March 2, 2012

Interpreting Interest Rate Policy Rule Prescriptions in the Presence of LSAPs

Edward Nelson of the Division of Monetary Affairs and John Roberts of the Division of Research and Statistics[1]

Summary

1. Both LSAPs and the federal funds rate are important monetary policy instruments, and hence their joint settings (as well as the public's expectations for future settings) are required to evaluate the overall stance of monetary policy.

2. While one approach emphasized in staff analyses and the research literature is to evaluate policy by comparing its implications with those of optimal control strategies for achieving the Committee's inflation and employment goals, monetary policy analysis also often compares the actual federal funds rate to the prescriptions of simple policy rules.

3. In current circumstances, an important technical challenge is how to preserve the simplicity of rule prescriptions in an environment of multiple policy tools. Conceptually, it may be appealing to attempt to consolidate the effects of LSAPs and the federal funds rate into a single measure of policy stance.

4. In practice, adjusting simple policy rule prescriptions for the effects of LSAPs requires a model of the effects of LSAPs on financial conditions, as well as a model of the effects of financial conditions on economic activity and inflation. Consequently, the adjustments involve a degree of model dependence that could be seen as departing from the spirit of simple policy rules. These practical difficulties also suggest that, at a minimum, prescriptions from adjusted policy rules need to be taken with considerable caution.

1. Background Discussion

In Tealbook B, the staff regularly reports prescriptions from a variety of monetary policy rules, including Taylor's original 1993 rule and a later version he examined in 1999.[2] The value of such rules as benchmarks to help inform policy decisions comes partly from their simplicity. For example, both versions of the Taylor rule imply that the federal funds rate responds to only two variables (the output gap and four-quarter inflation), with the versions differing only in their responsiveness to slack. This simplicity makes it easy to understand how the rule prescriptions

[1] The authors thank James Clouse, Eric Engen, William English, Christopher Erceg, Jon Faust, Michael Kiley, Thomas Laubach, David López-Salido, Stephen Meyer, William Nelson, David Reifschneider, Dan Sichel, and David Wilcox for helpful comments.

[2] These rules appeared in John B. Taylor, "Discretion versus Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 39(1), 1993, pp. 195–214, and John B. Taylor, "A Historical Analysis of Monetary Policy Rules," in J.B. Taylor (ed.), *Monetary Policy Rules*, University of Chicago Press, 1999, pp. 319–341.

respond to changes in economic conditions. In contrast, policies derived from optimal control simulations are much less transparent because they depend in a complicated manner on a large number of factors, including the baseline forecast for the economy, a specific model of the dynamics of the economy, and a loss function intended to approximate the preferences of the FOMC. Although this greater complexity means that optimal control policies take into account more potentially relevant factors than do simple rules, it comes at the cost of making the resulting policy prescriptions less transparent and more vulnerable to specification errors. Consequently, the research literature suggests that simple rules may be more robust.

Accordingly, policymakers have frequently looked to the prescriptions of simple rules as useful benchmarks when setting the federal funds rate.[3] However, recent developments—including decisions to cut the funds rate to its effective lower bound and to use nontraditional policy tools—have complicated the interpretation of simple rule prescriptions. With the federal funds rate target at its effective lower bound, additional stimulus cannot be provided by reducing the target for the funds rate—the usual focus of simple rule prescriptions. Partly as a result, the FOMC now provides considerable forward guidance about the likely future path of the funds rate. While simple rules can help inform such forward guidance, they can do so only if combined with information on the outlook well into the future—something about which there is considerably more uncertainty than the economy's current position. A further complication is that the Committee has supplemented its traditional funds rate instrument with a variety of new tools involving large-scale adjustments to the size and composition of the System Open Market Account portfolio.

In this new context for policymaking, a monetary policy strategy amounts to a joint plan for the funds rate and the securities portfolio, possibly supplemented with enhanced forward guidance about future policy actions. In this memo, we abstract from the overall design of such a strategy and instead focus on the narrower issue of the interpretation of federal funds rate prescriptions from Taylor-type rules when policymakers deploy both conventional and unconventional tools. In such an environment, if traditional Taylor-type rule prescriptions for the funds rate are to be used as benchmarks for overall monetary policy, do they need to be adjusted in light of the fact that other monetary policy tools are being used? That is, given the setting of the balance sheet, should we be adjusting the Taylor rules' funds rate prescriptions to reflect the fact that the other monetary policy tools are, to some extent, "doing the work" of the funds rate?

2. Issues involved in adjusting Taylor rules for LSAPs

As noted above, when the funds rate is the sole policy instrument, the discrepancy between the funds rate and the Taylor rule prescription provides a simple but useful benchmark for evaluating the stance of monetary policy. In analyzing the recent period, however, it may be helpful to

[3] See, for example, Laurence H. Meyer, "Structural Change and Monetary Policy," remarks before the Joint Conference of the Federal Reserve Bank of San Francisco and the Stanford Institute for Economic Policy Research, Federal Reserve Bank of San Francisco, March 3, 2000, and Donald L. Kohn, "John Taylor Rules," speech at the conference on John Taylor's Contributions to Monetary Theory and Policy, Federal Reserve Bank of Dallas, October 12, 2007. Texts of both these talks are available on the Board's public website, www.federalreserve.gov.

modify the monetary policy settings from the Taylor rule prescription to take account of the substantial monetary policy stimulus provided by LSAPs and related measures. One way to do so is to convert the policy accommodation implied by LSAPs into equivalent funds rate units, subtract this from the actual funds rate, and then treat this overall measure of accommodation as the variable to be used in comparisons of actual monetary policy with the Taylor rule prescription. Equivalently, one can adjust up the prescriptions of the policy rule by the LSAP effect, and compare those adjusted prescriptions to the actual funds rate. In what follows, we discuss some of the issues associated with this approach that arise at the conceptual level, and then turn to some practical considerations that arise in implementing such an adjustment.

a. Conceptual issues

The case for adjusting Taylor rule prescriptions for the effects of LSAPs depends on the perspective adopted about the role of Taylor rule prescription. One way of viewing the Taylor rule is that it leads to funds rate responses to the output gap and inflation that have been shown to deliver reasonable performance across a range of economic models, and in a way that is easy for the public to understand. From this perspective, the key property of the Taylor rule is that it implies a dynamic relationship between the short-term interest rate and two other key variables (the output gap and inflation) that stabilizes the gap and inflation in reaction to a variety of developments, including variations in term premiums, as well as other special factors that do not explicitly appear as right-hand-side variables in the Taylor rule, such as fiscal policy, other persistent demand shocks, or any other sources of time variation in the equilibrium real rate of interest. According to this view, the standard Taylor rule takes account of the effects of variations in term premiums—including those due to LSAPs—because the associated movements in longer-term interest rates set in train responses of the output gap and inflation, thereby altering the Taylor rule prescriptions. Thus, the standard Taylor rule prescriptions incorporate an implicit adjustment for LSAPs, embodied in the effects of LSAPs on the output gap and inflation; a further adjustment could be considered contrary to the spirit of the rule, especially as a practice of adjusting for special factors might lead to a number of such adjustments and so ultimately undermine the transparency and other beneficial aspects of a simple rule.

An alternative view of the Taylor rule prescription is that, because LSAPs are a monetary policy tool controlled by the Federal Reserve, the prescription in the presence of LSAPs should provide a benchmark for the *overall* stance of monetary policy. The standard comparison of the actual funds rate (R) and the Taylor rule prescription (R^T) focuses on the discrepancy ($R–R^T$). If, however, LSAPs have generated the equivalent of x units of funds rate reduction, then the monetary policy instrument setting is effectively $R–x$ and it is $R–x$, not R, that should be compared with the Taylor rule prescription R^T. Such a modification of the comparison—an "LSAP adjustment"—will have the effect of making the funds rate prescription higher than without the adjustment, as it is equivalent to saying that the appropriate Taylor rule benchmark value for the funds rate is R^T+x, not R^T.

Although such an adjustment may have merit, other modifications also could potentially increase the usefulness of simple rules as policy benchmarks in current circumstances. Several factors at work in recent years—notably the effective lower bound on the funds rate and unusually

persistent shocks—have disrupted the normal correlations of the funds rate, the output gap, and inflation. As a result, policymakers may want to exercise caution in interpreting the information provided by simple rules (LSAP-adjusted or not), and they may wish to consider whether making adjustments for other special factors might also be warranted. For example, the Taylor rule prescription in staff work assumes a given steady-state real interest rate, but one reason for deploying LSAPs might well be the onset of a protracted period in which the real interest rate consistent with normal resource utilization over the medium term is unusually low. Thus, while an LSAP adjustment of Taylor rule prescriptions might be appropriate, so too might be an adjustment to the Taylor rule intercept in recognition of the unusually low level of the neutral funds rate—an adjustment that would move the prescription in the opposite direction from that arising from an LSAP adjustment. This example illustrates that an LSAP adjustment might not by itself imply that a simple rule had been adequately modified for use in today's unusual circumstances.[4]

Thus, while there exists at the conceptual level a case for adjustment of the standard Taylor rule prescriptions for LSAPs, there are also some offsetting considerations. In the discussion that follows, however, we approach the problem from the perspective that an LSAP adjustment of the Taylor rule prescriptions might be desirable in principle. Taking this as given, we discuss a number of issues that arise in trying to quantify and implement the adjustment in practice.

b. Practical issues: mapping between LSAPs and funds rate policy

Clearly a translation of some kind is required if Taylor rule prescriptions are to be adjusted for LSAPs, as asset purchases are expressed in dollars while the Taylor rule prescription is in units of the funds rate. In practice, staff analysis has modeled LSAPs as influencing the term premiums embedded in longer-term interest rates. In converting movements of longer-term interest rates into a funds rate equivalent, the staff has generally used a "4-to-1" rule of thumb under which an LSAP operation that lowers the term premium component of ten-year Treasury rates by x percentage points is equivalent to a funds rate reduction of $4x$ percentage points. The staff rule of thumb for converting LSAPs into their funds rate equivalent is consistent with simple econometric estimates of the relationship between funds rate changes and Treasury bond yield changes prevailing during the "Great Moderation" period that preceded the financial crisis.[5]

[4] Another such adjustment has been suggested by David Reifschneider and John Williams (in "Three Lessons for Monetary Policy in a Low-Inflation Era," *Journal of Money, Credit and Banking*, Vol. 32(4), November 2000, pp. 936–966). They argue that in the aftermath of a prolonged period when the federal funds rate has been constrained by the zero bound, the federal funds rate should be held lower for longer than would be suggested by the conventional rule.

[5] A regression producing this estimate is reported on page 68 in Hess Chung, Jean-Philippe Laforte, David Reifschneider, and John C. Williams, "Have We Underestimated the Likelihood and Severity of Zero Lower Bound Events?," *Journal of Money, Credit and Banking*, Vol. 44(S1), February 2012, pp. 47–82 (also available as Federal Reserve Bank of San Francisco Working Paper No. 2011–01, January 2011). A roughly 4-to-1 rule is also supported by earlier findings in the literature, including those using simple regressions (such as William Poole, "Understanding the Term Structure of Interest Rates," *Federal Reserve Bank of St. Louis Review*, Vol. 87(5), September/October 2005, pp. 589–595) and identified vector autoregression (VAR) approaches (such as Charles L. Evans and David A. Marshall, "Monetary Policy and the Term Structure of Nominal Interest Rates: Evidence and Theory," *Carnegie-Rochester Conference Series on Public Policy*, Vol. 49(1), 1998, pp. 53–111). For further discussion, see Chung et al. (2012) and Stefania D'Amico, William B. English, David López-Salido, and Edward

The 4-to-1 rule is embedded in estimates of the effects of LSAPs given in past staff memos and public-domain research.

In practice, however, many complications and uncertainties attend any attempt to translate asset purchases into funds rate equivalents in a way that is reasonably accurate and informative. Although funds rate policy and LSAPs share the feature that they affect longer-term interest rates, the two monetary policy tools work in part through different channels and so the timing of their effects on the economy can differ. One important complication is that, beyond its influence on longer-term yields, funds rate policy may matter for aggregate demand through other channels; LSAPs, in contrast, are more narrowly restricted to working through the term structure channel.[6] A further complication is that staff analysis predicts the initial term-premium effects of LSAPs to diminish markedly over time, and to be greatly reduced well before the Federal Reserve's portfolio holdings return to more normal levels. As a consequence, the effects of the LSAPs already undertaken will be much smaller in mid-decade than they are today, even if the balance sheet is not smaller. Thus, the influence of the stock of securities holdings on longer-term interest rates changes over time, making the translation of LSAPs into funds rate units more difficult.

The practical difficulties just sketched suggest that the prescriptions of adjusted policy rules need to be interpreted with considerable caution; they even raise the possibility that monetary policymakers could potentially be better off if they focused on rule prescriptions without any LSAP adjustments. The next section explores, via model simulations, some of the practical complications associated with LSAP adjustments.

3. Simulation results on adjustment of Taylor (1999) rule prescriptions for LSAPs

In this section, we consider a situation in which monetary policymakers, in response to a massive adverse shock that drives the funds rate to its effective lower bound, turn to unconventional policy tools to try to replicate the economic outcomes that would be obtained under the unconstrained Taylor (1999) rule. To facilitate this analysis, we use a stylized macro model to consider the effects of two hypothetical policy tools that could be used in place of the federal funds rate once the funds rate hits its effective lower bound. To illustrate some key issues, we first examine the effects of a subsidy to private lenders that allows the private-sector short-term interest rate to mimic closely what the federal funds rate would have been in the absence of the zero bound. Obviously, such a policy tool does not exist in practice, but it is useful for illustrating that, under some restrictive conditions, it would be straightforward to adjust a policy

---

Nelson, "The Federal Reserve's Large-Scale Asset Purchases: Rationale and Effects," manuscript, Federal Reserve Board, February 2012.

[6] For example, Michael Kiley (in "The Aggregate Demand Effects of Short- and Long-Term Interest Rates," manuscript, Federal Reserve Board, January 2012) presents results calling into question a key assumption of the FRB/US model—that movements in the ten-year Treasury yield due to changes in expected future short-term interest rates (that is, future funds-rate policy actions) have equivalent effects to changes coming from the term premium. Such an asymmetry would arise if both short- and longer-term interest rates figured heavily in aggregate demand determination, as they might if short-term rates independently enter economic decisions, such as business plans that depend in part on the cost of short-term credit.

rule for the effects of unconventional policy. We then proceed to examine a policy instrument that may better approximate the operation of LSAPs in the real world, namely, a monetary policy that influences the term premium component of longer-term interest rates. In this case, LSAP adjustments to Taylor rules can lead to problematic results.

a. An interest-rate subsidy

A prescription from a Taylor-type interest-rate policy rule can be written as:

$$rff_t^T = r^* + \pi_t + \alpha(\pi_t - \pi^*) + \beta\, gap_t\,, \tag{1}$$

where rff^T is the Taylor rule prescription for the federal funds rate *rff*, π is the inflation rate over the past four quarters, and *gap* is an estimate of the output gap. In the Taylor (1999) version of this rule, $\alpha = 0.5$ and $\beta = 1.0$.

Suppose that the main variable underlying private-sector borrowing is not the federal funds rate but rather a private-sector short-term interest rate rs_t, which consists of two components:

$$rs_t = rff_t + sub_t\,. \tag{2}$$

where sub_t is a possible subsidy on private-sector borrowing. This private interest rate influences real spending via a term structure relationship. Specifically, the model equations describing the output gap, inflation, the longer-term interest rate and ten-year inflation expectations are (with an "E_t" prior to a variable denoting the expectation):

$$gap_t = 0.1\ E_t gap_{t+1} + 0.85\ gap_{t-1} - 0.1\ [rl_t - E_t\pi l_t - 3] + z_t \tag{3}$$

$$\pi_t = 0.9\ E_t\pi_{t+1} + 0.1\ \pi_{t-1} + 0.01\ gap_t \tag{4}$$

$$rl_t = \phi_t + (1-\theta)\ \Sigma_{j=0}^{\infty}\ \theta^j\ E_t rs_{t+j} \tag{5}$$

$$\pi l_t = (1-\theta)\ \Sigma_{j=0}^{\infty}\ \theta^j\ \pi_{t+j} \tag{6}$$

The long-term interest rate (rl_t) is therefore a function of expected future values of *rs*, plus a term premium, ϕ_t.[7] At the same time, inflation is determined via a forward-looking Phillips curve relationship. z_t in equation 3 is a shock to aggregate demand. Note that the decomposition of the short-term interest rate in equation 2 means that once the federal funds rate hits the effective lower bound, monetary policy has the option of paying a subsidy (*sub*) to push the private-sector interest rate below zero—an action that, via equations 3 to 6, will stimulate aggregate demand in the usual way.

Figure 1 shows how the economy responds to a recessionary shock (that is, a negative shock to z_t) in different monetary policy settings. Specifically, the black solid lines show what would

[7] The discount factor θ is chosen so as to make the effective duration of the long-term interest rate the same as that of a ten-year Treasury note.

happen if the nominal funds rate were free to follow the *unconstrained* prescriptions of the Taylor rule and policymakers undertook no unconventional policy measures. In contrast, the blue dotted lines show what would happen with the funds rate constrained by the ZLB and the policymakers implementing no unconventional measures. Finally, the red dashed lines show what would happen if the Committee were able to manipulate the hypothetical subsidy tool in such a way as to deliver a close approximation to the unconstrained Taylor outcomes for the private short-term interest rate, and so for real activity and inflation. In particular, once the unadjusted Taylor rule prescription for the funds rate falls below the effective lower bound, subsidies in this scenario are set using the formula:

$$sub_t = \eta\,[r^* + \pi_t + \alpha\,(\pi_t - \pi^*) + \beta\,gap_t\,]. \qquad (7)$$

If η were set to unity, the subsidy program would be large enough to replicate precisely the conditions prevailing under the unconstrained Taylor rule. In the simulation results reported as the red lines of figure 1, however, η is set to a value slightly below unity, simply to put some visual distance between the black and red lines on the chart.

As constructed, the subsidy does an excellent job of replicating the outcomes under the unconstrained Taylor rule. In particular, the ten-year bond yield is almost exactly the same as in the unconstrained case, as are the output gap and inflation. It is worth considering what different versions of the Taylor rule would prescribe in this case. The red dashed line in the lower-right panel shows what the standard Taylor rule—without an adjustment for the subsidy policy, as in equation 1—would prescribe. As can be seen, by this criterion, policy would not seem to be doing a very good job: The rule is prescribing a funds rate of more than −5 percent in the second year, when the actual funds rate is stuck near zero. Note, however, that this prescribed rate is approximately 150 basis points higher than the funds rate prescription that would arise if no unconventional policy measures had been undertaken (not shown). Thus, as previously observed, the standard Taylor rule prescriptions do imply a built-in adjustment to LSAPs, arising from the response of the output gap and inflation to the unconventional monetary policy actions.

Suppose, however, that we instead judge the stance of policy using an adjusted Taylor rule of the form:

$$rff_t^{TADJ} = r^* + \pi_t + \alpha\,(\pi_t - \pi^*) + \beta\,gap_t + sub_t \qquad (8)$$

The green dot-dashed line in the panel plots the outcome of this adjusted rule. Measured against this benchmark, the overall stance of monetary policy is appropriate because there is virtually no discrepancy between the rule prescription and the actual funds rate. It would therefore appear that if we can precisely translate the effects of unconventional policy into a funds rate equivalent, then setting policy on the basis of Taylor rule prescriptions that have been adjusted for the effects of unconventional policy would lead to outcomes that are very close to those achieved with the unconstrained rule. This result, however, depends on the availability of an idealized policy instrument: As we now show, the guidance provided by adjusted rules is less reliable when adjustments concern the "lumpier" effects of LSAPs on the term premium.

b. Influencing the term premium

In the analysis underlying figure 1, we assumed that policymakers have at their disposal an instrument that could precisely replicate the effects of the federal funds rate on private-sector interest rates. We consider now a case in which policymakers are able to influence the term premium ϕ_t in equation 5 through large-scale purchases of longer-term assets.

Figure 2 shows the effects of a policy that lowers the term premium on long-term interest rates. The black solid and blue dotted lines are the same as those in figure 1—that is, they show the effects of Taylor-rule policies with and without the effective lower bound constraint, and with no asset purchases. In the red dashed lines plotted here, policymakers announce a large-scale asset purchase program two quarters after the initial drop in aggregate demand, thereby prompting an immediate pronounced reduction in the term premium; thereafter, the term premium gradually returns to normal.[8] As can be seen in the middle right panel, with this intervention, the long-term interest rate is lower than in the case without asset purchases, but not quite as low as in the unconstrained case (the black solid line). Given the prominent role of long-term interest rates in determining spending in this model, it is perhaps not surprising that the output gap does not widen as much as in the constrained case without any change in the term premium, and that inflation is higher as well. Indeed, output and inflation are now reasonably close to the outcomes associated with unconstrained policy.

The federal funds rate in this simulation is set according to the Taylor rule—equation 1—with the effective lower bound imposed. As can be seen, the federal funds rate is raised above its effective lower bound sooner than in the case with no purchases, reflecting the stronger economy in this case. As in figure 1, the lower right panel considers how the policy stance would look from the perspective of a Taylor rule with and without an adjustment for the term-premium effect. In this case, the adjusted Taylor rule prescription is computed as:

$$rff_t^{TADJ} = r^* + \pi_t + \alpha\,(\pi_t - \pi^*) + \beta\, gap_t - 4\,\phi_t\,. \qquad (9)$$

Here, we are using the standard assumption, discussed in section 2b, of a 4-to-1 relationship between the effects of movements in long-term interest rates and movements in the federal funds rate.

The red dashed line shows the Taylor rule prescription with no adjustment for term-premium effects. This is the same as the red dashed line in the panel to the left, except that the lower bound is not imposed. This version of the rule prescribes a deeply negative federal funds rate and thus would suggest that actual policy—which sets the funds rate to zero—is not providing the needed amount of stimulus. The green dot-dashed line shows the prescription for the adjusted rule (equation 9). Based on its prescriptions, the overall stance of policy during the first three years is roughly in line with policymakers' objectives, in that the adjusted prescriptions are

[8] Under the program, the size of the Federal Reserve's balance sheet is assumed to increase steadily over the first two years, and then to remain constant at its new level until the federal funds rate begins to rise. From that point on, the balance sheet is assumed to shrink steadily, with its size and composition returning to normal within five years. These assumptions imply that the term premium effect would decline by more than half after four years, and would be close to zero after eight years.

close to the actual level of the federal funds rate. But from that point on, the adjusted rule provides persistently misleading policy advice. In particular, even though policy under the unadjusted Taylor rule (plus the LSAP program) is doing a good job of replicating outcomes for inflation and unemployment under the unconstrained Taylor rule, the adjusted rule would call for an earlier and faster tightening of conventional monetary policy.

To illustrate the potential economic implications of making policy-rule adjustments, Figure 3 compares outcomes under two different assumptions for the setting of conventional monetary policy after the LSAP program is announced—one in which the federal funds rate follows the prescriptions of an unadjusted rule (equation 1), and one in which it follows those of an adjusted rule (equation 9). As can be seen in the bottom left panel, with the term-premium adjustment, the federal funds rate rises above its effective lower bound four quarters earlier than in the unadjusted case. Because of this earlier tightening, output and inflation are lower, with the largest effect in each case being about ½ percentage point.

These results would seem to suggest that the central bank would, in this case, be better served by using an unadjusted policy rule in choosing the federal funds rate. Nevertheless, the adjusted rule may provide a better perspective on the overall stance of monetary policy during the first years of the economic slump. The bottom right panel again shows the prescriptions from two versions of the Taylor rule, with and without the term-premium adjustment. Here, the underlying simulation is the same as in the unadjusted case. Thus, the blue dotted line plotted here is the same as in the panel to the left, except that the zero bound is not imposed; the green dot-dashed line shows the outcomes for the same simulation, but using equation 9 (the adjusted Taylor rule) to generate the prescription. As can be seen, the blue dotted line indicates that policy during the first few years is not doing a very good job—the prescription calling for an additional 600 basis points of funds-rate equivalent stimulus—even though the policy in fact comes close to replicating the outcomes associated with the unconstrained Taylor rule. By contrast, the adjusted rule suggests that policy during this period is not far from being as stimulative as it should be, as the prescription comes much closer to the actual setting for the federal funds rate.

Uncertainty about the magnitude of LSAP effects might also be a concern, given that it could lead to significantly misspecified adjustments to simple rules. To explore this possibility, figure 4 considers the extreme case in which the central bank engages in an LSAP program thinking that it will have the same effects as in figures 2 and 3, but, in fact, the purchases have no effect on the term premium, and thus on aggregate demand. Thus, in the simulation shown in the red dashed lines, the central bank sets policy according to equation 9—that is, with an adjustment for what policymakers perceive to be the effects of the asset-purchase policy. This adjustment, however, is a mistake, because the purchase policy is in fact having no effect.

As can be seen in the lower left panel, the adjustment leads the central bank to raise interest rates three quarters earlier than is appropriate. The effects on output, however, are fairly small:

Output is about ½ percentage point lower than otherwise at the worst point, and inflation is almost 0.4 percentage point lower.[9]

The simulations in figure 4 illustrate the risks of making a term premium adjustment that is too large. Here, the (inappropriately) adjusted policy rule is giving more misleading advice than the (appropriately) unadjusted Taylor rule, in that the former markedly underestimates the degree to which the LSAPs are failing to fill the hole created by the inability to push the funds rate below zero in the four years after the shock. Perhaps more importantly, the adjusted rule calls for the funds rate to tighten earlier and faster than the unadjusted rule, which is presumably not desirable when the output gap remains wide and inflation is substantially below target. Of course, if policymakers mistakenly thought that the effects of LSAPs were smaller than they in fact were, the reverse would be true, and the unadjusted rule would provide worse guidance than the adjusted rule.

4. Concluding remarks

The preceding discussion has considered the possible costs and benefits of adjusting Taylor rule prescriptions for the impact of unconventional monetary policy measures, such as the asset purchases made by the Committee since 2008. Such an adjustment to the rule prescriptions would be over and above the implicit adjustment that automatically occurs in the regular Taylor rule prescriptions because of the effects of the unconventional measures on output and inflation. An adjustment has the appealing aim of explicitly recognizing the presence of two monetary policy instruments and consolidating their effects into a single measure of policy stance. Implementation of adjustments to simple policy rule prescriptions for the effects of LSAPs depends upon the model of the link between LSAPs and financial conditions, as well as the model of the connections between financial conditions and inflation and economic activity. Consequently, the adjustments may involve a degree of model dependence that departs from the spirit of simple policy rules. These practical difficulties suggest that, at a minimum, prescriptions from adjusted policy rules would need to be taken with considerable caution. Moreover, LSAP adjustment alone would not necessarily make simple policy rules appropriate benchmarks in the current policy environment, in which a number of factors have severely disrupted the normal correlations of the funds rate, the output gap, and inflation. In this environment, policymakers may need to be particularly eclectic when considering simple policy rule prescriptions, irrespective of whether these prescriptions make an explicit adjustment for LSAPs.

[9] One reason that the effect of the mistaken LSAP adjustment is relatively small is that by this time—five years after the initial purchases—the assumed effects of the policy on the term premium are only about one-fourth of their initial value. If asset purchases were presumed to have more-persistent effects on term premiums, the adverse consequences from a mistaken LSAP adjustment would likely be larger.

Figure 1
Effects of a Large Persistent Shock Under the Taylor (1999) Rule
With and Without the ZLB Constraint and Interest Rate Subsidies

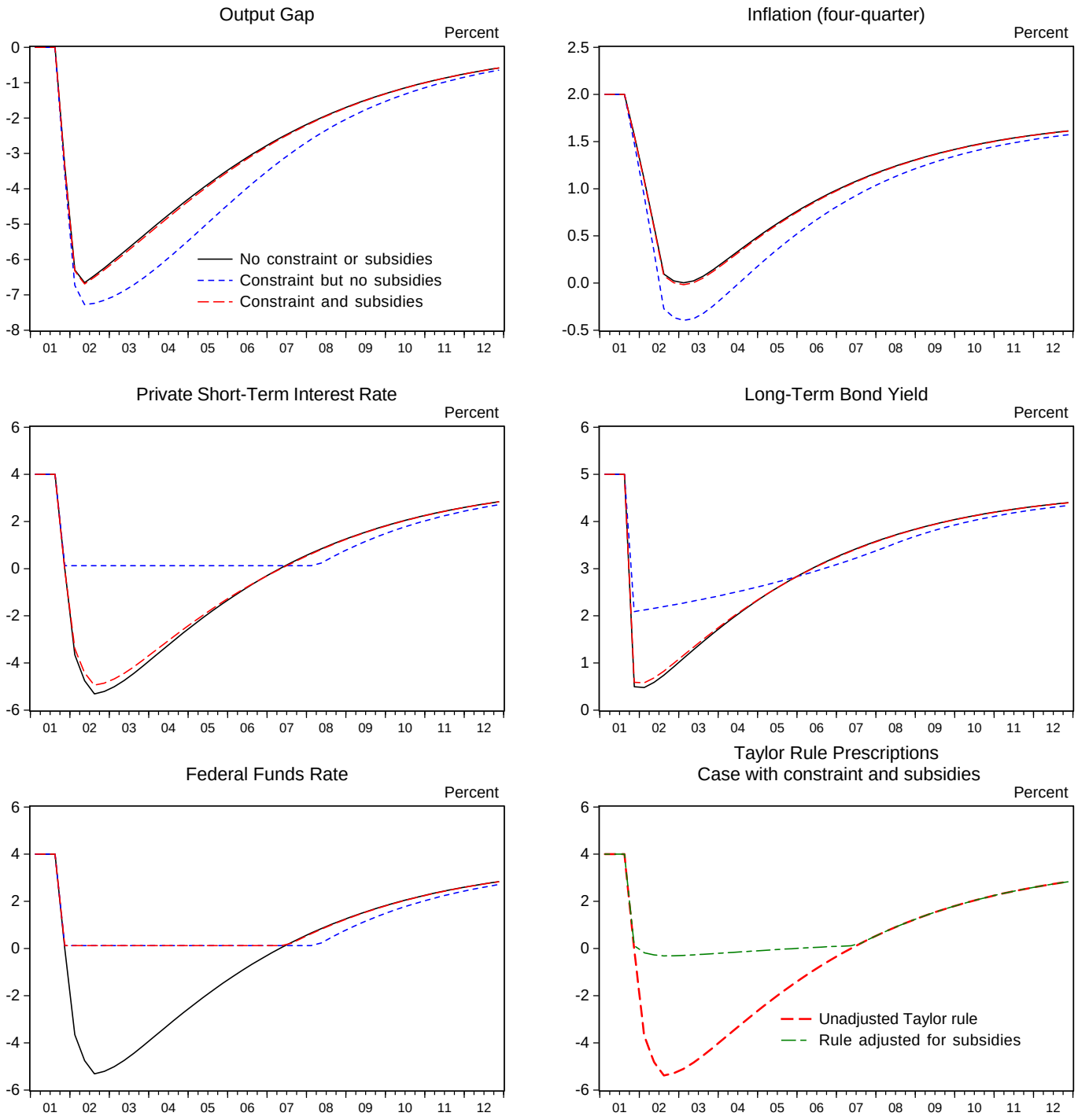

Figure 2
Effects of a Large Persistent Shock Under the Taylor (1999) Rule
With and Without the ZLB Constraint and Asset Purchases

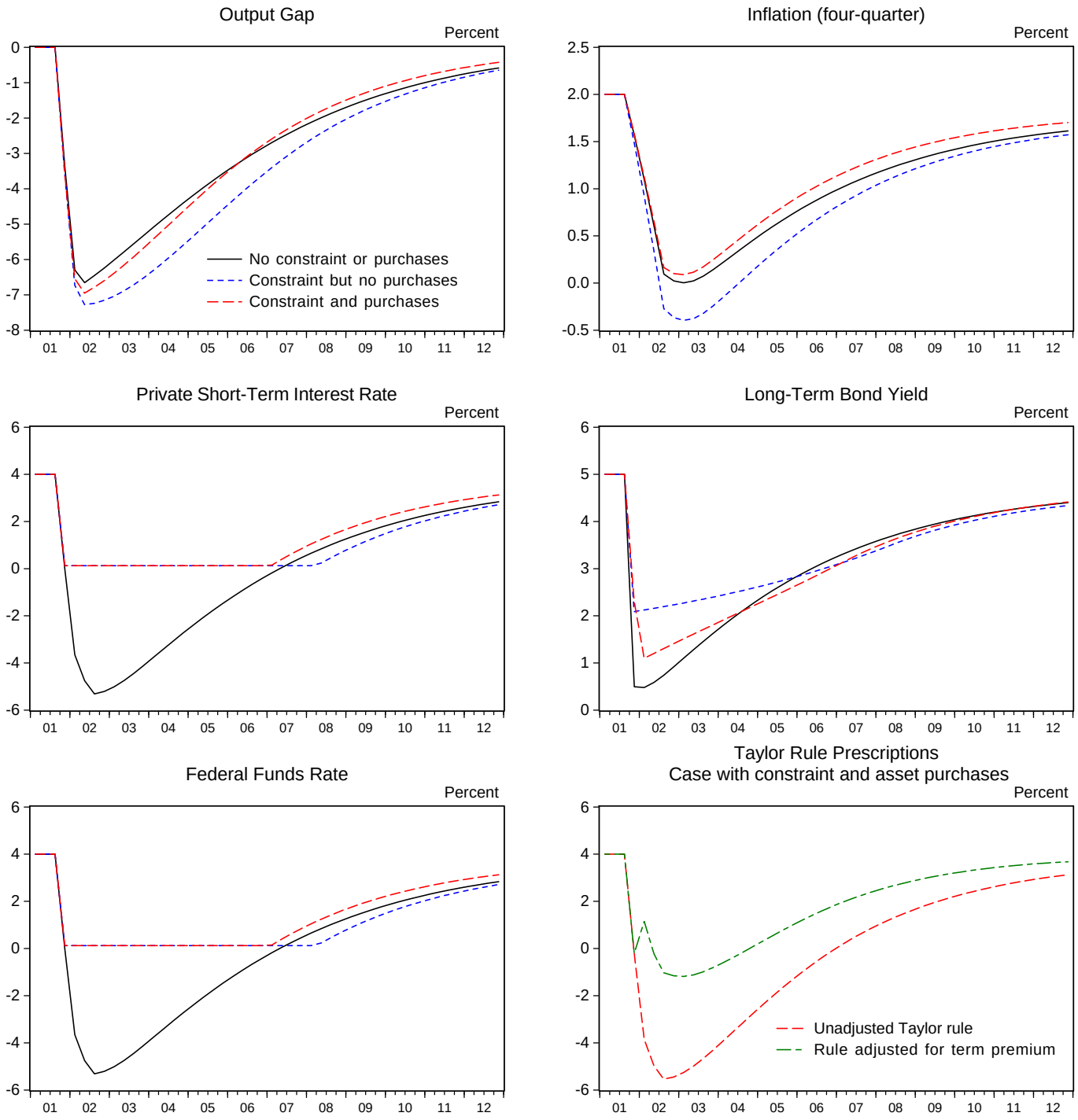

Figure 3
Effects of a Large Persistent Shock Under the Taylor (1999) Rule
With and without a Funds Rate Adjustment for Purchases

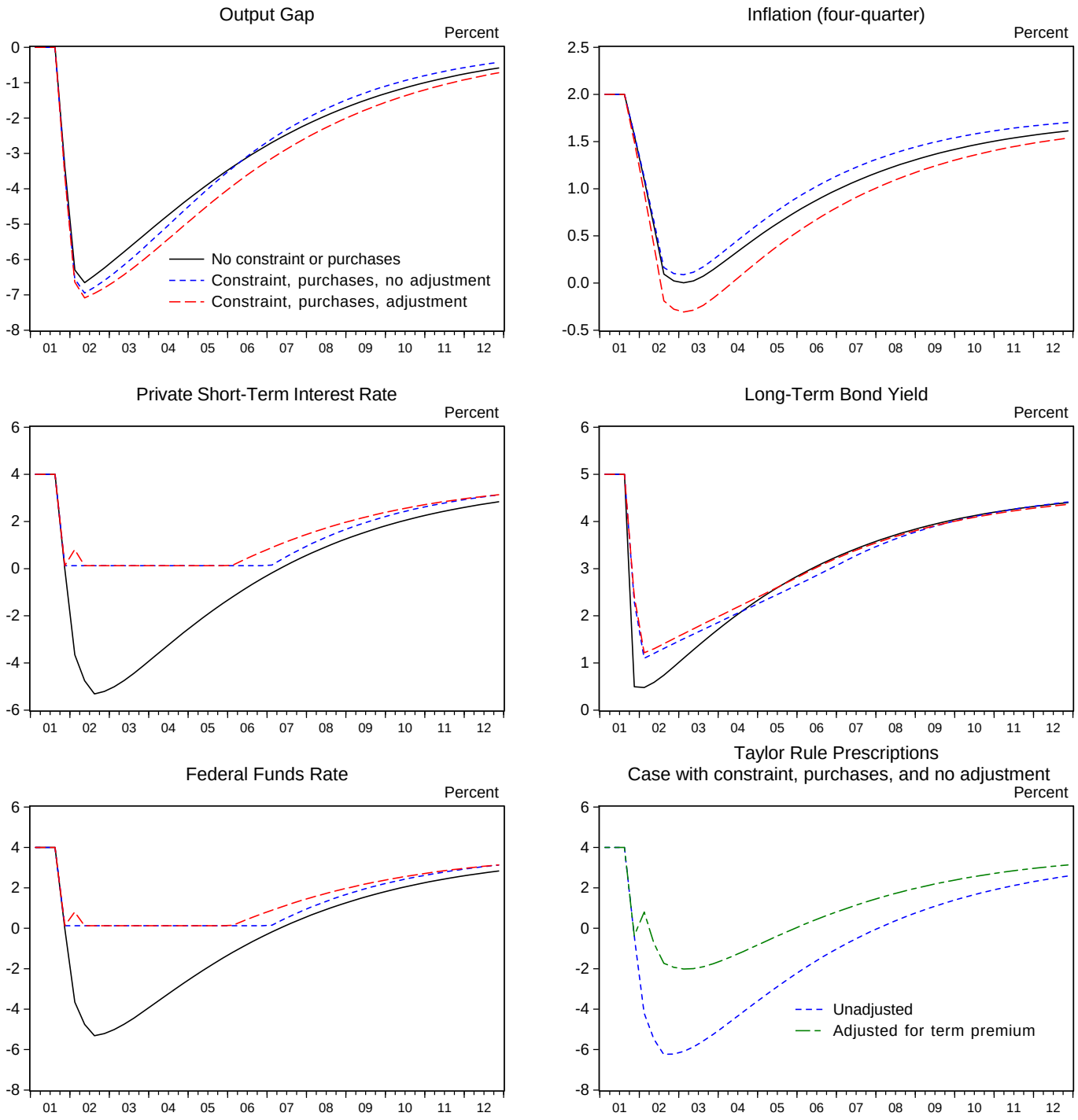

Figure 4
Effects of a Large Persistent Shock Under the Taylor (1999) Rule
With Ineffective Asset Purchases