

Inflation targeting: What have we learned?

Carl E. Walsh¹

University of California, Santa Cruz

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Abstract

Inflation targeting has been widely adopted in both developed and emerging economies. In this essay, I survey the evidence on the effects of inflation targeting on macroeconomic performance and assess what lessons this evidence provides for inflation targeting and the design of monetary policy. While macroeconomic experiences among both inflation targeting and non-targeting developed economies have been similar, inflation targeting has improved macroeconomic performance among developing economies. Importantly, inflation targeting has not been associated with greater real economic instability among either developed or developing economies. While costs shocks, such as the large rise in commodity prices that occurred in 2007 and early 2008, force central banks to make difficult short-run trade-offs, the ability to deal with demand shocks and financial crises can be enhanced by a commitment to an explicit target.

Introduction

It has been almost twenty years since New Zealand became the first country to adopt the monetary policy framework now called inflation targeting. Since New Zealand paved the way, more than twenty developed and developing nations have followed, and the number of inflation targeting central banks continues to grow. Turkey and Indonesia are the most recent to join the IT club. Central banks that have adopted inflation targeting seem happy with their choice, and Canada, as one of the earliest

¹ The John Kuszczak Memorial Lecture, prepared for "International Experience with the Conduct of Monetary Policy under Inflation Targeting," Bank of Canada, July 22-23, 2008. I would like to thank Mahir Binici for excellent research assistance and conference participants and an anonymous referee for comments and suggestions. Views expressed and remaining errors are my own. This paper was written during the first half of 2008. At that time, increased inflation was a major concern. Since then, policy makers have had to deal with the worsening financial crises and global recession, developments that have affected both inflation targeters and non-targeters. Thus, I give more emphasis in this article to inflation targeting as a means of reducing the risks of deflation than I did in the original lecture.

adopters, is no exception. In reviewing its experience with inflation targeting, the Bank of Canada has stated that "All the major benefits that an inflation-targeting framework was suppose to deliver have been realized and, in some cases, exceeded." (Bank of Canada 2006, p. 3).

This rosy view of inflation targeting is not universally shared, and most central banks have not moved to adopt inflation targeting. Debate over IT in the United States, a debate overshadowed in recent months by the on-going financial crisis originating in the subprime mortgage market and the deepening recession, has centered on the view that IT places too much emphasis on inflation, potentially at the expense of other monetary policy goals.² And some critics of IT see recent macroeconomic developments as the downfall of IT. Joe Stiglitz, for example, has written that "Today, inflation targeting is being put to the test – and it will almost certainly fail" (Stiglitz 2008).

But even if no additional central banks adopt inflation targeting, or if some current inflation targeters abandon it, inflation targeting will have had a lasting impact on the way central banks operate. Even among central banks that do not consider themselves inflation targeters, many of the policy innovations associated with inflation targeting are now common. Most prominently, transparency has spread from inflation targeters to non-inflation targeters.

In this essay, I discuss the empirical evidence on the effects of inflation targeting and some of the lessons for monetary policy that can be drawn from the experiences of inflation targeting central banks. First though, it will be helpful to review both the spread of inflation targeting and the ways its adoption might affect macroeconomic performance.

The spread of inflation targeting

Between 1971, when Nixon severed the U.S. dollar's tie to gold, until 1989 when the New Zealand Parliament passed its Reserve Bank Act, monetary authorities in developed and emerging market economies searched for a policy framework that could

² For example, see the exchange between Rick Mishkin (2004) and Ben Friedman (2004),

replace the Bretton Woods exchange rate system (Rose 2008).³ Monetary targeting was a prominent candidate during this period, and exchange rate regimes of various flavors were also common, particularly among developing economies. None of these policy regimes proved either completely successful or sustainable. Financial market innovations reduced the predictability of the relationship between nominal income and money that was a critical part of the transmission process for monetary policy, and managed exchange regimes frequently failed to create stable policy environments.

In 1984, with the election of David Lange's Labour government and the appointment of Roger Douglas as Finance Minister, New Zealand embarked on wide-ranging economic and governmental reforms that sought to define clear performance measures and systems of accountability for all government departments. As part of this reform process, the Reserve Bank Act of 1989 established the policy framework that we now call inflation targeting. The key aspects of the reform were 1) the establishment, in discussions between the central bank and the government, of a means to measure the central bank's performance (price stability but defined as an inflation target); 2) the grant to the Reserve Bank of the powers to pursue its assigned goal without government interference (i.e., central bank independence); and 3) a means of establishing accountability (through making the target public and holding the Governor of the Reserve Bank responsible for achieving it).

From New Zealand, inflation targeting spread quickly to other countries. Based on starting dates identified by Mishkin and Schmidt-Hebbel (2005), five countries had adopted inflation targeting by 1991, and by 1994, the number had grown to 10. Figure 1 illustrates this rapid growth in the number of countries that have adopted inflation targeting. Until 1997, targeters were evenly distributed among developed and emerging economies, but since the late 1990s, the growth has come primarily among developing and emerging market economies.

³ "A cynical view might be that inflation targeting has become attractive less because of advances in our discipline than because of a demand for a replacement for the gold standard, monetarism, and exchange rate anchors." Sims (2005, p. 283).

There is, of course, some controversy over how to precisely date the adoption of inflation targeting, particularly for many of the developing economies. For example, Mishkin and Schmidt-Hebbel date the beginning of inflation targeting in Chile in 1991 while the bank itself puts the full adoption of IT in late 1999.⁴ Some authors have distinguished between transitional periods, in which targets are announced but are reduced over time, from periods with constant targets. Most developing economies adopted inflation targeting while their inflation rates were still high, and they often employed targets that fell gradually over time. The start dates identified by Batini and Laxton (2007), for example, show a somewhat slower spread of inflation targeting, with the early adopters all being industrialized economies.

IT is feasible and sustainable

As Andy Rose (2008) points out, in contrast to exchange rate policy regimes, no country has left the inflation targeting family (see also Mihov and Rose 2008). This is actually quite remarkable and does suggest central banks perceive that inflation targeting brings benefits. So, the first lesson from the IT experience is that *inflation targeting is feasible and sustainable*.

This might sound like a rather limited lesson, but it isn't. After the end of the Bretton Woods system, many countries struggled to develop coherent frameworks for guiding monetary policy. In the U.S., various flavors of monetary aggregates targeting came and went, but the experience of other countries, particularly the small open economies that were among the early adopters of inflation targeting, is also instructive. Monetary targeting and exchange rate targeting were common alternatives, and countries frequently switched between them. Switzerland and Germany were viewed as perhaps the most consistent in pursuing money-based policies, but they were the exception. Few regimes were consistently adhered to.

⁴ Mishkin and Schmidt-Hebbel identify 1991:1 as the start of the converging-target period for Chile. They set 2001:1 as the start of Chile's stationary-target period.

And it isn't just that countries stick to inflation targeting. Mihov and Rose (2008) show that the durability of a monetary policy regime actually matters – old regimes produce better inflation outcomes than young regimes. And while we may think of inflation targeting as a relative newcomer among monetary regimes, it has been very durable. So, as Mihov and Rose state, “time is a good filter for monetary regimes, and inflation targeting has thus far shown itself to be the regime most likely to pass the test of time.” (2008, p. 1).

Many economists in, say 1985, or even 1995, would have been skeptical that inflation targeting, as we understand it today, could deliver satisfactory macroeconomic performance. Many would have argued that IT would not be politically sustainable, that central banks couldn't really control inflation effectively, that the attempt to do so would generate instability in the real economy. While the evidence to be discussed below has led some to question the role inflation targeting has played in producing low inflation, the weak but supportable hypothesis that ITers have done no worse than non-inflation targeters is, therefore, actually a surprising finding in itself, one that early critics of inflation targeting would not have expected.

Has inflation targeting mattered?

But while inflation targeting regimes have demonstrated their sustainability, have they actually mattered for macroeconomic performance?

Inflation targeting was widely adopted during what now appears to have been a benign economic era of low and stable inflation combined with steady economic growth. Galí and Gambetti (2009) report that during 1984-2005 the standard deviation of real U. S. GDP growth fell to less than half its 1948-1984 level. This reduction in macroeconomic volatility, which appears to have ended in 2007, is referred to as the Great Moderation. The sources of this moderation have not been fully identified (Stock and Watson 2003, Galí and Gambetti 2009). Were macroeconomic shocks simply smaller (the so-called good luck hypothesis)? Or did better policies, including inflation targeting, promote stable growth and low inflation (the good policies hypothesis). The recent financial crisis and global recession suggest that good luck may have played a more important role in the Great Moderation than previously thought. This is not to deny that many

countries, and not just inflation targeters, have enjoyed much better macro policies over the past twenty years than they did over the previous twenty years, but good policies may not have played the major role in generating the macro stability seen over the past two decades.⁵

If good luck played a significant role in accounting for the Great Moderation, it may be difficult to identify the marginal contribution of good policy, and, in particular, the contributions of inflation targeting. Many policies may deliver satisfactory macro performance when shocks are small. So it is perhaps not surprising that the empirical evidence has had difficulty finding a clear contribution of inflation targeting in accounting for macroeconomic performance. In general, studies that have focused just on the inflation experiences of industrialized economies find little effect of IT on either average inflation or the volatility of inflation. In contrast, studies based on the experiences of developing economies have found significant effects of inflation targeting.

Why might IT matter?

Before reviewing the empirical evidence on IT's impacts, it may be useful to consider why inflation targeting might make a difference. A monetary policy environment can be characterized by three aspects – constraints, objectives, and beliefs. First, there are the constraints that define the economic relationships that limit the achievable outcomes available to the central bank. In the simplest models employed for policy analysis, this constraint is represented by some variant of the Phillips curve. The second aspect of the policy environment is the set of objectives of the central bank. And the third aspect is the public's beliefs about the policy environment. Do they believe the central bank operates with discretion or with commitment? Are announcements credible? All three aspects of policy – constraints, objectives, and beliefs – can be influenced by inflation targeting.

To illustrate the effect of IT on constraints, consider a simple forward-looking Phillips curve of the form

⁵ As a referee notes, the good luck hypothesis is usually tested by examining the variances of residuals obtained from an economic model. If the model is a poor description of the economy, the only way it will be able to account for the decline in the volatility of output and inflation is through a decline in the volatility of the shocks.

$$\pi_{it} = \pi_{it}^T + \beta E_t(\pi_{t+1} - \pi_{t+1}^T) + \kappa x_t + \varepsilon_t$$

where π is the inflation rate, π^T is the central bank's inflation target, and x is the output gap. Cost shocks are represented by ε . Firms are assumed to index their prices to their assessment of the central bank's inflation target, and π_{it}^T is the public's current estimate of the central bank's target. This equation illustrates several ways in which inflation targeting can affect the short-run tradeoff between inflation and output.

First, the announcement of a formal inflation target can align the public's expectations of current and future target rates with the actual goals of the central bank. For example, reducing the public's assessment of the current and future target inflation rates would allow average inflation to fall without any associated cost in terms of real economic activity. By reducing the marginal costs of achieving low inflation, inflation targeting should be associated with lower average inflation without an associated increase in the volatility of real output.

Second, inflation targeting could improve the short-run tradeoff between output gap and inflation volatility. It could do so by anchoring the public's beliefs about future inflation. If a positive inflation shock causes the public to (incorrectly) adjust upwards their estimate of the central bank's target, a larger decline in the output gap is necessary to limit the rise in actual inflation. Greater stability of inflation expectations should reduce the volatility of inflation and improve the short-run inflation – real activity trade off faced by the central bank. This, in turn, means that the volatility of both inflation and real activity would be lower under inflation targeting. Thus, to the extent that a formal target anchors expectations about the central bank's goals, it allows the central bank to reduce both inflation and output volatility.⁶

⁶ Hutchison and Walsh (1998) provided one of the first attempts to assess empirically the impact of inflation targeting by investigating its effect on the output-inflation trade-off in New Zealand.

Third, if inflation targeting reduces the public's uncertainty about either the current target or future targets, the effect is similar to a decline in the volatility of cost shocks. This is most easily seen by rewriting the Phillips curve as

$$\pi_{it} = \pi_t^T + \beta E_t(\pi_{t+1} - \pi_{t+1}^T) + \kappa x_t + v_t$$

where the new error term is equal to

$$v_t = \varepsilon_t - (\pi_t^T - \pi_{it}^T)$$

The error term in the inflation equation is now composed of the original cost shock and errors in the public's forecast of the central bank's inflation target. Thus, reductions in forecast errors associated with the public's assessment of the inflation target, like a reduction in the variance of the cost shock, allow both inflation (around target) and the output gap to become more stable. This implies that the *greater predictability of inflation targets could easily be misinterpreted as good luck*.

Besides altering the constraints faced by the central bank, inflation targeting may alter the objectives of monetary policy, both from the internal perspective of the central bank by tying accountability to inflation, but also in the sense of clarifying to the public the objectives of policy. Prior to the advent of inflation targeting, most central bank charters included a list of desirable objectives, but attempting to pursue many of these objectives could conflict with achieving and maintaining low and stable inflation. For example, of the 35 countries evaluated by Cukierman, Webb, and Neyapti to construct their index of central bank independence, 24 were judged during the 1980s to have objectives that were potentially in conflict with price stability (Cukierman 1992, Appendix A). Central bank charters frequently listed goals that were controllable by the central bank (at least over an appropriate horizon) and others that the central bank could affect temporarily but not in a sustained manner. The goals were often not easily measured, even in principle, much less in practice. Ambiguous objectives lead to a lack of accountability. They also make a central bank more susceptible to political influence.

By clarifying the central bank's objectives, inflation targeting can promote accountability, but it can also cause the central bank to ignore other macroeconomic goals. And criticism of inflation targeting often focuses on the idea that IT central banks may sacrifice other objectives in their pursuit of low inflation (Friedman 2004). If this is the case, then real economic volatility should increase under inflation targeting.

Finally, IT may alter the public's beliefs about the central bank's commitment to low inflation. It may therefore allow the central bank to achieve some of the gains from an optimal commitment policy. For example, when the public is uncertain about the central bank's commitment to delivering low inflation, even a "strong" central bank will be forced to inflate at a higher than desired rate (Cukierman and Liviatan 1991). Making a formal commitment to a publicly announced target may influence private sector expectations and make achieving and maintaining low inflation easier. Though, as Donald Brash (2000, p. 4) has noted, "No amount of political promises, and no amount of institutional tinkering, will convince people that low inflation will be an enduring feature of the economic landscape if what they have actually seen over decades is promises regularly broken and the value of their money constantly shrinking."

Along all three of these dimensions – constraints, objectives, and beliefs – inflation targeting should be associated with a lower average level of inflation and lower inflation volatility. If IT reduces uncertainty about policy objectives, anchors future expected inflation, or allows the central bank to manage expectations better or to more closely mimic policy under commitment, the volatility of real economic activity should also be reduced. However, if inflation targeting is associated with a shift in policy objectives to give more weight to inflation, the volatility of real output should increase.

Now let us look at some of the evidence.

Evidence from industrialized economies

Countries that have adopted inflation targeting have experienced lower average inflation under IT than they did prior to its adoption. Table 1 reports mean inflation rates and their standard deviations during pre- and post-IT periods for the ten OECD countries that are inflation targeters. Inflation is measured by the Consumer Price

Index and the pre-IT period starts in 1962 and ends with the IT adoption date in each country.⁷ Inflation averaged over 9% in the pre-IT period and fell to just over 3% in the post-IT period. Excluding Mexico and Iceland, countries with average inflation rates significantly higher than the other countries in this sample, the average declined by over 4.5 percentage points, from 6.55% to 2%. Not just average inflation declined for the inflation targeters as a group, but inflation fell for every single country within the group.

This decline in average inflation was accompanied by a drop in inflation volatility, both in terms of the level of the standard deviation of inflation and as measured by the coefficient of variation (the standard deviation divided by the mean). As was true with mean inflation, the decline in volatility occurred for every inflation targeting country.

This common improvement in macroeconomic inflation outcomes is undoubtedly an important reason why central banks that adopted IT seem happy with the choice. However, the evidence in Table 1, as Ball and Sheridan (2005) were the first to point out, does not constitute evidence of a causal link between IT and better inflation outcomes. Over the past twenty years, all OECD countries have enjoyed, until recently, lower and more stable inflation rates. Table 2 reports mean inflation rates and standard deviation for the non-inflation targeting OECD countries for the entire sample and for pre-1990 and post-1990 periods. Because these countries did not adopt inflation targeting, there is no natural break point for measuring pre- and post-experience, so the choice of 1990 is arbitrary, but it serves to illustrate how the era of IT adoption has been an era of lower and more stable inflation behavior for both IT and non-IT countries. However, a simple difference-in-differences comparison suggests some impact of inflation targeting, with average inflation among non-inflation targeters falling 2.5%, from 7.72% to 5.22% between the pre- and post-1990 periods, while inflation fell 6.99% between the pre-IT and post-IT periods for the inflation targeters.

Figure 2 shows average inflation (CPI, four quarter moving average) for the inflation targeters and non-targeters among the OECD (minus Turkey). For the figure, Switzerland is treated as a non-targeter. While inflation targeters had higher inflation in the 1970s and early 1980s, the differences with the OECD average is relatively

⁷ I use the adoption dates identified by Mishkin and Schmidt-Hebbel (2007).

minor over this period. The gap between the two groups becomes pronounced, however, in the mid-1980s, immediately prior to the period during which inflation targeting began to be adopted. Perhaps this failure to match the inflation improvements of other OECD countries help motivate the adoption of inflation targeting. Between 1990 and 1995, inflation targeting was adopted by five of the six OECD inflation targeters (New Zealand, Canada, UK, Australia, and Sweden; I have excluded Finland and Spain because they eventually became part of the EMU), and average inflation among the inflation targeters dropped precipitously over this period, falling below that of the non-inflation targeters.

Figures 3 and 4, which plot pre-IT or pre-1990 inflation (fig. 3) and its volatility (fig. 4) against post-IT or post-1990 inflation provide a visual representation of the data from Table 1 and 2. IT countries are shown by circles; non-IT countries are shown by triangles.

The fact that not a single country is located above the 45 degree line in either figure reflects the decline in average inflation and its volatility across all countries. However, except for the two extreme outliers (Mexico and Iceland), neither figure suggests marked differences between inflation targeters and non-inflation targets among the OECD countries.

These simple plots support the basic conclusion reached by Ball and Sheridan (2005). Subsequent research has reexamined the effects of IT, but no clear effect on inflation outcomes has been found among OECD countries (Dueker and Fischer 2006, Lin and Ye 2007). The problem, of course, is that to assess the contribution of inflation targeting to macroeconomic performance in a particular country, we would like to compare actual outcomes with a counterfactual estimate of what outcomes would have been if inflation targeting had not been adopted. Unfortunately, there are no completely satisfactory methods for carrying out this counterfactual. We can't know what would have happened without inflation targeting. Of course, we can try to assess what did happen in a non-inflation targeting country that we feel is similar to an inflation targeter, and this is the approach adopted in the propensity score matching methodology (Lin and Ye 2007, Vega and Winkelried 2005, Wu 2006, Willard 2006).

Lin and Ye (2007) focus on the inflation performance of seven industrialized inflation targeters.⁸ Fifteen other non-inflation targeting major industrialized economies constitute the non-treatment group used in the propensity scoring exercise. In the first stage of their analysis, they conduct a probit regression and find that past inflation, money growth, the exchange regime, and the degree of central bank independence are significant predictors of whether a country adopts inflation targeting.⁹ Lin and Ye find that the probability of adopting inflation targeting is higher if the country's past inflation has been *lower* or its central bank has been *less* independent.

Based on various matching procedures, Lin and Ye conclude that the average effect of inflation targeting on the level of inflation is about 25 basis points, at an annual rate. And the effect is not statistically significant. They also find insignificant effects of inflation targeting on the volatility of inflation.

Should we conclude that inflation targeting, at least among industrial economies, has had little impact on inflation? I think such a conclusion would be premature.

According to the matching methods of Lin and Ye, countries similar to inflation targeters who did not adopt IT will be countries with relative low inflation. That is, in part, what it means to be similar to an IT adopter. So they end up essentially comparing IT countries with countries that also have low inflation. Perhaps not surprisingly, the marginal effect of IT is insignificant.

Evidence including developing economies

Most central banks that now target inflation are developing economies, and here, there is a much larger dispersion of inflation experiences. This variation may help in identifying the effects of inflation targeting. At the same time, a failure to find an effect among this group of countries would be more convincing evidence that inflation targeting is not a significant factor accounting for lower inflation. Investigating the

⁸ The inflation targeters are Australia, Canada, Finland, New Zealand, Spain, Sweden, and the United Kingdom. Finland and Spain joined the European monetary Union in 1999 and so are no longer classified as inflation targeters.

⁹ Surprisingly, they employ a measure of central bank governor turnover as their index of central bank independence (CBI). This measure of CBI was popularized by Alex Cukierman and co-authors, but they employed it only for developing economies. Standard measures of CBI based on central banking legislation were traditionally used when studying industrialized economies.

impacts of IT among developing countries is also of interest as it is among these countries that new adopters have come.

Mishkin and Schmidt-Hebbel (2005), Batini and Laxton (2005), and Vega and Winkelried (2005) are among those who find more significant and positive effects of inflation targeting by employing samples that include developing and not just developed economies. For example, Vega and Winkelried (2005) use a propensity scoring approach to study the effects of IT adoption for a sample that includes 109 countries, of which 23 are inflation targeters. In contrast to Lin and Ye (2007), Vega and Winkelried find that higher average inflation increased the likelihood of adopting inflation targeting. Openness tended to reduce the likelihood, as did greater inflation volatility. Turning to their estimates of the treatment effect of IT adoption, they find that even when controlling for the initial level of inflation, the adoption of inflation targeting was associated with lower average inflation among both developing and industrial economies. For developing economies in particular, the effect was quite strong, ranging from a reduction in average inflation of between 3 percent and 6 percent, depending on the method used to date IT adoption and whether initial inflation was controlled for.

These findings are consistent with the earlier conclusions of Corbo, Landarretche, and Schmidt-Hebbel (2002), Neumann and von Hagen (2002), Petursson (2004) and Mishkin and Schmidt-Hebbel (2005).

If the goal of inflation targeting is to achieve low and stable inflation, then evidence that IT leads to a reduction in average inflation addresses only part of the goal. However, Vega and Winkelried present evidence that inflation target has also contributed to a reduction in the volatility of inflation as well as its average level.

In a recent paper, Gonçalves and Salles (2008) focus specifically on developing economies, excluding industrial economies from among their inflation targeters and their non-inflation targeters. While Table 1 showed that the IT-8 experienced an average inflation rate of 6.55 percent in the pre-IT period, inflation among the IT countries examined by Gonçalves and Salles prior to their adoption of inflation targeting averaged 17 percent (Table 1, p. 314, 1980 to date of adoption). Following the same methodology as Ball and Sheridan (2005), they find that the effects of inflation

targeting were statistically and economically significant, with estimated reductions in inflation on the order of 2-2.5 percent. Surprisingly though, Gonçalves and Salles do not find a significant effect of inflation targeting on the volatility of inflation.

Effects on expected inflation

As discussed earlier, many of the potential benefits from inflation targeting act through its effect in anchoring expectations of future inflation. Several authors have investigated directly the impact that IT might have on expectations.

Johnson (2002) employed a panel approach to compare expected inflation among five inflation targeting countries (Australia, Canada, New Zealand, Sweden, and the U.K.) and six non-targeting countries (France, Germany, Italy, the Netherlands, Japan, and the U.S.) His findings were strongly suggestive of a direct impact of inflation targeting on expected inflation, with the introduction of inflation targeting associated with a significant drop in expected inflation. However, a primary objective of inflation targeting is to anchor inflation expectations, and on this dimension, Johnson's results were not supportive. He finds no difference in the variability of expected inflation across targeters and non-targeters.

Evidence that is more supportive of the anchoring role of inflation targeting has been found by Gürkaynak, Levin, and Swanson (2006) and Gürkaynak, Levin, Marder, and Swanson (2007). Using inflation expectations implied by bond yields, these authors do find a significant anchoring effect of inflation targeting. Specifically, in Gürkaynak, Levin, and Swanson (2006), evidence from the U.S., the U.K., and Sweden is used to test the responsiveness of inflation expectations to economic news. In the U.S., long-term inflation expectations react to news, suggesting these expectations are not firmly anchored. In contrast, no such response was found for Sweden, an inflation targeter. The most interesting case, however, was that of the U.K., where expectations did respond to news prior to 1997 but not afterwards. 1997 was of course the year the Bank of England received its independence. The better anchoring of expectations post-1997 suggests the importance of central bank independence for the credibility of an inflation targeting regime.

Gürkaynak, Levin, Marder, and Swanson (2007) extend their analysis to compare the U.S., Canada, and Chile. Consistent with the hypothesized role of inflation targeting,

expectations did not respond to news in either Canada or Chile. Finally, Levin, Natalucci, and Piger (2004) estimate the effects of lagged inflation on long-term inflation expectations for several IT and non-IT industrialized economies. They too find an effect of inflation targeting in anchoring inflation expectations. In the non-IT countries, lagged inflation is significantly correlated with expectations of future inflation, a correlation that is absent among the inflation targeters.

The importance of expectations is also found by Ravenna (2007) in his study of inflation targeting in Canada. He estimates a DSGE model of Canada to obtain historical shock series which can then be used to generate counterfactual experiments. Interestingly, Ravenna finds that the model predicts a significant decline in inflation volatility under inflation targeting, with most of this decline attributed to the impact of the policy switch on expectations.

A dramatic example of how inflation expectations can be affected and then anchored by inflation targeting is provided by Peru. In work in progress, Carrera (2008) has looked at the distribution of individual responses to a survey of inflation expectations in Peru since 2000. For each year from 2000 until 2007, Figure 5 shows the distribution of inflation expectations. (Survey respondents were queried in December about their inflation expectations for the coming year.) Also shown are the central bank's target ranges, together with the actual realized inflation rate.

As is apparent in the figure, the distribution of inflation expectations shifted significantly with the adoption of inflation targets. In 2000, almost all respondents expected inflation to be in excess of the target range of 3.5 to 4 percent. In 2001, the distribution of inflation expectations had shifted significantly towards the new range of 2.5 to 3.5 percent. Since 2002, almost all the mass of the distribution has been within the official target ranges. And expectations have generally stayed within the target range even when, as in 2006, realized inflation fell outside the target window.

To summarize, the evidence suggests that inflation targeting does succeed in anchoring inflation expectations. Since this was a primary objective of inflation targeting, it is reassuring to see that it has occurred.

Effects on the real economy

As noted earlier, most opposition to inflation targeting can be traced to a concern that other legitimate goals of macroeconomic policy will be neglected if the central bank adopts inflation targeting. This is a conceptually well-founded concern, and is based on the view that, under an IT framework, the central bank will place increased weight on inflation stabilization and reduce its concern for maintaining real economic stability. The first part of this argument accords with the theory of performance measures; individuals (and institutions) do tend to focus on the yardstick on which their rewards are based. And basic monetary policy models generally imply that policymakers face a trade off between inflation volatility and real economic volatility. Stabilizing inflation comes at a cost of more volatile real economic activity, so if inflation targeting does lead to a greater focus on inflation stabilization, it should come at the cost of greater output gap volatility.

Tables 3 and 4 show statistics for the growth rates of industrial production for inflation targeters and non-inflation targeters. Of the 25 countries in the two tables, only five (Korea, Switzerland, Finland, Ireland, and Turkey) experienced greater volatility in either the post-IT adoption period or, for non-targeters, the post-1990 period. On the face of it then, inflation targeting certainly does not appear to have been associated with any increase in real volatility. However, the general decline in output volatility across all countries is consistent with the good luck view of the Great Moderation period. Figures 6 and 7 provide a visual representation of the data from tables 3 and 4.

It may still be the case that, in an era of good luck, inflation targeting, by promoting an increased focus on inflation, leads to a relatively larger decline in the volatility of inflation. For example, in a simple model of optimal discretionary monetary policy, the variance of both inflation and the output gap should depend on the variance of inflation shocks, so both inflation and output will become more stable as the variance of these shocks declines. However, the ratio of the variances of inflation and the output gap should be independent of the shock variance and depend instead on the relative weight the central bank places on its inflation objectives. Thus, IT would be expected to reduce this ratio. Figure 8 plots the ratio of the standard deviation of inflation to the standard deviation of output growth (measured by industrial production) in the post-IT period (post-1990 for non-ITers) against this ratio for the

pre-IT (pre-1990) period. Inflation targeters are indicated by triangles, non-inflation targeters by diamonds. All points, with the exception of Greece, lie below the 45 degree line, indicating that inflation volatility has fallen relative to output volatility for both inflation targeters and non-targeters. Apparently all countries have placed an increased weight on achieving low and stable inflation, not just formal inflation targeters.

While the simple graphical presentation is suggestive, it is not conclusive. To investigate more formally whether inflation targeting has had a statistically significant impact on output growth volatility, the propensity score methodology employed by Lin and Ye (2007) to study inflation can be replicated for industrial production. The sample consists of 22 industrialized economies for 1985-1999. The inflation targeting countries are Australia, Canada, Finland, New Zealand, Spain, Sweden, and the U.K. The results are reported in Table 5.¹⁰ The results in Table 5a are based on IT starting dates that include periods during which the target might have changed (Non-constant IT, or NCIT), while Table 5b uses dates associated with constant inflation targets (CIT). The first stage probit regressions used to obtain the propensity score matches included lagged inflation, central bank turnover, real GDP growth, the government fiscal balance, and a dummy for a fixed exchange rate regime. Each column of Table 5 is based on a different matching method. Consistent with the basic message of Figure 7, the estimation results suggest that IT has not had a significant effect on average output growth or its volatility.

Turning to developing economies, the evidence is more suggestive that inflation targeting has contributed to greater inflation *and* real stability. Using a sample of 36 developing countries (13 targeters), Gonçalves and Salles (2008) investigate the effects of IT adoption on the volatility of real GDP growth. Inflation targeters had on average slightly lower real volatility than non-targeters *prior to the adoption of inflation targeting*. Despite starting from a point (on average) of lower volatility, IT had a statistically and economically significant effect in further lowering real economic volatility.

Summary on the effects of inflation targeting

¹⁰ This is based on work in progress with Mahir Binici and Conglin Xu.

The decline in inflation among industrialized economies over the past twenty years coincided with the adoption of inflation targeting, making it difficult to separate out any distinct contribution of the shift in policy regime. To a large degree, this reflects the benign economic environment of the last two decades. Good luck, in the sense of low volatility shocks, rather than the particular details of the monetary policy framework, may be the explanation for the era of stability. For developing economies, the role of inflation targeting seems to be more clearly beneficial, having had a significant effect in reducing average inflation and inflation volatility. It also is associated with a more stable real economy.

Finally, inflation expectations are affected by inflation targeting, becoming more firmly anchored in IT countries relative to non-IT countries. This conclusion is based primarily on industrialized economies, but it is also likely to hold for developing economies. Perhaps the surprising finding from the empirical evidence is that, while expectations are better anchored in industrialized IT countries, it has been difficult to find clear evidence among these economies that actual inflation has become more stable under inflation targeting.

Thus, the lessons to draw from the empirical evidence are what might be described as “non-negative.” The contribution of inflation targeting to low and stable inflation among industrial countries is weak, but it also has not had negative effects on real activity. It does seem to have anchored inflation expectations. For the developing economies, inflation targeting has been associated with lower and more stable inflation and real activity.

Don Kohn (2003, pp. 82-83) has stated that “The point of numerical targets is to constrain central bank flexibility in the pursuit of other objectives. That is both their benefit and their potential cost, as targeting central banks might feel limited in leaning against deviations of output from potential.” The evidence suggests these potential costs have not manifested themselves. Perhaps the real question is why the benefits of anchoring expectations aren’t more apparent.

Inflation targeting is not strict inflation targeting

If inflation targeting has led IT central banks to focus more on achieving inflation goals, non-IT central banks appear to have also done so. This raises the question – is there anything distinctive about inflation targeting? Is it simply one (among possibly many) forms of good monetary policy? Does inflation targeting even have unique characteristics, or is any reasonable monetary policy open to being labeled inflation targeting? Mervyn King has suggested this latter viewpoint in saying that “....any coherent policy reaction found can be described as inflation targeting.” King (2005 p.13).

Various authors have provided definitions of inflation targeting (Bernanke, Laubach, Mishkin, and Posen 1999, Amato and Gerlach 2002, Mishkin and Schmidt-Hebbel 2007, others), but at a minimum the central bank must formally announce an inflation target and the central bank's policy instrument must be adjusted in a manner consistent with achieving the target over some horizon. The key is that the inflation target serves as a nominal anchor (Mishkin and Schmidt-Hebbel 2005) and that the target is formally announced. In contrast to fixed exchange rate regimes or the use of monetary targets, inflation targeting defines the nominal anchor directly in terms of the key goal of monetary policy.

No serious definition of inflation targeting defines it in terms of a specific description of how actual policy is implemented. And certainly policy practices do vary among those countries that target inflation. For example, Lubik and Schorfheide (2007) find that both the Bank of England and the Bank of Canada respond to exchange rate movements. In contrast, they find that Australia and New Zealand do not.

Transparency is another dimension along which practice among IT central banks differs, with the Czech Republic, Iceland, New Zealand, Norway, and Sweden publishing forecasts for their policy interest rate, while other inflation targeters do not.

While inflation targeting regimes vary, no central bank appears to be a strict targeter, focused on achieving its inflation target regardless of the real consequences. Instead, inflation targeters behave in ways consistent with a concern for both inflation and real economic stability, that is, as so-called flexible inflation targeters.

That doesn't mean that some critics of inflation targeting haven't portrayed it in much cruder terms. For example, Joe Stiglitz (2008) has recently described inflation

targeting as implying “whenever price growth exceeds a target level, interest rate should be raised.” He concludes that such a policy recommendation has little to support it, either in theory or from empirical evidence, and that “there is no reason to expect that *regardless of the source of inflation*, the best response is to increase interest rates.” (italics in original).

One need only look at the first Policy Target Agreement (PTA) of the Reserve Bank of New Zealand to see that inflation targeting does not imply such a simpleminded approach to policy. That March 1990 PTA directed the Reserve Bank to achieve and maintain price stability, but besides providing a definition of price stability in terms of a specific price index (the CPI), the PTA included a number of opt out clauses that specified situations under which deviations from price stability might be warranted.¹¹ These included external terms of trade price shocks, changes in indirect taxes, price changes resulting from government levies, natural disasters, or (a particularly New Zealand concern), the outbreak of a major livestock disease (see Walsh 1995).

The explicit list of developments that would justify deviations from the inflation target have continued to be included in subsequent Policy Target Agreements. For example, the 2007 PTA states, under the heading “Inflation variations around target,” that

a) For a variety of reasons, the actual annual rate of CPI inflation will vary around the medium-term trend of inflation, which is the focus of the policy target. Amongst these reasons, there is a range of events whose impact would normally be temporary. Such events include, for example, shifts in the aggregate price level as a result of exceptional movements in the prices of commodities traded in world markets, changes in indirect taxes, significant government policy changes that directly affect prices, or a natural disaster affecting a major part of the economy.

b) When disturbances of the kind described in clause 3(a) arise, the Bank will respond consistent with meeting its medium-term target. (Policy Target Agreement 2007).

These opt outs consist of events we would classify as cost or supply shocks, the type of disturbances that do pose difficult trade-offs for aggregate demand management policies and that central banks continually face, whether they are inflation targeters or not.

¹¹ Recognizing the RBNZ’s success, PTA’s since 1992 have directed the bank simply to maintain price stability.

Similarly, the instructions from the government to the Bank of England state that the policy “framework is based on the recognition that the actual inflation rate will on occasions depart from its target as a result of shocks and disturbances.” Again, this is not a description of strict inflation targeting.

Is inflation targeting just good monetary policy?

If inflation targeting is not strict inflation targeting nor a simply minded response to inflation, is it instead simply good monetary policy? As Issing (2004, p. 171) notes, if the primacy of price stability or low inflation is taken as the defining characteristic of inflation targeting, then “the definition imposes few empirically testable restrictions on the implementation of monetary policy. As such, it does not allow inflation targeting strategies to be distinguished from other stability-oriented strategies and their relative merits to be evaluation.” Or, as expressed by Demertzis and Viegli (2008, p.57): “...conventional monetary policy models (Svensson 1999, 2003, Woodford 2003) allow for no difference in the way inflation targeting is modeled by comparison with other regimes. There is thus no explicit analysis of the way the provision of a specific numerical target may constitute a better anchor for private-sector expectations.”

If good monetary policy provides a nominal anchor and contributes towards reducing economic instability, then the policies followed by explicit IT central banks are good monetary policies, but they are not the only way one might choose to conduct policy. For example, while inflation has been widely adopted as the anchor of choice, Fatás, Mihov, and Rose (2007) suggest that what is critical is having some quantitative goal (inflation, money growth, exchange rate); the exact choice is less important.

One reason, therefore, that it may be difficult to distinguish a unique contribution of IT to inflation behavior among high income countries is that virtually all of them follow policies that could be described as inflation targeting. That is, among the non-IT countries, the euro area seems to behave like an ITeR, and the same could be said of the Federal Reserve.

Inflation targeting and communications

One difference between inflation targeters and non-targeters is the greater emphasis on transparency among ITers.

In many ways, transparency and communications are the hallmark of inflation targeting. But transparency has increased significantly among non-targeters as well. Dincer and Eichengreen (2007) have developed an index of central bank transparency which they construct for 100 central banks.¹² I focus on a subset 63 of these countries (I exclude Africa and several very small – generally island – nations). The horizontal axis of Figure 9 gives the value of the Dincer-Eichengreen transparency index in 1998, while the vertical axis measures the index value in 2005. Triangles are non-inflation targeters, circles are inflation targeters.

As is clear from the figure, almost all central banks have become more transparent – few (9 of 63) are on the 45 degree line, none are below it. Inflation targeters are on average more transparent and have seen the largest increases in transparency. But, inflation targeting central banks were also, on average, more transparent in 1998 than non-inflation targeters.

The need to anchor inflation expectations accounts for the shift to more transparency by non-inflation targeters as well as inflation targeters. But two issues have recently drawn attention concerning the current practices of inflation targeters. First, do IT central banks focus too much attention on inflation in their communications? And second, should they provide more information on the future path of the policy interest rate?

One of the great advantages of a policy framework that defines a nominal anchor in terms of an ultimate goal of policy is that it facilitates communications. It is easier to communicate to the public a policy expressed in terms of a goal such as maintaining low and stable inflation than it is to do so in terms of a monetary aggregate. I think all inflation targeters have found that the framework provides a successful means of organizing their communications with the public. In doing so, it has prompted them to continue to expand the range of and quality of the information they provide.

¹² Eijffinger and Geraats (2006) also have constructed an index of transparency for nine central banks, all representing developed economies.

In addition to facilitating communications with the public, there is another very important role played by an announced inflation target. A clearly defined and publically announced target promotes accountability.

But if accountability were the only rationale for transparency, why focus just on inflation? Should central banks also communicate about other objectives of policy? Faust and Henderson (2004, p. 135) for example, have argued that central bank communications should be more "balanced." And many critics of inflation targeting, such as Friedman (2004), have said that because inflation is only one of the goals of monetary policy, a framework that is expressed solely in terms of inflation, particularly if the central bank is held accountable only for its inflation goals, will inevitably mean other macroeconomic objectives will be neglected. Certainly this is the reasoning behind much of the opposition to formal inflation targeting in the United States, where inflation targeting is viewed as inconsistent with the Federal Reserve's dual mandate for low inflation and maximum sustainable employment.

The design of a framework for monetary policy is a perfect example of the case in which goals are hard to define precisely in theory and difficult to measure in practice. What is maximum sustainable employment? How would we know whether it was achieved? What is the output gap? In this type of environment, any system designed to establish benchmarks for accountability will need to rely on easily observed performance measures. Inflation is therefore the prime candidate to serve as the measure of central bank performance. It can be observed directly, and it is related to the more fundamental but vaguely defined and difficult to measure objectives of monetary policy (e.g. contributing to social welfare). The theory of performance measures tell us, however, that if accountability is tied to a specific outcome, the policy maker has an inherent bias towards ensuring the performance measure looks good, even if this comes at some sacrifice of the broader goals of policy. This, at least at the conceptual level, is a major potential disadvantage of inflation targeting. Goodfriend (2005, p. 312) notes that "The main objection to some sort of explicit, public commitment to inflation targeting is the concern that inflation targeting would focus the Fed too narrowly on inflation at the expense of output and employment."

An important lesson from the empirical evidence surveyed earlier, however, is that this issue has not been of practical relevance.

The standard argument for focusing communications solely on inflation objectives is based on two beliefs. The first is that, in the long run, monetary policy can only affect nominal variables like the inflation rate. The second is that while monetary policy does have significant short-run real effects, these are less well understood, more uncertain, and harder to estimate.

This is not a very compelling argument. While the short-run real effects of monetary policy may be subject to a great deal of uncertainty, it is exactly through this channel that the models employed by most central banks imply inflation is affected. Thus, understanding these linkages is critical for achieving low and stable average inflation.

Modern theoretical models provide a stronger argument for the role of inflation as the primary focus of central bank communications. These models emphasize the importance of forward-looking expectations for current macroeconomic developments. This is true with respect to both inflation and real activity. With respect to inflation, if prices and/or wages are sticky, price and wage setters must be forward looking in making their decisions. This is captured in the new Keynesian Phillips curve by the inclusion of the expected future inflation rate as a key determinant of current inflation. Forward-looking behavior is equally important in consumption and investment decisions and so aggregate demand and real economic activity will be influenced by expectations of future real activity. This is reflected in the presence of expected future output in the new Keynesian expectational IS curve.

Even though forward-looking expectations of both inflation and real output are important, only the expectations of future inflation are controllable by the central bank. Looking out three to four years, there is little disagreement with the statement that average inflation can reasonably be controlled; almost no one would make a similar statement with respect to real output. Thus, even though both are important, if the objective of a communications strategy is to affect expectations of future macroeconomic developments, there is a compelling case that the central bank should limit itself to talking about inflation.

It is interesting to note, however, that contrary to the argument of Friedman (2004), inflation targeting central banks typically also provide a great deal of information on projections for real output as well as for inflation. And the evidence recently surveyed by Blinder, Ehrmann, Fratzscher, De Haan, and Jansen (2008) suggests that markets react to speeches about future inflation and interest rates but not to central bank speeches about real economic activity.

Currently, the question at the frontier of debates over transparency is whether central banks should provide projections for the path of the future policy interest rate. So far, this is done in New Zealand, Norway, Iceland, the Czech Republic, and Sweden. Arguments against providing such projections include the fear any conditional projection would come to be viewed as a commitment and that policy committees would be unable to agree on a projection.

Many central banks, including both inflation targeters and non-targeters, provide forecasts of inflation and real output. In theoretical models, this is usually interpreted as providing projections on inflation and the output gap. In this case, the interest rate projection would only provide the public with the central bank's assessment of future demand shocks, shocks which presumably the policy rate will be adjusted to offset. In this case, one might question why the policy rate projection should be provided, given that inflation and output gap projections are announced.

However, most central banks produce output projections, not output gap projections. Therefore, the corresponding interest rate path is necessary for the private sector to determine the central bank's forecast of potential output. Since most central banks are likely to think their estimates of potential output are subject to large errors, this might explain some of the reluctance to announce policy rate projections. Thus, there may be a legitimate sense that interest rate projections are too noisy to be useful and that releasing them may lead to the type of informational problems highlighted by Morris and Shin (2002).

An argument for providing interest rate projection is that doing so would reduce uncertainty. In a standard policy model, the path of the interest rate consistent with given projections for inflation and the output gap is not unique. For example, consider

a standard baseline new Keynesian model of the simplest form, consisting of an inflation adjustment equation and an expectational IS curve:

$$\pi_t = \beta E_t \pi_{t+1} + \kappa x_t$$

$$x_t = E_t x_{t+1} - \left(\frac{1}{\sigma} \right) (i_t - E_t \pi_{t+1} - r_t^n)$$

Given this model, a feasible, and optimal, policy would set both inflation and the output gap equal to zero for all t . In this case, an interest policy consistent with such an equilibrium would ensure that $i_t = r_t^n$ for all t .¹³ Given zero inflation, it is clear that the output gap only depends on the current and expected future interest rate gaps $i_t - r_t^n$. This does not pin down a particular path for the interest rate. Thus, a policy that is expected to, at some future date, set

$$i_{t+i} = r_{t+i}^n + e_{t+i} \quad \text{and} \quad i_{t+2} = r_{t+2}^n - e_{t+1}$$

is also consistent with a current output gap of zero, yet this alternative path for the policy rate introduces additional market uncertainty. Thus, providing a path for the interest rate might reduce uncertainty.

A further reason for being more explicit about the future path of the policy rate is that doing so can aid the public's understanding of the central bank's policy. Rudebusch and Williams (2007) and Esupi and Preston (2007) argue that, in an environment of learning, it can be helpful for the central bank to be explicit about its policy rule. Providing projections may accomplish the same goal.

The value of providing more explicit direction to markets about the future path of the policy rate was illustrated by the "clarification" the ECB had to provide on June 11, 2008, the day after Jean-Paul Trichet had indicated the ECB would raise its policy rate in July. Markets interpreted this signal as indicating the beginnings of a series of

¹³ As is well known, such a policy leads to indeterminacy (Woodford 2003). To avoid this problem, we can assume that the policy rule actually followed is

$$i_t = r_t^n + \phi \pi_t$$

where ϕ is greater than 1 to satisfy the Taylor principle.

rate increases. The ECB apparently did not share this same belief, and so on the day after Trichet made his comments, ECB council members were correcting the markets, describing the planned rate increase as a one-off change.¹⁴

The same week, markets were trying to digest the implications of statements by Ben Bernanke that the chances of a serious downturn had fallen while the risks to inflation had risen. The speculation was that the Fed would raise interest rates before the end of the year. Least one think that only non-inflation targeters face this problem, the Bank of England experienced similar communications problems in early June of 2008.

These recent examples point to the potential value of providing a forecast path for the policy rate. If the objective is to anchor inflation expectations, why leave any unnecessary uncertainty? While concerns have been expressed that the conditional nature of rate projections will be misunderstood, this same concern applies to all forecasts provided by the central bank, and inflation targeting central banks have becomes quite practiced in conveying the uncertainty surrounding such forecasts. The home page of the Norges Bank, for example, provides a fan chart for the policy rate.

The current challenge

The past year has seen a new environment emerge, one that poses great challenges to central banks. During 2008, significant financial market disruptions and increases headline inflation due to a rise in the relative prices of food and energy threatened the hard won battle of the 1980s and early 1990s against inflation. While energy prices had declined by the end of 2008, the financial crisis worsened through 2008 and into 2009, and the United States entered a recession in December 2007. Many other countries experienced sharp declines in economic growth in 2008 and 2009. Inflation dropped in most countries, and concerns swung from avoiding inflation to preventing deflation.

¹⁴ Ralph Atkins, "ECB puts markets straight on rate rises," *Financial Times*, June 12, 2008, p. 1.

These developments are reminders that old lessons remain relevant, for both inflation targeters and non-targeters. For example, financial stability must be an important macroeconomic objective and monetary policy lending and discount window procedures designed to provide liquidity to financial markets can be critical in ensuring markets function smoothly.

While the current financial crisis in the United States is likely to lead to far-reaching reforms in the regulatory environment and may even affect the future role of the Federal Reserve, it has little direct relevance for the debate over inflation targeting. This is not just because the U.S. is not an inflation targeter. Instead, the reason is simply that responding to financial turmoil is completely consistent with the objectives of inflation targeting. Financial market crises reduce access to credit and generate negative wealth effects. These effects reduce real activity and inflation and, *ceteris paribus*, call for more expansionary monetary policy. Thus, reacting to financial market instability affects the path of the policy interest rate consistent with inflation targets, but the presence of such targets does not constrain a bank's ability to deal with a financial crisis.¹⁵ In most circumstances, responding to financial crises will be compatible with the goals of flexible inflation targeting.

In fact, the severity of the current recession and the fears of deflation that it has generated have strengthened the arguments in favor of inflation targeting. When the central bank's policy interest rate reaches zero, expectations of deflation serve to raise the real interest rate, reinforcing contractionary pressures on the economy. Inflation targeting calls for preventing inflation from falling too low as well as from letting it rise too high. Thus, it automatically calls for more expansionary policies in the face of contractionary economic disturbances. When the central bank is explicitly committed to a low but positive rate of inflation, it is less likely that the public will expect deflation. By anchoring inflation expectations at the target rate, a credible commitment to a positive inflation target may avoid the dangers of a deflation.

Also relevant for both targeters and non-targeters is the lesson provided by the classic work on operating procedures by Poole (1970). Given a financial disturbance that affects the demand for liquidity, the appropriate policy is simply to add or subtract

¹⁵ Mishkin (2000), in a review of inflation targeting experiences, concluded that IT central banks should not respond directly to asset prices or the exchange rate.

reserves in line with fluctuations in the demand for bank reserves. To the extent that the disturbances are limited to financial markets, with no spillover effects that would alter forecasts of inflation or real activity, no change in the level of interest rates is called for. This implication is in line with the notion that one primary advantage of an interest rate policy is that it can automatically offset some financial market disturbances and prevent these from having consequences for real activity or inflation.

Cost shocks will always cause problems

Energy and food price shocks pose different and perhaps more difficult policy challenges for inflation targeters. These shocks correspond to the cost shocks that are at the heart of the analysis of optimal monetary policy. In fact, most theoretical policy analysis focuses explicitly on understanding the trade-offs that exist between inflation variability and output variability in the face of cost shocks of the sort seen over the past year.¹⁶

Positive energy and food shocks beginning in 2007 meant that several IT central banks did, or were in danger of, breaching the upper bound on their target ranges. For example, inflation in Israel and New Zealand was running at about 4 percent compared to target ranges of 1-3 percent. The Governor of the Bank of England recently had to write to the Chancellor of the Exchequer to explain target breaches.¹⁷ Many developing economy inflation targeters have experienced significant increases in inflation. For example, inflation in Chile rose above 9 percent, over twice the upper bound of their 2-4 percent target range. The high degree of automatic wage indexation in Chile is undoubtedly making the central bank's job more difficult.

The rise in inflation in the face of food and energy price shocks was not limited to countries that target inflation, and if inflation expectations are more firmly anchored when the central bank has formally established inflation targets, then ITers may do better in limiting the inflationary impact of these price level shocks. However, inflation targeters did face unique challenges during the first half of 2008. Specifically, food and

¹⁶ In the context of a robust control approach to monetary policy, the worst-case scenario for the central bank involves the economy being hit with a positive cost shock just when it is experiencing a negative output gap (see Walsh 2004), a scenario with parallels to the situation in early 2008.

¹⁷ A former member of the UK Monetary Policy Committee recent wrote that he had expected the Governor of the Bank of England would probably need to write to the Chancellor roughly every 15 months; the 2008 case is only the second such letter since the Bank of England received its independence in 1997.

energy price shocks open up a gap between CPI inflation and the measures of core inflation that policy makers often rely on when assessing the stance of policy. These core measures typically remove food and energy prices precisely because of their volatility. Any gap between core measures of inflation on which policy makers focus and headline measures of inflation that attract the public's attention can threaten the credibility of inflation targeters, since formal targets have been defined in terms of CPI inflation.

The dilemma faced by small open economy inflation targeters who are food and energy importers is particularly acute. To avoid breaching targets in the face of shocks to the prices of imported goods, monetary policy would need to contract the domestic economy and possibly force a deflation in the prices of domestically produced goods. In practice, inflation targeters have not attempted to do this and instead have allowed CPI inflation to rise. Recent theory offers three arguments in support of such policies. First, Clarida, Galí, and Gertler (2002) show that in a simple new Keynesian model of the open economy, it is domestic price inflation, not CPI inflation, that should be stabilized if the objective is to maximize the welfare of the representative household. Second, theory implies that the welfare costs of inflation are largest in sectors of the economy with the stickiest prices. Since food and energy prices display little stickiness, responding quickly to shifts in demand and supply, there is a strong case for excluding them from the inflation rate the central bank attempts to control. Finally, wage rigidity may be a more important source of nominal rigidity than price stickiness, and this implies that stabilizing wage inflation may be more desirable than stabilizing price inflation.

While the first of these arguments is model specific and does not generalize, the other two provide useful guidance to policy makers. If central banks have not tried to prevent CPI inflation from rising, and they appear to have focused instead on core measures of inflation. They also have emphasized the importance of anchoring expectations and preventing the relative price shifts associated with commodity price increases from having second-round effects on wages. If expectations are more firmly anchored under inflation targeting, then the central bank has greater flexibility to respond to contractionary economic shocks, like those associated with a financial crisis, without jeopardizing medium-term inflation objectives. Thus, rather than

constraining the ability to deal with adverse shocks, flexible inflation targeting may provide more scope for stabilizing the real economy.

Of critical importance, though, is the recognition that monetary policy cannot offset the real effects of relative price shifts. As a recent *Monetary Policy Report* of the Swedish Riksbank notes, “It is not the task of monetary policy to attempt to influence changes in relative prices;....Global increases in commodity prices undermine the prosperity of Swedish households. Monetary policy cannot do anything about this.” (Riksbank MPR, 2008/2, page 7)

Perhaps the greatest risk of the rise in CPI inflation in many IT countries is the damage it may do to central bank credibility. For central banks with long histories of maintaining low inflation, temporary target breaches may have little impact on inflation expectations, but many central banks among the emerging market and developing economies have only recently become inflation targeters and do not have long track records of low inflation. For them, the gap between CPI inflation and their formal targets may call into question their commitment to inflation targeting. If so, inflation expectations will become that much more difficult to anchor. It also makes the task of communications more difficult.

One might argue that if we are entering into a new and more volatility global economic environment, then inflation targeters may need to widen their target bands. However, narrower bands, with more frequent breaches, are not necessarily a bad development. It is these target misses that provide central banks with the best opportunity to explain to the public why inflation has temporarily moved higher (or lower) and to show they have a consistent policy for ensuring a return to the inflation target. Accountability is strengthened by this process.

While the global slowdown should limit inflationary pressures, and energy prices have already receded from their peaks, the cost shocks of 2007 and 2008 serve as useful reminders that inflation targeting does not eliminate the need to balance inflation stability with real output stability. This balancing act is faced by all central banks. As Truman (2003, p. 6) has expressed it, “...inflation targeting does not solve many perennial judgment questions facing central banks, particularly with respect to supply disturbances that push inflation in one direction and economic activity in the other.”

Conclusions

Since IT was first adopted by the Reserve Bank of New Zealand, inflation targeting has spread widely. Despite its popularity, it is not without its critics who argue either that inflation targeting is not any more successful in controlling inflation than other alternative policy regimes or that inflation targeting causes the central bank to focus too much on controlling inflation at the cost of other competing macroeconomic objectives. A review of the empirical evidence on IT confirms that, among the industrialized group of countries, the inflationary experiences of targeters and non-targeters have been similar. Contrary to some predictions, however, industrialized inflation targeters have not seen any increase in real economic volatility. For emerging market and developing economies, the evidence shows that inflation targeting has improved macroeconomic performance in terms of delivering both lower inflation and a more stable real economy.

The evidence that IT has not worsened real economic instability is important, as most critics of inflation target have stressed the potential for IT central banks to neglect the real economy. It is clear that this has not happened, and the potential costs of IT that critics feared have not materialized.

In 2005, John Taylor said that “If central banks continue to focus on price stability and keep inflation low and stable, there is every expectation that the current degree of macroeconomic stability will continue.” (Taylor 2005, p. 1) Taylor’s belief that monetary policies of the type pursued by inflation targeting central banks would ensure macroeconomic stability has proven too optimistic. Financial meltdowns, such as the U.S. is experiencing at the time this is written, pose similar problems for IT and non-IT central banks. In that sense, they are irrelevant for the inflation targeting debate. More critical to evaluating inflation targeting are macro shocks that force central banks to balance the need to control inflation with their desire to limit economic contraction. Such shocks do not disappear just because monetary policy is well managed.

The current macro environment is posing the first real test for inflation targeters. However, inflation targeting has so far proven to be a durable regime, in part because

central banks have practiced *flexible* inflation targeting; inflation targeters have shown themselves to be concerned with real stability as well as with controlling inflation. This flexibility, and the potential to better stabilize the real economy when long-term inflation expectations are well anchored, suggest that IT will survive the current economic environment. In fact, the gains of adopting inflation targeting may become more apparent if the past success of IT regimes in anchoring expectations enable them to weather swings in energy and food prices with smaller second round effects on inflation and to prevent the spread of deflationary expectations.

The generally restrained behavior of inflation expectations over 2007 and early 2008, despite significant increases in CPI inflation in most countries during this period, stands in contrast to the experiences during the 1970s in the face of rising food and energy prices. This most likely it is a reflection of the greater credibility many central banks have gained over the past twenty years, regardless of the particular framework they have employed for implementing policy. However, the formal primacy of inflation in the communications strategies of IT central banks is well suited to explain why policies adapted to respond to the current global economic slowdown are still consistent with medium-term inflation control.

Is inflation targeting necessary for good monetary policy? No. In principle, other regimes could also provide the required nominal anchor while still ensuring the flexibility needed to promote overall economic stability. But as a system of maintaining a medium-run focus on controlling inflation, communicating clearly with the public about the ultimate objectives of monetary policy, and providing a measure of accountability, inflation targeting dominates the alternative choices

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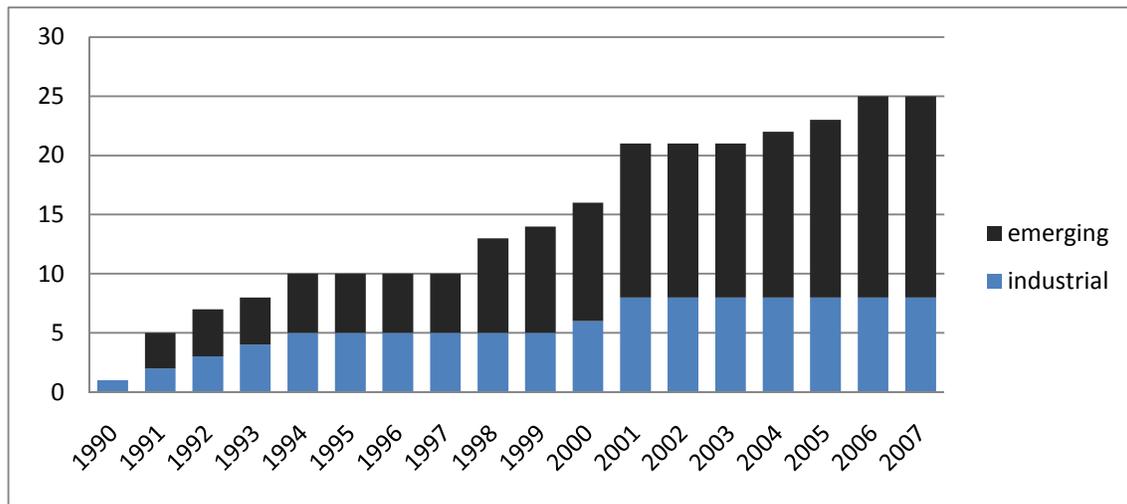


Figure 1: The spread number of inflation targeting central banks has grown steadily since 1990 (Dates: Mishkin and Schmidt-Hebbel 2007 and Rose 2007)

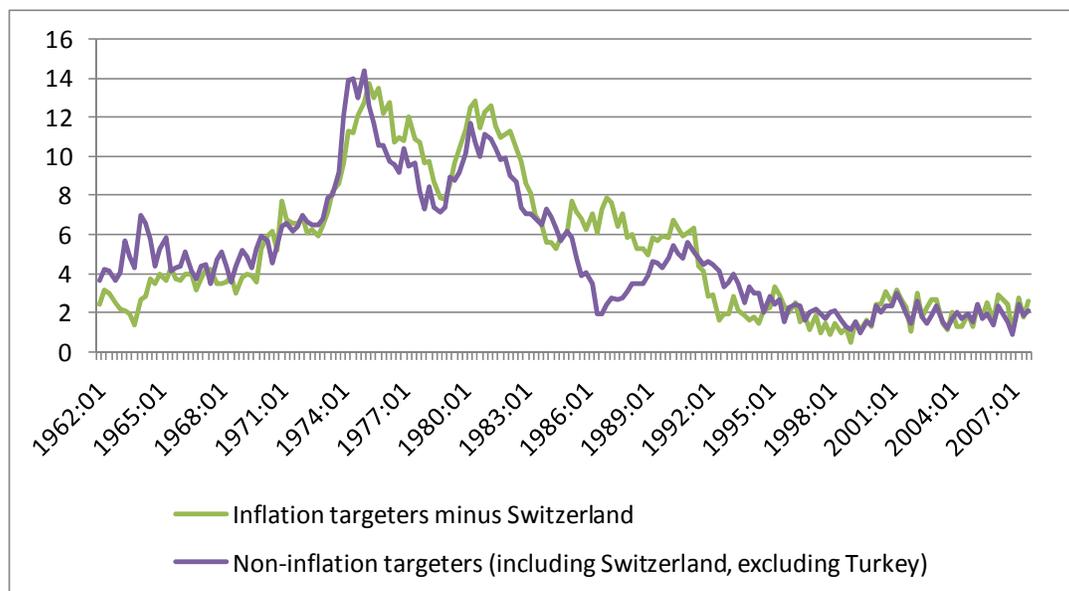


Figure 2: OECD inflation targeters and non-inflation targeters: 1962-2007 (excludes Turkey and classifies Switzerland as a non-targeter)

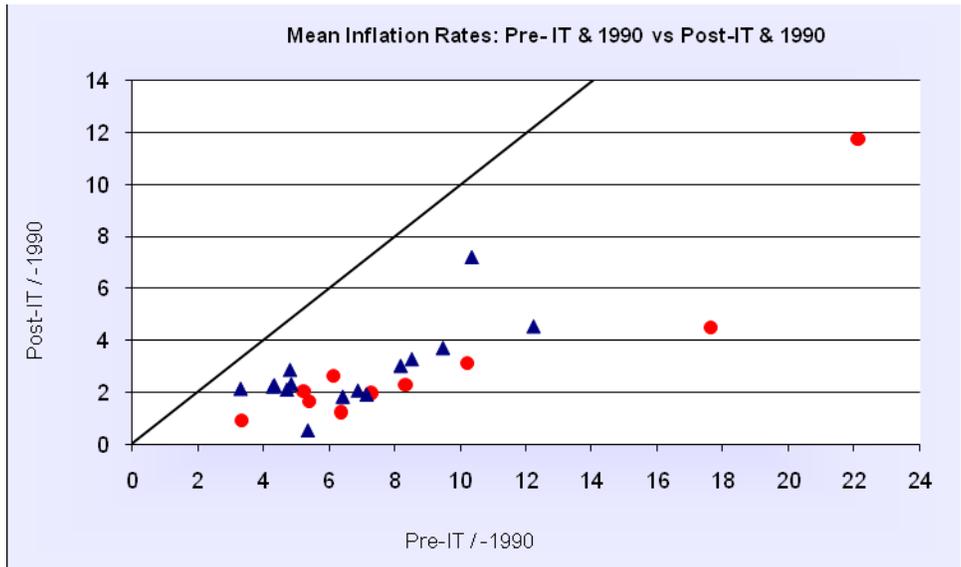


Figure 3: Pre and post mean inflation
 Circles: Inflation targeters; Triangles: non-inflation targeters

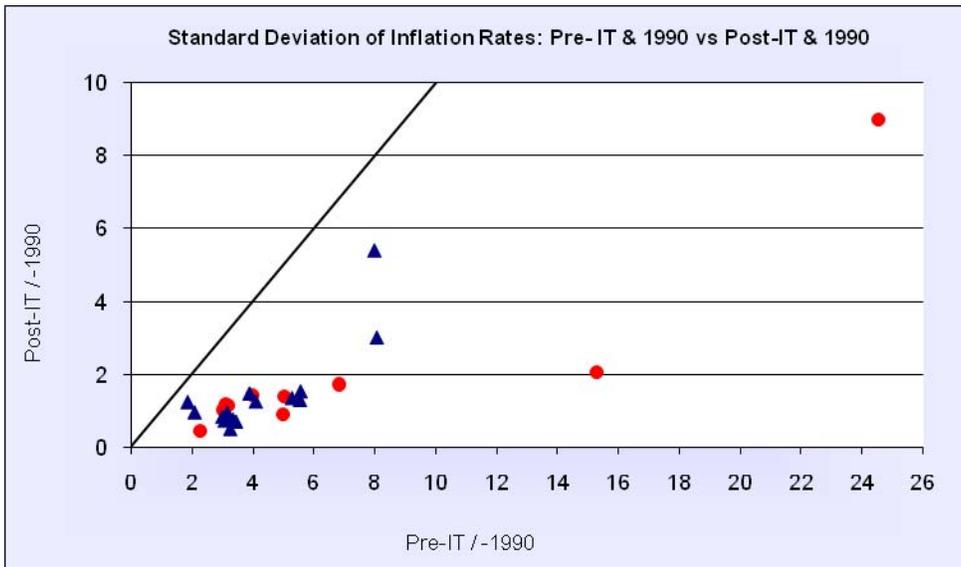


Figure 4: Pre and post inflation volatility
 Circles: Inflation targeters; Triangles: non-inflation targeters

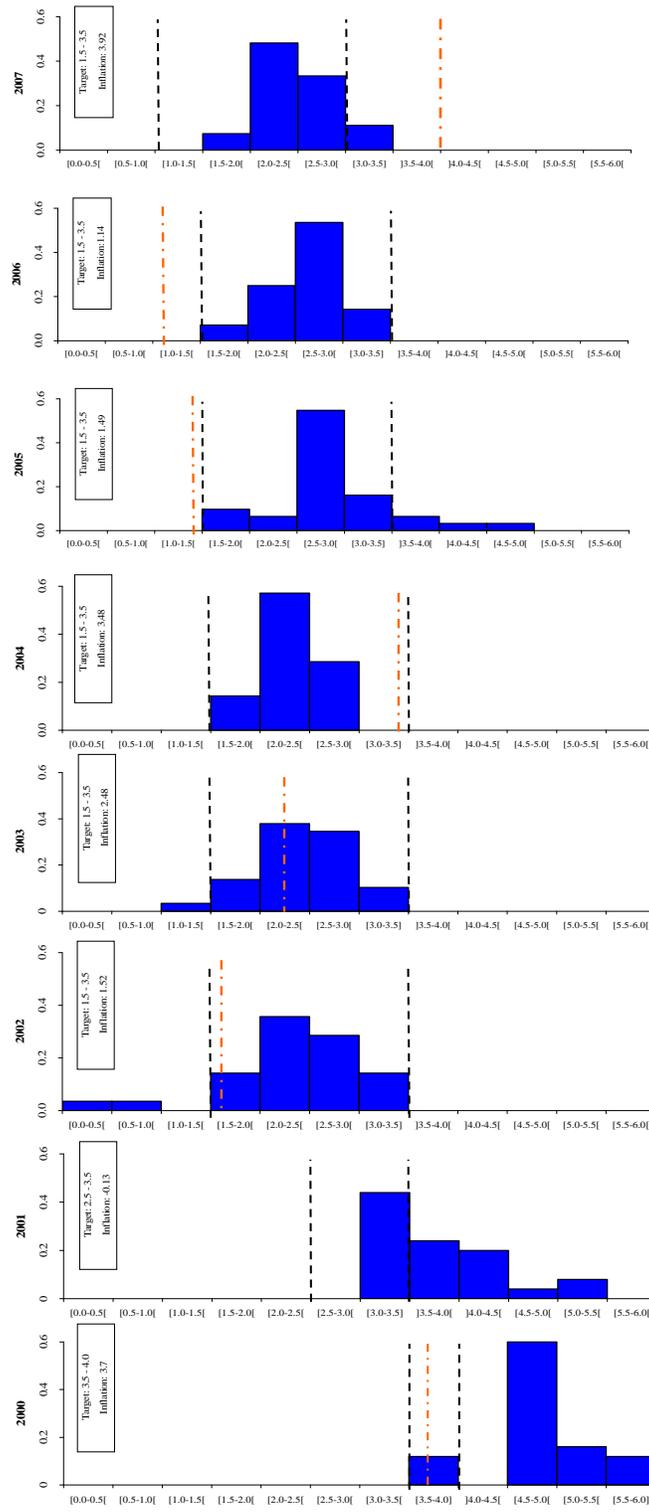


Figure 5: Inflation expectations in Peru

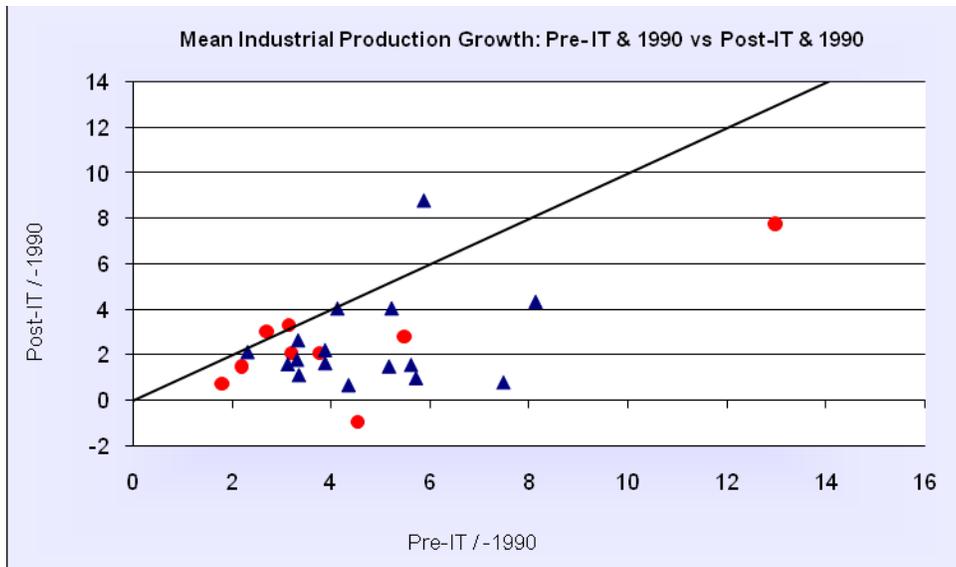


Figure 6: Pre and post growth rates of industrial production
 Circles: Inflation targeters; Triangles: non-inflation targeters

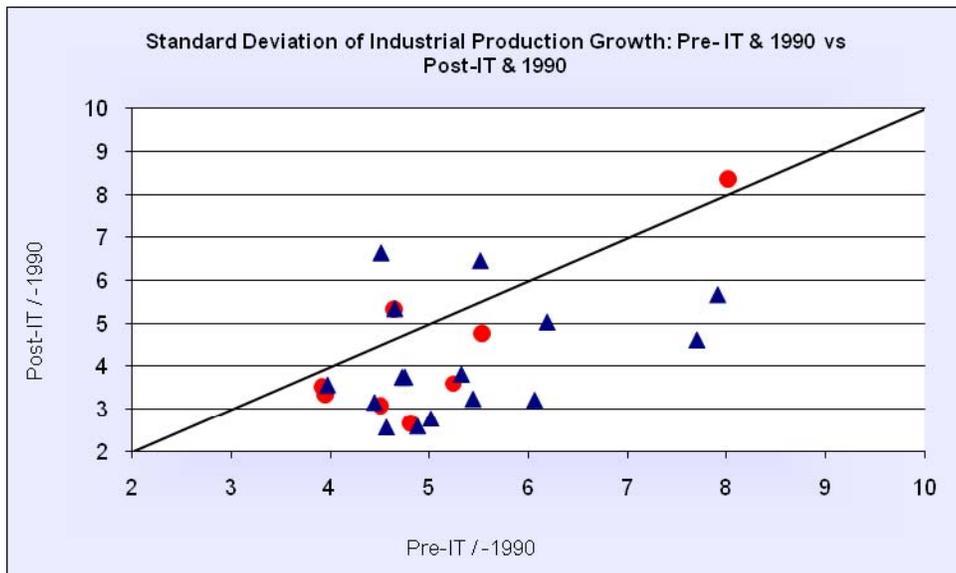


Figure 7: Pre and post growth volatility
 Circles: Inflation targeters; Triangles: non-inflation targeters

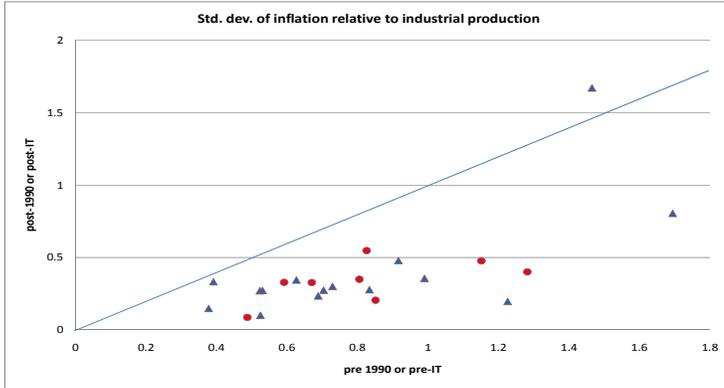


Figure 8: Inflation variability has fallen relative to the variability of industrial production in both IT and non-IT OECD countries
 Circles: Inflation targeters; Triangles: non-inflation targeters

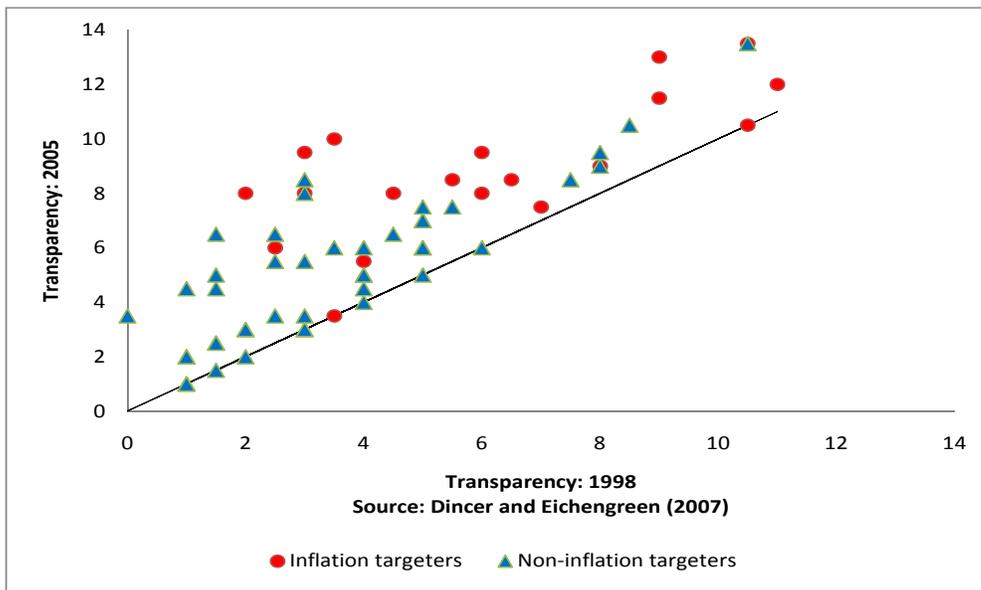


Figure 9: Transparency has increased among both inflation targeting and non-inflation targeting central banks.
 Circles: Inflation targeters; Triangles: non-inflation targeters

Table 1: Inflation Statistics for Inflation Targeting (IT) Countries

	Entire Sample		Pre-IT		Post-IT	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Australia	5.16	3.80	6.14	3.98	2.66	1.45
Canada	4.13	3.00	5.26	3.10	2.07	1.19
Korea	8.73	6.77	10.20	6.83	3.14	1.71
New Zealand	6.09	5.01	8.36	5.02	2.29	1.40
Norway	4.85	3.26	5.39	3.19	1.67	1.17
Sweden	4.97	3.50	6.37	3.02	1.19	1.00
Switzerland	2.95	2.26	3.35	2.27	0.94	0.46
United Kingdom	5.52	4.82	7.32	4.97	1.93	0.91
Iceland	15.70	14.87	17.61	15.27	4.50	2.06
Mexico	18.46	20.98	22.13	24.52	11.77	9.00
IT10*	7.66	6.83	9.21	7.22	3.22	2.03
IT8*†	5.30	4.05	6.55	4.05	1.99	1.16

*= The average of statistics above.

†= Excludes Iceland and Mexico

Table 2: Non-Inflation Targeting Countries

	Entire Sample		Pre-1990		Post-1990 (incl)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Austria	3.52	2.02	4.31	2.08	2.21	0.96
Belgium	3.74	2.77	4.73	3.06	2.10	0.74
Denmark	5.08	3.49	6.89	3.25	2.06	0.50
Finland	5.19	4.09	7.16	3.88	1.91	1.48
France	4.70	3.54	6.43	3.44	1.82	0.71
Germany	2.87	1.74	3.32	1.85	2.13	1.25
Greece	9.18	7.27	10.36	7.98	7.22	5.41
Ireland	6.25	5.11	8.19	5.54	3.01	1.30
Italy	6.56	5.16	8.53	5.56	3.28	1.54
Japan	3.55	4.07	5.37	4.09	0.52	1.26
Luxembourg	3.57	2.62	4.34	2.99	2.27	0.84
Netherlands	3.88	2.94	4.82	3.33	2.31	0.77
Portugal	9.35	7.61	12.24	8.06	4.54	3.02
Spain	7.32	5.09	9.48	5.28	3.70	1.36
United States	4.09	2.72	4.82	3.15	2.86	0.96
Turkey	29.68	21.36	22.56	17.86	41.55	21.54
Non-IT16*	6.78	5.10	7.72	5.09	5.22	2.73
Non-IT15*‡	5.26	4.02	6.73	4.24	2.80	1.47

*= The average of statistics above.

‡= Excludes Turkey

Table 3: Industrial Production Growth Rates for Inflation Targeting (IT) Countries

	Entire Sample		Pre-IT		Post-IT	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Australia	2.88	4.35	3.19	4.82	2.09	2.64
Canada	3.19	4.79	3.76	5.24	2.11	3.60
Korea	11.90	8.35	13.00	8.03	7.72	8.34
New Zealand	1.74	3.67	2.20	3.91	1.45	3.50
Norway	3.74	4.32	4.53	3.96	-0.92	3.34
Sweden	3.20	4.16	3.15	4.51	3.33	3.06
Switzerland	2.77	4.75	2.71	4.65	3.04	5.31
United Kingdom	1.46	3.72	1.81	4.32	0.76	1.92
Mexico	4.55	5.42	5.50	5.55	2.81	4.75
IT9*	3.94	4.84	4.43	5.00	2.49	4.05

*= The average of statistics above.

Table 4: Industrial Production Growth Rates for Non-IT Countries

	Entire Sample		Pre-1990		Post-1990 (incl)	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Austria	4.10	3.82	4.13	3.98	4.05	3.57
Belgium	2.55	4.08	3.13	4.45	1.60	3.16
Denmark	3.26	5.83	3.88	6.20	2.23	5.04
Finland	4.79	4.94	5.22	4.66	4.06	5.34
France	2.52	4.31	3.35	4.89	1.13	2.59
Germany	2.75	4.44	3.31	4.73	1.80	3.75
Greece	3.83	5.22	5.71	5.45	1.00	3.24
Ireland	6.97	5.58	5.87	4.52	8.80	6.65
Italy	2.98	5.47	4.35	6.07	0.69	3.21
Japan	4.98	7.45	7.48	7.71	0.81	4.62
Luxembourg	2.25	7.14	2.31	7.92	2.14	5.67
Netherlands	3.05	4.08	3.88	4.57	1.65	2.57
Portugal	3.80	4.74	5.17	4.76	1.51	3.75
Spain	4.03	5.18	5.61	5.33	1.58	3.82
United States	3.08	4.32	3.33	5.02	2.66	2.78
Turkey	5.61	6.39	8.13	5.52	4.35	6.46
Non-IT16*	3.78	5.19	4.68	5.36	2.50	4.14

*= The average of statistics above.

Table 5a: Treatment effect of NCIT on the level and variability of output growth rates

	Nearest Neighbor	3-Nearest Neighbor	r=0.03	Radius r=0.01	r=0.005	Local Linear Regression	Kernel
<i>Effect on the output growth rates</i>							
ATT	0.850	0.480	0.242	0.176	0.142	0.336	0.266
Std. Err.	(0.502)	(0.452)	(0.328)	(0.403)	(0.518)	(1.373)	(0.331)
P-value	0.11	0.28	0.44	0.65	0.79	0.81	0.42
<i>Effect on the variability of output growth rates</i>							
ATT	0.353	0.314	0.255	0.262	0.353	0.266	0.256
Std. Err.	(0.199)	(0.164)	(0.157)	(0.159)	(0.189)	(0.274)	(0.157)
P-value	0.08	0.06	0.11	0.09	0.07	0.36	0.10
No. of treated	47	47	47	44	40	47	47
No. of control	39	78	211	150	111	215	215
No. of obs.	86	125	258	194	151	262	262

Table 5b: Treatment effect of CIT on the level and variability of output growth rates

	Nearest Neighbor	3-Nearest Neighbor	r=0.03	Radius r=0.01	r=0.005	Local Linear Regression	Kernel
<i>Effect on the output growth rates</i>							
ATT	-0.638	-0.405	-0.214	-0.364	-0.340	-0.111	-0.096
Std. Err.	(0.566)	(0.477)	(0.424)	(0.484)	(0.560)	(0.429)	(0.383)
P-value	0.253	0.366	0.599	0.459	0.525	0.796	0.808
<i>Effect on the variability of output growth rates</i>							
ATT	0.206	0.242	0.220	0.262	0.222	0.239	0.239
Std. Err.	(0.231)	(0.199)	(0.176)	(0.211)	(0.252)	(0.188)	(0.168)
P-value	0.35	0.23	0.21	0.22	0.38	0.20	0.12
No. of treated	43	43	42	42	39	42	42
No. of control	35	66	190	145	97	195	195
No. of obs.	78	109	232	187	136	237	237