

No. 297, SEPTEMBER 2009



*C.D. Howe Institute*  
*Institut C.D. Howe*

# C.D. Howe Institute

# COMMENTARY

MONETARY POLICY

## Getting it Right When You Might Be Wrong:

The Choice Between Price-Level  
and Inflation Targeting

Jean Boivin



### **In this issue...**

Canada's 2 percent inflation targeting program works pretty well – but could targeting the price level work even better, especially when inflation and the price level might not be perfectly observed?

## THE STUDY IN BRIEF

### THE AUTHOR OF THIS ISSUE

JEAN BOIVIN is the Chair in Monetary Policy and Financial Markets at HEC Montréal and is currently Visiting Economist and Special Adviser at the Bank of Canada for the year 2009-2010.

The views expressed here are his own, and not those of the Bank of Canada

*Rigorous external review of every major policy study, undertaken by academics and outside experts, helps ensure the quality, integrity and objectivity of the Institute's research.*

\$12.00

ISBN-13: 978-0-88806-786-9  
ISBN-10: 0-88806-786-0  
ISSN 0824-8001 (print);  
ISSN 1703-0765 (online)

This *Commentary* argues that there are good reasons to believe that the Bank of Canada does not perfectly observe the “true” inflation rate and price level when implementing policy, perhaps as a result of measurement errors or conceptual difficulties in defining these indicators.

The Consumer Price Index is, at best, an approximate measure of the true cost of living in Canada. The need to rely on imperfect information affects the relative merits of inflation targeting (IT) and price-level targeting (PLT).

Up to now, the literature has suggested that PLT might be inferior to IT when inflation is subject to observational errors. However, this view is valid only when the central bank is oblivious to the presence of observational errors. Furthermore, the costs of ignoring observational errors can be as important as those at stake in the choice between IT, which does not take into account past deviations from the target, and PLT, which does.

When the central bank acknowledges that inflation and the price level are not perfectly observed and attempts to make allowance for this fact, a PLT regime might be superior to an IT regime, provided that the general public understands how such a regime works and bases its own decisions on that understanding.

Accordingly, the fact that inflation and price-level measures are indeed subject to the presence of observational errors might, in fact, be an additional argument in favour of PLT.

### ABOUT THE INSTITUTE

The *C.D. Howe Institute* is a leading independent, economic and social policy research institution. The Institute promotes sound policies in these fields for all Canadians through its research and communications. Its nationwide activities include regular policy roundtables and presentations by policy staff in major regional centres, as well as before parliamentary committees. The Institute's individual and corporate members are drawn from business, universities and the professions across the country.

INDEPENDENT • REASONED • RELEVANT

When measured against historical and international experiences, inflation targeting (IT) in Canada is a remarkable success story.

There has been a considerable reduction in the level and volatility of inflation since the Bank of Canada adopted inflation targeting in 1991 (Figure 1). Since mid-1992, inflation – measured as the year-over-year change in the Consumer Price Index (CPI) – has remained stable and close to its target of 2 percent. In fact, inflation expectations appear well anchored at that level. Importantly, the successful stabilization of inflation has not come at the cost of more volatile economic activity. In fact, the Canadian experience shows that it is possible to stabilize inflation over the medium run while still maintaining sufficient flexibility to mitigate short-term fluctuations elsewhere in the economy.

Despite this success, it is at least a theoretical possibility that an alternative policy framework – namely price-level targeting (PLT) – could have led to even better economic outcomes. Research on the topic has resulted in a series of compelling theoretical arguments showing why PLT might be superior to IT. Some of these arguments suggest that PLT might be more effective in preventing and dealing with deflationary situations when the nominal overnight interest rate approaches zero. Clearly, contemplating the potential benefits of PLT is particularly relevant in the current environment.

Given that the current IT regime has been successful in many respects, at least historically, it is particularly important that the actual merits of any alternative be thoroughly and rigorously investigated. As the saying goes, “If it ain’t broken, why fix it?” In particular, we need to be convinced that the theoretical environment in which these results are derived is characterized by properties that would matter in practice.

*What if the inflation and the price level are not observed in practice?*

Comparisons of IT and PLT have paid little attention to the idea that the inflation and price level relevant for monetary policy might not be perfectly observed. In fact, a central bank should care about the true underlying changes in the public well-being that stem from overall changes in the cost of living. Because of the difficulties associated with translating the concept of cost of living into an operational definition, any price index might be merely a useful, but imperfect proxy of what the central bank should be stabilizing.

Existing arguments in the literature suggest that PLT might be inferior to IT when inflation is observed imperfectly, since transitory errors in inflation imply persistent errors in the price level. In that case, targeting an imperfect measure of the price level could result in the central bank responding to errors that would introduce additional and persistent fluctuations in the economy that would, in turn, reduce economic well-being.

In this *Commentary*, I argue that there are good reasons to believe that the central bank might be currently implementing policy based on an unrealistic price level, perhaps as a result of calculation errors or conceptual difficulties in defining this measure. However, I also argue that when the central bank acknowledges that inflation and the price level are not perfectly observed, PLT is likely to be superior to an IT regime. Thus, the presence of measurement errors might be an additional argument in favour of PLT. But ultimately, as for most of the arguments in favour of PLT, this conclusion relies on how the public forms its expectations. Before discussing the role of imperfect information, it is useful to describe more explicitly IT and PLT, their differences and the existing arguments concerning why one might be superior to the other.

---

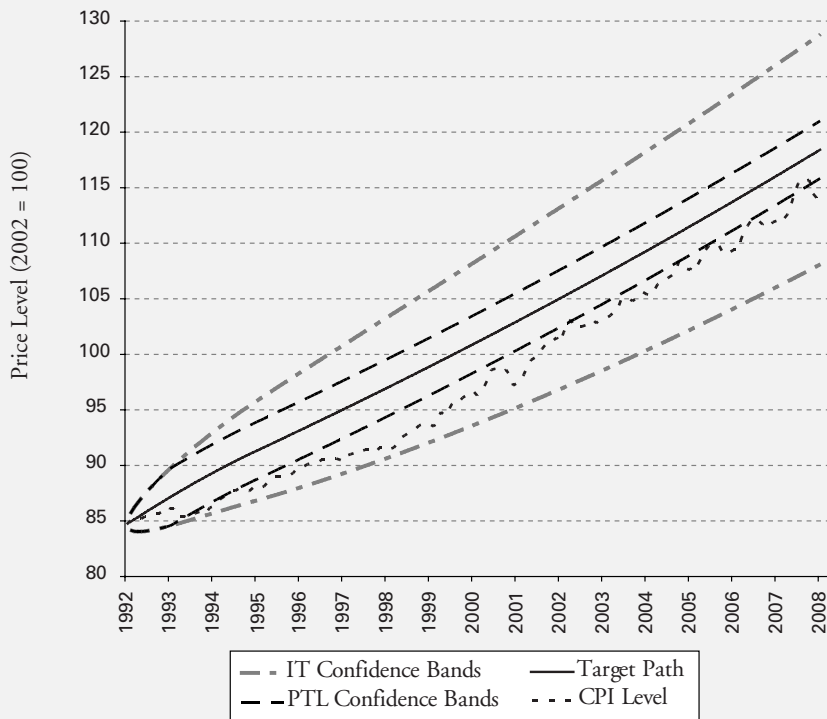
Support from the Social Sciences and Humanities Research Council of Canada, the National Science Foundation and the *Fond Québécois de Recherche sur la Société et la Culture* is gratefully acknowledged. I thank Marc Giannoni, David Laidler, Frederic Mishkin, Daniel Racette, Bill Robson and Nicolas Vincent for useful discussions and comments as well as participants at the Nov. 4, 2008 C.D. Howe Institute’s conference on Canada’s Monetary Policy Regime after 2011. Two anonymous readers also provided useful comments.

Figure 1: Monthly CPI inflation in Canada from 1961–2008 (Year-on-year percentage change)



Sources: Statistics Canada and Bank of Canada.

Figure 2: Price level, Targeted Path and Confidence Bands



Sources: Statistics Canada (CPI Level) and author's calculations.

## The Difference between Inflation Targeting and Price-Level Targeting<sup>1</sup>

A key feature of inflation targeting is that it does not require the central bank to do anything to correct past mistakes. Bygones are simply bygones. For instance, if inflation is unexpectedly higher than the target at some point – as in March 2003 – the current policy framework requires the central bank only to bring inflation back to 2 percent over the near term. But this overshooting of the target implies that the price level will remain higher than what was expected prior to this surprise, even after inflation returns to its 2 percent target. As these surprises accumulate over time, the price level can, in principle, wander far away from its expected path. As a result, in a successful inflation-targeting regime, where average inflation is on target, the actual price level in some years can be considerably different from a forecast that assumed prices would increase exactly by 2 percent every year over these years. Uncertainty about the price level over a long horizon can thus be considerable.

This is illustrated in Figure 2. The dotted line displays the level of the Consumer Price Index since December 1992. The solid line displays the price level that would have ensued if the Bank of Canada had never missed its announced target for inflation, which was 3 percent in December 1992, linearly declining to 2 percent until December 1995 and thereafter. The solid line thus represents the best forecast of the price level that one would have produced in December 1992 for the next 16 years, believing that the Bank of Canada would never miss its target.

As can be seen from this figure, the two price-level paths differ considerably. The actual price path has been systematically below that which would have been predicted in December 1992. That is, during this period, inflation undershot target more often than it overshot it. For instance, in February 1999, the price level in Canada was more than 6 percent

below what it would have been if inflation had been on target since December 1992.

In contrast, if the Bank of Canada had successfully targeted a price-level path increasing at the rate of the pre-announced inflation target, the actual price level (dotted line) should have been fluctuating around the targeted path (solid line). The deviations of the actual price level from the targeted path would have been transitory and would have averaged zero.

Targeting a 2 percent price-level path would have required the Bank of Canada to engineer inflation higher than 2 percent whenever inflation had fallen unexpectedly below 2 percent during that 16-year period. In short, under a price-level targeting regime, the central bank needs to correct past mistakes. Bygones are no longer bygones. For instance, throughout 1994, inflation was below 0.3 percent (except for January when it was 1.3 percent). If the Bank of Canada had been targeting the price level, it would have had to allow inflation to be above its target – which was between 2.3 percent and 2.7 percent in that year – for a sufficiently long period to offset this undershooting of the target. But as we can see from Figures 1 and 2, it did not.

The calculations in Figure 2 assume that Canada was under an IT regime as of December 1992. It is important to note that the importance of the departures from the hypothetical price path depends on when one thinks that the IT regime started. Officially, it began in December 1991 with an initial target of 4 percent that was to be brought down to 2 percent by December 1995.

However, based on official announcements, it is more difficult to identify the precise announced path for the inflation target during the regime's first year. This is why my discussion starts in December 1992. But some people would argue that it is really only after December 1995, when the announced long-term numerical target of 2 percent was achieved, that Canada was truly under an IT regime. Starting Figure 2 from December 1995, instead, would make the actual path of the price level look much closer to the hypothetical 2 percent target path.<sup>2</sup>

1 Although I will not spell out a model explicitly in the discussion that follows, the benchmark that I have in mind is in the general class of New Keynesian models where price rigidities are a central feature.

2 Both Parkin (2009, Fig 3) and Robson (2009, Fig 11) plot such charts.

Since the existence of an IT regime should not be defined by the numerical value of a target but by the fact that a central bank is officially committed to such a target, it is far from obvious that the experience before 1995 can be simply ignored. To the contrary, since part of the relative merit of PLT over IT lies in its ability to better anchor inflation expectations, the transition period leading to December 1995 seems particularly informative for this comparison. If the public believed the announced inflation target was realistic, the price-level path represented in Figure 2 fairly represents the best forecast of inflation as of December 1992. That remains the case, irrespective of the fact that it is only after December 1995 that the target had settled to 2 percent.<sup>3</sup>

### *Would price-level targeting have led to better economic outcomes in Canada?*

In attempting to answer this question, one might be tempted to infer from Figure 2 that no matter the potential merit of PLT, it is not likely that the actual economic outcomes would have been much better. The realized price level was, after all, not that far away from what would have been the targeted price path. By 2008, the gap between the realized price level and predicted PLT would have narrowed. As already discussed, moreover, this conclusion would be even more tempting if Figure 2 started instead in December 1995.

Unfortunately, the answer is not so simple. First, even though the price level seems not far from what would have been the targeted price level under PLT, the deviations between the two paths have been extremely persistent. It took about 15 years for the price level to close the gap, which it started to widen again in the very last part of the sample.

Second, the fact that the realized price path is not far from the 2 percent price-level path does not mean that the amount of ex ante uncertainty in December 1992 about what the price level would be over the next 16 years was small. Achieving this price level might only have been a matter of luck, for there is nothing in IT that would have guaranteed this outcome or that would have kept the actual price level close to the 2 percent path.

The confidence intervals plotted in Figure 2 illustrate this point. The widest confidence interval represents an estimate of the statistical uncertainty on the expected price-level path associated with an IT regime where there is no attempt to correct past mistakes. These intervals assume an IT regime during this period. As the figure makes clear, since IT does not attempt to correct any past mistakes, they contribute to growing uncertainty about the price level as we look further in the future. With a 16-year horizon, the uncertainty is considerable: a 95 percent confidence interval for the price level ranges roughly from 108 to 129, or about 8 percent on each side of the point forecast. As should be the case under a successful IT regime, the realization of the price level is within that confidence interval.

The narrower confidence intervals represent estimates of the uncertainty on the price level under a hypothetical PLT regime. In particular, such a regime assumes that at any point in time the departures from targets are of the same magnitude as in the IT case just discussed. However, under this scenario, the central bank credibly commits to correct these mistakes within a year.<sup>4</sup> In that case, the uncertainty on the price level is much narrower and does not increase as we look further into the future. With a 16-year horizon, a 95 percent confidence interval for the price level ranges roughly from 116 to 121, or about 2 percent on each side of the point forecast.

3 Another argument in favour of ignoring the experience prior to December 1995 is that the inflation behaviour in the initial years of the IT regime might have still been influenced by the policy steps taken prior to the adoption of IT. But for this reasoning to justify starting only in December 1995, these prior policy steps would have had to have extremely persistent effects; i.e., policy steps taken in 1991 would have had to influence inflation outcomes in 1994. However, the empirical evidence does not support this thesis. In fact, it is important to note that throughout 1994 inflation systematically undershot 2 percent, even though the official target at the time was still higher. If the prior policy steps are the explanation for this – and since these policy steps were known before the announcement of the targets – it is not clear why the announced inflation targets did not decline faster to 2 percent. In any case, as I now illustrate, even if the actual price level and the targeted price path were close to each other, as a December 1995 start date would suggest, that does not imply that a PLT regime would have produced equivalent economic outcomes to the current IT regime.

4 This is a counterfactual exercise that does not take into account the fact that if a PLT regime had been actually implemented during that period, the average size of the target misses would have been smaller.

Consequently, determining how close the realization of the price-level path is to a hypothetical price-level target path is not sufficient to bring out the potential benefits from a PLT regime. By promising to undo past surprises, thus ensuring that the price level returns to its expected path, PLT should lead to less uncertainty about long-run price levels. For long-term nominal contracting, this should lead to a smaller unexpected redistribution of wealth between creditors and debtors, a smaller default risk premium and, ultimately, better allocation of capital. This might be particularly important for retirement planning or for people living on a fixed income, provided that there are no financial instruments that can insure against that type of risk. However, while these arguments are compelling from a theoretical point of view, the literature does not yet provide a good guide on the likely quantitative importance of these benefits.

Even if these benefits were quantitatively important, moreover, it does not immediately follow that society's well-being would be increased with PLT. The economic health of society does not depend only on the stability of the price level, but also on the fluctuations in inflation and real activity. Since there is typically a short-term trade-off between these goals, it does not follow that PLT is superior at controlling fluctuations in inflation and in economic activity even if it might be better at controlling price-level movements. For these reasons, in general, relying purely on PLT is not the most desirable way to conduct monetary policy. How exclusively monetary policy should aim at a PLT will depend crucially on how the public forms its expectations.<sup>5</sup>

Since PLT implies undoing past mistakes with offsetting inflation movements, observers might believe that PLT would make inflation more volatile. But this reasoning ignores the fact that

PLT might affect the way different public expectations are formed. In a world where firms and consumers believe that the central bank will undo surprises on the expected path of the price level, they understand that they have less of a need to adjust prices in response to transitory shocks, especially if changing prices is costly. In this way, PLT makes inflation less volatile. This in turn leads to a better trade-off between inflation and real activity: lower inflation volatility does not have to be at the price of higher output volatility.<sup>6</sup>

A PLT policy framework might also be more effective in preventing and dealing with deflation, given its better leverage over expectations. First, as we have just argued, by reducing the need for firms to adjust prices in response to transitory shocks and by making inflation less variable, sustained deflation should be less likely under a credible PLT. That is especially the case if the targeted price-level path has a positive growth trajectory, as we have assumed so far.<sup>7</sup>

Second, PLT might be a more effective monetary policy than IT in a deflationary situation, particularly when the nominal interest rate gets close to its zero lower bound. To see why, consider again the case where the central bank is targeting a price level with a 2 percent growth path. Starting from a situation where the price level was initially on target, deflation would imply that the price level has fallen considerably below the targeted path. If the PLT regime is credible, consumers and firms should expect the central bank to engineer inflation higher than 2 percent in order to return the price level to its targeted path.

In contrast, under inflation targeting, the central bank would be expected to bring inflation back to 2 percent, but not higher. By forcing higher inflation than under IT and, thus, a lower real interest rate, PLT enables the central bank to respond more aggressively to a deflationary

5 See the survey by Côté (2007) and Ambler (2007) and the recent working papers section of the Bank of Canada initiative on evaluating IT versus PLT, such as Dib et al. (2008) and Coletti et al. (2008).

6 See Svensson (1999) and Vestin (2006).

7 Some people have argued that PLT might make deflation more likely (see, for instance, Fisher [1994] and Mishkin [2000]). If the targeted price-level path was flat, the logic behind this concern is pretty clear: whenever there is a surprise causing inflation to be positive, PLT would imply undoing the surprise with negative inflation. However, when the price level is targeted to grow at some rate, undoing an overshooting of the target does not necessarily require deflation.

environment. Under PLT, this can be done without undermining central bank credibility, since this higher inflation can be engineered without ever deviating from the pre-announced commitment. Consequently, even if nominal interest rates have fallen to zero, monetary policy might have more room under PLT to lower the real interest rate and stimulate the economy through this expectation channel.<sup>8</sup>

But research so far has not reached a definitive conclusion on the desirability of PLT over IT, and the potential benefits of a PLT regime cannot be claimed to unambiguously outweigh its potential downsides. The reason is that the benefits of PLT require the public to be fairly sophisticated in the way it forms its expectations about the expected path of the economy. At one extreme, the public might fully understand the implications of the monetary policy regime for the anticipated behaviour of the economy and exploit that understanding to form expectations about the future, which in turn will affect its current behaviour. In that case, PLT will have important leverage to stabilize the economy, as just explained.

However, at the other extreme, the public might form expectations about the future by simply extrapolating from what they observe today. In that case, the choice of the policy regime has no influence on the way expectations are formed. Therefore, PLT would not succeed in preventing prices from responding to transitory shocks, since firms would not take into account the fact that the price level will return to its expected path. In such a scenario, PLT would lead to more volatile inflation than IT and, potentially, of output, as any surprises in inflation would lead firms to adjust their prices more fully in response to transitory shocks. That sort of response would then have to be corrected by a larger movement of inflation in the opposite direction.

By the same logic, when the public forms expectations without taking account of the

implications of the policy regime, the edge that PLT could have in dealing with deflationary episodes disappears. The argument suggesting that PLT could be more effective for dealing with such situations is based on the greater leverage it would give the central bank over the public's expectations. But if these expectations do not play an important role in determining economic decisions, this channel will be muted.

Broadly speaking, the benefits of PLT over IT become more important as more consumers, firms and investors understand the role a policy regime has on the future behaviour of the economy and base their decisions on that understanding.<sup>9</sup> Clearly, no one can predict the extent to which public expectations would shift following a change in regime. To the extent that expectations do not adapt fully, the policy regime that best stabilizes inflation and output fluctuations will be neither pure PLT nor pure IT, but something in between that offsets, at least partially, past mistakes.<sup>10</sup>

There are, of course, many other considerations that might affect the performance of PLT relative to IT. Whether it is better to think of monetary policy as being implemented under commitment or discretion plays a role. When the regime is not perfectly credible, the relative merits of PLT and IT can also be affected in a number of ways. But the goal here is not to provide a complete taxonomy of all the factors at work. Rather it is to derive a better understanding of how imperfect information about inflation impacts the relative performance of PLT over IT.

### *Are the price level and inflation perfectly observed?*

In most of the research pertaining to the relative merits of PLT and IT, it is assumed that both the central bank and the public are concerned with this ultimate target of monetary policy as it is actually

8 See Eggertsson and Woodford (2003) for a formal illustration of the desirable features of PLT when the nominal interest rate is at its zero lower bound.

9 It is interesting to note, as Ball, Mankiw and Reis (2005) show, that to reap the benefits of PLT, the public does not need to have up-to-date information about the state of the economy. No matter the information on which expectations are based, what is crucial is that these expectations reflect an understanding of how the economy actually behaves under different policy regimes.

10 See Woodford (2003), Chapter 7.



measured. In this section, I want to argue that such an assumption is not necessarily realistic.

In order to implement an inflation-targeting regime, we need to take a stand on how we want to measure inflation. But what is the ideal measure of “true” inflation? In principle, it should summarize in a single number the effects on public well-being that stem from changes in an array of prices. Since this measure depends on the preferences of the public, it is tricky to estimate. For instance, consider the extreme case of two goods that consumers see as perfect substitutes. If the price of one of these changes while the other stays constant, a measure of inflation based on a weighted average of the prices of the two goods – where weights have been determined at some point in the past – would suggest an erosion of purchasing power. However, in terms of well-being, consumers are neither worse nor better off after the price changes. In that case, the “true” measure of inflation should be zero.

In Canada, the inflation-control target is defined in terms of the year-over-year rate of change in the CPI. This choice is reasonable in so far as this index reflects the cost-of-living changes that the public is experiencing. But for various reasons, including the fact that its weightings are updated only irregularly, the CPI is only an approximation, as Smith (2009) has argued in some detail.

There is, in fact, evidence suggesting that the CPI is not a true measure of inflation. In the United States, the 1996 Boskin Commission identified various biases in its CPI that led to changes in the way it is constructed. But research suggests that biases still remain, and these seem to be especially due to the difficulty of adjusting for quality improvements and outlet substitutions.<sup>11</sup>

In Canada, Rossiter (2005) estimates an average upward bias in the CPI of about 60 basis points. Accordingly, when the CPI inflation is 2 percent, Rossiter maintains that true inflation is 1.4 percent. If this bias were constant over time, and the Bank of Canada cared about targeting 2 percent, one

solution would be for the Bank to set a 2.6 percent CPI target. But there is no reason to think that this bias is constant. For instance, the pace of quality improvements could change over time, leading to a time-varying bias.<sup>12</sup>

But the CPI is certainly not the only single relevant measure of inflation for monetary policy. The growth rate of the GDP deflator provides a broader measure of all prices in the economy, although it includes the price of goods that are not relevant for consumers.

In that sense, the deflator of personal consumption expenditure (PCE), which is a sub-component of the GDP deflator, would be closer to a measure of the cost of living. This index referred to in official Canadian Sources, as the “chain price index for consumption,” differs from the CPI in terms of the weights that are attributed to each price and how they change over time. There are arguments suggesting that the PCE might, in some cases, be a better measure of inflation. For instance, it might be less subject to substitution bias since it is a chain-weighted index.

Annual data on PCE inflation are displayed in Figure 3, together with CPI inflation. The two measures share the same broad pattern, but there are still differences between the two: the CPI inflation seems slightly more volatile and since 2000 is, on average, about 50 basis points above the PCE inflation.

The point here is not to argue that the PCE deflator would be a better target measure. Rather, the point is to illustrate that two measures that are a priori reasonable provide a somewhat different inflation picture. To the extent that none of these measures can be argued to be superior in every respect, this might suggest that true inflation is actually not observed.

Based on these observations, it seems more realistic to think of the current inflation-control target as an imperfect measure of true inflation. In this context, one way to improve the conduct of monetary policy is to improve the measurement of true inflation. As Smith (2009) suggests, this could be achieved by updating more frequently the estimates of the biases in the CPI, and the basket of goods and services in the CPI, as well as improving the treatment of

11 See Haussman (2003), Haussman and Leibtag (2004) and Bills (2004).

12 Rossiter (2005) documents some of the change over time and across studies in the estimated biases.

Figure 3: CPI and PCE inflation in Canada, 1991–2007



Source: Statistics Canada.

imputed prices such as owner-occupied housing. Another possible improvement would be to move to a new chain-weighted price index.

However, even if these improvements were implemented, true inflation would still not be perfectly observed. Some of these suggested adjustments are based on estimates, and estimates are subject to uncertainty. That implies that the price level and inflation are themselves subject to uncertainty. Moreover, even if we measured what we intended perfectly, there might always remain some uncertainty about the proper conceptual definition of inflation needed for monetary policy. The “pure inflation” measure of Reis and Watson (2008), which is unobserved but estimated from disaggregated prices, is an example of an alternative measure that is conceptually different from either the CPI or the PCE deflator.

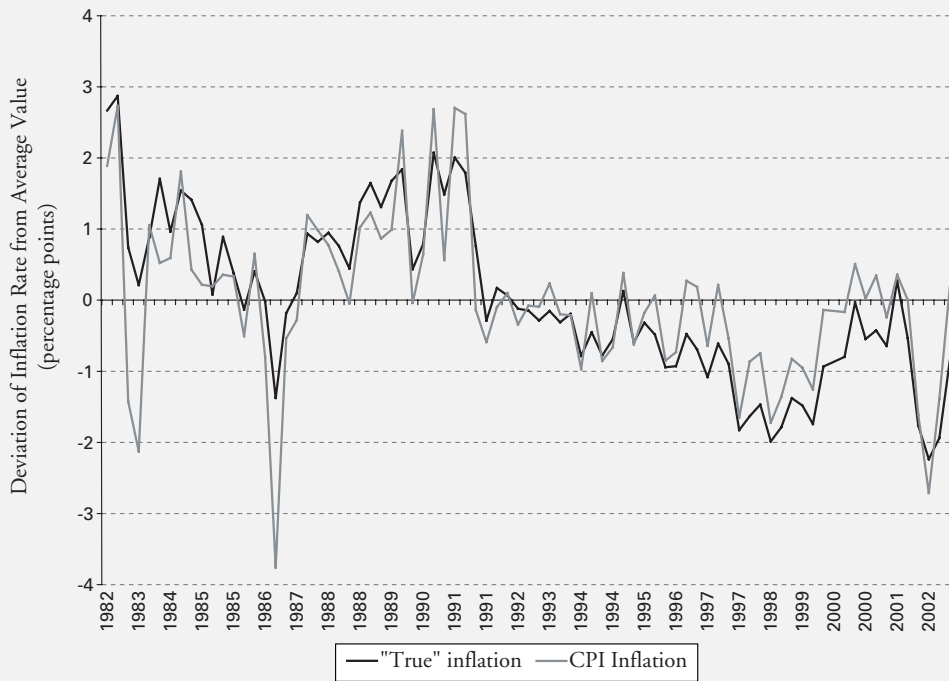
Thinking of inflation as imperfectly observed raises interesting questions. Does this uncertainty about true inflation matter in any meaningful sense

for the implementation and outcomes of monetary policy? Is there a reason to think that these issues bear on the choice between PLT or IT? We now turn to these questions.

### *What happens if inflation and the price level are not perfectly observed?*

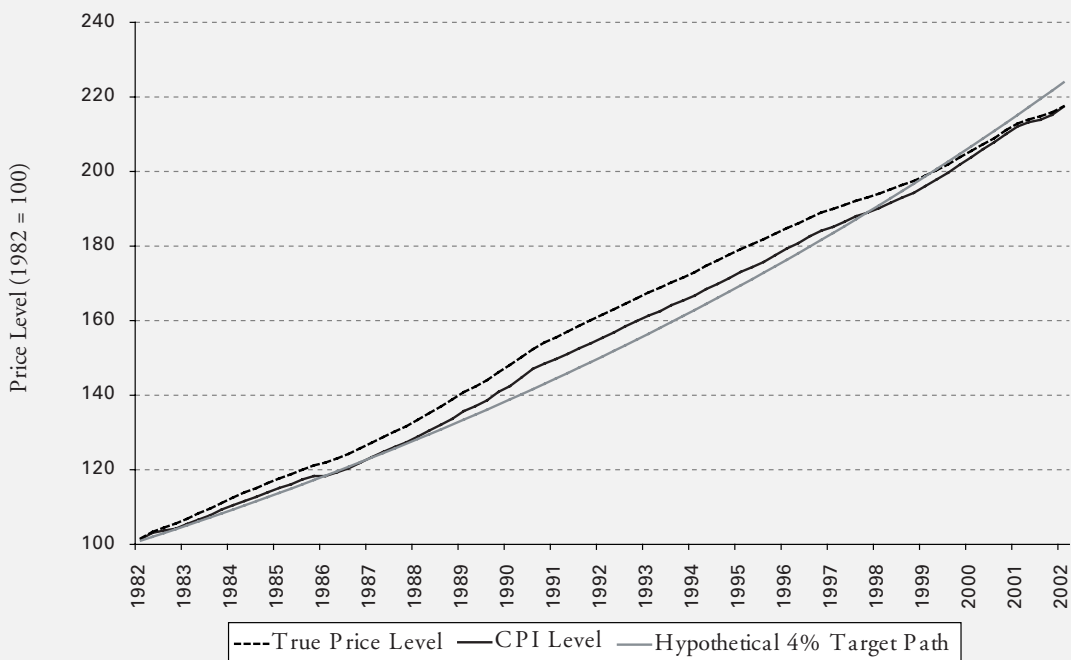
If actual inflation is imperfectly observed, the same is true for the price level. Rather than assuming that an observable indicator such as the CPI can measure inflation, one can treat it as an unobservable measure that needs to be estimated. One possibility is to treat any observable measures of inflation as noisy indicators of the true underlying inflation. Moreover, one can ensure that the estimated inflation measure is consistent with theory by imposing on its estimation the constraints stemming from a particular model of the economy. Figure 4 compares one such estimate of “true inflation” with CPI inflation for the 1984-to-2004

Figure 4: Boivin and Giannoni (2006) Estimate of True Inflation and CPI Deflation for the US (in deviation from their means)



Source: Boivin and Giannoni (2006).

Figure 5: CPI Level and Estimated True Price Level, US 1982–2002



Source: Author's calculations based on Boivin and Giannoni (2006).

period by plotting the deviations of these variable from their average value over the period.<sup>13</sup>

As is clear from Figure 4, the two measures of inflation are highly correlated. However, they display some high frequency differences. In the first half of the sample, true inflation was higher on average than CPI inflation, and in the second half it was lower.

Figure 5 shows the implication of these differences for the price level, on the arbitrary but inconsequential assumption that the CPI level and true price level equalled 100 in 1982 and the central bank targeted a 4 percent per annum rise in the price level. The estimation approach also assumes that the “measurement error” in inflation averages out to zero over the sample period. That is the reason why both measures of the price level start and end up exactly at the same point over the period. In other words, this exercise underestimates the deviation between the true price and CPI levels, as it forces both the starting and ending points to be the same for both measures.

Still, the estimated deviations are important and persistent. Toward the middle of the period, the CPI level is about 15 percent below that of the estimated true price level. According to these estimates, a central bank relying on the CPI level as it targeted the time path of the price level could steer the economy in the wrong direction for a considerable period of time. For instance, in 1992, a central bank targeting the hypothetical 4 percent price-level path might have felt a false sense of security from the fact that the CPI level was only about 3 percent above the targeted level. According to the estimated true price level, however, it was in fact about 7 percent above the targeted path. Thus, targeting the CPI level would have induced monetary policy to be looser than what was desirable. Since bygones are not bygones under PLT, targeting a price level that is not perfectly observed could lead to sustained and systematic monetary policy deviations from its intended path.

This example illustrates a potential drawback of PLT – it might be less resistant to measurement

errors than IT. In fact, this has been an important argument against PLT. As Mishkin (2000) notes:

“[If inflation is measured with error, it] implies that the measurement error of the price level is I(1), and that a price-level target results in growing uncertainty about the true price level as the forecast horizon grows. Thus, many of the arguments suggesting that a price-level target results in lower long-run uncertainty about the true price level may be overstated.”

As we argued in the previous section, the key advantages of PLT are to reduce uncertainty in predicting the price level in the longer-term future and to influence expectations toward a more favourable trade-off between inflation and real activity. In the presence of measurement errors, uncertainty in the true long-price level might be considerable, as transitory inflation measurement errors imply persistent price-level error. Moreover, while PLT may have a greater influence on expectations, those expectations will be problematic. By targeting an imperfectly measured price level, the central bank could end up creating unwanted fluctuations in the economy.

But what if the central bank instead saw the CPI as what it is – an imperfect measure of the price level? Using a modern structural macroeconomic model in which they compare cases where the central bank faces different informational constraints, Boivin and Giannoni (2008) argue that a central bank that is conscious of, and allows for, the presence of observational errors would significantly increase the public’s well-being compared to a central bank that naively responds to the noisy indicator as if it were the truth. Indeed, they suggest that the cost of ignoring observational errors might be greater than the potential costs associated with choosing between PLT and IT. When the state of the price level is not directly observed, there are a large number of indicators that could provide useful information to estimate it. Exploiting this information can reduce considerably the imperfect information problem.

13 The derivation of the “true inflation” measure is briefly explained in the Appendix Box A. This measure was estimated in earlier work, dealing with the US (Boivin and Giannoni 2006) and hence, it is based on US data. This choice has no bearing on the relevance of the following example.

Moreover, since the ideal policy requires partial offsetting of past mistakes, PLT would provide a better approximation to it than IT when observational inflation errors are present.

Contrary to previous thinking, then, the results of Boivin and Giannoni (2008) suggest that the existence of observational errors might be an additional argument in favour of PLT. How can that be? By attempting to allow for errors in the economic indicators, the central bank insulates the economy from additional fluctuations that responding to them might induce and which would be costly in terms of economic well-being. But there is more. As discussed above, the adoption of PLT can influence public expectations, provided that the public understands what PLT entails. Crucially, PLT implies that the central bank will undo past mistakes to return prices to their expected path. But the same principle applies to past observational mistakes in the price level. Under a PLT regime, as more information becomes available and the estimate of the price level is refined, the central bank will be forced to bring the new estimate of the price level as close to the target as possible. That means that the central bank will be correcting for past measurement errors in both the price level and inflation, which should help reduce the overall uncertainty in the true long-run price level.

The fact that the true inflation or price level might not be perfectly observed raises important communication challenges, of course. Indeed, at some level, it might be difficult to convey to the public that the ultimate target of monetary policy is not observed. This could contribute to a perception that monetary policy is less transparent since the attainment of its goals would become less easily verifiable. In that case, this could undermine central bank credibility. These are certainly valid concerns that need further investigation.

However, these challenges are not necessarily insurmountable. The fact that true inflation is not observable does not mean that what the central bank does is not verifiable. A central bank could publish its own estimate of current and past inflation in the same way that it can communicate its forecasts for future inflation. Importantly, it

could also explain exactly how it obtains these estimates, in a way that the public could reproduce and verify. After all, the rate of change of the CPI is just one such imperfect estimate of true inflation. As long as the recipe for estimating inflation is known and does not change, accountability will be preserved.

The central point of this discussion is that, contrary to previous arguments, the fact that inflation, the price level, or any other macroeconomic concept central to monetary policy is imperfectly observed, might provide an additional argument in favour of PLT. But the extent of the benefits we might expect in practice depends on the precise nature of the economic environment and, in particular, on whether the public expectations are based on a proper understanding of how the monetary policy regime affects the future path of the economy. More work is thus needed to determine what type of economic environment better characterizes the Canadian economy and to quantify the expected benefit of a PLT regime. However, if we find that we are in an environment favourable to PLT, with imperfect information on inflation and the price level, the benefit of adopting it would likely be larger, not smaller.

## Conclusion and Recommendations

Since inflation targeting has been successful in Canada, we need to be convinced of important benefits before we consider moving to an alternative framework. In that spirit, the Bank of Canada has undertaken ground-breaking research aimed at quantifying these potential benefits. This research should fill the void in our current understanding.

The goal of this *Commentary* has been to investigate one such feature of the economic environment that has to date received little attention: the role of errors in observing inflation. Existing arguments suggest that the presence of such observational errors might make PLT less desirable than IT. On the contrary, this analysis maintains that if the central bank is aware of the information reliability problem and takes it

explicitly into account in its decision-making process, PLT might become more desirable than IT.

However, the desirability of PLT depends on whether the public understands how the nature of the monetary policy regime should affect their expectations. To the extent that the research supports PLT, the presence of observational error is likely to make its benefits greater, not smaller. Recent research suggests that ignoring the presence of observational errors in inflation and price level could lead to costs that might even be greater than the relative benefits of moving from IT to PLT, or vice versa. This leads to a few recommendations:

- Ways to improve the quality of existing measures of inflation, perhaps along the lines suggested by Smith (2009), should be seriously considered. That implies devoting resources to implement technologies that minimize biases (e.g., updating the CPI basket

more frequently, etc.).

- In implementing monetary policy, the Bank of Canada should explicitly recognize that the actual rate of inflation – and eventually the price level – is subject to observational errors. The CPI and other price indicators should be seen as informative, but noisy, indicators of true inflation.
- The extent of uncertainty in current inflation – and eventually the price level – should be documented and communicated publicly.
- The possibility of reducing the uncertainty about the true inflation and the price level through the use of a large number of macroeconomic indicators should be investigated.

## Appendix A: Boivin and Giannoni (2006) data-rich estimate of “true inflation”

If no data can perfectly measure inflation, is it possible to obtain a better estimate of true inflation than the rate of change of the CPI itself? In principle, if additional information is available, the answer is yes.

When inflation is imperfectly observed, all observable measures should be interpreted as informative but noisy indicators of the true underlying inflation. For instance, the CPI inflation that we observe at a point in time,  $\pi_t^{CPI}$ , is the sum of true inflation,  $\pi_t$ , plus an observational error  $e_t^{CPI}$ :

$$\pi_t^{CPI} = \pi_t + e_t^{CPI}$$

The goal is to separate out  $\pi_t$  from  $e_t^{CPI}$ . Without additional information or assumptions this is not possible. However, two broad sources of additional information can help achieve this goal.

One is economic theory that provides information on how inflation should evolve over time in relation to other economic variables, such as output and interest rate. Economic theory can thus provide a set of structural relationships that true inflation should satisfy and that can be exploited to decompose  $\pi_t^{CPI}$  into  $\pi_t$  and  $e_t^{CPI}$ . More formally, economic theory provides a set of equations characterizing the process for  $\pi_t$ . This makes it possible to use observations on CPI and the Kalman filter to obtain an estimate of true inflation.\*

Another source of information comes from the availability of other macroeconomic indicators,

beyond CPI, that contain information about true inflation. For instance, the PCE inflation rate is another noisy indicator of true inflation. If both PCE and CPI move in proportion to true inflation but subject to different observational errors, we have:

$$\pi_t^{CPI} = \pi_t + e_t^{CPI}$$

$$\pi_t^{PCE} = \lambda \pi_t + e_t^{PCE}$$

In this case, the dynamics that CPI and PCE share must be explained by true inflation. True inflation can then be estimated as the common component of the two indicators. By exploiting the information from PCE, on top of CPI, it is thus possible to identify true inflation and to estimate it more precisely than if only one indicator is used. In principle, there could be many more indicators that are related to true inflation and using them in the estimation should contribute to a more precise estimate of true inflation.

The Boivin and Giannoni (2006) estimate of true inflation exploits both type of information. They treat true inflation as unobserved and estimate it by exploiting the structure of a fully specified state-of-the-art macroeconomic model as well as the information from a large set of macroeconomic indicators.

\*For an exposition of this technique, see A.C. Harvey (1990).

## References

- Ambler, Steve. 2007. "Price-Level Targeting and Stabilization Policy: A Review." Bank of Canada Discussion Paper. 2007-11.
- Ball, Larry, Gregory N. Mankiw and Ricardo Reis. 2005. "Monetary Policy for Inattentive Economies." *Journal of Monetary Economics* 52(4): 703-725.
- Bills, Mark. 2004. "Measuring the Growth from Better and Better Goods." NBER WP 10606.
- Boivin, Jean, and Marc Giannoni. 2006. "DSGE Models in a Data-Rich Environment." NBER WP 12772.
- Boivin, Jean, and Marc Giannoni. 2008. "Optimal Monetary Policy in a Data-Rich Environment." Mimeo. Columbia University and HEC Montréal.
- Coletti, Don, René Lalonde and Dirk Muir. "Inflation Targeting and Price-Level-Path Targeting in the GEM: Some Open Economy Considerations." Bank of Canada Working Paper, 2008-6.
- Côté, Agathe. 2007. "Price-Level Targeting," Bank of Canada Discussion Paper, 2007-8.
- Dib, Ali, Caterina Mendicino and Yahong Zhang. 2008. "Price Level Targeting in a Small Open Economy with Financial Frictions: Welfare Analysis," Bank of Canada Working Paper, 2008-40.
- Eggertsson, Gauti, and Michael Woodford. 2003. "The Zero-Interest Bound and Optimal Monetary Policy." *Brookings Papers on Economic Activity* 1, 139-211.
- Fisher, Stanley. 1994. "Modern Central Banking." In . F. Capie, C. Goodhart, S. Fisher and S. Schnadt, eds. *The Future of Central Banking: The Tercentenary Symposium of the Bank of England*. Cambridge: Cambridge University Press. 262-308.
- Harvey, A.C. 1990. *Forecasting, Structural Time Series Models and The Kalman Filter*. Cambridge: Cambridge University Press.
- Hausman, Jerry. 2003. "Sources of Bias and Solutions to Bias in the CPI." *Journal of Economic Perspectives* 17(1): 23-44.
- Hausman, Jerry, and Ephraim Leibtag. 2004. "CPI Bias from Supercenters: Does the BLS Know that Wal-Mart Exists?" NBER WP 10712.
- Mishkin, Frederic S. 2000. "Issues in Inflation Targeting." *In Price Stability and the Long-Run Target for Monetary Policy*. Bank of Canada. 203-222.
- Parkin, Michael. 2009. *What is the Ideal Monetary Policy Regime? Improving the Bank of Canada's Inflation Targeting Program*. Toronto: C.D. Howe Institute Commentary.
- Reis, Ricardo, and Mark Watson. 2008. "Measuring Changes in the Value of the Numeraire." Mimeo, Columbia University and Princeton University.
- Robson, William B.P. 2009. *To the Next Level: From Gold Standard to Inflation Targets, to Price Stability*. Toronto: C.D. Howe Institute Commentary
- Rossiter, James. 2005. "Measurement Bias in the Canadian Consumer Price Index." Bank of Canada Working Paper, 2005-39.
- Smith, Gregor. 2008. *The Missing Links: Superlative CPI Inflation and Inflation Expectations in Canada*. Toronto: C.D. Howe Institute Commentary.
- Svensson, Lars E.O. 1996. "Price-Level Targeting versus Inflation Targeting: A Free Lunch?" *Journal of Money, Credit and Banking* 31(3): 277-295.
- Vestin, David. 2006. "Price-Level versus Inflation Targeting." *Journal of Monetary Economics* 53(7): 1361-1376.
- Woodford, Michael. 2003. *Interest and Prices*. Princeton University Press.

*C.D. Howe Institute Commentary*© is a periodic analysis of, and commentary on, current public policy issues. Michael Benedict and James Fleming edited the manuscript; Heather Vilistus prepared it for publication. As with all Institute publications, the views expressed here are those of the author and do not necessarily reflect the opinions of the Institute's members or Board of Directors. Quotation with appropriate credit is permissible.

To order this publication please contact: Renouf Publishing Company Limited, 5369 Canotek Road, Ottawa, Ontario K1J 9J3; or the C.D. Howe Institute, 67 Yonge St., Suite 300, Toronto, Ontario M5E 1J8. The full text of this publication is also available on the Institute's website at [www.cdhowe.org](http://www.cdhowe.org).







- September 2009 Beach, Charles M., Alan G. Green, and Christopher Worswick. "Improving Canada's Immigration Policy." C.D. Howe Institute e-brief.
- September 2009 Burrows, Malcolm. "Unlocking More Wealth: How to Improve Federal Tax Policy for Canadian Charities." C.D. Howe Institute e-brief.
- September 2009 Le Pan, Nick. *The Path to Prosperity: Look Before you Leap: A Skeptical View of Proposals to Meld Macro- and Microprudential Regulation.* C.D. Howe Institute Commentary 296.
- September 2009 Chen, Duanjie, and Jack M. Mintz. *The Path to Prosperity: Internationally Competitive Rates and a Level Playing Field.* C.D. Howe Institute Commentary 295.
- August 2009 Van Riesen, Gretchen. *The Pension Tangle Achieving Greater Uniformity of Pension Legislation and Regulation in Canada.* C.D. Howe Institute Commentary 294.
- August 2009 Koepl, Thorsten V. *How Flexible Can Inflation Targeting Be? Suggestions for the Future of Canada's Targeting Regime.* C.D. Howe Institute Commentary 293.
- August 2009 Johnson, David. "Ontario's Best Public Schools, 2005/06 – 2007/08: An Update to *Signposts of Success* (2005)." C.D. Howe Institute e-brief.
- August 2009 Busby, Colin, Alexandre Laurin, and David Gray. "Back to Basics: Restoring Equity and Efficiency in the EI Program." C.D. Howe Institute e-brief.
- July 2009 Siklos, Pierre L. *As Good As It Gets? The International Dimension to Canada's Monetary Policy Strategy Choices.* C.D. Howe Institute Commentary 292.
- July 2009 Busby, Colin, and William B.P. Robson. "Equipping Ourselves in Tough Times: Canada's Improved Business Investment Performance." C.D. Howe Institute e-brief.
- July 2009 Banerjee, Robin, and William B.P. Robson. "Faster, Younger, Richer? The Fond Hope and Sobering Reality of Immigration's Impact on Canada's Demographic and Economic Future." C.D. Howe Institute Backgrounder 117.
- June 2009 Crow, John. "A Bank for All Seasons: The Bank of Canada and the Regulatory Challenge." C.D. Howe Institute e-brief.
- June 2009 Busby, Colin, and Alexandre Laurin. "Getting Off the Rollercoaster: A Stable Funding Framework for the EI Program" C.D. Howe Institute e-brief.
- June 2009 Doern, Bruce, and Robert Morrison. *Canada's Nuclear Crossroads: Steps to a Viable Nuclear Energy Industry.* C.D. Howe Institute Commentary 290.
- May 2009 Steele, Marion, and François Des Rosiers. *Building Affordable Rental Housing in Unaffordable Cities: A Canadian Low-Income Housing Tax Credit.* C.D. Howe Institute Commentary 289.
- May 2009 Dachis, Benjamin. "Low-Carbon Fuel Standards: Driving in the Wrong Direction." C.D. Howe Institute e-brief.
- May 2009 Moussaly-Sergieh, Karim, and François Vaillancourt. "Extra Earning Power: The Financial Returns to University Education in Canada." C.D. Howe Institute e-brief.
- May 2009 de Oliveira, Claire. *Good Health to All: Reducing Health Inequalities among Children in High- and Low-Income Canadian Families.* C.D. Howe Institute Commentary 288.

## SUPPORT THE INSTITUTE

For more information on supporting the C.D. Howe Institute's vital policy work, through charitable giving or membership, please go to [www.cdhowe.org](http://www.cdhowe.org) or call 416-865-1904. Learn more about the Institute's activities and how to make a donation at the same time. You will receive a tax receipt for your gift.

## A REPUTATION FOR INDEPENDENT, NONPARTISAN RESEARCH

The C.D. Howe Institute's reputation for independent, reasoned and relevant public policy research of the highest quality is its chief asset, and underpins the credibility and effectiveness of its work. Independence and nonpartisanship are core Institute values that inform its approach to research, guide the actions of its professional staff and limit the types of financial contributions that the Institute will accept.

For our full Independence and Nonpartisanship Policy go to [www.cdhowe.org](http://www.cdhowe.org).

**C.D. Howe Institute**  
67 Yonge Street  
Toronto, Ontario  
M5E 1J8

Canadian Publication Mail Sales  
Product Agreement #40008848