

Central Bank Performance under Inflation Targeting

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- *The inflation-targeting (IT) regime is 18 years old and is now being practised in more than 21 countries, providing enough evidence to assess the IT experience.*
- *This article analyzes the inflation record of IT central banks by looking at a broad range of factors that can influence deviations from the inflation target.*
- *The author finds that part of the cross-country and time variation in deviations of inflation from target can be explained by exchange rate movements, fiscal deficits, and differences in financial sector development. He also finds that a higher inflation target and a wider inflation-control range are associated with more variable outcomes for inflation and output.*
- *Although the literature tends to suggest that greater central bank transparency is desirable, these findings imply that transparency may not improve the accuracy of inflation targeting. Interestingly, central banks using economic models to guide policy do a better job of stabilizing inflation around the target and output around trend.*

Since inflation targeting (IT) was first adopted by the Reserve Bank of New Zealand in 1990, it has become an increasingly popular framework for monetary policy. It was adopted by the Bank of Canada in 1991, followed by the Bank of England in 1992. Since then, five other industrialized countries and 13 emerging-market economies have become inflation targeters, thereby providing sufficient evidence to assess the IT experience.

Inflation outcomes in the short run may be the result of several factors other than monetary policy, especially for small open economies like Canada's. Nevertheless, a successful IT central bank should, on average, be able to keep inflation close to its target. In this article, we analyze the performance of IT central banks in achieving their target and assess the empirical role of macroeconomic shocks, the financial environment, and the characteristics of the monetary policy framework as determinants of this performance.¹

In theory, we should expect more transparent central banks to have a better inflation record.

There is a general consensus among economists that central bank transparency (i.e., the extent to which information related to the policy-making process is disclosed) is an important aspect of the monetary policy framework. According to the International Monetary Fund's "Code of Good Practices on Transparency in Monetary and Financial Policies" (1999) the effectiveness of policy increases if the goals and instru-

1. This article summarizes and updates Bank of Canada Working Paper No. 2007-18 by Marc-André Gosselin (published under the same title).

ments of policy are known to the public.² If greater effectiveness of policy is associated with higher transparency, then, all else being equal, we should expect more transparent central banks to have a better inflation record. To verify this, we test the hypothesis that greater central bank transparency reduces deviations from the inflation target.

Using a panel of 21 IT countries over the period 1990Q1–2007Q2, we find that the ability of central banks to hit their target varies considerably. Part of the cross-country and time variation in performance can be explained by exchange rate fluctuations, fiscal deficits, and differences in financial sector development. We also find that central banks opting for a higher numerical target or a larger control range tend to observe larger inflation deviations, while central banks using economic models to guide policy do a better job of stabilizing inflation around the target and output around trend. Surprisingly, regression results indicate that measures of transparency are either uncorrelated or positively correlated with inflation and output deviations. These findings could have practical applications. For instance, a better understanding of the factors behind deviations from the inflation target could be useful to central banks debating the adoption of some form of IT. It could also help IT countries to improve the design of their monetary policy framework through learning from the experience of successful IT central banks.

The Inflation-Targeting Experience

Although there is extensive literature on the economic effects of having an inflation target, very few studies examine the inflation performance of IT central banks. Roger and Stone (2005) gather a number of stylized facts on the international experience with IT. When comparing actual and targeted inflation, they find that the mean absolute deviation (MAD) has typically been about 1.8 percentage points (pp), and the deviations vary considerably across country groups. There is a greater dispersion of outcomes around inflation targets in emerging-market economies than in developed countries. Disinflation countries, on average, have tended to exceed their target, while countries with a stable target have tended to undershoot their target.

Like Roger and Stone, Albagli and Schmidt-Hebbel (2004) examine various statistics on the extent to which countries miss their inflation targets. They take the analysis one step further, however, by performing a

panel regression of inflation deviations. To control for macroeconomic disturbances, Albagli and Schmidt-Hebbel include deviations of the exchange rate from its trend in their specification. They find that the higher the numerical target and the wider the control range, the more likely the inflation rate is to deviate from its target. They also find that deviations from target are negatively correlated with central bank independence and policy credibility (approximated with various measures of country risk).

Central Bank Transparency: Theory, Limits, and Evidence

Economists will generally argue that more information is better. Having a central bank more fully communicate its objectives, its assessment of economic conditions, and the expected effects of its policy actions will enhance social welfare, because agents will be better able to align their decisions with those of the central bank and the economy will adjust more smoothly. As Woodford (2005) argues, monetary policy is more effective when it is expected, since better information on the part of financial markets about central bank actions and intentions implies that the change in the policy rate required to achieve the desired outcome can be much more modest when expected future rates also move.³ Similarly, Svensson (2005) notes that greater transparency about central banks' operational objectives (in the form of an explicit intertemporal loss function), forecasts, and communications would improve the conduct of monetary policy. In principle, more transparent central banks should thus have a better inflation record, all else being equal, since greater transparency reduces uncertainty about future policy actions. Using a small analytical model, Demertzis and Hughes Hallett (2007) show that the variance of inflation increases with the lack of central bank transparency perceived by the public.

Greater transparency may not always lead to an improvement in welfare, however. Morris and Shin (2002) show that when the level of some variable (e.g., potential output or fundamental asset prices) is highly uncertain and the central bank is unlikely to have better information than the private sector, disclosure of the associated estimate may cause financial market participants to ignore their private information and to coordinate on the noisy disclosed estimate, leading to greater volatility. Similarly, using a model where the actual and perceived degrees of transpar-

2. Jenkins (2004) and Kennedy (2008) also highlight the importance of transparency in monetary policy making.

3. It is private sector expectations of the entire future path of the policy rate that matter for the economy. These expectations feed into longer-term interest rates and asset prices, which affect private sector decisions.

ency are allowed to differ from each other, Geraats (2007) shows that the perception of opacity makes financial markets more cautious in their response to central bank communications, which may reduce the volatility of private sector expectations. Cukierman (2005) enumerates a number of cases in which the optimal level of transparency is likely to be intermediate. For instance, it can be counterproductive for a central bank to publish advance signals about potential problems in parts of the financial system. Such publication might induce a run on the banks or other unpredictable movements that would force the central bank to take more expansionary steps than if the information were temporarily withheld. There might also be a compelling case for keeping the discussions of the monetary policy committee secret when there are disagreements within the committee. Mishkin (2004) argues that announcement of the central bank's objective function will complicate the communication process and weaken support for the central bank's focus on long-run objectives. In addition, some forms of increased transparency may not be feasible. Macklem (2005) points out that the complete state-

contingent monetary policy rule is too complex for a central bank to derive or communicate anytime soon.⁴

The empirical literature on central bank transparency often tries to identify the effects of a precise change in disclosure practices by individual central banks on specific economic or financial variables. For instance, Parent, Munroe, and Parker (2003) find that the introduction of a schedule of dates for policy interest rate announcements increased the predictability of the Bank of Canada's interest rate decisions and the financial markets' understanding of Canadian monetary policy.⁵ Chortareas, Stasavage, and Sterne (2002) show that the publication of more detailed central bank forecasts reduces average inflation in a cross-section of 82 countries. Although most empirical studies conclude that greater central bank transparency is beneficial, their primary limitation is that the findings for individual

4. The state-contingent monetary policy rule represents the central bank's optimal rule of conduct under all possible future contingencies for the direction the economy will take.

5. Muller and Zelmer (1999) come to similar conclusions with respect to the introduction of the Bank of Canada's *Monetary Policy Report* in 1995.

Measuring Central Bank Transparency

Transparency is a qualitative concept for which few precise measures exist. It is typically measured either for a very limited number of central banks or at a single point in time. Researchers usually look at three factors: whether the central bank provides prompt public explanations of its policy decisions; the frequency and form of forward-looking analysis provided to the public; and the frequency of bulletins, speeches, and research papers.

Based on such information, Eijffinger and Geraats (2006) construct comprehensive indexes that distinguish between five aspects of transparency relevant for monetary policy making: political, economic, procedural, policy, and operational transparency. Among the nine countries covered by the indexes, the most transparent institutions are the Reserve Bank of New Zealand, the Swedish Riksbank, and the Bank of England. The Bank of Canada ranks fourth.

Dincer and Eichengreen (2007) extend the indexes of Eijffinger and Geraats, using a sample that covers 100 central banks for every year from 1998 to 2005. Consistent with Eijffinger and Geraats, they find that the Reserve Bank of New Zealand, the Swedish

Riksbank, and the Bank of England were the most transparent central banks in 2005. The Bank of Canada ranks fifth, right behind the central bank of the Czech Republic. They also find that the trend towards greater transparency has been widespread, since no institution has moved in the direction of less transparency over this period.

Although these measures quantify the degree of openness of central banks based on the information provided, they do not necessarily reflect the extent to which the public understands the monetary authority's actions and signals. Central bank transparency may not be effective unless it can be appreciated by the public and incorporated into its economic behaviour. This issue motivated Kia and Patron (2004) to compute a market-based transparency index. Their index uses daily data on the federal funds and Treasury bill rates over the period 1982–2003 and has the advantage of reflecting what market participants understand from the Federal Reserve's actions and signals. Their definition of transparency is much narrower, however, since it only relates to day-to-day policy rate expectations.

cases cannot be easily generalized. Moreover, it is difficult to identify the impact of increased transparency on the basis of a time series when there may only be one significant change in disclosure practices in the sample period. Dincer and Eichengreen (2007) overcome these issues by constructing time-varying transparency indexes for the majority of the world's central banks (see Box, p. 17). They find that transparency has a broadly favourable, though relatively weak, impact on inflation and output variability.

Although most empirical studies conclude that greater central bank transparency is beneficial, their primary limitation is that the findings for individual cases cannot be easily generalized.

Inflation Performance under Inflation Targeting

To analyze the inflation performance of central banks under IT, we look at deviations of the rate of consumer price inflation from targeted inflation (year-over-year, quarterly). Although some central banks emphasize a core rate of inflation, we use total inflation as measured by the consumer price index (CPI), which is the most widely understood and used measure of inflation and is always used to define the official target variable. Total CPI inflation does not abstract from the potential effects of changes in indirect taxes on the recorded inflation rate, however. This is a caveat to our measure of performance, since short-run movements in inflation caused by changes in indirect taxes are not an indicator of monetary policy performance.⁶ This drawback also applies to previous studies. For central banks using a range for targeting inflation, the midpoint of the band is used as the numerical objective. This is a

6. Changes in indirect taxes can sometimes have a significant impact on a central bank's ability to hit the target (Bank of Canada 1991). Nevertheless, we use headline CPI because price series that account for the effect of changes in indirect taxes are not readily available for the countries sampled. Yet we were able to obtain CPI measures adjusted for the introduction of the Goods and Services Tax for Australia and excluding the effect of changes in indirect taxes in the case of Canada. If there were large effects of changes in indirect taxes in the other countries in the sample, our performance rankings could be biased in favour of Australia and Canada.

realistic assumption, since targeting the midpoint of the range maximizes the probability of keeping inflation within the band.⁷

The sample includes 21 IT economies: eight industrialized countries (Australia, Canada, Iceland, New Zealand, Norway, Sweden, Switzerland, and the United Kingdom) and 13 emerging-market economies (Brazil, Chile, Colombia, the Czech Republic, Hungary, Israel, the Republic of Korea, Mexico, Peru, the Philippines, Poland, South Africa, and Thailand).⁸ Each country's inflation target, or target range, and regime starting dates are taken from Mishkin and Schmidt-Hebbel (2007). For most countries, these data cover both a declining inflation target period (i.e., disinflation) and a period when the inflation target is stable. The sample starts at various dates (depending on the individual regimes) and ends in the second quarter of 2007.⁹

The inflation performance of industrialized economies as a group is rather good, with about two-thirds of target deviations smaller than 1 pp (Chart 1). There is no bias overall, since 50.2 per cent of the deviations are positive and 49.8 per cent are negative. Target misses of more than 2 pp occur very rarely. The average of the MAD from the target is about 1 pp (Table 1). Switzerland ranks first, with inflation deviating from the target by only 0.38 pp, on average. The United Kingdom has a very good performance, with a MAD of 0.66 pp. Canada comes third, with a MAD of 0.80 pp, which means that, on average, inflation deviations have been smaller than the 1 per cent band on either side of the target. Iceland, with the most limited IT experience among industrialized economies, is the worst performer, with inflation missing the target by 2.13 pp, on average. Looking at the transparency rankings (DE rank) of Dincer and Eichengreen (2007), there is no obvious link between our MAD rankings and the degree of transparency, which could suggest a weak

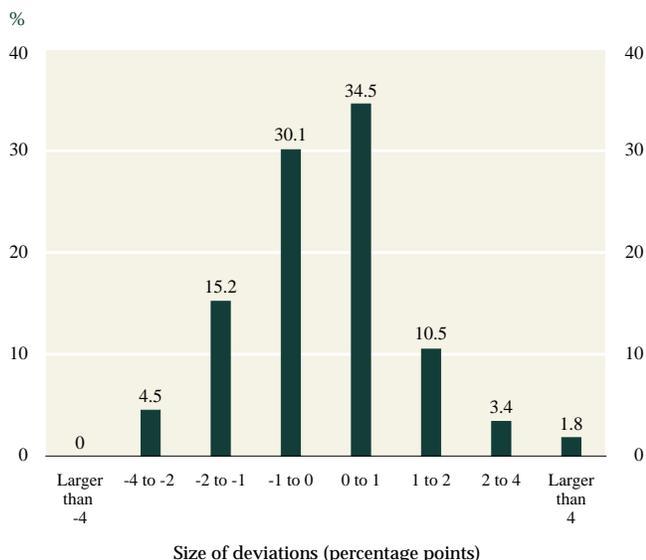
7. Paulin (2006) notes that, in practice, IT central banks tend to downplay the role of the edges of the range, viewing them primarily as a communication tool to provide clarity on the degree of tolerance with respect to the variance of inflation. The Bank of England is an exception since, whenever the target is missed by more than one percentage point, the Governor of the Bank must write an open letter to the Chancellor explaining the reasons why inflation has increased or fallen to such an extent and what the Bank proposes to do to ensure that inflation returns to the target.

8. We did not include the euro area because the European Central Bank does not consider itself an inflation targeter. Albagli and Schmidt-Hebbel (2004) and Roger and Stone (2005) also exclude the euro area from their sample. The Slovak Republic, Indonesia, Romania, and Turkey moved to IT in 2005–06.

9. See Gosselin (2007) for details on the IT parameters, e.g., starting dates, disinflation periods, numerical values, and definition of range.

Chart 1
Distribution of Inflation Deviations from Target

Industrialized economies



correlation between inflation performance and transparency.

As in Roger and Stone (2005), we find that central banks tend to exceed their inflation target during disinflation periods. Canada is an exception to this, however, with inflation below the target by 1.06 pp, on average.¹⁰

10. Excluding the effect of the tobacco tax reduction in 1994.

Table 1
The Inflation-Targeting Performance of Industrialized Economies

	IT start	MAD (pp)	MAD rank	DE rank	Bias (declining target)	Bias (stable target)	Persistence (quarters)	Large deviations	Beyond bands
Australia	1994Q3	0.85	4	6	-0.05	-0.05	5.97	7	29/52
Canada	1991Q1	0.80	3	4	-1.06	-0.02	2.91	4	12/46
Iceland	2001Q1	2.13	8	8	2.59	1.66	2.89	10	-
New Zealand	1990Q1	0.99	5	1	0.93	0.42	3.02	7	15/38
Norway	2001Q1	1.03	6	7	-0.56	-0.56	1.40	4	-
Sweden	1995Q1	1.08	7	2	-0.85	-0.85	3.95	5	24/50
Switzerland	2000Q1	0.38	1	5	-0.06	-0.06	1.43	0	-
United Kingdom	1992Q1	0.66	2	3	0.02	0.02	2.78	0	-
Average	-	0.99	-	-	0.82	0.07	3.04	4.63	43%

Sources: Author's calculations and Dincer and Eichengreen (DE) (2007)

Notes: MAD = mean absolute deviation of actual inflation from target; DE rank = transparency rankings in 2005 (industrialized IT countries only); bias = mean of inflation deviations; persistence = half-life of a 1 percentage point (pp) inflation deviation (computed using autoregressive coefficients); large deviations = absolute inflation deviations greater than 2 pp; beyond bands = number of times that inflation is outside of the control range during stable IT periods

This could reflect the Bank of Canada's determination to err on the side of tight monetary policy in the early stages of IT.

There is very little bias around the target during stable IT periods, especially in Australia, Canada, Switzerland, and the United Kingdom. Norway and Sweden have tended to undershoot their objective, while Iceland is the main overshooter. If we exclude Iceland, the average bias falls from 0.82 to -0.07 pp and from 0.07 to -0.16 pp during declining and stable IT periods, respectively.

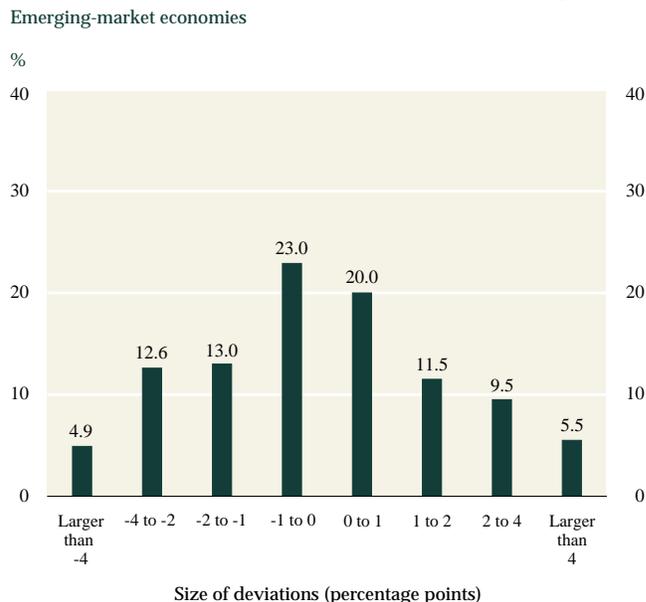
The persistence of inflation deviations, as measured by the half-life of a 1 pp deviation from the target, is consistent with the typical impulse-response functions from vector autoregression estimates. Deviations are the least persistent in Norway and Switzerland (half-life of 1.4 quarters) and the most persistent in Sweden and Australia (half-life of 4 and 6 quarters, respectively). Large target misses, measured by the number of times that inflation diverged from the target by more than 2 pp, never occurred in Switzerland and the United Kingdom. They are more frequent in Australia, New Zealand, and Iceland, which could reflect a greater exposure to commodity-price shocks. Although Canada might have been affected by such shocks, it managed to record only four large target misses. For countries using target bands, we also report the number of times that inflation has been outside the control range during periods of stable IT. By this metric, Canada has the best performance among industrialized countries, since inflation outcomes have been beyond the edges of the target band in only 12 out of 46 quarters. The Australian performance is weaker,

with year-over-year inflation outside of the range more than half of the time.¹¹

The performance of inflation-targeting regimes is relatively weaker and much more dispersed in emerging-market economies (Chart 2 and Table 2). Only 43 per cent of deviations for the group lie between -1 and +1 pp, and about 33 per cent of deviations are larger than 2 pp. The average of the MAD is 0.86 pp higher than for industrialized countries. The worst performers are Brazil, Israel, and South Africa, while Chile, the Republic of Korea, and Thailand have MADs comparable to those for industrialized countries. Disinflation periods are much more common in emerging-market economies. On average, there is a small negative bias around the inflation target, but the figure is skewed by the large undershooting in the Republic of Korea. There are significant cross-country differences, with Brazil and Hungary both exceeding their target by an average of 1.9 pp, and Colombia and the Republic of Korea undershooting their targets by averages of 1.5 and 3.0 pp, respectively. Bias is smaller during stable IT periods. The persistence of inflation deviations is higher for emerging-market economies, with an average half-life of 3.83 quarters compared with 3.04

11. Note, however, that the control range is narrower for Australia (between 2 and 3 per cent). Assuming a target band width comparable to that of the other industrialized countries reduces the frequency of target-range misses from 29 to 16 out of 52.

Chart 2
Distribution of Inflation Deviations from Target



quarters for industrialized countries. Persistence is particularly high for the Philippines and low in Peru. Large inflation deviations are frequent, especially in Brazil, Israel, and Poland. Although the control range

Table 2
The Inflation-Targeting Performance of Emerging-Market Economies

	IT start	MAD (pp)	MAD rank	DE rank	Bias (declining target)	Bias (stable target)	Persistence (quarters)	Large deviations	Beyond bands
Brazil	1999Q1	3.00	13	4	1.92		4.15	17	-
Chile	1991Q1	1.02	1	7	0.66	-0.27	2.05	8	6/26
Colombia	1999Q1	1.75	6	8	-1.53		4.59	14	-
Czech Republic	1998Q1	2.01	8	1	-0.95		2.34	14	-
Hungary	2001Q1	2.08	9	3	1.90		3.40	11	-
Israel	1992Q1	2.26	11	5	-1.14	-1.25	2.29	33	14/18
Korea, Republic of	1998Q1	1.16	2	5	-3.00	-0.03	3.99	6	15/30
Mexico	1999Q1	1.56	4	9	0.15	1.20	2.70	5	11/18
Peru	1994Q1	1.57	5	6	0.63	-0.67	1.16	13	10/22
Philippines	2001Q1	1.92	7	2	0.27		10.14	13	-
Poland	1998Q1	2.22	10	6	-1.13	-0.45	4.20	17	10/14
South Africa	2001Q1	2.31	12	4		0.61	4.18	10	12/26
Thailand	2000Q1	1.21	3	6		0.74	4.68	4	6/30
Average	-	1.85	-	-	-0.20	-0.02	3.83	12.7	46%

Sources: Author's calculations and Dincer and Eichengreen (DE) (2007)

Notes: MAD = mean absolute deviation of actual inflation from target; DE rank = transparency rankings in 2005 (emerging-market IT countries only); bias = mean of inflation deviations; persistence = half-life of a 1 percentage point (pp) inflation deviation (computed using autoregressive coefficients); large deviations = absolute inflation deviations greater than 2 pp; beyond bands = number of times that inflation is outside of the control range during stable IT periods

is generally larger, occasions when the target band is missed are somewhat more prevalent, on average, in these countries.

*Switzerland and the United Kingdom
obtain the best performance among
industrialized IT countries.*

Putting these various performance metrics together, it appears that Switzerland and the United Kingdom obtain the best performance among IT countries. Within the group of emerging-market IT countries, Chile and Thailand have the best records. The magnitude, persistence, and frequency of inflation deviations vary considerably across countries, perhaps because of the diversity of exogenous economic shocks, institutions, and monetary policy frameworks that characterize these economies. We will attempt to quantify the contribution of these factors.

Empirical Determinants of Deviations from the Inflation Target

We extend the work of Albagli and Schmidt-Hebbel (2004) by examining a more extensive set of factors that determine central bank performance under IT. One of our contributions is to try to account for transparency and other institutional measures specific to central banks, which helps us to determine what makes a successful IT central bank. As well, since the financial system is a key component of the monetary policy transmission mechanism, we also try to control for the financial environment. Krause and Rioja (2006) find that a more highly developed financial system improves the efficiency of monetary policy. Given this, we should expect central banks' success in hitting the inflation target to increase with the degree of financial market sophistication.

We follow Albagli and Schmidt-Hebbel and define central bank performance under IT as the absolute value of the difference between consumer price inflation and either the target or the centre of the control band. However, we broaden the definition of performance by also considering specifications in which performance is measured as a weighted average of the absolute value of deviations of inflation from the target and of output from potential (i.e., the central bank's loss

function). This is a reasonable exercise, since the monetary policy objective typically includes not only the stability of inflation around the target, but also the stability of the real economy. Where a supply shock shifts output and inflation in opposite directions, for example, some central banks may be willing to tolerate a one-time price-level movement rather than a disturbance in output.

Using the sample previously described, we regress absolute inflation deviations (or the bank's loss function) on the characteristics of the monetary policy framework and on control variables representing the macroeconomy and the financial environment. The set of macroeconomic control variables includes lags of the absolute value of deviations of output, the exchange rate, and the relative price of oil (all relative to their trend, as in Albagli and Schmidt-Hebbel). In addition to various measures of country risk, we use the lagged fiscal deficit relative to GDP to account for the dependence of successful disinflations on fiscal reforms, especially in emerging-market economies.¹² Control variables representing the financial environment can be grouped into those that capture the degree of financial market development (index of financial market sophistication and stock market capitalization, or turnover, relative to GDP) and those that reflect the health of the banking sector (e.g., indexes of bank financial soundness or strength or market share of state-owned banks).

The characteristics of the monetary policy framework can be grouped into three categories: IT parameters, transparency, and other possible explanatory variables. The first category includes the level of the inflation target, the width of the target range, and the policy horizon (i.e., the period over which inflation is expected to return to the target). Instead of trying to build measures of central bank transparency such as those described in the Box on p. 17, we use the indexes of Dincer and Eichengreen (2007).¹³ We also experiment separately with various proxies of the degree of openness of monetary institutions in their communications with the public, such as the number of inflation reports published per year, the provision of quantitative

12. Since inflation in smaller and more open economies is likely to be more exposed to foreign economic developments, we also try openness to trade and country size as variables to explain deviations from the inflation target. The macroeconomic control variables are lagged to avoid the issue of simultaneity.

13. We did not consider the measures of Kia and Patron (2004) and Eijffinger and Geraats (2006), since the former relies on daily data, making it virtually impossible to reproduce for many countries, while the latter covers only nine industrialized countries and does not vary over time.

forecasts, and the publication of minutes or voting records of monetary policy committee (MPC) meetings. These measures should exhibit enough variation across time and countries to properly identify transparency effects.¹⁴ Finally, although not directly related to the concept of transparency, we investigate the role of the frequency of official MPC meetings, the use of economic models (with more than 10 equations) to guide policy, the size of the MPC, and central bank independence.¹⁵

Several estimation results based on various econometric specifications, such as cross-section, pooled, and fixed-effects panel regressions, and regressions of instrumental variables, as well as a variety of definitions of the central bank's loss function, are reported in Gosselin (2007).¹⁶ Table 3 summarizes and updates the main empirical findings.

Among the macroeconomic control variables, we find that higher variability of the exchange rate and larger fiscal deficits increase the magnitude of deviations of inflation from the target. The statistical significance of the exchange rate is not a surprise, given that most of the countries in the sample are small open economies. The output gap is statistically insignificant, consistent with evidence of a flattening of the Phillips curve during the 1990s. The insignificance of oil prices is more of a surprise, however, especially given that we are looking at total inflation.¹⁷ The various measures of country risk examined by Albagli and Schmidt-Hebbel are not statistically significant either, presumably because this notion is already captured by other elements in

14. For instance, the transparency indexes of Dincer and Eichengreen (2007) take values of 6, 7, 7.5, 8, 9, and 9.5 for Switzerland, and 4, 4.5, and 5.5 for Mexico.

15. Some of the characteristics of the monetary policy framework exhibit time variation, which allows us to introduce them in conjunction with country-fixed effects. For instance, the number of Monetary Policy Reports per year published by the Bank of Canada changed from two to four in 2000. As well, the dummy variable for the publication of minutes or voting records of MPC meetings takes the value of 1 if and when this situation applies to a central bank. Gosselin (2007) provides the exact definition and source of all the explanatory variables that were considered potential determinants of inflation-target deviations and the central bank's loss function and reports selected descriptive statistics of the variables representing the monetary policy framework.

16. While some specifications incorporate country-fixed effects, we do not control for a number of country-specific effects that may be quite important, including: the weight of energy in the CPI basket times the elasticity of domestic energy prices with respect to the world price of oil (which may depend on taxes and regulation), the percentage of workers whose wages are formally indexed to the CPI, and the basket weight of regulated prices that are changed more than once a year.

17. A larger but barely statistically significant impact of oil could be obtained by multiplying the oil-price variable by a measure of how much oil the country uses.

Table 3

Key Determinants of Central Bank Performance and Their Correlation with Inflation Deviations or the Central Bank's Loss Function

	Inflation deviations	Loss
Macroeconomic variables		
Output deviations	ns	+
Exchange rate deviations	+	+
Oil-price deviations	ns	+, small
Country risk premium	ns	ns
Fiscal deficit/GDP	+	+
Financial environment variables		
Degree of financial market development		
Financial market sophistication	ns	ns
Stock market capitalization/GDP	ns	ns
Stock market turnover/GDP	ns	ns
Banking-sector health		
Soundness index of private banks	-	ns
Financial strength of private banks	-	ns
Market share of state-owned banks	ns	+, small
Institutional variables		
IT parameters		
Inflation-target level	+	+
Size of inflation-target range	+	+
Inflation-control horizon	-, small	ns
Transparency		
Dincer and Eichengreen (DE) index	ns	ns
Number of inflation reports per year	ns	ns
Provision of quantitative forecasts	ns	ns
Publication of MPC minutes	+	+
Other		
Frequency of official MPC meetings	ns	-, small
Use of models	ns	-
Size of MPC	-, small	ns
Central bank independence	-	ns

Notes: + and - indicate statistically significant positive and negative coefficients; *ns* corresponds to insignificant coefficients; *small* is added when the effect is statistically significant but economically small. The central bank's loss function is a weighted average of the absolute value of deviations of inflation from the target and of output from potential. MPC = monetary policy committee

the equation, such as the variable for the fiscal deficit. Regressions of the central bank's loss function produce similar results, except that lags of the absolute value of the output gap are now statistically significant. Oil-price deviations are positively correlated with loss, but the impact is small.

There is no statistical evidence of a relationship between central bank performance and the degree of financial market development. However, in line with Krause and Rioja (2006), we find some evidence that the health

of the private banking sector is positively correlated with meeting targets more consistently, since the soundness and financial strength of private banks are both negatively correlated with inflation deviations. The only control variable representing the financial environment that is statistically significant in regressions of loss is the market share of state-owned banks. The coefficient is positive, indicating that countries with less development in the private banking sector tend to have more variable output and inflation outcomes relative to targets.

Several interesting findings concern the role played by the characteristics of the monetary policy framework. Consistent with Albagli and Schmidt-Hebbel, we find that a higher value for the inflation target is associated with larger deviations. The size of the control range has the expected positive sign, presumably because countries that define their targets in a less-restrictive manner are more likely to deviate from the range's centre. Though by an economically small amount, a longer inflation-control horizon reduces target misses, which could suggest that by paying more attention to longer-term objectives, the monetary authority is better able to anchor the private sector's expectations for inflation. Surprisingly, there is no statistical relationship between the Dincer and Eichengreen (2007) transparency indexes and performance. This result could have been expected, however, given the absence of correlation between our MAD rankings and the transparency rankings, as we saw in Table 1. With regard to our transparency proxies, we do not find evidence of a link between performance and either the number of inflation reports published per year or the provision of quantitative forecasts, which is contrary to the findings of Chortareas, Stasavage, and Sterne (2002). Moreover, we find that central banks publishing the minutes or voting records of their MPC meetings tend to miss their objective by more than those that do not. This could be because minutes and voting records sometimes expose disagreements within the MPC, thereby complicating communications with the public.¹⁸ Another explanation for these findings could be that the requirement for transparency may act as a constraint on policy by

18. Another disadvantage of releasing minutes or voting records is that knowledge by committee members that their positions and arguments will become public information within a short period of time may inject short-term political and personal career factors into their deliberations and voting behaviour, which is likely to contaminate the monetary policy process with considerations other than the public interest (Cukierman 2005). Similarly, Kennedy (2008) argues that there is a need to protect the integrity of some internal policy deliberations, since the public release of policy advice and policy recommendations could stifle the free debate and consensus building that is necessary for sound policy making.

reducing flexibility and introducing bureaucracy. Central banks with larger MPCs have a slightly better inflation performance, consistent with the principle that, with some obvious limits, the greater the number of board members, the broader the range of experiences and perspectives, and hence the better their ability to deal with uncertainty and to process information (Berger, Nitsch, and Lybek 2006).¹⁹ We also find that independent central banks obtain significantly better inflation outcomes, which probably reflects a stronger ability to commit to price stability (Cukierman, Webb, and Neyapti 1992).

We obtain similar results with respect to the central bank's loss function. A higher level and a wider control range for the inflation target are both associated with larger monetary policy losses. The fact that the range variable remains positive and statistically significant in the loss regressions suggests that the benefits of lower output variance do not offset the costs of higher inflation volatility when central banks choose a wider control range. As with the regressions of inflation deviations, the publication of minutes is harmful to performance. Though by a small amount, we find that a greater frequency of official MPC meetings is associated with lower loss. This reduction could be the result of better-timed policy decisions or transparency benefits, in that more frequent meetings allow the central bank to convey its view to the public with greater efficiency. Finally, we find that central banks using models to guide the conduct of policy obtain significantly lower losses, highlighting the importance of economic models in making monetary policy (Coletti and Murchison 2002).

Conclusion

To recapitulate, our empirical analysis reveals that inflation and output deviations are positively correlated with exchange rate movements and fiscal deficits, negatively correlated with private banking sector health and central bank independence, and positively or not correlated with transparency. Furthermore, we find that deviations increase with the level of the inflation target and the width of the control range but decline if economic models are used to guide policy. What makes a successful IT central bank? To minimize deviations of inflation from target and of output from trend, IT central banks would benefit from having a low numerical target and a relatively narrow control range, confidential MPC meetings, economic models

19. We also experimented with squared transformations of some variables to see whether there is an optimal level of transparency; the results were qualitatively similar.

to guide policy decisions, and independence from the government.

Transparency may not improve the accuracy of inflation targeting.

Our findings that transparency may not improve the accuracy of inflation targeting should be interpreted cautiously, however. Although the empirical results suggest that greater transparency could reduce the central bank's ability to hit the inflation target, it is

important to keep in mind that central bank transparency is extremely difficult to measure accurately. The indexes used in this article attempt to measure and quantify all the information provided to the public by central banks, but do not necessarily reflect the extent to which the public understands the monetary authority's actions and signals. Nor do they capture the degree to which this information is incorporated into the public's economic behaviour. Therefore, given the rudimentary nature of these indexes of transparency, our results should be interpreted as preliminary until better measures are obtained.

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