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Inflation Targeting: Theory and Policy Implications

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Abstract

As with many monetary policy frameworks, inflation targeting is subject to the well-known problem of inflation bias. With inflation targeting, however, the bias becomes apparent not as inflation above desired levels, but as a wedge between the announced target and observed inflation. This inconsistency could render the framework neither credible nor enforceable since the target is overshoot on average. The problem can be addressed by assigning price stability as the single policy objective or by assigning a joint target for both inflation and output, provided that they are consistent. Many inflation targeting countries take the joint target approach implicitly through transparency measures which publicly assess monetary conditions in terms of potential output and output gaps.

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### Summary

Inflation targeting is a monetary policy framework under which policy decisions are guided by expected future inflation relative to an announced inflation target. Inflation targeting has been adopted by a number of industrial countries since 1989, and all have succeeded in bringing down inflation. However, it has not been tested over a full business cycle in most countries.

The purpose of this paper is to evaluate inflation targeting from a theoretical perspective and to assess its viability as a low-inflation--or price-stable--policy framework. Can inflation targeting deliver long-run price stability, or does it suffer from the drawbacks of other discretionary policies that lead in theory to an "inflation bias" and thus inflation above desirable rates?

Svensson has proposed inflation targeting as a means to lower inflation and offset the inflation bias inherent in discretionary policy regimes. Questions remain, however, as to whether inflation targeting alone can, as Svensson suggests, reduce inflation to desired levels because the underlying causes of the bias are not addressed. Under inflation targeting, the discretionary policy bias term will be seen as an overshooting of the announced target. The paper demonstrates that this inconsistency could lead to a breakdown of the framework through two channels: first, private agents will recognize the overshooting; and second, the overshooting will lead governments to enforce continually the central bank arrangements setting up the inflation target.

Credibility and enforceability can be restored if the central bank places full weight on inflation control and abandons any effort to stabilize output. This single objective, however, may prove undesirable to society because it raises output variability.

The paper suggests that the credibility and enforcement problems can also be resolved if the appropriate output target is pursued along with the inflation target. By targeting output at potential, incentives to trade off inflation for higher output--the source of the inflation bias--are eliminated. This outcome can be achieved implicitly through transparency measures in which central banks publish their inflation projections in terms of potential output and output gaps. As a result, contrary to conventional wisdom, monetary policy objectives for both inflation and output may be part of a credible policy framework. Finally, the first-best solution would be to raise the level of potential output to the social preference through structural measures.



## I. Introduction

Inflation targeting is a monetary policy framework under which policy decisions are guided by expected future inflation relative to an announced inflation target. Five industrial countries have announced formal inflation targets and targeting frameworks and several others appear to be following a targeting approach on an informal or unannounced basis.

The purpose of this paper is to evaluate inflation targeting from a theoretical perspective and to assess its viability as a low inflation--or price stable--policy framework. Simply put, can inflation targeting deliver long-run price stability or does it suffer from the drawbacks of other discretionary policies that, in theory, lead to an "inflation bias" and thus inflation above desirable rates? The remainder of the paper addresses the following:

(1) Inflation targeting is covered in the current theoretical debate on discretionary policies and inflation bias. Indeed, Svensson (1995) has proposed inflation targeting as a means to lower inflation and offset the inflation bias inherent in discretionary policy regimes.

(2) Questions remain, however, as to whether inflation targeting alone can reduce inflation to desired levels as Svensson suggests. Within the theoretical model, the underlying causes of the bias are not addressed by the inflation targeting regime and, as a result, inflation will systematically exceed the announced target. This inconsistency could lead to a breakdown of the targeting framework for two reasons: (1) private agents would see actual price increases overshooting the target and might conclude that the target is not credible; (2) the government-central bank arrangements setting up the target would be unenforceable because sanctions against the central bank would be continuously required. An inflation target range might help since the authority could perhaps keep inflation within the band by aiming for its lower end. Over time, however, the bias would push inflation up and perhaps out of the band.

(3) Inflation targeting could be made credible in two ways: (1) the authority announces and follows consistent inflation and output targets. Targeting output at a level consistent with nonaccelerating inflation addresses the underlying cause of inflation bias by eliminating the monetary authority's incentive to engineer surprise inflation. Thus, in contrast to "conventional wisdom," a dual monetary policy objective may enhance prospects for low inflation. (2) The authority commits to price stability as the sole monetary policy objective. By giving up the output objective, the monetary authority's incentive to deviate from announced plans with surprise inflation is eliminated. Such a commitment, however, may not be feasible.

Section II of the paper presents background material, including a definition of inflation targeting and a short summary of country experiences. Section III reviews the literature and presents the standard model to analyze monetary policy frameworks. Section IV applies the model to inflation targeting and identifies possible problems with the framework. Section V covers implementation and policy implications. Section VI concludes the paper.

## II. Background

### 1. What is inflation targeting?

Inflation targeting is a framework for conducting monetary policy in which decisions are guided by expectations of future inflation relative to the announced target. In the inflation targeting setup, the authorities announce a target or, more typically, a target range for future inflation. A change in the current policy stance is indicated if projected inflation over a one- to two-year time horizon falls outside of the announced range. Thus, expected future inflation, as measured by projected inflation, becomes the "intermediate target" (or more correctly an indicator variable) for monetary policy.

From the public's perspective, the monetary authority announces a target range for inflation that is consistent with the ultimate policy objective, typically price stability. The authority announces its intention to hold inflation in the future within the specified range, possibly with some additional leeway for pre-announced contingencies. Typical contingencies allow for price changes outside of the announced range resulting from a terms of trade shock or a shift in indirect taxes. Thus, pre-announced contingencies focus attention on measuring underlying inflation by accounting for inflationary influences outside of the control of the monetary authority.

Transparency measures can be an important part of the inflation targeting policy framework since the success of inflation targeting depends in part on whether private agents accept the officially announced target. As discussed below, inflation targeting leaves room for policy discretion and this freedom could tempt the monetary authority to raise output in the short term through expansionary policies. Put another way, potential inconsistencies between the inflation target and the preference to raise output beyond potential may render the inflation target approach neither credible nor enforceable. All of the inflation targeting countries have introduced credibility-enhancing measures, including more open policy discussions and interpretation of economic data.

A defining feature of inflation targeting is that the target variable, future inflation, is not observed. From an operational point of view, inflation targeting can therefore be seen as a two-step process in which the monetary authority must first make an inflation forecast to assess whether, under current policies, inflation is likely to remain within the announced target range. The second step is needed when future inflation is judged likely to move outside of the target range. In this instance, a feedback

rule that links policy actions to projected inflation is used to determine a path for monetary policy instruments that will bring the projected inflation rate into the target range. 1/

## 2. Country experiences

Five industrial countries have adopted formal inflation targets. 2/ New Zealand first announced an inflation target in 1989 as part of that country's economic reform and restructuring effort. Canada followed in early 1991. In the wake of the ERM crisis in September 1992, the United Kingdom announced an inflation target to replace the exchange rate anchor that had been in place for two years but had proved unsustainable. Under similar circumstances, Sweden and then Finland set up inflation targets after their exchange rate pegs were successfully challenged. Both countries had based monetary policies on fixed exchange rate baskets for much of the post-war period.

In each country, inflation rates fell after the inflation target policy was announced, but these declines were also associated with cyclical downturns and large output gaps. With recovery, inflation rates increased somewhat in all five countries and, by mid-1995, the upper target ranges were breached--but temporarily--in New Zealand and Sweden. Four of these countries, however, tightened policies ahead of significant increases in price pressure. 3/

## III. The Monetary Policy Literature--Underpinnings for Inflation Targeting

From the historical perspective of the rules versus discretion debate through the mid-1970s, inflation targeting could be classified in either category. 4/ It would be considered a rule if a clear mechanism linking policy instruments to the intermediate target, or in this case its nearest equivalent, future inflation, could be established. However, in view of the

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1/ The analytic tools needed for an operating inflation target can range from a set of reduced form equations linking policy instruments to projected inflation to a full macroeconomic model. Discussion of these operational considerations are beyond the scope of this paper.

2/ See Griffiths (1995) for a detailed description of each country's inflation target, the institutional framework and operation, and preliminary assessment. In addition to these countries, Australia and Spain have also announced inflation targets. Experiences in developing countries are discussed in Leiderman and Bufman (1995).

3/ In Finland, inflation has remained low and the authorities have not seen the need to tighten monetary policies.

4/ Haldane (1995) distinguishes between intermediate and final target policies. Countries with inflation targets follow final target strategies. He notes that the difference may be more semantic than economic since differences in practice are exaggerated.

uncertainty with which policy instruments affect future inflation, establishing the policy rule might be difficult, thus leaving the authority with discretion over how to set policy instruments.

In the mid-1970s, the rules versus discretion debate took a new path that developed the concepts of time consistency (or credibility) and inflation bias. The literature began with Kydland and Prescott (1977) who observed that policy makers might be tempted to exploit the inflation-output tradeoff characterized by the short-run Phillips curve. Monetary authorities may choose expansionary policies in an attempt to raise output above its potential level by engineering unexpected inflation. However, such policies are fully anticipated by private agents and serve only to raise the average rate of inflation with no impact on output. This increase in average inflation is known as inflation bias. 1/ In this literature, the distinction between rules and discretion rests on the notion of enforcement power (or commitment technology) that binds the monetary authority to a stated course. 2/

The remainder of this section is devoted to the standard theoretical model in the literature and optimal monetary policy operating practices (or rules) under alternative assumptions and policy approaches. Two general classes are considered. The first assumes that the monetary authority can commit in advance to a specific policy rule, such as a fixed monetary growth rate or an exchange rate peg. The second general class of examples assumes that the monetary authority can only operate with discretion because full commitment to a policy course is not credible. There is no political or other means by which the monetary authority can be bound to a policy rule. The commitment case is used as a benchmark for evaluating inflation and output outturns; the first example in the second general class of models serves as a starting point for a review of the inflation bias problem and the inflation targeting model.

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1/ As discussed below, the higher rate of inflation is relative to that which would be obtained if policy remained committed to not exploiting the short-run inflation-output tradeoff.

2/ The monetary authority cannot choose between rules and discretion. Rather, the classification of the framework follows from the environment in which the authority operates. See Persson and Tabellini (1990) for a more full treatment of this point.



# 1. The model setup

The typical theoretical model in the literature sets up the monetary policy problem as the minimization of a hypothetical social loss function (equation 1). <sup>1/</sup> Both private agents and the monetary authority seek to minimize deviations in inflation and output from social preferences,  $\pi^*$  and  $y^*$ , respectively. These are generally defined as zero inflation and a level of output above that corresponding to the natural rate of unemployment. The zero inflation assumption is consistent with price stability (assuming symmetric and offsetting shocks), while the social preference for output above the natural rate reflects the underlying assumption that rigidities in the labor market restrict potential supply. The parameter  $\lambda$  represents the relative social importance assigned to output: a higher  $\lambda$  places a greater weight on output deviations and a lesser weight on inflation. Thus for example, an inflation adverse society would be characterized by a low  $\lambda$  value and a low  $\pi^*$ .

$$L = (\pi - \pi^*)^2 + \lambda(y - y^*)^2 \quad (1)$$

The social loss function is minimized subject to the supply constraint, typically the short-run Phillips curve (equation 2). In this formulation, labor supply and therefore output are increased in the short run by an inflation surprise. (Output is also affected by supply shocks,  $\epsilon$ .) "Surprise" can occur in the model because the monetary authority benefits from an information advantage that allows it to change policy after private agents form expectations.

$$y = (\pi - \pi^e) - \epsilon \quad (2)$$

Two additional equations are needed to solve the monetary policy problem. Equation 3 describes private sector inflation expectations which are assumed to be rational, unbiased, and formed at time  $t-1$ , that is before monetary policies for period  $t$  are set. An important feature in the model is whether the monetary authority can affect private expectations. The extent to which the monetary authority can influence private expectations distinguishes the commitment and discretionary cases below.

$$\pi^e = E_{t-1}(\pi) \quad (3)$$

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<sup>1/</sup> The single period case is presented here. Barro and Gordon (1983) developed the multiperiod model in the context of reputation. This analysis and the possible overstating of the inflation bias problem is picked up at the end of this section.

Equation 4 gives a general format for a monetary policy operating procedure (rule) that minimizes the social loss function to achieve the optimal mix of inflation and output. <sup>1/</sup> With this format, the monetary authority can choose the underlying rate of inflation (the "a" parameter) that will prevail when there are no output shocks. It can also choose how it will respond to output shocks (the "b" parameter).

$$\pi = a + b\epsilon \quad (4)$$

Finally, the equations of the model are solved for the optimal policy rule, that is, expressions for "a" and "b" that minimize the social loss function. The following subsections develop policy rules under various environments and regimes.

## 2. Monetary policy with commitments--benchmark case

The standard model outlined above is used in the literature to show analytic solutions for inflation and output in various policy setting environments including inflation targeting. As benchmark, the model is typically evaluated under the assumption of full credibility and policy commitment. In this case, the monetary authority promises to refrain from inflation surprises. In addition, it commits to offset supply shocks, but only in a predictable and pre-announced way so that all possible disturbances,  $\epsilon$ , and their corresponding policy responses are known by the public in advance. These assumptions amount to a rules-based policy approach which by construction eliminates policy uncertainty.

Because the policy commitment is fully believed by the private sector, agents will base their inflation expectations on the policy rule alone since they believe that the monetary authority will stick to the pre-announced rule and will refrain from inflation surprises to raise output. Therefore, private agents adopt the socially preferred rate of inflation,  $\pi^*$ , as their inflation expectation. Through commitment, the authority exercises control over private sector expectations or, put another way, the monetary authority "internalizes" private expectations in its policy rule and does not need to consider the impact of its actions on private expectations. By contrast, private expectations are dependent on monetary authority actions in the alternative discretionary case outlined below.

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<sup>1/</sup> That the monetary authority is assumed to have full control over the inflation rate abstracts from operational issues such as economists' ability to predict inflation. See Baumgartner and Ramaswamy (1996) for a discussion of the inflation information content of financial and monetary variables. Adding forecast uncertainty to the theoretical model does change the analytic results.

The optimal values of the monetary policy parameters "a" and "b" in equation 4 are derived from the first order conditions of the social welfare function subject to the economic constraints of the supply curve. Expressions for these parameters are inserted into the optimal policy rule as shown in equation 5. 1/

$$\pi = \pi^* + \frac{\lambda}{1+\lambda} \epsilon \quad (5)$$

This policy rule is interpreted as follows. In the absence of supply shocks, the monetary authority sets inflation at the social preference,  $\pi^*$ . With a supply shock that, for example, lowers output, the monetary authority loosens monetary conditions (creating surprise inflation) to offset in part the output decline. The response to the shock depends on social preference tradeoff between output and inflation (the  $\lambda$  parameter) and is shown in the second term of equation 5. Equation 6 quantifies the extent to which output shocks are offset by monetary policy.

$$y = -\frac{\epsilon}{1+\lambda} \quad (6)$$

In the monetary policy literature, the commitment policy regime is often labeled as time inconsistent (or not credible) because the monetary authority has an *ex post* (that is, after private expectations are formed) incentive to deviate from its announced policy. Because private agents do not anticipate policy surprises, the monetary authority can increase output temporarily, and thereby improve the inflation-output outcome. Such an expansion, however, would violate the commitment to the policy rule making the commitment not credible or time inconsistent. 2/

Also within the literature, the outcome under the commitment rule is sometimes described as "second best," despite the fact that average inflation is held to that preferred by society. The second best description reflects the assumption that labor market rigidities lower potential supply. A first best outcome would address the labor market directly.

1/ Expressions for the values of the "a" and "b" parameters are derived from the first order conditions of the optimization problem. To see this, substitute private expectations ( $\pi^e = a$ ) and the monetary policy rule (equation 4) into the loss and output functions (equations 1 and 2 respectively) and take derivatives with respect to "a" and "b." To see equation 5, substitute the expressions for "a" and "b" into the policy rule (equation 4).

2/ Persson and Tabellini (1990) observe that the time inconsistent label is not appropriate in this case because, by assumption, the commitment regime requires full credibility and therefore time consistency.

### 3. Discretionary policies

In the discretionary regime, the monetary authority lacks the necessary credibility (or ability to commit) to convince private agents that it will not undertake a surprise expansion. In consequence, private agents rationally expect "surprise" policies and this then alters private expectations and the authority's ability to influence and control them. In contrast with the commitment case, the policymaker cannot assume that private expectations will equal the social preference  $\pi^*$ . Rather, to derive the optimal policy rule under discretion, the authority must take into account the impact of his future policies on private expectations. The resulting policy formula, shown in equation 7, includes a second constant term ( $\lambda y^*$ ). <sup>1/</sup> This term in the policy rule is called the inflation bias because it adds a constant rate of inflation to the policy rule under discretion compared to the commitment case.

$$\pi = \pi^* + \lambda y^* + \frac{\lambda}{1+\lambda} \epsilon \quad (7)$$

In the policy discretion case, both average and expected inflation exceed the social preference,  $\pi^*$ . The inflation bias stems from the assumption that private agents recognize the monetary authority's incentive to adopt expansionary policies and adjust their expectations accordingly. These higher private inflation expectations are taken into account by the monetary authority and incorporated in the optimal policy equation. However, because it is anticipated, the higher level of inflation has no impact on output.

To summarize, discretionary policies result in a higher average level of inflation but without an output improvement. In most instances, the commitment is not a viable option because the underlying incentive for the monetary authority to engineer a surprise expansion cannot be prohibited. Since the commitment case can generally be ruled out on these grounds, attention in the literature has focused on mechanisms of reducing or offsetting the inflation bias found within the class of discretionary policies. <sup>2/</sup>

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<sup>1/</sup> As in the commitment case, the optimal policy equation is derived from the first order conditions of the social preference function. However, under discretion, private expectations are derived by taking expectations of the first order conditions to reflect the fact that private agents take monetary actions into account. The resulting expression for private expectations is then substituted into the first order condition to arrive at the policy rule.

<sup>2/</sup> Discretionary policies are sometimes labeled "third best" because the inflation outcome is higher than in the commitment, or second best, case. Persson and Tabellini (1990) point out that the economic outcomes under commitment and discretionary regimes should not be compared since if a commitment can be made, time consistency (credibility) is not an issue.

The problem of inflation targeting as presented above is perhaps overstated because the model does not take into account monetary policy as a continuous process. 1/ By extending the model to multiple period repeated games, the monetary authority sees a link between current and future policies. In this extension, the incentive to create surprise inflation might be reduced since today's surprise could raise future inflation expectations and prove costly (in terms of the loss function) in future periods. Intuitively, the monetary authority may seek to avoid inflation surprise in the current period to establish reputation and enjoy benefits in the future. The importance of reputation effects depends on the tenure of the monetary authority since with a finite horizon, incentives for inflation surprises are not eliminated.

#### 4. Solutions to the inflation bias problem

The inflation bias results from a higher than desired rate of inflation when monetary decisions are guided by discretionary policies. While a commitment regime is preferable to discretion, fully credible policies are not feasible for most countries, and other means of reducing or offsetting the inflation bias need to be explored. A number of solutions have been proposed in the literature but most have either resulted in partial improvement or have introduced adverse consequences, such as increased variability in output. 2/ The next few paragraphs give a brief review of two representative approaches, the Rogoff conservative banker and Walsh's optimal contracts. The next section follows with a discussion of inflation targeting as a means of addressing the inflation bias.

Rogoff's (1985) conservative banker addresses the inflation bias through the government-central banker relationship. 3/ In this example, the government appoints a central banker who is more averse to inflation than the public at large (a  $\lambda$  parameter lower than society). As can easily be seen from equation 7, a smaller  $\lambda$  will reduce the inflation bias; it is eliminated when  $\lambda$  is zero, that is when the banker focuses solely on inflation. The drawback of this approach is an increase in output variability. 4/

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1/ For a summary of the multiperiod model and the role of reputation, see Persson and Tabellini (1994).

2/ For a summary of the proposed fixes, see Svensson (1995).

3/ To this point the paper has used "monetary authority" rather than "central banker" to identify the institution making policy decisions. It now switches to central banker to underscore the importance of the relationship between the government (the agent for the public at large) and the monetary institution, which can be separate.

4/ The increase in output variability can be seen from equation 7. With  $\lambda = 0$ , monetary policy will not be used to offset output shocks and the full variance will be seen in actual output.

Walsh (1995) addresses the inflation bias problem through the government-central bank relationship (optimal contracts). The proposed arrangement structures the central banker's personal employment contract to impose a penalty on the banker himself if inflation exceeds the socially preferred rate. The arrangement in effect, gives the banker an additional incentive to hold down inflation while at the same time observing social preferences. The added cost to the banker can be used to offset the inflation bias as shown in equation 8 where "c" is the banker's cost for each unit excess inflation. Set properly (that is at  $\lambda y^*$ ), the cost term can offset the bias and will have no adverse impact on output or its variability.

$$\pi = \pi^* + \lambda y^* + \frac{\lambda}{1+\lambda} \epsilon - c \quad (8)$$

Although the optimal contract approach can yield benchmark-best results (the commitment case), there may be problems with its implementation. First, the underlying cause of the inflation bias is not addressed and, in consequence, the tensions stemming from supply restrictions remain. 1/ In addition, Blinder (1995) has questioned the efficacy of contracts that impose personal costs for excess inflation on central bankers. He points out that central bankers take their jobs seriously and that personal financial incentives may be ineffective since many could earn higher salaries in the private sector.

#### IV. Inflation Targeting

Svensson (1995) has proposed inflation targeting as a means of tackling the inflation bias. Here too, the proposal works through the government-central bank relationship. With inflation targeting, the central banker is assigned by the government an explicit inflation target,  $\pi^b$ , that is lower than the social preference  $\pi^*$ . 2/ Policies remain discretionary, and private agents are assumed to take the target (which is announced) into consideration when forming their expectations. They do not, however, adopt it fully because, as with all discretionary policy regimes, they foresee the central bank's incentive to stimulate output through higher inflation. Thus, the monetary authority cannot internalize private sector inflation

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1/ This point on the underlying causes of the inflation bias is made in McCallum (1995).

2/ Under inflation targeting the central bank is assigned a policy goal but has discretion in how to achieve it. Thus, it has instrument but not goal independence. See Fischer (1995) for a more complete discussion.

expectations, and the optimal policy rule follows the same form as the standard discretionary case: with targeting, the social inflation preference  $\pi^*$  is replaced by the inflation target  $\pi^b$  (equation 9). <sup>1/</sup>

$$\pi = \pi^b + \lambda y^* + \frac{\lambda}{1+\lambda} \epsilon \quad (9)$$

It is easy to see from equation 9 that the policy rule includes the inflation bias common to discretionary policies ( $\lambda y^*$ ). But this can be offset and the social preference for inflation obtained by choosing the inflation target  $\pi^b$  sufficiently below the social preference (equation 10). With the inflation target so chosen, the optimal policy rule yields average and expected inflation at the social preference (equation 11). (There are no adverse implications for output and output variability). Inflation targeting, therefore, is a potential means of achieving an economic outcome similar or identical to that under commitment rules. The underlying cause of the bias, however, is again not addressed.

$$\pi^b = \pi^* - \lambda y^* \quad (10)$$

$$E(\pi) = E\left[\pi^* - \lambda y^* + \lambda y^* + \frac{\lambda}{1+\lambda} \epsilon\right] = \pi^* \quad (11)$$

The presence of the inflation bias term presents a potential problem for inflation targeting credibility: the optimal inflation rule yields an average inflation rate at the social preference but above the announced target. In effect, by announcing and following an inflation target, the central bank can potentially lower average inflation, but because it does not control or internalize private expectations and because private agents understand the central bank's incentive to adopt expansionary policies, the inflation bias term remains. However, the bias term now appears as wedge between average inflation and the announced target. Whether the policy approach is credible or feasible depends on the private expectations mechanism and the means by which the government assigns the inflation target to the central bank. Three possible outcomes are reviewed below.

#### 1. Overshooting the inflation target--private expectations

The first outcome incorporates the main assumptions outlined above. It assumes a discretionary environment in which private agents see both the announced inflation target and the central bank's incentive to raise output

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<sup>1/</sup> Equation 9 is derived by minimizing the social loss function. The problem is set up and solved identically to the standard case outlined above.

through surprise inflation. For its part, the central bank announces an inflation target that is low enough to offset the inflation bias and yield average inflation at the social preference rate.

The situation may not be stable. On average, inflation will be above the central bank's target, and, either immediately or over time, this overshooting will be recognized. The situation is sustainable only if the overshooting has no impact on private expectations. In this case, private agents understand and "accept" average inflation above the announced target and turn a "blind eye" to this inconsistency. Alternatively, private agents will lose faith in the target, and the inflation limiting benefits of the policy framework will break down. In effect, by announcing an inflation target, the central banker sets up a benchmark which is never met. <sup>1/</sup>

An inflation target range might help with the overshooting problem, but possibly for only a limited period of time. With a target range the central bank could aim for inflation low enough so that, including the bias, average inflation would remain under the upper limit of the announced band. Over time, however, the public might adjust its inflation expectations in line with the observed outcome so that average inflation would rise and eventually breach the upper limit.

## 2. Overshooting the government-central bank relationship

This example assumes that the central bank is assigned an inflation target by the government through a law or other arrangement which is not fully credible. As a result, the policy environment is discretionary. Private agents, however, place some faith (initially) in the target so that average inflation is brought down toward the social preference, but as in the first case, it overshoots the announced target.

In this example, the inflation target overshooting does not go unnoticed by the government. It must, under the terms of its arrangement with the central bank, take measures against the central bank for failing to deliver on the target. However, the central bank is doing its job correctly in that it sets policy according to the social loss function, the Phillips curve constraint, and the assigned inflation target. No action--short of a revision in the loss function--will change this outcome and the government will need to take action against the central bank continuously. The government-central bank inflation target arrangement therefore cannot be enforced and any initial credibility is lost. As argued above, a target range might help initially, but over time average inflation could rise above the range's upper limit resulting in a need for continuous action against the central bank.

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<sup>1/</sup> Reputation would work against inflation targeting. Drawing on this literature, the expectations 'trigger' function would set  $\pi^e = \pi^b$  with the initial inflation target announcement. However, when agents observe  $\pi > \pi^b$ , they would set their expectations to  $\pi^* + \lambda y^*$ .



### 3. A strong inflation target law

This case assumes that the government sets up an iron clad means of enforcing the inflation target assigned to the central bank and that private agents see the target as fully enforceable. Credibility would not be in question, and the central bank would internalize private expectations. By definition, therefore, the inflation targeting framework falls into the class of commitment policies and average and expected inflation equal the announced target.

## V. Implementation and Policy Objectives

The main cases presented above highlight the result that inflation bias and, therefore, credibility problems might not be addressed by inflation targeting alone. For inflation targeting policy frameworks to work, the underlying policy objective inconsistency needs to be addressed.

### 1. Dual policy objectives and transparency

One means of making inflation targets credible is to announce both inflation and output targets, provided they are consistent. <sup>1/</sup> In this way, the central bank's incentive to raise output through surprise inflation is eliminated and as a result the root cause of inflation bias is addressed. Svensson (1995) underscores this point and reminds his readers of the well-known result that if the output target is set equal to the natural rate, the policy conflict and the inflation bias are resolved. This can be seen intuitively. If the inflation and output targets lie on the long-run supply curve so that the output objective corresponds to nonaccelerating inflation, no tradeoff is needed to balance the two objectives and there is no incentive for policymakers to induce surprise inflation. The inflation bias is eliminated. <sup>2/</sup>

Output targets could be announced explicitly along with the inflation target or implicitly, for example, coming as part of efforts to make policies more open and transparent. <sup>3/</sup> Canada, Finland, Sweden, and the United Kingdom have all signaled implicit output targets as part of policy transparency measures. In these countries, the central bank publishes assessments of prospects for output relative to its potential--the output gap. By making known its views on inflation pressures in this context, the

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<sup>1/</sup> A working assumption is that the central bank has instrument independence. Output goal independence is also necessary, unless the government agrees to the output objective.

<sup>2/</sup> Svensson (1995), however, reaches the additional conclusion that under output persistence, the inflation bias remains.

<sup>3/</sup> In this context, efforts to raise output above potential must focus on structural policies that will first increase the level of potential output.

central bank signals an implicit output target. Ideally, the central bank explains the policy stance so that it is clear that policies will be tightened if inflation is likely to rise above the announced target.

## 2. A single policy objective

Another means of eliminating the inflation bias is to remove the central bank's incentive to surprise the public by adopting (or being assigned) price stability as the single policy objective. <sup>1/</sup> In this case, the inflation bias is absent since the central bank has no incentive to raise output through surprise expansionary policies. The drawback to such an approach, however, is that it precludes monetary responses to supply shocks which will result in higher output variability.

## VI. Summary and Conclusions

Inflation targeting is a framework for conducting monetary policy in which projected future inflation measured against an announced target is used to guide policy decisions. In this sense, projected inflation takes the role of an intermediate target.

Five industrial countries have put inflation targeting in place since 1989. In view of the forward-looking nature of the policy setup and the cyclical downturn that occurred in all of the inflation targeting countries in the intervening period, it is too early to judge the effectiveness of the framework based on the largely desirable inflation results observed so far. Four of the countries tightened monetary policies ahead of significant upturns in inflation. This early action is encouraging.

At the theoretical level, inflation targeting can be classified either as a rule or as discretionary. In the traditional rules versus discretion debate, the classification depends on the feasibility of developing a rule linking policy instruments to projected inflation, the nearest equivalent to an intermediate target in this setup. In the more recent time consistency literature, the classification would depend on the institutional setting for the government-central bank relationship.

In the general class of discretionary policies, the literature identifies an inherent bias that on average causes inflation to exceed the socially preferred level. This bias is sometimes offered as an explanation for higher than desirable inflation rates. By correctly choosing the inflation target, Svensson shows that the bias can be offset so that average inflation matches the social preference. However, in setting the low inflation target, an apparent inconsistency is introduced: average and expected inflation will exceed the announced inflation target. This

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<sup>1/</sup> In New Zealand, where the Reserve Bank's enabling legislation (the Reserve Act of 1989) identifies price stability as the single objective of monetary policy.

overshooting could cause the framework to break down through two channels. First, the target might lose credibility as private agents recognize that on average inflation will exceed the target. Second, the arrangements through which the government monitors the central bank would not be enforceable when inflation systematically exceeds the announced target.

Credibility and enforceability can be restored if the central bank places full weight on inflation control and abandons any effort to stabilize output. This single objective, however, may not be desired by society since it raises output variability.

The credibility and enforcement problems can be resolved if the appropriate output target is pursued along with the inflation target. By targeting output at potential, incentives to trade off inflation for higher output--the source of the inflation bias--are eliminated. This can come implicitly through transparency measures in which central banks publish their inflation projections in terms of potential output and output gaps. As a result, contrary to conventional wisdom, monetary policy objectives for both inflation and output may be a part of a credible policy framework. Finally, to achieve the first best solution, the level of potential output can be raised to the social preference through structural measures.

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