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Beyond Inflation Targeting: Should Central Banks Target the Price Level?

By George A. Kahn

Over the last two decades, many central banks have adopted formal inflation targets to guide the conduct of monetary policy. During this period, inflation has come down in many countries and been relatively stable by historical standards. This favorable performance to date, however, has not stopped economists and policymakers from considering other approaches to the conduct of policy. One idea that has gained considerable attention is price-level targeting. For example, the Bank of Canada is actively researching the use of price-level targets as an alternative to inflation targets in anticipation of its next policy agreement with the Government, set for 2011. Under a price-level target, a central bank would adjust its policy instrument—typically a short-term interest rate—in an effort to achieve a pre-announced level of a particular price index over the medium term. In contrast, under an inflation target, a central bank tries to achieve a pre-announced rate of inflation—that is, the change in the price level—over the medium term.

Price-level targeting offers a number of potential benefits over inflation targeting. While inflation targets have helped stabilize inflation,

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the future *level* of prices remains uncertain. Price-level targets would by definition remove much of this uncertainty. Price-level targeting also has the advantage of potentially generating greater stability of both output and inflation. Particularly in the current low-inflation environment, where nominal policy rates have fallen near zero, price-level targeting may help support expectations of a positive inflation rate. These inflation expectations, in turn, would keep real interest rates negative, thereby stimulating interest-sensitive spending and contributing to economic recovery.

While price-level targeting offers a number of potential benefits relative to inflation targeting, the benefits may be relatively small and uncertain. In addition, price-level targeting is untested in practice (except for Sweden in the 1930s) and would present challenges for policymakers in communicating with the public regarding the objectives and direction of policy over the medium run. As a result, price-level targeting will not likely be adopted by central bankers without considerable further research or a dramatic deterioration in economic performance that leads policymakers to fundamentally reconsider how they conduct monetary policy.

The first section of the article defines price-level targeting. The second section identifies how a price-level target can, in theory, improve economic performance relative to an inflation target. The third section provides a number of reasons why policymakers may be reluctant to move to price-level targeting.

I. WHAT IS PRICE-LEVEL TARGETING?

A primary goal of central banking is "price stability." For example, the Federal Reserve Act defines the goals of U.S. monetary policy as "maximum employment, stable prices, and moderate long-term interest rates." Taken literally, price stability is a constant price level. But, in practice, no modern central bank pursues literal price stability as a goal. Instead, central bankers have interpreted the goal of price stability more broadly. Former Federal Reserve Chairmen Paul Volcker and Alan Greenspan have defined price stability as a macroeconomic environment in which inflation is not a factor in the decisions of consumers and businesses. Other central bankers have interpreted price stability as a "low and stable" rate of inflation.[1] And, at many central banks,

price stability is defined explicitly as a numerical target for inflation in a particular price index. For example, the Bank of England defines price stability by an inflation target set by the Government of 2 percent annual inflation in the consumer price index.

While there is agreement that inflation is costly and should therefore be minimized, for a number of reasons policymakers nevertheless aim for an inflation rate above zero. First, available measures of inflation are imperfect and tend to overstate "true" inflation.[2] Second, a little inflation may make it easier for firms to reduce real wages—without cutting nominal wages—when necessary to maintain employment in an economic downturn.[3] Third, a negative inflation rate—deflation—could be even more costly than a similar rate of inflation, suggesting that a low rate of inflation might be desirable to insure against falling prices.[4] Finally, at very low levels of inflation, nominal short-term interest rates may be very close to zero, limiting a central bank's ability to ease policy in response to economic weakness. Because nominal rates cannot fall below zero, policymakers cannot cut short-term interest rates any further once they have lowered these rates to zero.[5]

For these reasons, proposals to target the price level do not usually suggest that policymakers pursue a constant price level. Rather, they typically recommend that policymakers set a target for the price level that rises over time. Thus, under a price-level target, the economy would experience an average inflation rate that was low but still positive. Even with this positive average inflation, though, consumers and businesses could be confident about where the price level will be many years into the future. This, in turn, would help them make better savings, investment, retirement, and other decisions that depend on predicting the price level 20 or 30 years from today.

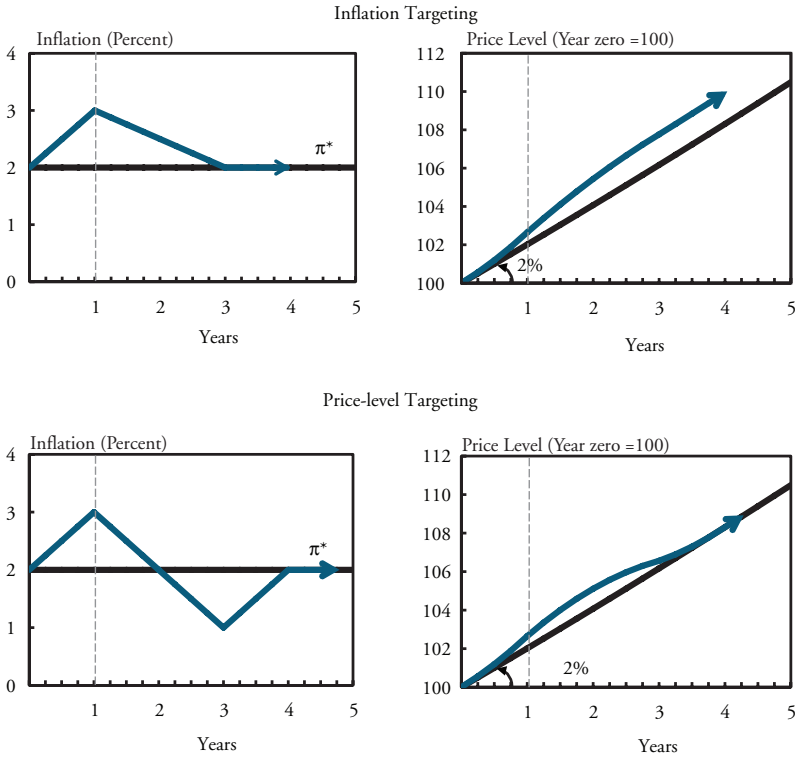
In contrast, a monetary policy that targets inflation, even at a low level, can leave considerable uncertainty about the price level many years into the future. This uncertainty arises because a central bank that targets an inflation rate will treat past target misses as bygones. When inflation deviates from target, the central bank will take actions to return inflation gradually to target without regard to any impact on the price level. Technically, inflation targeting introduces a random walk element into the price level. This random walk element implies that the price level can, over time, drift arbitrarily far from any given value.

Chart 1 illustrates the difference between inflation targeting and price-level targeting. This is a useful comparison because many central banks currently have formal inflation targets, and virtually all central banks, whether they have explicit inflation targets or not, aim to achieve a low and stable inflation rate over the medium term. The top left panel of the figure shows how an inflation-targeting central bank might respond to an economic shock that caused inflation to rise above the central bank's inflation target of π^*. In particular, if inflation were initially at its 2 percent (per year) target and the inflation shock caused inflation to rise to 3 percent in period 1, the central bank would adjust its policy instrument to push inflation back to its 2 percent target over the next several periods.

The top right panel shows how such a policy would affect the price level. The black line shows how the price level would evolve if inflation stayed on target at all times, rising at the rate of the 2 percent inflation target. The blue line shows how an inflation shock would increase the price level relative to an upward-sloping 2 percent path. Because an inflation targeting central bank treats bygones as bygones and moves the inflation rate back only to its 2 percent target, the economy experiences a period of inflation above 2 percent, and the price level rises permanently above the previous 2 percent path. Over time, with the economy intermittently buffeted with inflation shocks, the price level can drift arbitrarily far away from the fixed path for the price level.

In contrast, the bottom panel of Chart 1 shows how a price-level targeting central bank might respond to an inflation shock. Under a price-level target, a central bank would try to offset the impact of an inflation shock on the price level. As a result, as shown in the bottom left panel, if a shock caused inflation to rise from its 2 percent target to 3 percent, a price-level targeting central bank would try to push inflation down not only to its target but temporarily below its target. A period of above-target inflation would have to be matched by a period of below-target inflation. As a result, as shown in the bottom right panel, the price level would temporarily rise above the 2 percent price path but eventually return to the path. Over the medium term, under a price-level target, economic decision-makers could count on prices remaining close to a predetermined path.

Chart 1
INFLATION VS. PRICE-LEVEL TARGETING



Price-level targeting can also be compared with another, related policy strategy that researchers have suggested as a middle ground between price-level targeting and inflation targeting—*average*-inflation targeting (Nessén and Vestin).[6] Under an average-inflation target, policymakers would try to achieve an inflation rate today that, when averaged with inflation from previous periods, would equal a target inflation rate. For example, policymakers might set an average-inflation objective of 2 percent over three years. Then, if inflation two years ago had been 2 percent and inflation last year had been 3 percent, policymakers would need to aim for 1 percent inflation this year to achieve a three-year-average inflation rate of 2 percent.[7] Assuming the 1 percent inflation rate was achieved, policymakers would need to aim for 2 percent inflation next year.

Chart 2 illustrates this example over a longer time frame and shows the corresponding behavior of the price level. The top panel shows that inflation would oscillate around the average-inflation target. For every period after the initial shock, inflation in that period and the two previous periods would average out to 2 percent.[8] As a result, the average inflation target is always achieved even though inflation is continually fluctuating above and below 2 percent.[9]

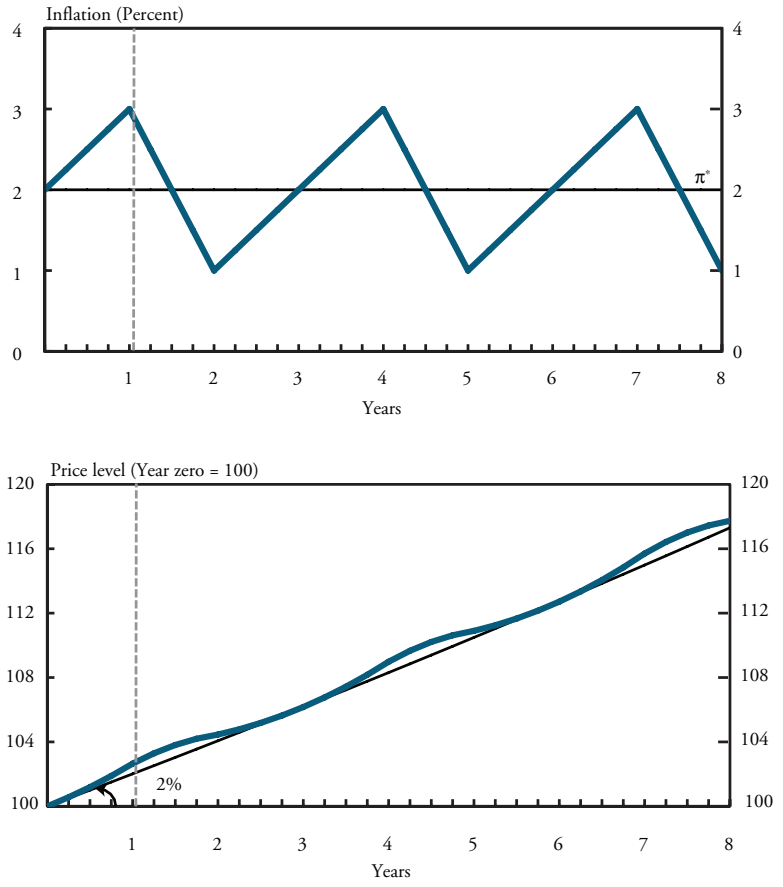
Similarly, the bottom panel shows that the price level also oscillates just above the path associated with a fixed 2 percent inflation rate—touching the path every third year. Although the price level deviates from the path, it never strays arbitrarily far from the path. Thus, average-inflation targeting shares with price-level targeting the property that the price level remains anchored to a predetermined path. Furthermore, it can be shown that the longer the period over which inflation is averaged under an average-inflation target, the more average-inflation targeting looks like price-level targeting (Nessén and Vestin).

In sum, a price-level target commits the central bank to keep the price level on a predetermined and, typically, upward-sloping path. While the slope of the path is the same as the central bank's inflation target, the response of the central bank to a deviation of inflation from target is different under a price-level target than under an inflation target. Under an inflation target, the central bank treats bygones as bygones, and an inflation shock permanently shifts the economy's price path to a different level. Under a price-level target, the central bank keeps the economy on a predetermined price path, requiring it to match any movement in inflation above target with an equal and opposite, policy-induced movement in inflation below target. Finally, a price-level target shares many of the properties of an average-inflation target, especially as inflation is averaged over many periods.

II. WHAT IS THE APPEAL OF PRICE-LEVEL TARGETING?

Price-level targeting has a number of features that make it potentially appealing as an alternative to inflation targeting. First, as suggested above, it reduces uncertainty about the level of prices far in the future. Second, and counterintuitively, it has the potential to reduce fluctuations in output and inflation when economic agents—generally, consumers and businesses—are forward looking and base their inflation expectations on

Chart 2
AVERAGE-INFLATION TARGETING
Three-year average target



the central bank's price-level target. Third, it has the potential to reduce the likelihood of sustained deflation or recession when interest rates are close to zero and traditional monetary policy tools are ineffective.

Reducing price-level uncertainty

One potential benefit of moving from an inflation target to a price-level target would be the associated reduction in future price-level uncertainty. Over time, the degree of price-level uncertainty accompanying an inflation-targeting monetary policy depends on the evolution

of shocks to inflation. Suppose for example a central bank targets the inflation rate at 2 percent per year and that the central bank can control the inflation rate up to a random, unpredictable control error, then:

$$\pi_t = .02 + u_t,$$

where π_t represents the inflation rate at time t and u_t represents the control error.[10] Recognizing that π_t is equal to the change in (the log of) the price level and rearranging terms yields the following expression for the price level:

$$p_t = .02 + p_{t-1} + u_t,$$

where p_t represents (the log of) the price level at time t.

The equation for today's price level can be used to project the future price level. Projecting the future price level is important for many decisions that involve long-term nominal commitments, such as the purchase of a long-term bond or the decision about when to retire. In particular, the price level n periods ahead is given by the following expression:

$$p_{t+n} = .02(n+1) + p_{t-1} + u_t + u_{t+1} + u_{t+2} + \ldots + u_{t+n}.$$

Thus, the actual price level n periods in the future will depend on the sum of the realizations of the control errors. Because the control errors are unpredictable, the expected value of the current and all future u_t terms is zero. The expected (log) price level n periods ahead is then $.02(n+1) + p_{t-1}$. Thus, if the price level last year was 100, the expected price level 20 years from now, given a steady inflation rate of 2 percent, would be 152.[11] This increase in the price level would mean that last year's income of $10,000 would be expected to buy only $6,579 worth of goods and services 20 years from now.

Over long periods, however, the uncertainty surrounding the expected future value of the (log) price level can get very large. By standard statistical formulas, the forecast error variance of the price level n periods in the future is n times the variance of u_t.[12] And, a 95 percent confidence band for the price level n periods into the future is roughly equal to the expected price level plus or minus 2 times the square root of $n[var(u_t)]$. This formula can be used to get a rough estimate of the long-run price-level uncertainty associated with a monetary policy that targets the inflation rate.[13]

While the Federal Reserve does not have an explicit numerical target for inflation, some analysts have characterized Fed policy since the early 1980s as acting as if it did (Taylor). Moreover, evidence suggests that from

1995 to 2007 inflation in the United States can be characterized as fluctuating randomly around its average level.[14] Assuming this behavior of inflation were to continue, it is possible to very roughly estimate the range of uncertainty of the future price level for the United States.

Estimates are based on the personal consumption expenditure (PCE) price index net of food and energy (the "core" PCE price index)—an index closely monitored by the Federal Reserve. Inflation is measured annually as the change in the core PCE price index from fourth quarter to fourth quarter from 1995:Q4 to 2007:Q4.[15] Over this period, the variance of core PCE inflation (around a constant 2 percent rate) is 0.13 percent. Thus, the variance of (the log of) the core PCE price level 20 years into the future is 20 times 0.13, or 2.6 percent. This implies that a 95 percent confidence band for the (log) price level 20 years into the future is the expected (log) price level plus or minus 3.2 percent (±2 times the square root of 2.6). Thus, if the price level today were 100, a worker expecting to retire in 20 years could expect a future price level of 152 and have 95 percent confidence that it would be between 147 and 157, assuming a 2 percent implicit inflation target.

Whether these numbers represent a large uncertainty cost in making plans 20 years into the future is a subjective judgment. McCallum, who estimates a considerably larger number for the United States using a similar methodology but different time period and measure of inflation, believes his estimate represents "a rather small amount of price-level uncertainty—at least in comparison with the magnitudes that prevailed over the 1960s, 1970s, and 1980s…" (pp. 1498-99). This suggests there would be little to gain in terms of reduced uncertainty about the future level of prices by moving from an implicit inflation target to a price-level target. But McCallum recognizes that his views may not be shared by all analysts. Moreover, the estimates based on the 1995 to 2007 data are from a period of relative stability. It is far from certain that this behavior of inflation will continue over a long time span.

Another way to gauge the degree of price-level uncertainty associated with inflation targeting is to examine the behavior of the price level in countries that have adopted explicit numerical objectives for inflation. The experience of these countries is mixed but generally supports the view that inflation targeting does not necessarily result in any considerable degree of price-level uncertainty. Chart 3 shows the price

level for Canada, the Euro area, New Zealand, Sweden, and the UK from the date their central banks adopted numerical inflation targets to today.[16] The black lines represent the price level that would have resulted if each central bank had, on a quarter-by-quarter basis, consistently hit its inflation target or—in cases where the target is expressed as a range—the middle of its target range. The blue lines show the actual evolution of the price level over time.

In some cases, the price level stays close to the path implied by the initial setting of the inflation target. For example, in the UK and the Euro area, the price level has remained remarkably close to a fixed 2 percent growth path despite the potential for the price level to drift off a fixed path under an inflation-targeting monetary policy. Although the Bank of England was explicitly targeting the inflation rate and the European Central Bank (ECB) had an explicit numerical inflation objective, their price paths look more like the price-level targeting illustration of Chart 1 (lower right panel) than the inflation-targeting illustration (upper right panel). This suggests that actual control errors in achieving the inflation target were small and offsetting. Of course, past behavior does not necessarily predict the future, and the apparent offsetting price shocks in the UK and Euro area may not prevail in the future.

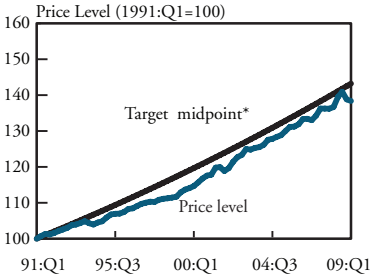
The experience of the other countries has been more varied. The Bank of Canada's inflation target has been associated with persistent, but relatively small, deviations from a fixed growth path for the price level. Over the first 30 quarters of the Bank's inflation-targeting regime, the price level drifted below a fixed growth path. But, over the next 40 quarters, it drifted back toward the growth path—indicating that the price level in 2009 is close to the level agents might have expected 18 years earlier. New Zealand has also experienced persistent, but temporary, deviations from a fixed price path. However, the Reserve Bank of New Zealand's target inflation rate has changed twice. Based on its initial target, shown by the dashed line, an economic agent in 1990 would have expected a much lower price level than actually occurred 18 years later. Finally, in Sweden, the price level has consistently drifted below a fixed price target.

Overall, the evidence suggests that inflation targeting does not necessarily lead to a drifting of the price level away from a fixed path. However, there are no guarantees. Thus, one advantage of a price-level

Chart 3

THE PRICE LEVEL IN SOME COUNTRIES WITH EXPLICIT NUMERICAL INFLATION OBJECTIVES

Canada

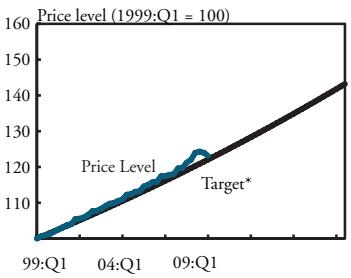


Quarters since adoption of inflation target

*The official inflation target is 1 to 3 percent as measured by the CPI.

Source: Bank of Canada

Euro Area

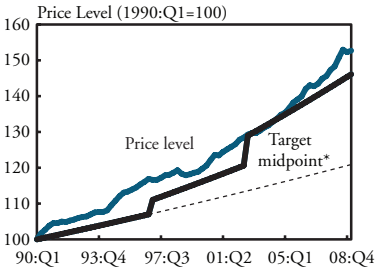


Quarters since adoption of inflation target

*The official inflation objective is "below, but close to 2 percent" as measured by the HICP.

Source: European Central Bank

New Zealand

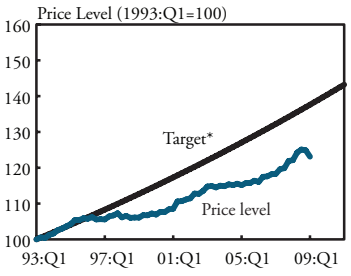


Quarters since adoption of inflation target

*The official inflation target was 0 to 2 percent from 1990:1 to 1996:4, 0 to 3 percent from 1997:1 to 2002:3, and 1 to 3 percent from 2002:4 to the present as measured by the CPI.

Source: Reserve Bank of New Zealand

Sweden

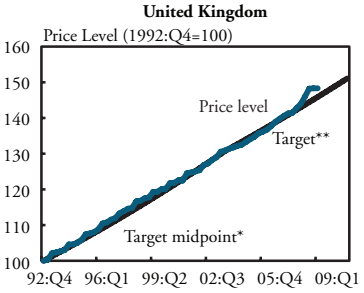


Quarters since adoption of inflation target

*The official inflation target is 2 percent, with a +/- 1 percent tolerance as measured by the CPI.

Source: Sveriges Riksbank

United Kingdom



Quarters since adoption of inflation target

*The midpoint of the official inflation target was 2 ½ percent as measured by the RPIX from 1992:4 to 2003:3.
**The official inflation target was 2 percent as mesured by the HICP from 2003:4 to the present.

Source: Bank of England

target would be to provide a stronger guarantee that the future price level would not drift far from the expected future price level.

Reducing variability in output and inflation

Early research comparing inflation targeting to price-level targeting dismissed price-level targeting as causing unacceptable volatility in inflation and output. More recent research has reached a starkly different conclusion.

Early research. Intuitively, price-level targeting would appear to reduce uncertainty about the future price level at the cost of an *increase* in the volatility of inflation. After all, any increase in inflation above the rate of increase in the price-level target would need to be matched by a period of inflation below target. Indeed, this intuition led many observers in the early 1990s to dismiss price-level targeting as a viable monetary policy strategy. For example, Fischer concluded that "Price-level targeting is thus a bad idea, one that would add unnecessary short-term fluctuations to the economy" (p. 282). This would also appear to be the implication from Chart 1, where a positive inflation shock must be offset with disinflation under a price-level target, but not under an inflation target.

Haldane and Salmon reach a similar conclusion based on an estimated model. The model consists of equations for real output, money demand, inflation, and wages. Importantly, policymakers are assumed to set interest rates based on backward-looking feedback rules that relate the interest rate to the equilibrium nominal rate and to deviations of either inflation from an inflation target or the price level from a price-level target. In addition, inflation expectations are assumed to be based on a backward-looking function of past inflation and past money growth. In the model, the major benefit of a price-level target relative to an inflation target is reduced uncertainty about the future price level. This uncertainty grows over time under inflation targeting.

The major cost of a price-level target comes from supply shocks—shocks such as an increase in oil prices that push the price level up and cause output to fall. Under a price-level target, these shocks would lead the central bank to tighten policy to extinguish the impact of the shock on the price level.[17] This, in turn, would further exacerbate the decline in output. In contrast, an inflation-targeting central bank would "for-

give—and forget" shocks to the price level. The result would be a permanent shift in the price-level path, but with less short-run inflation and output volatility. Thus, a price-level target could lead to greater variability in inflation *and* output over the short run compared with an inflation target.[18]

On net, determining whether a price-level target improved economic performance relative to an inflation target would depend on whether the cost of increased output and inflation variability was more or less than the benefit of greater long-run price-level certainty. Haldane and Salmon offer no guidance on how to evaluate this tradeoff.

Recent research. More recent research comparing price-level targeting to inflation targeting reaches a starkly different and somewhat counterintuitive conclusion. The key difference in this research is the assumption that the central bank behaves optimally subject to constraints. In a paper published in 1999, Lars Svensson suggested price-level targeting offered a "free lunch" to policymakers. Svensson's analysis assumes the central bank minimizes a loss function that reflects a dual mandate for price and output stability and takes one of two possible forms. In one case, the loss function penalizes fluctuations in inflation around an inflation target and in output around potential output. In the other case, the loss function penalizes fluctuations in the price level around a price-level target and in output around potential. The central bank is assumed to have perfect control over the inflation rate or the price level and, in each period, to determine the optimal inflation rate or price level based on the corresponding loss function.

In Svensson's model, the central bank is constrained by a short-run Phillips curve that relates real output to lagged real output and unexpected inflation.[19] The Phillips curve is neoclassical in the sense that prices are assumed to be set one period in advance and that unanticipated, rather than expected, inflation affects real output. In addition, agents are assumed to form expectations about inflation "rationally" in that they incorporate all available information and know the structure of the underlying model. This assumption is in contrast to earlier work in which inflation expectations were assumed to be backward looking. Finally, the central bank is assumed to behave optimally subject to the constraints imposed by the Phillips curve and the rational expectations assumption. Under these assumptions, Svensson

shows that a price-level target produces less volatility in inflation than an inflation target—with the same output volatility—as long as movements in output are persistent.[20]

The intuition for the result comes from the different decision rules the central bank uses to determine inflation in an inflation-targeting regime versus the price level in a price-level-targeting regime. Under inflation targeting, the optimal setting of the inflation rate depends on the output gap—the difference between actual and potential output. As a result, the variance of inflation is proportional to the variance in the output gap. Under price-level targeting, the optimal setting of the *price level* depends on the output gap. Therefore, inflation depends on the *change* in the output gap, and the variance of inflation is proportional to the variance of that change. With at least a moderate degree of persistence in the output gap, the variance of the change in the gap is smaller than the variance of the level of the gap. Therefore, price-level targeting results in a lower variance of inflation.[21]

Svensson's research renewed interest in price-level targeting but was criticized for its reliance on the neoclassical Phillips curve.[22] Other researchers, however, have replicated Svensson's results under an alternative specification of the Phillips curve—the so-called "new-Keynesian" Phillips curve. In contrast to the neoclassical Phillips curve, the new-Keynesian Phillips curve assumes prices are sticky for more than one period (as opposed to being reset every period) and output is affected by expected *future* inflation (as opposed to current unexpected inflation).[23] This new-Keynesian model arguably fits U.S. data better than a model based on the neoclassical Phillips curve and has become the workhorse model for nearly all analysis of monetary policy.

Vestin demonstrates how the forward-looking elements in a standard new-Keynesian model operate under inflation and price-level targets.[24] As in Svensson's paper, the central bank is assumed to minimize a loss function that penalizes output variability and either inflation or price-level variability. Vestin, like Svensson, finds that price-level targeting results in a more favorable tradeoff between inflation and output variability than inflation targeting.

The result depends on the way agents adjust their inflation expectations when confronted with a cost-push shock—a shock that raises costs of production and pushes up prices. In particular, agents expect

the central bank to act more forcefully under a price-level target. They know that the central bank will try to offset the effect of the shock on the price level over the next several periods by reducing output. As a result, agents adjust down their expectation of future inflation more aggressively than they would under an inflation-targeting central bank. This in turn reduces today's inflation rate, allowing the central bank to then limit the decline in real output. Thus, price-level targeting results in less variation in *both* output and inflation.[25]

Reducing downside risk in a low-inflation environment

Price-level targeting can also help stabilize output in a low-inflation environment. In such an environment, interest rates are also likely to be low, with limited scope for further reduction. And with most central banks using a short-term interest rate as the key instrument of monetary policy, their ability to influence short-term rates is important for effective stabilization policy. Since nominal interest rates cannot fall below zero, the closer short-term rates are to zero, the less scope there is for policymakers to lower rates to stabilize the economy in a downturn. Once interest rates fall to zero, conventional monetary policy is no longer available.

Moreover, if the economic downturn is accompanied by expectations of falling inflation, real interest rates will actually rise. Real rates—nominal rates adjusted for expected inflation—are important determinants of spending on business structures and equipment, housing, and consumer durables. Rising real rates have the potential to further dampen economic activity. Thus, at the zero nominal interest rate bound, policymakers not only lose the ability to lower nominal rates further, they also may be confronted with rising real rates and a downward spiral of economic activity.[26]

These issues are of particular importance in the current global economic environment. The financial crisis of 2008 has pushed the global economy into recession, and inflation has fallen sharply. Central banks, including the Federal Reserve, have pushed short-term interest rates close to zero. And policymakers have turned to a range of unconventional policies to stimulate economic activity. These include increasing the quantity of reserves in the banking system, outright purchases of long-term assets such as Treasury notes and mortgage-backed securities,

and managing expectations of future policy actions through central bank communications with the public.[27] One policy—that has not been tried—is a price-level target.

A number of researchers have pointed out that a price-level target can help mitigate the effects of the zero interest rate bound.[28] Suppose a negative shock—or series of negative shocks—pushes the economy into recession. The conventional monetary policy response would be for the central bank to lower its nominal policy rate, all the way to zero if necessary. At that point, even though nominal rates can fall no further, the central bank can still influence *real* rates. It can do so by influencing inflation expectations.

While an inflation target can help keep real rates from rising, a price-level target can actually exert downward pressure on real rates. Under a credible inflation target, medium-term inflation expectations will remain anchored at the inflation target, keeping real interest rates negative.[29] (The real rate would be anchored at zero minus the inflation target.) While these negative real rates would help support economic activity, policymakers can potentially do better with a price-level target. Under a credible price-level target, any decline in inflation that takes the price level below its target path must be matched by a subsequent rise in inflation. Therefore, the greater the downward pressure on inflation is today, the higher inflation will be expected in the future. This increase in medium-term inflation expectations results in an equal decrease in real rates, providing additional stimulus to economic activity even though nominal rates remain stuck at zero.[30]

A price-level target also makes it less likely that policymakers will encounter the zero bound in the first place. Billi shows that, in a new-Keynesian model, a price-level target can lead to less variability in the nominal interest rate than an inflation target and, therefore, a reduced likelihood of hitting the zero lower bound. This occurs because inflation expectations serve as a kind of automatic stabilizer, allowing the central bank to move interest rates less in response to economic shocks.

In summary, a price-level target has the potential to reduce uncertainty about the price level far into the future. It can also lead to less volatility in inflation and output. It can help stabilize output when

inflation is low and interest rates hit the zero bound. And, it can reduce the likelihood of hitting the zero bound in the first place.

III. WHY HAVEN'T CENTRAL BANKS ADOPTED PRICE-LEVEL TARGETING?

Economic researchers at universities and central banks are studying the merits of price-level targeting, but only policymakers at the Bank of Canada are seriously considering the possibility of actually doing it. If price-level targeting holds such promise, why has no other modern central bank considered adopting it? While economic theory suggests there may be benefits from price-level targeting, a number of practical considerations may make policymakers reluctant to embrace it. First, at least until recently, existing policy strategies appeared to be working well. Second, price-level targeting has not been tried in practice by any central bank since the 1930s. Third, the transition costs of moving to a price-level target may be large relative to the long-run benefits. Finally, adopting a price-level target may pose serious challenges for policymakers in communicating the objectives and direction of policy over the medium term.

If it ain't broke, don't fix it

One key reason why central banks have not adopted price-level targeting is that, at least until recently, existing policy strategies appeared to be working quite well. Over the last 20 years, many central banks have adopted inflation targets. Other central banks that have not adopted formal inflation targets, such as the Federal Reserve, have arguably responded more aggressively to deviations of inflation from desired levels than in the 1970s and early 1980s. As a result, inflation expectations have become better anchored.[31] In addition, inflation has come down and become more stable around the globe, and the business cycle has moderated. Indeed, the period since the early 1980s in the United States, and somewhat later in some other industrialized countries, has been called the "Great Moderation."

While economic performance has deteriorated considerably since 2007 due to the global financial crisis, central banks have responded aggressively with conventional and nonconventional policies. The full impact of these actions has not yet been felt. Thus, it is too early to

assess the success of the monetary policy response. It is also inherently difficult to determine whether an alternative approach would produce a better outcome in practice. Nevertheless, if it appeared that current policies were not proving effective in resolving the crisis, price-level targets might be one option that central bankers might want to consider.

It hasn't been tried in practice

Another reason central banks may not be willing to embrace price-level targeting is that they have no modern practical experience with such targets. All of the arguments supporting price-level targets come from economic theory and past empirical relationships. The economic theory is a highly stylized representation of the actual economy that abstracts from many real world considerations. Past relationships may not predict future behavior, especially when policy changes in a fundamental way. Therefore, before putting an untested policy strategy in place, policymakers may want to see that the benefits of price-level targeting are robust across a wider range of economic models, including models that incorporate more of the complex features of modern economies. Finally, while some policymakers may find price-level targets appealing, no central bank may be willing to be the first to implement them. Every central bank may be waiting to learn from the experience of another central bank.

While there is no modern example of a price-level targeting central bank, there is one historical precedent. At the onset of the Great Depression in 1931, Sweden went off the gold standard and adopted a price-level target. The rationale was to counter deflationary pressures associated with the depression and to prevent any inflation that might accompany an abandonment of the gold standard. In implementing the program, Sweden fixed the target for the consumer price index at its September 1931 level, which was normalized to 100 (Berg and Jonung).

The performance of the Swedish economy in the 1930s was better than that of many other countries, especially those that remained on the gold standard. From 1931 to 1936, the price level fluctuated in a range of 98.4 to 101.6 before rising above 102 in 1937. Corresponding to this behavior of the price level, monthly inflation ranged from roughly -8 percent to +8 percent at an annual rate, with 32 months of inflation, 21 months of deflation, and 14 months of unchanged prices. While industrial production fell 21 percent from 1929 to 1932, the decline was less

than half that in the United States over the same period. In addition, Sweden avoided sustained double-digit deflation. In 1937, however, Sweden abandoned its price-level target to prevent an appreciation of the Swedish krona relative to the British pound (Berg and Jonung; and Dittmar, Gavin, and Kydland).

While the Swedish experience provides a somewhat favorable impression of economic performance under a price-level target during a time of unusual economic stress, the applicability of the experience to a modern economy is questionable. In addition, it conveys little information about the use of a price-level target in more normal times. Finally, lessons learned from the experience of a small economy 70 years ago may not readily translate to a large modern economy such as the United States or the Euro area.

All that said, it is not out of the realm of possibility that a central bank could take the leap from inflation targeting to price-level targeting. After all, *inflation* targets were untried when the Reserve Bank of New Zealand adopted an inflation-targeting regime in 1990 and when the Bank of Canada and the Bank of England followed suit over the next couple of years. In addition, periods of crisis or generally subpar economic performance often lead to dramatic changes in monetary policy.[32] And at least one central bank is considering it.

In particular, the Bank of Canada has announced that it is actively studying price-level targeting as an alternative to inflation targeting. While inflation targeting is viewed as successful by the Bank of Canada, "there remains the question of whether the specific regime established in the 1990s will deliver the greatest contribution to economic performance in the decades ahead" (Duguay 2007). Accordingly, when the Bank last renewed its five-year inflation-targeting agreement with the Government in 2006, it published a background paper raising the question of whether the current 2 percent target for inflation was the right target and whether the Bank should adopt a target path for the level of prices (Bank of Canada; Duguay 2007).

In addition, the Bank began a comprehensive research program to vet the various alternatives before 2011 when the next inflation control target must be established between the Bank and the Government. The spring 2009 issue of the Bank of Canada's *Review* discusses the results of some of this research.[33] It concludes that "it is not yet clear whether

a price-level target would be preferable to our current inflation target. Further research into price-level targeting is thus a priority for the Bank's economists" (Amano, Carter, and Coletti, p. 5).

The transition costs may be large

Even if price-level targeting is a good idea, the transition cost of moving to a price-level target may be viewed as high. The public may question a central bank's commitment to a newly adopted policy of targeting the price level. And if the central bank's commitment is not credible—if the public doubts that the central bank will take actions to keep the price level on target over the medium run—inflation expectations may not adjust in line with the price-level target. The potential moderation in output and inflation fluctuations that price-level targeting promises may not be realized until the public "learns" that the central bank is committed to the price-level target.

Several economic studies have analyzed how central bank credibility affects the net benefits of moving from an inflation target to a price-level target. For example, MacLean and Pioro (MP) incorporate incomplete credibility into a model of the Canadian economy to examine whether a shift to a price-level target from an inflation target still reduces variation in inflation, output, and interest rates. Their approach assumes some agents have backward-looking expectations and, therefore, do not adjust their beliefs when the central bank announces that it will shift policies. Other agents are assumed to be forward looking and do adjust their beliefs. They find that, with a mix of backward-looking and forward-looking agents, moving to a price-level target can reduce volatility of inflation, output, and interest rates if the forward-looking agents immediately begin basing their expectations on the price-level target. "In other words, some degree of credibility is essential, but it is considerably less than complete credibility" (p. 155).

In another study, Kryvtsov, Shukayev, and Ueberfeldt (KSU) model credibility as a gradual adjustment of agents' expectations in response to a one-time shift in policy from an inflation target to a price-level target. Imperfect credibility is defined as "the economic agents' belief that the monetary policy might revert back to inflation targeting in the subsequent period" (p. 2). The authors find that imperfect credibility reduces the potential benefits of a price-level target. If agents think there is some

likelihood that policy will revert back to inflation targeting, the automatic stabilizer effect of expected future inflation on current inflation will be diminished. This, in turn, will lead the central back to adjust policy more aggressively to hit the price-level target. As a result, the longer it takes for the central bank to achieve full credibility, the smaller the net gain from price-level targeting, with the outcome eventually turning to a net loss (KSU).

MP and KSU examine the importance of credibility assuming that expectations are formed through a fixed process. Other researchers have examined how economic performance is affected when agents must "learn" over time that the central bank has shifted from an inflation target to a price-level target. For example, Gaspar, Smets, and Vestin (GSV) use a new-Keynesian model in which agents form expectations by "adaptive learning" to analyze how agents might use past economic performance to detect a change in policy regime. In contrast to the standard rational expectations assumption in the new-Keynesian literature, agents in the GSV model update their expectations regularly by estimating, each period, a regression of the price level on past price levels.[34] GSV show that, in the long run, adaptive learning converges to the same outcome as in the model with rational expectations. Thus, "even under adaptive learning (where agents are completely backward looking), eventually the benefits of price-level stability can be achieved in the long run" (p. 28).

GSV also show that the speed of convergence depends on the credibility of the announcement of the price-level target and the speed with which agents are assumed to learn. When the learning process is slow, the transition costs can be large and the move to a price-level target will not, on net, be beneficial. In contrast, with learning speeds that are somewhat higher—and consistent with empirical evidence on learning—the net benefits are positive. In any case, the net benefits can be increased if effective communication by the central bank can speed the learning process.

Communication may be difficult

Given the importance of central bank communication to credibility, a key question is how effectively a central bank can communicate with the public under a price-level targeting regime. Relative to an inflation-targeting regime, price-level targeting may pose a number of

challenges. In an inflation-targeting regime, the main information that needs to be communicated to the public is the inflation target and the time frame for achieving it. For example, the Bank of England's inflation target is 2 percent annually based on the consumer price index to be achieved "within a reasonable time period without creating undue instability in the economy."[35]

Communicating the goals of policy under a price-level target may be more complicated. In particular, if the central bank chooses to target an upward-sloping path for the price level, it would not be able to summarize the price-level target using a single number. At a minimum, the central bank would need to specify the level of the target in a base period (an intercept for the price path) and the rate of increase in the target price path over time (a slope). Alternatively, the central bank could announce the targeted level of the price index in each period in the future. In addition, as is the case under an inflation target, the central bank would need to indicate a time frame for returning to the target price path.

Other issues would further complicate communications. If the public cares more about inflation than the price level, or is accustomed to thinking in terms of inflation, it may be necessary or desirable to translate the target price path into an implied path for inflation. But, the implied inflation path would vary over time and therefore might also be difficult to communicate to the public. Moreover, the public might not embrace a time varying "target" for inflation—even if it were associated with a constant average inflation rate over the long run. In addition, if the price index targeted by the central bank is subject to revision, the entire future path of the price-level target would also need to be revised and communicated whenever the data collection agency revised the historical series or changed methodology. Finally, unless there are ways to constrain policymakers' discretion, the public may question policymakers' commitment to achieve a price-level target, and policymakers may be tempted to let bygones be bygones when the price-level target is missed. This would result in base drift in the price-level target and, if it became a regular feature of policy, would lead policy back to inflation targeting.

Many of these communication issues could be addressed through the modified version of price-level targeting described in Section I—average-inflation targeting. Recall that under an average-inflation target,

the central bank would keep the average inflation rate over a number of years at a constant target. Average-inflation targeting would share the property of price-level targeting that the price level would not drift over time away from a pre-determined path. Periods of inflation above target would need to be offset with periods of inflation below target. In terms of communication, average-inflation targets would share the property of inflation targets that they arguably can be communicated more simply and effectively. An average-inflation target could be summarized with a single number such as 2 percent over a rolling three-year period.[36]

Nessén and Vestin analyze the performance of an average inflation targeting regime relative to a price-level target. They find that, like a price-level target, an average-inflation target causes inflation expectations to act as an automatic stabilizer, reducing fluctuations in output and inflation. Thus, in practice, central banks may find average-inflation targeting an appealing, practical alternative to price-level targeting. Average-inflation targeting produces many of the same benefits as price-level targeting but may be easier to communicate to the public. In addition, to the extent the public is more focused on inflation than the price level, average-inflation targeting may be more readily accepted and more politically feasible.

IV. CONCLUSIONS

Many central banks implicitly or explicitly target inflation. It has long been recognized, however, that control over inflation does not guarantee control over the price level. Uncertainty about the price level far in the future can be addressed with a price-level target. But early research on price-level targets suggested they would result in greater near-term volatility of inflation and output.

More recently, researchers have revisited the idea of price-level targeting using modern macroeconomic models in which central banks follow optimal policies, economic agents are forward-looking, and expectations are formed rationally. In these models, it turns out that price-level targeting can reduce the volatility of inflation and output. In addition, in a low-inflation environment where the zero nominal interest rate bound constrains policymakers, a price-level target can help policymakers manage inflation expectations. Through this chan-

nel, they can influence real interest rates and keep monetary policy accommodative to support economic activity in a downturn.

Although price-level targeting has theoretical appeal, moving from an inflation target to a price-level target would be a big step for a central bank to take. It would be an even bigger step for a central bank that is not currently targeting inflation—such as the Federal Reserve. One reason is that, for at least the last 15 years and up until the current global financial crisis, economic performance appeared relatively good in most industrial countries. Despite the current global recession, policymakers remain confident that the policies they are currently pursuing will prove effective in stimulating economic recovery.

Another reason is that price-level targeting has not been tried in a modern economy. Policymakers may want greater confidence that its theoretical appeal will translate into real world benefits. In addition, the transition costs of moving to a price-level target are uncertain and depend on policymakers' credibility and economic agents' learning behavior. Finally, communicating with the public about how monetary policy will be conducted with a price-level target may be inherently difficult. Thus, central banks will not likely adopt price-level targeting without considerable further research or a dramatic deterioration in economic performance that leads policymakers to fundamentally rethink how they conduct monetary policy.

ENDNOTES

[1]William Poole, former president of the Federal Reserve Bank of St. Louis, is more explicit, suggesting that price stability should be defined as "zero inflation, properly measured." Recognizing biases in the measurement of inflation, he believes that price stability, in practice, "will likely be consistent with a small positive rate of measured inflation, say 0.5 to 1 percent, depending on the specific price index one looks at" (Poole and Wheelock, p. 6).

[2]See Boskin, Dulberger, Gordon, Griliches, and Jorgenson for discussion and estimates of the measurement bias in the consumer price index. Lebow and Rudd provide more recent estimates of the bias.

[3]See, for example, Akerlof, Dickens, and Perry (1996, 2000) and Akerlof and Dickens.

[4]Deflation is potentially a more serious problem than inflation because deflation lowers nominal asset values but typically not the nominal value of debt. To the extent assets are debt-financed, deflation raises the real cost of servicing debt. Servicing costs rise because debtors must make payments in dollars that are steadily increasing in real value. With asset values falling and real debt burdens rising, debtors may be forced to sell assets, putting further downward pressure on prices. Or, they may default on their loans, causing problems for banks and other lenders. Thus, falling prices can create a vicious cycle of rising real debt burdens and financial distress, leading in turn to more downward pressure on prices. (An early analysis of the debt-deflation problem is in Fisher. See Bernanke for a modern treatment of the subject.) Another problem with deflation is that it may make consumers and business delay purchases of goods and services in order to pay a lower price for them. This postponement of spending could exacerbate a slowdown in economic activity.

[5]Billi and Kahn discuss in greater detail the reasons for targeting a low, positive rate of inflation. They also discuss the costs of inflation and estimate the "optimal" rate of inflation. See Gramlich for a policymaker's perspective on the need for monetary policy to aim for a low, but positive, rate of inflation.

[6]Another hybrid approach is to include a convex combination of separate inflation and price-level targets in the objective function for the central bank. See Batini and Yates; and Black, Macklem, and Rose.

[7] Algebraically, $\pi^* = 1/3(\pi_0 + \pi_{-1} + \pi_{-2})$ where π^* is the average-inflation objective, π_0 is this year's inflation rate, π_{-1} is last year's inflation rate, and π_{-2} is the inflation rate two years ago. Thus, in the example, $2 = 1/3(\pi_0 + 3 + 2)$, so that $\pi_0 = 1$.

[8]After the initial shock, the inflation rate in any period, t, is given by the following equation: $2 = 1/3(\pi_t + \pi_{t-1} + \pi_{t-2})$ or $\pi_t = 6 - \pi_{t-1} - \pi_{t-2}$.

[9]In a more realistic setting, where the average-inflation target interacts with an output/inflation tradeoff, the oscillation would be damped over time (Nessén and Vestin).

[10]The control error, u_t, is assumed to have zero mean and finite variance.

[11]$152 = \exp[.02 \times 21 + \ln(100)]$

[12]Assuming the control errors are serially uncorrelated.

[13]McCallum (1999) uses this approach to estimate the price-level uncertainty in the United States based on one-step-ahead forecast errors over 1954 to 1991 for the GDP deflator. This approach assumes that, if the Federal Reserve followed an inflation-targeting policy, its inflation control errors would have a variance equal to that of the currently prevailing one-step-ahead forecast error, which McCallum takes as an approximation of the minimum feasible control error.

[14]Diron and Mojon show that forecasting core PCE inflation as a constant benchmark (either at 1.5 or 2.0 percent) "implies a relatively small error on average over the past 12 years" (p. 35). In fact, their constant benchmark forecast based on a 2 percent inflation rate performs better than a number of alternative models at a forecast horizon of four quarters and does only slightly worse than the best-fitting alternative model, which is a random walk.

[15]Observations are on an annual four-quarter rate of change basis to eliminate serial correlation, which might be present in quarterly data measured on a four-quarter rate of change basis.

[16]While the European Central Bank is not, in a strict sense, an inflation-targeting central bank, it does have an explicit numerical inflation objective.

[17]In the Haldane-Salmon model, policymakers respond only to deviations in the price level from the price-level target and not to deviations of output from potential output.

[18]See also Lebow, Roberts, and Stockton; Fillion and Tetlow; and Duguay (1994). Fillion and Tetlow find price-level targeting results in less inflation variability but greater output variability than inflation targeting.

[19]Technically, Svensson assumes a Lucas-type Phillips curve.

[20]Svensson also shows that, if the central bank can credibly commit to following an optimal rule instead of re-optimizing every period, then inflation targeting dominates price-level targeting. However, he questions whether it is realistic to expect that a central bank would be able to make a credible commitment. He notes that "The bank always has an incentive to renege, for instance by deviating in the current period and promising to follow the optimal rule from the next period onward" (p. 287). For further discussion of the Svensson model and its implications, see Dittmar, Gavin, and Kydland.

[21]Svensson also shows that, even if society prefers inflation stabilization to price-level stabilization, it will nevertheless be better off to assign the central bank a price-level objective. The variability of inflation will be lower than, and the variability of output the same as, under an inflation target as long as there is at least a moderate degree of output persistence.

[22]For example, see Kiley.

[23]Prices are "sticky" in the sense that only some producers can change prices in any given period. See Clarida, Galí, and Gertler for a discussion of the new-Keynesian model.

[24]See also Dittmar and Gavin.

[25]These results apply to the case where the central bank acts with discretion, re-optimizing every period. Vestin also examines the case where the central bank can credibly commit to a future path for the output gap. In this case, inflation targeting dominates price-level targeting. However, as Svensson suggests, commitment is generally thought to be an unrealistic option for real-world central banks. Moreover, Vestin shows that with an appropriately chosen loss function, a price-level target can deliver the commitment solution, assuming no exogenous persistence in the inflation process.

[26]Billi and Kahn discuss how policymakers might set an "optimal" inflation target—a target high enough to limit the likelihood of hitting the zero interest rate bound but low enough to limit the costs of inflation.

[27] Sellon reviews nonconventional methods of implementing monetary policy that may be effective even when short-term rates reach zero.

[28]See, for example, Eggertsson and Woodford; Gaspar, Smets, and Vestin; Svensson (2003); and Wolman.

[29]A *credible* target is one that the public believes the central bank is committed to achieving.

[30]Krugman discusses how a higher expected future price level and associated rise in expected inflation can mitigate the effects of the zero nominal interest rate bound.

[31]Evidence suggests that long-term inflation expectations have become better anchored in the Euro area and a number of inflation targeting countries—including Canada, Sweden, and the UK. While in the United States inflation expectations are better anchored today than in the 1970s and early 1980s, they appear to be less well-anchored than in other highly industrialized countries (Swanson; Gürkaynak, Levin, and Swanson; and Beechey, Johannsen, and Levin).

[32]The shift to monetary targeting in the United States in 1979 is one such example. In addition, some countries that adopted inflation targeting did so in response to undesirably high inflation rates.

[33]See, in particular, the articles by Amano, Carter, and Coletti; and Ambler.

[34]Technically, the learning process is by recursive least squares.

[35] *http://www.bankofengland.co.uk/monetarypolicy/framework.htm*

[36]The Reserve Bank of Australia has a version of such a policy objective. Its target is to achieve an inflation rate of 2 to 3 percent *on average, over the cycle.* However, the objective is different from that described in the text in that it is forward looking as well as backward looking. This is because the economy is usually in between business cycle peaks or troughs. In addition, since the length of the cycle varies, the period over which the objective is averaged varies and is unknown in real time.

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