

Implementation of Inflation Targets in Emerging Markets

José De Gregorio*
Central Bank of Chile

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Abstract

This paper looks at some issues surrounding the implementation of flexible inflation targets, with a particular focus on emerging markets. It starts by clarifying how to define an inflation target and how this is related to balancing the tradeoff between inflation and output. Flexible inflation targets, which define the objective of monetary policy in terms of a range for inflation and a time horizon for reaching the target when inflation deviates from the range, balance the benefits of price stability with the costs of achieving it. The paper also discusses the need for transparency and effective public communication to ensure the accountability and effectiveness of monetary policy. It also discusses the role of the exchange rate in an inflation targeting framework.

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1. Introduction

The main objective of the great majority of central banks in the world is controlling inflation. In some cases financial stability is an added objective; in others, employment or economic development objectives are also included. In the case of Chile there are two explicit objectives, namely, price stability and the “normal functioning of external and internal payments.” The latter objective, taken from the central bank’s charter, corresponds to financial stability,¹ which involves two dimensions. The first is the stability of the domestic financial system, which in simple terms may be described as avoiding financial distress and dealing with it when it occurs. The second is the normal functioning of the system of payments to and from the rest of the world, which in simple terms means avoiding balance of payments crises and difficulties of access to international financial markets.

To address the price stability objective, Chile follows an inflation targeting scheme. Chile is part of a worldwide trend in which a large and growing number of countries have adopted this approach to conducting their monetary policy (International Monetary Fund, 2005, chap. 4). In an inflation targeting regime, the central bank publicly announces a numerical objective regarding inflation, which may be either a specific number or a range. Although the target range itself is quite clearly defined, generally the percentage of the time that the central bank expects inflation to lie within the range is not made explicit, and, of course, one cannot expect inflation always to stay within the range, since inflationary or deflationary shocks will inevitably lead to deviations.² However, the central bank does generally set an explicit horizon within which the target is to be met and deviations are to be corrected.

In this paper I intend to clarify some issues regarding the definition of inflation objectives and the conduct of monetary policy under inflation targeting schemes. In particular, I will address the widespread but incorrect perception that such schemes imply that the central bank does not consider unemployment or output growth in conducting its policy. Although it is well understood in academic circles that the central bank does take these into account, it is less well understood among policymakers, and even less among the general public. I also discuss some issues concerning the use of inflation targets in practice, in particular the role of public communication and the exchange rate. To summarize, I attempt to show that:

- The inflation objective can be described in terms of a desired distribution for inflation. This may be thought of as defining an average value for inflation and its variability (variance). But in practice the target is defined by a mean value or a range.
- Setting the target as a mean and a variance is equivalent to defining the target in terms of a range and the percentage of the time one expects inflation to be in the range. This is comparable to setting the target around an inflation projection for the future, where the future time frame, or “policy horizon,” depends on the variance of

the inflation target. The greater the fraction of time inflation is sought to be within the range, the shorter the policy horizon must be.

- A flexible inflation targeting scheme, in which the target is defined along with a time horizon, reflects an objective function of the central bank that values not only price stability but also output and employment stability. In particular, a direct relationship also exists between the policy horizon and the central bank's tolerance of deviations of inflation from the target, on the one hand, and the importance attributed by the authorities to output deviations, on the other.
- Exchange rates are an important element in an inflation targeting regime in an open economy as long as fluctuations in the value of the currency have effects on inflation. Although many countries with floating exchange rates and low inflation have seen a decline in the pass-through from exchange rate fluctuations to changes in domestic prices, large exchange rate swings may still have effects on inflation, and hence should be considered when making monetary policy decisions.

2. Defining the Range for the Inflation Target and the Policy Horizon

The inflation target is fixed over a stated time horizon because it is recognized that inflation cannot be controlled in the short term, since monetary policy acts with a lag. Furthermore, and as discussed further below, a gradual adjustment of inflation when it deviates from the target avoids the costs, in terms of reduced economic activity, that would be incurred if inflation were returned to its target immediately. In other words, even if monetary policy did not operate with a lag, it would still be desirable to adjust gradually.³ Moreover, in general, when the inflation target is specified in the projection horizon, explicit reference is made to a precise point, which always corresponds to the center of the target range.

This section develops a simple framework that explicitly shows the different ways of defining a given inflation target. In the first subsection, the central bank is assumed to take inflation as given, and some equivalences are shown in the definition of the inflation target that are useful for understanding its formulation. The next subsection complements this discussion by adding economic structure and endogenizing the inflation process.⁴

2.1. A simple framework for understanding the inflation target

Consider a central bank whose target for inflation is defined as a range between $\bar{\pi}$ and $\underline{\pi}$, with its center equal to $\pi^* = (\bar{\pi} + \underline{\pi})/2$. Some central banks define the target in this way; for example, in Canada, Israel, and New Zealand this range is from 1 to 3 percent, in South Africa it is from 3 to 6 percent, and in Chile the range is from 2 to 4 percent.⁵ Other countries define the target as a single number, without specifying a range; for example, the United Kingdom sets a target of 2 percent, and Norway and Iceland 2.5 percent.

One can think of the inflation target and its range as corresponding to a probability distribution for inflation, with the objective understood as an expected value and a variance.⁶ However, in reality most central banks define a range rather than a variance, because a range is more easily understood by the general public. Also, defining a distribution rather than a range requires much more information and certitude than central banks have in practice. As this section should make clear, in order for these two concepts, range and variance, to be equivalent, one must define not only the range, but also the fraction of time that inflation is expected to be within the range—in other words, its probability of being within the range at a given time. I will denote this probability by x . In practice the value of x is not defined, although, as shown here, when a policy horizon is defined, the tolerated variability of inflation is given implicitly.

Once a target range is known, the first question to ask is what this range means. Central banks are reluctant to be specific, but it is useful to think of the central bank as wanting inflation to lie within the range x percent of the time. It suffices to specify these two parameters—the target range and the percentage x —to establish both the center of the range (that is, the expected value of inflation) and the variance. Specifically, given the assumption of a known symmetric distribution (for example, a normal distribution), and given the range and the percentage of the time inflation is expected to be within the range, one can immediately determine the variance of inflation. The greater the value of x , the lower the variance of inflation must be.

As shown by Svensson (1997), the inflation target may be operationalized by setting the objective in terms of an inflation projection over a given horizon, which in practice is usually between four and eight quarters. One reason for such a relatively long horizon is that monetary policy affects inflation with a lag. A second is that adjusting inflation rapidly to its target would entail undesired costs in terms of reduced economic activity and high unemployment, even if inflation were perfectly controllable. In other words, inflation targeting models do take unemployment into account. In fact, in the following section it is assumed, for the sake of simplicity, that the central bank determines inflation instantaneously, yet the optimal adjustment is still gradual.

Another relevant equivalence is that between the variance of inflation from its target and the policy horizon. Suppose that inflation follows a first-order autoregressive, or AR(1), process given by:⁷

$$\pi_t - \pi^* = \rho(\pi_{t-1} - \pi^*) + \varepsilon_t, \quad (1)$$

where ε_t is an independent and identically distributed (i.i.d.) random shock with a mean of zero and a variance of σ_ε^2 , and ρ is the autocorrelation coefficient, which is between zero and one. The expected value of inflation is π^* and its unconditional variance is:⁸

$$\sigma_\pi^2 = \frac{\sigma_\varepsilon^2}{1 - \rho^2}. \quad (2)$$

In making its monetary policy decisions, the central bank projects inflation into the future. The central bank observes ε_t , but from $t + 1$ forward, the best it can do is to assume that this shock will be zero. The inflation projection one period ahead, conditional on all of the information available at time t , will thus be $\rho\pi_t + (1 - \rho)\pi^*$, and the projection T periods ahead will be

$$E_t\pi_{t+T} = \rho^T \pi_t + (1 - \rho^T)\pi^*. \quad (3)$$

As the horizon lengthens (that is, as T rises), ρ^T approaches zero and the inflation projection approaches π^* . Consider now the case where the central bank announces that it wishes inflation to be around π^* in period T . More precisely, it wants the forecast of inflation to converge to π^* . In this respect, the objective of the central bank is the convergence of $E_t\pi_{t+T}$, where the relevant information set contains π_t . Therefore the conditional forecast $\rho^T \pi_t + (1 - \rho^T)\pi^*$ is the variable on which the operational objective of the central bank is based.

Given that only as T goes to infinity does the projection fully converge to π^* , it is assumed that a tolerance margin is allowed, expressed as the variance of the conditional forecast s . As a consequence, the variance of projected inflation that is obtained from equation (3) is:

$$T = \frac{\log s - \log \sigma_\pi^2}{2 \log \rho}, \quad (4)$$

$$= \frac{\log s - \log \sigma_\varepsilon^2 + \log(1 - \rho^2)}{2 \log \rho}, \quad (5)$$

In the latter expression it should be noted that, given that $s < \sigma_\pi^2$ and $\rho < 1$, both the numerator and the denominator are negative; accordingly, T is well defined, since it is necessarily positive. It follows that the greater the variance of target inflation, σ_π^2 , or in other words, the greater the range of inflation for a given x , the longer the policy horizon over which the conditional forecast is expected to converge toward π^* . Likewise, the greater the value of ρ , the longer the policy horizon, since the increased persistence of inflation slows down its convergence to the center of the target range.

In brief, it has been established that defining an inflation objective in terms of its mean and variance is equivalent to defining a range within which inflation is expected to remain during a given percentage of the time. This, in turn, is directly related to the projection horizon over which inflation is expected to converge toward its expected value.

Therefore, if one knows the inflation distribution, and assuming inflation follows an AR(1) process like that described in equation (1), we have established that all three definitions of the target shown below are equivalent:

- i. The inflation target has an expected value of π^* and a variance of σ_π^2 .
- ii. The inflation target is given by the range $[\underline{\pi}, \overline{\pi}]$ in which it is expected to be $x\%$ of the time.
- iii. Projected inflation is expected to be around π^* with a variance of s over a horizon of T periods ahead.

If one defines all the parameters of any one of these three definitions, one can then determine the parameters of the other two. Therefore, if one knew the economy's behavior exactly, it would be impossible to separate the inflation targeting decision from the policy horizon. However, in reality this behavior is not known with accuracy, and this explains the lack of numeric precision in all parameters of the objective function. Moreover, it may be argued that specifying these parameters may lead to inconsistency, precisely because of the uncertainty that exists with respect to the actual structure of the economy. For example, the target may be defined in terms of ii. or iii., but the value of T could be inconsistent with the target specified in ii., simply because the economy's structure is not fully known.⁹

As an alternative to defining all of the inflation target's parameters precisely, central banks have moved to increase transparency and provide public explanations of their deviations from the target in their periodic inflation reports, also called monetary policy reports. For example, whenever inflation in the United Kingdom deviates from its target, the governor of the Bank of England writes a formal letter to the Chancellor of the Exchequer to give an account of why the deviation has occurred. All these arrangements replace a more mechanical and explicit behavior with respect to the inflation target, in a world with much more uncertainty than is assumed in the models, with a public and transparent rendering of accounts. This practice recognizes that there are risks and contingencies that central banks' projection models cannot predict, nor can all policy responses to more complex scenarios than simple deviation of inflation from its target—particularly those associated with financial stability—be anticipated. It reflects the need to balance a well-defined rule, by which the central bank's performance can be evaluated, with proper flexibility in a real world that contains much uncertainty.

2.2. Is inflation all that matters?

Whereas the previous section assumed that the central bank takes the inflation process as given, this section goes further and adds structure to the economy, to understand where inflation comes from and how it relates to the output gap. This is done by deriving equation (1) above from the fundamental parameters of the economy, which in this case are given by preferences between unemployment and inflation along a Phillips curve. The value of ρ is determined by the monetary authorities, who gradually adjust inflation so as to reduce the cost of that adjustment in terms of output. The possibility of demand shocks is ignored.

Here I will use the model presented in De Gregorio (1995), which allows the optimal course of inflation to be derived from a social loss function, where the losses derive from inflation and output gaps, plus a Phillips curve that incorporates indexation of inflation. I will assume that the central bank has determined an optimal inflation rate π^* , but that it adjusts inflation gradually toward this rate in order to reduce welfare losses.

The social loss function is given by¹⁰

$$L = a(y - \bar{y})^2 + (\pi - \pi^*)^2, \quad (6)$$

where y is GDP and \bar{y} its full-employment level. It should be noted that here there is no inflationary bias as in Barro and Gordon (1983), since the central bank's preferences are socially optimal (Rogoff, 1985).¹¹

Inflation is determined by the following Phillips curve:

$$\pi_t = \alpha\pi_{t-1} + (1 - \alpha)E_{t-1}\pi_t + \delta(y - \bar{y}) + v. \quad (7)$$

The term v corresponds to an i.i.d. inflationary shock with zero mean and variance σ_v^2 . This Phillips curve incorporates persistence of inflation through the term $\alpha\pi_{t-1}$, which may be interpreted as the result of indexation of prices and salaries. A simple case is that of certain regulated utility prices, which are indexed to past inflation. The persistence term could also represent the outcome of overlapping decisions on prices and salaries as in the extension of Taylor (1980) proposed by Fuhrer and Moore (1995).¹² The parameter α can also be interpreted as related to the credibility of the inflation target. If the public is confident of the authorities' commitment to the inflation target, expectations will be more forward looking than if credibility is lacking, in which case the public may assume that past inflation will tend to be more persistent. The Phillips curve's slope is δ and, to simplify the notation, its inverse is defined as θ .

Solving for the output gap in the Phillips curve and replacing it in the objective function, we have that the first-order condition for the central bank's optimization is given by the following (subscript t is eliminated, and instead subscript -1 is used for a one-period lag):

$$\pi - \pi^* = \frac{1}{1 + a\theta^2} [\alpha a\theta^2 (\pi_{-1} - \pi^*) + (1 - \alpha)a\theta^2 (E_{t-1}\pi - \pi^*) + a\theta^2 v]. \quad (8)$$

Taking expectations from the above expression to solve for rational expectations of inflation, and replacing this expression in the same first-order condition, we obtain the following expression for optimal inflation:

$$\pi - \pi^* = \frac{1}{1 + \phi} (\pi_{-1} - \pi^*) + \frac{v}{1 + \phi\alpha}, \quad (9)$$

where

$$\phi \equiv \frac{1}{a\theta^2\alpha}. \quad (10)$$

Optimal inflation has the same form assumed in equation (1), where the autocorrelation coefficient and the error depend on the fundamental parameters of the model and on the inflationary shock. That is,

$$\rho = \frac{1}{1 + \phi} = \frac{a\theta\alpha}{1 + a\theta^2\alpha} \quad \text{and} \quad \varepsilon = \frac{v}{1 + \phi\alpha} \quad (11)$$

It should be noted that expected inflation is equal to the central value of the target range, π^* , and the variance is

$$\sigma_\pi^2 = \left(\frac{a\theta^2}{1 + a\theta^2} \right)^2 \frac{\sigma_v^2}{1 - \rho^2}. \quad (12)$$

From these equations it can be easily verified that ρ and σ_π^2 are increasing functions of a , α , and θ , and that σ_π^2 is increasing in the variance of the inflationary shock (σ_v^2). In section 2 it was shown that increasing the variance of target inflation is similar to extending the policy horizon or widening the target range, all else equal. An increase in the variance of inflation produces the same results. Since an increase in any of the three parameters (a , α , θ) increases both σ_π^2 and ρ , one can conclude that increases in those parameters also lengthen the policy horizon T , as can be seen from equation (5).

These results can be interpreted as follows:

- When the central bank is not concerned about unemployment (that is, $a = 0$), the value of ρ will be zero, and expected inflation will adjust to π^* in each period. Therefore the policy horizon collapses to zero: the central bank attempts to meet the inflation projection in each period. In this case inflation would equal π^* , because monetary policy would fully offset the effect of any inflationary shock. As a increases, the policy horizon lengthens, or, similarly, the inflation target variance increases.
- The greater the volatility of inflationary shocks, the greater the variance of target inflation, which in turn generates a longer policy horizon.

- Something similar occurs when the degree of backward-lookingness, measured by α , increases, as this also produces a slower adjustment and greater variability of the inflation target—the target range increases.
- When the slope of the Phillips curve decreases (δ falls and θ rises), the output gap has a smaller impact on inflation. Therefore the central bank will accept a greater inflation variance, or a longer policy horizon, because it does not want to vary the output gap too much to offset inflationary shocks.

Why does all this happen? Because even though the central bank defines its objective in terms of an inflation target, it also considers the costs, in terms of unemployment, of attaining the target. In other words, having an inflation target does not mean that unemployment costs are disregarded. It should be noted that although, in this model, monetary policy operates without lags, the inflation target is not intended to be met in the short term.

To sum up, the persistence of inflation declines, and the policy horizon shortens, in response either to a decline in a , that is, an increase in inflation aversion; or to a decline in α , the degree of indexation; or to an increase in the slope of the Phillips curve $\delta = 1/\theta$, that is, a decline in θ . The decline in inflation persistence should also be accompanied by a decline in the variance of inflation, as long as the variance of the inflation shock (σ_v^2) remains constant.

The advantage of specifying the macroeconomic stability objective in terms of an inflation target is that it avoids the inconvenience of defining two objectives that might be inconsistent. For example, defining a limit for output variation along with an explicit inflation target could make both objectives incompatible with the economy's structure.

There are additional complications when the target is specified in terms of the activity level, since full-employment output is not known with certainty, and therefore pursuing very low unemployment could lead to the traditional inflationary acceleration, or, conversely, underestimation of full-employment output could lead to too rapid a deceleration of inflation or even deflation.

However, the fundamental reason for choosing an inflation targeting regime is that otherwise inflation would be undetermined. Monetary policy deals with prices and inflation. Defining an inflation target provides an anchor for inflation.

3. Issues in Inflation Targeting: Institutions and Exchange Rates

In this section I will address two relevant issues for the implementation of inflation targets. The first is the use of public communication to report on the fulfillment of the inflation target. This is particularly relevant given that central banks do not have full control over inflation. I also discuss the limits to transparency, as well as the role of the exchange rate in

the inflation targeting regime. There is a natural place for exchange rate policy, and even exchange rate stabilization, in an inflation targeting regime, once one takes into account the inflationary consequences of exchange rate fluctuations. I also discuss the role of foreign exchange intervention as an exceptional measure.

3.1 Communication and transparency as substitutes for precision

Given the results presented above, inflation targeting central banks should define their objectives by stating a target range for inflation and indicating the percentage of the time they intend inflation to lie within that range. This is equivalent to saying that they should announce the mean and variability of inflation. Additionally, convergence of inflation to the target can be defined as an intermediate objective, in a policy horizon that takes into account both the costs of attaining the target and the lags with which monetary policy operates. In general, this horizon is defined as from one to three years. However, the definition of the target is not precise. It is not completely clear what fraction of the time (x in the model) the central bank expects inflation to be within the tolerance range, nor is the central bank precise about the distance from the center of the band it expects the forecast to be (s in the model).

In practice, there is uncertainty regarding the transmission mechanisms of monetary policy and the structure of the economy: the “true” parameters of the model in section 2 are unknown. This is particularly valid in emerging market economies, because of their frequent structural and policy changes. This makes it difficult to be precise in defining all of the parameters of the inflation target. When monetary policy is anchored by a fixed exchange rate or by targeted monetary aggregates, monitoring is very simple. It suffices to see whether the exchange rate is at the announced level or whether the monetary aggregates follow the announced path. With this information in hand, the public can evaluate whether the monetary policy objectives are being met. However, exchange rate and monetary anchors are less and less frequently used, since they are less efficient as a means of conducting monetary policy. Currently, most central banks instead set interest rates and pursue an implicit or explicit inflation target. Monitoring inflation is easy, but explaining deviations from the target is a more difficult task.

Inflation usually does deviate to some degree from the target. In Chile this has been the case since 2007, a period that has witnessed a sharp increase in food prices and a continuing rise in the oil price. But such deviations can have different causes: they may be due to some genuinely uncontrollable event or influence (such as a food price shock), or they may be due to the central bank failing to adopt a monetary policy consistent with its inflation target. For this reason, public communication and accountability are particularly important under an inflation targeting scheme. This is why most central banks that have adopted inflation targets prepare periodic inflation reports to inform the public about actual inflation performance and explain its consistency with monetary policy decisions. This increases the credibility of monetary policy and strengthens commitment to the inflation target.

But predictability and transparency can also improve the effectiveness of monetary policy. Predictability is desirable because it avoids abrupt adjustments in asset prices. Also,

it allows that the monetary policy and its expected future path be transmitted to the entire yield curve. In fact, monetary policy determines the interbank interest rate quite accurately, but aggregate demand depends on longer-term rates. Working capital depends on rates ranging from three months to one year, and investment on even longer-term rates. To the extent that monetary policy signals and strategy provide useful information for the market as it forms its expectations, the whole yield curve will be affected, and consequently monetary policy will be more effective.

Transparency also has its limits, and these are precisely related to the effectiveness of monetary policy, its decision-making independence, and the need for monetary policymakers' deliberations to be as frank and productive as possible. For example, in many countries the minutes of monetary policy meetings do not indicate which members take one position or another. This is reasonable, because what is more important is the tenor of the discussion, and revealing names could discourage members from speaking candidly at meetings, thus affecting the central bank's capacity to act with genuine independence. Full transcripts of the discussions are good for transparency and accountability, but these can be provided after a relatively long lag: the Federal Reserve Board, for example, releases transcripts after five years. How transparency is implemented in each country is specific to each case and its institutional tradition, but effective monetary policy in an inflation targeting framework invariably requires a high degree of transparency.

Finally, adoption of an inflation target in emerging market economies poses certain institutional requirements. The first is an independent central bank that is empowered to establish a policy horizon that extends beyond the political and electoral horizons. Also necessary is a solid fiscal situation, to avoid subordination of monetary policy to fiscal policy and so eliminate the possibility of inflationary financing, which undermines the credibility of the inflation target.

3.2 The role of the exchange rate and asset prices

Another key element in an inflation targeting regime is the exchange rate regime. If the economy is financially fully open, one cannot simultaneously adopt an independent monetary policy (that is, set the policy interest rate) and control the exchange rate —this is the well-known “impossible trinity.” Therefore a floating exchange rate regime is a prerequisite for an effective inflation targeting scheme. However, exchange rate fluctuations, in particular periods of persistent appreciation or depreciation, may create additional risks to macroeconomic stability that may require additional policy action.

After the bursting of the dot-com bubble in the United States some years ago, there was considerable discussion of whether the Federal Reserve should have raised interest rates preemptively, even in the absence of signs of rising inflation, so as to prevent the bubble from continuing to grow. This question has become even more urgent with the bursting of the housing bubble and the financial crisis that followed. Those who believe that preemptive action should have been taken argue that such action could have prevented, or at least attenuated, the financial crisis and economic slowdown that followed the bursting of the bubbles. Those on the other side maintain that monetary policy would have been neither effective nor necessary, because a slowdown would have followed even if the

bubble had deflated gradually, nor is there any certainty that an increase in interest rates could have prevented the bubbles.

This is certainly a second-order problem compared with the dilemma most emerging market economies face, namely, what to do about the exchange rate. Most countries have a preference for a “competitive” real exchange rate, one that gives an advantage to the country’s exports in foreign markets. This preference is natural in the wake of the many disastrous experiences with massive currency overvaluation under schemes of exchange rate inflexibility. Many considerations justify a flexible exchange rate regime, and this is not the place to discuss them.¹³ I will focus here only on the role of the exchange rate in an inflation targeting regime.

There has been much discussion of whether the exchange rate should or should not affect monetary policy decisions, that is, the setting of the policy interest rate.¹⁴ In the context of a Taylor rule, the question is whether or not the exchange rate should be an argument in the rule. In a more general context, it is important to remember that, rather than any mechanical rule for setting the interest rate, what needs to be considered is what trajectory of interest rates is consistent with the inflation target. To the extent that the exchange rate affects the inflation outlook, it is a relevant variable to consider when deciding monetary policy. Its effect on consumer price inflation is much more evident than its effect on the prices of other assets, such as house or stock prices. Suppose, for instance, that the currency appreciates sharply and unexpectedly. Even if the pass-through coefficient is relatively low, as it is particularly in countries that have an inflation target set by an independent central bank, such an appreciation should reduce inflationary pressure and therefore create room for a monetary easing, which should in turn reduce exchange rate pressure and provide a better guarantee of achieving the inflation target.¹⁵

Thus the exchange rate does affect monetary policy decision-making, but it does so because of its effect on inflation, without additional considerations of competitiveness or exchange rate volatility. Therefore when the exchange rate has an effect on inflation projections, monetary policy should take it into account. For example, if the currency depreciates and the depreciation begins to affect inflation, an increase in the interest rate will contribute to attaining the inflation target both through its impact on investment expenditure and consumption of durable goods, and through its effect on the exchange rate. In addition, such a move on the part of monetary policy should stabilize the exchange rate. In any event, it is worth stressing the importance of analyzing the reasons behind exchange rate movements. If the depreciation is due to an adverse external scenario, it may have less of an impact on the inflation outlook, and, accordingly, the monetary policy reaction would not necessarily be an increase in the interest rate.

Nevertheless, the direct effects of exchange rate fluctuations on inflation are not the only way the exchange rate can affect monetary policy decisions. Most central banks also have the objective of safeguarding financial stability. In Chile this objective is described in the central bank charter as the “normal functioning of internal and external payments.” This is interpreted as meaning that the central bank must seek to must avoid financial and exchange rate crises and extreme turbulence, as well as financial and exchange rate imbalances that could jeopardize macroeconomic stability. Undoubtedly one way to help

ensure financial stability is through the adoption of a flexible exchange rate, but this does not preclude the possibility of exchange rate bubbles threatening financial stability.

An exchange rate bubble is more complicated to deal with than an asset price bubble. If the authorities are certain that, for example, a housing bubble exists, they can increase interest rates in order to prick the bubble. But in an emerging market economy, if the currency is experiencing a bubble, leading to a severe appreciation, raising interest rates could worsen the problem by encouraging an increase in carry trade. However, central banks can use other tools to stabilize the foreign exchange market. In particular, they can intervene directly by increasing or reducing their holdings of foreign exchange reserves. But this must be an exceptional measure, linked to changes in the position of international liquidity, and undertaken within a predefined period of time.

More concretely, current experience, in Chile in particular,¹⁶ suggests that three main conditions must be met when implementing foreign exchange intervention in the context of an inflation targeting regime with a commitment to control inflation. First, it cannot pursue a specific value for the currency, because then the inflation target would be subordinated to the exchange rate objective, thus falling victim to the “impossible trinity.” Second, the depreciation that is expected to occur in the wake of the intervention must be consistent with the inflation outlook; otherwise credibility will be undermined. Implementing a mechanical rule for intervention, independent of the value of the currency, preserves monetary autonomy to use interest rates to control inflation. Third, the intervention must be completed within a predefined period: as already stated, intervention is an exceptional measure, and announcing a date for its termination strengthens the commitment to keep the intervention transitory. Experience also confirms that pursuing a mechanical rule for intervening, with some degrees of technical freedom, may be desirable to avoid speculation against the central bank.

Finally, a word about the objective of having a “competitive” real exchange rate that promotes exports. This discussion is similar to that on the natural unemployment rate, in that the fundamental determinants of the exchange rate are beyond the scope of monetary policy. If the authorities tried to hold the exchange rate permanently to a level inconsistent with its fundamentals, the result could be inflation, which would restore the real exchange rate to its equilibrium level. As argued before, when the authorities are relatively certain that the exchange rate has overreacted, and provided there are no inconsistencies with the inflation target, transitory intervention may provide some relief. But a permanent attempt to avoid an appreciation will lead to inflation, so that a real appreciation takes place after all, through higher inflation and not through a nominal exchange rate adjustment. In addition, as experience shows, such an attempt may encourage the entry of short-term capital, generating additional exchange rate pressure.

Monetary policy cannot affect the real exchange rate in the medium or the long run, since it is determined by its fundamentals, such as the degree of trade openness, productivity growth, fiscal policy, net international assets, and the terms of trade. Interest rate changes induce exchange rate fluctuations, but as long as they are incorporated properly in the context of an inflation targeting regime, the movements of interest rates should be stabilizing. The exchange rate, in turn, functions as a shock absorber.

4. Concluding Remarks

As I hope to have shown, targeting inflation on the basis of a range within which inflation is expected to stay most of the time is similar to fixing an objective for projected inflation over a given policy horizon, or indicating an expected value and a variance for inflation. Either way, the definition actually used by central banks is not quite accurate, since the structure of the economy is not known with sufficient certainty to allow precise definition of the target parameters. Moreover, some margin of flexibility must be allowed to address situations that are impossible to anticipate.

On the other hand, defining the monetary authority's objective in terms of an inflation target does not mean that the business cycle, particularly unemployment, is irrelevant to it. This is reflected in the fact that the target is not intended to be met always and under all circumstances, and in the fact that the target is established in the context of a policy horizon generally of one to three years.

This paper has used a simple analytical model to clarify these points but has omitted some relevant aspects of monetary policy practice, although these should not change the conclusions. The economy is subject to many kinds of shocks besides inflationary ones. This paper has not considered in detail the credibility of the central bank, but the very decisions it makes and the formulation of its objective reveal information about its ability to contain inflation, as well as about its commitment to the target. Incorporating these aspects adds much more complexity, but generally their implications point in the direction of rigorously meeting the target, since the more credibility the central bank enjoys, the less costly are the adjustments to achieve the inflation target. In terms of the model presented here, credibility can be thought of as reducing inertia and the degree of indexation, thus enabling a faster return of inflation to the target range when deviations occur. It can also be shown that increased credibility on the inflation objective allows a reduction in the variability not only of inflation, but also of output (De Gregorio, 2007). Indeed, this is what the world has witnessed with the Great Moderation.¹⁷

In this paper the need for optimal gradualism has been justified by inflation persistence. Excessive activism, in the sense of having a very short policy horizon, can be viewed as leading to greater volatility of interest rates and asset prices, which could lead to instability in the financial system. In a more general dynamic stochastic model, one could conceive of an optimal monetary policy whose horizon varies depending on the nature and magnitude of the shocks it encounters. In actual practice, the problem may be solved with escape clauses that allow for deviations from the target in exceptional situations, for example when financial stability is threatened.

The analysis of the model was presented in the context of a closed economy. Extension to an open economy and interactions with the exchange rate should not change the main conclusions of this discussion, but they certainly add new sources of fluctuation. This issue has been treated informally here in the light of accumulated experience in

emerging markets. In any event, incorporating elements of an open economy could provide an additional reason to adopt a medium-term horizon. If the central bank adopted a very short horizon or a very narrow target range, the principal mechanism of monetary policy pass-through to inflation would be the exchange rate rather than aggregate demand. This, in turn, could generate deviations of the exchange rate that might affect the external equilibrium of the economy—an important concern for emerging market economies subject to strong fluctuations in external financing. I have also discussed the role of the exchange rate in the context of an inflation targeting regime. As long as changes in exchange rates affect inflation, the exchange rate should be one of the variables that central banks take into account when deciding the stance of monetary policy. Doing so may also have a stabilizing effect on exchange rate fluctuations. However, in emerging markets there may be reasons to use additional instruments in periods of excessive fluctuation that threaten financial stability—financial market turbulence like that stemming from the U.S. subprime mortgage crisis is a pertinent example. In such a case, intervention in the foreign exchange market may be advisable as long as it is consistent with the inflation target. This has a parallel with discussions in industrial countries on preventing bubbles from generating financial fragility.

No distinction has been made here between core inflation, which is calculated for a subset of goods in the consumer price index (CPI), and so-called headline inflation. In general, inflation targets refer to headline rather than core inflation, although the latter tends to be more stable. Although theory tends to prefer core inflation, there are reasons (which are not fully rational from an analytical standpoint) why central banks prefer headline inflation. In the first place, use of any of the various alternatives to headline inflation would pose a problem of credibility and public understanding. In addition, if one were to eliminate goods whose prices are more volatile, such as fuels, from the target measure of inflation, the result would only be to reinforce the second-round effects of a shock on such prices. In other words, if the central bank wishes to minimize second-round effects, it should be willing to respond to cost shocks, even if the response is not immediate. Accordingly, fixing the target in terms of headline inflation provides an anchor to all prices.

Central banks do not directly control inflation, as assumed in the model presented here, but do so through the interest rate, which in turn affects aggregate demand and output. To generalize the results, it would be sufficient to specify aggregate demand, which could be affected through the interest rate so as to meet the expected inflation trajectory. However, the main results would not be altered, because it is inflationary shocks that generate the tradeoff between inflation and unemployment.

Finally, it could be argued that a flexible inflation targeting policy is inconsistent with a central bank mandate that is limited to price stability and financial stability. In fact, given that this mandate does not explicitly include output stability, as considered in the model presented here, one could conclude that the horizon should be kept at its minimum. This argument, however, contains two deficiencies. First, a monetary policy that targets inflation in each period, disregarding its effects on output, may undermine financial stability. Such a policy would lead to extreme volatility of interest rates and of output. This, in turn, could increase financial vulnerability, for example by inducing abrupt changes in the financial positions of firms and households. Second, central banks also have more

general objectives relating to the overall welfare of the population. In the case of the Central Bank of Chile, its charter says explicitly that “When passing its resolutions, the Board shall consider the general orientation of the Government’s economic policies.” This “general orientation” has to do with improving the welfare of the population, which necessarily implies taking into account the costs both of inflation and of output and employment fluctuations when pursuing monetary policy. In short, although inflation may seem to be the only concern of monetary policy in an inflation targeting regime, this paper has shown that this is not the case. Output and unemployment fluctuations are implicitly incorporated by allowing inflation to gradually adjust to its objective.

Consequently, a policy of flexible inflation targeting does consider full employment among its objectives. However, it is still preferable to organize monetary policy around a flexible inflation target. Doing so provides a nominal anchor to the economy, which in turn strengthens monetary policy credibility, a crucial element to minimize the costs of attaining price stability.

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¹ In fact, Title III of the Organic Constitutional Law explicitly refers to the central bank's authority to regulate the financial system and the capital market, as well as to its powers to safeguard the financial system's stability.

² Schemes of this type are known as “flexible inflation targets,” as opposed to “strict inflation targets,” because inflation is returned gradually to the target range when deviations from the conditional forecast occur. See Svensson (1999).

³ This argument is valid for supply shocks, which are the kind I analyze here. A more general model would allow for demand shocks, which require a different policy response. For the sake of simplicity, this paper omits demand shocks, as they do not change the conclusions.

⁴ A more general presentation of the model with additional discussion can be found in De Gregorio (2007), on which this part of the paper is based.

⁵ The exact phrasing of the target may differ across countries. For example, in some countries the target is stated as a range, whereas in others it is the center of the target plus or minus a deviation.

⁶ In what follows, I assume that inflation has a known symmetric distribution—specifically, a normal distribution—which is fully defined by its expected value and its variance.

⁷ I assume that ρ is known, and in the next section it is treated as endogenous. However, if ρ is uncertain, the value estimated by the central bank will affect the variability of inflation, and this effect will depend on whether ρ is under- or overestimated (Amano, 2007).

⁸ It suffices to take the variance of both sides of equation (1), where the unconditional variances of inflation and past inflation are the same and equal to σ_π^2 .

⁹ One might argue that estimating equation (1) is easy, and that from there the target may be determined with accuracy, but the relationship between inflation and monetary policy should be also known. The assumption of an AR(1) process is made for expository purposes, but in reality the univariate process could be more complicated. Furthermore, defining the target based on the estimation of reduced-form equations is a prime example of the Lucas critique.

¹⁰ This is a simplification of a more general loss function that could be more formally derived following Woodford (2003, chap. 6). Where indexation is present, the utility function will be somewhat different, but the main qualitative results presented in this paper should not change.

¹¹ Strictly speaking, from a welfare point of view the relevant objective is to minimize the present value of losses rather than the value in each period. The solution to that problem is significantly more complex; the details are presented in De Gregorio (2007). The assumption of a static loss function implicitly assumes that the central bank has no ability to commit to future policies, and so it optimizes period by period.

¹² For more details, see Walsh (2003), chapter 5.3. The existence of indexation is what complicates the solution of the problem when an intertemporal loss function is assumed. In the event that $a = 0$, the static and the intertemporal solutions are the same.

¹³ See Larrain and Velasco (2001) and Edwards and Levy Yeyati (2005).

¹⁴ See, for example, Ball (1999).

¹⁵ Chile has several times confronted abrupt changes in the exchange rate with inflationary and monetary policy implications, which were explicitly mentioned in the statements after the relevant monetary policy meetings (December 2005 and February, March, and April 2008).

¹⁶ Since Chile started floating the exchange rate in 1999, there have been three intervention episodes. Those of 2001 and 2002 occurred in the presence of major turmoil in the region and strong depreciation pressures (see De Gregorio and Tokman, 2007). The latest, which is ongoing at the time of this writing, began in the presence of a rapid appreciation in the context of high uncertainty in world financial markets due to the U.S. subprime mortgage crisis, and with the purpose of increasing international reserves in the face of a reduction in international liquidity during the last few years.

¹⁷ The Great Moderation was first discussed by Kim and Nelson (1999) and Blanchard and Simon (2001). For a discussion of the various hypotheses offered to explain the Great Moderation and, in particular, the role of better monetary policy, see De Gregorio (2008).