

# Inflation Expectations and the Conduct of Monetary Policy: A Review of Recent Evidence and Experience

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- *Inflation expectations play a critical role in the conduct of monetary policy, providing timely and useful information with respect to the central bank's credibility. Inflation expectations are a key determinant of actual inflation and are thus a crucial part of the analysis used by many central banks to generate inflation forecasts.*
- *Inflation expectations in countries with explicit inflation-targeting monetary policy regimes appear to be more forward looking and better anchored. During the 2008–09 period, despite the high volatility of short-term inflation expectations, expectations for longer-term inflation remained well anchored.*
- *As central banks seek to withdraw from the extraordinary measures enacted during the crisis, inflation expectations will be monitored closely.*

Maintaining price stability is the key objective of most central banks, and the recent financial crisis and global recession have produced important upside and downside risks to price stability. On the upside, inflationary pressure could emerge if monetary policy rates are left too low for too long, if extraordinary measures are withdrawn too slowly, or if fiscal budgets are not consolidated in a timely manner. On the downside are deflationary pressures from substantial and prolonged output gaps. Managing these respective risks to price stability is a key concern for central banks, and inflation expectations can provide them with important information as they consider exit strategies from extraordinary measures and the normalization of monetary policy. Moreover, to achieve their goal of price stability on an ongoing basis, it is crucial that central banks manage inflation expectations through policy actions.

This article explores the role of inflation expectations in the conduct of monetary policy. First, we review the various measures of inflation expectations that are used by central banks, including survey- and market-based indicators, and consider their respective advantages and disadvantages. Second, we examine why inflation expectations are so important in the conduct of monetary policy: namely, their crucial role in the framework used by central banks to understand, forecast, and control inflation. We then explore the role of inflation expectations as an indicator of central bank credibility. Simply, if economic agents view the central bank as credible, inflation expectations are more likely to be well anchored, further enhancing the effectiveness of monetary policy. Interestingly, institutional arrangements, such as adopting inflation targeting,

appear to enhance credibility. The importance of credibility is highlighted in the presence of inflation shocks: well-anchored inflation expectations can help the central bank look past temporary shocks to inflation, and required adjustments to the central bank's monetary policy instruments are also greatly reduced.

To shed further light on this subject, we analyze the behaviour of inflation, and inflation expectations, through the lens of the past two years—a challenging episode for central banks, as inflation quickly rose and then fell through 2008 and 2009. We note, however, that inflation expectations in most countries remained remarkably well anchored, despite the massive shocks that were affecting the economy, thus demonstrating the credibility of many central banks. In addition, the maintenance of well-anchored inflation expectations assisted the recovery, as the economy avoided a potentially destabilizing deflationary spiral. Thus, the episode provides valuable lessons with respect to the critical importance of credibility and well-anchored inflation expectations in the conduct of monetary policy. From this experience, we offer policy conclusions and note the need to improve measures of inflation expectations. We also highlight the need to better understand how households and firms form inflation expectations, and how those expectations affect price formation.

## Measuring Inflation Expectations

Before examining the importance of inflation expectations in the conduct of monetary policy, it is necessary to look at how they are measured in practice. There are two main sources of information on inflation expectations: surveys and markets. Their relative strengths and weaknesses are considered in turn.

### Surveys

Surveys of inflation expectations consider three types of respondents: households, businesses, and professionals (the latter are often referred to as market participants or experts). **Table 1** lists the most commonly referenced surveys, together with details on their structure.<sup>1</sup> Surveys typically ask respondents what they expect inflation to be in the next 4 to 8 quarters and in the next 5 to 10 years. Survey frequency varies from monthly to semi-annually, and

most are available from the 1990s onwards.<sup>2</sup> Studies of inflation expectations typically focus on the median range as the relevant indicator, since extreme observations may not be particularly informative. Disagreement among respondents to the same survey can be useful at times, however, since it can be interpreted as disagreement in the population or as a proxy for inflation uncertainty (Mankiw, Reis, and Wolfers 2003).<sup>3</sup>

### *There are two main sources of information on inflation expectations: surveys and markets.*

Most surveys are conducted at the national level: for example, in the United States, the Survey of Professional Forecasters, conducted quarterly by the Federal Reserve Bank of Philadelphia. Other examples include surveys by the University of Michigan, the Banco Central do Brasil, and the Bank of Japan. In Canada, the Conference Board of Canada conducts its Survey of Forecasters each quarter. The Conference Board forecasts are on a calendar-year basis, and the survey reports only the mean of respondents' inflation forecasts. The Bank of Canada's quarterly Business Outlook Survey reports on consultations with about 100 firms across Canada in sectors that broadly reflect the composition of the GDP. The survey asks firms their forecasts of annual consumer price index (CPI) inflation over the next two years, and reports the responses grouped into four ranges: below 1 per cent, 1 to 2 per cent, 2 to 3 per cent, and above 3 per cent.<sup>4</sup>

International surveys, such as Blue Chip Economic Indicators, the IFO World Economic Survey, and Consensus Economics' Consensus Forecast, allow for cross-country comparisons. The most widely used is the Consensus Forecast, which surveys a large cross-section of professional forecasters (currently more than 700 worldwide in more than 85 countries, including Canada), asking each one their predictions

<sup>1</sup> For further detail on the Michigan survey, the Livingston Survey, and the Survey of Professional Forecasters, see Curtin (1996), Croushore (1997), and Croushore (1993), respectively.

<sup>2</sup> The Michigan Survey of Consumer Attitudes and Behavior has been conducted quarterly since 1946, even though for the first 20 years respondents were asked only whether they expected prices to rise, fall, or stay the same.  
<sup>3</sup> Disagreement about the future path of inflation tends to rise with the inflation rate or when inflation changes sharply. Surveys of consumers usually reveal greater disagreement than surveys of economists, which show a smaller range of estimates across respondents.  
<sup>4</sup> The question on inflation expectations in its current form has been part of the survey since 2001.

**Table 1: Surveys of inflation expectations**

Survey	Participants	Start date	Frequency	Organization	Measures of inflation expectations and horizon
<b>United States</b>					
<b>Michigan Survey of Consumer Attitudes</b>	500 to 700 consumers	1978	Monthly	University of Michigan	Expected change in prices 12 months ahead
<b>Survey of Professional Forecasters</b>	34 professionals	1981	Quarterly	Federal Reserve Bank of Philadelphia	GDP deflator, CPI, PCE, and Core PCE: 6 quarters ahead, 5 and 10 years ahead
<b>Livingston Survey</b>	48 professionals	1946	Semi-annually	Federal Reserve Bank of Philadelphia	CPI: current quarter, 2 quarters ahead, 4 quarters ahead
<b>Europe</b>					
<b>Survey of Professional Forecasters</b>	59 professionals	1999	Quarterly	European Central Bank	CPI: point estimates and density forecasts for 1 year ahead, 2 years ahead, and 5 years ahead
<b>European Commission Consumer Survey</b>	39,900 consumers	1985	Monthly	European Commission	Expected changes in consumer prices 12 months ahead
<b>United Kingdom</b>					
<b>Bank of England-GfK/NOP</b>	2,000 consumers	2001	Quarterly	Bank of England and GfK/NOP	Expected change in shop prices 12 months ahead
<b>Citigroup/YouGov</b>	2,000 consumers	2005	Monthly	YouGov/Citigroup	Expected change in consumer prices of goods 12 months ahead
<b>Canada</b>					
<b>Survey of Forecasters</b>	500 firms	1985	Quarterly	Conference Board of Canada	Percentage of firms expecting price increases over the next 6 months and for the next calendar year
<b>Business Outlook Survey</b>	100 firms	1997	Quarterly	Bank of Canada	Expected annual rate of CPI inflation for the next 2 years
<b>Japan</b>					
<b>Bank of Japan Survey</b>	3,000 consumers	1993	Quarterly	Bank of Japan	Qualitative: will prices go up, down, or stay the same? And reference prices for judging change
<b>Other</b>					
<b>IFO World Economic Survey</b>	1,000 professionals in 90 countries	1991	Quarterly	IFO Research Center, w. support from the European Commission	Expected inflation 6 months ahead
<b>Consensus Economics</b>	700 professionals in 85 countries	1989	Monthly	Consensus Economics Inc.	Inflation for the current year, for next year, and for 5 to 10 years
<b>Blue Chip Economic Indicators</b>	50 professionals	1976	Monthly	Aspen Publishers	Inflation 0 to 7 quarters ahead for the United States, 1 to 2 years ahead for other major economies
<b>Banco do Brasil Business Survey</b>	1,000 professionals	2001	Daily	Banco do Brasil	IPCA inflation over the next 12 months

for growth, inflation, unemployment, and short- and long-term interest rates.

## Market-based measures

Inflation expectations can also be inferred from asset prices, such as break-even inflation rates (BEIRs).<sup>5</sup> The break-even inflation rate is the difference between the nominal yield on a fixed-rate bond and the real yield on an inflation-linked (or real return) bond of the same term and maturity. Real return bonds, such as U.S. Treasury Inflation-Protected Securities (TIPS) differ from non-indexed debt securities in that their principal is adjusted for changes in a specified price index.<sup>6</sup> Such indexation protects the purchasing power of the principal, which will have the same real value at maturity in terms of the power to buy items in a consumption basket as when the security was originally issued. BEIRs are easily derived for the United States and the United Kingdom, which have the deepest and most liquid markets for both nominal and real return bonds and issue at a wide range of maturity points (and hence the longest time series for the widest range of forecast horizons). Break-even inflation rates can also be calculated for Canada, France, and some other industrialized countries, but the data are much more limited.

## Advantages and disadvantages

Both measures of inflation expectations have advantages and disadvantages. Survey measures have three main advantages: (i) the breadth of coverage is large, including market participants, businesses, and households; (ii) some surveys have been conducted for many decades, allowing comparative analysis from previous inflationary (or deflationary) episodes; and (iii) surveys minimize market distortions, because they avoid certain biases, such as liquidity risk, inflation risk, and institutional distortions, that can affect market-based measures.

Surveys also have several shortcomings: (i) they are often conducted only quarterly or semi-annually and may therefore miss recent changes in inflation expectations. There are also lags between the time they are taken and publication of their results; (ii) surveys may be biased, since households may overweight price changes for frequently purchased goods and services,

such as gasoline and food;<sup>7</sup> (iii) comparison of survey results across countries is difficult, given differences in survey methodologies; (iv) responses are equally weighted, irrespective of respondents' ability to forecast inflation; and (v) the answers of some survey respondents may be strategic: market participants may have incentives not to reveal private information and thus tend towards consensus forecasts.

Data from market-based measures have many advantages.<sup>8</sup> First, BEIRs and various other measures of inflation expectations derived from asset prices are available daily. Second, market-based measures may reflect agents' expectations more accurately, since market participants "vote" with real money.<sup>9</sup> In addition, depending on the breadth and depth of the relevant markets, market-based measures can reveal inflation expectations across a wider range of forecast horizons than surveys.

There are, however, some concerns with BEIRs. They may suffer from the fact that the liquidity characteristics of the two instruments (nominal and real return bonds) differ considerably: while there are deep and liquid markets for regular, nominal return bonds, this is less true for real return bonds, and their implied yield may therefore be biased because of a variable liquidity premium between the two.<sup>10</sup> Moreover, during times of market stress, a flight to quality might distort nominal yields disproportionately.<sup>11</sup> Institutional factors and self-selection may also distort the information content of BEIRs, since some investors, such as pension funds and insurance firms, may have strong preferences for real return bonds,<sup>12</sup> thus leading to a premium for those bonds. In addition, BEIRs might suffer from mismatched cash flows. While coupon payments on nominal bonds are fixed, those on real return bonds rise with inflation. This means that each bond will react differently to changes in the expected path and variance of the inflation rate, biasing the BEIR. Finally, if the term structure of

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5 Inflation-indexed swaps could also be used to infer inflation expectations. An inflation-indexed swap is a derivative instrument where the payments under the contract depend on the value of an inflation index, such as the CPI.

6 In most cases, the index used is the CPI. A notable exception is the United Kingdom, where the Retail Prices Index is used.

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7 Thomas (1999) and Mehra (2002) suggest that the bias in survey forecasts may vary across accelerating versus decelerating inflation environments or across the business cycle.

8 For more details, see Christensen, Dion, and Reid (2004).

9 This is important in the current environment, since feedback between expectations of deflation and postponed consumption and investment would begin only if people act on those expectations.

10 In some markets, inflation-indexed swaps are more liquid than real return bonds, which suggests that inflation-indexed swaps may be a more reliable measure of inflation expectations.

11 During the financial crisis in 2008, the flight to safety implied a large premium for nominal bonds, leading to a large distortion in the BEIR.

12 For example, insurance firms may need to hedge liabilities that are indexed to inflation.

inflation expectations is not flat, BEIRS will be biased, and this bias will be greater at shorter horizons.<sup>13</sup>

Are survey and market measures able to give a reliable picture of current inflation expectations? In the Canadian context, Christensen, Dion, and Reid (2004) find that the BEIR in Canada is not a reliable measure of inflation expectations because of the maturity and liquidity characteristics of Real Return Bonds. Simply, Canada's Real Return Bonds have a 30-year maturity and are considerably less liquid than conventional 30-year bonds, which leads to frequent distortions in the measure of expected inflation. For the United States, Ang, Bekaert, and Wei (2007) find that survey data outperform market-based measures, times-series ARIMA models, and regressions using data on real economic activity. Consequently, the most recent evidence suggests that surveys may be a more reliable guide to inflation expectations for the United States and Canada.

## Inflation Expectations and Monetary Policy

Measures of inflation expectations play a key role in the conduct of monetary policy since they provide useful signals with respect to the credibility of the central bank and its long-run inflation objective. Inflation expectations are also a crucial part of the analysis used by many central banks to generate inflation forecasts. Inflation expectations are one of the main drivers of current inflation, because expected inflation influences current wage negotiations, price setting, and financial contracting for investment. Because of this link, central banks can affect current and future inflation by better anchoring agents' expectations of long-term inflation.

### Inflation expectations and central bank credibility

The analytical framework used by most central banks assumes that economic agents are mainly forward looking and rational, which has strongly influenced the design of monetary policy (Bernanke 2007). In this framework (and in practice), central banks can manage and stabilize inflation expectations, and hence inflation, through various factors, including the choice of policy regime, their actions, and their communications. For instance, an inflation-targeting regime in which the central bank commits to keep inflation at a specific

<sup>13</sup> A detailed explanation of this phenomenon can be found in Christensen, Dion, and Reid (2004).

rate or range over a specified period provides a clear, measurable commitment and a performance target. This policy commitment sends a clear signal to the public and to market participants about the priority of monetary policy and thus helps to anchor inflation expectations.<sup>14</sup> But having the correct regime is not enough: delivery is key. Credibility requires policy actions (Mishkin 2007), since these actions demonstrate the central bank's commitment to price stability and its ability to achieve it—making inflation expectations relatively insensitive to incoming data. Lastly, central banks can improve their credibility through clear and effective communication. Clarity about the goals of the central bank, and how it plans to achieve them, can further anchor inflation expectations, and thus inflation.

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### A review of the empirical literature

The theoretical basis for the use of inflation expectations is clear: well-anchored inflation expectations can help the central bank achieve its inflation objective. Whether this is true in practice is essentially an empirical question. To this end, there is a large literature on the interaction between inflation, inflation expectations, and the conduct of monetary policy.

#### *Inflation persistence and inflation expectations*

Inflation persistence or inertia is of concern to central banks, since it can inhibit the bank's ability to achieve its inflation objective. In particular, high persistence may suggest that economic agents form inflation expectations in a backward-looking (instead of forward-looking) manner. Backward-looking inflation expectations could therefore indicate that a central bank's credibility is low, potentially impairing the efficacy of its actions. Not surprisingly, postwar inflation data suggest that inflation has often tended to be highly correlated with lagged inflation; i.e., there is persistence in observed inflation. While some persistence may be intrinsic to an economy, the level will likely decline if expectations

<sup>14</sup> Price-level targeting could have a further stabilizing effect on inflation expectations, and this has been an area of active research by the Bank of Canada. See Ambler (2009) for a review of the research.

become more forward looking as a result of more credible monetary policy (Woodford 2006). Simply, the greater the importance of forward-looking expectations, the less persistent inflation should be (Rudd and Whelan 2007; Sims 2008).<sup>15</sup> Consequently, the question arises as to whether the institutional framework for monetary policy, through its effect on inflation expectations, can lower inflation persistence.

Many have argued that a simple way to make agents more forward looking is to introduce an inflation target. Several recent empirical studies test whether the institutional framework affects inflation persistence. Benati (2008) considers several alternative monetary policy regimes in a recent cross-country study, and finds that for inflation-targeting (IT) countries—Canada, Sweden, the United Kingdom, and New Zealand— inflation was persistent prior to the adoption of the IT regime. But since the adoption of IT, lagged inflation is no longer a statistically significant predictor of current inflation: i.e., persistence has declined. Likewise, inflation persistence in the euro area has declined since the adoption of the euro.<sup>16</sup> More recently, Mendes and Murchison (2009–10) examine inflation persistence in Canada and also find a substantial decline in persistence relative to the 1980s. They emphasize the importance of the adoption of the IT target in 1991. Results for the United States are more ambiguous, however, and seem sensitive to which measure of inflation is used. Benati (2008) finds that inflation measured by the GDP deflator and the Personal Consumption Expenditures (PCE) price index shows considerable persistence in the United States, even after 1995, while estimates of CPI inflation show almost no persistence. Benati's study and others suggest that past inflation experience influences current inflation, as well as expectations

about future inflation.<sup>17</sup> However, the extent of this influence appears to decline substantially as the monetary policy regime's commitment to price stability strengthens.<sup>18</sup>

### *Anchoring inflation expectations*

As discussed above, uncertainty about the central bank's objective, or its commitment to a target, can affect expectations of long-run inflation. A key argument in favour of inflation targeting is that it leads to better anchoring of inflation expectations. Several studies empirically test this assertion, which is also an implication of the rational-expectations model: if expectations are perfectly anchored, then long-run inflation expectations should not respond to current inflation (especially periods of higher-than-expected current inflation) or to other news about macro-economic conditions.

Empirical studies on the United States generally find that its inflation expectations have become more stable since the early 1980s, but they remain somewhat sensitive to current shocks. Stock and Watson (2007) find that changes in the trend component of U.S. inflation are highly persistent, but that the variation in trend inflation has declined substantially since 1983. This implies that unexpected changes to inflation are much less likely to persist in the United States than in the past and, thus, that inflation expectations have become better anchored. Likewise, the response of inflation expectations to shocks from the macroeconomy and from monetary policy has declined over the period, as has the volatility of inflation expectations (Clark and Davig 2008). Nevertheless, there remains enough variability in trend U.S. inflation for Bernanke (2007) to conclude that inflation expectations continue to be imperfectly anchored.

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<sup>15</sup> This literature also includes related work by Altissimo, Mojon, and Zaffaroni (2009); Cecchetti et al. (2007); and Kozicki and Tinsley (2003). The appropriate interpretation for the persistence of inflation is the source of an ongoing debate, particularly among Woodford (2006) and Rudd and Whelan (2007). While Rudd and Whelan are skeptical of rational expectations to describe how expectations are formed, they nevertheless emphasize that the role of expectations in the inflation process is "crucial" (p.32).

<sup>16</sup> The number and timing of policy regimes is exogenously determined in Benati's model, and he assumes a single regime from 1971 to 1991. Benati's findings of very high inflation persistence in pre-IT periods may reflect a failure to adequately control for changes in trend inflation for Canada. Crawford, Meh, and Terajima (2009) allow for endogenous timing of regime changes and find that prior to inflation targeting Canada's inflation persistence was considerably lower than Benati's estimate.

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<sup>17</sup> Other evidence for the United States is mixed: Rudd and Whelan (2007) do not find that U.S. inflation is less persistent after the Volcker disinflation. This is consistent with research by Kozicki and Tinsley (2005, 2009), who find that it took a considerable period to build monetary policy credibility following the Great Inflation of the 1970s. They argue that this was partly due to the lack of a clear inflation target. Cogley and Sbordone (2005, 2008), however, find that inflation persistence in the United States is minimal after controlling for shifts in trend inflation.

<sup>18</sup> Improvements in central bank credibility appear to be linked primarily to the choice of an inflation-targeting regime, rather than to additional communication or transparency. A few central banks, in the belief that greater transparency would help anchor expectations, have published their policy interest rate path. Andersson and Hofmann (2009) assess whether these forward guidance strategies of the central banks of New Zealand, Norway, and Sweden have helped anchor expectations of long-term inflation. They find that all three countries already had well-anchored inflation expectations and that publishing the interest rate path, on its own, did not improve the degree to which those expectations were anchored.

Market-based measures of U.S. inflation expectations also suggest imperfect anchoring: Gürkaynak, Sack, and Swanson (2005) demonstrate that forward U.S. interest rates at long horizons react significantly to various macroeconomic and monetary policy surprises. Similarly, Potter and Rosenberg (2007) find that shocks to short-run inflation expectations (2 to 5 years) continue to pass through to measures of long-run inflation expectations (9 to 10 years).

Kozicki and Tinsley (2005, 2009) study the Great Inflation of the 1970s and the post-Volcker disinflation period in detail, and conclude that the lack of an explicit monetary policy objective in the United States contributed to unanchored inflation expectations well into the late 1980s. In contrast, they show that after the Bundesbank announced medium-term targets for money growth in the mid-1970s, bond market measures of German inflation expectations soon began to track the Bundesbank's target.<sup>19</sup> Kozicki and Tinsley (2005) find that private sector expectations were slow to adjust to the lower-inflation regime in the United States, even though actual inflation declined quite quickly after 1979. They interpret their results as consistent with an initial lack of credibility regarding the Federal Reserve's long-term commitment to low and stable inflation following the high-inflation episodes in the 1970s and 1980s.

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Recent international comparisons also provide evidence on the importance of the monetary policy regime for anchoring expectations. Several cross-country studies indicate that, as with inflation persistence, inflation expectations seem better anchored in countries with inflation-targeting regimes. These studies find that, unlike non-targeting countries, inflation expectations in IT countries, such as Canada, the United Kingdom, and Sweden, are not correlated to actual inflation, nor are they as sensitive to macroeconomic news or

<sup>19</sup> At the end of 1974, the Bundesbank began a regime officially described as money targeting; however, Bernanke and Mihov (1997) argue that inflation, rather than money growth, seemed to be the actual target variable.

monetary policy surprises.<sup>20</sup> Overall, the existing research implies that expectations of long-term inflation in the United States are stable but imperfectly anchored, while countries with explicit inflation targets appear to have better-anchored expectations of long-term inflation. Moreover, better-anchored inflation expectations lead to lower inflation persistence.

### **Other influences on inflation expectations**

The importance of credibility and the monetary policy regime for anchoring inflation expectations may ignore other important features of the inflation process, such as relative prices, especially those for food and energy, which are beyond the immediate control of the central bank. Clark and Davig (2008) find that shocks to food prices have a significant and persistent effect on expectations of long-run inflation in the United States. Energy prices, however, were not found to have a significant impact.<sup>21</sup> Galati, Poelhekke, and Zhou (2008) test whether the sharp increases in food and commodity prices that occurred between 2006 and mid-2008 led to a de-anchoring of inflation expectations in the euro area. Employing market data on interest rate swaps and inflation swaps (a more liquid market than inflation-indexed bonds) to measure inflation expectations in the euro area, they find evidence that inflation expectations became more sensitive to inflation news after June 2007, suggesting some drift in the inflation expectations of market participants away from the ECB's target. This evidence suggests that policy-makers must not take well-anchored inflation expectations for granted.

## **Recent Trends in Inflation Expectations**

The 2008–09 period provides an excellent lens through which to examine the importance of inflation expectations for the conduct of monetary policy.

### **Survey data: History and the crisis**

The historical behaviour of inflation expectations has evolved largely in line with the theory presented above: as central bank credibility has improved, inflation

<sup>20</sup> See for example, Levin, Natalucci, and Piger (2004); Gürkaynak, Levin, and Swanson (2006); Gürkaynak et al. (2006); and Beechey, Johannsen, and Levin (2008).

<sup>21</sup> The authors point out that energy prices are volatile and that forecasters may, therefore, expect their movements to be transitory and may not place much weight on price changes. Food prices, however, tend to be more persistent and also make up a larger share of the CPI basket, which may lead forecasters to incorporate food-price movements into their expectations more readily.

**Table 2: The development of inflation and inflation expectations**

		Canada		Euro area		Japan		Norway		Sweden		Switzerland		United Kingdom		United States	
		mean	std. dev	mean	std. dev	mean	std. dev	mean	std. dev	mean	std. dev	mean	std. dev	mean	std. dev	mean	std. dev
Actual Inflation (CPI y/y)	I	1.4	0.7	1.8	0.6	0.5	0.9	2.1	0.6	0.9	1.2	0.7	0.6	2.0	0.5	2.4	0.6
	II	2.4	0.9	2.1	0.4	-0.6	0.4	2.2	1.4	1.6	0.9	0.9	0.5	1.2	0.3	2.5	0.8
	III	2.0	0.7	2.2	0.8	0.2	0.8	2.1	1.2	1.6	1.3	1.2	0.9	2.5	0.8	2.9	1.6
Expected inflation 4 quarters ahead	I	1.8	0.3	-	-	0.4	0.6	2.9	0.4	2.0	1.1	1.0	0.2	2.8	0.5	2.8	0.4
	II	2.0	0.3	1.6	0.2	-0.4	0.3	1.9	0.6	1.9	0.4	1.1	0.4	2.3	0.2	2.3	0.4
	III	1.8	0.6	1.8	0.5	0.1	0.6	2.0	0.7	1.7	0.9	1.0	0.4	2.3	0.9	2.2	1.1
Expected inflation 8 quarters ahead	I	2.0	0.3	-	-	0.8	0.6	2.6	0.5	2.4	0.8	1.2	0.0	3.1	0.6	3.0	0.4
	II	2.0	0.1	1.7	0.1	-0.2	0.5	2.2	0.2	2.1	0.3	1.3	0.2	2.3	0.1	2.4	0.3
	III	1.9	0.1	1.9	0.3	0.6	0.3	2.0	0.3	1.9	0.3	1.2	0.3	2.5	0.3	2.2	0.2
Expected inflation 5 to 10 years ahead	I	2.0	0.3	-	-	1.4	0.5	2.1	0.1	2.4	0.5	1.9	0.2	3.0	0.4	3.0	0.4
	II	2.0	0.1	1.9	0.1	0.8	0.4	2.3	0.2	2.0	0.0	1.6	0.1	2.3	0.1	2.5	0.1
	III	2.0	0.0	1.9	0.0	1.3	0.2	2.3	0.1	2.0	0.0	0.0	0.1	2.6	0.2	2.3	0.2

Note: Period I runs from the second half of 1994 to the first half of 1999; period II runs from the second half of 1999 to the first half of 2004; and period III runs from the second half of 2004 to the first half of 2009.

Source: Consensus Economics

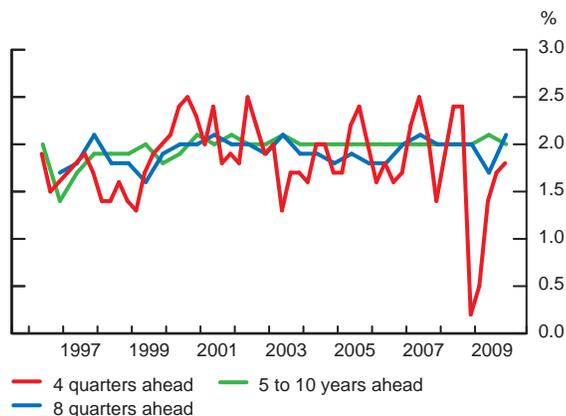
expectations have become better anchored. **Table 2** presents the mean and standard deviation for actual CPI inflation and for inflation expectations 4 quarters ahead, 8 quarters ahead, and 5 to 10 years ahead, for seven advanced economies and the euro area. The data are divided into three periods: period I ranges from the second half of 1994 to the first half of 1999, period II from the second half of 1999 to the first half of 2004, and period III from the second half of 2004 to the first half of 2009. As a general trend, the mean and variance of inflation expectations converged over time to the mean and variance of actual inflation, especially in the 1994–99 and 1999–2004 periods. Moreover, as the forecast horizon becomes longer, expectations are much closer to actual inflation. Importantly, as a potential signal of growing central bank credibility and well-anchored inflation expectations, the standard deviation of the inflation forecasts 5 to 10 years ahead for most countries has fallen sharply over the past 10 years. Canada is an exception,

since inflation expectations and actual inflation had already fallen significantly by 1994, and therefore the improvement over the periods considered in the table is smaller than for other countries.

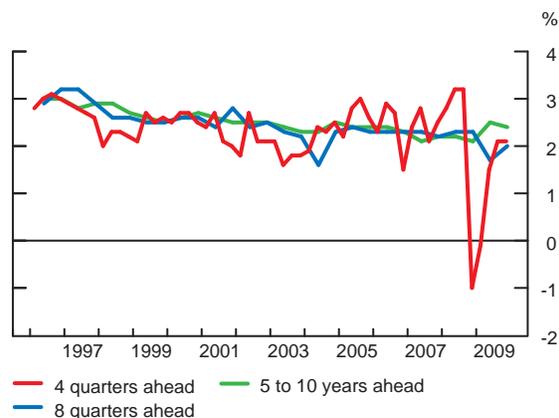
An examination of more recent data provides valuable insights into the importance of well-anchored inflation expectations. Survey data from Consensus Economics for Canada, the United States, the United Kingdom, and the euro area show that since 2007, expectations of short-run inflation have been quite volatile (**Chart 1**). In particular, the sharp and seemingly persistent rise in energy, food, and commodity prices in 2008 led to higher headline inflation, a feature that was reflected in rising expectations of shorter-term inflation. For example, in mid-2008, expectations for inflation 4 quarters ahead reached more than 3 per cent in the United States and the United Kingdom, over 2.5 per cent in the euro area, and increased in Canada but to slightly less than

## Chart 1: Inflation expectations

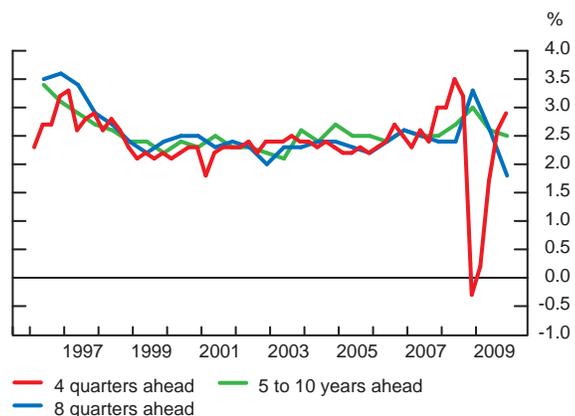
a. Canada



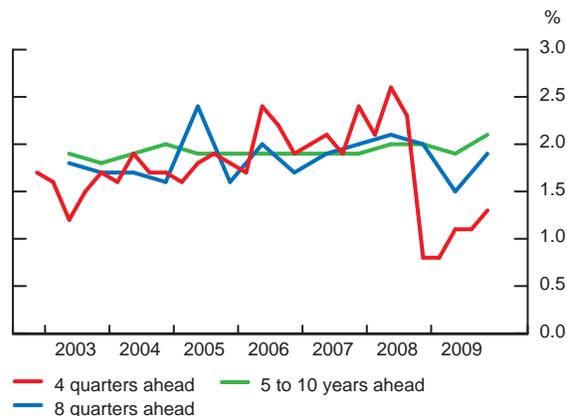
b. United States



c. United Kingdom



d. Euro area



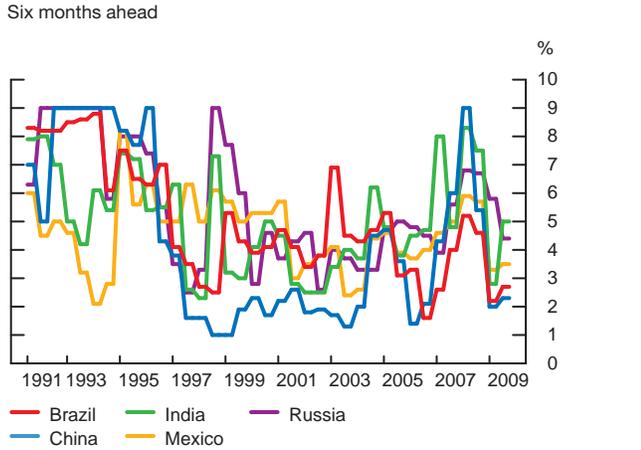
Source: Consensus Economics

2.5 per cent. The increase in inflation expectations in mid-2008 was even more prevalent for emerging-market economies (**Chart 2**). Following the collapse of Lehman Brothers, the economic and financial turbulence intensified, and expectations for inflation 4 quarters ahead fell sharply, actually turning negative in the United States (December 2008 to March 2009), the United Kingdom (December 2008), and Sweden (March 2009). This was partly due to the collapse in commodity prices and fears of a sharp recession. In Canada, inflation expectations 4 quarters ahead also fell, although to a lesser extent. The sharp decline in expectations of short-run inflation at the height of the credit crisis suggests that market participants in some countries expected deflation in 2009, albeit that expectation was short lived. In fact, inflation expectations began to rise again later in 2009 as economies

began to stabilize, although they currently remain lower than the levels prior to the crisis.

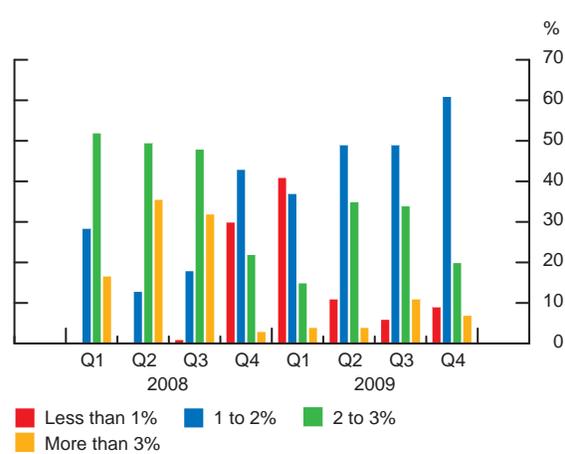
Despite the high volatility of short-term inflation expectations, expectations for longer-term inflation remained better anchored. Expectations for inflation 8 quarters ahead declined much less. During the most severe part of the crisis, the Bank of Canada's Business Outlook Survey of inflation expectations 2 years ahead found that over 40 per cent of firms expected inflation below 1 per cent, but by the second quarter of 2009 that share had dropped back to just 11 per cent of respondents (**Chart 3**). Furthermore, expectations for long-term inflation (5 to 10 years ahead) remained essentially flat in most countries (ranging from 2.0 per cent to 2.5 per cent), despite the observed negative rates of inflation and the length of the recession. In consumer surveys, expected inflation

**Chart 2: Inflation expectations in emerging-market countries**  
Six months ahead



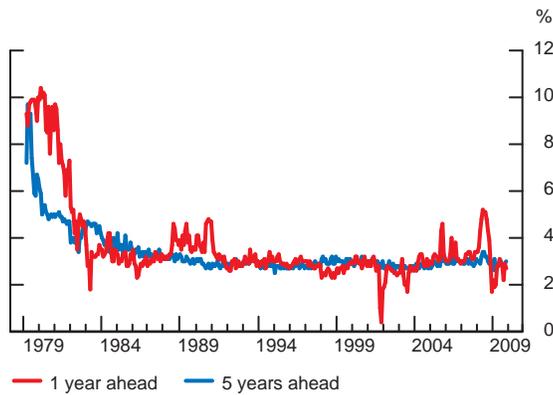
Note: The index is constructed by aggregating responses and assigning a value of 1 to lower inflation, 5 to same inflation, and 9 to higher inflation.  
Source: IFO Institute

**Chart 3: Bank of Canada Business Outlook Survey**  
Percentage of firms expecting CPI inflation over the next two years to be:



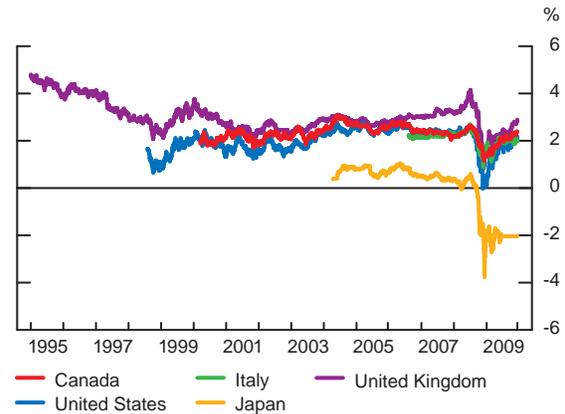
Source: Bank of Canada

**Chart 4: Inflation expectations in the United States (Michigan Survey)**



Sources: DataStream/Michigan University

**Chart 5: Breakeven inflation rates**  
Selected maturities



Source: Bloomberg

5 years ahead also remained relatively flat over the crisis period. For example, the Michigan survey indicates that U.S. consumers believed that inflation one year ahead would fall between mid-2008 and late-2008, but they did not expect deflation. In fact, consumers' inflation expectations remained close to the average of 3 per cent reported for the last decade

**(Chart 4).**<sup>22</sup> Thus, in both types of surveys (households and professionals), long-term inflation expectations remained well anchored, and the central banks' credibility remained intact.

<sup>22</sup> Although there appears to be a persistent upward bias in consumer surveys, one observes that consumers' inflation expectations move roughly in line with the inflation expectations of professional forecasts. For example, the Bank of Japan's consumer survey of expectations of inflation one year ahead for March 2008 was 7.6 per cent, while the Consensus inflation forecast for the same period was 0.4 per cent. While less extreme, the Michigan survey of households also reports inflation expectations that are on average 0.5 percentage points higher than typical expert forecasts (from 1996 to 2008).

## Market-based measures

The survey data suggest that inflation expectations, while volatile in the short run, are well anchored for longer horizons. However, since many surveys occur only quarterly or semi-annually, they may not have captured the true volatility of inflation expectations during the crisis. To address this issue, we examine BEIRs for the United States, the United Kingdom, Canada, and Japan.<sup>23</sup> As in the surveys of professionals, expectations for long-term inflation for the United States remained well anchored, except for a brief period at the height of the crisis, when BEIRs fell to close to zero. In Japan, BEIRs fell below zero in 2009 (Chart 5).<sup>24</sup> In contrast, inflation expectations for the inflation-targeting United Kingdom and Canada remained above 1 per cent during the crisis for the BEIR measures considered.

## Lessons from recent evidence

The recent financial crisis highlights the usefulness of inflation expectations within the framework for conducting monetary policy. Before the crisis, energy and food prices increased significantly, and expectations for shorter-term inflation rose accordingly. Expectations for long-term inflation remained well anchored, however, since households and firms were able to look through the commodity-price shock. This anchoring of expectations allowed policy-makers to look past the increase in energy prices, avoiding a possible policy mistake (in the absence of well-anchored inflation expectations, central banks may have been forced to raise interest rates just as the crisis was about to intensify, only to reverse them later). Clearly, the gains associated with well-defined inflation objectives and enhanced credibility helped to anchor inflation expectations and thus the inflation outcomes for many central banks.

*The experience of the crisis emphasized the importance of well-anchored inflation expectations.*

<sup>23</sup> BEIRs may suffer from liquidity risk: while there are deep and liquid markets for regular, nominal return bonds, this is less true for real return bonds, and their implied yield may therefore be biased.

<sup>24</sup> Expectations of negative inflation for Japan are not surprising, given Japan's recent experience with deflation.

The experience of the crisis itself, from the collapse of Lehman Brothers onwards, again emphasized the importance of well-anchored inflation expectations. In the autumn of 2008, commodity prices fell dramatically, and fears of a severe recession intensified. In fact, expectations for inflation 4 quarters ahead also fell sharply, and even went negative in some jurisdictions (market-based measures revealed a similar pattern). However, longer-term inflation expectations remained well anchored, despite the opening of large and likely persistent output gaps. This clearly indicates that central banks maintained their credibility, despite the massive shocks that were affecting the economy. The maintenance of well-anchored expectations assisted the recovery, since the economy avoided a potentially destabilizing deflationary spiral.

## Conclusions and Avenues for Future Research

Inflation expectations play a critical part in the conduct of monetary policy, providing timely and useful information with respect to the central bank's credibility. Inflation expectations form a key part of the information set used by central banks to understand and forecast inflation. Importantly, much of the existing research indicates that central banks that have a clear and credible commitment to low and stable inflation, especially those with inflation-targeting regimes, have been very successful in anchoring inflation expectations over the past two decades.

Inflation expectations will continue to inform policy-making, as central banks seek to withdraw from the extraordinary measures enacted during the crisis and beyond. In normalizing monetary policy rates, inflation expectations will be monitored closely, given the crucial role of credibility in anchoring inflation expectations. Massive fiscal stimulus packages and future pressure on fiscal budgets related to demographic change have led to record fiscal deficits and to high projected ratios of debt to GDP over the coming years in many advanced economies. Some market participants have expressed concerns that debt levels may become unsustainable and will eventually be monetized (although this concern has not yet materialized in measures of inflation expectations). In such an environment, inflation expectations can provide a useful leading indicator of whether fiscal and monetary policy credibility has been maintained.

Further research is required in several areas. First, how households and market participants form inflation expectations is not well understood. Bernanke

(2007) has called for more emphasis on incorporating learning and imperfect information in the modelling of inflation and of inflation expectations. Second, both survey and market measures exhibit biases over time. Accounting for these biases when interpreting measures of inflation expectations requires further consideration. Finally, more cross-country data on inflation expectations are needed, especially on the

expectations of firms and business owners. Since business representatives participate directly in setting prices and wages, more insight into the inflation expectations of price-setting firms in a larger set of countries and over different time horizons, would be very helpful to policy-makers.

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