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# WHAT RULE FOR THE FEDERAL RESERVE? FORECAST TARGETING

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**ABSTRACT**

How would the policy rule of forecast targeting work for the Federal Reserve? To what extent is the Federal Reserve already practicing forecast targeting? Forecast targeting means selecting a policy rate and policy-rate path so that the forecasts of inflation and employment "look good," in the sense of best fulfilling the dual mandate of price stability and maximum employment, that is, best stabilize inflation around the inflation target and employment around its maximum level. It also means publishing the policy-rate path and the forecasts of inflation and employment forecasts and, importantly, explaining and justifying them. This justification may involve demonstrations that other policy-rate paths would lead to worse mandate fulfillment. Publication and justification will contribute to making the policy-rate path and the forecasts credible with the financial market and other economic agents and thereby more effectively implement the Federal Reserve's policy. With such information made public, external observers can review Federal Reserve policy, both in real time and after the outcomes for inflation and employment have been observed, and the Federal Reserve can be held accountable for fulfilling its mandate. In contrast to simple policy rules that rely on very partial information in a rigid way, such as Taylor-type rules, forecast targeting allows all relevant information to be taken into account and has the flexibility and robustness to adapt to new circumstances. Forecast targeting can also handle issues of time consistency and determinacy. The Federal Reserve is arguably to a considerable extent already practicing forecast targeting.

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> *The Fed has a rule.* The Fed's rule is that we will go for a 2% inflation rate; we will go for the natural rate of unemployment; we put equal weight on those two things; we will give you information about our projections, our interest rate. *That is a rule*, and that is a framework that should clarify exactly what the Fed is doing. (Bernanke, 2015b)

# 1 Introduction

How should the Federal Reserve conduct monetary policy so as to best fulfill its mandate of price stability and maximum employment? What decision-making process should the Federal Reserve follow, what information should it rely on, and how should it set is policy instruments? What of its information, deliberations, and decision should the Federal Reserve publish? How can the Federal Reserve's policy conduct best be reviewed and how can the Federal Reserve most effectively be held accountable for fulfilling its mandate?

These issues are arguably always of importance, but they became more urgent in the context of recently proposed legislation by the U.S. Congress. According to the Fed Oversight Reform and Modernization (FORM) Act (U.S. Congress, 2015) and, with identical words, the Financial CHOICE Act (U.S. Congress, 2017), the FOMC Chair shall within 48 hours after each FOMC meeting submit a "Directive Policy Rule" (DPR) which identifies the "Policy Instrument" and "includes the coefficients" through which the "Intermediate Policy Inputs" determine the level of the policy instrument. In particular, the DPR shall

> include a statement as to whether the Directive Policy Rule substantially conforms to the Reference Policy Rule and, if applicable, (A) an explanation of the extent to which it departs from the Reference Policy Rule; (B) a detailed justification for that departure; ... (U.S. Congress, 2015, section 2)

Importantly, the Reference Policy Rule is specified in words and numbers to be the standard Taylor (1993) rule for the federal funds rate,

$$i_t = 2 + \pi_t + 0.5\,(\pi_t - 2) + 0.5\,y_t, \tag{1}$$

where $i_t$ denotes the federal funds rate in quarter $t$, $\pi_t$ denotes inflation over the previous four quarters and $y_t$ denotes the gap between GDP and an estimate of potential GDP.

Clearly, these provisions in the legislation makes the Taylor rule the benchmark for the Federal Reserve's monetary policy, and if there are any departures from the rule, these departures require "a detailed justification." Furthermore, the Government Accountability Office (GAO) would be responsible for determining whether the FOMC's DPR would meet all the legislation's criteria.

Any time the FOMC's DPR was judged not to be in compliance with the GAO-approved rule, or anytime the FOMC just changed its DPR, the GAO would have to conduct a full review of monetary policy and submit a report to the Congress.

As explained in a letter from Chair Yellen to the Congress (Yellen, 2015), for several reasons the provisions of the FORM Act would severely impair the Federal Reserve's ability to carry out its congressional mandate to promote effectively the goals of maximum employment and stable prices. One obvious reason is that the provisions would threaten the Federal Reserve's considerable independence in deciding how to best fulfill its mandate. The provisions would effectively put the Congress and the Government Accountability Office in the role of reviewing short-run policy decisions and in a position to influence those decisions in real time. There is considerable theoretical and ample historical evidence that such short-run political interference in monetary policy leads to poor economic outcomes.

Another reason is that there are considerable problems with Taylor-type rules that make them lead to poor economic outcomes in many situations. A Taylor-type rule is too restrictive and mechanical, does not take into account all relevant information, and lacks the flexibility required to handle complex and changing situations.[1]

More precisely, as discussed in Svensson (2003b), first, a Taylor-type rule is not optimal, in the sense of best stabilizing both inflation around the inflation target and unemployment around its long-run sustainable rate, and in some circumstances it is far from optimal. A Taylor-type rule makes the policy rate respond with some fixed coefficients to the current inflation gap and either the current GDP gap or the current unemployment gap.

But good monetary policy needs to respond to much more information than is contained in the current observations of those gaps. In particular, in order to best fulfill the mandate of maximum employment and price stability, it is not sufficient for the policy rate to respond only to the current levels of inflation, GDP, and employment or unemployment. Instead, optimal policy requires a response to the *determinants* of the future realizations of inflation and employment. These determinants normally include the current levels of inflation, GDP, and employment or unemployment but, importantly, also many other variables and shocks. Second, the relevant information depends on circumstances and changes over time. In order to best achieve the mandate, there is a crucial role of *judgment* (information, knowledge, and views outside the scope of a particular model) in modern monetary policy, and the appropriate use of good judgment can dramatically improve

[1] Federal Reserve Board (2017) discusses the Federal Reserve's views on and current use of different policy rules.

monetary policy performance (Svensson, 2005). But a Taylor-type rule leaves no room for judgmental adjustments. Third, the beneficial development of monetary policy due to learning and new information will conflict with the legislation of (or commitment to) a particular Taylor-type rule. Finally, in spite of considerable academic work and promotion, no central bank has actually chosen to commit itself to a Taylor-type rule (and prominent central bankers are very critical of the idea). In short, a Taylor-type rule is not optimal, in the sense of best achieving the mandate, and too rigid to adapt to changing circumstances.

A possible answer to these problems, in particular to the second one mentioned above, is that a Taylor-type rule should not be followed mechanically. Instead, deviations from the rule are allowed. The rule should be seen as mere "guidelines" for monetary policy. This is the view expressed in the original proposal of Taylor (1993) and, in more detail, in Taylor (2000). A problem with this answer is that the rule is then *incomplete*: some deviations are allowed, but *there are no rules for when deviations from the Taylor-type rule are appropriate*. As discussed in some detail in Svensson (2003b), this arguably makes the use of simple instrument rules such as Taylor-type rules as mere guidelines for monetary policy too vague to be operational.[2]

What rule for the FOMC's monetary policy setting would then better fulfill the Federal Reserve's mandate over time and also make the Federal Reserve's policy sufficiently transparent so that the Federal Reserve can be held accountable for fulfilling the mandate? This paper suggests that *forecast targeting* is likely to allow the FOMC to effectively fulfill its mandate as well to be held accountable for fulfilling the mandate. Indeed, forecast targeting is the rule that Bernanke (2015b) briefly refers to in the quote at the beginning of this paper, suggesting that the Federal Reserve is already to some extent practicing forecast targeting.[3] Forecast targeting means setting the policy rate (the federal funds rate) and the policy-rate path so that the resulting forecasts for the Federal Reserve's "target variables"—inflation and employment (or unemployment)—best fulfill the Federal Reserve's mandate of maximum employment and price stability. Forecast targeting also involves publishing and justifying the FOMC's policy-rate path and forecasts for inflation and

[2] Walsh (2015, 2017) provides a discussion of the pros and cons of goals-based and rules-based monetary policy (the latter there meaning commitment to a Taylor-type rule) in a New Keynesian model in which the central bank is subject to political pressure or for other reasons deviates from the socially optimal goals. In particular, he shows that equilibrium central-bank deviations from the socially optimal policy or from the Taylor-type rule then depend on these pressures and the degree of commitment to the Taylor-type rule. He refers to this as a "rule" for the deviations from the Taylor-type rule. I find it difficult to see this specific result as a general operational and verifiable rule for such deviations.

[3] Forecast targeting rather than Taylor-type rules is discussed and promoted in, for example, Bernanke (2004, 2015a), Kohn (2007, 2012), Qvigstad (2005), Svensson (1997, 2003b, 2011), and Woodford (2004, 2007, 2012). The term "inflation-forecast targeting" was introduced in Svensson (1997), and the term "forecast targeting" in Svensson (2003b).

employment. This serves to effectively implement the selected policy in order to make it credible with the financial market and other economic agents, as well as to make it possible to hold the Federal Reserve accountable for fulfilling its mandate.[4]

To clarify how forecast targeting works, consider for simplicity a situation of relatively normal times when the Federal Reserve is not doing any active balance-sheet policy but is only using a policy (interest) rate, the federal funds rate, as its policy instrument. Furthermore, assume for simplicity that the labor-market participation rate is independent of monetary policy, so that for monetary policy purposes employment varies negatively one-to-one with unemployment. Then maximum employment corresponds to what FOMC (2019) calls the longer-run normal rate of unemployment, what I will call the (minimum) long-run sustainable unemployment rate. Under this simplification, the Federal Reserve's mandate is to keep inflation close to its target of 2% and unemployment close to its estimated long-run sustainable unemployment rate.

Two important circumstances then need to be taken into account: First, monetary policy actions tend to influence economic activity and prices with a lag. Therefore, monetary policy is more effective in fulfilling the mandate if it is guided by *forecasts of future* inflation and unemployment rather than by current inflation and unemployment.

Second, the current policy rate has a very small direct impact on economic activity and prices. What matters for economic activity and prices is instead market *expectations of future* policy rates. These expectations affect longer-term interest rates and asset prices, which in turn have an impact on activity and prices. It is the entire expected path of future policy rates that affects economic activity, not the policy rate over the next few days and weeks. This means that an effective monetary policy decision cannot only consist of setting the current policy rate; it must explicitly or implicitly also involve the selection of a policy-rate path, a forecast of the future policy rate. Not to discuss and select a policy-rate path is an incomplete decision-making process (Svensson, 2007a).

Given this, a rule for the FOMC that effectively fulfills its mandate is to select a policy rate and a policy-rate path so that the resulting forecasts for inflation and unemployment "look good." Here, "looking good" means best fulfilling the Federal Reserve's mandate, that is, best stabilizing inflation around its target and unemployment around its long-run sustainable rate.[5]

Why is this rule, forecast targeting, better than a Taylor-type rule? First, it takes into account

[4] Rudebusch and Williams (2008) provide early support for publishing the Federal Reserve's policy-rate projection.

[5] Some technical issues to ensure determinacy and the terminal conditions on the chosen policy-rate path are discussed in section 3.5.

all relevant information available to the Federal Reserve. It takes into account the information about the economy, economic activity, and prices that has an impact on the forecasts of inflation and unemployment at a given policy-rate path. It also takes into account all relevant information about the transmission mechanism of monetary policy, that is, how changes in the policy-rate path affect the forecasts of inflation and unemployment at given information about the current state of the economy. Second, the rule therefore adapts to new information and changes in circumstances, and it allows for judgmental adjustments. It avoids the restrictiveness and inflexibility of a Taylor-type rule. The selected policy-rate path and forecasts of inflation and unemployment will in practice be a combination of model simulations, sometimes from several models, and judgmental adjustments.

However, for successful implementation and realization of the selected policy, the policy-rate path needs to be credible, in the sense of market expectations of future policy rates being aligned with the policy-rate path. Implementation of monetary policy is largely about the management of expectations (Woodford, 2004). This includes making the *actual* financial conditions align with the *intended* financial conditions, where the latter can be seen as represented by the policy-rate path. Economic agents' expectations of future inflation also matter. If the FOMC manages to make the inflation target credible, in the sense of making economic agents' inflation expectations align with the inflation target, stabilization of inflation around its target is easier, because actual inflation is much affected by previous expectations of inflation. Then it is also easier to stabilize unemployment around its long-run sustainable rate. The tradeoff between stability of inflation around the target and of unemployment around its long-run sustainable rate becomes more favorable.

The most effective contribution to making the policy-rate path credible with the market participants and other economic agents is to publish the policy-rate path and the forecasts of inflation and unemployment and justify them and the policy decision. Not to publish the policy-rate path would be to hide the most important information (Svensson, 2007a). Forward guidance is then the default, in the sense that there is forward guidance in the form a published policy-rate path. Normally, this is a forecast conditional on current information, not a commitment. Therefore, like other forecasts, it often changes at the next decision. In exceptional situations, for example, when the Federal Reserve is restricted by the effective lower bound (ELB) for the policy rate, it may be a commitment through a certain date (time-dependent) or conditional on a specific outcome of inflation or employment (state-dependent).[6]

A common argument against publishing a policy-rate path is that market participants would not

[6] See Bernanke (2017) for a recent discussion.

understand that it is a conditional forecast that changes over time but interpret it as commitment and be confused when it changes. The Reserve Bank of New Zealand, the Bank of Norway, and the Riksbank have published their policy-rate paths since 1997, 2005, and 2007, respectively. There is thus considerable experience of such publication. I am not aware of that market participants in these countries have had any difficulties understanding that the policy-rate path is a forecast, not a commitment. The Riksbank used to repeat at every publication of the path that "it is a forecast, not a promise." After a few years, these reminders were certainly redundant. The Federal Reserve could repeat the same phrase, if there would be concerns about misunderstandings.

In addition to justifying how new information since the last decision has affected the forecasts and the selected policy-rate path, the justification of the decision may include demonstration of why the inflation and unemployment forecasts "look good," that is, best fulfill the Federal Reserve's mandate. If required, this can be done by showing that other policy-rate paths than the one selected lead to inflation and unemployment forecasts that look less good, that is, do not fulfill the mandate as well. This can be done more explicitly with the use of what can be called mean squared gaps, which quantify the deviation of the inflation forecast from the inflation target and the deviation of the unemployment forecast from the long-run sustainable unemployment rate (Svensson, 2011).

It is common to argue that central banks should convey their reaction function to the market participants and other economic agents. However, under forecast targeting the reaction function, meaning how the policy rate and the policy-rate path respond to information available to the central bank, is far too complex to write as a simple formula such as a Taylor-type rule. It is actually too complex to write down, period—that is, as a mathematical function describing precisely how the policy rate responds to different kinds of information. The policy rate and policy-rate path will normally respond to all relevant information, that is, all information that shifts the forecasts of inflation and unemployment. This is a long and changing list, with response coefficients that cannot be specified in advance.

But the reaction function can be conveyed in more general and approximate but still both systematic and simple terms. If initially the forecasts look good, for any piece of information that shifts the inflation forecast up (down) and/or shifts the unemployment forecast down (up), policy will normally be tightened (eased), meaning that the policy-rate path will shift up (down). If this response is understood by and credible with the market participants, any new information that is deemed to shift up (down) the inflation outlook or shift down (up) the unemployment outlook, may result in a market response that shifts up (down) the yield curve. This way the financial conditions may shift in the appropriate direction and perhaps even of the appropriate magnitude even before the central bank has responded with a new policy rate and policy-rate paths at the next decision.

Finally, the publication and justification of the FOMC's policy-rate path and inflation and unemployment forecasts make it possible to hold the FOMC accountable for fulfilling the mandate. The policy-rate path and forecasts of inflation and unemployment, the FOMC's justification of them and its fulfillment of its mandate can be scrutinized and reviewed both in real time and after the fact, that is, after the outcome for inflation and unemployment have been observed, by external observers and experts and at the usual hearings in congressional committees (Svensson, 2012).

Altogether, forecast targeting can be seen as a case of "constrained discretion" (Bernanke and Mishkin, 1997), where the constraint to fulfill the mandate is made most explicit.

In the rest of the paper, section 2 discusses the interpretation and specification of the Federal Reserve's mandate. Section 3 discusses how the Federal Reserve can effectively fulfill its mandate by the decision-making process of forecast targeting. Section 3.2 provides an example with a comparison of the performance of forecast targeting and a Taylor rule when there are expectations of future shocks. Section 3.3 discusses the implementation of the policy decision, and section 3.4 summarizes the forecast-targeting policy rule in three steps. Sections 3.5 and 3.6 discuss how the issues of determinacy and time-consistency can be handled. Section 3.7 clarifies the reaction function under forecast targeting, and section 3.8 clarifies the distinction between forecast targeting, instrument rules, and targeting rules. Section 4 discusses how the Federal Reserve can be held accountable. Section 4.1 shows an example, from the Riksbank's monetary policy decision in February 2013 (Sveriges Riksbank, 2013), of how alternative policy-rate paths and corresponding forecasts of inflation and unemployment (including mean squared gaps) can be used to examine whether the decision best fulfills the mandate. Section 5 includes a discussion of to what extent the Federal Reserve is already practicing forecast targeting. Section 6 provides some conclusions.

## 2 The mandate

The one-page well-written FOMC "Statement on Longer-Run Goals and Monetary Policy Strategy" (FOMC, 2019, first adopted in January 2012) clarifies the Federal Reserve's monetary policy goals and strategy. The Federal Reserve's statutory mandate is to promote maximum employment and price stability.[7] The FOMC has decided that a symmetric 2% inflation target is most consistent

[7] More precisely, the Congress has given the Federal Reserve the statutory mandate "to promote effectively maximum employment, stable prices, and moderate long-term interest rates." Moderate long-term interest rates will

over the longer run with its statutory mandate. Regarding maximum employment, the FOMC notes that the maximum level of employment, in contrast to the rate of inflation, is largely determined not by monetary policy but by nonmonetary factors that affect the structure and dynamics of the labor market. These factors may change over time and may not be directly measurable. Consequently, it would not be appropriate to specify a fixed goal for employment; rather, the maximum level of employment must be estimated from a range of indicators and such estimates are uncertain and subject to revision. An important indicator is the FOMC's estimate of what it calls the longer-run normal rate of unemployment.

The FOMC provides further information on how it sets monetary policy:

> In setting monetary policy, the Committee seeks to mitigate deviations of inflation from its longer-run goal and deviations of employment from the Committee's assessments of its maximum level. These objectives are generally complementary. However, under circumstances in which the Committee judges that the objectives are not complementary, it follows a balanced approach in promoting them, taking into account the magnitude of the deviations and the potentially different time horizons over which employment and inflation are projected to return to levels judged consistent with its mandate. (FOMC, 2019)

Given this, the mandate can be well formalized by a standard quadratic loss function of inflation and employment. If, for simplicity, the labor-market participation rate is assumed to be independent of monetary policy, maximum employment can be replaced by the (minimum) longer-run normal unemployment rate. The mandate can then be expressed in terms of a standard quadratic loss function of inflation and unemployment. Furthermore, a "balanced approach," and the explicit statement of former Chair Bernanke (2015b) in the quote at the beginning of this paper can be interpreted as an equal weight on stabilization of inflation and on stabilization of unemployment. Indeed, then Vice Chair Yellen (2012, p. 13 ) stated:

> The balanced-approach strategy endorsed by the FOMC is consistent with the view that maximum employment and price stability stand on an equal footing as objectives of monetary policy.

Furthermore, Vice Chair Clarida (2019, p. 5) notes:

> As a practical matter, our current strategy shares many elements with the policy framework known in the research literature as "flexible inflation targeting." However, the Fed's mandate is much more explicit about the role of employment than that of most flexible inflation-targeting central banks, and our statement reflects this by stating that when the two sides of the mandate are in conflict, neither one takes precedent over the other.

normally follow from low and stable inflation.

Then the quarter-$t$ loss, $L_t$, can be represented by the quadratic loss function,

$$L_t = (\pi_t - \pi^*)^2 + (u_t - u^*)^2, \tag{2}$$

where $\pi_t$ denotes the inflation rate, $\pi^*$ denotes the 2% inflation target, $u_t$ denotes the unemployment rate, and $u^*$ denotes the FOMC's (latest) estimate of the longer-run normal unemployment rate, which I will call the (minimum) long-run sustainable unemployment rate. Furthermore, the inflation rate, $\pi_t$, and the unemployment rate, $u_t$, can be seen as the two target variables of monetary policy (target variables are the variables that enter the loss function). Here we should not forget the important difference, mentioned above, that the target for inflation, $\pi^*$, is determined by the FOMC, but the target for unemployment, the long-run sustainable unemployment rate, $u^*$, is *estimated*, not determined, by the FOMC, because it is determined largely by nonmonetary structural factors beyond the control of monetary policy.[8]

This quadratic loss function thus implies the independent stabilization of inflation around the inflation target and the unemployment rate around the longer-run normal rate. Furthermore, in line with the quotes above of Yellen (2012), Bernanke (2015b), and Clarida (2019), the two objectives have equal weight in the loss function. Given this, it is arguably a good representation of the dual mandate. A quadratic loss function of inflation and unemployment can also be derived as a quadratic approximation to household welfare in some simple models. But this is less relevant here. The relevant property here is that the loss function is a good representation of the Federal Reserve's legislated mandate.

In a given quarter $t$, the mandate for the future can then be formalized as setting monetary policy so as to minimize the intertemporal loss function

$$\mathrm{E}_t \sum_{\tau=0}^{T} \delta^\tau L_{t+\tau} = \mathrm{E}_t \sum_{\tau=0}^{T} \delta^\tau [(\pi_{t+\tau} - \pi^*)^2 + (u_{t+\tau} - u^*)^2], \tag{3}$$

where $\mathrm{E}_t$ denotes FOMC expectations conditional on its information in quarter $t$, $T$ denotes a finite horizon (measured in quarters), and $\delta$ is a discount factor that satisfies $0 < \delta \leq 1$ and in practice is very close to or equal to one.[9]

[8] Because the FOMC's estimate of the long-run sustainable rate may change over time, it could be indexed by the quarter of the latest estimate.

[9] The horizon, $T$, can in theory be infinite, but in practice it is finite, for example, 20 quarters. Central banks often publish forecasts for up to 12 quarters. A finite horizon also implies that the intertemporal loss function converges not only for $0 < \delta < 1$ but also for $\delta = 1$.

# 3 Fulfilling the mandate

What rule for the FOMC's monetary policy setting may then effectively fulfill the Federal Reserve's mandate over time? That is, what rule would minimize the intertemporal loss, (3)? Here, given the problems of Taylor-type rules noted in section 1 (examined in more detail in Svensson (2003b)), I consider more general rules, rules in the sense of "prescribed guides for monetary policy."

Let us simplify somewhat by considering a situation of normal times, when the Federal Reserve is not doing any active balance-sheet policy but is only using the policy (interest) rate, currently the federal funds rate, as its policy variable. Furthermore, let us, as above, consider inflation and unemployment as the two target variables.[10]

Two important circumstances then need to be taken into account. First, monetary policy actions tend to influence economic activity and prices with a lag. Monetary policy has a small or zero impact on inflation and unemployment in the current quarter. The major impact is in future quarters. Therefore monetary policy is more effective in fulfilling its mandate if it is guided by *forecasts of future inflation and unemployment* rather than (estimates of) current inflation and unemployment.[11]

Second, the current policy rate has a very small direct impact on economic activity and prices. What matters for economic activity and prices is instead market expectations of future policy rates. These expectations affect longer-term interest rates and asset prices, which in turn have an impact on activity and prices. It is the entire expected path of future policy rate that affects economic activity, not policy rate over the next few days and weeks.

## 3.1 The monetary policy decision

It follows that an effective monetary policy decision cannot only consist of setting the current policy rate; it must explicitly or implicitly also involve the selection of an expected path for the future policy rate. Given this, the rule for the FOMC that would best fulfill its mandate is to select a policy-rate path such that, conditional on this path and current information about the economy, the resulting forecasts for inflation and unemployment "look good." Here, "looking good" means best fulfilling the Federal Reserve's mandate, that is, best stabilizing inflation around its target

[10] That is, under the assumption that the labor market participation rate is approximately independent of monetary policy. If it is not, the loss function should be expressed in terms of the employment rate instead of the unemployment rate.

[11] One should remember that current inflation and unemployment are not directly observed in real time. The numbers published by statistics authorities are therefore also estimates, "nowcasts," of the "true" current inflation and unemployment.

and unemployment around its long-run sustainable rate.

Let me make this a bit more precise with some notation and definitions, following Svensson (2011). First, let $i^t \equiv (i_{t,t}, i_{t+1,t}, ..., i_{t+T,t}) \equiv \{i_{t+\tau,t}\}_{\tau=0}^{T}$ denote the policy-rate path in the current quarter $t$. Here $i_{t,t}$ denotes the current policy rate and $i_{t+\tau,t}$ for $\tau = 1, 2, ..., T$ denotes the FOMC's quarter-$t$ forecast of, or plan for, the policy rate in future quarters $t+\tau$. Second, let $\pi^t \equiv \{\pi_{t+\tau,t}\}_{\tau=0}^{T}$ and $u^t \equiv \{u_{t+\tau,t}\}_{\tau=0}^{T}$ denote the FOMC's forecasts of inflation and unemployment.

Under forecast targeting, these forecasts should be (probability) mean forecasts, not modal forecasts. Modal forecasts imply a rather bizarre "perfectionist" loss function, which is difficult to defend (Svensson, 2003a, section 6). Note that, relative to a modal forecast, a mean forecast can be seen as a risk-adjusted forecast. Mean forecasts are sufficient for optimal policy if the conditions for so-called certainty equivalence are fulfilled (a linear model, additive shocks, and a quadratic loss function). It is not obvious to what extent mean forecast targeting (relying on certainty equivalence and hence only on mean forecasts) is still an acceptable approximation when there is model uncertainty, multiplicative uncertainty, and so on (Brainard, 1967; Söderström, 2002). Depending on the precise nature of the uncertainty, optimal policy may be more or less aggressive than the certainty equivalent policy. My experience is that, in many practical situations, the information available is not sufficient to decide in what direction optimal policy deviates from the certainty-equivalent one, in which cases I find it justified to stay with the certainty-equivalent policy. The main exception is the nonlinearity caused by the ELB on nominal interest rates. When there is a risk that the ELB will bind in the future, policy should—all else being equal—normally be more expansionary than the certainty-equivalent one. The central bank should not "keep its powder dry." The ELB will not prevent the central bank from tightening policy in response to future positive shocks that increase inflation and reduce unemployment. But it may prevent the central bank from easing policy sufficiently in response to future large negative shocks. This results in a downward (upward) bias and volatility of future inflation (unemployment) that—all else being equal—justifies some current policy easing, so as to increase the future distance to the ELB and thereby reduce the risk of a future binding ELB (Reifschneider and Willams, 2000; Williams, 2019).[12]

Third, define the forecast loss, $L_{t+\tau,t}$, as

$$L_{t+\tau,t} = (\pi_{t+\tau,t} - \pi^*)^2 + (u_{t+\tau,t} - u^*)^2. \tag{4}$$

It represents the loss from deviations of quarter-$t$ forecasts of quarter-$(t+\tau)$ inflation and unem-

[12] Clouse (2018) provides a pedagogical discussion of some of these issues.

ployment from, respectively, the inflation target and the long-run sustainable unemployment rate. Then the quarter-$t$ intertemporal forecast loss, $\mathcal{L}_t$, is given by

$$\mathcal{L}_t = \sum_{\tau=0}^{T} L_{t+\tau,t} = \sum_{\tau=0}^{T} (\pi_{t+\tau,t} - \pi^*)^2 + \sum_{\tau=0}^{T} (u_{t+\tau,t} - u^*)^2, \tag{5}$$

where the discount factor, $\delta$, for simplicity has been set equal to one.

Furthermore, the deviations of the inflation forecast from its target and the unemployment forecast from its long-run sustainable rate can be measured by the mean-squared gaps for inflation and unemployment, defined as follows. The intertemporal forecast loss, (5), divided by the horizon, can be written

$$\mathcal{L}_t/T = \mathrm{MSG}_t^{\pi} + \mathrm{MSG}_t^{u}, \tag{6}$$

where $\mathrm{MSG}_t^{\pi}$ and $\mathrm{MSG}_t^{u}$ denote the mean squared gaps (MSGs) for, respectively, inflation and unemployment and are defined as

$$\mathrm{MSG}_t^{\pi} \equiv \sum_{\tau=0}^{T} (\pi_{t+\tau,t} - \pi^*)^2/T, \tag{7}$$

$$\mathrm{MSG}_t^{u} \equiv \sum_{\tau=0}^{T} (u_{t+\tau,t} - u^*)^2/T. \tag{8}$$

Thus, the MSG for a variable is the average deviation of the forecast of the future variable from the target for the variable. A smaller MSG for a variable indicates better mandate fulfillment for the variable, with a zero MSG indicating (unlikely) perfect mandate fulfillment.[13]

Given this, the rule for the FOMC that would best fulfill its mandate is to select a policy-rate path, $i^t$, so that that, conditional on this path and current information about the economy and prices, the shocks hitting the economy, and the transmission mechanism of monetary policy, the resulting forecasts for inflation, $\pi^t$, and unemployment, $u^t$, "look good". Here, "looking good" means "mandate-consistent," in the sense of mitigating the deviations of the inflation and unemployment forecasts from, respectively, the inflation target and the long-run sustainable unemployment rate; more precisely, minimizing the sum of the MSGs of inflation and unemployment, (6). Equal weight on the MSGs indicate a "balanced approach."

Forecasts of inflation and unemployment can be generated with the methods of anticipated alternative policy-rate paths of Laséen and Svensson (2011) or of unanticipated policy interventions of Leeper and Zha (2003) , or a combination of the two methods. Svensson (2005) shows how to

[13] Division by the horizon $T$ to get mean squared gaps instead of cumulative squared gaps is not necessary but allows a convenient analogy with the well-known concept of mean squared errors in statistics.

incorporate judgment in a systematic way. In particular, determinacy in a forward-looking setting requires a terminal condition on a given policy-rate path, which is further discussed in section 3.5.

Note that setting monetary policy to minimize the deviations of the *forecasts* from their targets means that the forecasts of inflation and unemployment are effectively used as *intermediate* target variables for inflation and unemployment, the actual target variables. Using forecasts as intermediate target variables justifies the name *forecast targeting*.[14]

This decision-making process means that the monetary policy decision takes into account all relevant new and old information available to the FOMC, including information about the economic activity and prices, the inferred shocks hitting the economy, and how the inflation and unemployment forecasts depend on the policy-rate path, that is, the transmission mechanism of monetary policy.

More precisely, the decision-making process means that new information is "filtered through the forecasts," and such filtering determines what information is relevant for the decision. New information that for a given policy-rate path affects the forecasts of inflation and unemployment is relevant for the decision; new information that does not affect the forecasts for a given policy-rate path is not relevant for the decision.

The policymakers need to have a view or a "model" of the transmission mechanism and the determination of future inflation and unemployment. But this does not have to be a singular model such as the Federal Reserve's FRB/US or the Riksbank's RAMSES. Instead it is a general view and understanding of the working of the macro economy and monetary policy, inspired by a set of several models and a large set of research results. It is the kind of general understanding of the macro economy that most senior and experienced macro economists would have. It is also the understanding that any particular issue may be well represented by a particular model, but every model is a simplification for a particular purpose, and no single model is enough for all purposes. In particular, forecasts and policy decisions cannot rely on models and simple observable data alone. All models are drastic simplifications of the economy, and data give an imperfect view of the state of the economy. Therefore, judgmental adjustments in both the use of models and the interpretation of their results—adjustments due to information, knowledge, and views outside the scope of any particular model—are a necessary and essential component in modern monetary policy (Svensson, 2005).

[14] The idea that inflation targeting implies that the inflation forecast becomes an intermediate target was introduced in King (1994). The term "inflation-forecast targeting" was introduced in Svensson (1997), and the term "forecast targeting" in Svensson (2003b).

Furthermore, this decision-making process involves continuing updating and learning about the state and working of the economy and the transmission process of monetary policy. Indeed, I would like to argue that this decision-making process is fully consistent with what is called Bayesian learning and Bayesian optimal policy. A Bayesian optimal policy involves in this context not only choosing a policy-rate path (and any other policy instruments) so as to minimize an intertemporal loss function, conditional on all relevant prior and new information, including all information about the state of the economy and the outlook for relevant exogenous variables, as well as continuous learning by Bayesian signal extraction and updating. It also includes taking into account the different possible models of the transmission mechanism and the probabilities that they are correct, other aspects of model uncertainty, judgment, scientific evidence, practical experience, and so on. Indeed, such Bayesian optimal policy is arguably the most robust monetary policy among available alternatives.[15]

## 3.2 An example of forecast targeting vs. the Taylor rule

An example from Svensson (2005) can illustrate the importance of taking all relevant information into account. In this example, the new relevant information is information about future inflation and demand shocks. Two empirical models of the US economy are used.

### 3.2.1 A backward-looking model

The Rudebusch and Svensson (1999) backward-looking estimated model of the US economy has two equations for inflation and the output gap. By assuming an Okun coefficient of 2, the output-gap equation can be converted to an unemployment-gap equation, using the simplified relation $u_t = -y_{t/2}$, where $u_t$ and $y_t$ here denote the unemployment gap and output gap, respectively, measured in percentage points. Then the equations for the inflation rate and the unemployment gap are (with converted estimates rounded to two decimal points)

$$\pi_{t+1} = 0.70\,\pi_t - 0.10\,\pi_{t-1} + 0.28\,\pi_{t-2} + 0.12\,\pi_{t-3} - 0.28\,u_t + z_{\pi,t+1} \tag{9}$$

$$u_{t+1} = 1.16\,u_t - 0.25\,u_{t-1} + 0.05\,(\Sigma_{j=0}^{3} i_{t-j}/4 - \Sigma_{j=0}^{3}\pi_{t-j}/4) + z_{u,t+1}. \tag{10}$$

The period is a quarter, $\pi_t$ denotes quarterly GDP inflation measured in percentage points at an annual rate, and the policy rate, $i_t$, is the quarterly average of the federal-funds rate, measured in percentage points at an annual rate. All variables are measured as differences from their

[15] See the discussion in Svensson (2013) of the robust interest rules promoted in Orphanides and Wieland (2013) for more about the properties of forecast targeting and Bayesian optimal policy.

means, their steady-state levels. Furthermore, $z_{\pi,t+1}$ and $z_{u,t+1}$ denote shocks to inflation and the unemployment gap in quarter $t+1$.

The period loss function used in the optimization is

$$L_t = \pi_t^2 + u_t^2 + 0.2(i_t - i_{t-1})^2, \tag{11}$$

where $\pi_t$ inflation is measured as the difference from the inflation target, so the steady state of inflation is assumed to equal the inflation target. The discount factor, $\delta$, is set to unity. As in Rudebusch and Svensson (1999), a modest weight on interest-rate smoothing is added as a convenient way not to get unrealistically large policy-rate movements.[16] Standard impulse responses to current shocks are shown in figure 5 in the appendix.

Figure 1 shows a situation in which, before and including quarter 0, inflation has equaled the target, the unemployment gap has equaled zero, and all inflation and demand shocks have been zero. Furthermore, the central bank's expectations—that is, its probability means—of future shocks have all been zero (although the perceived variance of the shocks may be significant).

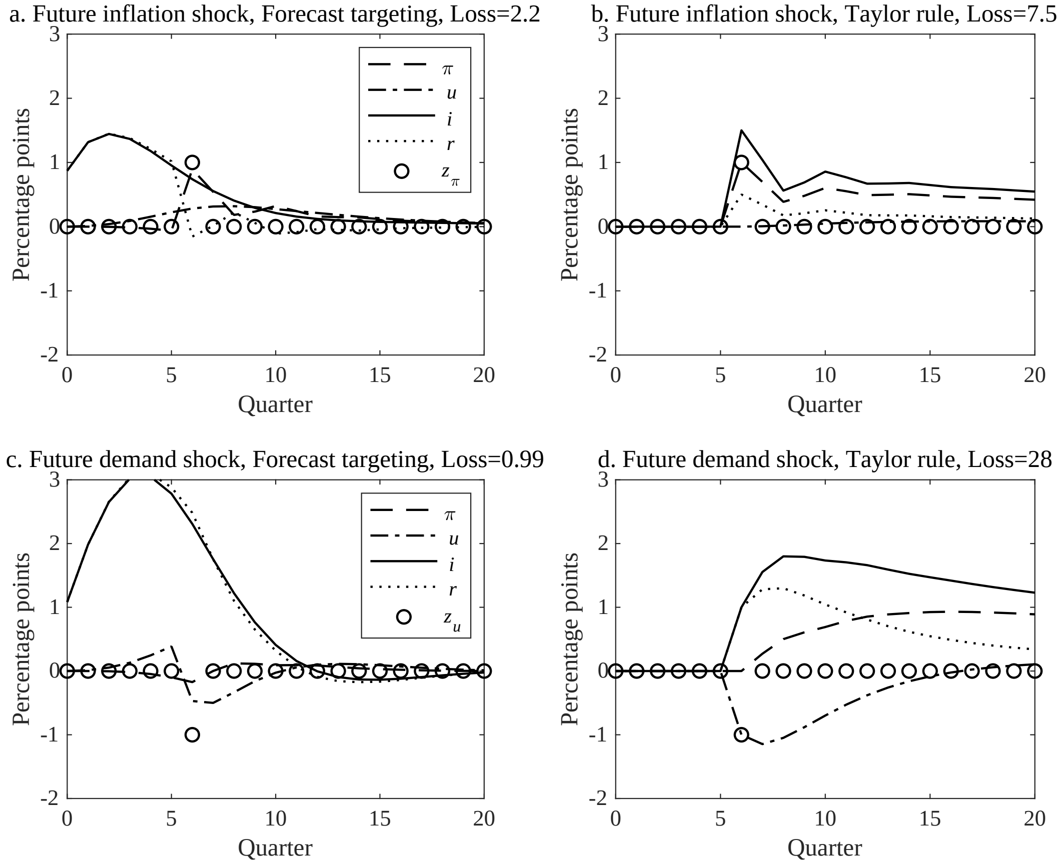
Panel a refers to a situation in which the central bank receives new information in quarter 0 that makes it expect an inflation shock in quarter 6 with a mean of 1 percentage point, whereas expected inflation shocks for all other quarters and expected unemployment shocks for all quarters remain zero. The circles in panel a show the expected inflation shocks. Behind these expected shocks could be a perceived probability distribution of future realizations with substantial variance.

The central bank is assumed to conduct optimal forecast targeting, taking into account the new information about a future expected shock to inflation. Given this, panel a has two interpretations. In the first interpretation, it shows the central bank's expectations in quarter 0 of the future inflation shocks, $z_\pi^0 \equiv \mathrm{E}_0(z_{\pi 1}, z_{\pi 2}, ..., z_{\pi T}) \equiv (z_{\pi 1,0}, z_{\pi 2,0}, ..., z_{\pi T,0}) \equiv \{z_{\pi\tau,0}\}_{\tau=1}^T$ as well as the central bank's optimal policy-rate path in quarter 0, $i^0 \equiv \{i_{\tau,0}\}_{\tau=0}^T$, and the corresponding optimal policy projection for inflation, $\pi^0 \equiv \{\pi_{\tau,0}\}_{\tau=0}^T$, unemployment, $u^0 \equiv \{u_{\tau,0}\}_{\tau=0}^T$, and real interest rate, $r^0 \equiv \{r_{\tau,0}\}_{\tau=0}^T$.[17] In the second interpretation, it shows the impulse responses starting in quarter 0 to an expected positive inflation impulse in quarter 6. That is, it shows the time series of the realizations of the policy rate, inflation, and unemployment for the particular realizations of the future inflation and unemployment shocks that are exactly equal to the central-bank's expectations in quarter 0.

[16] Using the quarterly inflation rate at an annual rate is a simplification. Using a 4-quarter inflation rate would be closer to the Federal Reserve's mandate. The main points of the example are not affected by the simplification.

[17] In the Rudebusch and Svensson (1999) model, the real interest rate that affects the unemployment gap and is plotted in figure 1 is $r_t = i_t - \pi_t$, that is, the policy rate minus the current inflation rate.

Figure 1: Forecast targeting and the Taylor rule: Backward-looking model




Note: The period loss function is $L_t = \pi_t^2 + u_t^2 + 0.2(i_t - i_{t-1})^2$. The Taylor rule is $i_t = 1.5\,\pi_t - u_t$. The real interest rate that affects the unemployment gap in the Rudebusch and Svensson (1999) model is $r_t = i_t - \pi_t$, which is plotted in the figure. The intertemporal loss reported excludes the interest-rate term, which is small. See Svensson (2005) for details.

Using the second interpretation, we see that the central bank raises the policy rate preemptively from quarter 0, in order to contain the future inflation shock. This causes the unemployment gap to increase somewhat, but inflation is contained. When the inflation shock arrives in quarter 6, inflation jumps one percentage point but falls back towards the target in a couple of quarters. The unemployment gap slowly falls back to zero. The total intertemporal loss, (5), is 2.2 units (including only the inflation and unemployment terms and excluding the term corresponding to interest-rate smoothing, which is in any case small in these simulations).

Panel b refers to a situation in which the central bank just follows the standard Taylor rule, (1), suggested by the CHOICE and FORM Acts.[18] Expressed in terms of the unemployment gap, under

[18] Using the quarterly inflation rate at an annual rate instead of the 4-quarter inflation rate in the Taylor rule is a simplification but does not affect the main points of the example.

the maintained assumption of an Okun coefficient of 2, it is

$$i_t = 1.5\,\pi_t - u_t. \tag{12}$$

Under the Taylor rule, the central bank does not move the policy rate until inflation or unemployment moves. It raises the policy rate by 1.5 percentage points in quarter 6 when the inflation shock hits. But the Taylor rule puts the central bank behind the curve. It only slowly increases unemployment and slowly brings inflation back towards the target. The loss is 7.5 units, substantially larger than under forecast targeting.[19] This is due to both to the lack of preemptive policy with the Taylor rule and to the modest tightening that the Taylor rule implies once the inflation shock occurs. The policy rate is only raised a modest amount above the increased inflation, and the real interest rate increases only a little. In contrast, in panel a, the policy rate is raised substantially before the shock while inflation is flat, so the real interest rate rises substantially. The backward-looking Rudebusch-Svensson model has substantial inertia and autocorrelation in both inflation and unemployment, and optimal policy involves strong preemptive movements to keep inflation close to target and the unemployment gap close to zero.

Panel c shows the situation in which the central bank in quarter 0 instead receives new information about a future positive demand shock in quarter 6, which is assumed to result in an expected negative unemployment shock of 1 percentage point. Optimal preemptive policy involves a substantial tightening and rise of the real interest rate that succeeds in stabilizing inflation close to the target as well as stabilizing the unemployment-gap movements. The loss is 1.0 units.

Panel d shows that, in this case, the Taylor rule raises the real interest later and less, which stabilizes inflation and unemployment much less than forecast targeting. The lack of preemptive policy before the shock and the modest effectiveness once the shock has occurred allows inflation to rise and stay above the target for a considerable time. Again, the central bank gets behind the curve. The loss is a large 28 units.

What if the expected shock does not materialize? Consider the top two panels, showing the impulse responses to the new information in quarter 0 about the expected future inflation shock in quarter 6. Suppose there are no realizations of current shocks and no further information about expected future shocks through quarter 5. Then the economy would develop according to the panels through quarter 5. Suppose then, in (the beginning) of quarter 6, that the expected shock does not materialize.

[19] The losses reported include any losses beyond the quarter-20 forecast horizon.

The shock not materializing is equivalent to receiving the expected inflation shock of 1 percentage points but also at the same time an unanticipated inflation shock of $-1$ percentage point. Under forecast targeting in panel a, the appropriate policy response is equal to the negative of the policy-rate impulse response of a current 1 percentage point inflation shock. It is the negative of the impulse response shown in panel a in figure 5. Thus, the negative of the impulse responses in figure 5 is shifted 7 quarters to the right, to quarter 6, and then added to the impulse responses to the expected future shock in panel a of figure 1.

For the Taylor rule in panel b of figure 1, the unexpected negative inflation shock cancels the expected shock, and neither inflation, GDP, and the policy rate changes. Put differently, the impulse responses in panel b starting in quarter 6 are equal to the negative policy responses starting in quarter 0 in panel b of figure 5.

Similarly, in panel c of figure 1, if the expected demand shock does not materialize, the response under forecast targeting are given by adding the appropriately scaled and shifted negative of the impulse responses in panel c of figure 5.

This is a very special case of an expected future shock and later a current unexpected shock that exactly cancels the expected shock. More realistically, there would be new information about current and expected future shocks every quarter. For instance, expectations about future shocks in a particular future quarter would be updated over time. Forecast targeting would adjust the policy-rate path and the forecasts of inflation and GDP, taking into account both current and expected future shocks. The Taylor rule would just respond to shocks that affect current inflation and GDP.

#### 3.2.2 A forward-looking model

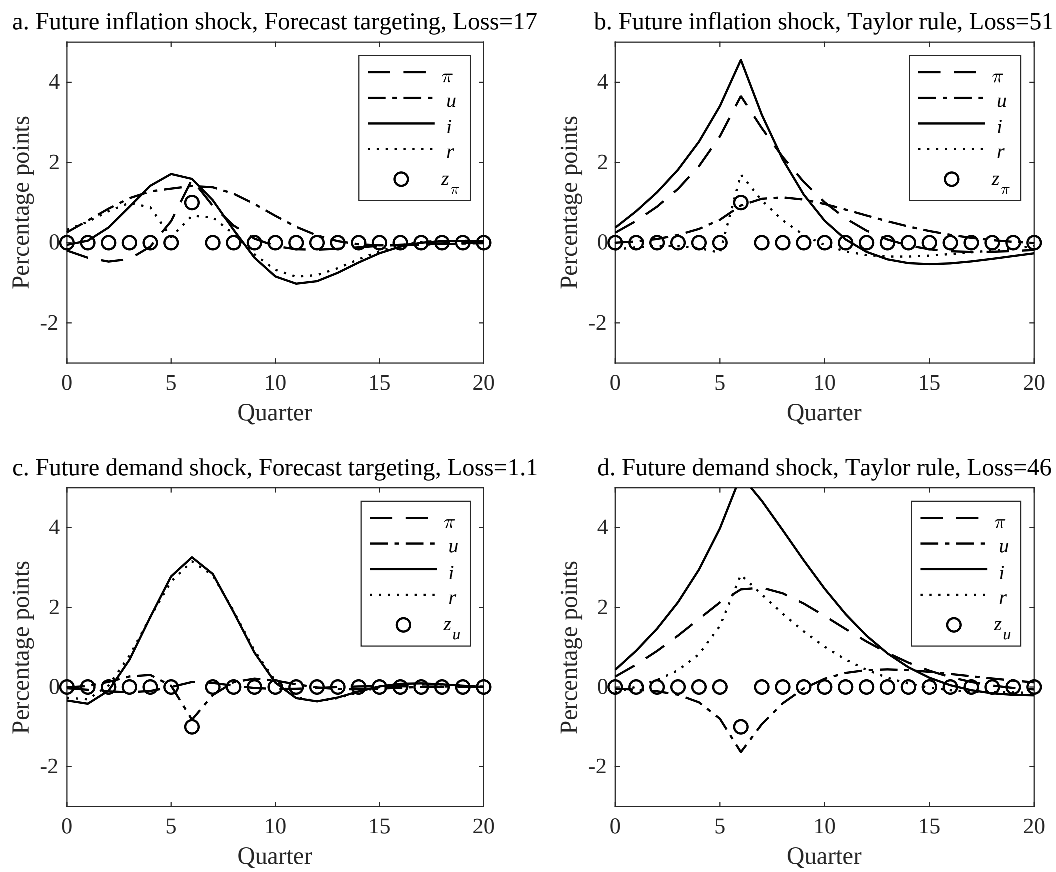
The forward-looking estimated New Keynesian model of Lindé (2005) of the US economy also has two equations for the inflation rate and the output gap. With the assumption of an Okun coefficient of 2, it can be expressed in terms of the unemployment gap, with the following (converted) parameter estimates,

$$\pi_t = 0.457\, \pi_{t+1|t} + (1 - 0.457)\, \pi_{t-1} - 0.096\, u_t + z_{\pi t}, \tag{13}$$

$$u_t = 0.425\, u_{t+1|t} + (1 - 0.425)\, u_{t-1} + 0.078\, (i_t - \pi_{t+1|t}) + z_{ut}, \tag{14}$$

where $\pi_{t+1|t}$ and $u_{t+1|t}$ denote private-sector rational expectations in quarter $t$ of inflation and unemployment in quarter $t+1$. Standard impulse responses to current shocks are shown in figure 6 in the appendix.

Figure 2: Forecast targeting and the Taylor rule: Forward-looking model




Note: Forecast targeting minimizes the loss function $L_t = \pi_t^2 + u_t^2 + 0.2(i_t - i_{t-1})^2$. The Taylor rule is $i_t = 1.5\,\pi_t - u_t$. The real interest rate that affects the unemployment gap in the Lindé (2005) model is $r_t = i_t - \pi_{t+1|t}$, which is plotted in the figure. The intertemporal loss reported excludes the interest-rate term, which is small. See Svensson (2005) for details.

Panel a in figure 2 shows the same situation for the central bank as in panel a in figure 1. The central bank has in quarter 0 received new information that results in an expected positive inflation shock of 1 percentage point in quarter 6. Furthermore, the private sector has received the same information about the future shock, either independently or conveyed by the central bank, and have the same expectations as the central bank.

Optimal forecast targeting again involves preemptive policy. Policy tightening raises the unemployment gap and shortens the period of inflation overshooting the target. The loss is 17 units.

Panel b shows the outcome under the Taylor rule. Because the private sector is forward-looking and takes the future inflation shock into account, inflation increases substantially above the target before the shock arrives. Thus, the Taylor rule raises the policy rate and involves some indirect preemptive policy. However, the private sector is even more preemptive in raising inflation substantially, and the real interest rate does not move until the inflation shock occurs, after which inflation falls.[20] The central bank is again behind the curve, the policy tightening in terms of the real interest rate is too late and too small, and a large overshoot of inflation results. The loss is a large 51 units.

Panel c again shows the situation in which the central bank and the private sector have received information about a positive demand shock and a corresponding expected negative unemployment shock of 1 percentage point in quarter 6. The optimal policy projection, taking this information into account, is to raise the policy rate before the expected unemployment shock, which moderates the expected impact on the unemployment gap. The inflation projection remains very flat, and the real interest rate is close to the policy rate. The resulting intertemporal loss is very small, 1.1.

Panel d shows that the private sector reduces the unemployment gap and increases inflation in anticipation of the future demand shock. The Taylor rule then raises the policy rate substantially. The increase in the real interest rate is also substantial. But the increase is nevertheless too late compared to forecast targeting and as a result the central bank is also here behind the curve. A large overshoot of inflation and a substantial undershoot of the unemployment gap result. The loss is large, 46 units, especially in comparison with the small loss from the unemployment shock under forecast targeting.

As discussed above for the backward-looking model, the case when the expected shock does not materialize is equivalent to an unexpected negative shock that cancels the expected shock. The outcome can be shown by adding the appropriately shifted negative impulse responses in figure 1. The loss is less if the expected shock does not materialize. The Taylor rule does much worse than forecast targeting, regardless of whether expected shock materializes or not.

In summary, these results indicate that the Taylor rule performs considerably worse than forecast targeting when there are expected future shocks.

In these two examples, the optimal policy-rate path and the forecasts of inflation and unemployment under forecast targeting are for simplicity generated by two given models, where information about expected future shocks are taken into account. In practical applications of forecast targeting, the policy-rate path and forecasts of the target variables would normally be generated by a combination of model simulations from several models as well as from a substantial application of

[20] Recall that the forecast in quarter 0 of the real interest rate in quarter $t$ is $r_{t,0} = i_{t,0} - \pi_{t+1,0}$, the policy-rate forecast minus the inflation forecast leaded 1 quarter.

judgment—that is, information, knowledge, and views outside the scope of a particular model.

### 3.3 Implementation

The decision under forecast targeting selects the policy-rate path and inflation and unemployment forecast that, *if believed by the market and other economic agents*, best fulfills the mandate. A successful implementation of the selected policy involves making the policy-rate path credible, in sense of market expectations aligning with the policy-rate path. The policy-rate path can be seen as representing the FOMC's *intended* monetary policy, or *intended* financial conditions. Market expectations of future policy rates and resulting market yield curves for different assets can be seen as the *actual* monetary policy, the *actual* financial conditions. The implementation of monetary policy involves trying to make the actual financial conditions equal to the intended financial conditions.

However, not only market expectations of the future policy rate but also economic agents' expectations of future inflation, unemployment, GDP and other economic variables matter. In particular, if the FOMC manages to make the inflation target credible, in the sense of making economic agents' inflation expectations align with the inflation target, stabilization of inflation around its target is much easier, because economic agents' individual decisions that result in (economy-wide) inflation are much influenced by the agents' expectations of (economy-wide) inflation.[21]

The most effective contribution to making the policy-rate path and inflation forecasts credible is to publish them and justify the decision. In addition to justifying how new information since the last decision has affected the forecasts and the selected policy-rate path, the justification of the decision may include the publication of inflation and unemployment forecasts for alternative policy-rate paths different from the selected one and the demonstration that these forecasts do not fulfill the mandate to the same extent. That demonstration may use MSGs for inflation and unemployment as quantitative measures of the degree of mandate fulfillment.

### 3.4 The forecast-targeting rule summarized

The forecast-targeting rule can be summarized as these three steps:

1. For a given initial policy-rate path (for example, the policy-rate path from the previous decision), construct new inflation and unemployment forecasts, taking into account new information received since the previous decision.

[21] See Svensson and Woodford (2005) for details.

2. If the new inflation and unemployment forecasts "look good" (meaning best fulfilling the mandate), select the given policy-rate path as the decision; if the new inflation and unemployment forecasts do not look good, adjust the policy-rate path so that they do look good.

3. Publish the policy-rate path and inflation and unemployment forecasts and justify the decision in order to make the published path and forecasts credible, meaning making market participants' and other economic agents' expectations align with the published path and forecasts. The justification of the decision may include the publication of inflation and unemployment forecasts for alternative policy-rate paths different from the selected one and the demonstration that these forecasts do not fulfill the mandate to the same degree. MSGs for inflation and unemployment as quantitative measures of the degree of mandate fulfillment may be used.

### 3.5 Determinacy

By the well-known result of Sargent and Wallace (1975), for an exogenous policy rate the (rational-expectations) equilibrium in a forward-looking model may be indeterminate. It is therefore necessary to make sure that any selection and announcement of a policy rate and policy-rate path under forecast targeting with the help of a forward-looking models do not encounter the problem of indeterminacy.

Uniqueness of policy simulations with exogenous policy-rate paths in forward-looking models can be ensured by two alternative terminal conditions at a future terminal horizon at quarter $\bar{T}$, beyond the horizon at quarter $T$ for the published forecasts. One terminal condition is that policy switches to a given reaction function for which the equilibrium is unique—for example, the optimal reaction function without any judgmental modifications. Alternatively, the forecasts of inflation and unemployment are restricted to reach a steady state in which they are equal to, respectively, the inflation target and the long-run sustainable unemployment rate, that is, $\pi_{t+\bar{T},t} = \pi^*$ and $u_{t+\bar{T},t} = u^*$. The terminal horizon is then extended until the forecasts for inflation and unemployment within the forecast horizon have converged and are no longer sensitive to the terminal horizon (see Svensson, 2005; Svensson and Tetlow, 2005; Laséen and Svensson, 2011).

However, there is a further indeterminacy issue, which is discussed in detail in Svensson and Woodford (2005) and summarized in Svensson (2011, section 3.7). The announcement of a policy rate and a policy-rate path (also if they are consistent with an optimal reaction function) and corresponding forecasts of inflation and unemployment may, even if these are credible with economic agents and their expectations are aligned with the announcement, not be sufficient to ensure determinacy. This can be understood by noting that the optimal policy-rate under commitment will be a function of present and past exogenous shocks and thereby in the end be exogenous and subject to the Sargent and Wallace (1975) result. In this case, an explicit or implicit out-of-equilibrium commitment—understood by and credible with the economic agents—may be required. Such a commitment is typically quite intuitive, such that it is understood that the central bank will—all else being equal—raise (lower) the actual policy rate sufficiently above (below) the previously announced policy-rate path, if realized inflation exceeds (falls short of) the forecast or realized unemployment falls short of (exceeds) the long-run sustainable unemployment rate. Such a commitment can thus be seen as a kind of Taylor principle applied to realized deviations of inflation and unemployment from the previous forecasts.[22]

### 3.6 Time consistency

There is another somewhat technical issues that need to be sorted out, namely time consistency. In forward-looking models, or more generally in situations in which economic agents' decisions depend on their expectations of future outcomes, there is a well-known time-consistency problem. The time-consistency problem implies that optimization under commitment, that is, optimization under commitment to a future history-dependent policy, is normally better than optimization under discretion, that is, reoptimization in the future without any such commitment (Backus and Driffill, 1986; Currie and Levine, 1993). Woodford (1999) has suggested optimization "in a timeless perspective" as a possible solution to this.

The issue of time-consistency in this context is discussed in detail and resolved in Svensson and Woodford (2005) and summarized in Svensson (2011, section 3). The desired history dependence under commitment can be imposed in two ways. First, the intertemporal forecast loss, (5), can be modified by the addition of a term that represents the cost of deviating from previously announced policy. The MSGs, (7) and (8), can then be adjusted by adding to each MSG this term divided by $2T$.[23] Alternatively, as shown in Giannoni and Woodford (2003) and Svensson and Woodford

[22] Similar results as in Svensson and Woodford (2005) have later appeared in Atkeson, Chari, and Kehoe (2010).
[23] The intertemporal forecast loss, (5), is then replaced by

$$\mathcal{L}_t = \sum_{\tau=0}^{T}(\pi_{t+\tau,t} - \pi^*)^2 + \sum_{\tau=0}^{T}(u_{t+\tau,t} - u^*)^2 + \ell_t, \tag{15}$$

where $\ell_t$ is the cost of deviating from previous promises, more precisely a history-dependent function of the difference between the quarter-$t$ realization of the forward-looking variables and the previous forecasts and expectations of these

(2005) and summarized in Svensson (2011), a history-dependent restriction on the policy-rate path and the forecasts can be added. This means that (5) is minimized for a restricted set of policy-rate paths and forecasts that satisfy this restriction in addition to the equations of the model used; see Svensson (2011, equations (28) and (29)). If the FOMC decides to restrict its policy choices to those consistent with such commitment, the Federal Reserve staff would then present policy alternatives that either have modified MSGs or are subject to the restriction mentioned.

Alternatively, the FOMC may decide that commitment and related history dependence is unenforceable and impractical. Then the policy simulations can be done under the assumption of discretion, as discussed in Svensson (2011, section 3.6). It may also be relevant to show policy simulation under both commitment and discretion, so as to examine how different they are and whether the difference is of any practical significance.

The transparency of forecast targeting, with the publication, explanation, and justification of policy-rate paths and forecasts of inflation and unemployment, should allow the FOMC a substantial degree of commitment, if it becomes established that deviations from previously published paths and forecasts only come with good explanations. Forecast targeting may imply a policy that is approximately optimal under commitment.

In a situation in which the policy rate is restricted by the ELB, a commitment to a policy-rate that is "lower for longer" is normally more effective in stimulating the economy by lowering longer-term interest rates. Such a commitment may involve a significant time-consistency problem. Enforcing a commitment in such situations is discussed in some detail in Bernanke (2017), including the role of a temporary price-level target path.

### 3.7 The reaction function

It is common to argue that central banks should convey their reaction function to the market participants and other economic agents. However, under forecast targeting the reaction function, meaning how the policy rate and the policy-rate path respond to information available to the central bank, is far too complex to write down as a simple formula such as a Taylor-type rule. It is actually

variables; see Svensson (2011, equation (26)). Then the definition of the MSGs, (7) and (8), is replaced by

$$\text{MSG}_t^\pi \equiv \sum_{\tau=0}^{T} (\pi_{t+\tau,t} - \pi^*)^2/T + \ell_t/(2T), \qquad (16)$$

$$\text{MSG}_t^u \equiv \sum_{\tau=0}^{T} (u_{t+\tau,t} - u^*)^2/T + \ell_t/(2T). \qquad (17)$$

too complex to write down, period—that is, as a mathematical function describing precisely how the policy rate responds to different kinds of information.

First, the reaction function is not just the current policy rate (a scalar) that is a function of a list of arguments. It is the current policy rate *and* the policy-rate path (a vector) that is a function of a list of arguments. Second, an explicit list of arguments, consisting of the possible pieces of information that the policy rate and policy-rate path may need to respond to, is too long to be conveyed. In particular, central banks cannot anticipate all future pieces of information and shocks that may occur and may be relevant to respond to. In terms of a model, the optimal reaction function will require responses to all the relevant state variables and the expected future shocks. In the real economy this is a very long and changing list. Third, it is impossible to specify in advance the appropriate magnitude of all the response coefficients, in particular for any new shocks appearing. Furthermore, the response coefficients will depend on specific circumstances at the time, including how persistent the shocks are judge to be, whether the transmission mechanism of monetary policy is judged to be weaker or stronger than usual, and so on.

As an example, even for the relatively simple completely specified backward-looking model with just two equations and information that only affects expected future shocks to inflation and unemployment, (9)–(11), the optimal reaction function, taking into account expected future shocks, is rather complicated. It is given by

$$i_t = F_i X_t + R_i z^t, \tag{18}$$

where $F_i$ is the row 9-vector of response coefficients to the column 9-vector of predetermined variables, $X_t \equiv (\pi_t, \pi_{t-1}, \pi_{t-2,}\pi_{t-2}, u_t, u_{t-1}, i_{t-1}, i_{t-2,}i_{t-3})'$.[24] Furthermore, $R_i z^t$ represents the response to the expected future shocks, $z^t = \{z_{t+1+\tau,t}\}_{\tau=0}^{\infty} \equiv \{\mathrm{E}_t z_{t+1+\tau}\}_{\tau=0}^{\infty}$, where $z_t = (z_{\pi t}, z_{ut})'$. It is given by the first element of the column 10-vector resulting from the linear operator $R$ given by

$$Rz^t = \sum_{\tau=0}^{\infty} R_\tau \left[ \begin{array}{c} \mathrm{E}_t z_{t+1+\tau} \\ 0_{7\times 1} \end{array} \right] = \sum_{\tau=0}^{\infty} R_\tau \left[ \begin{array}{c} z_{t+1+\tau,t} \\ 0_{7\times 1} \end{array} \right], \tag{19}$$

where the $10 \times 9$ matrices $\{R_\tau\}$ satisfy $R_\tau = HJ^\tau K$, $\tau = 0, 1, ...$, where the matrices $H$, $J$, and $K$ are outputs of the algorithm that solves for the optimal policy and depend on the parameters of the model and the loss function (see Svensson, 2005, online appendix, for details).[25]

[24] In this case, $F_i = (1.215, 0.408, 0.516, 0.167, -2.772, 0.673, 0.474, -0.064, -0.033)$.

[25] For expected inflation shocks up to 6 quarters ahead, the response coefficients are $\{\partial i_t / \partial z_{\pi,t+1+\tau,t}\}_{\tau=0}^{5} = (1.144, 1.083, 1.031, 0.983, 0.933, 0.872)$. For the expected unemployment shocks, they are $\{\partial i_t / \partial z_{u,t+1+\tau,t}\}_{\tau=0}^{5} = (-2.671, -2.514, -2.268, -1.926, -1.508, -1.083)$. Thus, $i_0 = 0.872$ in panel a of figure 1 and $i_0 = 1.083$ in panel c (in the latter case the expected shock is negative in quarter 6).

However, fortunately the reaction function can be conveyed in more general and approximate but still both systematic and simple terms. For example, if initially the forecasts look good, for any new piece of information that shifts the inflation forecast up (down) and/or shifts the unemployment forecast down (up) for a given policy-rate path, policy will normally be tightened (eased), meaning that the policy-rate path will shift up (down). If this response is understood by and credible with the market participants, any new information that is deemed to shift up (down) the inflation outlook or shift down (up) the unemployment outlook may result in a market response that shifts up (down) the yield curve (or, more precisely, a forward-rate curve such as the Overnight Index Swap (OIS) curve), even before the central bank has responded with the same shift in the policy-rate path.

Thus, with such behavior of the market, the market may do a good part of the work of the central bank before the central bank acts itself. In that case, it is of course important for maintaining credibility that the central bank completes the policy move by moving its policy rate and policy-rate path accordingly at the next decision. The publication and justification of the new policy-rate path and the forecasts will also be an opportunity to try to correct any over- or under-adjustment by the market. For this, it may be effective to let the justification includes how the central bank interprets how new information has shifted the forecasts of inflation and unemployment before any adjustment of the policy-rate path (corresponding to step 1 in the summary of the forecast-targeting policy rule in section 3.4).

In this case, to a naive observer, it may look like the central bank is to a large extent just following the market, whereas the truth is that a well-informed market to a large extent is anticipating the central bank's policy setting.

The central bank can convey the reaction function in these more general terms more explicitly by showing model simulations for alternative assumptions about the shocks and exogenous variables. For example, by showing a simulation with a larger future shock to inflation, the central bank can demonstrate that the optimal policy-rate path shifts up (as in the example in section 3.2). Similarly, by showing a simulation with a larger negative future shock to unemployment, it can show that the optimal policy-rate path shifts up also for this shock.

Such policy simulations showing optimal policy-rate paths and outcomes for alternative assumptions about exogenous variables and shocks can be called "alternative scenario" simulations. Their purpose is thus to illustrate how the central bank would respond to alternative exogenous shocks and new information.

It is worth noting that alternative-scenario simulations are conceptually different from simulations showing the outcome of/forecasts for inflation and unemployment for alternative policy-rate paths for given assumptions about the exogenous variables and shocks. These can be called "alternative policy" simulations. Their purpose is to justify the selected optimal policy-rate path by showing that alternative policy-rate paths—for example, tighter or looser policy—would be expected to lead to less good outcomes than the one selected. MSGs can be used for this purpose (section 4.1).

### 3.8 Forecast targeting, instrument rules, and targeting rules

A monetary policy rule can generally be defined as "a prescribed guide for monetary policy conduct."[26] Forecast targeting, summarized in a simplified way in section 3.4, is thus a monetary policy rule. However, most of the literature on monetary policy rules have used a more narrow interpretation of a policy rule, namely what can be called an *instrument rule*, in which the central bank's policy instrument, typically a short interest rate, is set as a given function of a given set of observable variables. In given model, the corresponding optimal reaction function—for example, (18) and (19)—can be seen as an optimal instrument rule. But the discussion has mostly focused on *simple* instrument rules, in which the policy instrument is set as a function of only a few variables. The best known is the Taylor (1993) rule, shown in (1). Similar simple instrument rules can be called Taylor-type rules.[27]

However, other rules are possible, such as *targeting rules* (a.k.a. target rules), that is, conditions

[26] Svensson (2003b) provides a more extensive discussion of monetary policy rules.

[27] Instrument rules can be divided into two categories, explicit instrument rules and implicit instrument rules (Svensson and Woodford, 2005; Svensson, 2003b). An *explicit instrument rule* is a reaction function where the instrument responds to predetermined variables only. Its implementation then consists of the central bank observing the predetermined variables in the beginning of the period, and then calculating, announcing, and setting the instrument according to this instrument rule. The implementation obviously requires that the relevant predetermined variables must be observed by the central bank, but since the predetermined variables in a particular period are independent of the instrument setting in that period, no further complications arise. An *implicit* instrument rule is a relation between the current instrument and some of the current forward-looking variables. Then, since the forward-looking variables depend on the instrument setting, the instrument and the forward-looking variables are simultaneously determined. Thus, an implicit instrument rule is actually an *equilibrium condition*, a relation that holds in equilibrium. The implementation of an implicit instrument rule, that is, how to get to the desired equilibrium, is not trivial but a complex issue. This fact has largely been overlooked in the literature, except, for example, in Svensson and Woodford (2005) and Svensson (2003b, 2005).

In the forward-looking model in section 3.2.2, the Taylor rule in (12) implies that the policy rate responds to the forward-looking variables inflation and unemployment, which in turn respond to the policy rate. That is, the Taylor rule is an implicit instrument rule and really a sophisticated equilibrium condition. A more realistic Taylor rule is when the policy rate responds to the lagged inflation and unemployment gap, making it an explicit instrument rule in the forward-looking model,

$$i_t = 1.5\,\pi_{t-1} - u_{t-1}. \qquad (20)$$

In the forward-looking model above, the explicit Taylor rule performs slightly worse than the implicit one.

for (the forecasts of) the target variables. One such rule is that policy should be set such that the inflation forecast is close to the inflation target at some specified horizon, such as two years. This rule is arguably too rigid to represent flexible inflation targeting and the dual mandate (Svensson, 1997). Another rule—consistent with the dual mandate—is that the forecasts of the inflation gap and the unemployment gap should normally have the same sign and be in reasonable proportion to each other until they close (Qvigstad, 2005).

An optimal targeting rule is a first-order condition for optimal monetary policy that involves the targeting variables only.[28] It corresponds to the standard efficiency condition of equality between the marginal rates of substitution and the marginal rates of transformation between the target variables, the former given by the monetary-policy loss function, the latter given by the transmission mechanism of monetary policy. An optimal targeting rule is invariant to everything else in the model, including additive shocks and judgment and the stochastic properties of additive shocks. Thus, it is a more compact and robust representation of optimal monetary policy, more robust than the optimal reaction function.

Targeting rules are called "target criteria" in Giannoni and Woodford (2003, 2017). They show that, with a quadratic loss function, it is always possible to rewrite the first-order condition for optimal policy as an optimal targeting rule that only contains target variables. As a well-known example, the standard New Keynesian model with only inflation and the output gap in the quadratic loss function has the simple and elegant targeting rule

$$\pi_t - \pi^* + \frac{\lambda}{\kappa}(y_t - y_{t-1}) = 0 \tag{21}$$

for optimal policy under commitment, where $\lambda$ is the relative weight on stabilizing the output gap in the loss function and $\kappa$ is the coefficient of the output gap in the New Keynesian Phillips curve.

The optimal targeting rule is simple and elegant in simple models, such as the forward-looking standard New Keynesian model or the simple backward-looking model of Svensson (1997).[29] They may therefore seem attractive as possible rules for monetary policy. However, in more realistic models with more lags, the optimal targeting rules become quite complicated linear combinations of several lags of (forecasts of) the target variables, with coefficients that depend in a more complicated way on the structure and coefficients of the models. In particular, deriving optimal targeting rules for the larger models actually used by central banks—such as the Federal Reserve's FRB/US or the

[28] Svensson and Woodford (2005), Svensson (2003b), and Giannoni and Woodford (2017) provide an extensive discussion of targeting rules.

[29] However, as noted in Svensson (2003b, section 5.4), they are quite different for simple backward- and forward-looking models.

Riksbank's RAMSES —would result in quite complicated targeting rules with many lags. Therefore, I consider optimal targeting rules from more realistic models non-operational, believe that it is so far unrealistic to use optimal targeting rules as guides for practical monetary policy, and that the simple and robust rule of forecast targeting is much preferable.[30]

# 4 Accountability

Can the FOMC be held accountable if it practices forecast targeting? Yes, forecast targeting can be scrutinized and reviewed by external observers if the Fed provides enough information. The Fed needs to publish the policy-rate path and forecasts of inflation and unemployment and justify that they are internally consistent as well as consistent with available information about the economy and its structure and dynamics. It also needs to demonstrate that alternative policy-rate paths—typically representing tighter and easier policy, respectively, than the selected policy—result in worse mandate fulfillment than the selected policy. These explanations, justifications, and demonstrations can be scrutinized and reviewed both in real time and after the fact—that is, after the outcome for inflation and unemployment have been observed—by external observers and experts and at the regular hearings in the Congressional oversight committees (Svensson, 2012).

## 4.1 An example: Reviewing the policy decision

The publication of the policy-rate path and forecasts of inflation and unemployment allows a review of the policy decision, especially if the result from alternative policy-rate paths is also published. An obvious criterion for an appropriate policy-rate path is that it should not be the case that a lower or higher policy-rate path leads to better mandate fulfillment.[31]

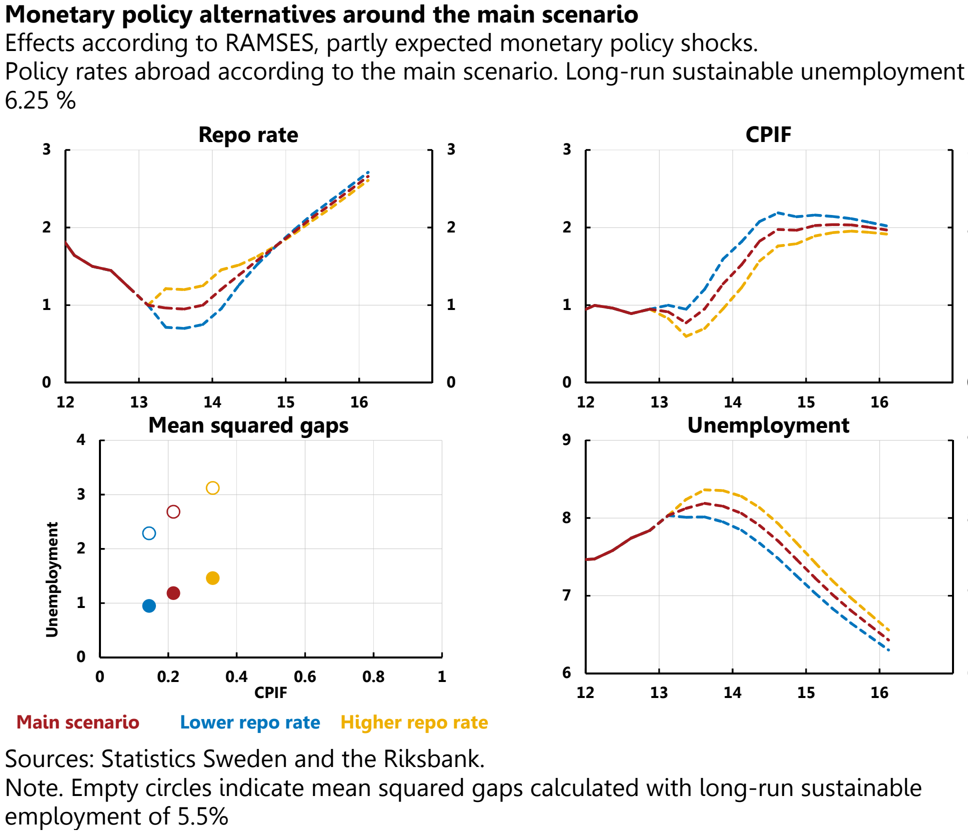
It is possible to review this with the aid of a figure such as figure 3, which is from the minutes of the Riksbank policy meeting of February 2013 (Sveriges Riksbank, 2013, figure 4). It is one of the similar four-panel figures that—during my term as a deputy governor and member of the Executive Board—I regularly brought to the Riksbank policy meetings for discussion and justification of my decision. The four panels show the repo-rate path (top left; the repo rate is the Riksbank's policy rate), the MSGs for inflation and unemployment (bottom left), the forecast of the CPIF inflation

[30] With arguably not the best terminology, forecast targeting was called a "general targeting rule" and targeting rules were called "specific targeting rules" in Svensson (2003b).

[31] This can be seen as a simple application of the so-called Calculus of Variations in optimization theory: A different policy should not give a better outcome.

rate (top right),[32] and the forecast of the unemployment rate (bottom right).

Figure 3: Monetary policy alternatives around the main scenario. (For interpretation of the references to color in the text, the reader is referred to the web version of this article.)




Source: Sveriges Riksbank (2013, figure 4).

The center dashed red (dark gray in black-and-white print) lines refer to the majority's choice of a repo-rate path and resulting forecasts of inflation and unemployment. The red (dark gray) circles in the bottom-left panel show the corresponding MSG points with the coordinates of the MSGs for inflation and unemployment measured along, respectively, the horizontal and vertical axes. The filled and unfilled circles refer to MSG points calculated with a long-run sustainable unemployment rate of, respectively, 6.25% (the majority's estimate) and 5.5% (my estimate). The inflation target is 2%.

The blue and yellow (medium and light gray) dashed lines refer to, respectively, a lower and a higher repo-rate path and corresponding forecasts of inflation and unemployment. It is obvious that the lower repo-rate path is better than the majority choice; the forecast of inflation is higher and closer to the target of 2% and the forecast of unemployment is lower and closer to the long-run

[32] CPIF inflation is CPI inflation when mortgage rates in the housing component of the CPI are held constant.

sustainable unemployment rate, regardless of whether the latter is 6.25% or 5.5%. Consistent with this, in the bottom-left panel, the MSG points for the lower repo-rate path (the blue [medium grey] circles) are southwest of the corresponding MSG points for the majority's repo-rate path (the red [dark gray] circles).

In this trivial (but nevertheless real-world) example, the MSG points are not needed for the conclusion that the lower repo-rate path is better than the center repo-rate path. In this case, the lower policy-rate path fulfills the mandate better for both inflation and unemployment; there is no tradeoff. It is also obvious that an even lower policy-rate path would be better than the blue (medium gray) path in in the top-left panel.

In a non-trivial case, there would be a tradeoff between stabilizing inflation and unemployment. For example, the forecasts of inflation and unemployment would both be above (or both be below) the inflation target and the long-run sustainable unemployment rate, respectively. Then the alternative MSG points for a given long-run sustainable unemployment rate would not line up southwest-northeast but northwest-southeast, and the best repo-rate path would be the one minimizing the sum of the MSGs.[33] Indeed, a necessary condition for a policy-rate path to be a candidate for best fulfilling the mandate is that alternative policy-rate paths do not result in MSG points southwest of the candidate's MSG point.[34] [35]

Clearly, the publication of the policy-rate path and corresponding forecasts of inflation and unemployment gives external observers and experts considerable possibilities to review how well the FOMC fulfills its mandate and to hold the FOMC accountable for this.

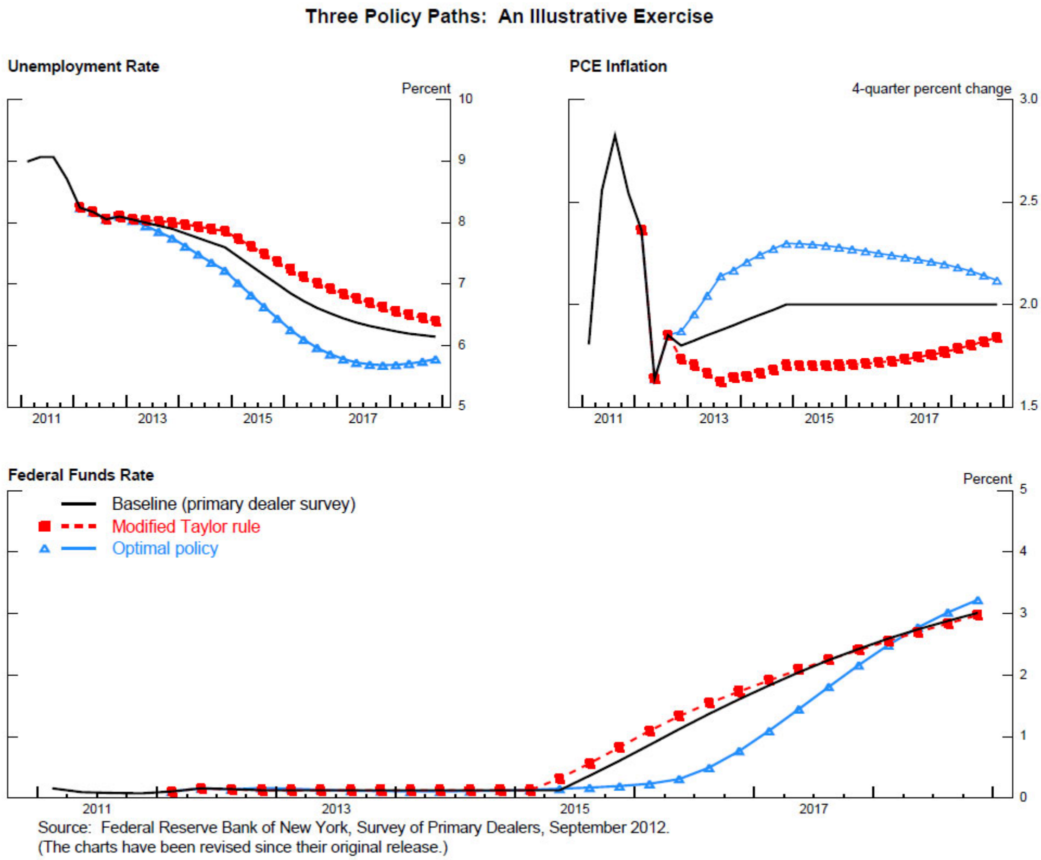
The discussion in Yellen (2012) of revolution and evolution in communication by central banks is very relevant here, in particular the figure of three policy-rate paths and the resulting forecasts of inflation and unemployment shown in figure 4. In particular, a fourth panel could be added with the MSG points for the different policy-rate paths.

[33] Iso-loss lines with a slope of minus one, corresponding to equal weight on the MSGs for inflation and unemployment, can be added to the bottom-left panel. Then the best repo-rate path is the one for which the MSG point lies on the iso-loss line that is closest to the origin.

[34] These MSGs were not adjusted for a possible time-consistency problem, discussed in section 3.6. There is no reason to believe that the adjustment would be large in this case or that it would be sufficiently different for the different policy alternatives to affect the ranking.

[35] Furthermore, in this real-world case, the majority's forecasts of inflation and unemployment in figure 3 were conditional on the majority's assumption of a high forecast of foreign interest rates, much above implied market forward rates. As shown in Sveriges Riksbank (2013, figure 5), assuming a lower forecast of foreign interest rates, in line with implied forward rates, resulted for a given policy-rate path in a stronger exchange-rate forecast and thereby an even lower inflation forecast and an even higher unemployment forecast. Then an even lower repo-rate path was called for, which I dissented in favor of. See the minutes (Sveriges Riksbank, 2013) for details. The minutes, published in about two weeks after the meeting, are *attributed*; thus, in Sweden individual members of the Executive Board can be held accountable in real time not only for their votes and decisions but also for their individual statements and arguments at the policy meeting, regardless of whether they are dissenters or not.

Figure 4: Three Policy Paths: An Illustrative Exercise.




Source: Yellen (2012).

# 5 Does the Federal Reserve already practice forecast targeting?

Forecast targeting can be summarized by the three steps in section 3.4. To what extent is the Federal Reserve already practicing forecast targeting? The Federal Reserve staff's optimal-control simulations described and discussed in Brayton, Laubach, and Reifschneider (2014) and used for example in Yellen (2012) and the optimal policy projections discussed in Svensson and Tetlow (2005) lend themselves well to steps 1 and 2, the selection of an appropriate policy-rate path. Regarding step 3, the publication and justification of the decision, the FOMC is already publishing its *Summary of Economic Projections* (SEP), which include economic projections of the FOMC participants under their individual assessments of projected appropriate monetary policy.

These projections have received considerable emphasis in the Chair's press conference after policy meetings. For example, as Chair Bernanke noted in his opening remarks at the press conference on April 27, 2011 (before the publication of interest-rate projections, which began in January 2012):

> The Committee's economic projections provide important context for understanding

today's policy action as well as the Committee's general policy strategy. Monetary policy affects output and inflation with a lag, so current policy actions must be taken with an eye to the likely future course of the economy. Thus the Committee's projections of the economy, not just current conditions alone, must guide its policy decisions. The lags with which monetary policy affects the economy also imply that the Committee must focus on meeting its mandated objectives over the medium term, which can be as short as a year or two but may be longer, depending on how far the economy is initially from conditions of maximum employment and price stability. (Bernanke, 2011, pp. 4–5)

For another example of the use of the projections, in June 2010 the FOMC's projections for underlying inflation were below the mandate-consistent level, and its projections for unemployment were above the estimate of the sustainable unemployment rate. Indeed, with reference to these circumstances, Chair Bernanke (2010) concluded, in a speech shortly before the FOMC announced QE2:

> Given the Committee's objectives, there would appear—all else equal—to be a case for further action.

However, the median projections of the federal funds rate, inflation, and unemployment in the SEP are obviously conceptually different from the forecast-targeting policy-rate path and forecasts of inflation and unemployment discussed previously. Importantly, the projections in the SEP are not the result of a joint FOMC decision. The median projections reported are the medians of the modal projections of each individual FOMC participant (that is, voter or non-voter) rather than of each individual member (voter). It thus gives equal weight to voters and non-voters. Furthermore, all voters need not have the same weight in the decision; in particular, the Chair has more weight than others in the decision.

Also, the median projections of the federal funds rate, inflation, and unemployment are inconsistent, in the sense that they are not the projections of a median participant. Instead they may consist of a combination of projections of different participants, combinations that are likely to vary across the federal funds rate, inflation, and unemployment. In addition, the participants may have different models of the economy and the transmission of monetary policy. Thus, the median projection of the federal funds rate is generally not consistent with the median forecasts of inflation and unemployment. Publishing participants' initials with the projections would provide more information and moderate some of these problems.

However, even if the SEP is conceptually different from the forecast-targeting policy-rate path and forecasts of inflation and unemployment, it is not clear how quantitatively different they are from a joint FOMC decision. Majority voting about paths in a committee may result in medians consisting of sections from different committee members, but it is not clear whether this would be problem of quantitative importance.[36] But it is clear that the SEP is more of a snapshot of the views of the FOMC participants and that the medians of the SEP are not a conscious joint decision by the FOMC.

A decision-making process whereby the FOMC arrives at an explicitly joint policy-rate path and corresponding inflation and unemployment forecasts would be more consistent with forecast targeting. The FOMC has undertaken some experiments in constructing a consensus policy-rate path and forecasts of inflation and unemployment. They are discussed in some detail under the heading "Experimental Consensus Forecast" in the October 2012 transcripts, FOMC (2012, pp. 201–279). There were several difficulties noted about constructing consensus forecasts. According to a summary of a staff memo about the experiment presented at the meeting, among these difficulties, reaching a consensus on the appropriate medium- and longer-term policy path could be extremely difficult. One reason was that the policymaking environment was unusually complex with both unconventional portfolio actions and forward guidance being important policy tools. Another reason was that participants who could agree on the appropriate policy action to be taken at a given meeting might nevertheless disagree about the appropriate stance of policy further out in the future. Some, but not all, such disagreement might be because participants would disagree about the likely future evolution of asset purchases. But it was noted that even in normal times, the FOMC has typically only described its policy decision in terms of the change in the funds rate agreed to at a particular meeting, not the anticipated future path of policy.

There were also some production-related challenges. Because the Committee's policy decisions are not known in advance of the meeting, it would not be possible to guarantee the production of a forecast that incorporates the Committee's policy decision in time for the Chair's press conference. A required delay would reduce the usefulness of the forecast for communication purposes. The participants were also not clear about how they should determine and express whether they support the proposed consensus outlook.

In view of these difficulties, the FOMC abandoned the consensus forecast exercise at the time—perhaps not permanently—and instead focused on improvements on the SEP.

It is obvious that a decision process that includes reaching a consensus on the policy-rate path faces difficulties when the FOMC also decides on balance-sheet policies and thus has several policy

[36] Svensson (2007b) discusses majority voting on forecast paths and argues that they are completely feasible and already occurring in a few central banks. For example, the nine-member monetary policy committee of Bank of England makes decisions on the quarterly forecast paths of inflation, unemployment, and GDP growth three years out. It is not obvious that a twelve-member FOMC could not do the same and include a policy-rate path as well.

instruments. However, when the balance-sheet reduction is set on autopilot and the FOMC has the federal funds rate as its one policy instrument, perhaps such a decision-making process is nevertheless possible and can be followed, perhaps with some iterations between the Board and the Banks. From a production point of view, having the press conference the next day—as is done at the Riksbank—may help with the production problems.

Nevertheless, forecast targeting has arguably to some extent already been practiced with the current median projections in the SEP, as the quotes above from Bernanke (2010, 2011, 2015b) suggest. Furthermore, the FOMC can to some extent be held accountable in real time with the current SEP. With some reservations due to the problems mentioned, it is possible to compare the median projection of the federal funds rate with market expectations and the median projections of inflation and unemployment with, respectively, the 2% target and the FOMC's estimate of the long-run sustainable rate and assess whether the FOMC is best fulfilling its mandate.

# 6 Conclusions

If the FOMC seeks to fulfill its mandate of maximum employment and price stability, while also being held accountable for fulfilling that mandate, forecast targeting is likely to dominate a Taylor-type rule. Forecast targeting means selecting a policy rate and policy-rate path so that the forecasts of inflation and employment (or unemployment) "look good," in the sense of best stabilizing inflation around the Federal Reserve's target of 2% and employment around its maximum level. The justification may involve demonstrations that other policy-rate paths would lead to worse mandate fulfillment. Publication and justification may contribute to making the policy-rate path and the forecasts credible with the financial market participants and other economic agents and thereby more effectively implement the FOMC's policy. Importantly, with such information made public, external observers and experts can review FOMC policy, both in real time and after the fact, that is, after the outcomes for inflation and employment have been observed. This way the FOMC can be held accountable for fulfilling its mandate. In contrast to simple policy rules that rely on very partial information in a rigid way, such as a Taylor-type rule, forecast targeting allows all relevant information to be taken into account and has the flexibility and robustness to adapt to new circumstances.

Furthermore, the FOMC is already practicing forecast targeting to some extent, with the publication in the *Summary of Economic Projections* of the participants' projections of the federal funds rate, inflation, and unemployment. Although these projections are not a joint decision of the FOMC, it is not clear how quantitatively different they are from a joint decision. They have already been used by the Chair to explain and justify policy decisions, and they are also used by external observers to some extent to hold the FOMC accountable for fulfilling its mandate. Making the projections a joint decision by the FOMC would make them more suitable for explaining and justifying the decision and for holding the FOMC accountable for fulfilling its mandate.

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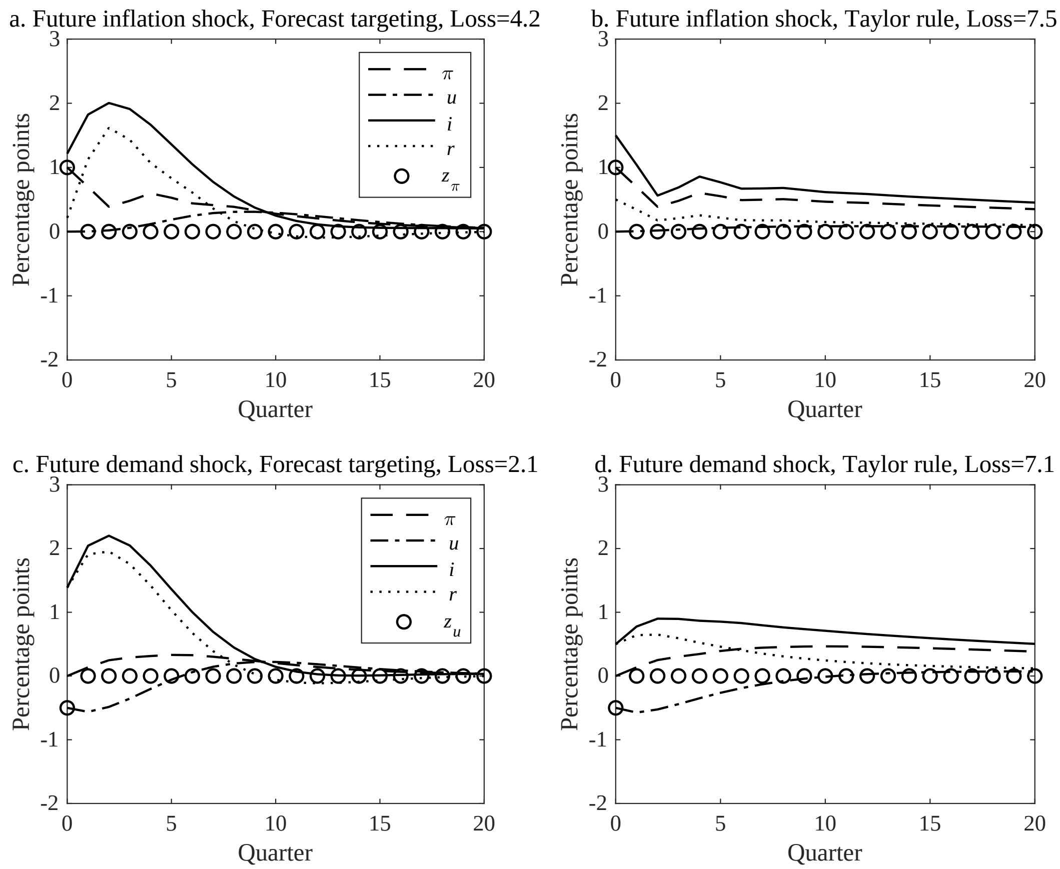
# Appendix

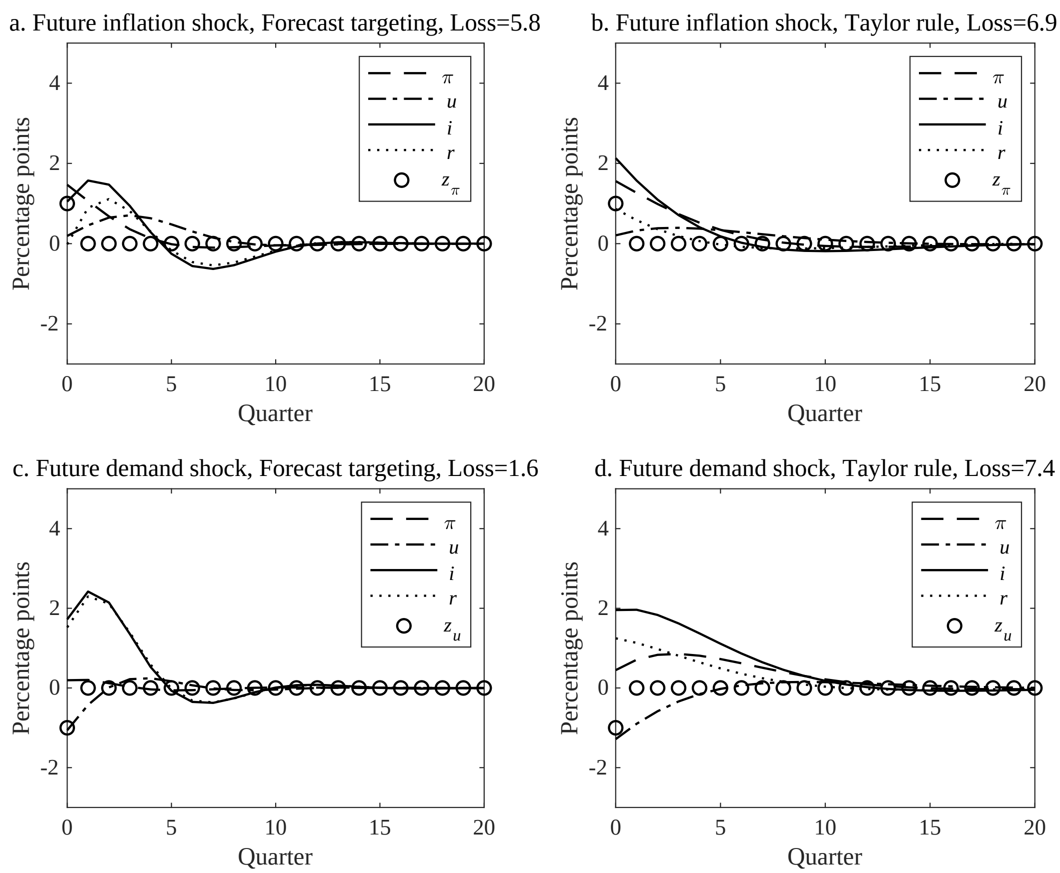
## A The backward- and forward-looking model: Impulse responses

Figure 5: Forecast targeting and the Taylor rule: Backward-looking model, impulse responses




Note: The period loss function is $L_t = \pi_t^2 + u_t^2 + 0.2(i_t - i_{t-1})^2$. The Taylor rule is $i_t = 1.5\,\pi_t - u_t$. The real interest rate that affects the unemployment gap in the Rudebusch and Svensson (1999) model is $r_t = i_t - \pi_t$, which is plotted in the figure. The intertemporal loss reported excludes the interest-rate term, which is small. See Svensson (2005) for details. In the top two panels, there is an inflation shock of 1 percentage point in quarter 0. In the bottom two panels, there is an unemployment shock of $-0.5$ percentage point (a GDP shock of 1 percentage point) in quarter 0.

Figure 6: Forecast targeting and the Taylor rule: Forward-looking model, impulse responses




Note: Forecast targeting minimizes the loss function $L_t = \pi_t^2 + u_t^2 + 0.2(i_t - i_{t-1})^2$. The Taylor rule is $i_t = 1.5\,\pi_t - u_t$. The real interest rate that affects the unemployment gap in the Lindé (2005) model is $r_t = i_t - \pi_{t+1|t}$, which is plotted in the figure. The intertemporal loss reported excludes the interest-rate term, which is small. See Svensson (2005) for details. In the top two panels, there is an inflation shock of 1 percentage point in quarter 0. In the bottom two panels, there is an unemployment shock of $-1$ percentage point (a GDP shock of 2 percentage point) in quarter 0.