Monetary Policy Strategies for the Federal Reserve[*]

Lars E.O. Svensson
Stockholm School of Economics, CEPR, and NBER

First draft: April 2019
This version: December 2019

Abstract

The paper finds that the general monetary policy strategy of "forecast targeting" is more suitable for fulfilling the Federal Reserve's dual mandate of maximum employment and price stability than following a simple "instrument" rule such as a Taylor-type rule. Forecast targeting can be used for any of the more specific strategies of annual-inflation targeting, price-level targeting, temporary price-level targeting, average-inflation targeting, and nominal-GDP targeting. These specific strategies are examined and evaluated according to how well they may fulfill the dual mandate, considering the possibilities of a binding effective lower bound for the federal funds rate and a flatter Phillips curve. Nominal-GPD targeting has substantial both principal and practical disadvantages and is found to be inferior to the other strategies. Average-inflation targeting is found to have some advantages over the other strategies.

JEL codes: E52, E58

Link to latest version: https://larseosvensson.se/files/papers/monetary-policy-strategies-for-the-federal-reserve.pdf

---

Contents

1   Introduction

The Federal Reserve is undertaking a broad review of the Federal Reserve's monetary policy framework this year. As explained by Vice Chair Clarida (2019), the Federal Reserve will examine the policy strategy, tools, and communication practices that it uses to pursue its dual-mandate goals of maximum employment and price stability. The review is not provoked by any dissatisfaction with the existing policy framework, but given the unprecedented events of the past decade, the Federal Reserve believes it is a good time to step back and assess whether, and in what possible ways, it can refine its strategy, tools, and communication practices to achieve and maintain these goals as consistently and robustly as possible. By conducting the review, the Federal Reserve wants to ensure that it is well positioned to continue to meet its statutory goals in coming years. The review will also evaluate the new policy tools and communication practices that the Federal Reserve has used in response to the financial crisis 2008–2009 and the Great Recession.

A significant background for the review is that neutral interest rates appear to have fallen in both the US and other advanced economies, and this global decline is widely expected to persist for years. All else being equal, a fall in neutral rates increases the likelihood that a central bank's policy rate will reach its effective lower bound (ELB) in future economic downturns (Kiley and Roberts, 2017). That development, in turn, could make it more difficult during downturns for monetary policy to support spending and employment and keep inflation from falling below the inflation target.

Another key development in recent decades is that inflation appears less responsive to resource slack. The short-run Phillips curve appears to have flattened. A flatter Phillips curve reduces the role of aggregate demand and increases the role of inflation expectations in controlling inflation and keeping inflation close to its target.

The Federal Reserve has been charged by the US Congress with a dual mandate to achieve maximum employment and price stability. Clarida (2019) notes that the review will take this mandate as given. It will also take as given that a 2 percent rate of inflation in the price index for personal consumption expenditures (PCE) is the operational goal most consistent with the Federal Reserve's price stability mandate. Furthermore, the review will focus on three broad questions, highlighted by events of the past decade.

The first question is, "Can the Federal Reserve best meet its statutory objectives with its existing monetary policy strategy, or should it consider strategies that aim to reverse past misses of the inflation objective?" The background for this is that the Federal Reserve's current approach, as that of other central banks conducting flexible inflation-targeting, treats past deviations of inflation from the target—including the persistent shortfalls of inflation from the target that many advanced economies have experienced over most of the past decade—as "bygones." There is no attempt to

offset past inflation undershoots of the inflation target with future overshoots, or vice versa. Given the fall in the natural interest rate and the resulting increase in the probability that the ELB will bind in the future, persistent undershoots may be more likely. This may move inflation expectations below the inflation target and make it more difficult to achieve the target.

Several academics and central bankers have suggested various "makeup" strategies for the Federal Reserve, such as price-level targeting, temporary price-level targeting, and average-inflation targeting. Under these, policymakers seek to undo, in part or in whole, past inflation deviations from target. To the extent such strategies become credible, a shortfall of inflation from the target will raise inflation expectations, lower the real interest rate also if the ELB is binding, and this way provide stimulus to the economy and help increasing inflation back toward the target. Furthermore, the direct effect of inflation expectations on inflation in the Phillips curve may raise inflation, in spite of the Phillips curve being flat.

This "automatic" stabilization property of makeup strategies makes them attractive as a remedy against a binding ELB. In models, it has also been shown that they can provide better general performance—improved stability of both inflation and employment—including in situations when the ELB does not bind. However, the automatic stabilization requires that the strategies have become credible and that the private sector believes that the central bank will deliver and make up according to the strategy. This probably requires that economic agents need to see the policy practiced and its principles obeyed for some time, in order to believe that it will be maintained and be successful in the future. This is similar to how the first inflation-targeting central banks had to earn the credibility of their inflation target.

The second question is, "Are the existing monetary policy tools adequate to achieve and maintain maximum employment and price stability, or should the toolkit be expanded?" The third question is, "How can the FOMC's communication of its policy framework and implementation be improved?"

This paper will mainly deal with the first question, on makeup monetary policy strategies. It will also discuss the general strategy of "forecast targeting" and compare it to some extent to the alternative of following a simple "instrument rule" such as a Taylor-type rule. The discussion of the communications part of forecast targeting will touch on the third question. The second question will not be dealt with.

First, relying on a more extensive treatment in Svensson (2019), the paper briefly summarizes why forecast targeting is a better general strategy to achieve the Federal Reserve's mandate— interpreted as flexible inflation targeting—than following a Taylor-type rule. Then, the paper considers the pros and cons relative to standard flexible inflation targeting of four specific "makeup" monetary policy strategies: flexible price-level targeting, a temporary price-level target when the

ELB binds, flexible average-inflation targeting, and nominal-GDP targeting. The main conclusion is that, on balance, flexible average-inflation targeting has some advantages over the other strategies. Nominal-GPD targeting has substantial both principal and practical disadvantages and is found to be inferior to the other strategies.

The paper is outlined as follows: Section 2 summarizes the Federal Reserve's mandate—interpreted as flexible inflation targeting (Clarida, 2019)—and a loss function consistent with the mandate. Section 3 summarizes why forecast targeting dominates Taylor-type rules as a general strategy to fulfill the mandate. Section 4 further contrasts forecast targeting with the common habit of representing alternative monetary policy strategies not with loss functions of target variables to be minimized but with simple instrument rules where the policy rate responds to the target variables. Section 5 examines price-level targeting, section 6 discusses temporary price-level targeting when the ELB binds, and section 7 considers average-inflation targeting. Section 8 examines nominal-GDP targeting, and section 9 presents some conclusions. An appendix contains some technical details.

2 The Federal Reserve's 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.[1] The FOMC has decided that a "symmetric 2% inflation goal" is most consistent over the longer run with its statutory mandate.[2] 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 clarification 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

---

[1] 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 normally follow from low and stable inflation.

[2] The word "symmetric" was added in January 2016.

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)

As discussed in Svensson (2019), given this, the mandate can be well formalized by a standard quadratic loss function of inflation and employment representing flexible inflation targeting (where "flexible" means some weight on also stabilizing the real economy; "strict" would refer to stabilizing inflation only). 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 (appendix A). The mandate can then be expressed in terms of a standard quadratic loss function of inflation and unemployment.

Furthermore, the "balanced approach" can be interpreted as an equal weight on stabilization of inflation and stabilization of unemployment—especially given several statements of "equal weight," "equal footing," and "neither one takes precedent over the other" by, respectively, Bernanke (2015b), Yellen (2012), and Clarida (2019).

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

$$L_t = (\pi_t - \pi^*)^2 + (u_t - u_t^*)^2. \tag{1}$$

Here π_t denotes the annual (4-quarter) inflation rate in quarter t,

$$\pi_t \equiv p_t - p_{t-4}, \tag{2}$$

where p_t denotes the natural logarithm of the price level. Furthermore, π^* denotes the 2% inflation target, u_t denotes the unemployment rate (measured so that, for example, 0.04 is 4%), and u_t^* denotes the FOMC's (latest) estimate of the longer-run normal unemployment rate, which I will call the (minimum) long-run sustainable unemployment rate. The inflation rate, π_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).[3] In line with the "balanced approach," the loss function (1) has equal weights on stabilizing unemployment around the long-run sustainable unemployment rate and inflation around the inflation target.[4]

---

[3] 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.

[4] It should be noted that, if the Okun coefficient is assumed to be 2, such that the unemployment gap is related to the GDP gap by $u_t - u_t^* = -(1/2)(y_t - y_t^*)$ (where y_t and y_t^* denote GDP and an estimate of potential GDP, respectively), the loss function in terms of the GDP gap will be

$$L_t = (\pi_t - \pi^*)^2 + (1/4)(y_t - y_t^*)^2, \tag{3}$$

that is, with a relative weight on $1/4$ rather than unity on GDP-gap stabilization. Thus, it matters that the "balanced approach" refers to employment rather than GDP.

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

$$\mathrm{E}_t \sum_{\tau=0}^{T} \delta^\tau L_{t+\tau} = \mathrm{E}_t \sum_{\tau=0}^{T} \delta^\tau [(\pi_{t+\tau} - \pi^*)^2 + (u_{t+\tau} - u^*_{t+\tau})^2], \qquad (4)$$

where E_t denotes FOMC expectations conditional on its information in quarter t, T denotes a finite horizon (measured in quarters), and δ is a discount factor that satisfies $0 < \delta \leq 1$. In practice, it is close to or equal to one.[5]

3   Fulfilling the mandate: Forecast targeting

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?

Svensson (2019) argues that the general policy rule—or general policy framework—of *forecast targeting* best achieves the Federal Reserve's mandate. In particular, it better fulfills the mandate than the common suggestion to follow a Taylor-type rule, where by a Taylor-type rule I mean variants of the original Taylor (1993) rule. Forecast targeting also provides answers to the other questions above.

Forecast targeting means selecting a policy rate and policy-rate path so that the forecasts of inflation and employment "look good." Here "looking good" means best fulfilling the dual mandate of price stability and maximum employment, that is, best stabilizing inflation around the inflation target and employment around its maximum level. Forecast targeting 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

---

[5] 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 $\delta = 1$.

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.[6]

As argued in some detail in Bernanke (2015a) and Svensson (2019), the Federal Reserve is already to some extent practicing forecast targeting. In particular Bernanke (2015a) states:

> The FOMC's policy framework corresponds to what Lars Svensson has called a targeting rule (see my 2004 speech, "The Logic of Monetary Policy" [Bernanke (2004)] for further discussion). In a targets-based framework, the central bank forecasts its goal variables—inflation and employment, in the case of the Fed—and describes its policy strategy for bringing the forecasts in line with its stated objectives. Although targeting rules are not mechanical, they do provide a transparent framework that, importantly, is robust to changes in the structure of the economy or the effectiveness of monetary policy, so long as those changes can be incorporated into forecasts. Targeting rules also conform to the basic economic dictum that principals (in this case, Congress and the public) are better off monitoring their agents' outputs (in the case of the FOMC, the outcomes of policy choices) rather than their inputs (the specific settings of policy instruments).

The terminology used may need some clarification. I believe "forecast targeting" is the most appropriate name for this general policy framework—or general policy rule. I have previously also used the terms targeting rule, forecast-targeting rule, or general forecast-targeting rule.[7] Bernanke (2004) and Erceg et al. (2012a) use the term "forecast-based targeting." Some confusion is possibly caused by the practice in some of the literature of using the term "forecast-based policy rules" for simple instrument rules in which the policy rate responds to forecasts of the target variables, as in Levin et al. (2003). Using such forecast-based *instrument* rules is different from forecast targeting.

3.1 Accountability and commitment

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 most explicit.

---

[6] 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).

[7] The term "inflation-forecast targeting" was introduced in Svensson (1997) and the term "forecast targeting" in Svensson (2003b).

The transparency of forecast targeting—with the publication, explanation, and justification of policy-rate paths and forecasts of inflation and unemployment—may allow the FOMC a substantial degree of commitment. This may be especially so, if it becomes established that deviations and shifts from previously published policy-rate paths and forecasts come with good explanations. Forecast targeting may imply a policy that is approximately optimal under commitment.[8]

3.2 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 as a simple formula such as a Taylor-type rule. It is actually too complex to write down, period. 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.[9]

But the reaction function can be conveyed in more general 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—perhaps even of the appropriate amount—even before the central bank has responded with a new policy rate and policy-rate paths at the next decision.[10]

3.3 Forecast targeting summarized

Forecast targeting can be summarized and simplified as these three steps:

1. For a given 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.[11]

---

[8] Issues of time-consistency, discretion, and commitment with forecast targeting are discussed in some detail in Svensson and Woodford (2005) and Svensson (2011, 2019). Appendix B shows how the intertemporal loss function can be modified to be consistent with optimal policy under commitment.

[9] Svensson (2019, section 3.2) includes an examples in two empirical models of the US economy of how forecast targeting performs much better than a Taylor rule when there is information about future shocks to inflation and demand that forecast targeting but not a Taylor-type rule responds to.

[10] To an outside observer, it would look like the FOMC would be mechanically following the market. But it would actually be the market anticipating FOMC policy decisions.

[11] Svensson (2011, 2019) discusses how some issues of determinacy with an exogenous policy-rate path can be

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 participant's 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.[12]

In support of the view that the Federal Reserve is already to some extent practicing forecast targeting, one can note that, regarding steps 1 and 2 about the selection of an appropriate policy rate path, the tools and techniques needed are already on display in the many simulations presented in the Tealbook B document prepared by the Federal Reserve Board staff for FOMC meetings, especially the simulations of the so-called Constrained and Unconstrained Optimal Control Policy shown in Federal Reserve Board (2013, p. 9) (reproduced as figure 1).[13]

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 receive considerable emphasis in the Chair's press conference after policy meetings.[14]

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 it is from a joint

managed. Regarding, determinacy, by the well-known result of Sargent and Wallace (1975), for an exogenous policy rate the (rational-expectations) equilibrium may be indeterminate. Uniqueness of policy simulations with exogenous policy-rate paths in forward-looking models can be ensured by a terminal condition at a future quarter, $\bar{T}$, beyond the forecast horizon, T, where (i) either policy is assumed to switch to a reaction function for which the equilibrium is unique, or (ii) 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 $u_{t+\bar{T},t} = u^*$ (Svensson, 2005; Svensson and Tetlow, 2005; Laséen and Svensson, 2011).

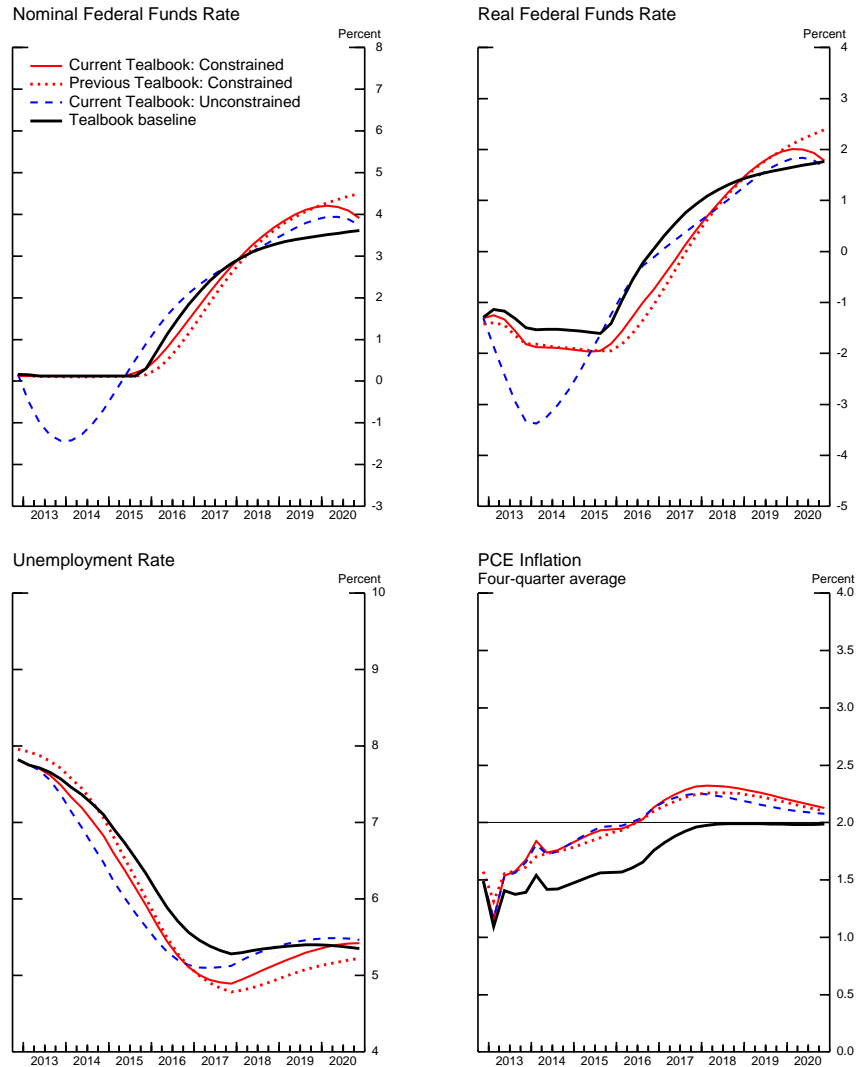Furthermore, as discussed in detail in Svensson and Woodford (2005), theoretically, the announcement of a policy rate and a policy-rate path and forecasts of inflation and unemployment—even if these are credible with economic agents and their expectations are aligned with the announcement—may not be sufficient to ensure determinacy. Instead 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. Similar results to those in Svensson and Woodford (2005) have later appeared in Atkeson et al. (2010).

[12] Mean squared gaps (MSGs) for inflation and unemployment as quantitative measures of the degree of mandate fulfillment may be used (appendix B). An example is given by a then typical figure in the Riksbank minutes of the February 2013 policy meeting, discussed in Svensson (2019, section 4.1).

[13] The Federal Reserve staff's optimal-control simulations have been described and discussed in Brayton et al. (2014). See Svensson and Tetlow (2005) for the technique of incorporating various assumptions as judgment and "add factors" in optimal policy projections.

[14] Se Svensson (2019) for examples.

Figure 1: Constrained vs. Unconstrained Optimal Control Policy

Nominal Federal Funds Rate

- Current Tealbook: Constrained
- Previous Tealbook: Constrained
- Current Tealbook: Unconstrained
- Tealbook baseline

Real Federal Funds Rate

Unemployment Rate

PCE Inflation
Four-quarter average

Source and note: Federal Reserve Board (2013, p. 9). The figure compares optimal control simulations derived for the January 2013 Tealbook with those for the December 2012 Tealbook. Assumptions about underlying economic conditions used in the staff's baseline forecast and about balance sheet policies are incorporated. Policymakers are assumed to place equal weights on keeping headline PCE inflation close to the Committee's 2 percent goal, on keeping the unemployment rate close to the staff's estimate of the effective natural rate of unemployment, and on minimizing changes in the federal funds rate.

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.[15] But it is clear that the SEP is more of a snapshot of the different views

---

[15] Svensson (2007) 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.

of the FOMC participants and do not represent a joint decision by the FOMC members.[16]

Nevertheless, 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 unemployment rate and assess whether the FOMC is best fulfilling its mandate.

4 Alternative monetary policy strategies, forecast targeting, and simple instrument rules

Forecast targeting has above been discussed as a general monetary policy strategy to fulfill the Federal Reserve's mandate. The mandate has been interpreted as the specific strategy of flexible inflation targeting, corresponding to a loss function such as (1), with annual inflation and the unemployment rate (or the employment rate) as the two target variables. But forecast targeting can obviously be applied to alternative interpretations of the mandate, such as the specific strategies of flexible price-level targeting, flexible temporary price-level targeting, flexible average-inflation targeting, and nominal-GDP targeting, when these alternative strategies are associated with corresponding alternative loss functions. For the first three alternative strategies, annual inflation is replaced as a target variable by the price level or average inflation; for nominal-GDP targeting, the two target variables of inflation and unemployment are replaced the single target variable of nominal GDP.

However, it is important to note that using forecast targeting and a loss function to implement these alternative strategies is very different from the common practice of using a specific simple "instrument" rule to represent and implement the alternative strategies. As discussed in detail in Svensson (2003b, 2011), a problem and source of confusion in the literature on monetary policy is

---

[16] 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, including that that the policymaking environment was unusually complex with both unconventional portfolio actions and forward guidance being important policy tools. Some, but not all, disagreements among participants might be because they would disagree about the likely future evolution of asset purchases. 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. 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 such a decision process that includes reaching a decision on the policy-rate path faces difficulties when the FOMC also decides on balance-sheet policies and thus has several policy 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 possible and can be followed. 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.

that it remains quite common to specify monetary policy strategies *not* primarily in terms of a loss function that is increasing the deviations of the target variables from their target levels. Instead the strategies are specified in terms of a simple instrument rule where the policy instrument—the policy rate—*responds* to the target-variable gaps, that is, the gaps between the target variables and their target levels. Then, by "targeting" a variable is not meant *minimizing* the deviation from its target level but *responding* to the deviation. There are actually several examples of this in the staff memos presented to the FOMC when alternative policy strategies have been discussed in 2011 and 2012 (Erceg et al., 2011, 2012a,b).

Indeed, many simple instrument rules that have been used in the literature can be written on the form

$$i_t = \rho i_{t-1} + (1 - \rho)[r^* + \pi_t + R_t], \tag{5}$$

where the coefficient ρ satisfies $0 \leq \rho < 1$ and denotes the degree of inertia (the degree of policy-rate smoothing). Such inertia serves to introduce some history-dependence in the policy (Woodford, 2003b). Furthermore, r^* denotes an estimate of the neutral real interest rate, and the term R_t includes the response to the target-variable gaps.

In this approach, flexible *inflation* targeting, aiming to stabilize the inflation and GDP gaps, is then represented by a Taylor-type rule, for which

$$R_t = a(\pi_t - \pi^*) + b(y_t - y_t^*), \tag{6}$$

and $a, b > 0$ denote the response coefficients of the inflation and GDP gaps, respectively. In particular, for the Taylor (1993) rule, $\rho = 0$ and $a = b = 0.5$. For an inertial Taylor (1999) rule, instead $\rho > 0$, $a = 0.5$, and $b = 1$. *Strict* inflation targeting would then be characterized by a response to the inflation gap only, that is, $a > 0$ and $b = 0$.[17]

Along this approach, flexible *price-level* targeting would be characterized by a response to both the price-level gap and the GDP gap,

$$R_t = a(p_t - p_t^*) + b(y_t - y_t^*), \tag{7}$$

where $p_t - p_t^*$ denotes the price-level gap, that is, the gap between (the log of) the price level, p_t, and (the log of) the price-level target, p_t^*. Then *strict* price-level targeting might be represented by responding to the price-level gap only, that is, $b = 0$.

---

[17] In contrast, Svensson (1997) includes an example of a simple model in which the optimal reaction function that minimizes the loss function corresponding to strict inflation targeting, $L_t = (\pi_t - \pi^*)^2$, is of the form $i_t = r^* + \pi_t + a(\pi_t - \pi^*) + b(y_t - y_t^*) + cx_t$. Here, x_t is an exogenous variable that affects inflation and aggregate demand, and the nonzero coefficients a, b, and c depend on the parameters of the Phillips curve, the aggregate-demand function, and the dynamics of the exogenous variable. Optimal policy requires a response to all relevant state variables—the state variables that affect the forecasts of the target variable(s)—not just the target variable(s).

Flexible *average-inflation* targeting could be represented by responding to the average-inflation and GDP gaps,

$$R_t = a(\bar{\pi}_t - \pi^*) + b(y_t - y_t^*), \tag{8}$$

where, for example, $\bar{\pi}_t = (p_t - p_{t-20})/5$ denotes average inflation over the last 5 years (20 quarters) at an annual rate.

In particular, *nominal-GDP* (level) targeting would be represented by responding to the nominal-GDP gap,

$$R_t = a(Y_t - Y_t^*), \tag{9}$$

where $Y_t - Y_t^*$ denotes the nominal-GDP gap, that is, the gap between (the log of) nominal GPD, $Y_t \equiv p_t + y_t$, and (the log of) the nominal-GDP target, $Y_t^* \equiv p_t^* + y_t^*$.[18]

However, because

$$a(Y_t - Y_t^*) = a[(p_t + y_t) - (p_t^* + y_t^*)] = a(p_t - p_t^*) + a(y_t - y_t^*), \tag{10}$$

it follows that, for the special case when the response coefficients are equal, $b = a$, the instrument rule corresponding to flexible price-level targeting, (7), would be identical to the rule corresponding to nominal-GDP targeting, (9).

For a concrete example, consider the memo on alternative monetary policy frameworks for the November 2011 FOMC meeting (Erceg et al., 2011). There, an analysis of flexible inflation targeting, price-level targeting, and nominal-GDP targeting is not done in terms of forecast targeting and the minimization of the corresponding loss functions. Instead, it is done in terms of alternative simple policy rules, more precisely (Erceg et al., 2011, footnote 10) using (5) with $\rho = 0.9$ and

$$R_t = 0.5(\pi_t - \pi^*) + (y_t - y^*), \qquad \text{Flexible inflation targeting,} \tag{11}$$

$$R_t = p_t - p_t^*, \qquad \text{Strict price-level targeting,} \tag{12}$$

$$R_t = (p_t + y_t) - (p_t^* + y^*). \qquad \text{Nominal-GDP targeting,} \tag{13}$$

As we observed above, if *flexible* price-level targeting had been represented with an additional unitary response to the GDP gap in (12), the simple instrument rule would have been identical to that for nominal-GDP targeting, (13). This in spite of the very different loss function (20) for flexible price-level targeting and (21) for nominal-GDP targeting—illustrated in the corresponding figures 16–19—to be examined in section 8. Clearly, two very different loss functions can hardly be minimized with the same reaction function.

Above in section 3, several reasons have been given why forecast targeting is a better way to achieve the mandate interpreted as flexible inflation targeting—with the period loss function (1) and

---

[18] Here p_t refers to (the log of) the GDP deflator.

the intertemporal loss function (4)—than following a simple instrument rule such as a Taylor-type rule. For the same reasons, forecast targeting is a better way also to achieve the mandate when interpreted as the alternative strategies to be examined. Good monetary policy implies responding to all relevant state variables, that is, responding to all information that affects the forecasts of the target variables, which includes much more information than the current values of the target variables.

5 Price-level targeting

Flexible inflation targeting—with a loss function such as (1)—implies that past inflation deviations are disregarded, "bygones are bygones." Even if there has been a long period of inflation under-shooting the target—because policy has not been sufficiently expansionary, for example because of a binding ELB—there is no attempt to later undo the undershooting by overshooting the target for some time. If average inflation falls below the target for long periods, inflation expectations may fall below the target and make achieving the target more difficult in the future.

To avoid such outcomes, some economists and policymakers have advocated various "makeup" strategies, where the policy involves undoing, partly or completely, past inflation deviations from the target. These strategies are also referred to as "history dependent" (Woodford, 2003a). Flexible price-level targeting, in which past inflation deviations eventually are completely undone, is prominent among these strategies and has been much discussed recently (for example, Bernanke, 2017; Bullard, 2018; Evans, 2019; Williams, 2017). Instead of stabilizing inflation around an inflation target, it involves stabilizing the price level around a price-level target. The price-level target is not constant but follows a deterministic increasing path corresponding to a steady positive inflation rate.[19]

Flexible price-level targeting can be represented by the loss function

$$L_t = (p_t - p_t^*)^2 + (u_t - u_t^*)^2, \tag{14}$$

where p_t^* denotes the (log) price-level target and is given by

$$p_t^* = p_{t-1}^* + \pi^*. \tag{15}$$

Thus, the price-level target corresponds to a price-level target path that increases by the constant rate π^*, for example, 2%. Importantly, using forecast targeting to minimize the period loss (14) and intertemporal loss (4) is different from applying the simple instrument rule (7).

---

[19] There is a considerable amount of past research on price-level targeting and the relative performance of inflation targeting and performance, discussed, for instance, in the surveys by Ambler (2009) and Hatcher and Minford (2014).

In (14), it is assumed that the FOMC reinterprets the "balanced" approach to refer to unemployment relative to the price-level gap rather than to the inflation gap. An alternative is that the FOMC retains the balanced approach to refer to the inflation gap, in which case a non-unity weight on unemployment-gap stabilization relative to price-level stabilization may be appropriate.[20]

If inflation targeting means that past inflation deviations from the target are disregarded and not undone by policymakers, this should in principle introduce a unit root in the price level. This means that price level would not be trend-stationary. That is, it would be nonstationary also after the removal of a deterministic trend. This in turn implies that the conditional variance of the future price level would increase without bound with the horizon. The price-level would in principle behave like a random walk with drift. Given this, it is a bit ironic that inflation targeting with a low inflation target is widely referred to as "price stability." "Low inflation" might be a more appropriate name.

In contrast, price-level targeting would make the price level trend-stationary, and the price level would display mean reversion toward the price-level target path. The conditional variance of the future price level would be bounded and long-run price-level uncertainty would be much less than under inflation targeting. Price-level targeting would make long-run inflation stable and close to the implicit inflation target.

The second paragraph above—starting with "If inflation targeting..."—uses the expression "in principle" twice. This is because the *practice* looks quite different for several advanced economies. The figures 3, 5, 7, 9, and 11 of the price levels of Canada, Australia, the euro area, the UK, and the US show that the price-level outcomes for these economies, up to around the financial crisis 2008–2009, do not look like that of a random walk but surprisingly similar to that of price-level targeting (Rosengren, 2013; Ruge-Murcia, 2014). In fact, Canada looks like price-level targeting further, into 2014, and the euro area also looks pretty much like this into 2014. (Figures 2, 4, 6, 8, and 10 show the corresponding annual and 5-year inflation rates. Figures 12 and 13 allow a comparison between the PCE core and PCE deflator outcomes of inflation and the price level for the US.)

Canada stands out among these economies. Using data from 1993:M1 to 2013:M3, Ruge-Murcia (2014) can indeed *reject* the hypothesis that the Canadian CPI has a unit root, and he *cannot reject* that the CPI is trend-stationary.[21] The reasons why the Canadian price-level has so closely

---

[20] The determination of such a relative weight is complicated (Vestin, 2006). Depending on the dynamics of the economy and expectations formation, price-level targeting may decrease inflation variability and reduce any negative inflation-gap bias because of the ELB. Simulations with realistic models and assumptions about expectations formation are required to settle the issue of whether a non-unity relative weight is warranted. It is also possible to consider variants of flexible price-level targeting with some remaining weight on inflation stabilization.

[21] In contrast, Ruge-Murcia (2014) cannot reject a unit root for the price levels of Australia, New Zealand, Sweden, and the UK, and he rejects the hypothesis of trend stationarity. In a previous working paper with a shorter sample of
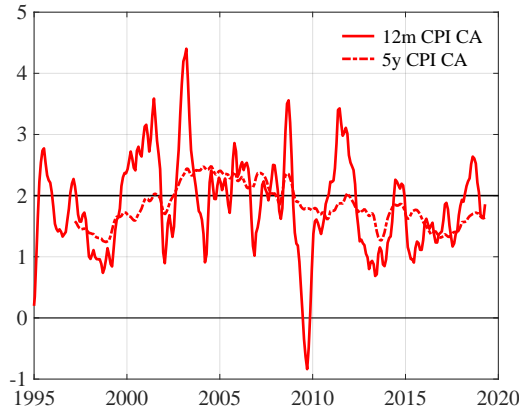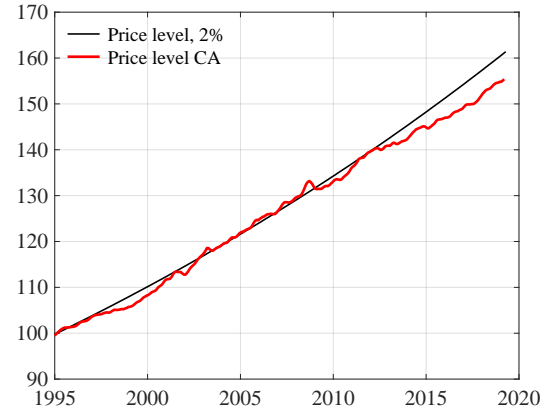
Figure 2: CPI inflation: Canada.

Figure 3: CPI: Canada.

Source and note: Thomson Reuters Datastream. 3-month trailing moving average. The Bank. of Canada has an "inflation-control" target of 2% for the CPI.
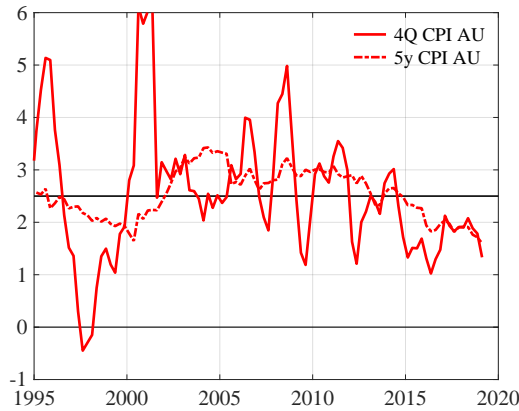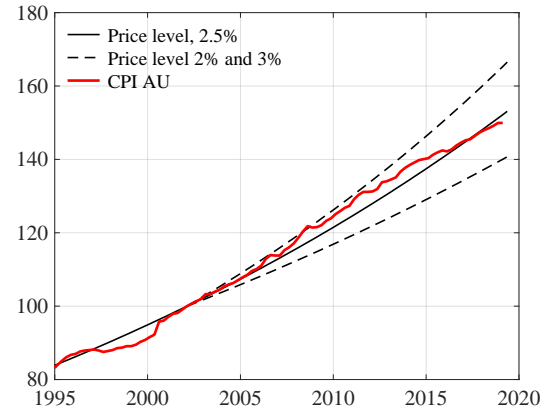

Figure 4: CPI inflation: Australia.

Figure 5: CPI: Australia.

Source and note: Thomson Reuters Datastream. 3-month trailing moving average. The Reserve Bank of Australia has an inflation target of 2–3% over the "medium term" (previously over the "[business] cycle"). On July 1, 2000, a 10 % goods and services tax was introduced in Australia. As a result, the CPI price level increased by 3 %. Hence the annual inflation rate was increased by 3 percentage points for the next 4 quarters, and the 5-year inflation rate was increased by 0.6 percentage points for the next 5 years. The increase in the price level was fully anticipated by the public and financial markets, and the Reserve Bank of Australia did not seek to offset the effect of on the price level (Debelle, 2018).

followed a price-level target path has been discussed in several papers, including Kamenik et al. (2013) and Ruge-Murcia (2014).[22] The reasons mentioned include small symmetric shocks or some inherent error-correcting behavior in the policy setting, for example, a high degree of interest-rate smoothing—but not that the Bank of Canada has covertly and consciously pursued price-level targeting.

One benefit of price-level targeting compared with inflation targeting is that long-run uncertainty

---

1992:M10–2009:M12, he could reject a unit root for the UK. This is consistent with the UK price level overshooting the implicit price level target from 2009 onward (figure 9).

[22] See Ruge-Murcia (2014) for a summary of the discussion.
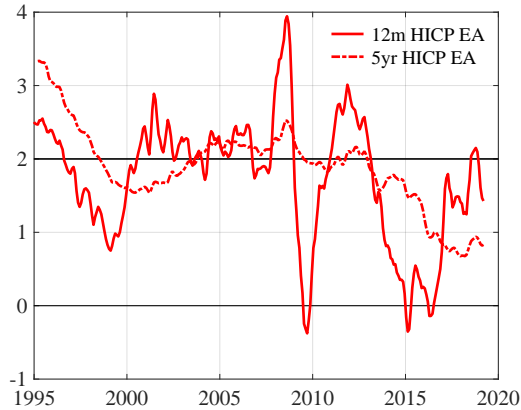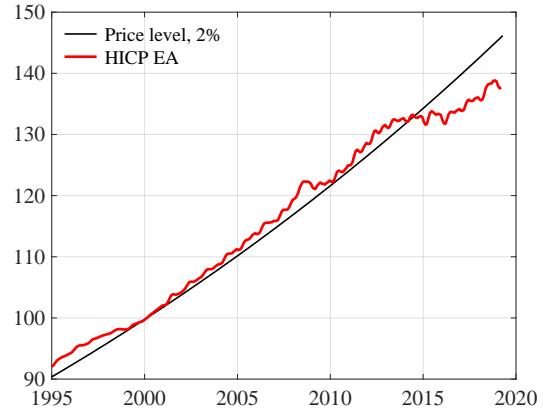
Figure 6: HICP inflation: Euro area.

Figure 7: HICP: Euro area.

Source and note: Thomson Reuters Datastream. 3-month trailing moving average. The ECB aims to maintain HICP inflation "below, but close to, 2% over the medium term."
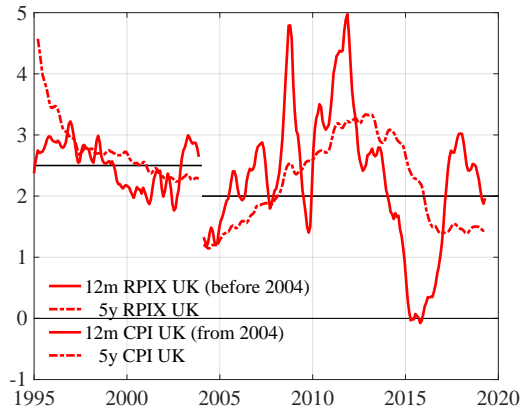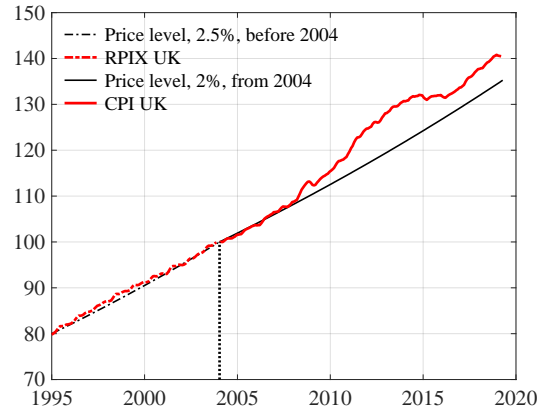

Figure 8: RPIX and CPI inflation: UK.

Figure 9: RPIX and CPI: UK.

Source and note: Thomson Reuters Datastream. 3-month trailing moving average. From 2004, Bank of England has had an inflation target of 2% for the CPI, which is the name used for the HICP in the UK. Before 2004, it had a target of 2.5% for the RPIX.

about the price level is smaller. Another much discussed benefit is that, if the price level falls below a *credible* price-level target, inflation expectations would rise and reduce the real interest rate even if the nominal interest rate is unchanged. The reduced real interest rate would stimulate the economy and bring the price level back to the target. Furthermore, to the extent that the Phillips curve is similar to an expectations-augmented Phillips curve, the increase in inflation expectations would have a separate direct effect on inflation, parallel to the interest-rate effect. Thus, credible price-level targeting may imply some—or even substantial—"automatic" stabilization. Theoretical research (summarized in Ambler, 2009; Bank of Canada, 2011; Hatcher and Minford, 2014) has shown that this automatic stabilization may result in less variability of both inflation and output.

The automatic stabilization would be highly desirable, especially in situations when the ELB
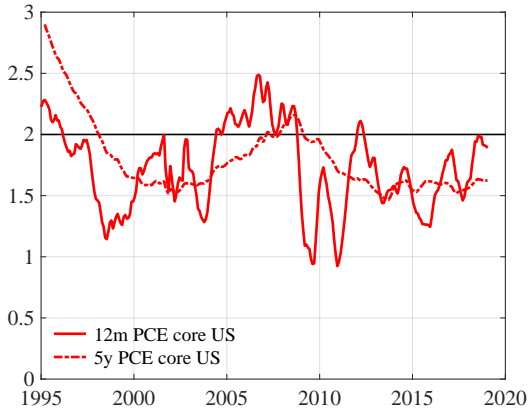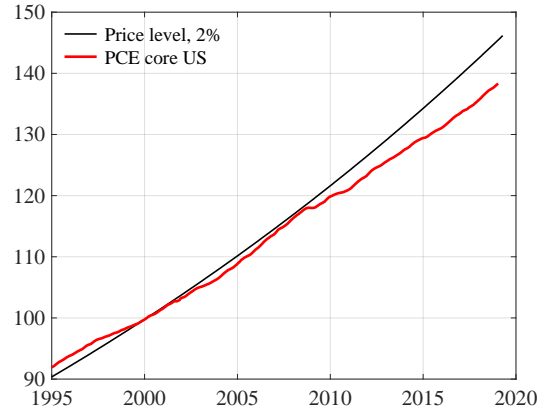
Figure 10: PCE core inflation: US.

Figure 11: PCE core: US.

Source and note: Thomson Reuters Datastream. 3-month trailing moving average. The Federal Reserve was considered by many to have an unofficial inflation target of 2% from around 2000. From 2012 it has an official inflation goal of 2% for the PCE deflator.

Figure 12: PCE core and PCE inflation: US.
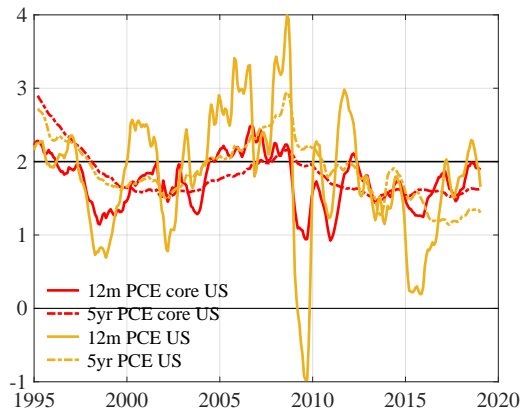
Figure 13: PCE core and PCE: US.
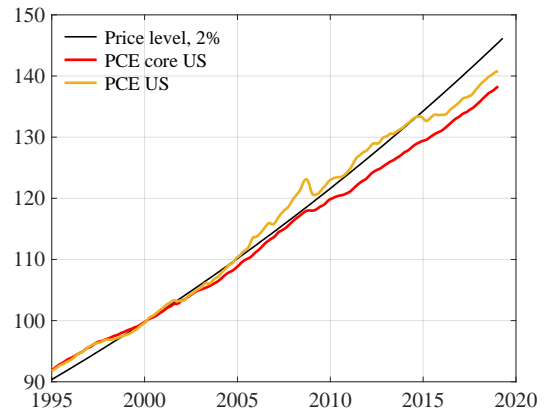
Source and note: Thomson Reuters Datastream. 3-month trailing moving average.

is binding and the nominal interest rate cannot be further reduced. This attractive property of price-level targeting has increased the interest in price-level targeting in recent years.

However, the automatic stabilization would work to the extent that the price-level target is *credible*, in the sense of the private sector believing that the central bank will take action to limit deviations of the price level from the target and successfully bring the price level back to the target. For such credibility to develop, economic agents probably need to see price-level targeting being operated and consistently applied over time by the central bank, in the same way as inflation-targeting central banks have had to achieve credibility of their inflation target by consistently operating inflation targeting over some time.

As Bernanke (2017) notes, the "bygones are not bygones" aspect of price-level targeting is a two-edged sword. Under symmetric price-level targeting, the central bank cannot "look through" shocks

to the Phillips curve—"cost-push" shocks—that temporarily drive up inflation, but must commit to tightening policy in order to reverse the effects of the shock on the price level. This reversal could be gradual and responsive to real-side conditions, as indeed flexible price-level targeting implies. Nevertheless, it implies a possibly painful tightening even as the negative supply shock depresses employment and output. The real cost is reduced if the price-level target is credible and inflation expectations shift down, but if not, offsetting possible supply shocks and positive inflation shocks would be more costly.

The Bank of Canada has done considerable research on price-level targeting and seriously considered it in its 2011 5-yearly review of the "inflation-control" target (Bank of Canada, 2011). It concluded (p. 14):

> Recent research has shown that modest, but economically significant, potential gains from price-level targeting can be found in the most favourable model simulations, with these gains prospectively enhanced once the costs and risks of the ZLB are incorporated. However, these models assume that agents are forward-looking, fully conversant with the implications of price-level targeting and trust policy-makers to live up to their commitments. While positive, albeit smaller, net gains from price-level targeting may still be available if these conditions are not fully satisfied, it is not presently clear that they would be sufficiently satisfied in the real world for the Bank to have confidence that price-level targeting could improve on the current inflation-targeting framework.

Thus, the bank did not take the jump. Explicit price-level targeting may only have occurred in real life in Sweden during the 1930's, but the period of explicit price-level targeting is too short and too special for any general conclusions to be drawn.[23]

However, the evaluation of price-level targeting in Canada was done up to 2011, when the actual outcome was more or less indistinguishable from that of price-level targeting (figure 3). Furthermore, when the Bank were doing theoretical model simulations to compare the performance of inflation targeting and price-level targeting, it apparently used a policy reaction function with a large coefficient on the lagged interest rate (close to a "difference rule") in the simulations, which generated results that were very close to those of price-level targeting. As a result, the net benefits of moving to inflation targeting may have seemed smaller for Canada than they would for other economies. In particular, an increased probability of being constrained by the ELB would increase the net benefit of moving.[24]

---

[23] See Berg and Jonung (1999) for a discussion of the good Swedish experience of price-level targeting during the Great Depression.

[24] According to John Murray—previously Deputy Governor of Bank of Canada—Douglas Laxton, at the IMF, was the first to uncover this result, and the first to imply that the Bank of Canada was doing price-level targeting. Murray (2019) further says: "We were surprised and noted that if we had been price-level targeting, we were completely unaware of it. At first, we credited it to the symmetric nature of the shocks that must have been hitting the economy. It was only later, when we were doing some simulations to compare the performance of inflation targeting and price-level targeting, that we realized that our existing policy reaction function generated results that were very close those

In any case, the Federal Reserve needs to do its own cost-benefit analysis to assess the pros and cons of a move to flexible price-level targeting, regardless of the Canadian one, while taking into account the relevant parameters, including the probability of being constrained by the ELB.

As seen in figures 14 and 15, Sweden and the Riksbank represent a clear outlier among inflation targeters in terms of price-level and inflation performance, with a persistent downward inflation bias. Because inflation expectations have nevertheless been well anchored at the target until the around 2011, inflation persistently undershooting the target has likely had costs in the form of persistently higher unemployment (Svensson, 2015). Already in an evaluation of Swedish monetary policy 1995–2005, commissioned by the Swedish Parliament, Giavazzi and Mishkin (2006, pp. 77-78) warned about this downward bias and its associated loss in output and employment. Some reasons for the undershoot and possible remedies—including a 5-year average-inflation target to avoid the persistent downward bias—are discussed in Svensson (2013, 2018).
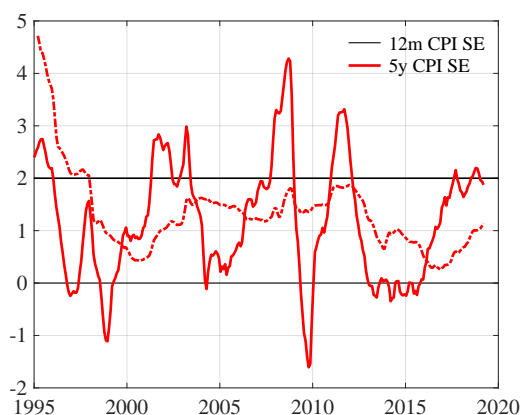
Figure 14: CPI inflation: Sweden.

Figure 15: CPI: Sweden.
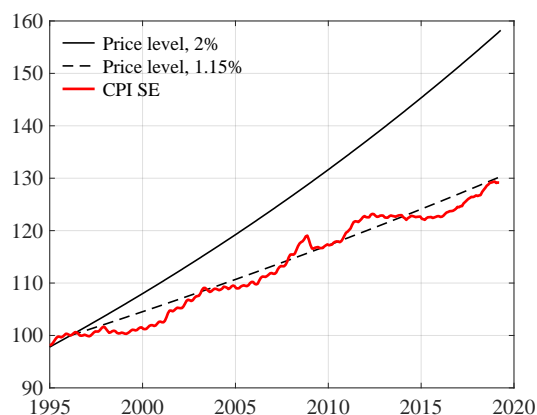
Source and note: Thomson Reuters Datastream. 3-month trailing moving average. The Riksbank had a target of 2% for CPI inflation since 1995. In September 2017 it switched to a 2% target for the CPIF (which excludes effects of changes in mortgage rates on the housing-cost component in the CPI).

To paraphrase FOMC (2019), in setting monetary policy under flexible price-level targeting, the FOMC would seek to mitigate deviations of the price level from its longer-run goal and deviations of employment from the FOMC's assessments of its maximum sustainable level. These objectives would generally be complementary. However, under circumstances in which the FOMC would judge that the objectives are not complementary, it would follow a balanced approach in promoting them, taking into account the magnitude of the deviations and the potentially different time horizons over which employment and the price level are projected to return to levels judged consistent with its

of price-level targeting. Adding a lagged interest rate term to the reaction function with a large coefficient on it was the reason. The downside of this result was that it made selling a move to price-level targeting more difficult—though, clearly, if you're not doing it intentionally and it's not well advertised, you never get the full benefit."

mandate.[25]

It is often said that price-level targeting would be more difficult to communicate than inflation-targeting. I am not convinced that this need to be so. First, financial markets should not have any difficulties in understanding price-level targeting. Second, I don't see why it necessarily would be more natural for the general public to think in terms of the rate of change of the price level than in terms of price level itself. Already now, much discussion about prices of goods, services, and assets—in particular, exchange rates—and of wages is as much in terms of levels as in rates of change. Much discussion of macroeconomic aggregates—such as employment, unemployment, and GDP—is in terms levels and not only in terms of changes. With a price-level target, much discussion would focus on the current and future price level and its relation to the price-level target path rather than the rate of inflation. Graphs of price-level paths will likely be more common in the media than of inflation rates. In any case, if the price level has fallen below the path, it can be said both that the price level needs to go back up toward the path and that inflation will have to be above the long-run average for a while.

The move from inflation targeting to full-fledged price-level targeting may nevertheless seem too risky to many central bankers. An intermediate alternative and a smaller move is to temporary price-level targeting when the ELB is binding.

6 Temporary price-level targeting when the ELB binds

At the September 2010 meeting of the FOMC, Chicago Fed President Evans proposed a temporary price-level target for the Federal Reserve (Evans, 2010b).[26] The proposal included a mock-up of a potential FOMC announcement from the upcoming November 2010 meeting, which described the economic situation, the rationale, the specific policy actions, additional commentary and some frequently-asked-questions posed in discussions with his staff. The background for the proposal was that, in Evans' opinion, much more policy accommodation was appropriate at the time. He believed that the US economy was best described as being in a bona fide liquidity trap. Evans (2010a) also presented the temporary price-level target at a conference at the Boston Fed.

Evans proposed a state-contingent price-level target consistent with an average annual increase of 3% from the core PCE index value in December 2007, when the recession began. Monetary policy actions were to be taken to achieve this target path. Specifically, this state-contingent policy objective was to be pursued until actual core PCE prices had attained the target-level path. Once

---

[25] However, as noted above on page 14 and in footnote 20, the appropriate degree of "balance" needs to be carefully considered.

[26] The original 2010 proposal was authorized for public release by the FOMC Secretariat on November 20, 2017, after the publication of Bernanke (2017) in October.

this condition had been achieved with sufficient confidence, policy would return to an affirmed normal response patterns to achieve 2 percent PCE inflation over the medium-term. The policy would be supported by large-scale asset purchases. The mock-up FOMC announcement also stated that "In the event other supporting actions are deemed helpful or necessary to meet the target-price-level path within a reasonable timeframe, the Committee will take all necessary actions"— a "do whatever it takes" statement close to two years before that of ECB President Draghi.

Thus, this was a temporary price-level target with an exit—once the target had been achieved with sufficient confidence—to a 2% inflation target over the medium term. Had the FOMC taken the jump and the proposal been adopted in the fall of 2010, we would no doubt have been a bit wiser today. Its outcome would have been an obvious major discussion point at this conference, if today's conference had indeed still taken place—and had not been considered redundant.[27]

More recently, Bernanke (2017) has proposed that, in a situation away from the ELB, the FOMC should announce that it will apply a temporary price-level target when the ELB is binding in the future. In future situations in which the policy rate is at or near the ELB, a necessary condition for raising the policy rate would be that average inflation since the date at which the policy rate first hit the ELB be at least 2 percent. Beyond this necessary condition, in deciding whether to raise the policy rate from zero, the FOMC would consider the outlook for the labor market and whether the return of inflation to target appears sustainable.

The average-inflation criterion is equivalent to a temporary price-level target, which applies only during the ELB episode. The criterion is couched in the language of inflation targeting, which Bernanke considered to be an advantage from a communications perspective.

Hebden and López-Salido (2018) (HLS) and Bernanke, Kiley, and Roberts (2019) (BKR) provide evaluations of variants of Bernanke's proposal in the form of simulations of Federal Reserve models. Unfortunately, from my point of view—and typically, given the discussion in section 4—they interpret Bernanke's proposal not in terms of forecast targeting and approximately optimal policy but in terms of alternative simple instrument rules, more precisely as a temporary deviation from Taylor-type rules (see appendix C for details).

HLS interpret Bernanke's proposal as a Taylor-type policy rule where the response to an average-inflation gap since the start of the ELB episode is added. Under the assumption of model-consistent expectations and thus that the policy is credible, HLS show that, when the responses coefficient of

---

[27] I am naturally very favorably inclined to Evans's proposal. My own 2000 proposal for Japan, the Foolproof Way of Escaping from a Liquidity Trap (further discussed in Svensson, 2003a), has two similarities and one major difference. It involved an upward-sloping price-level target path to undo the undesired deflation; a currency depreciation and a temporary crawling peg in order to achieve the price-level target; and, once the price-level target had been achieved, an exit to a floating exchange rate and normal inflation or price-level targeting. The Czech National Bank has successfully used a variant of the Foolproof Way—with a currency depreciation and temporary peg, but without a price-level target—to achieve its inflation target (Al-Mashat et al., 2018).

the average-inflation gap is chosen optimally, the temporary price-level/average-inflation targeting rule gives better macroeconomic outcomes than most other instrument rules considered in the literature, including the Taylor (1993) and Taylor (1999) instrument rules.

BKR also discuss variants of Bernanke's proposal in terms of a simple instrument rule. Here, an inertial Taylor (1999) rule is augmented by the price-level gap, which is given by the accumulated (not average) inflation short-fall since the quarter when the ELB started to bind. The price-level gap is included as long as it is negative.

For these policies with a negative average-inflation or price-level gap added to Taylor-type rules, lift-off may occur while these gaps still are negative, if the inflation and GDP gaps are sufficiently positive. However, BKR also consider variants of Bernanke's original "threshold rule," according to which the policy rate would remain at zero regardless of GDP and current inflation until a threshold condition such as nonnegative average-inflation or price-level gap obtains, at which point the policy is determined by a Taylor-type rule and the ELB condition. They furthermore consider both the case when all private agents have model-consistent expectations understand and believe the policy rule and the case when only asset-market participants have such expectations.

In particular, under the threshold rule, they take into account that, if the ELB period is extended and the cumulative inflation shortfall is large, the implied commitment to overshoot inflation may be correspondingly large. This they consider could be problematic and risk possible unanchoring of inflation expectations. To mitigate against such risks, they consider a price-level gap with limited memory and shorter "look back."

Overall, the simulations of BKR confirm earlier results that the modified Taylor-type rules, the "low-for-longer" rules, deliver better economic performance than the traditional rules. The relative advantage of low-for-longer policies is generally somewhat less with less than complete model-consistent policies, but several policies still retain a substantial advantage over traditional rules. In particular, rules with price-level gaps with shorter look backs of three years or even one year deliver significant improvements over traditional rules under both expectations assumptions.

These proposals for temporary price-level/average-inflation can be seen as compromises between inflation targeting with a higher inflation target and permanent price-level targeting. However, if they are only applied occasionally and temporarily, economic agents will not be very used to them, and considerable explanation and communication may be necessary. But this may still not be sufficient for the temporary price-level target to be credible, in which case the favorable effect of raised inflation expectations will be reduced or not occur. Credibility normally needs to be earned, meaning that economic agents need to see the policy put into practice and its principles obeyed for some time, in order to believe that it will be maintained and be successful in the future. A

permanent compromise may be preferable, such as permanent average-inflation targeting.

7   Average-inflation targeting

Average-inflation targeting here means flexible inflation targeting when the central bank has a target for average inflation over a longer period than a year. For simplicity and concreteness, let me assume a 5-year averaging period, without forgetting that the appropriate averaging period remains to be determined.[28] The 5-year (20-quarter) average inflation rate (at an annual rate) in quarter t, $\bar{\pi}_t$, is then given by

$$\bar{\pi}_t = (p_t - p_{t-20})/5 = (\pi_t + \pi_{t-4} + \pi_{t-8} + \pi_{t-12} + \pi_{t-16})/5, \tag{16}$$

where we recall that π_t by (2) denotes the annual inflation rate in quarter t, $p_t - p_{t-4}$.

The central bank may want to put some weight on both the 5-year and the 1-year inflation rate, corresponding to the loss function

$$L_t = \mu_{\bar{\pi}}(\bar{\pi}_t - \pi^*)^2 + (1 - \mu_{\bar{\pi}})(\pi_t - \pi^*)^2 + (u_t - u_t^*)^2, \tag{17}$$

where $\mu_{\bar{\pi}}$ denotes the relative weight on 5-year inflation and satisfies $0 < \mu_{\bar{\pi}} \leq 1$, with a value less than 1 corresponding to the situation when there is weight on both the 5-year and the 1-year inflation rate. Even if the central bank wants to stabilize the 5-year inflation rate, it may want to avoid too much variability of the 1-year rate. Furthermore, (17) assumes that the FOMC would interpret its balanced approach to imply a unitary relative weight on unemployment stabilization. Whether or not the appropriate relative weight on unemployment stabilization is unity under flexible average-inflation targeting is an issue that remains to be settled.

Nessén and Vestin (2005) have examined the properties of average-inflation targeting in a model with a Phillips curve with both forward- and backward-looking elements.[29] [30] Svensson (2013) has proposed some weight on a 5-year inflation target for the Riksbank as a way of mitigating the persistent downward bias in the inflation outcome since 1996 (clearly visible in figures 14 and 15). Svensson (2018) has proposed some weight on a 5-year average-inflation target for the ECB.[31]

---

[28] In particular, the results of BKR for a temporary price-level targeting with a shorter look back indicates that a shorter averaging period, such as 3 years, may be appropriate.

[29] Under the assumption of optimization under discretion, Nessén and Vestin (2005) find that, in a purely forward-looking economy, price-level targeting dominates average- and annual-inflation targeting. For a more backward-looking economy, there are intermediate cases when average-inflation targeting with an appropriate choice of the relative weight on output-gap stabilization dominates both price-level targeting and annual-inflation targeting. The more backward-looking the economy becomes, the shorter the optimal averaging period. The optimal relative weight on output-gap stabilization under average-inflation targeting needs to be chosen with care.

[30] The approach to average-inflation targeting in Nessén and Vestin (2005) is closely related to the work on "hybrid" price-level targeting in Batini and Yates (2003), Cecchetti and Kim (2005), and Røisland (2006).

[31] For the Riksbank and the ECB, Svensson (2013, 2018) has proposed that the phrase "without prejudice to the

Most recently, Williams (2018) and Mertens and Williams (2019a,b) have discussed average-inflation targeting as a possible policy for the Federal Reserve in handling future problems of a binding ELB. However, they model average-inflation targeting not as a loss function with average inflation as an argument but as an instrument rule with a lower intercept when the ELB does not bind. This is equivalent to raising the implicit annual inflation target. Reifschneider and Willams (2000) used the same method to increase the inflation target, referring to the reduction of the intercept as "risk adjustment."[32] This results in inflation overshooting the original inflation target when policy is not constrained by the ELB. In order to result in average inflation equal to the original target, the increase in the inflation target/reduction in the intercept has to be calibrated to the estimated future level and binding frequency of the ELB.

Flexible average-inflation targeting as in (17) would involve the FOMC putting some weight on keeping 5-year inflation close to the target and include a forecast of the 5-year inflation rate in the SEP. It is not necessary but may be natural to extend the forecast horizon from 3 to 5 years for at least annual and 5-year inflation but perhaps also for the other variables in the SEP.

To paraphrase FOMC (2019), in setting monetary policy under average-inflation targeting, the FOMC would seek to mitigate deviations of [both] average [and annual] inflation from its longer-run goal and deviations of employment from the FOMC's assessments of its maximum sustainable level. These objectives would generally be complementary. However, under circumstances in which the FOMC would judge that the objectives are not complementary, it would follow 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.[33]

In mitigating deviations of average inflation from the inflation target, the FOMC would have incentives to prevent annual inflation from persistently under- or overshooting the inflation target for longer periods. Any undershooting of annual inflation for a couple of year would normally be followed by some overshooting, in order to stabilize average inflation around the target. More precisely, if average inflation during the past $2\frac{1}{2}$ years have undershot the target, normally average inflation over the coming $2\frac{1}{2}$ would overshoot the target, in order to bring the 5-year average inflation closer to the target—while also always taking into account the outlook for the labor market, corresponding to the last term in (17).[34]

---

objective of price stability" in the mandate should not be interpreted as some kind of a hierarchical mandate. Instead it should simply be fulfilled by keeping the 5-year inflation rate close to a symmetric inflation target and otherwise allow standard flexible inflation targeting and a dual mandate. Such an interpretation would be fully consistent with the Maastricht Treaty and the 2018 texts on the ECB's website (Svensson, 2018).

[32] For details, see appendix D

[33] As implied by footnote 29, again the appropriate degree of "balance" needs to be carefully considered.

[34] Doyle (2018) has suggested an "error-correcting inflation target" for the Federal Reserve, to replace its current

Several central banks seem to have some (arguably irrational) "fear of overshooting," which may cause an undershooting bias of inflation. Average-inflation targeting would normalize overshooting after undershooting and help against this fear.

In the current situation in the US, 5-year average inflation has undershot the inflation target for some 8 years (figure 10 with core PCE inflation).[35] Under average-inflation targeting, monetary policy would—all else being equal—aim to make annual inflation overshoot the target for a few years in order to bring 5-year inflation closer to the target.

A 5-year average-inflation target is similar to having a 5-year price-level target that exceeds the current price level by about 10%.[36] In a situation when the ELB starts binding, this would correspond to the temporary price-level target proposed by Bernanke (2017), in particular, when the latter is coached in terms of average inflation, except that Bernanke's temporary average-inflation target does not have a fixed horizon. This is because a necessary condition for raising the policy rate would be that average inflation since the date at which the policy rate first hit zero be at least 2%, regardless of how soon or late that occurs. However, as noted by BKR and mentioned in section 6, a fixed averaging period may be preferable also when policy is constrained by the ELB.

An important difference to the temporary price-level target is that the flexible average-inflation targeting will be permanent and operate all the time. Market participants and the general public will see the policy put into practice and its principles obeyed. This makes it more likely that it will be credible and incorporated in normal expectations formation. Then it is more likely to be credible also when the ELB is binding, and thus that it will help in achieving a better economic performance in such situations.

Furthermore, suppose that the average-inflation target becomes credible. Then, away from the ELB and under normal circumstances, inflation expectations may move in favorable directions, and some of the automatic stabilization under a credible price-level target would also occur under average-inflation targeting. If annual inflation has been undershooting the target for a couple of years, expectations of annual inflation for the next couple of years would move above the target, thus inducing more expansionary monetary policy by reducing the real interest rate at unchanged nominal interest rates.

In particular, with inflation expectations entering the Phillips curve, higher inflation expectations would through this channel independently increase inflation. This may be particularly advantageous

---

fixed 2 percent objective. The new target would be a 10-year rolling average centered on the latest month's data, therefore encompassing the past 5 years of data and a 5-year projection. So, if inflation was systematically below target in the preceding half decade, the target would adjust upward to hit the full decade target, correcting the earlier error. Monetary policy, anticipating the next 5 years, would have to be set accordingly.

[35] Figure 12 shows that 5-year PCE inflation has undershot the target even more the last few years.

[36] $1.02^5 - 1 = 10.4\%$.

if the Phillips curve is now flatter and inflation is less responsive to slack in the labor market and other relevant markets.

In a way, the desired outcome is for expectations of annual inflation to be less anchored to the inflation target and move around in desirable ways, whereas inflation expectations over several years ahead would remain anchored to the inflation target.

However, if annual inflation has overshot the target for several years, symmetric average-inflation targeting requires that—all else being equal—annual inflation should be brought down to undershoot the target for a couple of years. If the automatic stabilization is working, inflation expectations would come down and in this way reduce the required tightening of policy and possible associated employment cost. Furthermore, the weight on unemployment stabilization implies a gradual, optimal return to the average inflation target. Nevertheless, there are situations—such as some positive cost-push shocks—when tightening may be rather undesirable and when it may be justified to allow average inflation to overshoot for some time and allow a corresponding permanent increase in the price level.

A clear example is provided by the introduction of a 10% goods-and-services tax in Australia on July 1, 2000, figure 4. As a result, the CPI price level increased by 3 %. Hence the annual inflation rate was increased by 3 percentage points for the next 4 quarters, and 5-year inflation was—all else being equal—increased by 0.6 percentage points for the next 5 years. The increase in the price level was fully anticipated by the public and financial markets, and the Reserve Bank of Australia did not seek to offset the effect of it on the price level (Debelle, 2018).[37]

Another possible example is from the UK (figure 8). In the UK, annual inflation and 5-year inflation was high and above the target during the financial crisis 2008–2009 and several years after—in contrast to what was the case in several other economies. Although the high inflation was involuntary, overshooting the target when unemployment is high is consistent with successful flexible inflation targeting.[38] A thorough counterfactual analysis of average-inflation targeting is required to assess how average-inflation targeting would have performed during this period and whether it would have been costly to stabilize average inflation more. In particular, one should not forget that, with a 5-year average-inflation target, 5-year inflation is a bygone after 5 years.

Given these examples, I believe that it needs to be considered whether or not some explicit escape clause should be included in average-inflation targeting. Furthermore, the appropriate weights on

---

[37] The Reserve Bank of Australia has an inflation target of 2–3% over the "medium term" (previously over the "[business] cycle"). A question is whether this should be interpreted an average-inflation target, especially because the typical business cycle may be 5–6 years long. As far as I can see, the actual practice of the RBA is hardly different from that of a standard flexible inflation targeter with a 2.5% inflation target.

[38] The unemployment rate rose from 5.2% in 2008Q2 to 7.8% in 2009Q2 and stayed around 8% until 2013Q2, when it started to drop rapidly. Inflation overshot the target during 2010–2013.

average and annual inflation, the appropriate length of the averaging period, and the relative weight on employment stabilization requires further and thorough studies and considerations.

Flexible average-inflation targeting represents considerable continuity of current inflation targeting but contains considerable potential for improvements. In particular, credibility of an average-inflation target would imply movements of inflation expectations and automatic stabilization that would improve performance when the ELB binds and possibly improve inflation control for flatter Phillips curves.

Furthermore, if average-inflation targeting works well, it allows possible further benefits by evolution toward a longer averaging period and an even larger relative weight on average inflation than on annual inflation, thus approaching price-level targeting. If it does not work well, it allows a retreat back to current annual-inflation targeting.

8 Nominal-GDP targeting[39]

Nominal-GDP (NGDP) targeting has been suggested as a suitable monetary policy over the years, for example, by Taylor (1985), Hall and Mankiw (1994), McCallum and Nelson (1999), Frankel (2012) and Frankel in Bernanke et al. (2018), and Garín et al. (2016). It has never been tried in practice.

Recently, several papers have proposed NGPD targeting with the argument that it may contribute to more complete financial markets by making non-contingent nominal contracts state-contingent in a welfare-improving way (Koenig, 2013; Sheedy, 2014; Azariadis et al., 2019; Bullard and DiCecio, 2019; Bullard and Singh, 2019; Beckworth, 2019). The papers argue that this would create better risk-sharing between debtors and creditors, make nominal loans more like equity and nominal debt less risky, stabilize the ratio of nominal debt and nominal debt payments to nominal incomes, and improve financial stability. The idea is that the countercyclical inflation created by NGDP targeting would cause real debt burdens to vary in a procyclical manner. As a result, debtors would benefit during recessions and creditors would benefit during booms. Fixed nominal-priced loans would act more like equity than debt and thereby promote financial stability.[40] However, proposing completion of financial markets, improved risk-sharing, and financial stability as goals

---

[39] In the previous conference version of the paper, nominal-GDP targeting was briefly examined in the appendix of the paper and found to be inferior to flexible price-level targeting. During the audience Q&A session of the paper (Federal Reserve Bank of Chicago, 2019), Eric Sims, Evan Koening, and James Bullard suggested that a monetary policy strategy of nominal-GDP targeting might have better properties than suggested by the paper. In response to this, the discussion of nominal-GDP targeting has been expanded and put in the main text.

[40] Persson and Svensson (1989) provide an early analysis of how monetary and exchange-rate policies may change the risk characteristics of nominal bonds and in some cases allow a completion of asset markets. Nominal-GDP stabilization and resulting countercyclical price movements make nominal bonds have risk characteristics like shares of GDP.

for monetary policy is clearly proposing a new and different mandate for the Federal Reserve, not consistent with the current dual mandate of both stable prices and maximum employment. The Federal Reserve's review of its monetary policy framework takes the existing mandate as given. Furthermore, there is by now considerable evidence and reasons why financial stability is not a suitable goal for monetary policy and why financial stability and financial-market efficiency must be achieved with macro- and microprudential policy (Bernanke, 2015c; IMF, 2015; Williams, 2015; FOMC, 2016; Svensson, 2017a).[41]

Targeting the level of nominal GDP can be represented by the loss function

$$L_t = (Y_t - Y_t^*)^2, \tag{18}$$

where Y_t denotes the log of nominal GDP and Y_t^* denotes the log of the NGDP target. The latter may be given by

$$Y_t^* = Y_{t-1}^* + G^*,$$

corresponding to a deterministic path for nominal GDP that grows at the constant rate G^*. Nominal GDP satisfies $Y_t \equiv p_t + y_t$, where y_t denotes the log of (real) GDP and p_t (in this section) denotes the log of the GDP deflator. The NGDP target satisfies $Y_t^* \equiv p_t^* + y_t^*$, where y_t^* denotes an estimate of potential output and p_t^* denotes an implicit price-level target determined by the difference between Y_t^* and y_t^*.

---

[41] In particular, monetary policy leaning against the wind (LAW)—meaning tighter policy for financial-stability purposes—has been much discussed and examined. The costs of LAW include lower inflation and higher unemployment; the benefits include possibly lower probability and magnitude of financial crises. Using a robust framework with a minimal number of assumptions together with conventional benchmark estimates of the effect of the policy rate on unemployment and debt and of the effect of debt on the probability and magnitude of crises, Svensson (2017a) shows that the costs of LAW exceed the benefits by a large margin. To overturn this result, policy-rate effects on the probability and magnitude of crises need to be more than 5–40 standard errors larger than the benchmark estimates. Adrian and Liang (2018) have challenged the robustness of this result and argued that alternative "reasonable assumptions" about the effect of the policy rate on the probability or magnitude of a crisis would overturn it. However, as is shown in Svensson (2017a,b), these alternative assumptions require estimates that are 12–43 standard errors larger than the estimates of Schularick and Taylor (2012), Jordà et al. (2013), and Flodén (2014).

After a thorough discussion of the evidence at its April 2016 meeting, the FOMC reached a similar conclusion about the costs and benefits of LAW: "Most participants judged that the benefits of using monetary policy to address threats to financial stability would typically be outweighed by the costs ...; some also noted that the benefits are highly uncertain" (FOMC, 2016).

It is always possible to construct more complicated calibrated models with a number of special and unrealistic assumptions in which the configuration of costs and benefits imply that some positive LAW is optimal. But then the results are not robust to alternative and more realistic assumptions. Gourio et al. (2018) present such a model, in which a financial crisis results in a permanent drop of 10% in productivity, capital, output, and consumption and a permanent rise in the marginal disutility of labor so as to keep employment and unemployment unchanged. In spite of this large cost of a financial crisis, the optimal LAW is nevertheless small, corresponding to a reduction of the annual probability of crises of only 9 basis points, from 2.08% to 1.99%, implying on average one crisis in 50.3 years instead of one in 48.1 years. Such small LAW is hardly economically significant.

I have not yet seen a robust and convincing empirically-based demonstration that the benefits of LAW would exceed the costs. This of course does not exclude that new future estimates or unforeseen situations could arise in which the benefits do exceed the costs.

Importantly, NGDP targeting implies a single mandate, stabilizing NGDP, which treats prices and GDP as perfect substitutes, with a one-to-one tradeoff. In contrast, the dual mandate implies stabilizing two variables independently, prices and employment, which treats prices and employment as imperfect substitutes. As then San Francisco Fed President Williams put it in the discussion of the staff memo by Erceg et al. (2011) on alternative monetary policy framework at the FOMC's November 2011 meeting (FOMC, 2011, p. 71):[42]

> Nominal income targeting seems to muddy the waters. Investors care separately about prices and about quantities. And, importantly, we care separately about prices and about quantities. Looking at only nominal income, which mashes together prices and quantities, seems to me at this time to be counterproductive and could undermine the anchoring of inflation expectations.

8.1 Comparing NGDP targeting and (flexible) price-level targeting

It is instructive to compare NGDP targeting to (flexible) price-level targeting, with the loss function (14), where the "balanced approach" to price-level targeting is interpreted to imply equal weight on stabilizing prices and unemployment.

First, the price-level loss function (14)—which is in terms of prices and unemployment—need to be converted to a loss function in terms of prices and GDP. Assume an Okun coefficient of 2 and that GDP and unemployment gaps satisfy

$$y_t - y_t^* = -(u_t - u_t^*)/2. \tag{19}$$

Then, the loss function in terms of prices and GDP that corresponds to price-level targeting can be written

$$L_t = (p_t - p_t^*)^2 + (1/4)(y_t - y_t^*)^2, \tag{20}$$

with a relative weight on stabilizing the GDP gap equal to $^1/_4$. The surface and contours of the price-level-targeting loss function (20) are shown in figures 16 and 17 as functions of the price and GDP gaps, $p_t - p_t^*$ and $y_t - y_t^*$.

The loss function for NGDP targeting, (18), can be expanded in terms of the price-level gap and the GDP gap as

$$L_t = (Y_t - Y_t^*)^2 = [(p_t + y_t) - (p_t^* + y_t^*)]^2 = [(p_t - p_t^*) + (y_t - y_t^*)]^2. \tag{21}$$

The surface and contours of the loss function (21) are shown in figures 18 and 19 as functions of the price and GDP gaps.

---

[42] However, as mentioned in section 4, NGDP targeting in Erceg et al. (2011) is not modeled as a loss function to be minimized but implemented with a Taylor-type rule where the policy rate responds to the NGDP gap, (5) and (13). This is in turn indistinguishable from implementing flexible price-level targeting with a Taylor-type rule with the coefficients of the price-level and GDP gaps being equal, (10).

Figure 16: Loss function surface as a function of price and GDP gaps: Flexible price-level targeting. (For color, see web version of article.)
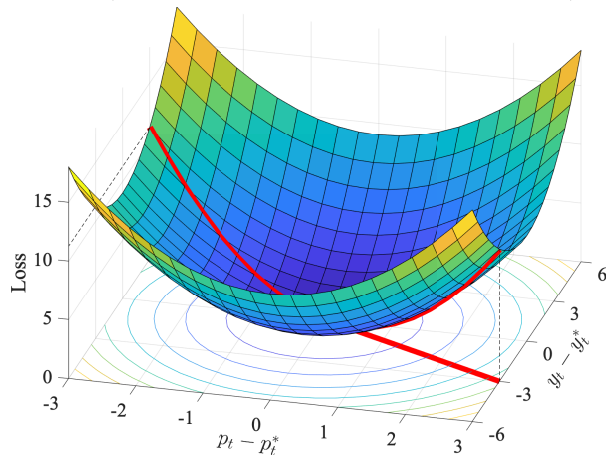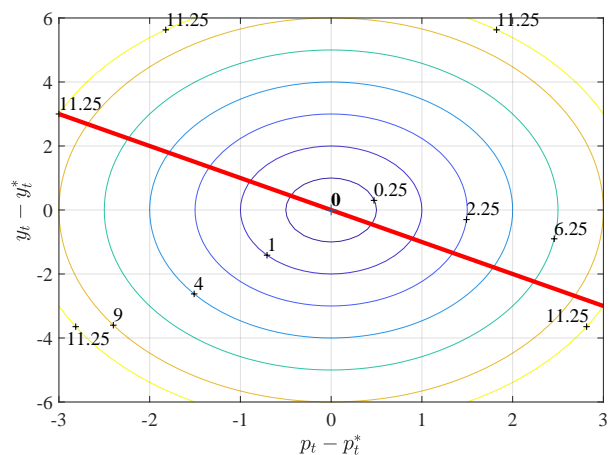
Figure 17: Loss function contours as a function of price and GDP gaps: Flexible price-level targeting.

Note: Surface and contours of the loss $L_t = (p_t - p_t^*)^2 + (1/4)(y_t - y_t^*)^2$ as function of the price gap, $p_t - p_t^*$, and GDP gap, $y_t - y_t^*$. The thick red line (gray in black-and-white print) shows the combinations of price levels and GDP for which the (log of) nominal income $Y_t = p_t + y_t$ equals the target $Y_t^* = p_t^* + y_t^*$.

Figure 18: Loss function surface as a function of price and GDP gaps: Nominal-GDP targeting. (For color, see web version of article.)
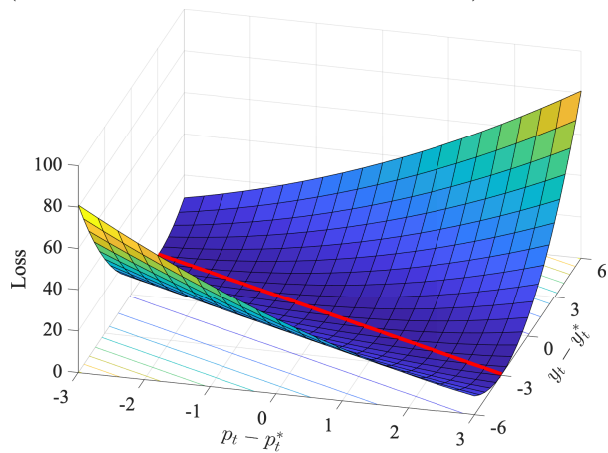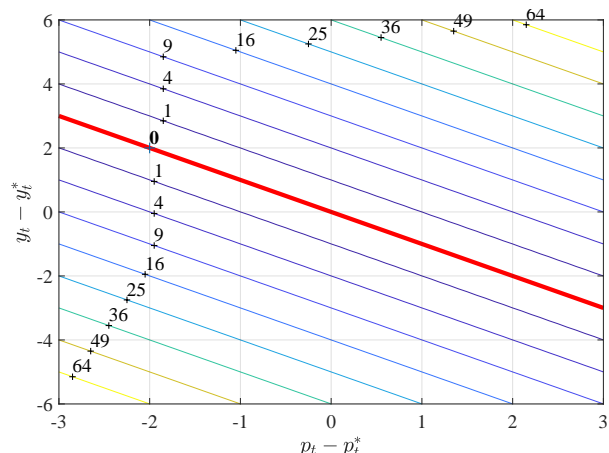
Figure 19: Loss function contours as a function of price and GDP gaps: Nominal-GDP targeting.

Note: Surface and contours of the loss $L_t = (Y_t - Y_t^*)^2 = [(p_t - p_t^*) + (p_t - p_t^*)]^2$ as function of the price gap, $p_t - p_t^*$, and GDP gap, $y_t - y_t^*$. The thick red line (gray in black-and-white print) shows the combinations of price levels and GDP for which the (log of) nominal income $Y_t = p_t + y_t$ equals the target $Y_t^* = p_t^* + y_t^*$.

We see a rather dramatic difference between the loss functions for price-level targeting and NGDP targeting.[43] Under NGDP targeting, the loss is zero along the straight line in $(p_t - p_t^*, y_t - y_t^*)$-space that corresponds to a zero NGDP gap,

$$(p_t - p_t^*) + (y_t - y_t^*) = (p_t + y_t) - (p_t^* + y_t^*) = Y_t - Y_t^* = 0. \tag{22}$$

This is the straight thick red (gray in black-and-white print) line from the point $(p_t - p_t^*, y_t -$

[43] For simplicity, the difference between PCE-deflator and GDP-deflator price gaps is disregarded.

$y_t^*, \text{Loss}) = (-3, 3, 0)$ to the point $(3, -3, 0)$ in figures 18 and 19.

In contrast, under price-level targeting, the loss is zero only for the point $(p_t - p_t^*, y_t - y_t^*) = (0, 0)$ but rises rapidly to $3^2 + (1/4)3^2 = 11.25$ at the points $(p_t - p_t^*, y_t - y_t^*) = (3, -3)$ and $(-3, 3)$; see the thick red (gray) line in figures 16 and 17.

This reflects that the price level and the GDP level are perfect substitutes under NGDP targeting, the result of there being only *one* target variable, nominal GDP, and thus a single mandate, stabilizing NGDP. Instead, under (flexible) price-level targeting there are *two* independent target variables, the price level and employment (where the latter may be replaced by the corresponding GDP level), and thus a dual mandate. Under NGDP targeting, there is a constant unitary trade-off between prices and GDP. Under price-level targeting, there is a variable tradeoff. In addition, the relative weight on stabilizing the GDP gap in (20) is $1/4$ rather than unity, implying that for price and GDP gaps of equal size, the marginal rate of substitution of GDP for prices, $dy_t/dp_t|_{L_t= \text{const.}}$, is 4 in absolute value rather than unity.[44]

The fact that the loss functions are so different indicate that the optimal reaction functions would be different, counter to the tendency of representing NGDP targeting and flexible price-level targeting with similar—or even identical—simple instrument rules as discussed in section 4.

8.2   Further issues

Some proponents of NGDP-growth targeting, such as Frankel (2012) and Frankel in Bernanke et al. (2018), seem to confuse inflation targeting with *strict* inflation targeting—that is, with the loss function $L_t = (\pi_t - \pi^*)^2$ with zero weight on stabilizing employment and GDP and thus a single mandate, inflation stabilization. Compared with strict inflation and strict price-level targeting, NGDP targeting has the apparent advantage of putting some implicit positive weight on stabilizing GDP and employment. But the relevant comparison is with *flexible* inflation or price-level targeting, in which comparison NGDP growth or level targeting is at a disadvantage.

Importantly, there are serious practical problems with NGDP targeting, as discussed in some detail by then Vice Chair of the Board Yellen at the November 2011 FOMC meeting (FOMC, 2011, pp. 80–82). She noted that that there would be enormous practical challenges in implementing this framework, which may help explain why no other central bank has ever followed such an approach. In particular, it would not be appropriate for the target path to be permanently fixed. Rather, it would need to be revised whenever there were significant changes in the estimated level or growth

---

[44] The loss function (20) for flexible price-level targeting has a variable marginal rate of substitution of GDP for prices, $dy_t/dp_t|_{L_t= \text{const.}} = -(\partial L_t/\partial p_t)/(\partial L_t/\partial y_t) = -4(p_t - p_t^*)/(y_t - y_t^*)$, whereas the loss function (21) for flexible price-level targeting has a constant unitary marginal rate of substitution of GDP for prices, $dy_t/dp_t|_{L_t= \text{const.}} = -(\partial L_t/\partial p_t)/(\partial L_t/\partial y_t) = -1$.

rate of potential output. Importantly, such revisions would need to be retrospective as well as prospective. There would be public confusion on such occasions, and people would complain that the Federal Reserve is changing the goal posts.

Additional problems, noted by Mishkin (1998), are that data on nominal GDP are reported with a larger lag and less frequency than consumer prices and unemployment. Also, the concepts of consumer-price inflation and unemployment are much better understood by the public than the concept of nominal GDP, which can easily be confused with real GDP. Consequently, communication may be more difficult.

In summary, NGDP level or growth targeting has substantial both practical and principle disadvantages relative to flexible price-level or inflation targeting, including not being consistent with the Federal Reserve's dual mandate. There are good reasons why no central bank has chosen NGDP targeting.

9 Conclusion

This paper has argued that forecast targeting is a better general strategy to achieve the Federal Reserve's mandate than following a Taylor-type rule. In particular, the transparency of forecast targeting—with the publication, explanation, and justification of policy-rate paths and forecasts of inflation and unemployment, and the possibility of holding the FOMC accountable for its policy and forecast—may allow the FOMC a substantial degree of commitment. This may be especially so, if it becomes established that deviations and shifts from previously published policy-rate paths and forecasts come with good explanations.

Furthermore, the paper has considered the pros and cons relative to standard flexible inflation targeting of four "makeup" strategies: flexible price-level targeting, a temporary price-level target when the ELB binds, flexible average-inflation targeting, and nominal-GDP targeting.

Nominal-GPD targeting has substantial both principal and practical disadvantages and is found to be inferior to the other strategies. In particular, by making GDP and prices perfect substitutes, it actually implies a single mandate and is not consistent with the dual mandate, which makes that stable prices and maximum employment two separate and independent goals. The practical disadvantages include longer reporting lags and large ex post revisions of data. The latter will require both retrospective and prospective revisions of the target path, with large communication difficulties.

On balance, I find that average-inflation targeting has some advantages over the other strategies. Relative to inflation targeting, it has some desirable automatic stabilization properties, if it would

become credible. Then inflation expectations would move in a way that would mitigate problems of both a binding ELB and a flatter Phillips curve. Furthermore, average-inflation targeting would normalize overshoots of the annual inflation target after undershoots, thereby help against the irrational fear of overshooting the inflation target that several central banks have displayed.

Relative to a temporary price-level target when the ELB binds—which can alternatively be described as a temporary average-inflation target—average-inflation targeting has the advantage that it would be operating all the time and not just when the ELB is binding. This means that economic agents would see it in continuous operation over time, which makes it more likely that it would be well understood and also be credible. Realistically, credibility may have to be earned over time and may not come immediately, which implies a strong argument for a strategy that operates all the time.

Relative to price-level targeting, average-inflation targeting is a smaller step from annual-inflation targeting. There is a considerable continuity with annual-inflation targeting in that average-inflation targeting can be seen as just a matter of extending the inflation-averaging period, from one year to a few years. This is likely to be an advantage in communicating it. Nevertheless, it can be also seen as a half-way step toward price-level targeting.

Furthermore, average-inflation targeting as described here is quite flexible. It allows for some weight on both the annual and the multi-year average-inflation target, keeping some aspect of annual-inflation targeting. If average-inflation targeting is successful, the averaging period can be extended, this way getting closer to price-level targeting. If less successful, average-inflation targeting allows for a retreat to annual-inflation targeting.

The choice of the appropriate weights on stabilizing average inflation, annual inflation, and employment—in order to best correspond to the Federal Reserve's "balanced approach" and "equal footing", once average inflation has entered the loss function—has been left open in this discussion. This choice needs careful and thorough examination by the Federal Reserve before a move to average-inflation targeting. The choice of the averaging period also needs consideration. I have used a 5-year period as an example, but the appropriate averaging period could be longer or shorter than that.

Another issue left open is whether or not there is a case for some escape clause for special situations where it may be inappropriate to enforce the symmetry of the makeup mechanism. This issue would also be relevant for a move to price-level targeting.

References

Adrian, Tobias, and Nellie Liang (2018), "Monetary Policy, Financial Conditions, and Financial Stability," *International Journal of Central Banking* 14(1), 73–130.

Al-Mashat, Rania, Kevin Clinton, Douglas Laxton, and Hou Wang (2018), "Czech Republic: Transition to the Frontier," in Adrian, Tobias, Douglas Laxton, and Maurice Obstfeld (eds.), *Advancing the Frontiers of Monetary Policy*, chap. 10, International Monetary Fund, pages 155–183, https://www.bookstore.imf.org/books/title/advancing-the-frontiers-of-monetary-policy.

Ambler, Steve (2009), "Price-Level Targeting and Stabilization Policy: A Survey," *Journal of Economic Surveys* 23(5), 974–997.

Atkeson, Andrew, V.V. Chari, and Patrick J. Kehoe (2010), "Sophisticated Monetary Policies," *Quarterly Journal of Economics* 125(1), 47–89.

Azariadis, Costas, James Bullard, Aarti Singh, and Jacek Suda (2019), "Incomplete Credit Markets and Monetary Policy," *Journal of Economic Dynamics and Control* 103(June), 83–101.

Bank of Canada (2011), *Renewal of the Inflation-Control Target: Background Information—November 2011*, Bank of Canada, https://www.bankofcanada.ca/wp-content/uploads/2011/11/background_nov11.pdf.

Batini, Nicoletta, and Anthony Yates (2003), "Hybrid Inflation and Price-Level Targeting," *Journal of Money, Credit and Banking* 35(3), 283–300.

Beckworth, David (2019), "The Financial Stability Case for a Nominal GDP Target," *Cato Journal* 39(2), 419–447, https://www.cato.org/cato-journal/springsummer-2019/financial-stability-case-nominal-gdp-target.

Berg, Claes, and Lars Jonung (1999), "Pioneering Price Level Targeting: The Swedish Experience 1931-1937," *Journal of Monetary Economics* 43(3), 525–551.

Bernanke, Ben S. (2004), "The Logic of Monetary Policy," speech at the National Economists Club, Washington, DC, December 2, Federal Reserve Board, https://www.federalreserve.gov/boarddocs/speeches/2004/20041202/default.htm.

Bernanke, Ben S. (2015a), "Monetary Policy in the Future," blog post, April 15, 2105, Brookings Institution, https://www.brookings.edu/blog/ben-bernanke/2015/04/15/monetary-policy-in-the-future/.

Bernanke, Ben S. (2015b), "Remarks at the Brookings Institution on the FORM Act," video clip, Brookings Institution, https://www.youtube.com/embed/KJmA5JDNpKg?start=42&end=60&version=3.

Bernanke, Ben S. (2015c), "Should Monetary Policy Take Into Account Risks to Financial Stability," blog post, April 7, 2015, Brookings Institution, https://www.brookings.edu/blog/ben-bernanke/2015/04/07/should-monetary-policy-take-into-account-risks-to-financial-stability/.

Bernanke, Ben S. (2017), "Monetary Policy in a New Era," prepared for the conference on Rethinking Macroeconomic Policy, Peterson Institute, Washington, DC, October 12–13, 2017, Brookings Institution, https://www.brookings.edu/wp-content/uploads/2017/10/bernanke_rethinking_macro_final.pdf.

Bernanke, Ben S., Olivier J. Blanchard, Jeffrey Frankel, Frederic S. Mishkin, and John C. Williams (2018), "The Options: Keep It, Tweak It, or Replace It," panel at the event "Should the Fed

Stick with the 2 Percent Inflation Target or Rethink It?", January 8, 2018, Brookings Institution, https://www.brookings.edu/events/should-the-fed-stick-with-the-2-percent-inflation-target-or-rethink-it/.

Bernanke, Ben S., Michael T. Kiley, and John M. Roberts (2019), "Monetary Policy Strategies for a Low-Rate Environment," *AEA Papers and Proceedings* 109(May), 421–426, including online appenix, https://doi.org/10.1257/pandp.20191082.

Bernanke, Ben S., and Frederic S. Mishkin (1997), "Inflation Targeting: A New Framework for Monetary Policy," *Journal of Economic Perspectives* 11(Spring), 97–116.

Brayton, Flint, Thomas Laubach, and David Reifschneider (2014), "Optimal-Control Monetary Policy in the FRB/US Model," FEDS Notes, November 21, Federal Reserve Board, https://www.federalreserve.gov/econresdata/notes/feds-notes/2014/optimal-control-monetary-policy-in-frbus-20141121.html.

Bullard, James (2018), "A Primer on Price Level Targeting in the U.S." presentation on January 10, 2018, Federal Reserve Bank of St. Louis, https://www.stlouisfed.org/~/media/files/pdfs/bullard/remarks/2018/bullard_cfa_stlouis_10_january_2018.pdf.

Bullard, James, and Riccardo DiCecio (2019), "Optimal Monetary Policy for the Masses," Working Papaper 2019-009C, Federal Reserve Bank of St. Louis, https://research.stlouisfed.org/wp/more/2019-009.

Bullard, James, and Aarti Singh (2019), "Nominal GDP Targeting with Heterogenous Labor Supply," *Journal of Money, Credit and Banking,* forthcoming.

Cecchetti, Stephen G., and Junhan Kim (2005), "Inflation Targeting, Price-Path Targeting, and Output Variability," in Bernanke, Ben S., and Michael Woodford (eds.), *The Inflation-Targeting Debate*, chap. 4, University of Chicago Press, pages 173–195, https://www.nber.org/chapters/c9558.pdf.

Clarida, Richard H. (2019), "The Federal Reserve's Review of Its Monetary Policy Strategy, Tools, and Communication Problems," speech in New York, February 22, 2019, Federal Reserve Board, https://www.federalreserve.gov/newsevents/speech/clarida20190409a.htm.

Debelle, Guy (2018), "Twenty-five Years of Inflation Targeting in Australia," in Simon, John, and Maxwell Sutton (eds.), *Central Bank Frameworks: Evolution or Revolution?*, Reserve Bank of Australia, pages 53–68, https://www.rba.gov.au/publications/confs/2018/pdf/rba-conference-volume-2018-debelle.pdf.

Doyle, Peter (2018), "An Error-Correcting Inflation Target," Alphaville guest post, December 12, 2018, Financial Times, https://ftalphaville.ft.com/2018/12/12/1544614200000/An-error-correcting-inflation-target-/.

Erceg, Christopher, Jon Faust, Michael Kiley, Jean-Philippe Laforte, , David López-Salido, Steve Meyer, Edvard Nelson, David Reifschneider, and Robert Tetlow (2012a), "An Overview of Simple Policy Rules and ther Use in Policymaking in Normal Times and Under Current Conditions," Memo for the FOMC Meeting July 31–August1, 2012, Federal Reserve Board, https://www.federalreserve.gov/monetarypolicy/files/FOMC20120718memo02.pdf.

Erceg, Christopher, Michael Kiley, and David López-Salido (2011), "Alternative Monetary Policy Frameworks," Memo for the FOMC Meeting November 1–2, 2011, Federal Reserve Board, https://www.federalreserve.gov/monetarypolicy/files/FOMC20111006memo02.pdf.

Erceg, Christopher, Michael Kiley, and David López-Salido (2012b), "Simple Rules and Optimal Policies in Staff Models," Memo to the FOMC, March 2012, Federal Reserve Board, https://www.federalreserve.gov/monetarypolicy/files/FOMC20120303memo03.pdf.

Evans, Charles (2010a), "Monetary Policy in a Low-Inflation Environment: Developing a State-Contingent Price-Level Target," panel contribution in Boston, October 16, 2010, Federal Reserve Bank of Chicago, https://www.chicagofed.org/publications/speeches/2010/10-16-boston-speech.

Evans, Charles L. (2010b), "A Proposal for a State-Contingent Price-Level Objective," proposal to the FOMC, September 14, 2010; authorized for public release by the FOMC Secretariat on November 20, 2017, Federal Reserve Bank of Chicago, https://www.federalreserve.gov/monetarypolicy/files/FOMC20100914memo01.pdf.

Evans, Charles L. (2019), "Long-Term Economic Trends and Monetary Policy Frameworks and Strategies," summary of presentation on May 6, 2019, Federal Reserve Bank of Chicago, https://www.chicagofed.org/publications/speeches/2019/long-term-economic-trends-and-monetary-policy-frameworks-and-strategies.

Federal Reserve Bank of Chicago (2019), "Summary of Audience Q&A - Session #5: Monetary Policy Strategies," summary, Federal Reserve Bank of Chicago, https://www.chicagofed.org/~/media/others/events/2019/monetary-policy-conference/session-5-audience-qa-summary-pdf.pdf?la=en.

Federal Reserve Board (2013), "Report to the FOMC on Economic Conditions and Monetary Policy, Book B, Monetary Policy: Strategies and Alternatives," Tealbook B, January 24, 2013, Federal Reserve Board, https://www.federalreserve.gov/monetarypolicy/files/FOMC20130130tealbookb20130124.pdf.

Flodén, Martin (2014), "Did Household Debt Matter in the Great Recession?" Supplement to blog post on Ekonomistas.se, https://www.martinfloden.net/files/hhdebt_supplement_2014.pdf.

FOMC (2011), "Transcript of the Meeting of the Federal Open Market Committee on November 1–2, 2011," transcript, Federal Reserve Board, https://www.federalreserve.gov/monetarypolicy/files/FOMC20111102meeting.pdf.

FOMC (2012), "Transcript of the Meeting of the Federal Open Market Committee on October 23–24, 2012," transcript, Federal Reserve Board, https://www.federalreserve.gov/monetarypolicy/files/FOMC20121024meeting.pdf.

FOMC (2016), "Minutes of the Federal Open Market Committee, April 26–27," minutes, Federal Reserve Board, https://www.federalreserve.gov/monetarypolicy/files/fomcminutes20160427.pdf.

FOMC (2019), "Statement on Longer-Run Goals and Monetary Policy Strategy," adopted effective January 24, 2012, as amended effective January 29, 2019, Federal Reserve Board, https://www.federalreserve.gov/monetarypolicy/files/FOMC_LongerRunGoals.pdf.

Frankel, Jeffrey (2012), "The Death of Inflation Targeting," Vox Column, June 19, 2012, https://voxeu.org/article/inflation-targeting-dead-long-live-nominal-gdp-targeting.

Garín, Julia, Robert Lester, and Eric Sims (2016), "On the Desirability of Nominal GDP Targeting," *Journal of Economic Dynamics and Control* 69(21-44), https://doi.org/10.1016/j.jedc.2016.05.004.

Giannoni, Marc P., and Michael Woodford (2003), "Optimal Interest-Rate Rules: I. General Theory," NBER Working Paper No. 9419, https://www.nber.org/papers/w9419.

Giavazzi, Francesco, and Frederic S. Mishkin (2006), "An Evaluation of Swedish Monetary Policy between 1995 and 2005," Report to the Swedish Parliament, Sweden's Parliament, https://www.riksdagen.se/globalassets/10.-sprak/engelska/reports-from-the-riksdag/an-evaluation-of-swedish-monetary-policy-between-1995-and-2005.pdf.

Gourio, François, Anil K. Kashyap, and Jae W. Sim (2018), "The Tradeoffs in Leaning Against the Wind," *IMF Economic Review* 66(1), 70–115.

Hall, Robert E., and N. Gregory Mankiw (1994), "Nominal Income Targeting," in Mankiw, N. Gregory (ed.), *Monetary Policy*, chap. 2, University of Chicago Press, pages 71–94, https://www.nber.org/chapters/c8329.pdf.

Hatcher, Michael, and Patrick Minford (2014), "Stabilization Policy, Rational Expectations, and Price-Level versus Inflation Targeting: A Survey," CEPR Discussion Paper No. 9820, Centre for Economic Policy Research, https://cepr.org/active/publications/discussion_papers/dp.php?dpno=9820.

Hebden, James, and David López-Salido (2018), "From Taylor's Rule to Bernanke's Temporary Price Level Targeting," Finance and Economics Discussion Series 2018–051, Federal Reserve Board, https://www.federalreserve.gov/econres/feds/files/2018051pap.pdf.

IMF (2015), "Monetary Policy and Financial Stability," Staff Report, International Monetary Fund, https://www.imf.org/external/np/pp/eng/2015/082815a.pdf.

Jordà, Òscar, Moritz Schularick, and Alan M. Taylor (2013), "When Credit Bites Back," *Journal of Money, Credit and Banking* 45, Supplement(2), 3–28.

Kamenik, Ondra, Heesun Kiem, Vladimir Klyuev, and Douglas Laxton (2013), "Why is Canada's Price Level So Predictable?" *Journal of Money, Credit and Banking* 45(1), 71–85.

Kiley, Michael T., and John M. Roberts (2017), "Monetary Policy in a Low Interest Rate World," *Brookings Papers on Economic Activity* (Spring), 317–380, https://www.brookings.edu/wp-content/uploads/2017/08/kileytextsp17bpea.pdf.

Koenig, Evan F. (2013), "Like a Good Neighbor: Monetary Policy, Financial Stability, and the Distribution of Risk," *International Journal of Central Banking* 9(2), 57–82, https://www.ijcb.org/journal/ijcb13q2a3.htm.

Kohn, Donald L. (2007), "John Taylor Rules," speech in Dallas, October 12, Federal Reserve Board, https://www.federalreserve.gov/newsevents/speech/kohn20071012a.htm.

Kohn, Donald L. (2012), "It's Not So Simple," in Koenig, Evan F., Robert Leeson, and George A. Kahn (eds.), *The Taylor Rule and the Transformation of Monetary Policy*, chap. 7, Hoover Institution Press, pages 173–182.

Laséen, Stefan, and Lars E.O. Svensson (2011), "Anticipated Alternative Instrument-Rate Paths in Policy Simulations," *International Journal of Central Banking* 7(3), 1–35, https://www.ijcb.org/journal/ijcb11q3a1.pdf.

Levin, Andrew, Volker Wieland, and John C. Williams (2003), "The Performance of Forecast-Based Monetary Policy Rules Under Model Uncertainty," *American Economic Review* 93(3), 622–645.

McCallum, Bennett T., and Edward Nelson (1999), "Nominal Income Targeting in an Open-Economy Optimizing Model," *Journal of Monetary Economics* 43(3), 553–578.

Mertens, Thomas, and John C. Williams (2019a), "Monetary Policy Frameworks and the Effective Lower Bound on Interest Rates," *AEA Papers and Proceedings* 109, 433–437, https://doi.org/10.1257/pandp.20191083.

Mertens, Thomas, and John C. Williams (2019b), "Tying Down the Anchor: Monetary Policy Rules and the Lower Bound on Interest Rates," Staff Report No. 887, Federal Reserve Bank of New York, https://www.newyorkfed.org/research/staff_reports/sr887.

Mishkin, Frederic S. (1998), "International Experiences with Different Monetary Policy Regimes," Seminar Paper No. 648, Institute for International Economic Studies, http://su.diva-portal.org/smash/get/diva2:327976/FULLTEXT01.pdf.

Murray, John (2019), "Price-Level Targeting and the 'Difference Rule'," private email, quoted by permission.

Nessén, Marianne, and David Vestin (2005), "Average Inflation Targeting," *Journal of Money, Credit and Banking* 37(5), 837–863.

Persson, Torsten, and Lars E.O. Svensson (1989), "Exchange Rate Variability and Asset Trade," *Journal of Monetary Economics* 23, 485–509, https://doi.org/10.1016/0304-3932(89)90043-3.

Qvigstad, Jan F. (2005), "When Does an Interest Rate Path 'Look Good'? Criteria for an Appropriate Future Interest Rate Path—A Practician's Approach," Staff Memo No. 2005/6, Norges Bank, https://www.norges-bank.no/globalassets/upload/import/publikasjoner/arbeidsnotater/pdf/arb-2006-05.pdf.

Reifschneider, David, and John C Willams (2000), "Three Lessons for Monetary Policy in a Low-Inflation Era," *Journal of Money, Credit and Banking* 32(4), 936–966, https://www-jstor-org.ez.hhs.se/stable/pdf/2601151.pdf.

Røisland, Øystein (2006), "Inflation Inertia and the Optimal Hybrid Inflation/Price-Level Target," *Journal of Money, Credit and Banking* 38(8), 2247–2251.

Rosengren, Eric S. (2013), "Should Full Employment Be a Mandate for Central Banks?" speech on April 12, 2013, Federal Reserve Bank of Boston, https://www.bostonfed.org/news-and-events/speeches/should-full-employment-be-a-mandate-for-central-banks.aspx.

Ruge-Murcia, Francisco (2014), "Do Inflation-Targeting Central Banks Implicitly Target the Price Level?" *International Journal of Central Banking* 10(2), 301–326, http://www.ijcb.org/journal/ijcb08q4a6.pdf.

Sargent, Thomas J., and Neil Wallace (1975), "'Rational' Expectations, the Optimal Monetary Instrument, and the Optimal Money Supply Rule," *Journal of Political Economy* 83(2), 241–254.

Schularick, Moritz, and Alan M. Taylor (2012), "Credit Booms Gone Bust: Monetary Policy, Leverage Cycles, and Financial Crises, 1870-2008," *American Economic Review* 102(2), 1029–1061.

Sheedy, Kevin D. (2014), "Debt and Incomplete Financial Markets: A Case for Nominal GDP Targeting," *Brookings Papers on Economic Activity* (Spring), https://www.brookings.edu/wp-content/uploads/2014/03/2014a_Sheedy.pdf.

Svensson, Lars E.O. (1997), "Inflation Forecast Targeting: Implementing and Monitoring Inflation Targets," *European Economic Review* 41(6), 1111–1146.

Svensson, Lars E.O. (2003a), "Escaping from a Liquidity Trap and Deflation: The Foolproof Way and Others," *Journal of Economic Perspectives* 17(4), 145–166.

Svensson, Lars E.O. (2003b), "What Is Wrong with Taylor Rules? Using Judgment in Monetary Policy through Targeting Rules," *Journal of Economic Literature* 41(2), 426–477.

Svensson, Lars E.O. (2005), "Monetary Policy with Judgment: Forecast Targeting," *International Journal of Central Banking* 1(1), 1–54, https://larseosvensson.se/2005/05/01/monetary-policy-with-judgment-forecast-targeting/.

Svensson, Lars E.O. (2007), "Optimal Inflation Targeting: Further Developments of Inflation Targeting," in Mishkin, Frederic S., and Klaus Schmidt-Hebbel (eds.), *Monetary Policy under Inflation Targeting*, vol. 11 of *Central Banking, Analysis, and Economic Policies*, Central Bank of Chile, pages 187–225, https://larseosvensson.se/files/papers/OITFD.pdf.

Svensson, Lars E.O. (2011), "Inflation Targeting," in Friedman, Benjamin M., and Michael Woodford (eds.), *Handbook of Monetary Economics, Volume 3b*, chap. 22, Elsevier, pages 1237–1302, https://larseosvensson.se/files/papers/HandbookIT.pdf https://www-sciencedirect-com.ez.hhs.se/science/article/pii/B9780444534545000104.

Svensson, Lars E.O. (2012), "Evaluating Monetary Policy," in Koenig, Evan F., Robert Leeson, and George A. Kahn (eds.), *The Taylor Rule and the Transformation of Monetary Policy*, chap. 10, Hoover Institution Press, pages 245–274, https://larseosvensson.se/files/papers/EvalMP.pdf.

Svensson, Lars E.O. (2013), "Some Lessons from Six Years of Practical Inflation Targeting," *Sveriges Riksbank Economic Review* 2013:3, 29–80, https://larseosvensson.se/files/papers/Svensson-paper--Some-lessons-from-six-years-of-practical-inflation-targeting.pdf.

Svensson, Lars E.O. (2015), "The Possible Unemployment Cost of Average Inflation below a Credible Target," *American Economic Journal: Macroeconomics* 7(1), 258–296.

Svensson, Lars E.O. (2017a), "Cost-Benefit Analysis of Leaning Against the Wind," *Journal of Monetary Economics* 90(October), 193–213, https://www.sciencedirect.com/science/article/abs/pii/S030439321730082X.

Svensson, Lars E.O. (2017b), "How Robust Is the Result That the Cost of 'Leaning Against the Wind' Exceeds the Benefit? Response to Adrian and Liang," working paper (also available as CEPR Discussion Paper DP11744), Stockholm School of Economics, https://larseosvensson.se/files/papers/how-robust-is-result-that-cost-of-leaning-exceeds-benefit-response-to-adrian-and-liang.pdf.

Svensson, Lars E.O. (2018), "The Future of Monetary Policy and Macroprudential Policy," in *The Future of Central Banking: Festschrift in Honour of Vítor Constâncio*, European Central Bank, pages 69–123, https://larseosvensson.se/2018/05/16/the-future-of-monetary-policy-and-macroprudential-policy/.

Svensson, Lars E.O. (2019), "What Rule for the Federal Reserve? Forecast Targeting," *International Journal of Central Banking,* forthcoming, https://larseosvensson.se/2017/10/14/what-rule-for-the-fed-forecast-targeting/.

Svensson, Lars E.O., and Robert J. Tetlow (2005), "Optimal Policy Projections," *International Journal of Central Banking* 1(3), 177–207, http://www.ijcb.org/journal/ijcb05q4a6.htm.

Svensson, Lars E.O., and Michael Woodford (2005), "Implementing Optimal Policy through Inflation-Forecast Targeting," in Bernanke, Ben S., and Michael Woodford (eds.), *The Inflation-Targeting Debate*, chap. 2, University of Chicago Press, pages 19–83, https://www.nber.org/chapters/c9556.pdf.

Taylor, John B. (1985), "What Would Nominal GDP Targeting Do to the Business Cycle?" *Carnegie-Rochester Conference Series on Public Policy* 22, 61–84.

Taylor, John B. (1993), "Discretion vs Policy Rules in Practice," *Carnegie-Rochester Conference Series on Public Policy* 39, 195–214.

Taylor, John B. (1999), "Introduction," in Taylor, John B. (ed.), *Monetary Policy Rules*, Chicago University Press, pages 1–14, https://www.nber.org/chapters/c7412.pdf.

Vestin, David (2006), "Price-Level versus Inflation Targeting," *Journal of Monetary Economics* 53(7), 1361 – 1376.

Williams, John C. (2015), "Macroprudential Policy in a Microprudential World," FRBSF Economic Letter 2015-18, Federal Reserve Bank of San Francisco, https://www.frbsf.org/economic-research/publications/economic-letter/2015/june/macroprudential-policy-in-a-microprudential-world/.

Williams, John C. (2017), "Preparing for the Next Storm: Reassessing Frameworks and Strategies in a Low R-star World," FRBSF Economic Letter 2017-13, Federal Reserve Bank of San Francisco, https://www.frbsf.org/economic-research/files/el2017-13.pdf.

Williams, John C. (2018), "Monetary Policy Strategies for a Low-Neutral Interest-Rate World," speech on November 30, 2018, Federal Reserve Bank of New York, https://www.newyorkfed.org/newsevents/speeches/2018/wil181130.

Woodford, Michael (2003a), *Interest and Prices: Foundations of a Theory of Monetary Policy*, Princeton University Press.

Woodford, Michael (2003b), "Optimal Interest-Rate Smoothing," *The Review of Economic Studies* 70(4), 861–886.

Woodford, Michael (2004), "Inflation Targeting and Optimal Monetary Policy," *Federal Reserve Bank of St. Louis Review* 86(4), 15–41.

Woodford, Michael (2007), "The Case for Forecast Targeting as a Monetary Policy Strategy," *Journal of Economic Perspectives* 21(4), 3–24.

Woodford, Michael (2012), "Forecast Targeting as a Monetary Policy Strategy: Policy Rules in Practice," in Koenig, Evan, Robert L. Leeson, and George A. Kahn (eds.), *The Taylor Rule and the Transformation of Monetary Policy*, chap. 8, Hoover Institution Press, pages 185–233.

Yellen, Janet L. (2012), "Revolution or Evolution in Central Bank Communications," speech at the Hass School of Business, University of California, Berkeley, November 13, Federal Reserve Board, https://www.federalreserve.gov/newsevents/speech/yellen20121113a.htm.

Appendix

A Endogenous or exogenous labor-market participation rate

Let the quarter-t loss, L_t, be represented by the quadratic loss function,

$$L_t = (\pi_t - \pi^*)^2 + (\ell_t - \ell_t^*)^2, \tag{A.1}$$

where ℓ_t denotes the employment rate and ℓ_t^* denotes the FOMC's estimate of the maximum (sustainable) employment rate.

Let $u_t \equiv \bar{\ell}_t - \ell_t$ denote the unemployment rate, where $\bar{\ell}_t$ denotes the labor-market participation rate. Let $u_t^* \equiv \bar{\ell}_t^* - \ell_t^*$ denote the FOMC's estimate of the minimum (sustainable) unemployment rate, where $\bar{\ell}_t^*$ denotes the FOMC's estimate of the maximum (sustainable) participation rate. Then

$$\ell_t - \ell_t^* \equiv (\bar{\ell}_t - u_t) - (\bar{\ell}_t^* - u_t^*) = (u_t^* - u_t) - (\bar{\ell}_t^* - \bar{\ell}_t). \tag{A.2}$$

If the labor-market participation rate is exogenous to monetary policy, we can set $\bar{\ell}_t^* = \bar{\ell}_t$, so then

$$\ell_t - \ell_t^* = u_t^* - u_t, \tag{A.3}$$

and the loss function can be written as in (1)

B Forecast targeting: The intertemporal forecast loss function

Forecast targeting can be presented a bit more precisely with some notation and definitions, following Svensson (2011, 2019). 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 mean 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 mean forecasts of inflation and unemployment.

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

$$L_{t+\tau,t} = (\pi_{t+\tau,t} - \pi^*)^2 + (u_{t+\tau,t} - u^*)^2. \tag{B.1}$$

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

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

where the discount factor, δ, for simplicity has been set equal to one.

Furthermore, the deviations of 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, (B.2), divided by the horizon, can be written

$$\mathcal{L}_t/T = \text{MSG}_t^\pi + \text{MSG}_t^u, \tag{B.3}$$

where MSG_t^π and MSG_t^u denote the mean squared gaps (MSGs) for, respectively, inflation and unemployment and are defined as

$$\text{MSG}_t^\pi \equiv \sum_{\tau=0}^{T} (\pi_{t+\tau,t} - \pi^*)^2/T, \tag{B.4}$$

$$\text{MSG}_t^u \equiv \sum_{\tau=0}^{T} (u_{t+\tau,t} - u^*)^2/T. \tag{B.5}$$

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 (expected) mandate fulfillment for the variable, with a zero MSG indicating (unlikely) perfect (expected) mandate fulfillment.[45]

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, (B.2), can be modified by the addition of a term that represents the cost of deviating from previously announced policy. The MSGs, (B.4) and (B.5), can then be adjusted by adding to each MSG this term divided by $2T$.

The intertemporal forecast loss, (B.2), is then replaced by

$$\mathcal{L}_t = \sum_{\tau=0}^{T} (\pi_{t+\tau,t} - \pi^*)^2 + \sum_{\tau=0}^{T} (u_{t+\tau,t} - u^*)^2 + \ell_t, \tag{B.6}$$

where ℓ_t here 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 variables; see Svensson (2011, equation (26)). Then the definition of the MSGs, (B.4) and (B.5), is replaced by

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

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

Alternatively, as shown in Giannoni and Woodford (2003) and Svensson and Woodford (2005) and summarized in Svensson (2011), a history-dependent restriction on the policy-rate path and the forecasts can be added. This means that (B.2) 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.

---

[45] 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.

C   Temporary price-level targeting when the ELB binds

Hebden and López-Salido (2018) (HLS) examine the policy rule[46] $\geq$

$$i_t = \max[\, i_t^T + \min(f\,\mathrm{AIG}_{t,t_1}, 0), 0\,] \quad f > 0, \text{ where} \tag{C.1}$$

$$i_t^T = (1-\rho)r^* + \pi_t + a(\pi_t - \pi^*) + b(y_t - y_t^*) \quad \text{and} \tag{C.2}$$

$$\mathrm{AIG}_{t,t_1} = \sum_{j=t_1}^{t} \frac{\pi_j - \pi^*}{j + 1 - t_1}. \tag{C.3}$$

That is, the ELB is set at zero, i_t^T denotes the interest rate for a Taylor-type rule, AIG_{t,t_1} denotes the average-inflation gap since the quarter in which the ELB started to bind, quarter t_1, and f denotes the response coefficient of the average-inflation gap. Then the policy rate equals zero when $i_t^T + f\,\mathrm{AIG}_{t,t_1} \leq 0$, equals $i_t^T + f\mathrm{AIG}_{t,t_1}$ when this expression is positive and $\mathrm{AIG}_{t,t_1} \leq 0$, and equals i_t^T when i_t^T and AIG_{t,t_1} are both positive. HLS also examine an optimal versions of the rule, where the response coefficient f—but not the other coefficients—are chosen to minimize a quadratic loss function of inflation and unemployment gaps.

Bernanke et al. (2019) (BKR) also discuss variants of Bernanke's proposal in terms of a simple instrument rule.

$$i_t = \max\{\, (1-\rho)i_{t-1} + \rho[r^* + \pi_t + 0.5(\pi_t - \pi^*) + (y_t - y_t^*) + \alpha \min(\mathrm{PLG}_{t,t_1}, 0)], 0\}, \quad \alpha > 0, \tag{C.4}$$

where

$$\mathrm{PLG}_{t,t_1} = \sum_{j=t_1}^{t} (\pi_j - \pi^*)/4. \tag{C.5}$$

Here, an inertial Taylor (1999) rule is augmented by the price-level gap, PLG_{t,t_1}, which is given by the accumulated (not average) inflation short-fall since the quarter, t_1, when the ELB started to bind. The price-level gap is included as long as it is negative.

For a policy rule such as (C.1)–(C.3) or (C.4) and (C.5), lift-off may occur while the price-level gap is negative if the inflation and GDP gaps are sufficiently positive. However, BKR also consider variants of Bernanke's original "threshold rule," according to which the policy rate remains at zero regardless of GDP and current inflation until a threshold condition such as $\mathrm{PLG}_{t,t_1} \geq 0$ obtains, at which point the policy is determined by a Taylor-type rule and the non-negativity condition. They furthermore consider both the case when all private agents have model-consistent expectations understand and believe the policy rule and the case when only asset-market participants have such expectations.

In particular, under the threshold rule, they take into account that if the ELB period is extended and the cumulative inflation shortfall is large, the implied commitment to overshoot inflation may be correspondingly large, which they consider could be problematic and risk possible unanchoring inflation expectations. To mitigate against such risks, they consider a price-level gap with limited memory, n, and thus a shorter "look back" given by

$$\mathrm{PLG}_{t,t-n} = \sum_{j=0}^{n} (\pi_{t-n+j} - \pi^*)/4. \tag{C.6}$$

---

[46] The notation of Hebden and López-Salido (2018) and Bernanke et al. (2019) has been modified to agree with the one used in the present paper.

D An interest-rate rule with a lower intercept

When the ELB does not bind, Mertens and Williams (2019a,b) consider interest-rate rules of the form

$$i_t = \theta_0 + \theta_E \mathrm{E}_t \pi_{t+1} + \theta_\varepsilon \varepsilon_t + \theta_\mu \mu_t, \tag{D.1}$$

where $\theta_E > 1$ and ε_t and μ_t are zero-mean i.i.d. shocks to a the New Keynesian aggregate-demand function and Phillips curve, respectively. The inflation target is initially set to zero.

The corresponding interest-rate rule with an nonzero inflation target, π^*, can be written

$$
\begin{aligned}
i_t &= r^* + \pi^* + \theta_E(\mathrm{E}_t \pi_{t+1} - \pi^*) + \theta_\varepsilon \varepsilon_t + \theta_\mu \mu_t \\
&= [r^* - (\theta_E - 1)\pi^*] + \theta_E \mathrm{E}_t \pi_{t+1} + \theta_\varepsilon \varepsilon_t + \theta_\mu \mu_t,
\end{aligned} \tag{D.2}
$$

where r^* is the neutral real interest rate.

Comparing D.1 and D.2, we can identify θ_0,

$$\theta_0 \equiv r^* - (\theta_E - 1)\pi^*. \tag{D.3}$$

Thus, we see that, because $\theta_E > 1$, lowering the intercept θ_0 implies raising the inflation target π^*.