



Renewal of the Inflation-Control Target

Background Information—November 2011



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Introduction

The Government and the Bank of Canada have renewed Canada's inflation-control target for a further five-year period, ending 31 December 2016. Under this agreement, the Bank will continue to conduct monetary policy aimed at keeping inflation, as measured by the total consumer price index (CPI), at 2 per cent, with a control range of 1 to 3 per cent around this target.

Canada adopted an inflation-targeting regime in 1991, with a target of 2 per cent since 1995. Inflation has averaged very close to 2 per cent over that period, as measured by the consumer price index (CPI), and the standard deviation of inflation has fallen by roughly two-thirds, compared with the 1970s and 1980s. In other words, inflation has become low, stable and predictable.

As a result, Canadians have benefited in a number of important ways. An improved inflation environment has allowed consumers and businesses to manage their finances with greater certainty about the future purchasing power of their savings and income. Interest rates have also been lower in both nominal and real terms across a range of maturities. More broadly, low, stable and predictable inflation has helped to encourage more stable economic growth in Canada and lower and less-variable unemployment.

The experience since the last renewal of the inflation-control agreement in 2006 has underscored these benefits, especially the relative stability of Canada's economy during the recent global economic and financial crisis, the largest in the past 75 years. Section 1 of this background document reviews Canada's experience with inflation targeting.

At the time of the last renewal, the Bank committed to continue its research into potential improvements that might build on the success of the current framework. A concerted and ambitious research agenda focused on evaluating whether two specific changes—targeting a lower rate of inflation or a path for the level of prices—could provide significant net benefits to the Canadian economy and Canadian households. Subsequently, the global economic crisis delivered a powerful reminder that price stability and financial stability are inextricably linked, and that pursuing the first without due regard for the second risks achieving neither. In addition to casting the Bank's ongoing research in a different light, the experience of the crisis prompted the Bank to add a third item to its research agenda in preparation for the renewal—asking to what extent monetary policy should take account of financial stability considerations.

Sections 2 through 4 of this background document discuss the Bank's findings with respect to these three issues. As explored in Section 2, Bank research has further strengthened the case for lowering the inflation target, although the risks of doing so are higher than had previously been appreciated. A lower inflation target would increase the risk of more frequent and more severe encounters with the zero lower bound on nominal interest rates (ZLB), a concern that must now be taken more seriously in light of the recent crisis. Section 3 reviews the Bank's work on price-level targeting (PLT), which has reinforced the theoretical advantages of PLT, but also the challenges such a regime would face in attempting to realize those advantages in practice. Section 4 looks at the interactions among financial stability, macroeconomic stability and the policies that are of potential relevance to both, drawing out the appropriate lessons from the crisis for monetary policy in Canada. These lessons reinforce the value of Canada's flexible inflation-targeting framework, including its ability to respond to external shocks and its occasional role in supporting financial stability.

The Bank remains committed to ongoing research on the monetary policy framework. Section 5 of this background document discusses the Bank's agenda in this regard. The priority will be to extend the Bank's research to better understand the interactions between the financial system and the real economy, focusing on the implications of these interactions for the conduct of monetary policy in Canada. Section 6 summarizes the Bank's flexible approach to inflation targeting within Canada's monetary policy framework.

1. Canada's experience with inflation targeting

Canada first announced an inflation target in February 1991. The initial objective was to reduce inflation from around 4 to 5 per cent to a rate of 2 per cent by the end of 1995. The focus then shifted toward maintaining a low, stable and predictable 2 per cent rate of inflation. The inflation target has been renewed on five occasions since 1991 (in 1993, 1998, 2001, 2006 and now 2011).

The effectiveness of Canada's inflation-targeting regime was well established at the time of its last renewal in 2006. The main benefits expected from the regime had been realized and, in some cases, exceeded. Inflation fell rapidly following the introduction of the targets, averaging close to 2 per cent between 1991 and 2006, with the volatility of inflation also declining substantially from the pre-targeting period. As the credibility of the regime became established, inflation expectations converged to the 2 per cent target as well, fostering lower and more stable interest rates across the yield curve. Real economic growth was stronger and significantly more stable through the first 15 years of Canada's inflation-targeting experience, compared with the pre-targeting period, and the unemployment rate fell to a 30-year low.

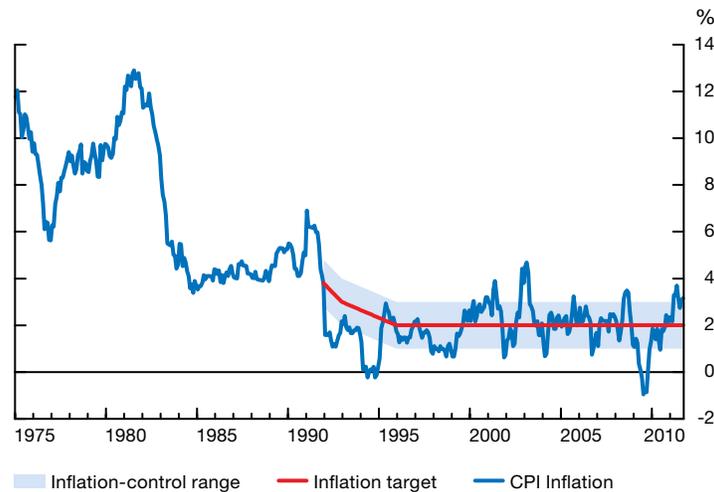
The inflation-targeting regime was an important contributing factor to Canada's improved economic performance through this period (Jenkins and O'Reilly 2001; Longworth 2002). It allowed Canadian businesses and households to read price signals more clearly, to respond to relative price shocks more promptly and generally to allocate resources more efficiently. Many other factors also played a role, including the entrenchment of sound fiscal policy in Canada, as well as structural reforms. In addition, Canada's economy benefited from the relatively tranquil global environment that has come to be known as the "Great Moderation." The economy also showed greater flexibility and adaptability in the face of shocks than had been the case in the 1970s and 1980s.

The global economic and financial crisis of 2008–09 was a far larger shock than anything the Canadian economy had previously experienced during the inflation-targeting period, putting the regime to an unprecedented test. It passed the test, but the experience provided notable lessons for the future and reinforced the value of the regime's flexibility.

Although Canada could not avoid acute downward pressure on economic activity and inflation in late 2008 as the global economy experienced a deep, synchronous recession, the effects in this country were relatively contained.

Canada's recession proved to be its mildest in 30 years,¹ with inflation returning quickly to the 2 per cent target (**Chart 1**) and output to its pre-recession peak within two years. As shown in **Table 1**, the average rate and volatility of total CPI inflation since the last renewal in 2006—a period dominated by the crisis and its aftermath—were not materially different from earlier periods in the inflation-targeting regime. In contrast, in the United States, the volatility of CPI inflation rose markedly.

Chart 1: Consumer price index inflation
12-month rate of increase, monthly data



Sources: Statistics Canada and Bank of Canada calculations

Last observation: September 2011

Some of this volatility reflected unusually wide swings in commodity prices, in contrast to the greater relative stability of core inflation over the past five years (**Technical Box 1**). With respect to the real economy, while real GDP growth has been weaker, on average, since the 2006 renewal, reflecting Canada's first recession in nearly two decades, the average rate of unemployment was very close to that seen through the preceding five-year period of uninterrupted expansion.

Canada's inflation-targeting regime proved to be an important asset throughout the crisis. It provided a clear framework within which the Bank could supply the aggressive monetary stimulus required in response to the large external shock. By April 2009, the Bank lowered the policy rate to its lowest possible level and provided extraordinary forward policy guidance in the form of a commitment to maintain the policy stance through the second quarter of 2010, expressly conditional on the outlook for inflation. The Bank also used the flexibility in Canada's approach to inflation targeting to vary the horizon over which to return inflation to 2 per cent, lengthening the horizon beyond two years in order to mitigate excess volatility. Although over the past 20 years the Bank has sought to return inflation to target on a horizon of 6 to 8 quarters on average, reflecting the nature of the shocks hitting the economy during that time, there has been considerable variation in the inflation-targeting horizon. According to projections published by the Bank since 1998 in its *Monetary Policy Reports*, April 2009 marked the eighth occasion where the Bank extended the targeting horizon beyond 8 quarters, while there have been several other occasions where the horizon was shortened to fewer than 6 quarters (**Chart 2**).

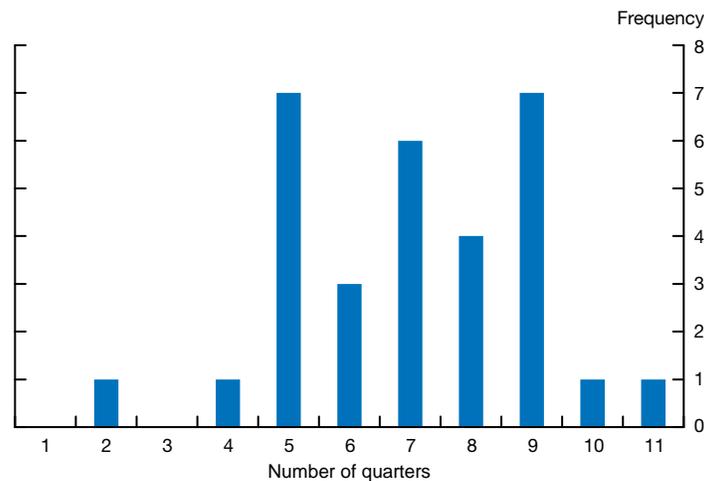
¹ The increase in the unemployment rate from its pre-recession trough to its peak through the 2008–09 recession was 2.8 percentage points, compared with 4.9 percentage points through the recession of the early 1990s and 6.0 percentage points through the recession of the early 1980s. The cumulative loss of output through the 2008–09 recession was also considerably smaller than it was during the two previous cycles.

Table 1: Canada's Economic Performance

Average (%)				
	1975M1 to 1991M1	1991M2 to 2011M10	1991M2 to 2006M10	2006M11 to 2011M10
CPI: 12-month increase	7.1	2.0	2.1	1.9
Real GDP growth ¹	3.0	2.6	3.1	1.1
Unemployment rate ²	8.9	8.2	8.6	7.1
3-month interest rate ³	10.9	4.1	4.7	2.2
10-year interest rate ⁴	10.7	5.6	6.2	3.5
Standard deviation				
	1975M1 to 1991M1	1991M2 to 2011M10	1991M2 to 2006M10	2006M11 to 2011M10
CPI: 12-month increase	2.9	1.2	1.2	1.1
Real GDP growth ¹	3.6	2.5	2.0	3.3
Unemployment rate ²	1.7	1.6	1.6	1.0
3-month interest rate ³	3.0	2.1	1.8	1.7
10-year interest rate ⁴	2.0	1.9	1.6	0.5

Note: Table incorporates CPI data through September 2011 and real GDP data through the second quarter of 2011.

1. Annualized quarter-over-quarter growth rate for quarters within the time period
2. Unemployment data start in 1976M1, owing to the introduction of a new labour force survey at that time.
3. The 3-month interest rate refers to the 3-month prime corporate rate from Statistics Canada, series v121812, Table 176-0041.
4. Owing to data availability, the 10-year interest rate refers to the over 10-year government bond yield prior to June 1982 (Statistics Canada, Table 176-0041, series v121758); after June 1982, it is based on the 10-year government bond yield from Statistics Canada (Table 176-0041, series v121790).

Chart 2: Target horizon of year-over-year total CPI inflation

■ Inflation-targeting horizons in *Monetary Policy Reports* from 1998 to October 2011

Source: Bank of Canada

In addition, through the crisis, the Bank expanded the terms of its short-term lending facilities to support liquidity in the financial system, as well as to reinforce the extraordinary monetary stimulus in place. Canada's credible inflation-targeting regime was a critical anchor through these turbulent times, giving the Bank an unwavering goal to guide these policy actions, and providing financial markets and the public with a clear means to understand the rationale behind them. That understanding is reflected in the relative

Technical Box 1

Core inflation and the underlying trend in inflation

The inflation target is set in terms of the 12-month increase in the total consumer price index (CPI). The CPI is used as the basis for the target because it is the most relevant estimate of the cost of living for the majority of Canadians.

The prices of some of the goods and services included in the total CPI basket, such as those significantly influenced by world commodity prices, are particularly volatile. To the extent that movements in these prices are not expected to persist beyond the time it takes for monetary policy to have its full effect, it would not be advisable for the Bank to rely solely on the current rate of total CPI inflation as a guide in setting monetary policy that is appropriate to achieve the inflation target in the future. Thus, the Bank seeks to “look through” transitory changes in the rate of total CPI inflation by focusing on measures that are considered to better reflect the underlying trend in inflation. These “core” inflation measures are used as operational guides for monetary policy in pursuit of the target for total CPI inflation, providing an indication of where total inflation is headed in the absence of remedial monetary policy actions. That is, core inflation is monitored to help achieve the total CPI inflation target, not as a replacement for it.

The Bank’s preferred measure of core inflation, known as the CPIX, strips out many of the most volatile components of total CPI.¹ As can be seen in **Table 1-A**, the variability of the CPIX is substantially lower than that of the total CPI. As well, the mean values for the rates of increase in the CPI and CPIX are similar in all sub-periods of the inflation-targeting experience in Canada.

Table 1-A: Total vs. Core Inflation

12-month rate of increase (%)				
	1991M2 to 1995M11	1995M12 to 2001M4	2001M5 to 2006M10	2006M11 to 2011M9
Total CPI	2.2	1.8	2.3	1.8
Core CPI (CPIX)	2.1	1.5	2.0	1.8
Standard deviation				
	1991M2 to 1995M11	1995M12 to 2001M4	2001M5 to 2006M10	2006M11 to 2011M9
Total CPI	1.8	0.7	0.9	1.1
Core CPI (CPIX)	0.4	0.3	0.4	0.4

No measure of core inflation, including the CPIX, can perfectly capture the underlying trend in inflation at a given point in time, since these measures can also be influenced by transitory factors. As a result, the Bank looks at a wide range of measures in assessing the underlying trend of inflation, and no one measure is relied upon exclusively. While the Bank intends to continue using CPIX as its preferred measure of core inflation, the usefulness of this and other measures is assessed on an ongoing basis.

Thus, as it has in the past, the Bank will apply considerable judgment in the use of the CPIX and other measures of core inflation, in conjunction with other indicators, to assess the underlying trend in inflation, with the goal of keeping total CPI inflation on target over time.

¹ To construct the CPIX, the following eight components are excluded from the all-items index: fruit and vegetables, gasoline, fuel oil, natural gas, intercity transportation, tobacco, and mortgage-interest costs. The effects of changes in indirect taxes on the remaining CPI components are also excluded.

stability of inflation expectations during the crisis, which remained well anchored to the 2 per cent target (**Chart 3**).²

Beyond the monetary stimulus provided by the Bank within the inflation-targeting framework, the strength of the broader domestic policy and regulatory framework was an essential factor in the Canadian economy's resilience in the face of the global crisis. Years of prudent fiscal policy ensured that Canadian governments had room to manoeuvre in cushioning the shock and contributing to the recovery. Canada's banking system was robust, managed prudently and sufficiently capitalized, and business and household balance sheets were relatively sound.

Canada's inflation-targeting framework has now demonstrated its worth through both tranquil and troubled times. Despite this success, it is incumbent on the Bank to draw the appropriate lessons from the crisis, particularly from the experiences of others for whom price stability proved insufficient to prevent economic and financial disaster. These lessons have shaped the Bank's perspectives on the three questions around which the research agenda on Canada's monetary policy framework has been organized, as discussed in the following sections.

Chart 3: Measures of inflation expectations

Monthly data



a. Forecast 6 to 10 years ahead taken from the semi-annual survey by Consensus Economics Inc.

b. Interest rate differential on 30-year nominal and Real Return bonds (monthly)

Sources: Consensus Economics Inc. and Bank of Canada calculations

Last observation: September 2011

² In addition to inflation expectations, the spread between yields on nominal and Real Return bonds can be affected by a number of factors, including the relative liquidity of the instruments.

2. Targeting a lower rate of inflation

As documented in Section 1, the entrenchment of low, stable and predictable inflation over the past 20 years has improved the economic well-being of Canadians, removing much of the uncertainty and economic costs associated with the high and variable inflation that Canadians experienced in the 1970s and 1980s. Nonetheless, a 2 per cent inflation target does not eliminate all of the costs associated with inflation. Achieving the target still causes the price level to double roughly every 35 years, which may contribute to money illusion and more generally complicate inter-temporal decision-making. At the time of the last renewal in 2006, therefore, the Bank initiated an ambitious research effort to determine whether an inflation target lower than 2 per cent would generate significant net benefits for the economy and for Canadian households.

Based on this research effort, as well as on the experience of recent years, the Bank's view is that an inflation target lower than 2 per cent could be expected to bring some added benefits to Canadians by further reducing the costs associated with inflation. However, pursuing a lower target will also bring additional risks and costs associated with the zero lower bound on interest rates (ZLB), as was brought into stark relief during the recent crisis. In this respect, the net benefits of pursuing a lower target are highly uncertain.

Benefits of lower inflation

The ultimate goal of maintaining low inflation is to preserve the value of money. While many aspects of the economy do reflect and adjust to low, stable and predictable inflation, some costly distortions remain.

Researchers have identified four primary channels through which inflation imposes costly distortions on the economy. First, inflation can introduce uncertainty in that price movements might not provide a clear signal of the relative demand for a given product, leading to erroneous ex post decisions and a misallocation of resources (Lucas 1973). Moreover, since many contracts are specified in nominal terms, the greater variability that is associated with higher inflation can lead to larger random redistributions of income and wealth—for example, as higher unexpected inflation shifts wealth from creditors to debtors by reducing the real value of nominal assets and liabilities. Hence, a lower inflation target can reduce these uncertainties, thereby promoting the more efficient functioning of the economy.³

³ Regardless of the inflation rate being targeted, there is greater uncertainty about the long-run price level under an inflation-targeting regime than there would be in a regime where the central bank attempted to reverse past deviations of inflation from target. The potential for price-level targeting to reduce this form of uncertainty is discussed in Section 3.

Second, various types of price and wage rigidity can make inflation costly (Woodford 2003). To the extent that firms adjust their prices infrequently and in a staggered manner over time, lower inflation reduces price dispersion, which may lead to a more efficient allocation of resources and, hence, higher levels of aggregate output and economic welfare. The price stickiness produced by nominal price contracts can also cause inflation to lower expected profits, leading to a decline in the value placed on innovation, which restrains investment and productivity. Similarly, staggered wage contracts and downward nominal wage rigidity can distort labour markets and the overall economy, with the implications depending on the level of inflation.

Third, inflation, by raising certain types of nominal incomes (interest income and capital gains, for example), increases the real value of tax obligations even if real incomes do not change (Feldstein 1997). This is the case even where the income tax system is fully indexed to inflation, such as in Canada. Furthermore, firms' use of historical cost for inventory investment and depreciation when calculating tax implies that, under circumstances of general price inflation, deductions may be included at too low a real price, leading to an overstatement of corporate profits. This, in turn, raises the effective corporate tax rate and reduces investment.

Fourth, inflation imposes a cost on holdings of highly liquid assets, such as currency, whose zero or minimal rate of return does not fully adjust to inflation.⁴ Lower trend inflation would reduce this cost, thus providing greater incentive to hold transaction balances and facilitating trade. In addition, this would provide lower-income households in particular with a less costly way to save, given the costs associated with insuring against inflation through other financial transactions.

At the time of the last renewal, it had been established that these costs are mitigated to a significant extent by a 2 per cent inflation target. Subsequent research at the Bank has sought to quantify the potential benefits of further reducing the inflation target. This research, concentrating on pricing behaviour and reduced disincentives to holding money, has generally found a stronger case for a lower—if not slightly negative—target rate for inflation (**Technical Box 2**). However, the gains from further reducing inflation in Canada remain subject to considerable uncertainty, since models employed to quantify the additional benefits of lower inflation have produced a range of estimates. Moreover, these models typically abstract from the costs and risks associated with very low rates of inflation. The importance of these costs and risks has been magnified by the experience of the recent crisis, as discussed below.

Costs and risks associated with lower inflation

At the time of the 2006 renewal, it was recognized that the greatest prospective cost associated with an inflation target lower than 2 per cent would be the risk of more frequent and more severe encounters with the zero lower bound on nominal interest rates (Summers 1991). Nonetheless, at that point, only Japan offered a recent example of an economy operating with interest rates effectively at zero. More recently, with many advanced countries, including Canada, hitting the ZLB, the risks and costs associated with the ZLB must now be taken more seriously, although these experiences will be useful in providing additional lessons on how to deal with the ZLB.

⁴ Milton Friedman (1969) noted that money is essentially costless to produce yet facilitated exchange. Since inflation serves as an effective tax on money, Friedman concluded that the inflation rate that would maximize its use and best promote the efficiency of the economy would be negative, and roughly equal to the equilibrium or neutral real rate of interest.

Technical Box 2

New research results on the benefits of lower inflation

The Bank's research since 2006 on the benefits of lower inflation extended earlier work along a number of important lines. In particular, some promising work at the Bank has incorporated growth and nominal wage contracts into a New Keynesian model. Amano, Moran, Murchison and Rennison (2009), for example, study optimal inflation in a model with exogenous productivity growth and staggered nominal price and wage contracts. Their results suggest that negative inflation is optimal. That is, deflation partially compensates for nominal wage rigidity by allowing the real wage to rise as labour productivity improves. When realistic parameters are used, the wage effect is found to have stronger welfare implications than price dispersion, so deflation near the rate of productivity growth is optimal. Amano, Moran, Murchison and Rennison (2009) also find that a move from 2 per cent inflation to the optimum improves welfare to a greater degree than had been estimated in previous studies, particularly those featuring staggered price setting as the only friction.

Amano, Carter and Moran (2010) examine the interaction between inflation and growth in a model where growth is endogenous. The authors find that trend inflation can have a large negative effect on the growth rate of an economy. The model also incorporates staggered nominal price and wage setting. Staggered pricing leads to inefficient pricing decisions and, consequently, to lower levels of expected profits (relative to a zero-inflation economy). Since expected profits are lower, the value of innovation falls, so firms invest less in research and development, thus hindering the growth rate of the economy. This work tends to find welfare gains that are even larger than in Amano, Moran, Murchison and Rennison (2009).

In other work at the Bank, Cao et al. (2010) evaluate the welfare effects of lowering the long-run inflation target in a life-cycle, heterogeneous-agent model of housing, nominal debt and money. Assuming that housing and debt transactions are costly, while money holdings are not subject to any transactions costs, money enjoys a natural advantage as a vehicle for self-insuring against idiosyncratic earnings risk. The authors find that reducing the long-run rate of inflation from 2 per cent to 1 per cent reduces the cost of holding money and therefore facilitates the use of money for self-insurance. They conclude that a reduction in the rate of inflation would increase welfare, both in aggregate and for the majority of the population.

The lower the inflation target, the lower the “equilibrium” nominal policy interest rate will be, and thus the more likely that shocks will push interest rates to the ZLB during “normal” times. Research at the Bank and elsewhere suggests that encounters with the ZLB should be quite rare at a 2 per cent inflation target, but may be four times more likely at a 1 per cent target and 16 times more likely at a zero per cent target, with these lower targets making it likely that the ZLB will be encountered through the ordinary course of the business cycle.⁵ Moreover, not all of the models used to produce these estimates fully account for tail risks and adverse financial feedback loops like those observed during the crisis, nor do they all incorporate the likelihood that the equilibrium real interest rate has declined over time. Properly accounting for these factors may imply even greater risk of hitting the ZLB.⁶

⁵ These values are based on work by Murchison (forthcoming).

⁶ See Chung et al. (forthcoming).

The costs of hitting the ZLB depend on the effectiveness, reliability and costs of available unconventional policy instruments (**Technical Box 3**). Central banks stuck at the ZLB in recent years have developed and implemented a number of these unconventional tools. In Canada, the Bank was able to influence interest rate expectations and provide additional easing even after its target interest rate had hit the lower bound, by committing to keep the overnight interest rate exceptionally low, conditional on the outlook for inflation (He 2010). Other central banks, such as the U.S. Federal Reserve, have used similar extraordinary policy guidance, as well as more ambitious unconventional tools such as quantitative easing (QE) and credit

Technical Box 3

Costs of and responses to the zero lower bound on interest rates

Under current institutional arrangements, nominal interest rates cannot fall below zero, since agents can always hold zero-yielding currency.¹ Nonetheless, there may be circumstances where a central bank would like to lower nominal interest rates below zero in order to achieve the sufficiently negative real (inflation-adjusted) interest rates needed to stimulate the economy in response to a large negative shock. In the aftermath of the 2008 crisis, the zero lower bound (ZLB) on interest rates became just such a binding constraint for many central banks, which were then forced to use unconventional monetary policy tools, such as extraordinary forward guidance, quantitative easing and credit easing.

Initial assessments and subsequent research have led to an emerging consensus that credit easing and asset purchases succeeded in reducing credit spreads and yields, thereby providing further easing of financial and monetary conditions and stimulating aggregate demand. These policy measures were most effective when they were (i) targeted to specific market failures, (ii) sufficiently large relative to the targeted market, and (iii) clearly communicated. The effectiveness of such policies, however, appears to depend crucially on underlying financial and economic conditions. While unconventional policies implemented during the crisis were generally successful, their effectiveness under less-disruptive market conditions remains an open question.² Moreover, unconventional policies can have important negative externalities, including potential financial market distortions and, ultimately, concerns with respect to central bank credibility and independence (Kozicki, Santor and Suchanek 2011). Finally, there is uncertainty about the exit from unconventional policies, in particular regarding the challenge of smoothly unwinding these policies (which often result in significant changes to the size and composition of central bank balance sheets) once economic conditions warrant monetary policy tightening. In sum, the ZLB will remain a constraint to the extent that unconventional policy tools may be more costly and/or less reliable and effective than the conventional interest rate instrument.

¹ In practice, the effective lower bound for nominal interest rates is not precisely zero. In the aftermath of the crisis, most central banks, including the Bank of Canada, stopped short of lowering policy interest rates to zero in order to preserve the efficient functioning of short-term financial markets. On the other side, negative nominal interest rates are possible and have been observed on occasion, although generally as a result of transitory technical factors; current institutional arrangements in most countries make negative interest rates difficult to engineer.

² For instance, the magnitude of the effects of the Federal Reserve's second round of large-scale asset purchases (dubbed QE2) seems to have been more modest than for the first round of purchases. This may be because the first round was implemented at a time of considerable strain in financial markets, severely weakened macro-economic conditions and low confidence, while the second round took place in an overall improved financial and economic environment, implying fewer distortions to be mitigated by the interventions.

easing (QE). QE and CE have provided additional stimulus, lowering interest rates across the yield curve and compressing the spreads between the interest rates on private and government securities.

The costs associated with some of these unconventional policy tools will only be known over time. These costs could include financial market distortions and logistical difficulties in managing and eventually unwinding large holdings of securities. With many central banks now employing a variety of unconventional policy instruments at the ZLB, a better understanding of the size and nature of these costs, and of the effectiveness and reliability of the tools themselves, should become available in the period ahead.

There are several ways that the risks and costs associated with the ZLB could be reduced, which, in turn, would lessen the risk of moving to a lower inflation target. Most important in this regard are the comprehensive financial sector reforms being undertaken by the G-20. These reforms are expected to significantly reduce the size and frequency of financial shocks, as well as the variability of real output. Another possible solution is price-level targeting. As is explored in the next section, the additional stabilizing properties of a price-level target might allow central banks to provide greater certainty concerning the long-run value of money while helping to mitigate the risks associated with the ZLB. Finally, it is possible that unconventional monetary policy tools will prove to be more effective on net, under both ordinary and extraordinary circumstances, than is currently thought.

In addition to the risks associated with the ZLB, two other potential costs of moving to an inflation target lower than 2 per cent were identified at the time of the 2006 renewal: measurement bias in the CPI and downward nominal wage rigidities. The Bank continues to view neither as a significant impediment to adopting a lower inflation target. Measurement bias in the CPI in Canada appears to be small and relatively stable over time. Updated research at the Bank puts the measurement bias in Canada's CPI inflation at around 0.5 per cent, similar to that estimated in previous studies.⁷ Downward nominal wage rigidities are a risk because a lower inflation target would make it more likely that some nominal wages will occasionally need to decline to facilitate economic adjustment. If workers are reluctant to accept these declines, the process of real adjustment in the labour market will be impeded, inhibiting the efficient functioning of the economy. In other words, a positive inflation target "greases the wheels" of the economy. While there is some evidence of downward nominal wage rigidities in Canada, their effects do not appear to be economically significant (Crawford and Wright 2001).

The bottom line

The economic benefits of lower inflation have been brought into sharper relief by recent research, strengthening the case for a lower inflation target. However, research and, more importantly, experience have also highlighted the sizable risks associated with the ZLB and thus the pursuit of a lower inflation target. While the prospective benefits of a lower inflation target are believed to be greater than previously estimated, before these benefits can be pursued with confidence, central banks must find a way to limit the probability of hitting the ZLB and to deal with it more effectively when they do hit it. In sum, while the prospective benefits of a lower inflation target look greater than they did in 2006, so do the risks.

⁷ See Sabourin (forthcoming); Rossiter (2005); and Crawford (1998).

3. Price-level targeting

While Canada's inflation-targeting (IT) framework has successfully reduced the uncertainties and costs associated with high and volatile inflation, it might be possible to further reduce uncertainty regarding the long-run price level. Under the current IT framework, bygones are bygones. In other words, monetary policy focuses on achieving the inflation target on a forward-looking basis, ignoring past deviations between actual and targeted inflation. To the extent that these deviations accumulate, the expected price level becomes increasingly uncertain as one looks further out into the future.

An alternative regime, price-level targeting (PLT), could address this source of uncertainty. Under PLT, monetary policy would seek to make up for past deviations in order to restore the price level to a predetermined path. For example, following a period of below-target inflation, policy would seek a period of above-target inflation in order to ensure that average inflation corresponds to targeted inflation (the desired rate of change in the price level) over time (**Technical Box 4**). In addition to providing greater price-level certainty over the long run, theory suggests that a PLT regime may also result in greater macroeconomic stability over shorter horizons (Svensson 1999). At the time of the 2006 renewal, the Bank launched an ambitious research effort to investigate this possibility for Canada, asking, "Would a price-level target produce significant net benefits for the economy and for Canadian households?"

Informed by the research, it is the Bank's view that realizing the theoretical net benefits of PLT would likely be challenging in practice. Recent research has shown that modest, but economically significant, potential gains from PLT can be found in the most favourable model simulations, with these gains prospectively enhanced once the costs and risks of the ZLB are incorporated. However, these models assume that agents are forward-looking, fully conversant with the implications of PLT and trust policy-makers to live up to their commitments. While positive, albeit smaller, net gains from PLT may still be available if these conditions are not fully satisfied, it is not presently clear that they would be sufficiently satisfied in the real world for the Bank to have confidence that PLT could improve on the current inflation-targeting framework.

Technical Box 4

The difference between inflation targeting and price-level targeting

Inflation targeting (IT) and price-level targeting (PLT) have different implications for the short- and long-run behaviour of inflation and the price level. For example, consider the consequences of a temporary shock that raises inflation.¹ Under IT, the central bank would tighten monetary policy in order to return inflation to target. In the absence of any additional shocks, the increase in inflation would be temporary—inflation would eventually return to target and remain there. **Figure 4-A (i)** provides an example of the time profile of inflation under IT. Although the increase in inflation is only temporary, the consequent increase in the price level is permanent. Hence, in the absence of additional offsetting shocks, the price level will be permanently higher (**Figure 4-A (ii)**).² This is often referred to as “base drift” in the price level.

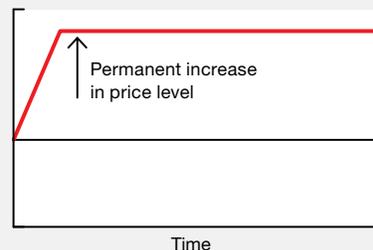
In contrast, under PLT, the central bank aims to return the price level to some target path—base drift is eliminated. Consider again the example of a temporary shock that raises inflation. Higher inflation implies that the price level rises. To return the price level to target, the central bank must now do more than simply return inflation to its trend level. It must keep monetary policy tight for a longer period in order to push inflation below trend, thereby bringing the price level back down to its target (**Figure 4-B**).

Figure 4-A: Inflation and the price level under inflation targeting

(i) Inflation



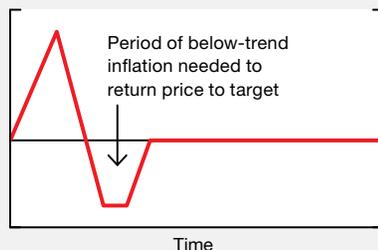
(ii) Price level



Source: Bank of Canada calculations

Figure 4-B: Inflation and the price level under price-level targeting

(i) Inflation



(ii) Price level



Source: Bank of Canada calculations

¹ Under a temporary shock that reduces inflation, the dynamics described here would be equivalent but would run in the opposite direction.

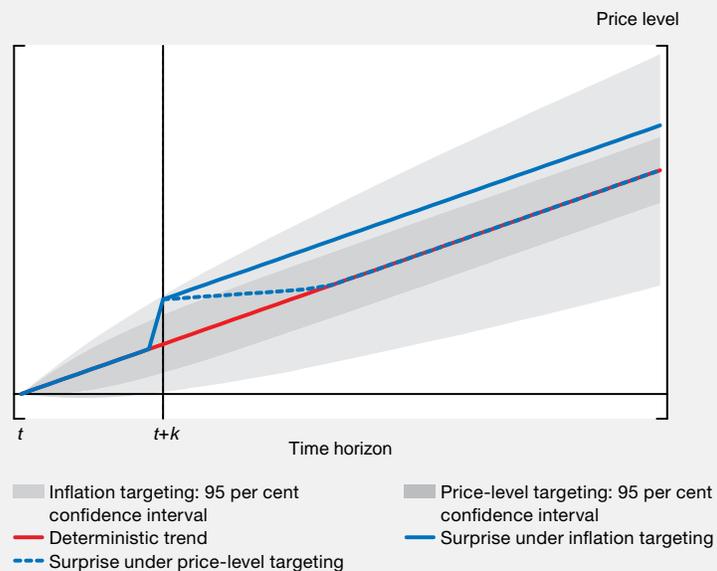
² The price-level plots in Figures 4-A and 4-B are drawn relative to a deterministic trend. Under a 2 per cent inflation target (or 2 per cent trend inflation under PLT), the deterministic trend of the price level would increase by 2 per cent per year. Incorporating such a trend into the figures would cause the price-level paths to have an upward slope, without changing any of the substantive conclusions.

Technical Box 4 (continued)

As noted in the text, the base drift in the price level that accompanies IT has an undesirable implication: uncertainty about the price level grows as one looks further into the future, because bygones are bygones under IT. Since an inflation-targeting central bank does not attempt to reverse price-level movements, temporary deviations of inflation from target can have permanent effects on the price level. As the effects of such deviations accumulate over time, the price level can, in principle, wander far from its expected path.

On the other hand, a price-level targeting central bank would take actions to undo the effects of shocks on the price level, thus limiting the degree of uncertainty at all horizons (**Figure 4-C**).³

Figure 4-C: Price-level uncertainty: Inflation targeting vs. price-level targeting



Source: Bank of Canada calculations

³ In Figure 4-C, the price level will lie within the light grey-shaded region in 95 per cent of possible cases under IT, while under PLT, it will lie within the narrower dark grey-shaded region in 95 per cent of cases. These confidence intervals, generated with a simple New Keynesian model (e.g., Woodford 2003) contrast the growing price-level uncertainty under IT with the finite uncertainty under PLT. These are general features of IT and PLT. The price level (and the associated confidence interval) trend up over time because the figures are drawn under the assumption of a positive inflation target or positive trend inflation under PLT. More generally, the trend could have any slope, depending on the assumed average rate of inflation. In particular, with zero average inflation, the trend would be flat. Moreover, the precise shape and width of the bands can vary with the assumed model and policy rules. Hence, no quantitative significance should be attributed to these intervals (and for this reason, the axis scales have been omitted). The solid and dashed blue lines provide examples of the price-level dynamics that would follow an inflation surprise at time $t+k$ under IT and PLT, respectively.

Benefits of price-level targeting

There are two ways that price-level targeting could be expected to improve on inflation targeting with respect to the economic welfare of Canadians: greater long-run certainty about the price level and greater short-run macroeconomic stability. Since real-world experience with PLT is limited to a brief

period in the 1930s when Sweden adopted it,⁸ the Bank has employed a variety of model simulations to try to quantify these two sources of potential benefits from PLT.

First, greater long-run certainty about the price level should be a source of increased welfare for savers and investors. Unexpected movements in the aggregate price level would lead to fewer arbitrary redistributions of wealth if people understood that these deviations would be reversed in the future, as required under a PLT regime. Meh, Ríos-Rull and Terajima (2010) find that such arbitrary inflation-induced redistributions of wealth could be reduced by a factor of three, compared with those in an IT regime, with the benefits accruing principally to those in lower-income brackets.⁹ In addition, one would expect that greater certainty about the long-run price level would lead to lower risk premiums on long-term bonds, reducing the cost of capital, raising the level of fixed investment and generating a higher level of economic activity. Meh, Quadrini and Terajima (2009) suggest that PLT could thus substantially raise capital investment.

Second, under PLT, the central bank's credible commitment to reverse deviations in the price level from its targeted path leads expectations to automatically "lean against" shocks, thus mitigating their impact. For example, the knowledge that policy will act to generate a period of above-target inflation following a period of below-target inflation discourages firms from moving prices as dramatically in response to the initial shock, and the residual increase in near-term inflation expectations would encourage higher current spending, providing a further stabilizing effect (**Technical Box 5**). This self-correcting aspect of PLT is found to result in less-volatile employment, inflation, interest rates and economic output across a wide range of models, compared with an IT regime. Based on simulations using the Bank's main projection model, ToTEM, the benefits of this greater prospective stabilization under PLT are comparable to a 25-basis-point reduction in the standard deviation of inflation. While such a reduction is much smaller than that realized upon the introduction of inflation targeting in Canada in the 1990s, it is not economically insignificant. An alternative approach estimates that the gains from PLT would be equivalent to a permanent increase in the level of Canadian consumption of about 0.6 per cent (De Resende, Dib and Kichian 2010).

The stabilizing properties of PLT could also make encounters with the zero lower bound less frequent than under IT, and the automatic movement of expectations under PLT should make any encounter with the ZLB easier to get out of. The more the price trend undershoots the target, the more the central bank would need to stimulate the economy to make up the undershoot, and the more inflation expectations would thus be expected to rise and real interest rates to fall (as long as the commitment to making up the undershoot remains credible), thus supporting spending and prices. Until recently, models have not typically accounted for this potential benefit of PLT, although its value has come to be better appreciated in light of the experience of recent years. Indeed, model simulations that explicitly incorporate costs associated with the ZLB have estimated that switching from IT to PLT would yield substantially higher economic benefits than those quoted above.¹⁰

⁸ A description of PLT in Sweden is given in Berg and Jonung (1999). It has also been argued that policies adopted in the United States during the Great Depression amounted to a de facto regime of price-level targeting. See, for example, Eggertsson (2008).

⁹ The extent of the difference in redistributions under the two regimes is determined by the use of long-term nominal assets and liabilities in the economy. Doepke and Schneider (2006) and Meh and Terajima (forthcoming) find that households in the United States and Canada hold large proportions of their nominal assets and liabilities in long-term forms (e.g., pensions and mortgages).

¹⁰ See Coibion, Gorodnichenko and Wieland (2010).

Technical Box 5

The importance of expectations in a price-level-targeting regime

Expectations can play an important stabilizing role under PLT, if economic agents understand the mechanics of the regime, perceive it to be credible and behave in a forward-looking manner. As explained in Technical Box 4, implementing a price-level target requires the central bank to ensure that periods of above-trend inflation are followed by periods of below-trend inflation and vice versa. It is the anticipation of these inflation dynamics that can lead economic agents to behave in a stabilizing manner under PLT.

Consider a situation under PLT in which the price level is above target. If agents understand the regime and believe that the central bank will do what is necessary to return the price level to target, they should expect below-trend inflation in the future. This expectation has two important consequences. First, to the extent that firms plan to keep the prices they set today in place for several periods, the expectation of lower inflation in the future will lead them to attenuate price increases today. Second, the expectation of lower inflation in the future raises the real interest rate (the interest rate adjusted for expected inflation). It is the real interest rate that affects the consumption, saving and investment decisions of households and firms. A higher real interest rate causes economic agents to save more and spend less, thereby diminishing demand. Both channels bring inflation down by reducing firms' incentives to raise prices, thus requiring smaller adjustments in production. In contrast, under IT, expectations do not play as much of a stabilizing role, since agents have no reason to expect that periods of above-target inflation will be followed by periods of below-target inflation.

The stabilizing properties of expectations under PLT hinge critically on the assumptions that PLT is understood and perceived to be credible, and that agents make decisions in a forward-looking manner. Recent research has explored the implications of relaxing those assumptions. In particular, work at the Bank and elsewhere has considered the possibility that some agents use simple rules of thumb to make decisions. These rules of thumb may embody alternative types of expectations formation, including the expectation that future inflation will be equal to inflation in the recent past (backward-looking) or that future inflation will be equal to the target or average level of inflation (static). These alternatives undermine the performance of PLT by eliminating the stabilizing effect of the expectation that the price level will systematically return to target (Amano, Mendes and Murchison 2009). The quantitative implications of alternative types of expectations formation are sensitive to the models in which they are embedded. Nevertheless, simulations using ToTEM and other models at the Bank suggest that as the proportion of agents with forward-looking expectations declines toward 50 per cent, the advantages of PLT over IT appear to diminish quickly.¹

Assessing how economic agents actually form expectations is difficult. Making such an assessment for a hypothetical PLT regime is complicated by the virtual absence of real-world experience with the regime. In an attempt to shed some light on this issue, researchers are applying the techniques of experimental economics to infer the extent to which experimental participants can forecast inflation in a simulated PLT environment (Amano, Engle-Warnick and Shukayev 2011). The results indicate that agents' expectations do adjust in order to take

¹ For example, see Murchison (forthcoming).

Technical Box 5 (continued)

into account the tendency of the price level to return to a predetermined target under PLT. Nevertheless, agents do not fully exploit the implications of PLT when forming their expectations. These experiments constitute a useful starting point that could be refined along a number of margins. In particular, further study could shed light on the types of information and communication that might facilitate understanding of a PLT regime.

Challenges associated with price-level targeting

The models identifying prospective benefits from switching to PLT from IT generally assume that agents are forward-looking, are fully conversant with the implications of PLT and trust policy-makers to live up to their commitments. If these conditions do not hold fully, as indeed they are unlikely to do in the real world, the net benefits of PLT would be reduced or even reversed.

For PLT to improve on IT, expectations must move the “right” way. Households and firms must understand that their medium-term inflation expectations should rise (fall) when actual inflation falls (rises), in order to produce the automatic stabilization benefits of PLT. If expectations do not move in this manner, PLT could be destabilizing relative to IT. The extent to which people need to form their expectations in a way that reflects a forward-looking understanding of PLT, and the extent to which they could actually be expected to do so upon the introduction of a PLT regime, are both open questions that are under investigation (**Technical Box 5**).

Effective central bank communications could help agents better understand the implications of PLT, although the challenge would be greater than under the current IT regime, since it would involve shifting their focus from the rate of inflation to the position of the price level, a shift that might not come naturally. Some of the communications challenges under PLT could be reduced if the targeted price level incorporated no trend (i.e., a zero per cent inflation target that makes up for past deviations), since the central bank would be committing to the easily understood goal of maintaining the price level constant over time.

The benefits of PLT also rely on the full credibility of the central bank’s commitment to make up for past deviations in prices from the targeted path. If, for example, agents doubted the central bank’s willingness to cause substantial losses in output by tightening policy in order to reverse an upside surprise to the price level, expectations will not move as needed to produce the automatic stabilizing benefits of PLT. In fact, this dilution of the expectations channel could destabilize the economy, even in a self-reinforcing manner, since larger movements in output and interest rates would then be necessary to produce the desired movement in the price level—in turn amplifying doubts about the central bank’s willingness to take these steps. Clearly, under such circumstances, the potential for greater long-run price-level certainty under PLT would also be lost. Model simulations suggest that if agents attach even a small probability to the central bank using an “escape clause” to let bygones remain bygones, PLT may be inferior to IT.¹¹

Research at the Bank has diminished concerns regarding a potential third challenge to PLT, related to externally driven relative price shocks. Canada’s small, open economy is commonly subject to such shocks, which often

¹¹ See Cateau et al. (2009); Masson and Shukayev (2011); and Kryvstov, Shukayev and Ueberfeldt (2008).

stem from changes in the global supply of and demand for commodities. While the current IT framework “looks through” one-off shocks, PLT would require that policy move so as to produce relative changes in other prices to offset the shock. For example, under PLT, a large increase in oil prices would necessitate relative declines in other prices in order to restore the price level to its desired trend. To the extent that those other prices proved to be sticky, generating the required adjustment might introduce greater volatility in output, inflation and interest rates than under IT. Model simulations suggest, however, that the increase in volatility stemming from relative price shocks in Canada would be more than offset by the stabilizing movement of expectations under a PLT regime, although this again relies on expectations moving the “right” way under a credible regime.¹²

The bottom line

Given the current state of knowledge, the potential benefits of PLT in increasing long-term certainty about the price level and providing greater short-term macroeconomic stability, relative to the current IT framework, do not clearly outweigh the costs and risks associated with real-world expectations and credibility falling short of the model ideal.

This assessment could change in the future, however. First, further research, as well as the development of effective communications strategies, might provide some assurance that PLT would be sufficiently well understood, acted upon and credible that the prospective benefits of a PLT regime could be expected to emerge. Second, the benefits of PLT could eventually come to be seen as more valuable than they currently appear. For example, the potential for PLT to reduce the frequency and impact of encounters with the ZLB would decrease the risk of moving to a lower inflation trend. The potential for PLT to provide longer-term price-level certainty would better anchor expectations when using flexibility to address financial stability considerations (Carney 2009), as is discussed in Section 4.

¹² See Coletti, Lalonde and Muir (2008) and Murchison (2010).

4. Monetary policy and financial stability

The financial system is an integral part of the economy. Financial intermediation is a key enabler of economic activity, channelling savings to productive investments and helping households and businesses to manage risk. Better allocation of capital and better risk management ultimately lead to improved standards of living. But, as the recent global financial crisis illustrated, a breakdown in this intermediation process can have severe consequences for the economy. In response to this experience, the Bank added a third question to its renewal research agenda, asking to what extent monetary policy should take account of financial stability considerations.

This question long predates the crisis, but has taken on added importance in recent years. The Bank's view on this issue has likewise evolved over time. In the past, the question had been framed to ask whether central banks should respond to asset prices. In the late 1990s and early 2000s, the Bank's view was that asset prices were relevant for the setting of monetary policy only to the extent that they helped forecast output and, ultimately, inflation. With this viewpoint, any response to movements in asset prices would simply occur as a matter of course in the pursuit of price stability. Furthermore, while it was clear that asset prices could become severely misaligned, it was thought that the best contribution that a central bank could make to economic stability in the context of an asset-price bubble would be to minimize the damage associated with the bursting of the bubble by reacting with timely remedial action after it had occurred.

At the time of the last renewal of the inflation-targeting agreement, however, the Bank recognized that because the effects of financial imbalances on output and inflation could manifest themselves over a long period of time, some flexibility might be needed with regard to the time horizon over which inflation should be expected to return to target. While this flexibility might involve sacrificing some inflation performance over the usual policy horizon, it would lead to greater financial, economic and, ultimately, price stability over a somewhat longer horizon. As explored later in this section, the recent crisis has further refined the Bank's understanding of how this flexibility should be applied. In particular, this experience has underlined the importance of focusing on indebtedness rather than asset prices as a defining feature of dangerous financial imbalances, as well as the scope for policy to be pre-emptive in addressing these imbalances as they build rather than just after they unwind.

Over the past 20 years, the nature of the shocks hitting the economy typically made it desirable to return inflation to target over a period of 6 to 8 quarters. There has been considerable variation in this horizon, however, as befits the response of a flexible inflation-targeting approach to different circumstances and types of shocks. Owing to the stability of Canada's financial system over the past two decades, the Bank has not actually had occasion to make pre-emptive use of the flexibility of the inflation-targeting regime in response to a buildup of financial imbalances. Nonetheless, recent experience in many other countries has demonstrated the value of such flexibility, and thus the potential need for its use in Canada to be treated as more than just a theoretical possibility.

Lessons from the crisis

In addition to underlining the importance of the flexibility inherent in Canada's approach to inflation targeting, the recent experience abroad has provided further important lessons regarding the nature of the interactions between the financial sector and the economy, which must inform the evolution of Canada's macroeconomic and regulatory policy approach to financial stability.¹³

First, the recent crisis clearly demonstrated that not all financial imbalances are created equal. Experience has shown that imbalances fuelled by a credit boom, which may manifest itself in asset-price movements, pose the greatest risk to the economy, because of the powerful deleveraging process they induce when they unwind (**Technical Box 6**). When exuberant credit creation is not part of the buildup of financial imbalances, the deleveraging process and the consequences for the economy are not as dramatic.

Second, recent experience has also reminded us that the seeds of crisis can be sown in tranquil times. A stable economic environment can itself contribute to the buildup of financial imbalances as complacency sets in, risk aversion diminishes and the capacity of the financial sector to take on leverage increases (**Technical Box 7**). This buildup of vulnerabilities and imbalances can evolve over a long period, slowly exposing the wider economy to increasing risk of financial crisis. In short, macroeconomic stability clearly does not guarantee financial stability.

Third, the crisis exposed the fallacy of composition that strong individual financial institutions, while necessary, are not sufficient to ensure the safety and soundness of the financial system as a whole. Actions that may appear individually appropriate can be collectively destabilizing, particularly in times of stress. For instance, an institution might be sufficiently sound to absorb an adverse shock as long as the shock affects only that institution. But the same institution might not be able to absorb the shock if many other institutions are exposed to it as well, and it leads to a generalized deleveraging and fire sales of assets. The crisis also revealed the extent to which the deep interconnectedness of the financial system can produce important vulnerabilities, since the tight and complex links among financial institutions and markets were shown to be capable of generating, transmitting and amplifying shocks with outsized consequences for the system as a whole.¹⁴

¹³ See Borio (2011) for a recent summary of the lessons from the crisis and the potential implications of these lessons for monetary policy and regulation.

¹⁴ See Brunnermeier and Pedersen (2009); U.K. Financial Services Authority (2009); Group of Thirty (2010); and Hanson, Kashyap and Stein (2011).

Technical Box 6

Financial imbalances are not all created equal

Financial imbalances that involve credit excesses have been shown to pose a greater threat to macroeconomic and financial stability than those that do not. Easy access to credit amid exuberant economic expectations leads to increased demand for assets, pushing their prices higher, which can in turn collateralize an even greater expansion of credit. This mutually reinforcing feedback loop between credit creation and asset prices leaves an economy increasingly vulnerable to adverse shocks, the incidence of which can spark a sudden and powerful feedback loop in the other direction—a forced deleveraging process whereby a drop in confidence and economic activity weakens balance sheets, leading banks to reduce credit and tighten lending standards, in turn further reinforcing the decline in confidence and economic activity. The more powerful these credit-facilitated feedback loops become, the greater the excesses through the boom, and the greater the weight of the resulting debt and capital stock overhangs on the economy will be—restraining consumption and investment, disrupting financial intermediation and putting pressure on government budgets.¹

Recent experience reinforces the compounding role of credit in financial boom-and-bust cycles. The scale and scope of the credit excesses seen in the countries at the centre of the recent global crisis, and the severity of the crisis and its aftermath, are unmatched in the post-Second World War era. In contrast, the technology bubble of the late 1990s featured an equity-price boom that was not significantly funded by excess credit, and the unwinding of that imbalance resulted in a relatively short and mild recession.

Research has more systematically verified the critical role of credit in the incidence and severity of financial imbalances. There is considerable cross-country evidence that banking crises tend to be preceded by unusually strong credit (as well as asset-price) booms and tend to be followed by slow, protracted recoveries associated with permanent output losses.² For example, Reinhart and Reinhart (2010) find that in the decade following severe financial crises, growth rates tend to be 1 percentage point lower and unemployment rates 5 percentage points higher; recent work by the Basel Committee on Banking Supervision (BCBS) in the context of Basel III reviews the literature on the cost of financial crises, and notes the enormous potential costs in terms of foregone GDP. Research at the International Monetary Fund (IMF) finds specifically that recessions associated with severe credit crunches tend to result in a cumulative loss of output roughly twice as large on average as those that do not feature credit crunches. The IMF analysis finds further that a bust in house prices also tends to be associated with a longer and deeper recession, although not to the same extent as indicated by a credit crunch. The effects of a bust in equity prices are found to be smaller still.

Since financial imbalances associated with a credit boom are particularly dangerous and broad-based in their impact, various measures of credit contain useful information about the buildup of financial vulnerabilities.³ One measure of leverage, the ratio of total private sector credit to GDP relative to trend, has been identified in a number of studies as a particularly informative indicator of

¹ Adrian and Shin (2010) provide a summary of the dynamics of these feedback loops.

² See Claessens, Kose and Terrones (2009); Haugh, Ollivaud and Turner (2009); BCBS (2010a); and Crowe et al. (2011).

³ See Kaminsky and Reinhart (1999) and Borio and Lowe (2002).

Technical Box 6 (continued)

financial vulnerability, and is employed by the BCBS in its “Guidance for National Authorities Operating the Countercyclical Capital Buffer.”⁴

The important lesson here is that not all financial imbalances are created equal, and this requires policy-makers to pay particular attention to credit in taking a multifaceted approach to financial stability.

⁴ See Basel Committee on Banking Supervision (2010b).

Technical Box 7

A stable macroeconomic environment could foster excessive risk-taking behaviour

The most recent financial crisis developed against a backdrop of a long period of economic stability, demonstrating that macroeconomic stability does not guarantee financial stability. In fact, it may cause instability to develop by inducing excessive risk-taking behaviour. Two channels through which this could happen have received particular attention:

- **Extrapolative expectations**

During long periods of economic stability, people can become complacent, believing that good times and low interest rates are here to stay. This can induce them to become overconfident and underestimate risk, leading to lower risk premiums and deteriorating lending standards. In fact, system-wide risks are often at their peak when typical measures of risk are at their lowest.¹

- **Search for yield**

In a low interest rate environment, contracts and incentives can also push investors to actively search for higher returns and take on more risk. For instance, financial institutions with contractual obligations to deliver pre-established minimum returns may be forced to switch to riskier, higher-yielding assets. Furthermore, the structure of compensation for financial market participants can be tied to short-term market performance, providing an incentive to take on excessive risks.²

There is growing empirical evidence on the importance of these channels. Periods of reduced economic volatility and low risk premiums are typically associated with rapid credit growth, which seems to reflect at least in part financial intermediaries engaging in riskier activities. For example, in periods of low interest rates, financial institutions tend to rely more heavily on market-based short-term financing. During periods when risk is perceived to be low, banks tend to be more willing to lend to borrowers with bad credit histories and more uncertain prospects, while the leverage taken on by banks can be about 20 per cent

¹ Borio and Zhu (2008) discuss the need to incorporate risk-taking channels in monetary policy analysis, including that of extrapolative expectations. Sims (2009) argues that rational inattention and differences of opinion in expected inflation can generate excess investment in real capital. See also Dubecq, Mojon and Ragot (2009); Adrian and Shin (2010); and Dell’Ariccia, Laeven and Marquez (2010).

² Rajan (2006) describes how a low interest rate environment following a high-rate period gives market participants an incentive to search for yield. Carney (2010) discusses the factors that have led to a low interest rate environment in major advanced economies and the implications for financial stability and economic growth. Diamond and Rajan (2009) identify the search for yield to be one proximate cause of the crisis.

Technical Box 7 (continued)

higher.³ Corroborating this evidence, empirical studies suggest a greater probability of bank defaults following an extended period of low interest rates.⁴

Expectations concerning the policy response can create moral hazard problems that exacerbate these risk-taking channels. In particular, financial institutions might take on more risk if they expect public authorities to absorb part of the losses in the event of a large negative shock, making the entire financial system more vulnerable.⁵

- 3 Adrian, Moench and Shin (2010) analyze how risk premiums and intermediary balance sheets are connected. Gertler, Kiyotaki and Queralto (forthcoming) use a structural macroeconomic model with financial intermediation to analyze the risk-taking behaviour of banks. Jiménez et al. (2008; forthcoming) and Maddaloni and Peydró (2011) investigate the effects of monetary policy on the credit risk of individual bank loans and on lending standards. Progress is also being made on these issues at the Bank of Canada (e.g., Cociuba, Ueberfeldt and Shukayev (forthcoming); Damar, Meh and Terajima (2010); and Paligorova and Santos (2011)).
- 4 For instance, if interest rates are kept low for 10 consecutive quarters, all else being equal, the probability of default for an average bank goes up by about 3.3 per cent (Gambacorta 2009). See also Altunbas, Gambacorta and Marques-Ibanez (2010) for a complementary analysis.
- 5 Farhi and Tirole (forthcoming) analyze a mechanism in which institutions adopt a more risky balance sheet as authorities intervene to support distressed institutions. A similar result is also found in Gertler, Kiyotaki and Queralto (forthcoming).

Broad policy implications

Clear implications for policy-makers emerge from these lessons. First, if financial imbalances are not all created equal, they cannot all be treated equally, with credit-fuelled imbalances, which have been shown to be most dangerous, requiring particular attention. Second, the potential for financial imbalances to build during periods of tranquility underscores the need for policy-makers to exercise constant vigilance. Third, a greater appreciation of system-wide risks requires a greater focus on system-wide vulnerabilities.

The first line of defence against a buildup of financial imbalances is responsible behaviour by individuals and institutions. Next comes regulatory and supervisory policy, or what might be termed “microprudential” policy. Stress testing should focus on excessive mismatches in maturities and currencies, look for evidence of forbearance (such as ailing industries receiving a disproportionate share of loans or the loosening of standards for existing debtors) and analyze the impact of sharp moves in yield curves. This is reflected in a major reform of the regulatory and supervisory framework currently under way at the international level. Basel III and other G-20 initiatives will help to make the global financial system more resilient, ultimately benefiting Canadians. In particular, the introduction of a maximum leverage ratio in those countries that did not previously have one, as well as new trading book rules and liquidity standards, will help curtail excessive leverage and maturity transformation.

Reflecting the lessons of the crisis, the regulatory and supervisory approach is being enhanced by the adoption of a system-wide perspective, with new macroprudential measures under development. In addition to the greater quality and quantity of capital, the Basel III agreement also provides for the introduction of a countercyclical capital buffer ranging from 0 to 2½ per cent of risk-weighted assets. Deploying this buffer will further increase the resilience of the system in the event a crisis occurs and, by leaning against excessive credit creation, may help prevent a crisis by mitigating the buildup of system-wide risk. Importantly, starting in 2016, internationally active

Canadian financial institutions will be required to build up such a buffer if they have exposure to a foreign jurisdiction that has implemented the requirement, whether or not Canada has activated its own buffer. In addition, other macroprudential measures are under consideration, such as through-the-cycle margining that would help curtail liquidity cycles.

Monetary policy implications

These defences will go a long way to mitigate the risk of financial excesses, but in some cases, monetary policy may still have to take financial stability considerations into account.

First, as the Bank has made clear in the past, to the extent that financial imbalances affect the near-term outlook for output and inflation, financial stability considerations are already taken into account in the setting of monetary policy. For example, exuberance in financial markets that leads to material inflationary pressures over the projection horizon would be taken into account by monetary policy as a matter of course. Monetary policy may also need to be used to minimize the damage to inflation and output associated with the bursting of an asset-price bubble.

Second, the introduction of the new regulatory and supervisory tools that have been agreed upon will change the behaviour of both the economy and the financial sector. The evolving system-wide approach to financial stability will change the way that monetary policy is transmitted through the economy and, importantly, might also have more direct implications for the setting of monetary policy. For instance, as past experiences suggest, financial vulnerabilities that will require a tightening of the countercyclical capital buffer might arise at a time when there are no visible upside pressures on inflation over the usual policy horizon. The tightening of such a broad-based macroprudential tool will put downward pressure on inflation, which monetary policy will have to take into account (**Technical Box 8**).

Third, in some exceptional circumstances, monetary policy might have to take financial stability into consideration even more directly. Where imbalances pose an economy-wide threat and/or where the imbalances themselves are being encouraged by a low interest rate environment (**Technical Box 7**), monetary policy might itself be the appropriate tool to support financial stability (**Technical Box 8**). Monetary policy has a broad influence on financial markets and on the leverage of financial institutions that cannot easily be avoided. This “bluntness” makes monetary policy an inappropriate tool to deal with imbalances that are of consequence to only a specific sector, but a potentially valuable tool in addressing imbalances that may eventually have economy-wide implications. Furthermore, a general understanding that monetary policy will be employed to counteract the buildup of such risks and imbalances is likely to enhance the stabilizing impact of this approach (Mishkin 2011; Christensen and Meh, forthcoming).

The analysis required to determine whether we are confronted with exceptional circumstances that warrant such a complementary monetary policy response will be similar to, and will build on, the ongoing monitoring required of macroprudential authorities. Because credit-fuelled imbalances are particularly dangerous and broad-based in their impact, monitoring measures of aggregate credit or leverage will be important (**Technical Box 6**). However, imbalances may materialize in different ways and for different reasons, so the assessment of risks and vulnerabilities to the financial system cannot rely solely on a single type of indicator. Other sources of information will be necessary to form a view on the reasons behind the movements in credit, as well as to assess the degree of vulnerability. For

Technical Box 8

In the face of broad-based imbalances, monetary policy might have a role to play

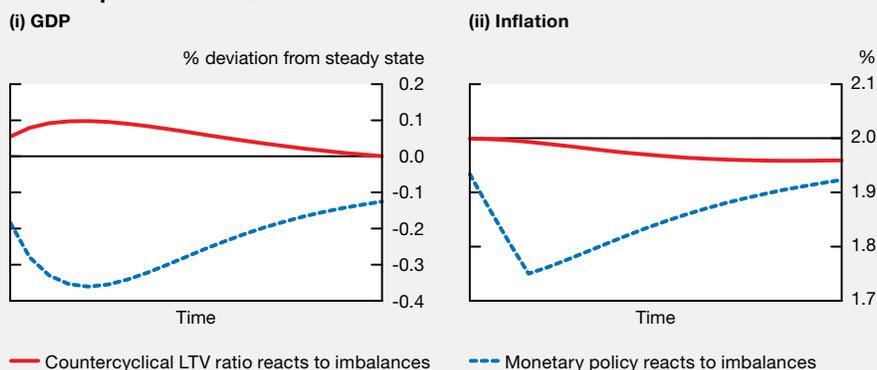
Whether monetary policy should actively respond to financial imbalances depends on their nature.

When financial imbalances remain concentrated in a specific sector, well-targeted macroprudential tools should usually be sufficient. Monetary policy is not well suited to address such imbalances, since monetary policy affects the entire economy, meaning that the interest rate increase required to curtail sectoral imbalances would come at the cost of undue restraint on the economy as a whole. For instance, research at the Bank of Canada has investigated the performance of macroprudential tools and monetary policy in response to a hypothetical rise in exuberance in the housing sector that leads to a surge in household credit.¹ This work suggests that using monetary policy to curtail 60 per cent of the impact on household credit would come at the cost of a decline in output of 0.35 per cent and a fall in inflation to about 0.25 percentage points below its target (Figure 8-A). Using a macroprudential tool in the form of a countercyclical loan-to-value (LTV) ratio can achieve the same dampening effect on the real estate sector with less adverse impact on output and inflation.²

It is possible, however, that financial imbalances could become broad-based, with a significant impact on output and inflation. In such a case, the use of broad-based macroprudential tools would be warranted, and monetary policy might also play a useful role. To the extent that these imbalances generate inflationary pressures, the tightening response of monetary policy will also help support the financial stability objective. In other cases, broad-based financial imbalances could build up without generating significant inflationary pressures.³

For instance, exuberance could stem from excessive optimism about future productivity, which would thus be associated with downward pressures on inflation.

Figure 8-A: Macroprudential tools are sufficient to deal with sector-specific imbalances



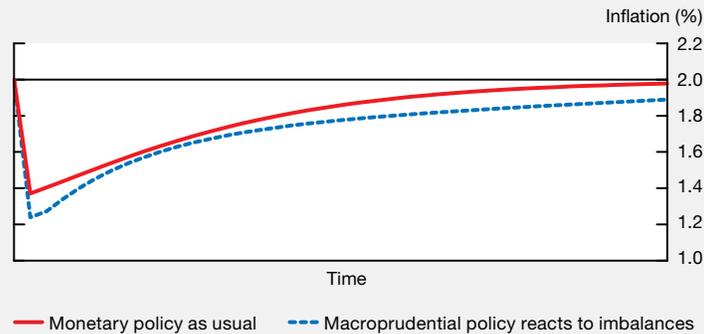
Source: Bank of Canada calculations

- 1 See Boivin, Lane and Meh (2010) for more details and analysis.
- 2 The set of prudential tools targeted to the housing sector includes a maximum loan-to-value ratio (LTV), countercyclical LTV ratios, shorter amortization periods and higher premiums on CMHC-insured mortgages. The simulations shown here assume that when the LTV ratio changes, the entire stock of outstanding mortgages is subject to the new LTV ratio, not just the new mortgages. If, in practice, the changes in LTV applied only to new mortgages, the impact would be smaller in the short run.
- 3 An example would be a case where the financial imbalance is driven by higher productivity growth (e.g., the “New Economy”) that creates exuberance in the financial system, causing a surge in credit and a decline in inflation.

Technical Box 8 (continued)

Tightening the macroprudential tool would put additional downward pressures on inflation (**Figure 8-B**). In this case, the setting of monetary policy will either have to adjust or allow inflation to fall below the target for a longer period.⁴

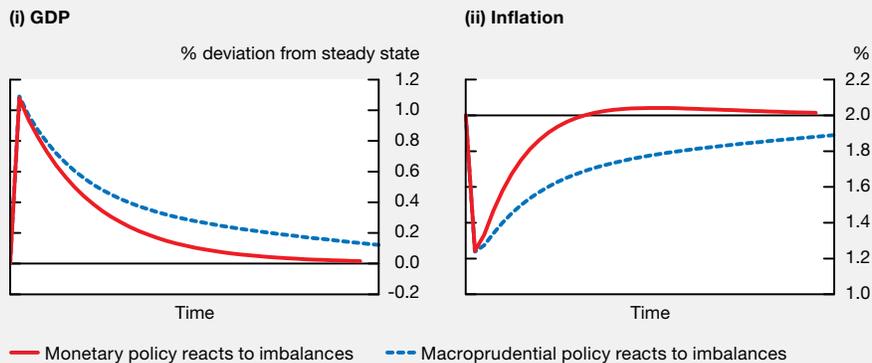
Figure 8-B: Broad-based financial imbalances might require that monetary policy accommodate greater transient deviations of inflation from target



Source: Bank of Canada calculations

In the face of broad-based imbalances, there may be scope for monetary policy to play a more direct role. Broad-based imbalances might require wide-reaching policy tools—in which case, monetary and macroprudential policies might be similar in terms of their impact on the economy (**Figure 8-C**).

Figure 8-C: Monetary policy may be an appropriate tool when financial imbalances are broad-based



Source: Bank of Canada calculations

In contrast to the case where imbalances remain contained within a sector, the bluntness of monetary policy could eventually prove to be an asset under these circumstances, particularly if, for example, monetary policy may be contributing to the imbalances through the setting of low interest rates otherwise dictated by the short-term macroeconomic outlook (**Technical Box 7**).

In summary, the broad impact of monetary policy makes it an inappropriate tool to deal with sector-specific imbalances, but a potentially valuable tool within the flexible inflation-targeting regime in addressing imbalances that may eventually have economy-wide implications.

⁴ See Bailliu, Meh and Zhang (2010) for more details. See also Angelini, Neri and Panetta (2011) and Nakornthab and Rungcharoenkitkul (2010).

example, the financial system may be more vulnerable if there has been strong growth in both credit and asset prices. The development of a larger set of tools and indicators to detect threats to financial stability is at a relatively early stage. The Bank will continue to work on developing such tools, including better models of real-financial linkages, indicators of financial vulnerabilities and various stress-testing models.

Because the consequences of financial excesses may be felt over a longer and more uncertain horizon than other economic disturbances, the potential may exist for tension among output, inflation and financial stability considerations over the typical two-year monetary policy horizon. In these circumstances, the Bank would need to use the flexibility available to it under the inflation-targeting agreement to bring inflation back to target over a somewhat longer horizon, consistent with the longer-run pursuit of low, stable and predictable inflation.

The bottom line

Economic stability and financial stability are inextricably linked, and pursuing the first without due regard for the second risks achieving neither. But clear assignment of responsibilities remains crucial. The paramount goal of monetary policy is price stability. The primary tools to deal with financial stability are micro- and macroprudential regulation and supervision. Macroprudential tools are not a substitute for monetary policy in controlling inflation, and monetary policy cannot substitute for proper micro- and macroprudential supervision and regulation in maintaining financial stability.

At the same time, it must be recognized that both sets of tools have an impact on both financial and economic stability. By leaning against a credit cycle and building a buffer to absorb a potential shock in case it cannot be entirely contained, macroprudential tools such as the countercyclical capital buffer should contribute to greater economic and price stability. Similarly, monetary policy can contribute to financial stability directly in some circumstances by complementing macroprudential policy, particularly when broad-based imbalances are building or unwinding.¹⁵

Overall, the lessons of the crisis make it clear that a key virtue of Canada's inflation-targeting framework is its flexibility. A framework anchored on a solid and credible inflation target provides the flexibility for monetary policy to play an occasional role in supporting financial stability.

¹⁵ See Eichengreen et al. (2011) for an international analysis of rethinking central banking. See also Woodford (forthcoming) for a recent analysis of the interaction between monetary policy and financial stability.

5. Future research agenda

The experience of the past 20 years has demonstrated the strength of Canada's flexible inflation-targeting framework for monetary policy. This experience has, however, also emphasized that the economic and financial forces that shape the environment in which monetary policy operates are constantly evolving, and our understanding of these forces must evolve accordingly. That is why the Bank has been, and remains, committed to ongoing research on the monetary policy framework and its implementation. As part of this ongoing effort, three areas will receive particular attention over the next five years.

The first concerns the links between financial market developments and the economy, including the international ramifications of these links. Analysis of how real-financial linkages matter for the economic outlook has a long history at the Bank, and further progress has been made in recent years in incorporating these linkages more explicitly into the Bank's main policy models. But the recent crisis underscored the need for central banks around the world to intensify these efforts. In particular, the various channels through which financial and macroeconomic developments can feed back on each other need to be better understood. Greater understanding of the risk-taking channel of monetary policy (**Technical Box 7**), the interaction between monetary and macroprudential policies, and the use and performance of early-warning indicators of potential financial crisis is required.

The second area concerns the zero lower bound on nominal interest rates and its implications for the conduct of monetary policy. With interest rates in many countries reaching the ZLB, many central banks have had to employ unconventional policies to provide the required additional monetary policy stimulus. This experience prompted a reassessment of how frequently the ZLB might be encountered in the future. Drawing on the range of experience with unconventional policies across countries, the Bank will be assessing the relative effectiveness of these policies and their potential costs.

The third area concerns the more fundamental issue of expectations formation. The way the public adjusts to changing economic conditions and forms a view about the future is critical to the effectiveness of monetary policy. Many monetary policy issues—such as the nature of the link between financial developments and the economy, the relative merits of PLT over IT, or the effectiveness of unconventional policies—depend on how the public forms expectations and how it learns. A better understanding of expectations formation can also contribute to the effectiveness of monetary policy in informing the Bank's communications strategies. The

Bank will continue its work modelling the implications of various assumptions regarding how expectations are formed, using survey data and drawing on experimental economics.

While these three areas clearly warrant further study, the experience of recent years underscores the importance of flexibility in the monetary policy research agenda. This applies not only to the direction of the research but also to its application, since further evidence and experience could shed new light on old questions. In particular, as policy-makers refine their degree of confidence regarding their ability to deal with the risks and consequences associated with financial vulnerabilities, both here and abroad, the benefits stemming from a lower inflation target or a price-level target might appear more valuable and/or the costs more manageable, leaving scope for these possible innovations in the monetary policy framework to be revisited in the future.

6. The Bank's flexible approach to inflation targeting

The objective of Canada's monetary policy is to enhance the well-being of Canadians by contributing to sustained economic growth, rising levels of employment and improved living standards. The best way monetary policy can achieve this goal is by giving Canadian households and businesses confidence in the value of their money. Canada's experience with inflation targeting over the past two decades has demonstrated that this is best accomplished by keeping inflation low, stable and predictable.

Monetary policy in Canada aims to achieve and maintain a 2 per cent rate of inflation over time, defined in terms of the 12-month rate of change in the total CPI. Canada's monetary policy functions symmetrically around the inflation target. In other words, the Bank is equally concerned about inflation rising above or falling below the 2 per cent target.

The Bank conducts monetary policy through changes in its target overnight rate of interest.¹⁶ These changes are transmitted to the economy through their effects on the whole spectrum of market interest rates, domestic asset prices and the exchange rate. A reduction in the policy interest rate can be expected to reduce market interest rates, raise asset prices and lower the external value of the Canadian dollar. This will tend to boost demand for Canadian products by encouraging consumers and businesses in Canada to save less or borrow more and by supporting exports while restraining imports. The opposite is true when the policy interest rate is increased.

A floating exchange rate is an important element of Canada's monetary policy framework. In addition to its role in the transmission of monetary policy, the flexibility of the Canadian dollar allows the Bank to pursue an independent monetary policy directed toward achieving the inflation target and stabilizing the Canadian economy. Movements in the exchange rate itself also serve as automatic buffers, helping to insulate the economy from external and internal shocks.

Through these channels, an easing (tightening) of monetary policy can be expected to boost (restrain) total demand for Canadian goods and services. The balance between the strength of this demand and the economy's productive capacity is, over time, the primary determinant of inflationary pressures in the economy. Through its policy actions, the Bank pursues this balance in a manner that is consistent with achieving the 2 per cent inflation target over time.

¹⁶ When the zero lower bound on interest rates is binding, additional monetary easing required to attain the inflation target can be implemented through three main alternative instruments: (i) conditional statement on the future path of policy rates; (ii) quantitative easing; and (iii) credit easing. The Annex to the April 2009 *Monetary Policy Report* describes these instruments and the principles guiding their use.

Monetary policy actions take time to work their way through the economy and to have their full effect on inflation. For this reason, monetary policy must always be forward looking, with the policy rate set based on the Bank's judgment regarding how inflation is likely to evolve in the future. Making that assessment requires a careful examination of the economic evidence pertaining to the balance of supply and demand in the economy and other factors affecting underlying inflationary pressures. In this regard, the Bank uses core inflation as an operational guide for Bank policy in pursuit of the target for total CPI inflation. Along with other measures of inflationary pressures, core inflation is monitored to help achieve the target for total CPI inflation: it is not a replacement for total CPI inflation.

In assessing the stance of monetary policy appropriate to achieve the inflation target, the Bank must also make a judgment regarding the most appropriate horizon over which to return inflation to target. This judgment is necessary because, when taking monetary policy actions to stabilize inflation at target, the Bank must also manage the volatility that these actions may induce in the economy and financial markets, which can be detrimental to the well-being of Canadians. This must be taken into account as the Bank pursues low, stable and predictable inflation as a means to promoting a stable, well-functioning economy.

The most appropriate horizon for returning inflation to target will vary depending on the nature and persistence of the shocks buffeting the economy. There are, broadly speaking, three sets of circumstances under which it may be desirable to return inflation to target, from above or below, over a horizon that is somewhat longer than usual. First, the unfolding consequences of a shock could be sufficiently large and persistent that a longer horizon might be warranted in order to provide greater stability to the economy and financial markets. Stability considerations could lead the Bank to accommodate over a somewhat longer period, for example, the inflationary consequences of an unusually large and persistent increase in oil prices, or the disinflationary consequences of a severe global slowdown, including the possible constraints of the zero lower bound on interest rates.

Second, through a longer targeting horizon, monetary policy can also promote adjustments to financial excesses or credit crunches. For instance, there could be situations where, even though inflation is above target, ongoing monetary policy stimulus and a somewhat longer horizon to return inflation to target would be desirable in order to facilitate the adjustment to broad-based deleveraging forces that are unfolding. On the flip side, a tighter monetary policy that allows inflation to run below target for a longer period than usual could help to counteract pre-emptively excessive leverage and a broader buildup of financial imbalances (**Technical Box 8**).

Third, the optimal inflation-targeting horizon will vary depending on the evolution of the risks to the outlook. Shocks to the economy, both observed and prospective, are inevitably subject to a degree of uncertainty. In some situations, risks to the inflation outlook could be skewed to the downside. In these cases, a balance must be struck between setting monetary policy to be consistent with the most likely outlook and the need to minimize the adverse consequences in the event that downside risks materialize. This would warrant a more stimulative setting for monetary policy than would otherwise be desirable in the absence of the downside risks. However, if the downside risks fade away rather than materialize, the resulting stronger inflationary pressures would merit returning inflation to target over a longer horizon. The opposite would be true under circumstances where risks to inflation are skewed to the upside.

In short, changing economic circumstances could demand some flexibility in the horizon over which the Bank seeks to restore inflation to target. This flexibility has been an inherent feature of the monetary policy framework in Canada and all other countries that practice inflation targeting.

A further critical element of Canada's inflation-targeting framework is a clear and transparent communications approach, which is important to both the accountability and effectiveness of monetary policy. The Bank regularly reports its perspective on the forces at work on the economy and their implications for the path of inflation, including the horizon over which inflation is expected to return to target.

The Bank's scope to exercise appropriate flexibility with respect to the inflation-targeting horizon is founded on the credibility built up through its demonstrated success in achieving the inflation target. This reinforces the importance of the Bank's relentless focus on the objective of achieving the 2 per cent inflation target over time, which ultimately remains the best contribution that monetary policy can make to the economic well-being of Canadians.

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