using available instruments to minimize the gap between nominal income and this target (or a forecast of the gap). It is useful to decompose the nominal income target into a price level component and an activity component (that is, $y_N* = p*y*$, where $p*$ is the price level target, and $y*$ is the real output target). Accordingly, nominal income targeting can be regarded as an extension of price level targeting that adjusts for variations in real output. Nonetheless, nominal income targeting does not necessarily require agreement on an estimate of the output gap, as different views on the output gap would simply imply different paths for the price level over the medium term to achieve a given nominal income target. Once the nominal income gap is closed, however, such a strategy would imply similar outlooks for inflation and economic growth in the longer run, assuming broadly similar views of potential GDP growth going forward.

Just as the choice of a target level is a major ingredient of price level targeting, the choice of a target path for nominal income is important for nominal income targeting. The Committee's past communications would suggest simply extrapolating a 2 percent growth rate for the price

component of nominal income. With regard to the target path for output, a natural choice would be to base $y*$ on current estimates and forecasts of the economy's potential output, and then to update the projections on a periodic basis. The bottom panel of Figure 4 shows the target path for nominal income that is generated by assuming the target equaled actual nominal GDP in the fourth quarter of 2007 and grows at the rate of 2 percent plus the past and projected growth rate of potential output estimated by the staff. Based on current estimates of the output gap of around 6 percent, the nominal income gap would be around 7 percent in the third quarter of 2011. Of course, communicating revisions to the path of the nominal income target in response to changes in estimates of potential output could raise formidable challenges.

One appealing feature of a nominal income target is that it explicitly recognizes both sides of the dual mandate. Indeed, the equal weights on the price level gap and output gap would likely be viewed by the public as suggestive of a similar degree of concern for both the price stability and employment objectives. A nominal income target could also provide effective forward guidance to reinforce market perceptions about the strength of the Committee's desire to keep interest rates low for an extended period, given that the gap between nominal income and target could initially be quite large. Another desirable feature is that nominal income targeting—like price level targeting—could be effective in helping to keep inflation expectations well-anchored. In particular, if the target output path converged to the economy's true potential, nominal income targeting would cause an eventual return of the price level to its target path, with the degree of inflation overshooting limited by past shortfalls. In addition, the fact that nominal income targeting involves a direct response to real activity may make it better suited to cushion the impact of adverse demand and supply shocks, a topic we revisit below. Of course, the FOMC would need to make it clear to the public that the nominal income targeting framework is not in fact a cover for engineering a temporary or perhaps permanent rise in the inflation target; to this end, the Committee would want to demonstrate that the implicit gap in resource utilization underlying the initial nominal-income gap is reasonable.

Performance of each strategy under several scenarios

We now turn to an evaluation of how each strategy is likely to operate under three scenarios—the September Tealbook baseline (modal) outlook for activity and inflation; a scenario in which adverse demand shocks lead to a moderately severe recession; and a scenario in which adverse price shocks push core PCE inflation above 3 percent for a year or two and then only slowly dissipate. Consistent with our earlier discussion, we assume that forward guidance designed only to clarify that policy will be consistent with historical behavior can be approximated by the outcome-based funds rate rule used in the Tealbook; in contrast, we assume that forward guidance under commitment is consistent with an inertial version of the Taylor (1999) rule. For price-level and nominal-income targeting, we assume inertial rules in which the deviation of the intermediate target from its desired level is the only factor governing movements in the federal funds rate.[10] Most of this section focuses on simulations using the FRB/US model; results from several other models are discussed after the FRB/US model simulations.[11]

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[10] In particular, the inertial Taylor (1999), price-level, and nominal income rules for the nominal federal funds rate ($R(t)$) are given by

$$R(t) = 0.9R(t{-}1) + 0.1(r* + \textit{four-quarter Core PCE Inflation}(t) + \textit{FACTORS}(t))$$

Outcomes under the modal outlook: Figure 5 (page 20) presents the outcomes under each strategy given the modal outlook. Since the strategy focused on clarification does not affect market perceptions by assumption, the outcomes under this strategy are assumed to equal those presented in the September Tealbook; in particular, the unemployment rate is above 8 percent at the end of 2013 and above 7¼ percent at the end of 2014, with PCE inflation below 1½ percent in both of those years.

Unemployment is noticeably lower and inflation higher under the strategy of forward guidance with commitment: The unemployment rate is roughly 7½ percent at the end of 2013 and 6½ percent at the end of 2014, with PCE inflation near 2½ percent in those years. Assuming that policymakers place equal weights on keeping unemployment near its long-run sustainable level and inflation near two percent, these outcomes represent a significantly better outcome than the Tealbook baseline because the inflation gap is of similar magnitude to its baseline value (albeit positive rather than negative), while the unemployment gap is much smaller.

The outcomes under nominal income targeting are still more favorable. In particular, the unemployment rate outcomes in 2013 and 2014 are similar to those under the aggressive (inertial) Taylor rule, but inflation does not rise as much (and is much closer to 2 percent). The more moderate rate of inflation in the out-years under this strategy occurs because policy late in the simulation is tighter than under the inertial Taylor rule, reflecting the fact that the policy normalizes as nominal income approaches its objective later this decade. In contrast, under price level targeting unemployment is higher, although inflation stays near 2 percent; indeed, the small initial price-level gap (from Figure 3) implies that the nominal federal funds rate is increased almost immediately under this specification of price level targeting. Overall, the price level targeting results show desirable inflation outcomes but undesirable unemployment outcomes. The relatively poor performance on the latter dimension reflects that this policy rule does not respond directly to resource gaps, as would be required to stabilize unemployment in the FRB/US model.

Outcomes in a moderately severe recession: We now consider how each strategy performs under a recession scenario, in which aggregate demand weakens enough to bring the unemployment rate to over 11½ percent for much of 2012 and 2013 under the baseline (clarification) strategy (which uses the outcome-based rule); results appear in Figure 6 (page 21). Core PCE inflation falls to about 0 percent by 2014 and the federal funds rate remains at its effective lower bound until the end of 2015.

The inertial Taylor (1999) rule leads to modestly lower unemployment in 2014 and 2015, but only cushions the severity of the downturn slightly; the rule also cushions the decline in inflation, which falls below 1 percent in 2012–2014 but returns close to the long-run objective in subsequent years. In contrast, nominal income targeting provides a more substantial cushion for both unemployment and inflation, limiting the rise in unemployment and mitigating the decline in inflation. These effects arise because of the self-correcting nature of nominal income

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where *FACTORS*(*t*) is the sum of the output gap and ½ times the deviation of four-quarter core PCE inflation from 2 percent for the Taylor (1999) rule, the price-level gap for the price level targeting rule, and the nominal income gap for the nominal income targeting rule.

[11] The simulations incorporate the effects of the large-scale asset purchase program that was completed at the end of June, as well as the maturity extension program announced after the September FOMC meeting.

targeting: As the shortfall in activity lowers nominal income directly and through lower prices, policy is expected to remain accommodative for longer, thereby providing additional stimulus.

Price level targeting again limits the downward pressure on inflation, but does little in the FRB/US model to boost output and employment; as a result, the unemployment rate essentially follows the same path generated under the baseline outcome-based rule. These findings may appear at odds with a large academic literature that has emphasized that a price level targeting rule performs much better in stabilizing real activity when the economy is constrained by the zero-lower bound than a rule which simply responds to inflation and unemployment (as both the outcome-based and Taylor (1999) rules do). Although the models used to bring out the benefits of price level targeting are typically highly stylized, one generic feature that accounts for this result is that inflation is typically assumed to be much more responsive to the unemployment gap than in FRB/US. This steeper "Phillips Curve" slope helps price level targeting perform relatively well during deep recessions in which the economy is constrained: Given that prices fall substantially during the recession, the public expects very low real interest rates during the recovery, both because the price-level gap is still large as the economy recovers and holds down nominal interest rates, and because inflation must rise in order to close the price level gap.

Outcomes in response to adverse price shocks: Although concerns about downside risks to the economy are probably predominant at the moment, it is also relevant to consider how these various strategies would perform in the face of other shocks, such as an adverse upward shift in inflation. Figure 7 (page 22) reports results in response to a marked increase in short-run inflation expectations (that is, shocks to the Phillips curve) that pushes PCE inflation to 3 percent in 2012 and to 2½ percent in 2013 and 2014. Under the baseline outcome-based rule (and hence under our assumption regarding forward guidance designed only to clarify objectives), policy tightens in late 2012 and the unemployment rate is near 8 percent at the end of 2014.

The inertial Taylor rule is much more accommodative, reflecting its high weight on resource utilization. As a result, inflation rises to close to 4 percent for several years, significantly above recent norms, and remains near that level; at the same time, this policy keeps unemployment relatively low. Such a large persistent increase in inflation might, however, have additional contractionary effects not accounted for in the simulation, such as might arise if the higher inflation prompted a large increase in risk premiums on nominal bonds.

In contrast, nominal income targeting does a better job stabilizing both inflation—which remains near 3 percent in 2012 and falls thereafter—and unemployment—which falls to near 7 percent in late 2014, ¾ percentage point lower than under the historical outcome-based rule. As for price-level targeting, it clearly limits the inflationary impact of these shocks, as policy tightens rapidly, but this limit on inflation comes at a substantial cost in terms of unemployment.

Summary and additional considerations

Several results stand out from the preceding simulations. First, price level targeting appears to deliver good performance on the price stability criterion but disappointing results for employment. This contrasts with findings reported in the research literature suggesting that such a strategy is also good at stabilizing resource utilization. As noted above, this tension with research findings arises because our empirical models, including FRB/US, have a less tight link between resource utilization and inflation than assumed in many of the (stylized) models used in

the literature. While the additional stability of inflation that may accompany price-level targeting could have some beneficial effects (for example, lowering bond term premiums in ways not considered in our models), these benefits seem very unlikely to outweigh the direct effects that suggest price-level targeting may not be a good strategy for providing additional stimulus.

In contrast, communication of a policy stance similar to an inertial Taylor rule could provide stimulus and cushion against adverse demand shocks, as suggested in September's forward guidance memo. However, such a policy strategy may perform poorly in response to adverse, persistent inflation shocks. The deterioration in performance relative to the outcomes-based rule in response to the adverse price shock above was large enough to suggest that financial markets could react adversely to the inflationary implications of such a strategy under certain conditions.

Nominal income targeting appears to combine the best features of a price level target and behavior like an aggressive Taylor rule, by limiting inflation pressures while also stabilizing resource utilization. Indeed, as shown in Figure 8 (page 23), the simple nominal income targeting rule we have assumed approximates the "optimal" policy well for the modal outlook.

To assess the robustness of the nominal income targeting strategy, Figures 9-11 (page 24-26) compare the performance of this strategy both to the baseline rule and the optimal control policy under the modal outlook in the EDO model (Figure 9), the small model similar to that of Fuhrer-Moore (Figure 10), and in the open economy SIGMA model (Figure 11). Nominal income targeting performs considerably better than the baseline rule in stabilizing both inflation and unemployment in all three models; similar results obtain under the two alternative scenarios examined above. Even so, it is clear from the figures that nominal income targeting is noticeably less accommodative than the optimal policy in the EDO and SIGMA models. In particular, the optimal policy strategy implies a sharper rise in inflation than under nominal income targeting in both models, reflecting the relatively low inflation persistence. By contrast, nominal income targeting closely tracks the optimal policy in the small model, as its relatively high degree of inflation persistence makes it unattractive to try to use inflation as a lever to provide accommodation in that model.

Nominal income targeting would also present challenges not explored in these simulations. As with all the strategies considered, nominal income targeting affects expectations because it is seen as a form of commitment. These effects may be reduced if the public does not believe the Committee's willingness to adhere to the nominal income targeting framework. For example, forward guidance about how the Committee would act five or more years in the future might well be discounted or ignored by the private sector. The public would have to be informed about how a nominal income targeting regime would operate in an environment in which the usual tool for achieving the target—the federal funds rate—is constrained by the zero-lower bound. It would be important to educate the public on how key features such as the target output path were determined and revised. Moreover, complementary policies such as Federal Reserve purchases of longer-term securities, in addition to communication, may also help boost the credibility of the Committee's commitment to the intermediate target. In achieving all these steps, changes in communication that involved more detailed long-run projections, with explicit links between the policy strategy, the path of the federal funds rate and the balance sheet, and the resulting outlook for goal variables, as highlighted in the forecast targeting literature and employed by some flexible inflation targeting countries such as Sweden, may contribute to the success of nominal income targeting.

Figure 4
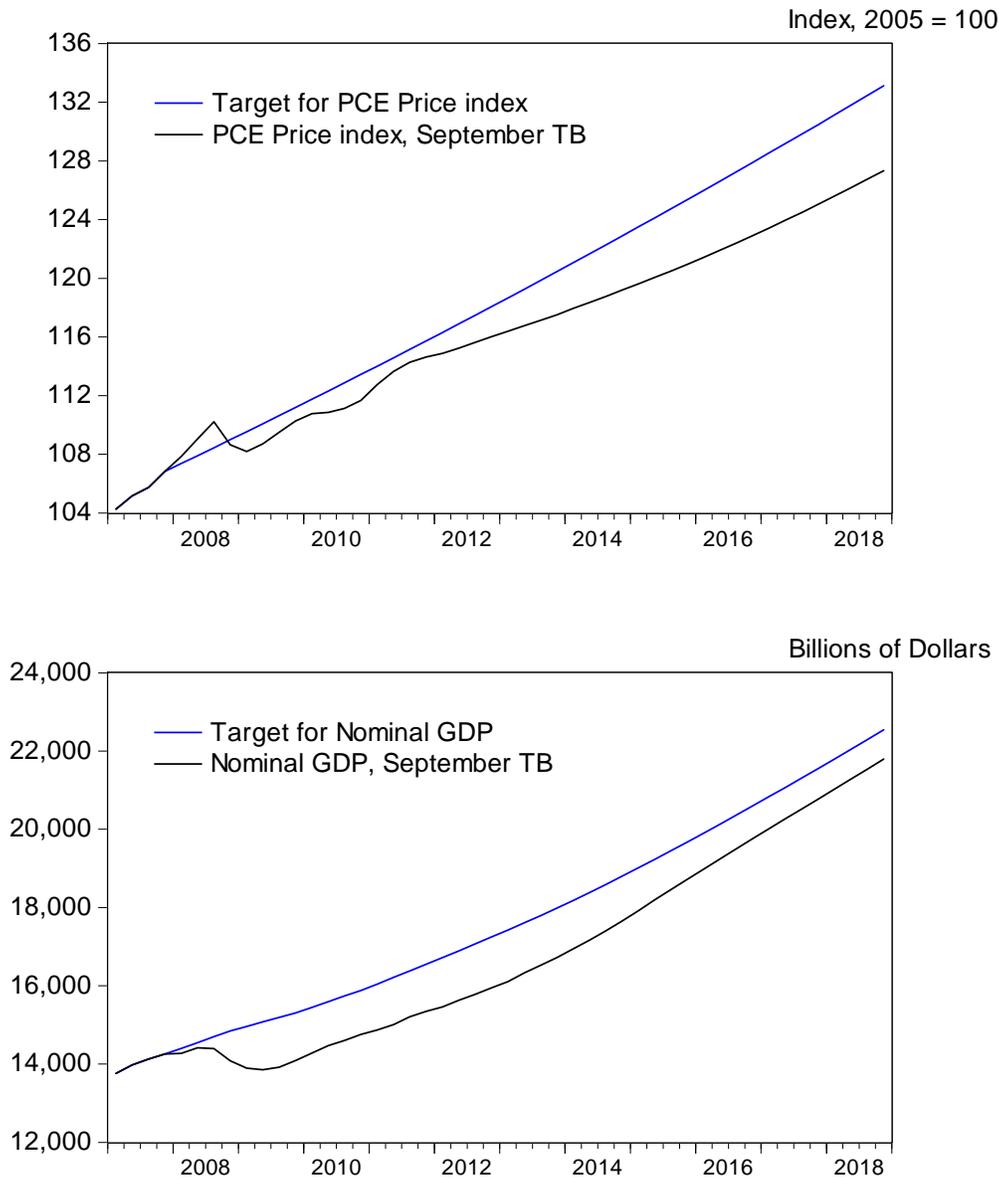Intermediate Targets for the Price Level (PCE index) and Nominal GDP

Index, 2005 = 100

Target for PCE Price index
PCE Price index, September TB

Billions of Dollars

Target for Nominal GDP
Nominal GDP, September TB

Figure 5
Outcomes For Different Strategies Under the Modal Outlook

Federal Funds Rate

Legend:
- Price-level targeting (dashed)
- Nominal-income targeting (red)
- Forward guidance (Inertial Taylor (1999)) (blue)
- Clarificaton (Outcome-based rule) (black)

Unemployment Rate

PCE Inflation (four-quarter)
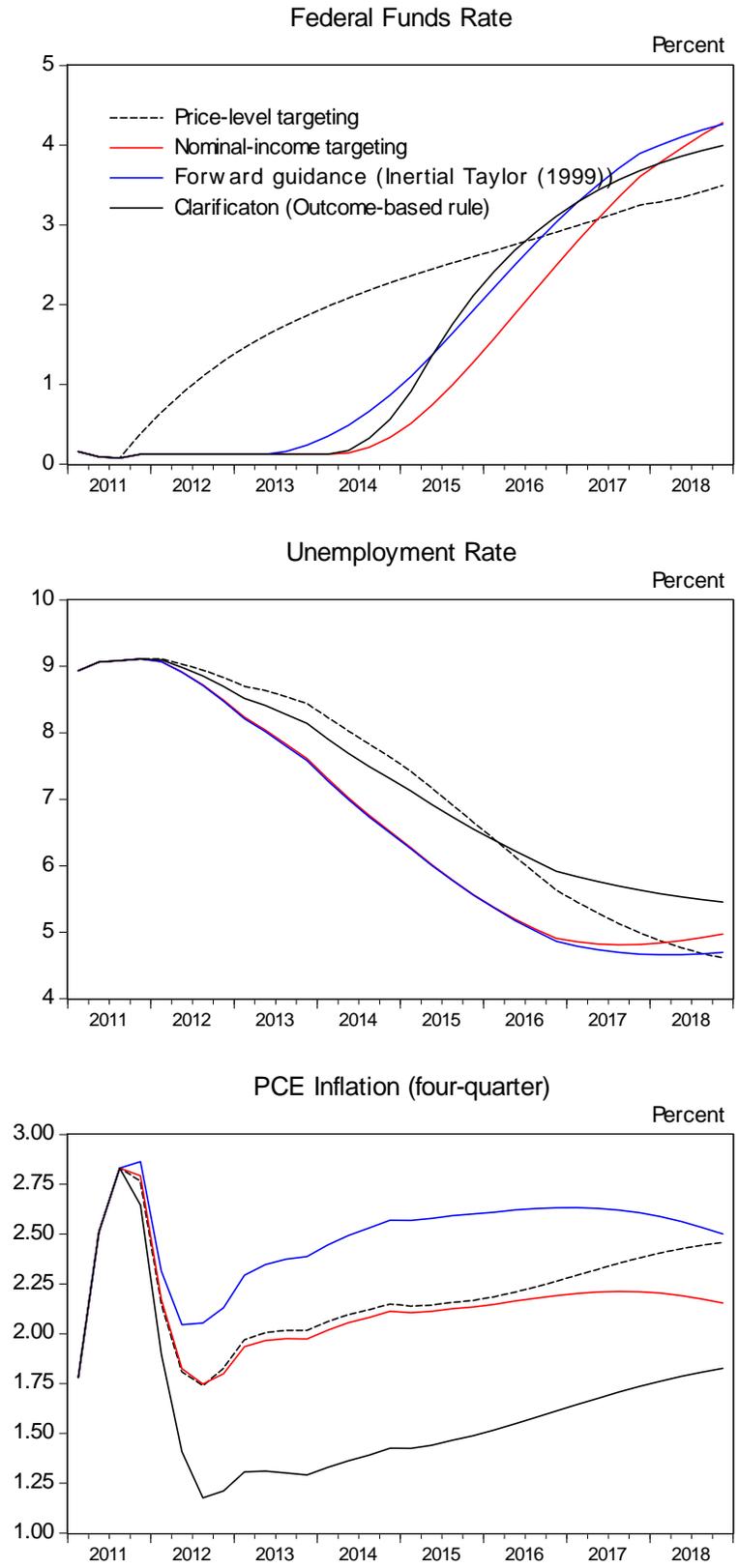
Figure 6
Outcomes For Different Strategies Under A Recession Scenario

Federal Funds Rate

Legend:
- Price-level targeting
- Nominal-income targeting
- Forward guidance (Inertial Taylor (1999))
- Clarificaton (Outcome-based rule)

Unemployment Rate

PCE Inflation (four-quarter)
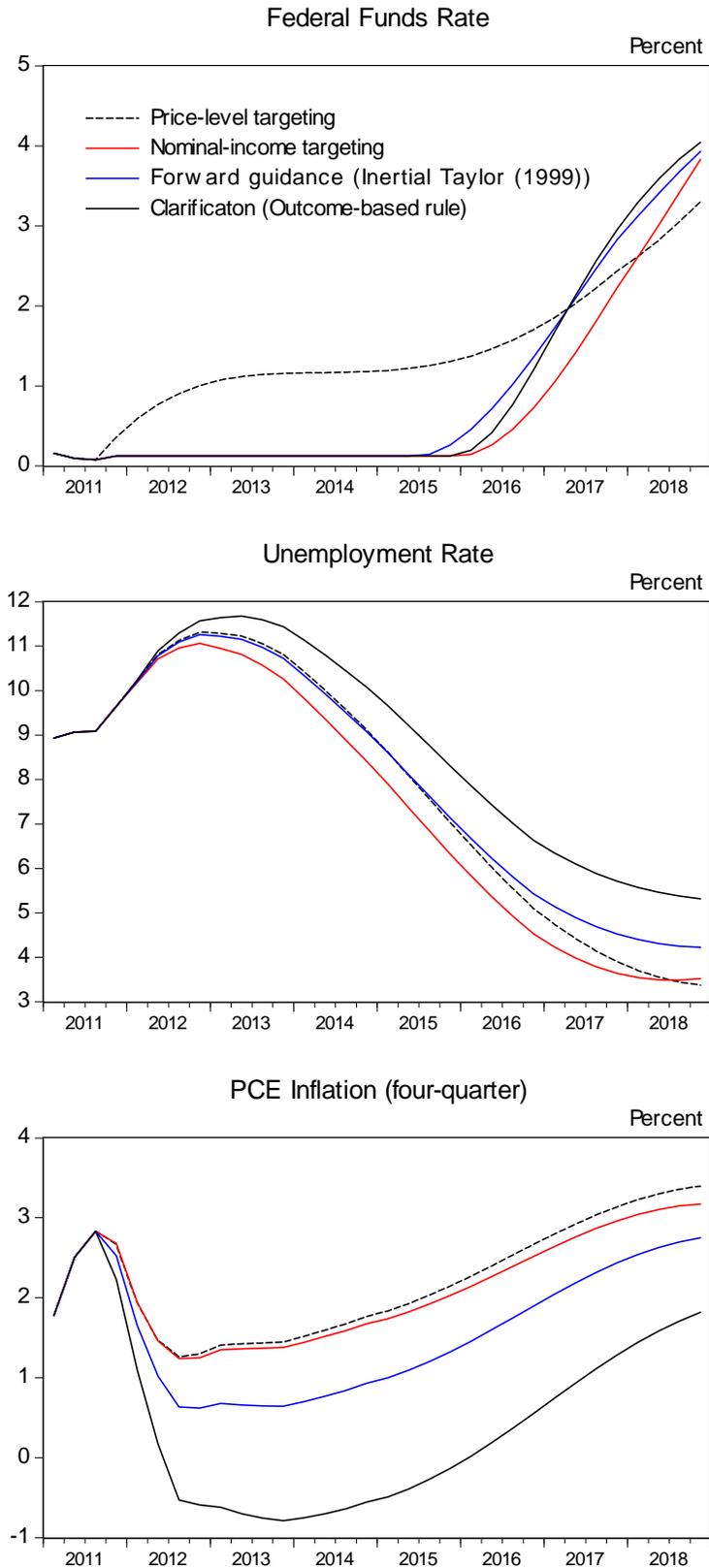
Figure 7
Outcomes For Different Strategies In Respose to Adverse Price Shocks

Federal Funds Rate

Percent

- - - - Price-level targeting
——— Nominal-income targeting
——— Forward guidance (Inertial Taylor (1999))
——— Clarificaton (Outcome-based rule)

Unemployment Rate
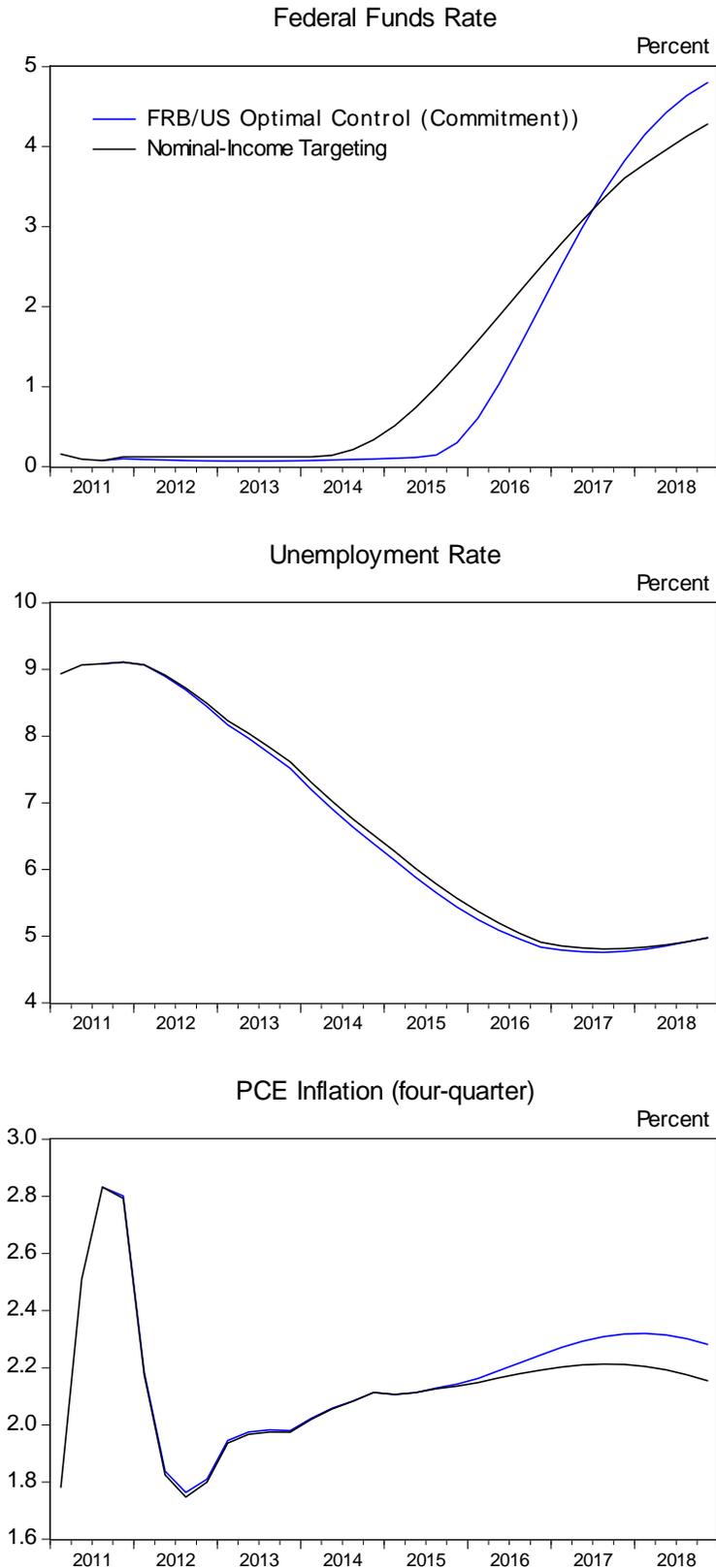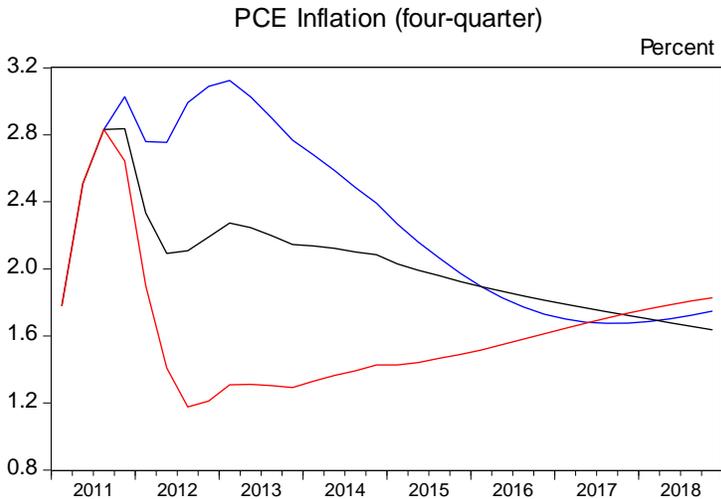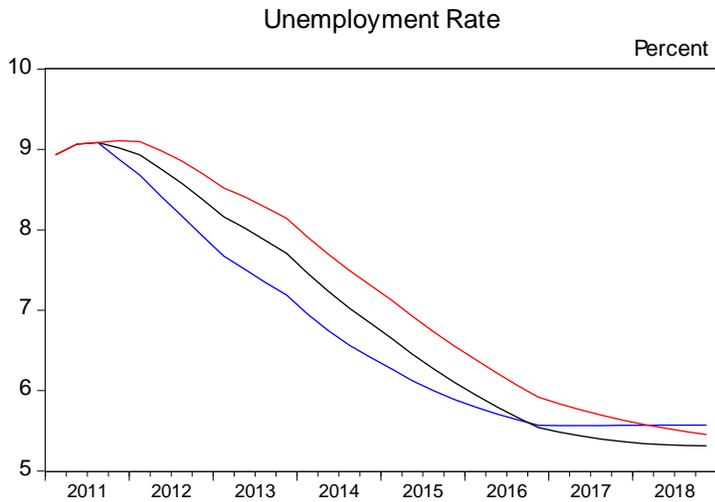
Percent

PCE Inflation (four-quarter)

Percent
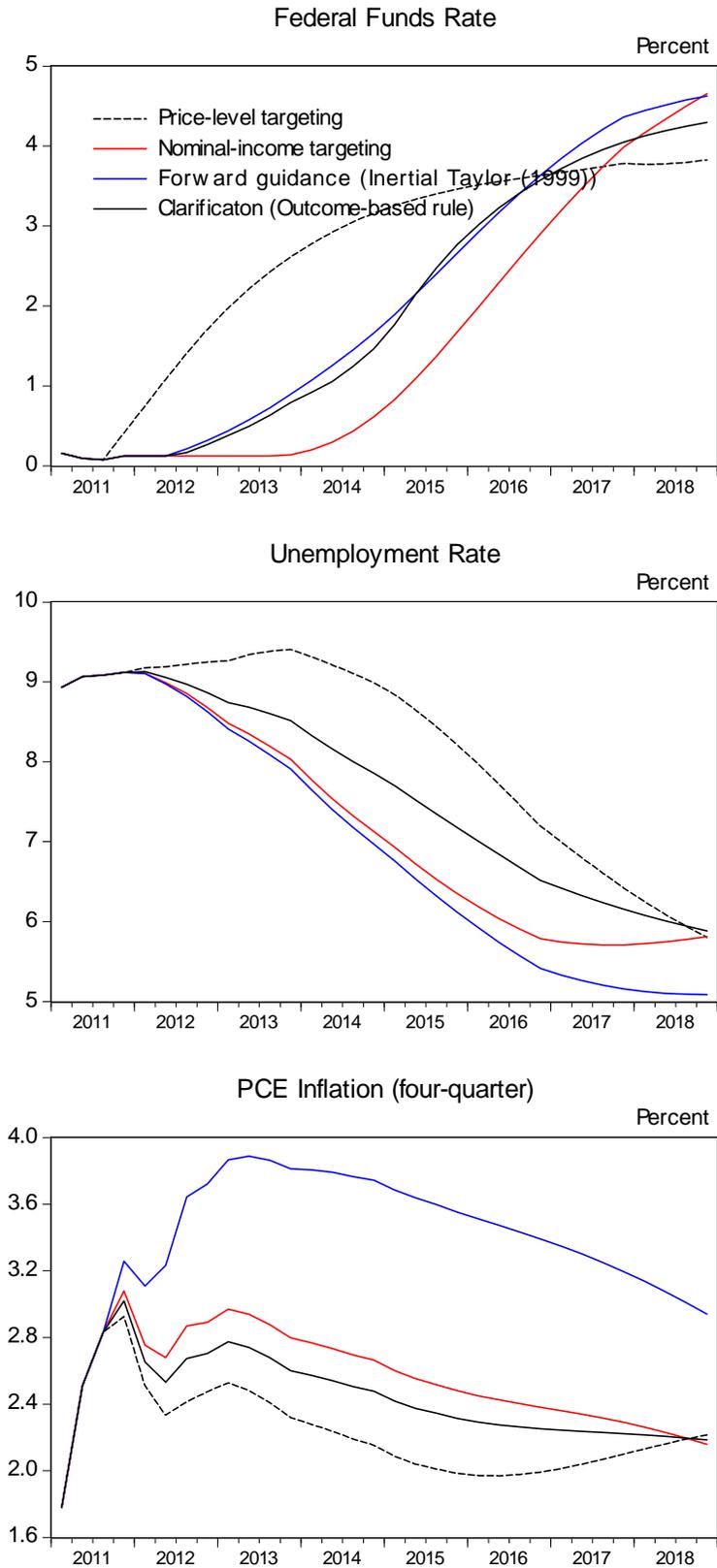
Figure 8
Comparison of Nominal Income Targeting and Optimal Control Under Commitment

Federal Funds Rate

Percent

FRB/US Optimal Control (Commitment))
Nominal-Income Targeting

Unemployment Rate

Percent

PCE Inflation (four-quarter)

Percent

Figure 9
Comparison of Nominal Income Targeting and Optimal Control Under Commitment
EDO (DSGE) model

Federal Funds Rate

Percent

Unemployment Rate

Percent

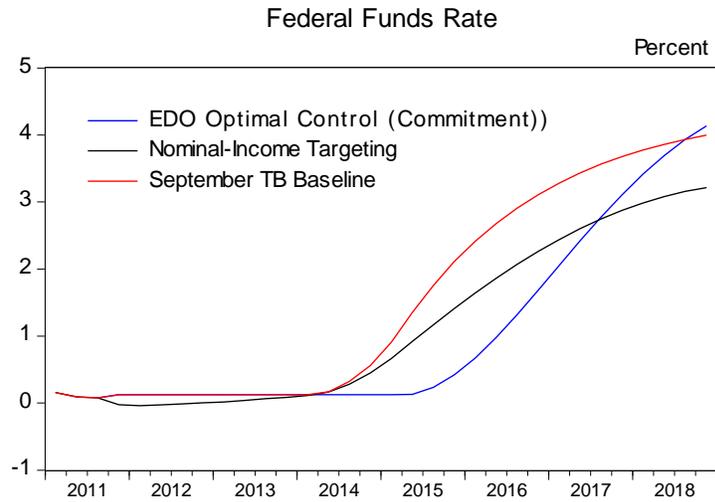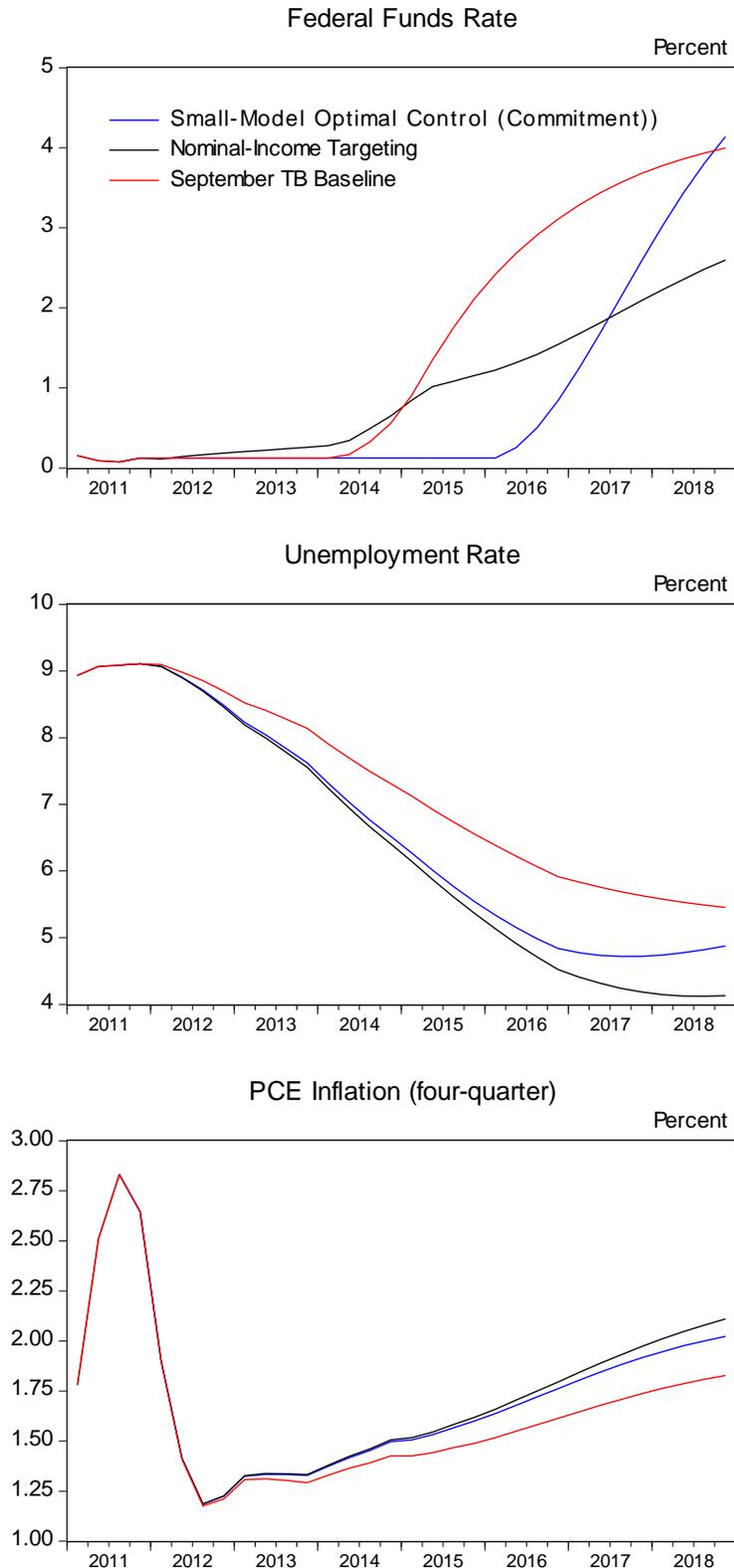### PCE Inflation (four-quarter)

Percent

Figure 10
Comparison of Nominal Income Targeting and Optimal Control Under Commitment
Small Model

Federal Funds Rate

Percent

Small-Model Optimal Control (Commitment))
Nominal-Income Targeting
September TB Baseline
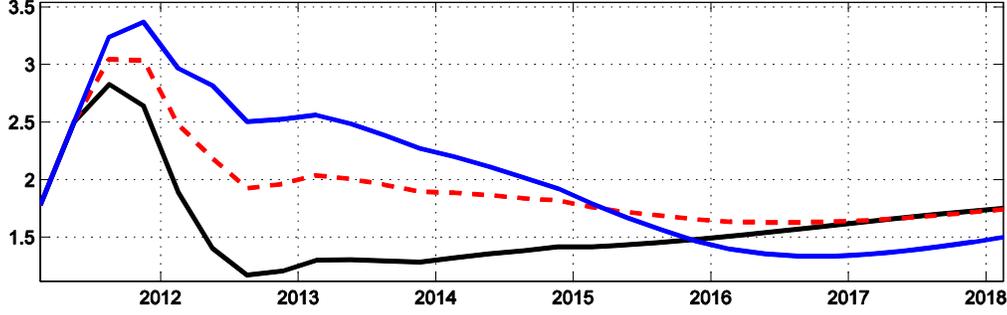
Unemployment Rate

Percent

PCE Inflation (four-quarter)

Percent

Figure 11
Comparison of Nominal Income Targeting and Optimal Control Under Commitment

Federal Funds Rate

Legend:
- Outcome-based
- Nominal Income Targeting (SIGMA)
- Optimal Control (SIGMA)
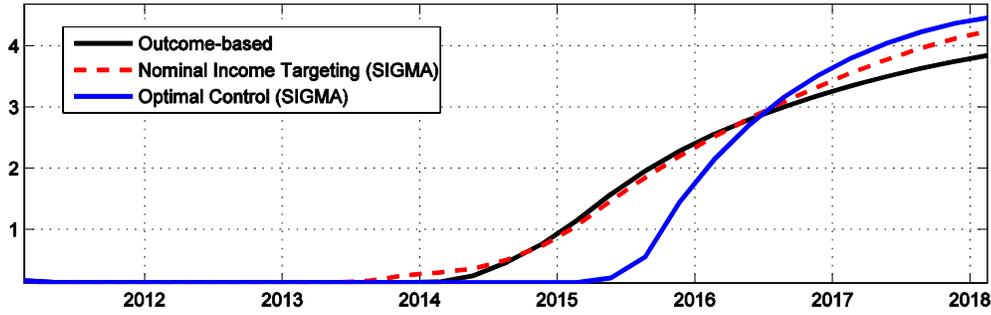
Unemployment Rate
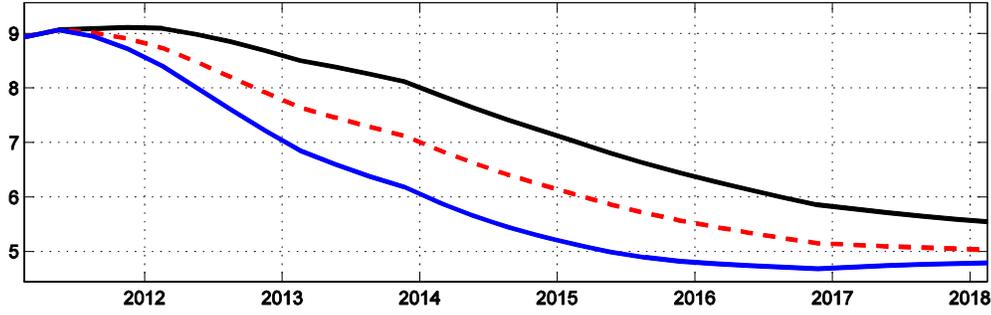
PCE Inflation (four-quarter)

4. Risks associated with the various strategies

As the preceding discussion has highlighted, strategies to provide more stimulus likely require a considerable ability on the part of the FOMC to manage expectations. Some aspects of the monetary transmission mechanism or the assumptions regarding financial market, firm, and household reactions to such policies may differ in important respects from the predictions of the models we have considered. This section discusses this issue in some detail. As background for this discussion, it is important to keep in mind that most of the previous simulations are based on models that assign a key role to inflation expectations and real long-term interest rates in the transmission mechanism of monetary policy and in inflation dynamics. The effects of the new policies could differ substantially if instead:

- expectations respond differently because of a lack of credibility or alternative views by the public of the effects of these policies (such as the belief that they are inherently inflationary);
- any increase in inflation under these strategies puts upward pressure on nominal interest rates or (through increased perceived risks) on term premiums that counteract, in part or in full, the intended stimulus; or
- a higher rate of inflation erodes real disposable income for a time because nominal wages lag the rise in prices by more than policymakers anticipate, leading in turn to temporary weakening in demand as constrained households respond negatively to the transitory reduction in income.

Before turning to each of these risks, one factor that is worth mentioning is that the strategies we consider all involve, at least in expectation, inflation only modestly above the long-run objective of 2 percent. While policies that use intermediate level targets, such as nominal income and price level targeting, might induce some temporary boost to inflation, such policies, if credible, are designed to limit undesirable fluctuations in long-run inflation expectations and inflationary risks. That is, using a "level" intermediate target as policy anchor would imply that long-run inflationary risks are *reduced*, not increased—again, assuming the policy is seen as credible. Finally, the movements in inflation above the target previously discussed are modest in historical perspective, and fall far short of calls for substantial inflation (on the order of, for example, 4 or 5 percent) that some observers have suggested might be desirable. With that thought in mind, the remainder of this section takes these concerns in turn.

Credibility, inflation expectations, and inflation risk premiums

An underlying assumption throughout the preceding discussion of the effects of different strategies is the existence of a high level of central bank commitment and credibility, which contributes to the movements in expectations that lead to the stimulus to activity and anchoring of inflation expectations associated with, for example, nominal income targeting. A lower level of credibility would reduce the stimulus from such strategies and could contribute to undesirable movements in inflation expectations.

Another issue related, at least indirectly, to credibility is the importance of expectations in determining asset prices and inflation dynamics in the models analyzed above, where, for

example, expectations of inflation are a key determinant of inflation and contribute centrally to the stability of inflation under price level and nominal income targeting. Alternative views of the inflation process, placing a greater weight on inertia and backward-looking behavior, would imply less benefit from these strategies; of course, a view that inflation dynamics were primarily backward-looking would also imply little risk that inflation expectations would rise in response to adoption of such policies.

A major change in the policy framework could potentially lead to a substantial upward shift in long-run inflation expectations, thereby worsening the tradeoff between inflation and real activity. In particular, Committee members might be concerned that a policy change whose quantitative dimensions were not well understood could provoke both an undesirably large shift in inflation expectations and a rise in the inflation-risk component of bond premiums, thereby boosting real long-term interest rates and potentially hindering the pace of economic recovery. In addition, a major shift in framework could lead private agents to grow more concerned about the outlook if they, for example, were to interpret the shift in strategy as indicating that policymakers see the situation as even more dire than market participants currently assess. In principle, the different strategies would entail different degrees of uncertainty regarding the effects of temporary increases in inflation on long-run inflation risks and hence on the price of risk; in this regard, it is relevant to note that the more aggressive forward guidance such as suggested by an inertial Taylor (1999) rule showed the most significant drift in inflation in response to unanticipated price shocks.

The ability of a new policy framework to deliver lower long-term real interest rates, and hence additional stimulus, depends critically on risk premiums and inflation expectations adjusting in the rational, anticipatory manner discussed above. Clearly, the benefits would be lower, the smaller the influence of future policy commitments on actual and expected inflation, or the less wage-and-price setting exhibits forward-looking behavior. Yet, a policy that entails higher inflation expectations, if not well understood, is likely to have some significant costs on the dynamics of adjustment. Higher inflation expectations may translate into greater inflation uncertainty, which may in turn reduce economic efficiency and the accuracy of relative price signals. In addition, higher inflation expectations and increased uncertainty might translate into higher inflation risk premiums, thereby increasing nominal and real long-term interest rates.

To illustrate the conditions under which the fairly favorable outcomes under nominal income targeting shown earlier may fail to materialize should inflation expectations and term premiums react in unanticipated ways, we consider a pair of FRB/US simulations in Figure 12 on page 31. In the first, private agents perceive the adoption of a nominal-income target approximately 7 percent above the current level of nominal income as a back-door approach to inflating prices precipitously; this perception is implemented by assuming that private agents actually view the target as implying a desired *price* level 7 percent above trend, rather than nominal income 7 percent above trend. We further assume that policymakers feel pressured to validate this expectation. As a result (and as shown in Figure 12 in the lines labeled "misperception of target"), inflation rises markedly and averages 3¼ percent from 2012 to 2018; the loose stance of monetary policy and low real interest rates implied by the jump in inflation allow the unemployment rate to fall precipitously to about 3½ percent in 2017. The second simulation builds on the first and further assumes that the jump in inflation also leads to a substantial rise in

term premiums and hence nominal long-term interest rates, which increase to a level 100 basis points above baseline over 2012. The adverse shift in financial conditions crimps demand and implies that the unemployment rate increases, relative to baseline, through 2014.

These simulations illustrate how unanticipated reactions to a shift in strategy, whether involving a more stimulative stance or a discrete change to an intermediate-targeting regime, could potentially raise inflation while weakening activity. Such effects would seem more likely if the policies were interpreted as indicating a desire to raise inflation substantially. As none of the policies, and most especially price level or nominal income targeting, are intended or expected to result in such an outcome, communications that specify clearly the policies' objectives and their expected effects—through, for example, more detailed projections from the Committee showing the expected effects of its actions—would likely be helpful in reducing (albeit not eliminating) such risks.

A larger role for nominal interest rates

The model simulations, as in most of the academic literature, assume that economic activity and other asset prices mostly depend on real interest rates, but it is possible that nominal rates matter directly to a larger extent than embedded in the models considered. For example, nominal interest rates play a small role in influencing residential investment in the FRB/US model, reflecting (in part) some role for nominal debt service in mortgage approvals. Financial institutions may assess a borrower's creditworthiness on the basis of her debt service-to-income ratio more broadly. This means that credit availability may deteriorate for numerous potential borrowers if long-term nominal rates rise. In addition, an older literature links equity market valuation to nominal interest rates, while recent evidence suggests that confusion between changes in nominal and real interest rates would reduce real house prices when inflation increases—a form of money illusion.[12] If such effects are sizable, an increase in long-term expected inflation that translates into an increase in nominal bond yields may well lead to an increase in the equity premium and a tightening of financial conditions. A development like this would weigh on economic activity and would go in the direction of making the change in strategy counterproductive. As noted above, most of the strategies considered do not imply inflation much above 2 percent across several scenarios and involve lower nominal interest rates, so these risks would not appear outsized. Nonetheless, there could be less stimulus to activity if this risk materialized.

Low interest sensitivity of demand and outsized role for disposable income and real wages

Overall, the expansionary effects on output of the strategies discussed in this memo would be smaller to the extent that aggregate demand is relatively insensitive to movements in long-term real interest rates. This risk may be especially salient at the current time, as credit constraints facing some firms and households may limit their ability to respond to lower interest rates. This concern may be particularly important for the housing market. However, as we emphasized above in section 2, housing activity is not an especially significant portion of the stimulus under the policies we examine. Moreover, a reduced interest sensitivity of total spending does not necessarily imply that efforts to lower interest rates further to provide additional stimulus are

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[12] For example, see Modigliani and Cohn (1979) and Brunnermeier and Julliard (2008).

unwarranted; indeed, such a development could be read as justifying an even larger reduction in interest rates in order to provide the stimulus needed to achieve desirable outcomes for inflation and unemployment.

Financial constraints on both households and firms may also make aggregate demand more sensitive to changes in disposable income. If alternative strategies led to higher inflation and eroded disposable income because real wages were unable to adjust fully to the higher inflation rate, consumption and investment outlays by financially constrained households could be curtailed.

Overall, the benefits of temporary increases in inflation in terms of additional stimulus to aggregate demand will be lower than expected if a sufficiently large fraction of agents are unable to respond to changes in the expected future real interest rates while other consumers, who merely consume their wage income, have their purchasing power eroded by the effect of unexpected price inflation on real wages.[13] On the other hand, reductions in the real wage, and therefore in firm's real marginal cost, could lead to increased profits, spilling over to higher labor demand and increased dividend income for asset holders. These aspects of the expansionary policy would counter any adverse impact of interest rates and real wages on aggregate demand.

Adverse feedback loop from higher commodity prices

Policies viewed as excessively expansionary might also undermine the pace of the recovery through unanticipated effects on commodity prices. Any of the previously discussed strategies might be viewed by participants in commodity markets as entailing a greater than desirable risk of future U.S. inflation, which could induce a run-up in oil and other commodity prices in conjunction with a decline in the foreign exchange value of the dollar. Damage to the ongoing recovery would arise from the loss of purchasing power (or "effective tax increase") faced by U.S. consumers as a result of an increase in imported commodity prices.

Strategies such as price level and nominal income targeting would—if credible—probably mitigate the impact of commodity price shocks on inflation. Nonetheless, unexpected increases in commodity and oil prices would be particularly troubling if they led to a marked rise in longer-run inflation expectations, and if such an increase were to prove difficult to reverse because of a low sensitivity of inflation to slack (that is, because of a flat Phillips curve). Overall, if strategies targeting the price level or nominal income are not very credible, fluctuations in output and inflation may be more pronounced than originally expected. Specifically, a lack of credibility may lead to a more persistent rise in inflation, thereby forcing policymakers to raise interest rates.

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[13] For example, see Galí, López-Salido and Vallés (2007).

Figure 12
Outcomes when Nominal Income Targeting Is Misinterpreted
Case 1: Jump in Inflation Expectations; Case 2: Increase in Term Premiums

Federal Funds Rate

Unemployment Rate

PCE Inflation (four-quarter)
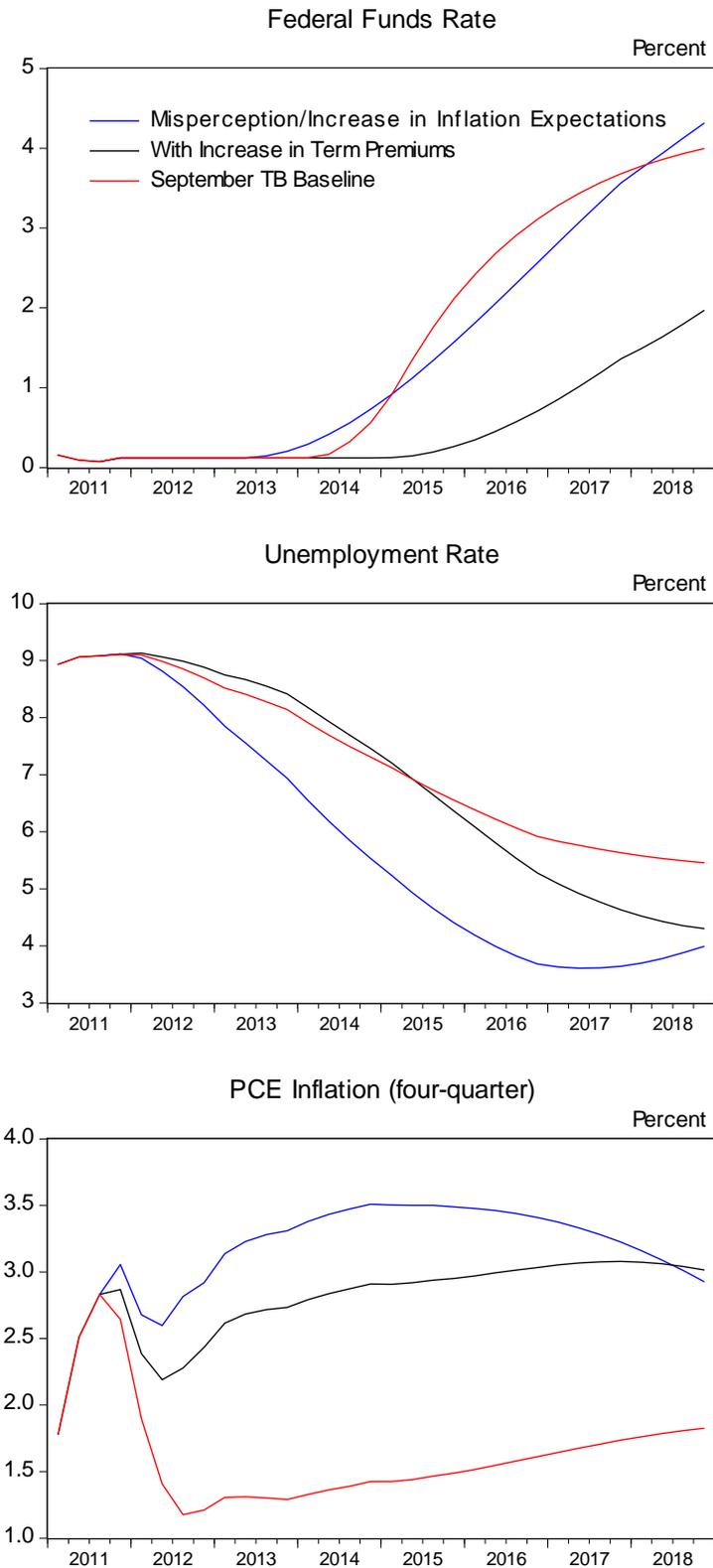
5. Communication and Balance Sheet Management as Complementary Tools

Given the modal outlook, even the most stimulative policies considered above imply only a modest overshooting of inflation above the long-run goal of 2 percent. Even so, these strategies represent some degree of change from market perceptions of the current policy strategy, and an implicit or explicit desire to boost inflation might be perceived as inconsistent with past communication. Specifically, some prominent speeches by various FOMC participants in the past have explicitly rejected policies aimed at pushing medium-term inflation above target unless the outlook deteriorated to a significant extent. Policymakers might worry that economic agents would see more stimulative policies as an unconditional promise that undermines clarity about the long-run inflation objective.

It is unclear which strategy would imply greater risks in this area: For example, forward guidance designed to provide additional stimulus may be sufficiently unclear about the long-run exit strategy to increase the risk of unanticipated effects, whereas an intermediate target could communicate more clearly the conditions that would lead to a return to more normal conditions for policy; alternatively, an intermediate target may strike some private agents as new and confusing. Small moves toward clarifying forward guidance might have limited benefits in terms of improving the economic outlook or providing insurance against more adverse scenarios, yet they may also have the lowest risk as they represent an incremental shift relative to the current strategy.

For any change in the strategy to be successful, especially over a period in which the Federal funds rate is constrained by the zero lower bound, the credibility of the new strategy is critical. Yet credibility can be fragile, and the accompanying communications strategy therefore needs to be constructed and managed to consolidate the reputation of the central bank. Therefore, a substantial effort would be needed in the communication strategy of the Committee if it were to shift strategies significantly. For example, central banks that have attempted to most clearly follow the recommendations of the research literature on forecast targeting have produced forecasts for their goal variables and policy setting over an extended period that illustrate how their policy strategy achieves the desired outcomes; the *Inflation Report* of the Riksbank is an example. Shifts in this direction would require either a very substantial revision to the SEP, a revamping of the Monetary Policy Report, or a new communications product. The additional clarity concerning strategy and views on the outlook would support the types of strategies we have discussed.

Other tools could also be used to support the strategies. For example, policymakers may wish to accompany a move to a more stimulative policy strategy, such as nominal income targeting, with balance sheet actions, such as purchases of Treasury securities and agency-backed MBS, to illustrate the Committee's commitment to provide more stimulus in a visible way.[14] Such actions could both signal the Committee's resolve, thereby lowering real interest rates, as well as affect term and risk premiums in a supportive manner.

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[14] Staff analysis has ascribed a significant role to the impact of balance sheet expansion on term premiums; see Li and Wei (2011). Krishnamurthy and Vissing-Jorgenson (2011) assign a larger role to signaling.

The size of the balance sheet as policy normalizes is also an important issue for policymakers to consider, in order to avoid circumstances that undermine the benefits of the commitment. By and large, adhering to a clear commitment strategy would include the use of the appropriate tools to remove accommodation (including, for example, interest on excess reserves) at the appropriate time and pace to avoid any undesirable overshooting in activity or inflation. While these challenges are formidable, they do not appear to represent obstacles to achieving a better outlook for inflation and activity under the strategies we have outlined.

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Appendix: Comparison of Macroeconomic Models Used in Our Analysis

The simulations considered in this memo employ four macroeconomic models: the staff's FRB/US model, a small model, the staff's U.S. DSGE model (EDO), and the staff's multicountry DSGE model, SIGMA. These models differ along several dimensions—including the extent to which forward-looking behavior is model-consistent, the degree to which the equations of the models are derived from explicit household and firm optimization problems, and the elasticities of spending and inflation to monetary policy actions.

The small model has not previously been emphasized in staff reports to the Committee, but was included in this analysis in order to provide an alternative framework that provides a different perspective with regard to inflation dynamics while being closely tied to the data. This model consists of four equations plus a characterization of policymaker behavior, such as a simple reaction function or an optimal-control policy. The aggregate demand equation links the output gap to two of its own lags and a long-term interest rate, as in Fuhrer and Moore (1995) and Fuhrer and Rudebusch (2004); the term-structure equation determines the long-term interest rate via the expectations hypothesis; the Phillips curve links core PCE price inflation to its own lag and lead and the output gap; and an Okun's law equation links the unemployment rate and output gap.

As highlighted in the main text, the different properties of the four models lead to somewhat different results under various policy strategies, with the most important difference involving the sensitivity of inflation to the monetary policy stance. To illustrate the basic properties of the models, table A1 reports the responses of real GDP, the unemployment rate, and core PCE inflation at horizons of 8 and 12 quarters to an anticipated increase in the nominal federal funds rate that lasts 8 quarters. With regard to real activity, the responses are very similar—real GDP falls about ½ percent below baseline and the unemployment rate increases ¼ percentage point relative to baseline in response to the shocks; this similarity is to be expected, as the models were (partially) calibrated to be similar along this dimension. The inflation responses differ more across models, with the small model exhibiting little inflation response, the FRB/US model exhibiting a larger response in the third year, and the EDO model exhibiting a larger near-term response. These differences in the inflation response drive some of the results presented in our analysis.

Table A1: Response of Key Variables to an Anticipated Increase
In the Nominal Federal Funds Rate of 100 Basis Points Lasting 8 Quarters

Model	Real GDP (percent)		Unemployment Rate (percentage points)		Core PCE Inflation (percentage points)	
	8th quarter	12th quarter	8th quarter	12th quarter	8th quarter	12th quarter
Small Model	-0.5	-0.5	0.3	0.3	-0.0	-0.0
FRB/US	-0.6	-0.4	0.3	0.3	-0.1	-0.2
EDO	-0.5	-0.4	0.2	0.2	-0.3	-0.2
SIGMA	-0.9	-0.6	0.4	0.3	-0.1	0.1

Notes: Each column reports the deviation from baseline in response to the assumed change in the nominal federal funds rate. Core PCE inflation is measured on a four-quarter basis.