

Using Thresholds to Clarify the Conditionality in the Committee's Forward Guidance for the Federal Funds Rate

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I. Introduction

In the lead-up to the September FOMC meeting, policymakers projected that, absent further stimulus from monetary policy, the pace of recovery was unlikely to be strong enough to generate more than a very gradual pace of improvement in labor market conditions before 2015 and that inflation would remain at or below the Committee's 2 percent objective. Against this backdrop, the Committee decided to provide additional policy accommodation, including clarifying its forward guidance regarding the federal funds rate by indicating that "a highly accommodative stance of monetary policy will remain appropriate for a considerable time after the economic recovery strengthens" and that conditions would likely warrant an exceptionally low federal funds rate at least through mid-2015.

For some time, financial market participants appear to have understood that the Committee's forward guidance is conditional and that the statement links the timing of an increase in the funds rate to the evolving economic outlook for unemployment and inflation. Nonetheless, to help ensure that the clause indicating that accommodative "policy will remain appropriate for a considerable time after the economic recovery strengthens" will have its intended effects on private-sector expectations, such guidance could be buttressed by spelling out the economic conditions under which the Committee might raise the target for the federal funds rate earlier or later than mid-2015. In addition, The Committee could further clarify its approach to policy by indicating how it anticipates adjusting the federal funds rate target in response to evolving economic conditions once the firming of policy begins.

This memo considers the merits of replacing the current date-based forward guidance with specific threshold values of inflation and unemployment that would need to be attained before the Committee would take action to increase the federal funds rate (although these merits would also presumably apply to a strategy in which the Committee retains the date-based guidance but supplements it with announced thresholds).¹ We begin with a conceptual discussion of some of the potential benefits of using a threshold strategy as well as some of the challenges that might

¹ The latter approach could underscore the notion that the adoption of thresholds is meant to clarify the Committee's current strategy, rather than signaling a significant shift in policy. In addition, combining thresholds with date-based guidance might be better understood by financial market participants who have become accustomed to the date-based guidance. However, policymakers may be concerned that retaining a date could move the private sector's attention away from the quantitative thresholds—and from the conditionality of the outlook for the target federal funds rate more broadly—thereby leaving the impression that the Committee has committed to a specific time-dependent policy. If so, the Committee could choose to retain the date-based guidance the first time the threshold language is added to the statement or the Chairman could provide the expected date of first tightening in his press conference.

arise, particularly in the area of communication.² This section also discusses the possibility of expanding upon the forward guidance regarding liftoff by providing additional information on the Committee's likely policy strategy once it has begun raising the target federal funds rate.

After this conceptual discussion, the memo turns to model simulations designed to evaluate the potential implications of a threshold strategy for the future path of the federal funds rate and for macroeconomic performance. Among other things, this analysis explores the likely effects of different threshold settings under a range of economic conditions; it also considers the effects of alternative assumptions about the behavior of monetary policy after a threshold is crossed. Subject to the usual caveats that necessarily apply to any model-based analysis, the three main lessons from these simulations are:

- An arrangement under which inflation and unemployment thresholds guide the timing of a return to a “normal” policy setting—as approximated by having the federal funds rate follow the prescriptions of some simple policy rule after either of the thresholds is crossed—would likely perform fairly well under a variety of economic conditions. Thus, the model simulations suggest that the Committee could use thresholds to clarify its communications without compromising macroeconomic performance—subject to the caveat that the Committee may wish to avoid setting the thresholds too aggressively.
- The stimulus provided by the adoption of economic thresholds is likely to be small if their announcement does not materially alter market expectations for both the likely date of liftoff and the subsequent pace of policy firming. In fact, if the announcement merely pushes out market expectations for the likely start of tightening by a quarter or two, but otherwise leaves perceptions of the Committee's longer-term strategy unaffected, the simulations suggest that the additional stimulus would probably be negligible.
- However, if the announcement of thresholds (possibly accompanied by other information) were to convince the public that the Committee intends to pursue a persistently more accommodative strategy than previously anticipated, then the additional stimulus could be considerable. For example, model simulations indicate that if the market initially anticipates that the Committee will follow the prescriptions of the outcome-based rule after liftoff, but then comes to understand that policy will instead be guided by an inertial version of the Taylor (1999) rule, the pace of recovery would quicken noticeably. Whether the announcement of thresholds alone would generate these expectational effects is, however, questionable.

In addition, the model section considers some issues that arise when thresholds are defined in terms of the unemployment rate and projected inflation. Two important conclusions that emerge from this analysis are:

² The forward guidance discussed here treats the federal funds rate target as the instrument that the Committee would adjust first when policy tightening begins. In addition, the discussion in this memo takes for granted that, in the period immediately ahead, adjustments to forward guidance language will be concentrated in the area of funds-rate policy rather than balance-sheet policy.

- Because the amount of slack in labor markets is uncertain, reliance on an unemployment threshold creates a risk that the Committee could keep policy persistently easier or tighter than it would choose if it had full information about the economy. However, this risk attends any strategy that uses measures of slack to help guide the setting of the funds rate, and the use of thresholds may not exacerbate it greatly. Moreover, the consequences of such a measurement error would be modest provided that inflation expectations remained reasonably well-anchored and the Committee corrected its error once it saw inflation rising substantially above target.
- Because inflation, even projected inflation, is subject to a certain degree of inherent volatility, setting the inflation threshold at a level only modestly above 2 percent would make it highly likely that this threshold would be crossed relatively early despite a still-elevated level of unemployment. As a result, economic outcomes (particularly for unemployment) could be less favorable than those obtained with a higher inflation threshold; alternatively, this development could possibly lead to the Committee needing to explain in its public communications why the federal funds rate target was not being raised despite the inflation threshold being crossed.

Following the model-based analysis, we discuss the communications challenges that would likely be associated with using thresholds for economic conditions in the Committee's forward guidance and then offer some illustrative statement language intended to address those challenges.

II. Potential Benefits and Complications in the Use of Thresholds—Conceptual Issues

Policymakers might take the view that using thresholds to quantify forward guidance would increase the clarity of Committee's intentions and improve the private sector's understanding of the monetary policy reaction function. In particular, quantitative thresholds could enable market participants to obtain a better understanding of how the date of policy firming might shift in response to changes in the economic outlook. If forward guidance improves investors' understanding of the Committee's reaction function, such guidance may make it more likely that market responses to incoming news will move medium- and longer-term interest rates in a direction and by an amount consistent with the Committee's view regarding the likely future path of short-term rates, thereby contributing to macroeconomic stability. In addition, enhancing the clarity regarding the Committee's intentions might also reduce uncertainty about the future stance of policy and that, in turn, might contribute to reduced interest rate risk premiums.

If the Committee were to decide to adopt thresholds, it might do so with a view to building upon the expectational benefits that have apparently been obtained under the existing approach to forward guidance. The Committee's guidance about the likely starting date for policy firming seems to have influenced the private sector's expectations in a desirable way, in the sense that market-based estimates of the expected federal funds rate path appear to have shifted over time in a manner broadly consistent with both the Committee's evolving strategy for achieving the

dual mandate and changes in the economic outlook.³ Currently, market-based estimates of the most likely path for the funds rate are approximately in line with the September statement's forward guidance. Moreover, market expectations for the start of policy firming have moved over time in response to incoming economic news in a manner suggesting that investors generally understand that the date is conditional on economic conditions. Nevertheless, some private-sector agents may still be misinterpreting the current guidance as an unconditional commitment, invariant to changes in economic conditions, or may not understand the nature of the conditionality of the date. If so, thresholds may significantly improve communication, helping the private sector to gain a better understanding of the economic conditions that would have to be met before it would become appropriate to increase the target for the federal funds rate, thereby allowing investors to adjust their expectations for policy appropriately in response to incoming economic data.

To the extent that the private sector does not fully appreciate either the intended thrust of the FOMC's strategy or the conditional nature of the forward guidance, but instead bases its expectations on the mistaken view that the Committee is simply committing to keep the funds rate near zero until a specified date, the value of the current date-based forward guidance is reduced. For example, moving the date in when stronger-than-expected information arrives could undercut the value of the date as a commitment device if the private sector fails to understand that such a change is consistent with the Committee's strategy for restoring full employment with inflation running close to its 2 percent objective. Conversely, moving the date out when the Committee decides to pursue a more accommodative strategy than previously envisioned (possibly in response to weaker-than-expected data) may be misinterpreted by the public as an overly negative signal about the medium-term outlook for the economy.

In addition, thresholds could provide additional stimulus if they led financial market participants to revise their previous expectations so that they now anticipate that the recovery would need to be further advanced or inflation higher before the Committee would commence tightening. However, such additional stimulus would likely be limited because expectations about the path of the funds rate after its departure from the effective lower bound also play a crucial role, and a potentially more important one, in determining the degree of accommodation associated with a Committee policy decision. Indeed, the benefits—in terms of improved economic performance—from strategies such as the optimal control strategy or nominal income targeting strategy regularly presented in the Tealbook derive largely from the property that the expected increase in the funds rate following the start of firming occurs at a gradual pace that permits inflation to slightly exceed the 2 percent target and unemployment to fall modestly below the natural rate for a time during the latter half of this decade. These benefits are unlikely to be delivered by thresholds alone—and indeed may be difficult to obtain even if accompanied with

³ For example, as noted in the Chairman's Jackson Hole speech on August 31, the Blue Chip consensus projections of the unemployment rate expected to prevail when tightening begins have declined markedly over the past few years, suggesting that the Committee's forward guidance has led market participants to see the Committee as willing to maintain a highly accommodative stance of policy for longer than previously believed.

explicit guidance about longer-run policy because these expectational benefits rest on policymakers' ability to make long-horizon commitments.⁴

Thresholds have an important operational aspect that the Committee might wish to highlight in its public communications: Crossing a threshold need not imply that the federal funds rate must immediately move above its effective lower bound. Instead, the crossing of a threshold may simply signal that the Committee intends to begin taking a more standard approach to determining the appropriate stance of monetary policy, perhaps by following more closely the prescriptions of simple policy rules. Under this approach, policymakers could well decide that economic conditions and other factors at the time of crossing warrant keeping short-term interest rates near zero for a while longer. Indeed, such a decision could be quite likely if the Committee set the unemployment threshold at a high level and the inflation threshold close to 2 percent (a point that will be illustrated in the model simulation results discussed below). If the Committee did indeed interpret the consequences of threshold crossing in this way, it would presumably wish to stress publicly that crossing a threshold is not synonymous with the onset of policy firming.

The tendency for inflation to exhibit short-run volatility, especially when measured on a headline basis, is an important consideration in the selection of an inflation threshold. In particular, shocks to food, energy, and other factors can cause pronounced transitory movements in inflation. As a result, using realized inflation over, say, the past twelve months to define a threshold would greatly increase the odds that the threshold would be crossed in situations in which the longer-run outlook for inflation remains benign. One way to mitigate this problem would be to set the inflation threshold at a very high level, but this approach would have the disadvantage of potentially delaying the response of policy to a perceived persistent rise in inflation. As an alternative, in this memo we focus on inflation thresholds defined in terms of projected inflation between one and two years ahead. As shown in the simulation analysis below, expressing the inflation threshold in terms of projected inflation markedly reduces the likelihood that policy is firming in response to the transitory effects of shifts in oil prices and other temporary factors. At the same time, this approach to setting an inflation threshold has its drawbacks; for example, it creates a potential risk for the FOMC's credibility if the Committee's inflation projections deviate too markedly and/or persistently from private sector forecasts.

Of course, establishing thresholds for inflation and unemployment could involve costs as well as benefits. The use of thresholds would require significant changes in statement language; as a result, the Committee may choose to delay making subsequent changes for fear of confusing investors or undermining its credibility. The Committee also might feel that embracing thresholds would close off the option of making a more fundamental change in strategy—such as the adoption of nominal GDP targeting, forecast targeting, or some other substantial departure from current practice—that it might regard as appropriate in the event of a highly adverse deflationary shock. Finally, establishing thresholds raises the risk that the Committee might later

⁴ Specifically, the effectiveness of an optimal, commitment-based, strategy depends on convincing the private sector that the same policy strategy will be continued long into the future. Accordingly, the scope to influence expectations necessarily involves being able to persuade the private sector that the Committee will continue to adhere to the strategy for many years, including after the time at which the unemployment rate has returned to a level consistent with maximum employment. In practice, however, the private sector may doubt that the Committee will follow through on such long-horizon commitments.

conclude that tightening policy is appropriate before a threshold is crossed. The Committee might, for example, conclude that the natural rate of unemployment is higher than it had thought or that very low interest rates were contributing to financial imbalances that could not be addressed using regulatory or supervisory measures. We discuss this possibility further in the communications section of the memo.

III. Macroeconomic Effects of Thresholds—FRB/US Simulation Results

In this section, we explore the potential macroeconomic effects of adopting a threshold strategy using simulations of the FRB/US model. We begin by examining these effects under the economic conditions reported in the consensus outlook discussed by the Committee at the September meeting, as well as in response to some illustrative shocks to aggregate demand and supply. We then consider both the macroeconomic implications of setting thresholds at different levels and the importance of what monetary policy does after a threshold is crossed. In light of the highly uncertain outlook for real activity and inflation, we next investigate the likely performance of a threshold strategy in the face of unexpected economic developments, based on the sort of shocks that have hit the economy over the last 40 years. Finally, we discuss some potential issues created by defining thresholds in terms of the unemployment rate and projected inflation.

Several caveats to the analysis are worth highlighting. First, our results are generated using a single model, FRB/US. While we believe that the FRB/US model is a useful tool for this sort of analysis, some Committee participants may be skeptical of the accuracy of its particular characterization of both the economy's dynamics and the economy's inherent volatility. Second, our analysis employs the September consensus forecast as a baseline, but some may not agree with that forecast's assessment that considerable slack remains in labor markets, or that the recovery will likely remain subdued despite a very accommodative stance of monetary policy. Finally, some participants may be concerned about a key assumption imposed in most (but not all) of our simulation analysis—that long-run inflation expectations would remain well anchored at 2 percent even if actual inflation were to run somewhat higher for a time.

Macroeconomic dynamics under a threshold strategy—illustrative simulations

Our analysis starts with the assumption that the public currently expects the economy to evolve along the lines shown in the September consensus forecast of the Committee. A key feature of this projection—plotted as the black lines in Figure 1—is that the FOMC keeps the funds rate near zero until the middle of 2015 but thereafter allows it to rise according to the prescriptions of the estimated outcome-based policy rule. We then consider the consequences of an announcement that the FOMC intends to follow a threshold strategy in which the federal funds rate will be held near zero until the unemployment rate falls below 6.5 percent, as long as overall PCE inflation over the medium term is projected to remain at or below 2.5 percent.⁵ As noted

⁵ Specifically, the inflation threshold is defined in terms of the eight-quarter-ahead projection of the trailing four-quarter average of total PCE price inflation as forecast by the FRB/US model. In the absence of future shocks, the inflation forecast will equal the actual future rate of inflation generated in the simulation and will be consistent with the current and projected future path for policy.

earlier, we employ a projection-based inflation threshold in order to reduce the possibility that transitory fluctuations in inflation related to energy or other shocks could lead to the threshold being crossed.⁶ In addition, the simulations assume that once either threshold condition is crossed, the federal funds rate then follows the prescriptions of the estimated outcome-based policy rule.⁷ (The switch in policy is not necessarily tantamount to an immediate increase in the federal funds rate, however, because conditions at the time of crossing may not lead the policy rule to call liftoff.) The public is assumed to understand the announced change in policy and to view it as fully credible. As illustrated by the blue lines in Figure 1, the implications of these particular threshold settings for the outlook would be minor, because the threshold condition for the unemployment rate (which prompts the switch to the outcome-based rule) is about the same as the projected level of the unemployment rate at the time of liftoff in the baseline.

Of course, the outlook might turn out appreciably different from what is envisioned in the September consensus forecast. In that case, under a threshold strategy, the liftoff date for the federal funds rate target and the subsequent path for the funds rate would adjust automatically to changes in real activity and inflation in a manner broadly similar to what occurs under the outcome-based rule or other simple policy rules. Figure 2 illustrates this point with a pair of scenarios in which aggregate demand turns out to be unexpectedly stronger (blue lines) or weaker (red lines). Again, monetary policy in these simulations follows a strategy that combines an unemployment threshold of 6.5 percent and a projected inflation threshold of 2.5 percent; once one of the thresholds is crossed, policy follows the prescriptions of the outcome-based rule after liftoff. As can be seen, stronger real activity causes the liftoff date to shift forward to early 2014, while weaker real activity pushes the onset of tightening off until early 2017. In turn, these policy responses help to stabilize real activity and inflation over time.

From a policy perspective, supply shocks are more difficult to deal with than demand shocks because they push inflation and real activity in opposite directions, thereby sending conflicting signals to policymakers. Reflecting these cross currents, standard Taylor-type rules typically call for keeping short-term interest rates relatively constant in response to shifts in oil prices or changes in the level of potential output because, for example, the effects of higher inflation on the stance of policy are largely offset by the effects of increased slack. Perhaps not surprisingly, threshold strategies behave in a similar manner in response to many supply shocks; indeed, threshold strategies are even less responsive than standard policy rules to such supply shocks as long as economic conditions do not shift sufficiently to cross the thresholds.

Figure 3 illustrates this behavior by simulating the effects of three different supply shocks—an unexpected persistent rise in labor force participation (red lines), an unexpected persistent decline in labor force participation (blue lines), and a jump in the level of crude oil prices (green

⁶ Other possible approaches for the inflation threshold are discussed in section IV.

⁷ For computational convenience, the Federal Reserve's portfolio holdings are assumed to follow the same path as in the baseline, rather than responding endogenously to changes in economic conditions or to the timing of liftoff.

lines)—under the same threshold strategy.⁸ In the case of the two labor force participation scenarios, the funds rate remains near zero into the second half of 2015 because the shocks never cause inflation to cross its threshold nor appreciably change the date at which unemployment crosses its threshold.⁹ Beyond this point, the federal funds rate runs modestly below baseline in response to the lower inflation that results from the increase in slack that initially follows the rise in labor force participation and potential output; the opposite occurs in response to lower labor force participation. The funds rate also remains near zero until mid-2015 in the case of higher oil prices; despite the spike in realized headline inflation, projected inflation never rises above 2½ percent because—with the public’s long-run inflation expectations remaining well-anchored—the FOMC correctly anticipates that the surge in inflation will be temporary. In mid-2015, however, monetary policy begins to tighten as the unemployment threshold is finally crossed; the funds rate past this point stays somewhat above baseline in response to somewhat higher inflation.

One noticeable feature of these FRB/US simulations is that the various demand and supply shocks lead to extended, albeit modest, shifts in the rate of inflation. (We discuss the potentially more serious implications of errors in the measurement of the natural rate below.) This feature would be a cause for concern if it reflected some undesirable side effect of the threshold strategy. But this behavior also occurs in simulations in which policymakers do not use thresholds and instead always follow the prescriptions of the outcome-based rule (not shown). Rather than arising because the thresholds themselves cause monetary policy to be insufficiently activist, the results shown in Figures 2 and 3 primarily reflect a relatively high inherent persistence of inflation in the FRB/US model combined with a relatively moderate response of the outcome-based rule to increases in inflation.

Ability of thresholds to provide additional accommodation

Under a threshold strategy, the response of monetary policy and the economy overall would depend on the specific settings chosen by the Committee. For example, if the Committee chose a relatively low threshold for the unemployment rate and a high threshold for inflation, it would effectively signal that it intends to be persistently more accommodative than might be suggested by its average historical behavior or by most simple policy rules. One way to assess the potential stimulus from thresholds is through model simulations. As before, we assume that the public initially expects the economy to evolve as projected in the September consensus forecast. The Committee then alters its forward guidance by announcing specific unemployment and inflation

⁸ In the stronger labor force participation scenario, the participation rate gradually moves to a level 1 percentage point above baseline; in the weaker scenario, the participation rate settles out at a level 1 percentage point below baseline. These two scenarios are motivated by the significant revisions that the staff has made in recent years to its estimate of trend labor force participation. (Note that the qualitative effects of level shocks to trend labor productivity would be similar to the simulated responses to shifts in trend labor participation.) Likewise, oil prices have been quite volatile in recent years, and thus the oil price scenario involves a \$20 per barrel jump in oil prices in late 2012 and early 2013, with prices gradually returning to baseline several years later.

⁹ In the first two scenarios here, the shifts in trend labor force participation have relatively small effects on the unemployment rate because the accompanying shifts in potential output are recognized by households and firms and so spark compensating adjustments in consumption, investment, and hiring. For example, if the trend participation rate shifts up relative to baseline, households recognize the additional income implicit in that move and boost their spending; likewise, firms boost their workforces and capital stocks. However, the resulting changes to the level of real activity are not initially as large as the shifts in potential output.

thresholds, along with a statement that it intends to follow the prescriptions of the outcome-based policy rule following a crossing of either threshold.

The results from this exercise are shown in Figure 4. In general, lower unemployment thresholds result in later liftoff dates and hence a stronger pace of recovery. However, little or no stimulus is imparted by this type of strategy if the unemployment threshold is set at a level above what is approximately consistent with current expectations for the beginning of policy firming. Thus, a 7 percent unemployment threshold provides no additional stimulus, while a 6 percent unemployment threshold—combined with a projected inflation threshold of 2.75 percent—yields both stronger real activity and somewhat higher inflation. In this case, an aggressive strategy that sets the unemployment threshold at 5.5 percent and the inflation threshold at 3 percent yields macroeconomic performance similar to that achieved under a constrained optimal control policy. (We hasten to add that this similarity to optimal control is not a general property of this strategy but instead reflects the specific conditions of the baseline; moreover, contrary to the results shown here, more aggressive threshold settings do not always result in better macroeconomic performance, as we will demonstrate below.) In all of these simulations, the unemployment rate is the operative threshold that determines the timing for the onset of policy firming; given the baseline outlook, the inflation threshold is not a binding constraint.

Threshold strategies and the role of policy after crossing

As noted earlier, announcement of thresholds alone would provide no direct information regarding the likely path of the federal funds rate after liftoff. Because expectations about the longer-run path of the funds rate play an important role in the monetary transmission mechanism, the effective stimulus imparted by any threshold strategy thus depends importantly upon market participants' perceptions of the likely behavior of the funds rate after a threshold condition is satisfied. So far, we have assumed that the FOMC reverts to the outcome-based rule for setting the federal funds rate once the unemployment rate falls below its threshold and/or projected inflation rises above its threshold. As was shown in Figure 1, such a strategy at present would imply little change in real activity, inflation, and interest rates relative to the baseline, in part because the September consensus forecast had the funds rate following the prescriptions of the outcome-based rule after mid-2015.

Figure 5 illustrates the potential implications of altering market expectations regarding the behavior of the funds rate after liftoff, again conditional on the underlying consensus outlook for real activity and inflation, and assuming that the FOMC sets the unemployment rate threshold at 6.5 percent and the projected inflation threshold at 2.5 percent. The black lines replicate the results previously reported in Figure 1 for the threshold strategy defined using the outcome-based rule. By contrast, the red lines report outcomes when the public understands that the FOMC will instead revert to the Taylor (1999) rule after a threshold is crossed, while the blue lines show comparable results using an inertial version of the Taylor (1999) rule.¹⁰ As the figure shows, the late-2015 jump in the federal funds rate that occurs under the non-inertial Taylor rule

¹⁰ The inertial Taylor (1999) rule is defined as: $i(t) = 0.85 i(t-1) + 0.15[r^* + 1.5 \pi(t) - 0.5 \pi^* - gap]$, where the nominal federal funds rate target is i , the equilibrium real short-term interest rate is r^* , the inflation rate is π , the inflation target is π^* , and gap is the output gap (the percent difference between actual real GDP and its potential level). This rule is the same as one of the simple policy rules reported in Part B of the Tealbook.

modestly reduces the stimulus provided by the overall threshold strategy relative to that provided when policymakers revert to the somewhat more gradualist outcome-based rule; as a result, unemployment is slightly higher and inflation is slightly lower. The opposite holds when the public anticipates that the FOMC will tighten policy more gradually after liftoff by following the prescriptions of the inertial Taylor rule. In particular, because this more gradualist form of the threshold strategy keeps the funds rate noticeably lower for longer, it helps promote a somewhat faster recovery, accompanied by modestly higher inflation. Under the baseline economic conditions, the simulated outcomes for unemployment and inflation with the inertial Taylor rule end up being quite similar to those obtained under optimal control (green lines). Again, this result highlights the potential importance of guidance about the Committee's intentions for the stance of monetary policy after the onset of tightening.

The performance of different threshold settings in a stochastic economy

Our analysis so far has examined how threshold strategies influence real activity, inflation, and interest rates under baseline conditions and in response to a few illustrative shocks to aggregate demand and supply. We now broaden the analysis by evaluating macroeconomic performance under threshold strategies in response to a wide range of economic disturbances. To do this, we run simulations of the FRB/US model in which the model is repeatedly subjected to shocks of the sort experienced since the late 1960s. This stochastic-simulation approach allows us to construct probability distributions for future economic conditions, conditional on the particular characterization of monetary policy used in the simulations and the dynamics of the model.¹¹ By repeating this exercise using various assumptions for monetary policy (that is, the values of the thresholds and the rule to be followed after liftoff), we can explore how changes in policy could influence such things as average macroeconomic performance or the likelihood that tightening will begin by a certain date.

As might be expected, the values of the thresholds have a noticeable effect on the timing of the onset of policy firming. This point is illustrated in Figure 6A, which reports simulated probability distributions for the date of liftoff under various threshold settings, conditional on monetary policy reverting to the prescriptions of the outcome-based rule after at least one of the threshold conditions is crossed (solid black lines).¹² For comparison, the figure also reports the simulated probability distribution for the date of liftoff when policymakers eschew thresholds and instead always follow the prescriptions of the outcome-based rule (dashed black lines). As can be seen, less aggressive threshold settings, such as ones in which the unemployment

¹¹ The stochastic simulations are run by shocking various components of aggregate spending, productivity and hiring, wages and prices, asset prices, and other factors from 2012:Q4 through 2017:Q4, with the shocks in each quarter randomly drawn from the 1969-2009 set of FRB/US model equation residuals; 3800 replications of these simulations are used to construct the probability distributions, conditional on a given monetary policy. In the simulations, agents are forward-looking but do not anticipate the random shocks until they occur. Expectations of financial market participants are model-consistent and take full account of the (non-linear) implications of the zero lower bound and the threshold rules. In contrast, expectations of wage and price setters are derived from a small-scale VAR model, not the full FRB/US model. This latter assumption—which differs from the usual rational-expectations assumption used in the simulations regularly reported in Part B of the Tealbook—is made to avoid convergence problems and to ensure that the simulated standard deviations of inflation are in line with the actual variability of inflation over the past twenty years.

¹² The distributions plotted in Figures 6A-C are smoothed versions of the raw histograms from the stochastic simulation results, accomplished using a cubic spline.

threshold is set at a relatively high level and the inflation threshold is set only modestly above 2 percent, have comparatively little effect on the timing of the first increase in the federal funds rate. But as the unemployment threshold declines and the inflation threshold rises, the probability mass shifts to the right, substantially decreasing the odds that tightening will begin before 2015 and increasing the likelihood that it will occur later in the decade.¹³ As shown in Figures 6B and 6C, qualitatively similar shifts in the probability distribution (albeit less pronounced) occur when monetary policy follows the prescriptions of the Taylor (1999) rule or the inertial Taylor (1999) rule after a threshold is crossed.

Figures 6A-C also illustrate that crossing a threshold does not necessarily imply an immediate firming in policy. The red lines show the simulated distribution of the date at which one or both thresholds is crossed, conditional on the particular combination of thresholds and post-crossing policy rule. Relative to the distributions of the liftoff date, the crossing date distributions are all shifted to the left, indicating that economic conditions at the time of crossing are often not sufficiently robust for the rule to call for an immediate rise in the federal funds rate. As can be seen in the upper left panel of all three figures, this situation is especially likely to occur if the unemployment threshold is set at a relatively high level and the inflation threshold is set only slightly above the Committee's inflation objective. In contrast, if the thresholds are set aggressively, tightening usually occurs in the quarter immediately after crossing, as indicated by the similarity of the crossing and liftoff distributions reported in the lower right panels.

Table 1 provides additional statistics about the expected date of crossing and liftoff under the various strategies, as well information about economic conditions at the time of crossing. Key findings from this analysis are:

- The choice of threshold levels has a marked influence on the average date that threshold crossing occurs, with the median date ranging from late 2013 to early 2016, depending on the aggressiveness of the threshold settings and the particular post-crossing policy rule. In contrast, the average date for the onset of tightening is less sensitive to the particular strategy in effect, with almost all combinations of thresholds and post-crossing rules yielding median liftoff dates in 2015.
- Whether the unemployment or inflation threshold is the first one to be crossed is quite sensitive to the particular combination of thresholds chosen to guide policy. For example, when the unemployment threshold is 7 percent and the inflation threshold is 2¼ percent, a threshold crossing is associated with the inflation threshold 60 percent of the time under the outcome-based rule, and 78 percent of the time under the inertial Taylor rule. But if the unemployment threshold is aggressively set at 5½ percent and the inflation threshold is raised

¹³ Under the outcome-based rule and in the absence of thresholds, the date of liftoff has a pronounced bi-modal distribution, primarily because the rule's prescriptions are sensitive to *changes* in the output gap as well as to the *level* of slack and the rate of inflation. As a result, if real GDP growth were to pick up sufficiently in the next few quarters, the rule would call for the funds rate to rise even though the unemployment rate was still elevated and inflation was still subdued. Setting a relatively low unemployment threshold for policy action tends to override this effect, however, thereby reducing the bi-modality of the liftoff distribution.

to 3 percent, then a threshold crossing is associated with crossing of the unemployment threshold between 83 and 95 percent of the time, depending on the post-crossing rule.¹⁴

- In situations where the unemployment rate is the first threshold crossed, the mean rate of actual inflation at the time of crossing increases with the aggressiveness of the setting of the unemployment threshold. But even if the unemployment threshold is set as low as 5½ percent, the mean rate of actual inflation at the time of crossing is only 2 percent. And although the upper bound of the interquartile range is about 2.7 percent, in most cases the elevated level of actual inflation is temporary, reflecting the transitory influence of movements in oil prices and other factors.
- In situations where the projected inflation rate is the first threshold crossed, the mean rate of unemployment at the time of crossing is close to 7½ percent if the threshold is set tightly at 2¼ percent. But if the projected inflation threshold is set loosely at 3 percent, the mean rate of unemployment at crossing is closer to 6 percent.

A key question is whether thresholds would improve or worsen macroeconomic performance under a range of economic conditions, not just those characterizing the baseline outlook. Table 2 sheds some light on this issue by presenting summary statistics from the stochastic simulations for inflation, unemployment, and other measures. As shown in the first few columns, thresholds have modest effects on the expected value of both inflation and unemployment over the medium term. For example, thresholds of 5.5 percent for the unemployment rate and 3 percent for projected inflation, combined with the outcome-based rule, cause the mean value of the inflation rate in 2017 to be about 2.4 percent, as compared to just under 2.2 percent without thresholds; the same strategy lowers the mean rate of unemployment in 2017 to 5 percent, as compared to 5.3 percent when policymakers always follow the prescriptions of the outcome-based rule.¹⁵ At the same time, thresholds do not appreciably affect the variability of real activity and inflation: The standard deviation of inflation is little affected by the threshold setting, while the standard deviation of the unemployment rate declines slightly. In addition, other analysis (not shown) indicates that thresholds do not markedly alter the probabilities of extreme events, such as the likelihood of experiencing very high rates of inflation or elevated rates of unemployment.

An alternative way to assess the macroeconomic effects of thresholds is to use a scoring system similar to that employed to compute the optimal policy paths reported in Book B of the Tealbook. Under this approach, policymakers' "losses" are assumed to equal the cumulative sum from late 2012 through the end of 2017 of squared deviations of headline PCE inflation from 2 percent, squared deviations of the unemployment rate from its natural rate, and squared quarterly changes in the federal funds rate.¹⁶ As shown in Table 2, mean and median losses initially tend to fall as threshold settings become more aggressive in simulations where the funds

¹⁴ In Table 1, the percentage of crossings caused by the unemployment rate and the percentage caused by projected inflation sum to more than 100 percent because both thresholds are sometimes reached simultaneously.

¹⁵ Late 2017 is chosen as the reference date for these statistics because it is the point of maximal difference between average conditions in the stochastic simulations and conditions in the baseline. Past this point, average differences decline rapidly, and by late 2020 the mean rates of inflation and unemployment in the simulations are 2 percent and 5.5 percent—the same as in the baseline.

¹⁶ Cumulating the losses through 2025 does not qualitatively alter the statistics reported in Table 2; in particular, it does not change the relative performance of different combinations of thresholds and post-crossing policy rules.

rate after crossing is set using either the outcome-based rule or the inertial Taylor rule.¹⁷ Past some point, however, increasing the aggressiveness of threshold settings causes expected losses to increase; for example, expected losses are lowest with an unemployment threshold of 6 percent and a projected inflation threshold of 2½ percent under both the outcome-based and the inertial Taylor rule after liftoff. These results suggest that overly-ambitious settings for thresholds could be counterproductive. A similar conclusion is suggested by the final column of the table, which reports the percentage of individual simulations in which the particular threshold settings led to lower losses than would have been occurred if policymakers had eschewed thresholds altogether. Past some point, increasing the aggressiveness of the threshold settings causes the share of simulations with improved macroeconomic conditions to fall below 50 percent (although even this outcome could be acceptable if the expected improvements were large and the deteriorations small).

Potential issues with using the unemployment rate as a threshold

Although the stochastic simulation analysis takes into account many sources of uncertainty about the outlook, one important aspect that is not included in that analysis is measurement uncertainty. This omission is especially significant with regard to the natural rate of unemployment, which is unobserved and estimated with a considerable degree of uncertainty. If the natural rate is underestimated, policymakers could believe that there is more economic slack than is actually the case, leading them to inadvertently keep the stance of policy easier than intended, resulting in unexpectedly high inflation. Of course, this risk arises with any monetary policy strategy that uses measures of slack to assist in guiding the setting of the federal funds rate target. However, it may be particularly pertinent in the case of a threshold strategy because the value of the natural rate would be presumably a key consideration in choosing the value of the unemployment threshold.

To illustrate the implications of underestimating the natural rate of unemployment when using a threshold strategy, simulations are analyzed in which the natural rate is higher than in the baseline and policymakers take some time to recognize this situation. In these simulations, the actual natural rate of unemployment rate, now and through the rest of the decade, is 1 percentage point higher than in the baseline. Although the public is assumed to correctly assess the size of the unemployment gap, policymakers initially believe that the margin of slack is 1 percentage point wider than it actually is, and only gradually come to appreciate that slack is less than they had estimated. As a result, the effective stance of monetary policy is for a time easier than the one that policymakers believe they have set.

The simulations are run under three different policy assumptions. In the first case, the FOMC does not use thresholds but instead always sets the federal funds rate in line with the prescriptions of the outcome-based rule. In the second case, the FOMC adopts a “moderate” threshold policy of 6.5 percent for the unemployment rate and 2.5 percent for projected inflation,

¹⁷ In contrast, thresholds provide no reduction in expected losses when combined with the Taylor (1999) rule. However, this result reflects the “losses” associated with the marked jumps in the federal funds rate that tend to occur in the simulations after crossing a threshold (as is illustrated in Figure 5). If participants anticipate that they are likely to behave more gradually than implied by this non-inertial rule, however, then the adverse scoring of thresholds under Taylor (1999) is largely irrelevant.

while in the third case the unemployment and inflation thresholds are set aggressively at 5.5 percent and 3.0 percent, respectively. As indicated in the charts shown on the left-hand side of Figure 7, even when long-run inflation expectations are perfectly anchored, either threshold policy results in higher actual inflation than a policy that simply follows the outcome-based rule. By itself, this result is not surprising because—as shown in Figure 4—threshold strategies naturally lead to somewhat higher inflation even when the natural rate is not measured with error. But other simulations (not shown) demonstrate that the inflationary effects of natural rate mismeasurement are exacerbated only modestly by thresholds if long-run inflation expectations are well-anchored.¹⁸

The panels on the right-hand side of Figure 7 illustrate the potential consequences of overestimating labor market slack when long-run inflation expectations are not firmly anchored. In these examples, the credibility of the FOMC is undermined by policymakers' persistent estimation error, and in response households, firms, and investors mark up their expectations for inflation in the long run. Moreover, the extent to which they revise their long-run inflation expectations increases with the aggressiveness of the FOMC's announced policy. As a result, inflation rises more markedly under the two threshold policies, to the point of creating a persistent inflation problem in the case of the aggressive threshold settings.

These simulations suggest that underestimating the natural rate should not pose a serious problem for a threshold strategy so long as policymakers are diligent in re-evaluating their estimates of the natural rate and monitoring that inflation expectations remain well anchored.¹⁹ But if policymakers continue to inadvertently misjudge the level of slack in the economy, and if inflation expectations are allowed to rise significantly and are difficult to move back down, then, like other monetary strategies that depend at least in part on estimates of slack in resource utilization, an unemployment threshold could lead to elevated inflation over time.²⁰

¹⁸ This effect can be seen by comparing the simulation results reported in Figures 4 and 7 for case in which the unemployment and projected inflation thresholds are 6.5 percent and 2.5 percent, respectively, to the case where these thresholds are 5.5 percent and 3.0 percent. As shown in Figure 4, when the natural rate is measured without error, the incremental inflation effect of adopting the more aggressive set of thresholds is about two tenths of a percentage point. But as shown in Figure 7, the incremental effect of setting the thresholds more aggressively is about three tenths of a percentage point when policymakers underestimate the level of the natural rate.

¹⁹ Indeed, measures of long-run inflation expectations have remained remarkably stable since the mid-1990s, although this fact does not guarantee that they will stay well anchored in the future.

²⁰ A separate but related issue is whether the unemployment rate is a good measure of overall labor market conditions. Although no economic indicator is perfect, the unemployment rate has proven to be a reliable indicator of the state of the labor market and the overall economy. Changes in the unemployment rate have been highly correlated with other broad economic indicators such as real GDP growth or the change in payroll employment. Even so, like many economic data series, month-to-month movements in the unemployment rate tend to reflect some combination of both statistical noise and economic signal. As a result, policymakers probably should be cautious about interpreting monthly data for the unemployment rate when it is close to a threshold and possibly look to take more signal from movements in the unemployment rate that are sustained over the course of a few months. (Sampling variation alone results in a 90-percent confidence interval for the one-month change in the unemployment rate of about plus or minus 0.2 percentage point.)

Potential issues with using projected inflation as a threshold

As noted earlier, defining an inflation threshold in terms of projected inflation markedly reduces the likelihood of early liftoff in response to the transitory effects of shifts in oil prices and other factors. Nevertheless, this approach does not entirely eliminate this risk; in the stochastic simulations, projected headline inflation over the next two years displays a significant degree of variation despite the assumption that the public's expectations of inflation in the long run are solidly anchored at 2 percent. This inherent variability is a key reason why policymakers might wish to be cautious about choosing too low a setting for the inflation threshold.

That this risk is real, and not just an artifact of some idiosyncratic feature of the FRB/US simulations, is illustrated in Figure 8. This figure shows the median projections reported in the Survey of Professional Forecasters (SPF) from 1990 to 2007 for CPI inflation in the coming year. As can be seen, these projections display considerable variation from quarter to quarter and over longer periods. The figure also reports the central tendency of mid-year FOMC inflation projections made over the same period (note the changing price measure); again, the projections display considerable variation over time. The upper panel of Figure 9 reveals that this variation in inflation forecasts at the one-year horizon has continued since the initiation of the SEP in late 2007. In contrast, the variation in SPF inflation forecasts at a two-year horizon has been quite low over the last five years (lower panel), although movements in both the level and width of the FOMC central tendency have been considerable.

Defining a threshold in terms of projected inflation also creates a potential risk for the FOMC's credibility if the Committee's inflation projections deviate too markedly or persistently from private sector forecasts. Until recently, such deviations appear to have been relatively rare; as shown in Figure 8, the median SPF projections generally fell inside the central tendency of the FOMC's projections from 1990 to 1999 when both were measured on a CPI basis, and the latter would probably be true for the 2000-2007 period as well if the forecasts were adjusted for measurement differences.²¹ As shown in the lower panel of Figure 9, however, since the start of the financial crisis private forecasters have been persistently predicting inflation at a two-year horizon to run at a noticeably higher level than the FOMC anticipated.

Whether such differences in inflation forecasts would be controversial is unclear. After all, private forecasters are hardly of one mind about the inflation outlook; in the latest SPF, the forecasts for PCE inflation in 2014 ranged from 1.3 percent to 2.9 percent. In any event, should the issue of the "reasonableness" of the Committee's forecast become an issue, the Committee would always have the option of providing more information on the thinking underlying its outlook.

²¹ The FOMC based its inflation forecasts on the chained PCE price index from 2000 through 2003 and on core chain-weighted PCE prices from 2004 through 2007:Q3. Over the latter period, the average wedge between actual CPI inflation and the measure used by the FOMC is 90 basis points using currently-published data; the average wedge between actual CPI inflation and the FOMC's measure is also very large over the period from 2000 to 2003, particularly when measured using real-time data.

IV. Communications Challenges Created by the Use of Quantitative Thresholds

While quantitative thresholds could help clarify the Committee's reaction function or provide additional policy stimulus, they would also present a number of communications challenges. In this section, we first discuss several of those challenges and then discuss ways they could be addressed by adjusting the statement language. We will take as our starting point the draft forward guidance provided in paragraph 5' of the version of Alternative B distributed to the Committee at the September meeting. The examples in this section use a threshold for unemployment of 6½ percent and a threshold for inflation of 2½ percent, but the Committee could of course choose different values.

In broad terms, threshold language would need to convey that the Committee will maintain the current target range for the federal funds rate at least until one of two conditions has been met:

1. There has been significant progress toward achieving maximum employment, or
2. Inflation by a specified measure exceeds, or is projected to exceed, the Committee's 2 percent objective by an unacceptable margin.

Ideally, thresholds would be cast in terms of readily verifiable and easily understandable measures. In addition, because of the material impact on current financial conditions of expectations about policy in the medium-term, it would be desirable if the language provided information about how the funds rate would be adjusted after a threshold is crossed.

One communication challenge arises because the thresholds would likely differ from the Committee's longer-run objectives and the public may not understand the distinction. A threshold for the unemployment rate would likely be above the level the Committee sees as consistent with maximum employment because monetary policy is adjusted gradually and operates with a lag. In light of the fact that unemployment currently is well above levels the Committee judges consistent with maximum employment in the longer run, the threshold for inflation would likely be above 2 percent because the Committee has opted to follow a balanced approach in achieving its dual objective.

A second challenge is that it is difficult to formulate a threshold for inflation in terms of the realized headline inflation rate because headline inflation is often buffeted by significant but transitory shocks. As noted earlier, a threshold that is high enough to avoid premature tightening of the funds rate in response to a transitory uptick in realized inflation would likely be too high to avert a persistent and unwanted rise in inflation that stemmed from forces other than transitory supply shocks. However, a threshold cast in terms of a forecast risks appearing unverifiable, and if it is based on a core or trimmed-mean inflation measure it risks appearing misaligned with the Committee's price stability objective.

A third challenge is that the threshold language describes monetary policy in terms of two variables, but the Committee draws on a wide range of indicators when setting monetary policy. Those indicators provide information on current economic conditions, the pace at which the economy is moving toward achieving the mandate, and the risks to achieving the mandate, including risks stemming from threats to financial stability. Forward guidance using thresholds

requires a tradeoff between instilling public confidence that the FOMC would keep the funds rate unusually low at least until the threshold conditions were met and the risk that the Committee could conclude that other indicators warranted an initiation of policy tightening prior to a threshold being crossed.²²

A final challenge is that, as illustrated by the simulation results in the preceding section, the impact of monetary policy on current financial conditions depends at least as much on investors' expectations for policy after the onset of policy firming as on the expected start date of firming. This challenge would be particularly acute in the event that the Committee wished to provide additional stimulus by adopting thresholds that indicated the current target range would be maintained for longer than the public currently expects. If market participants did not change their view of the Committee's medium-term preferences, they would simply expect that a more protracted period of the funds rate at the lower bound would be followed by more rapid tightening, limiting the resulting easing of current financial conditions.²³

The threshold language distributed to the Committee at its September meeting (the language in paragraph 5' of Alternative B) includes elements designed to address these challenges:

To support continued progress toward maximum employment and price stability, the Committee expects that a highly accommodative stance of monetary policy will remain appropriate for a considerable time after the economic recovery strengthens.²⁴ In particular, the Committee also decided today to keep the target range for the federal funds rate at 0 to ¼ percent and currently anticipates that this exceptionally low range for the federal funds rate will be appropriate at least as long as the unemployment rate exceeds 6½ percent, provided that inflation at a one- to two-year horizon is projected to be no more than a half percentage point above the Committee's 2 percent objective and longer-term inflation expectations continue to be well anchored. In determining the time horizon over which it maintains a highly accommodative stance of monetary policy, the Committee will also consider the pace of improvement in labor market conditions and other indicators of economic activity and prices.

The first challenge—that the thresholds would be misunderstood to be the Committee's longer-run objectives—is addressed by referring to the inflation threshold as "...a half percentage point above the Committee's 2 percent objective." An alternative would be to refer to the threshold as "close to the Committee's 2 percent objective" as in paragraph 3 of Alternative B" in the September Tealbook. The Committee may be concerned, however, that referring to inflation as "close to 2 percent" would suggest to market participants that 2 percent was a ceiling, not a

²² Because the forward guidance is cast using thresholds, not triggers, the language would not constrain the ability of the Committee to refrain from tightening policy after a threshold is crossed if it concluded that maintaining the current target range for the federal funds rate was appropriate.

²³ See "Approaches to Clarifying the Conditionality in the Committee's Forward Guidance," memo to the Committee by Brian Doyle, Spence Hilton, Michael Kiley, Andrew Levin, David Lopez-Salido, Steve Meyer, Ed Nelson, Matt Raskin, David Reifschneider, and Robert Tetlow (September 12, 2011).

²⁴ We have replaced "exceptionally low levels of the federal funds rate" with "a highly accommodative stance of monetary policy" to align more closely with the statement that was released at the conclusion of the meeting.

longer-run objective.²⁵ Balancing these concerns, the statement could maintain an explicit percentage point margin but emphasize that the Committee will conduct policy so as to bring inflation back to 2 percent over time, taking into account both elements of the dual mandate in a balanced way.

The draft statement expresses the inflation threshold as an escape clause on the unemployment threshold: "...the Committee... currently anticipates that this exceptionally low range for the federal funds rate will be appropriate at least as long as the unemployment rate exceeds 6½ percent, provided that inflation at a one- to two-year horizon is projected to be no more than a half percentage point above the Committee's 2 percent objective." This formulation expresses the inflation condition as a threshold—the Committee would not be committing to raise the funds rate if projected inflation rose above 2½ percent; it might not do so, for example, if the unemployment rate were very high—but could mistakenly be interpreted as a trigger, that is, a commitment to raise the funds rate if the condition were met. To avoid this possible source of confusion, the Committee could, instead, express the unemployment and inflation thresholds in a symmetrical manner, for example "the Committee currently anticipates maintaining this target range at least as long as the unemployment rate is above 6½ percent and inflation at a one- to two-year horizon is projected to be below 2½ percent." A possible shortcoming of the alternative version, however, is that it could be misinterpreted as indicating that the Committee was setting out to increase inflation.

The risk that the 6½ percent unemployment threshold would be misunderstood to be the Committee's target for maximum employment is addressed by the indication that the target range would remain appropriate "at least as long as" the unemployment rate exceeds the threshold, suggesting that an unemployment rate below 6½ percent would be welcome. The Committee has not reached consensus on a specific level of unemployment that it sees as consistent with maximum employment, but there are a couple of wording adjustments that could help reduce the risk that the public would conclude that the unemployment threshold was a target. For one, the guidance could reiterate the range of estimates for longer-run normal rates of unemployment from the SEP, as in the Committee's statement of its longer-run goals and policy strategy.²⁶ For another, the guidance could indicate that the low target range for the federal funds rate would be appropriate at least until the unemployment rate has fallen *below* the threshold, as in the note President Kocherlakota circulated to the Committee before the September meeting (rather than "at least as long as the unemployment rate *exceeds*" the threshold).²⁷ Specifically, the threshold could be "at least until the unemployment rate falls below 6½ percent."

The second challenge—the communication problems raised by the volatility of the headline inflation rate—is addressed in the September draft of the threshold language by casting the

²⁵ If the Committee sought to provide additional accommodation by pushing expectations for medium-term inflation above the 2 percent longer-term objective while using forward guidance and asset purchases to hold down medium- and longer-term nominal interest rates (and hence reducing real interest rates), the "close to" language would seem especially inappropriate.

²⁶ The Committee's statement of its longer-run goals and policy strategy, which was released on January 25, 2012, is available at <http://www.federalreserve.gov/newsevents/press/monetary/20120125c.htm>

²⁷ "President Kocherlakota's Memo on Alternative Policy Statements," memo to the Federal Open Market Committee (September 12, 2012).

inflation threshold in terms of the projection for inflation at a one- to two-year horizon.²⁸ Projected inflation is much less influenced by transitory movements in the volatile components of the price index than realized inflation. The draft forward guidance is not specific, but the implication is that the forecast used to evaluate the threshold is the Committee's forecast. (The threshold could be evaluated using results from the SEP, for instance.²⁹) Outside observers may be skeptical, however, that the Committee would be willing to report an inflation projection above 2½ percent if it wished to maintain the current target range for the federal funds rate. Alternatively, the Committee could base the threshold on the forecast of an outside and independent source, such as the Blue Chip consensus forecasts or the Survey of Professional Forecasters, accepting the risk that the outside forecast could differ materially from the Committee's. In particular, if the Committee chose not to be guided by the outside forecast, it would have to explain that decision carefully to the public.³⁰

Another alternative would be to express the threshold in terms of realized 12-month core inflation, which is not only readily verifiable by outside observers and less volatile than headline inflation, but also a reasonably good predictor of headline inflation.³¹ The use of core inflation could, however, be viewed as a deviation from the Committee's mandate for total inflation, so the Committee may prefer to use 12-month headline inflation but to note explicitly—albeit at the cost of making the threshold less verifiable and concrete—that a transitory increase in inflation arising from movements in a volatile component of the index would not necessarily by itself trigger a tightening of policy. One risk with such an approach would be that the 12-month headline inflation measure would be temporarily depressed by a decline in the price of a volatile component during a period when underlying inflation was high enough to warrant a tightening of policy.

Turning to the third challenge—that the Committee looks at a wide range of indicators when setting monetary policy—the draft language recognizes the role of additional information in several ways. First, in addition to specifying an inflation threshold, the language notes that policy could be tightened if longer-term inflation expectations were to become unanchored. The stability of long-run inflation expectations is generally viewed as critical to the Committee's ability to achieve both components of its dual mandate, and for this reason a marked and sustained move in a range of expectational indicators would likely warrant a vigorous policy response, including the possible abandonment of any announced thresholds. Second, the forward guidance states that the Committee “currently anticipates” that the low target range will be maintained at least until a threshold is crossed. By implication, the Committee could change its view in the future, presumably based on incoming information. Third, the final sentence indicates that the Committee “will also consider other indicators of economic activity and prices”

²⁸ The requirement that longer-term inflation expectations remain well anchored is addressed below.

²⁹ In “A Review of the Consensus Forecast Initiative,” Laubach et al., sent to the Committee on October [12], 2012, the staff note that it might be beneficial to report the median forecast of FOMC participants or the median forecast of non-dissenting members in the SEP. Those median forecasts could be helpful in where projected inflation stands in relation to the value of the inflation threshold given in the statement.

³⁰ Indeed, the median forecasts for headline PCE inflation in the latest Survey of Professional Forecasters were 2.0 percent in 2013 and 2.2 percent in 2014, notably higher than the corresponding medians of participants' forecasts reported in the September SEP.

³¹ For an analysis of the predictive power of core or trimmed inflation measures for top-line inflation see the weekly nonfinancial Board briefing by Alan Detmeister, September 24, 2012.

when determining the appropriate length of time to maintain an accommodative stance for policy. As worded, the final sentence could be interpreted not only as providing reasons why policy might not be tightened after a threshold was crossed, but also as an escape clause that would allow for an earlier firming in the event that other factors made tightening appropriate before either threshold is reached. These factors could include, for example, evidence of a lower level of potential output and a higher level of the natural rate of unemployment than had been thought. Alternatively, policymakers might become concerned that the sustained period of low interest rates was fueling financial imbalances that could not be appropriately addressed with regulatory and supervisory tools. To cover that possibility, it might be appropriate to change the end of the sentence from “economic activity and prices” to “economic and financial conditions.” Such an escape clause would seem most appropriate if the Committee primarily views the threshold language as a means of providing greater clarity about some of the key factors likely to determine its policy response to changing economic conditions than if it intended the thresholds to represent more of a commitment.

Alternatively, the Committee may view the threshold language as primarily a means to promote more rapid recovery by providing a commitment that brings about stimulative changes in private expectations. If so, the Committee may wish instead to stress that it intends to maintain the current target range for the federal funds rate as long as the unemployment and inflation thresholds are not crossed, and that even then the Committee may choose to keep the funds rate very low for some time afterwards based on readings on a range of indicators. For example, after stating that the target range would be maintained at least until a threshold was crossed, the statement could state that “the Committee may determine that the current target range for the federal funds rate is appropriate for even longer based on the pace of improvement in labor market conditions and other indicators of economic activity and prices.” Even with this change, the use of “currently anticipates” could leave the Committee room to tighten policy before a threshold was crossed if it determined that doing so was appropriate.

The threshold language in paragraph 5’ of September’s Alternative B does not address the final communications challenge—it provides no guidance on the likely course of the funds rate once firming has commenced. Although the first sentence states that “a highly accommodative stance of monetary policy will remain appropriate for a considerable time after the economic recovery strengthens,” this phrase is followed by “in particular” and then the threshold language, indicating that the statement is about policy until, not after, the first increase in the federal funds rate. If the Committee wished to provide additional guidance about the funds rate after the onset of firming, it could conclude the paragraph with a sentence indicating that, when it became appropriate to begin to remove policy accommodation, the Committee would “take a balanced approach consistent with maintaining satisfactory progress toward maximum employment in a context of price stability.”³²

After applying some of the options for addressing the communications challenges discussed above to paragraph 5’, the forward guidance could be expressed as follows:

³² Alternatively, the Committee could chose language similar to that included in the memo from September 16, 2011, perhaps along the lines of: “Once it begins the process of normalizing the stance of monetary policy, the Committee expects to proceed at a gradual pace in order to promote continued economic expansion, inflation near mandate-consistent levels over the medium-term, and well-anchored longer-run inflation expectations.”

To support continued progress toward maximum employment and price stability, the Committee expects that a highly accommodative stance of monetary policy will remain appropriate for a considerable time after the economic recovery strengthens. In particular, the Committee also decided today to keep the target range for the federal funds rate at 0 to ¼ percent and currently anticipates that this exceptionally low range for the federal funds rate will be appropriate at least ~~as long as~~ **until** the unemployment rate ~~exceeds~~ **falls below** 6½ percent, provided that inflation at a one- to two-year horizon is projected to be no more than a half percentage point above the Committee's 2 percent objective and longer-term inflation expectations continue to be well anchored. [In determining the time horizon over which it maintains a highly accommodative stance of monetary policy, the Committee will also consider the pace of improvement in labor market conditions, and other indicators of economic **and financial conditions** activity ~~and prices~~.] **The Committee may determine that the current target range for the federal funds rate is appropriate for even longer based on** the pace of improvement in labor market conditions and other indicators of economic activity and prices.] **When the Committee decides to begin to remove policy accommodation, it will take a balanced approach consistent with maintaining continued satisfactory progress toward maximum employment in a context of price stability.**

Alternatively, the Committee may prefer to express the inflation criteria in terms of realized inflation. If so, the guidance could be expressed as follows:

To support continued progress toward maximum employment and price stability, the Committee expects that a highly accommodative stance of monetary policy will remain appropriate for a considerable time after the economic recovery strengthens. In particular, the Committee also decided today to keep the target range for the federal funds rate at 0 to ¼ percent and currently anticipates that this exceptionally low range for the federal funds rate will be appropriate at least ~~as long as~~ **until** the unemployment rate ~~exceeds~~ **falls below** 6½ percent, provided that **the 12-month growth rate of the price index for personal consumption expenditures is** inflation at a one- to two-year horizon ~~is projected to be~~ no more than a half percentage point above the Committee's 2 percent objective and longer-term inflation expectations continue to be well anchored. **A transitory increase in inflation owing to fluctuations in the prices of energy or other volatile components of the price index would not necessarily by itself warrant an increase in the target range.** [In determining the time horizon over which it maintains a highly accommodative stance of monetary policy, the Committee will also consider the pace of improvement in labor market conditions, and other indicators of economic **and financial conditions** activity ~~and prices~~.] **The Committee may determine that the current target range for the federal funds rate is appropriate for even longer based on** the pace of improvement in labor market conditions and other indicators of economic activity and prices.] **When the Committee decides to begin to remove policy accommodation, it will take a balanced approach consistent with maintaining continued satisfactory progress toward maximum employment in a context of price stability.**

Table 1. Influence of Threshold Settings and the Post-Liftoff Policy Rule On the Expected Timing of Threshold Crossing and Related Factors, Derived from Stochastic Simulations of the FRB/US Model

	Median Date of:		Percentage of Crossings Caused By Reaching the: ¹		Actual Inflation Rate When the Unemployment Threshold is Crossed		Unemployment Rate When the Projected Inflation Threshold is Crossed		
	Crossing	Liftoff	Unemployment Threshold	Projected Inflation Threshold	Mean	Interquartile Range	Mean	Interquartile Range	
Outcome-based Rule									
$\pi = 2.25, U = 7.0$	2014Q2	2015Q1	52.0	60.0	1.64	(0.93, 2.32)	7.49	(7.11, 7.89)	
$\pi = 2.25, U = 6.5$	2014Q2	2015Q1	34.4	74.7	1.61	(0.93, 2.25)	7.34	(6.88, 7.84)	
$\pi = 2.50, U = 6.5$	2015Q1	2015Q2	71.4	37.5	1.74	(1.05, 2.40)	7.02	(6.53, 7.50)	
$\pi = 2.50, U = 6.0$	2015Q1	2015Q2	53.6	55.6	1.79	(1.16, 2.42)	6.81	(6.23, 7.37)	
$\pi = 2.75, U = 6.0$	2015Q2	2015Q3	84.0	21.6	1.90	(1.24, 2.53)	6.51	(5.99, 7.00)	
$\pi = 3.00, U = 5.5$	2015Q4	2015Q4	90.5	12.0	2.04	(1.38, 2.70)	6.18	(5.61, 6.62)	
Taylor (1999) Rule									
$\pi = 2.25, U = 7.0$	2014Q2	2015Q3	55.1	55.1	1.59	(0.90, 2.27)	7.52	(7.14, 7.89)	
$\pi = 2.25, U = 6.5$	2014Q3	2015Q3	41.9	66.8	1.59	(0.92, 2.21)	7.34	(6.88, 7.83)	
$\pi = 2.50, U = 6.5$	2015Q1	2015Q3	77.4	29.3	1.73	(1.04, 2.37)	7.06	(6.54, 7.55)	
$\pi = 2.50, U = 6.0$	2015Q2	2015Q3	65.0	41.8	1.76	(1.14, 2.40)	6.83	(6.23, 7.43)	
$\pi = 2.75, U = 6.0$	2015Q3	2015Q4	90.3	13.1	1.87	(1.23, 2.52)	6.51	(5.98, 7.00)	
$\pi = 3.00, U = 5.5$	2016Q1	2016Q1	95.3	6.0	2.02	(1.37, 2.64)	6.17	(5.55, 6.59)	
Inertial Taylor Rule									
$\pi = 2.25, U = 7.0$	2013Q4	2015Q2	36.3	78.0	1.65	(0.95, 2.31)	7.53	(7.15, 7.92)	
$\pi = 2.25, U = 6.5$	2014Q1	2015Q2	20.0	88.3	1.63	(0.91, 2.24)	7.41	(6.97, 7.87)	
$\pi = 2.50, U = 6.5$	2014Q3	2015Q2	53.6	59.5	1.76	(1.06, 2.42)	7.02	(6.57, 7.48)	
$\pi = 2.50, U = 6.0$	2014Q3	2015Q3	36.3	74.2	1.81	(1.14, 2.41)	6.84	(6.28, 7.39)	
$\pi = 2.75, U = 6.0$	2015Q1	2015Q3	71.5	39.2	1.90	(1.23, 2.55)	6.49	(5.96, 6.99)	
$\pi = 3.00, U = 5.5$	2015Q3	2015Q4	83.2	24.0	2.04	(1.39, 2.69)	5.96	(5.42, 6.42)	

1. Percentage of crossings caused by each threshold sums to more than 100 percent because both thresholds are sometimes crossed simultaneously.

Table 2. Macroeconomic Performance Under Different Threshold Settings and Post-Crossing Policy Rules, Based on Stochastic Simulations of the FRB/US Model

	Actual PCE Inflation ¹		Unemployment Rate ¹		Policymaker Loss ²		Welfare Improvement Share ³
	Mean	Standard Deviation	Mean	Standard Deviation	Mean	Median	
Outcome-based Rule							
No thresholds	2.16	1.07	5.28	1.10	103.78	93.58	NA
$\pi = 2.25$, $U = 7.0$	2.18	1.07	5.26	1.09	103.21	93.52	66.76
$\pi = 2.25$, $U = 6.5$	2.20	1.07	5.26	1.09	102.09	92.69	72.33
$\pi = 2.50$, $U = 6.5$	2.21	1.07	5.21	1.07	102.14	92.79	61.61
$\pi = 2.50$, $U = 6.0$	2.26	1.06	5.14	1.05	100.47	91.21	62.58
$\pi = 2.75$, $U = 6.0$	2.28	1.06	5.11	1.04	101.04	91.89	55.70
$\pi = 3.00$, $U = 5.5$	2.39	1.06	4.96	1.01	103.89	93.09	49.03
Taylor (1999) Rule							
No thresholds	2.13	1.06	5.28	1.07	107.95	97.89	NA
$\pi = 2.25$, $U = 7.0$	2.13	1.06	5.28	1.07	108.03	97.89	66.88
$\pi = 2.25$, $U = 6.5$	2.14	1.06	5.26	1.06	107.71	97.79	69.61
$\pi = 2.50$, $U = 6.5$	2.15	1.06	5.26	1.06	108.32	98.67	55.00
$\pi = 2.50$, $U = 6.0$	2.18	1.06	5.22	1.05	108.11	98.65	51.97
$\pi = 2.75$, $U = 6.0$	2.19	1.06	5.20	1.03	109.57	100.71	39.58
$\pi = 3.00$, $U = 5.5$	2.27	1.06	5.08	0.99	113.16	104.87	31.77
Inertial Taylor Rule							
No thresholds	2.43	1.10	4.93	1.11	99.95	91.42	NA
$\pi = 2.25$, $U = 7.0$	2.43	1.10	4.93	1.11	99.92	91.44	54.02
$\pi = 2.25$, $U = 6.5$	2.43	1.10	4.93	1.11	99.76	91.18	64.49
$\pi = 2.50$, $U = 6.5$	2.44	1.10	4.92	1.11	99.69	91.17	55.97
$\pi = 2.50$, $U = 6.0$	2.46	1.09	4.90	1.10	99.08	90.77	58.21
$\pi = 2.75$, $U = 6.0$	2.47	1.09	4.87	1.08	99.33	91.07	47.19
$\pi = 3.00$, $U = 5.5$	2.54	1.09	4.78	1.08	99.80	91.88	39.81

1. Means and standard deviations based on simulated values for four-quarter PCE inflation and the unemployment rate in 2017Q4, the date at which the mean differences of inflation from 2 percent and the unemployment rate from its natural rate are the greatest.
2. Policymaker loss equals the cumulative sum from 2012Q4 to 2017Q4 of squared deviations of the unemployment rate from its natural rate, squared deviations of total PCE inflation from 2 percent, and squared quarterly changes in the federal funds rate, all discounted at a 4 percent annual rate.
3. Proportion of simulations in which policymaker loss is less than what would occur if policy eschewed thresholds and always followed the operative policy rule.

Figure 1: Implications of a Threshold Strategy for the Baseline Outlook
 (outcome-based rule combined with unemployment threshold = 6.5% and projected inflation threshold = 2.5%)

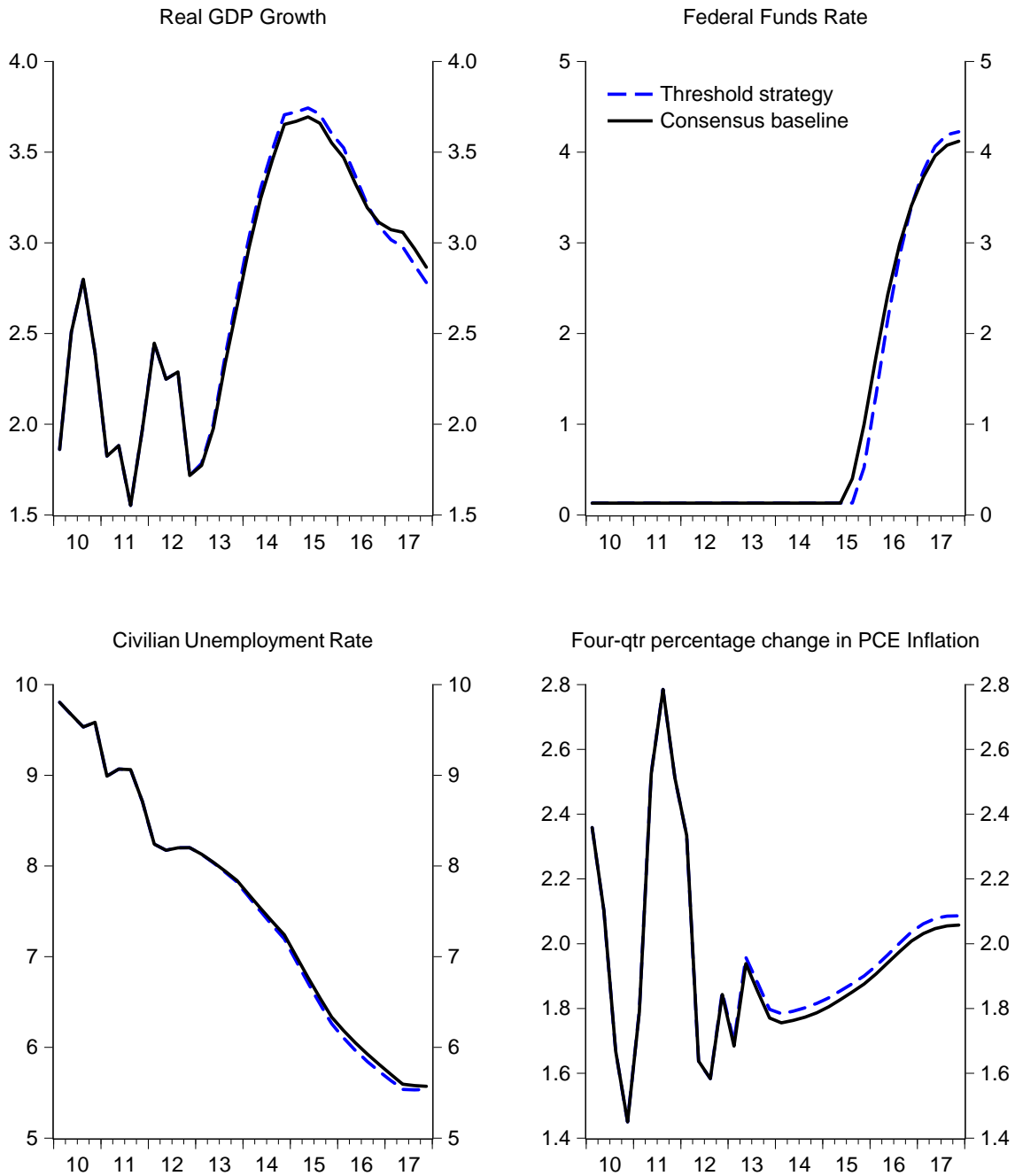


Figure 2: Performance of a Threshold Strategy in the Face of Unanticipated Shocks to Aggregate Demand (outcome-based rule combined with unemployment threshold = 6.5% and projected inflation threshold = 2.5%)

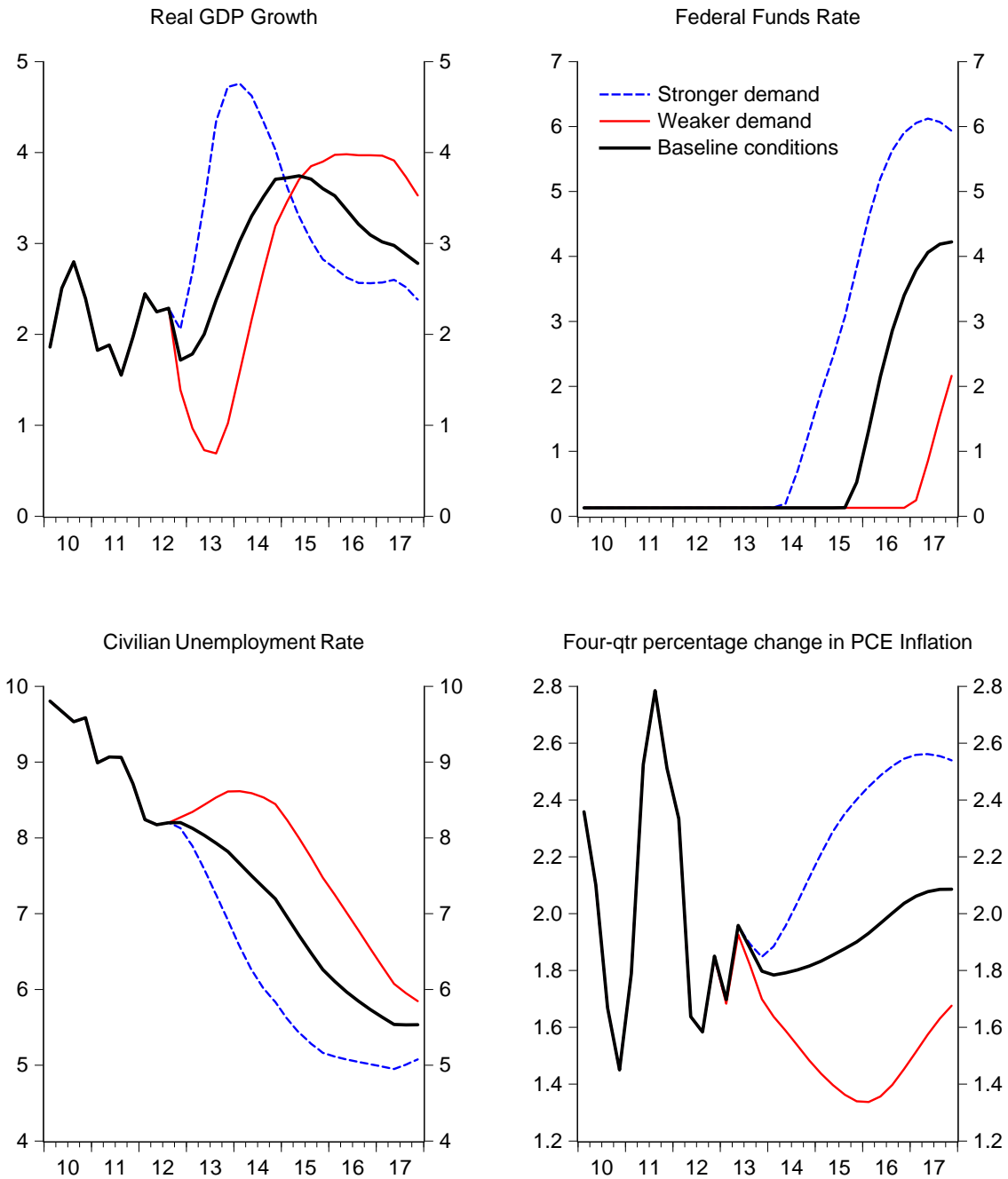


Figure 3: Performance of a Threshold Strategy in the Face of Unanticipated Shocks to Aggregate Supply (outcome-based rule combined with unemployment threshold = 6.5% and projected inflation threshold = 2.5%)

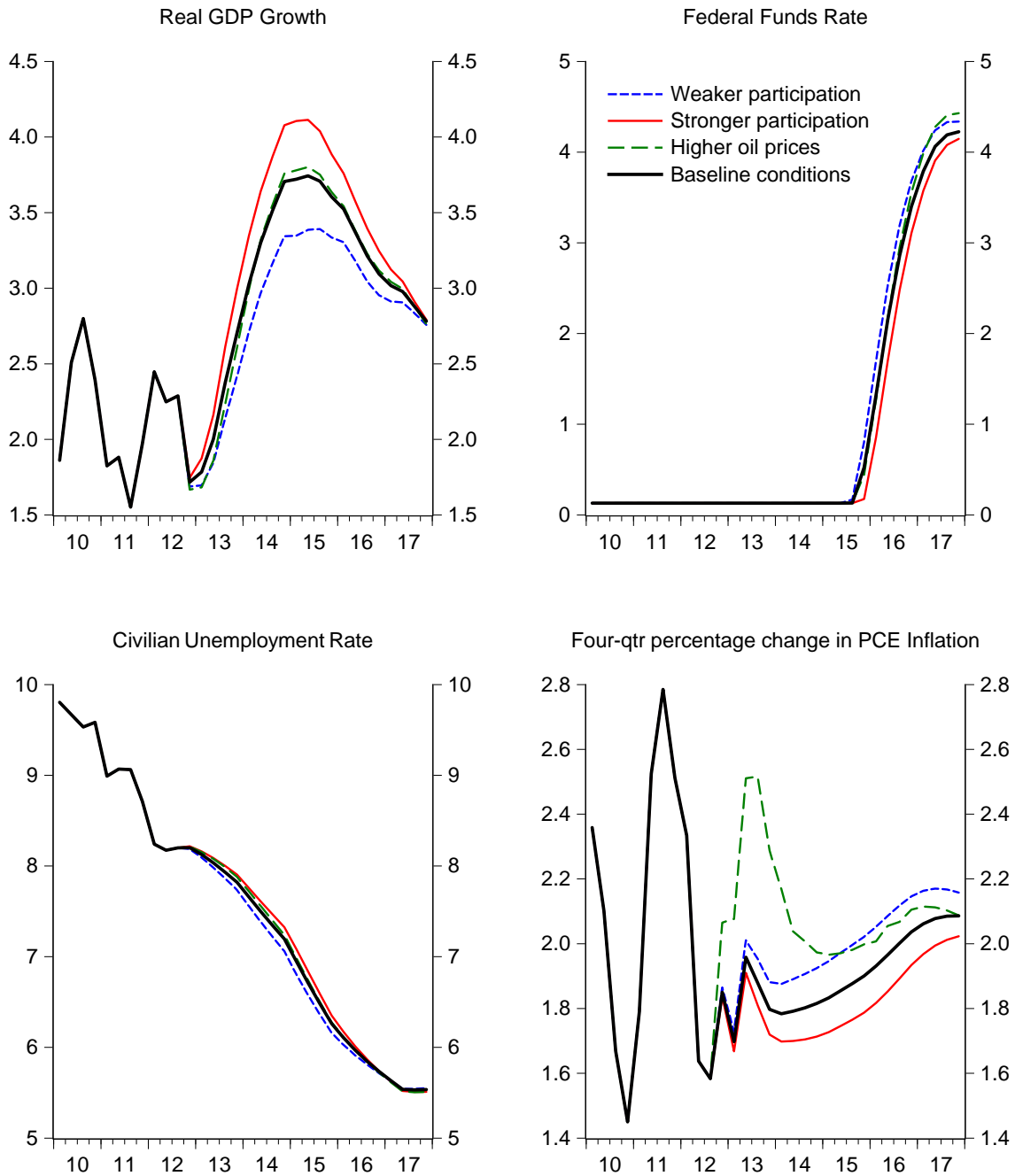


Figure 4: Implications of Alternative Threshold Settings
Outcome-based rule

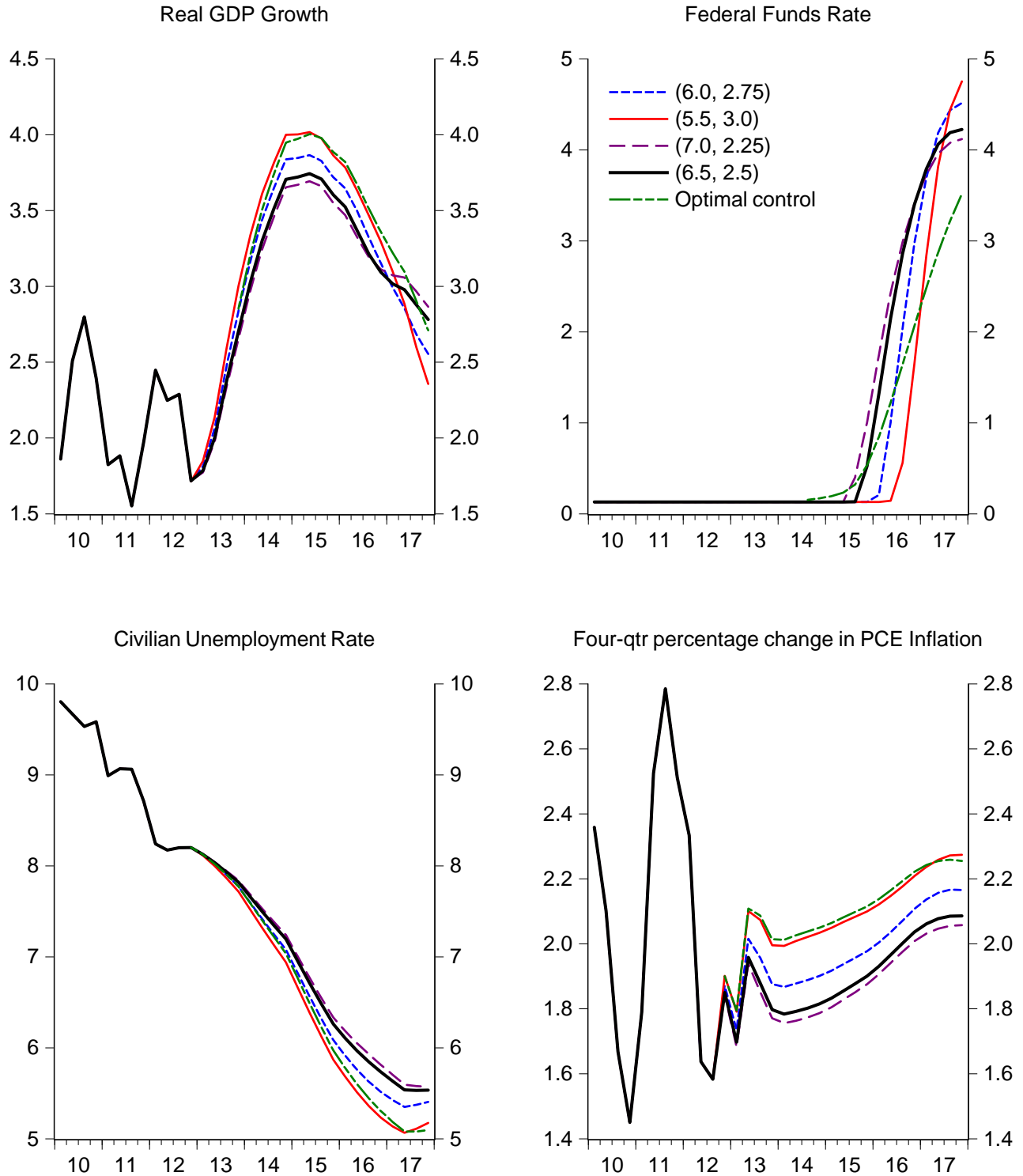


Figure 5: Implications of Combining Thresholds with Different Rules for Setting Policy After Crossing (unemployment threshold = 6.5% and projected inflation threshold = 2.5%)

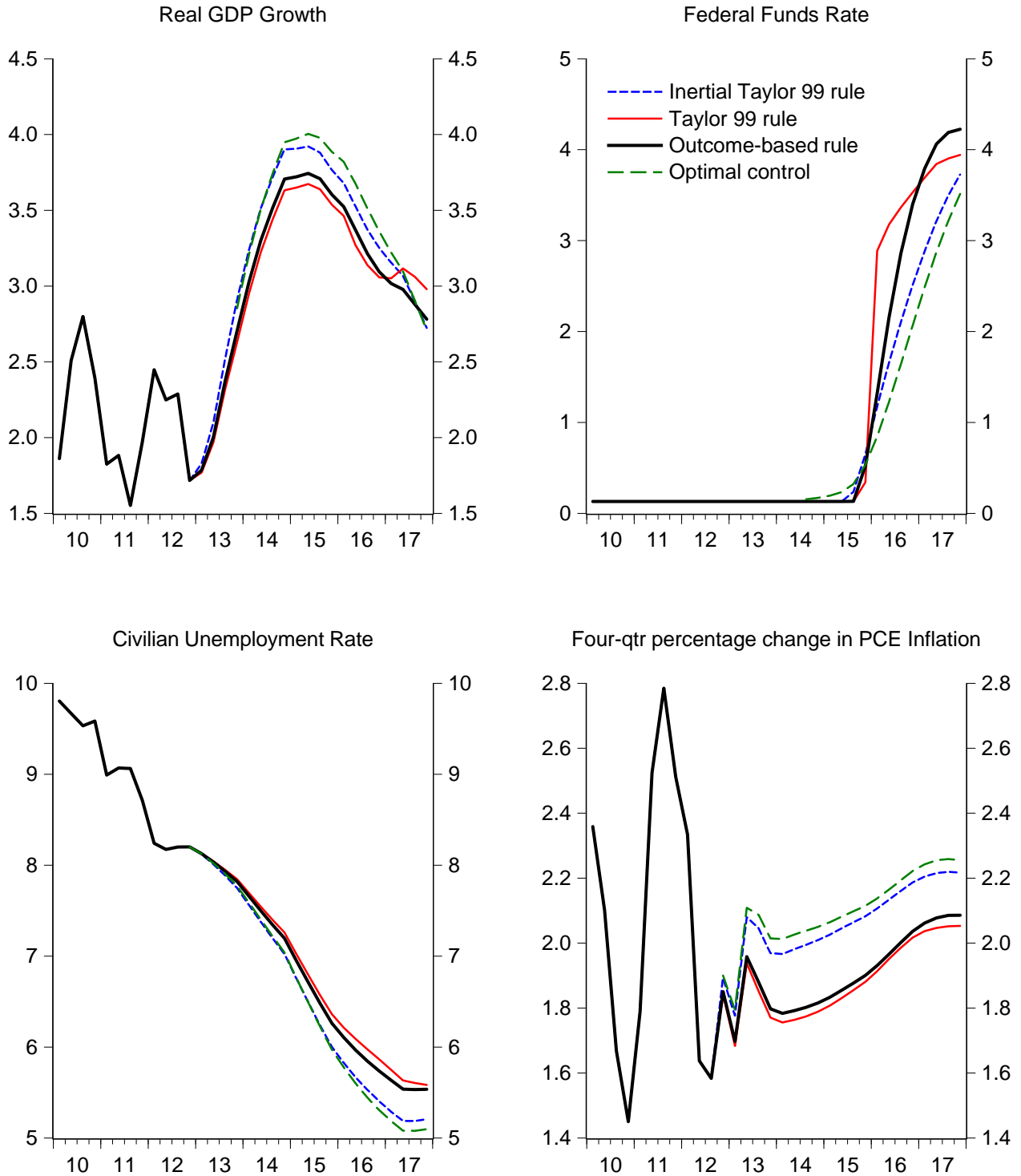


Figure 6A

Simulated Probability Distribution for the Date at which Tightening Begins Under Different Threshold Settings, With Policy Based on the Outcome-Based Rule After Crossing

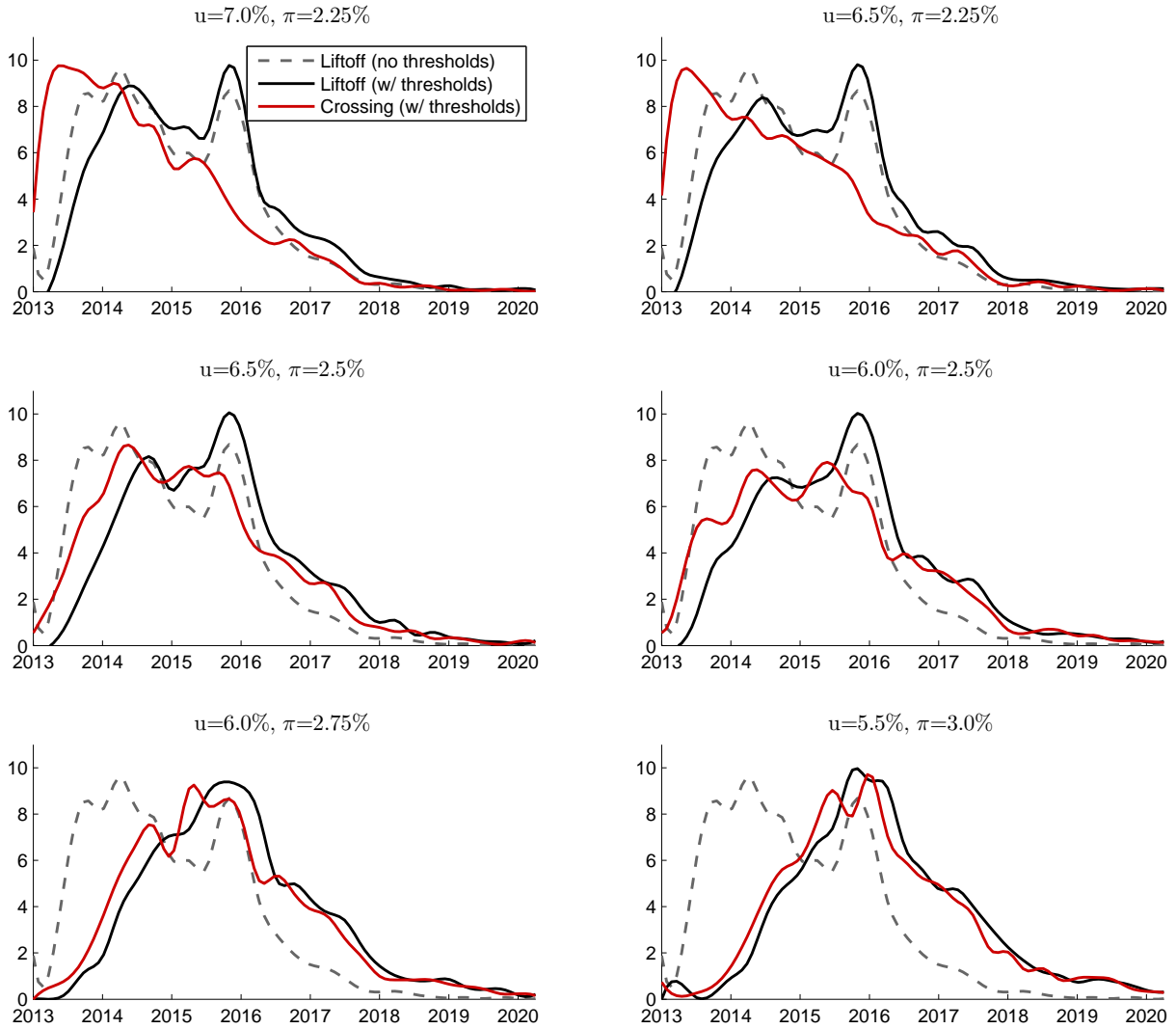


Figure 6B

Simulated Probability Distribution for the Date at which Tightening Begins Under Different Threshold Settings, With Policy Based on the Taylor (1999) Rule After Crossing

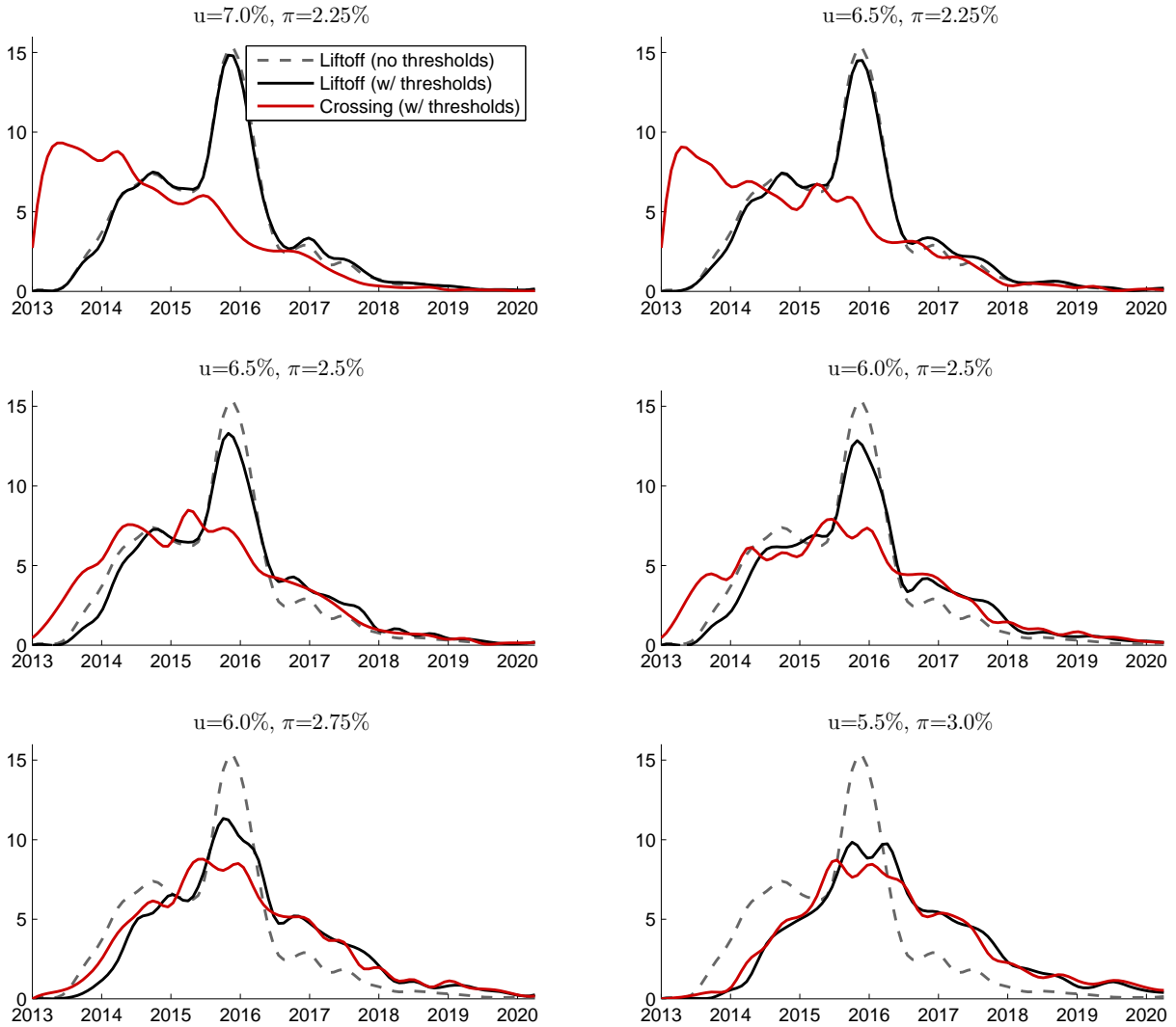


Figure 6C

Simulated Probability Distribution for the Date at which Tightening Begins Under Different Threshold Settings, With Policy Based on the Inertial Taylor Rule After Crossing

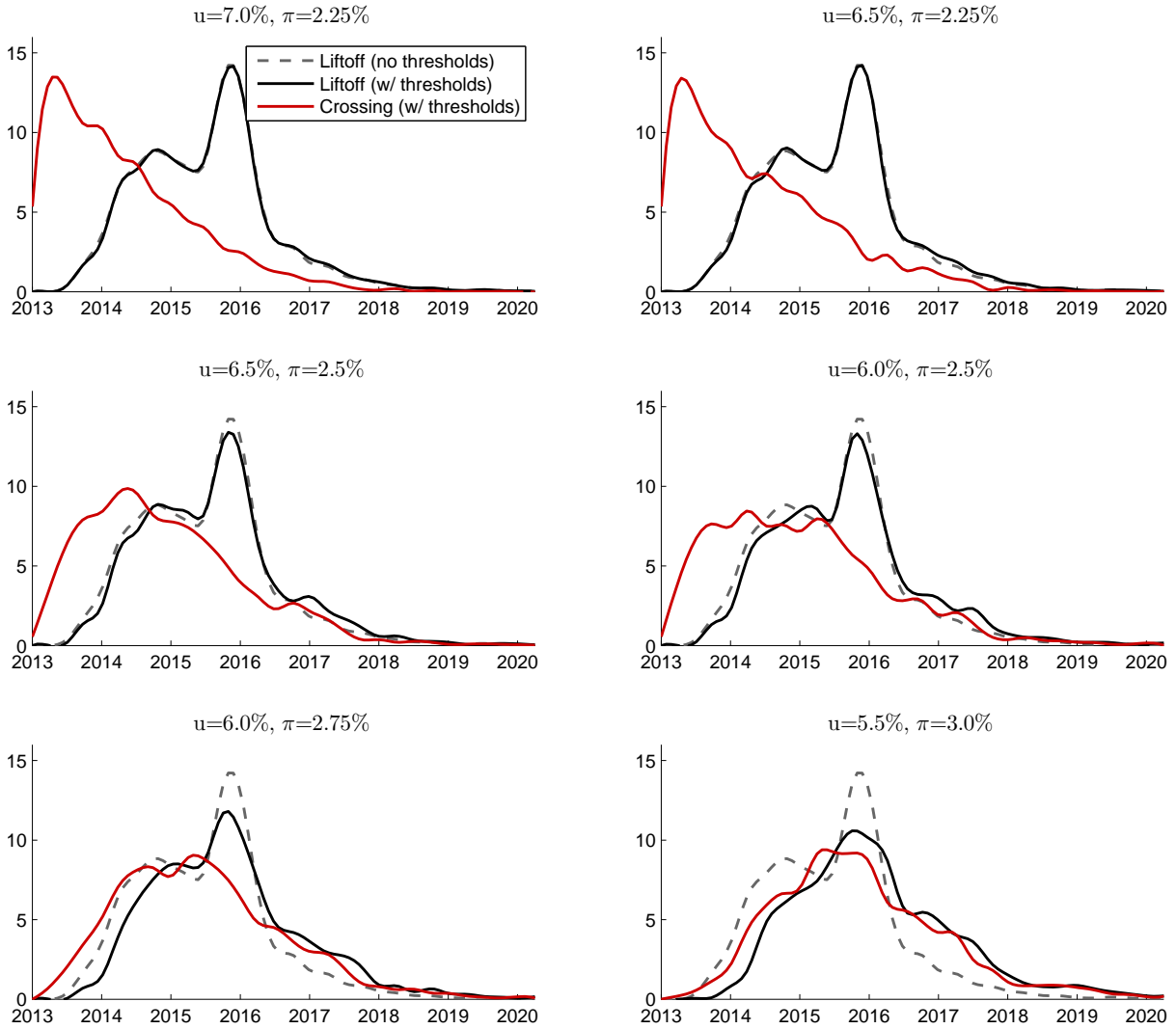


Figure 7: Macroeconomic Effect of Adopting Thresholds When the Natural Rate is Mismeasured (outcome-based rule)

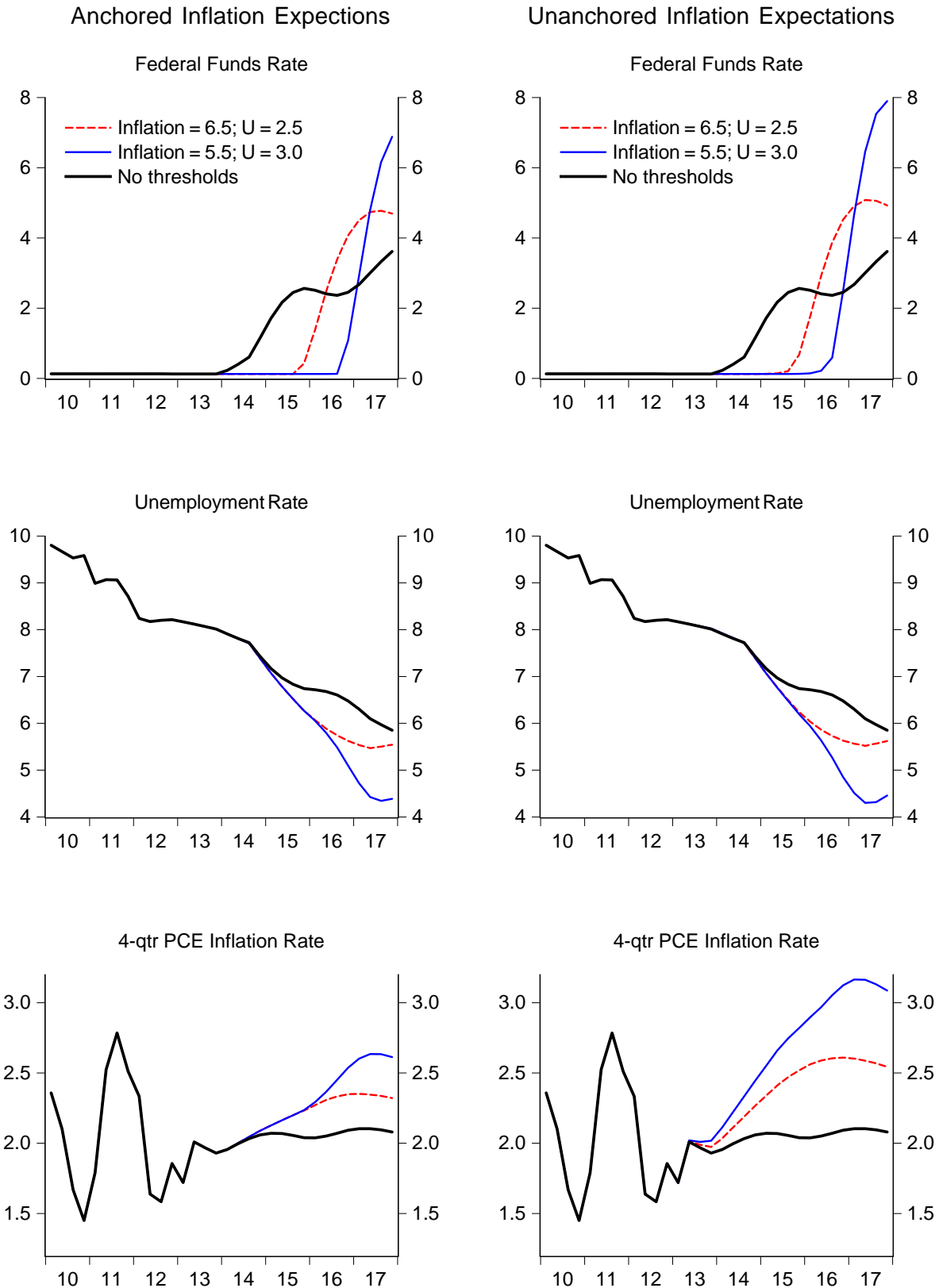


Figure 8 Pre-SEP FOMC and SPF Forecasts of One-Year-Ahead Inflation

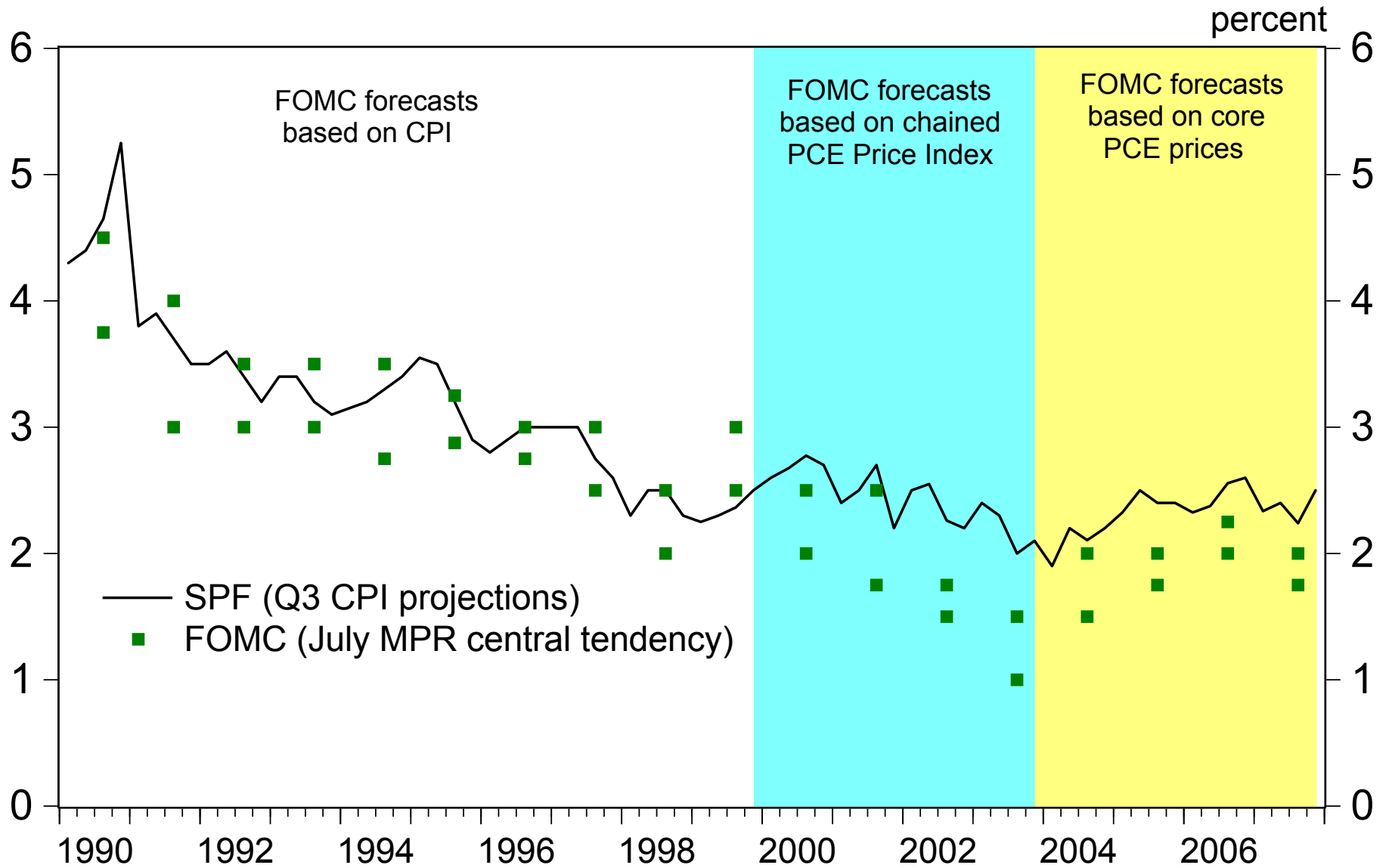
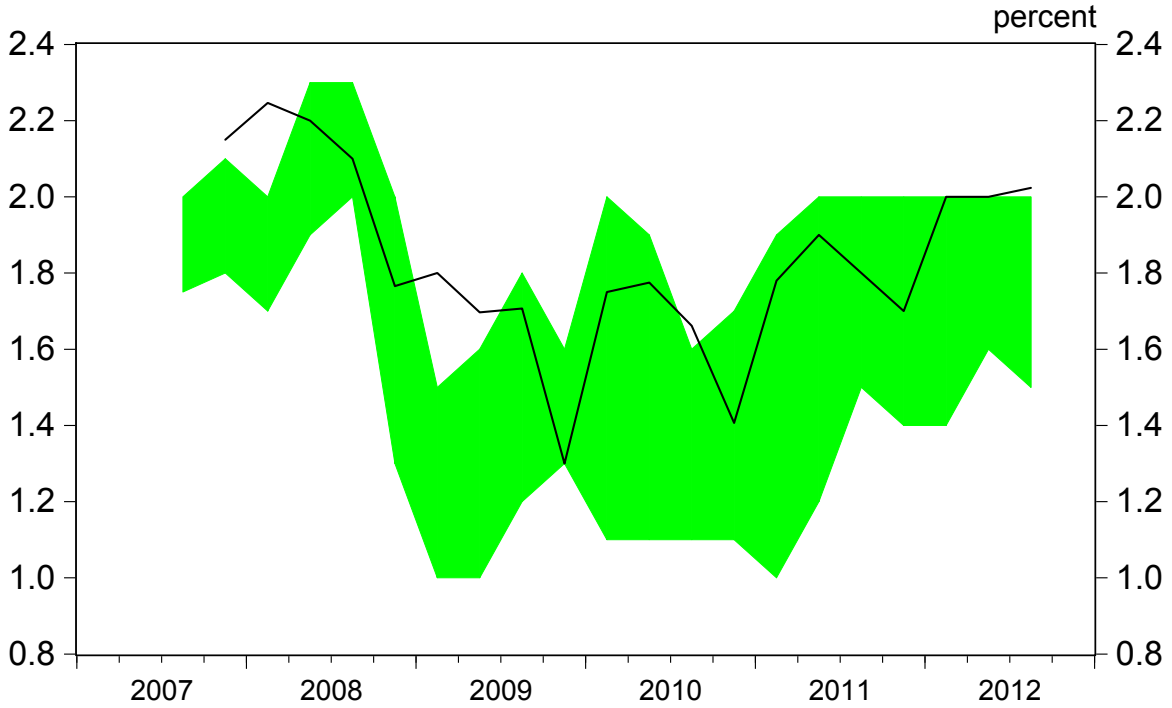


Figure 9 SEP and SPF Projections of Total PCE Inflation

— SPF ■ SEP central tendency

Projected Inflation in the Following Year



Projected Inflation Two Years Ahead

