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MONETARY POLICY

Bumps in the Road: Ever-Evolving Monetary Policy in Canada

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- In this paper, the authors investigate the responses of the Bank of Canada to inflation and economic conditions using a novel dataset that contains data and forecasts that were available to policymakers at the time monetary policy decisions were made.
- Over the inflation-targeting years from 1991, the Bank's responses have evolved. The Bank gradually increased its response to the state of the economy, measured by the output gap, and gradually shifted its response from temporary inflation to persistent expected future inflation deviations, whether overshoots or undershoots, from its 2 percent target.
- We also find that the Bank responded differently to positive and negative future inflation deviations, and these differences evolved over time. The Bank's response gradually shifted from positive (overshoots) to negative (undershoots) expected future inflation deviations.
- The Bank's asymmetric response to the expected future inflation deviations contributed to the delay of interest rate hikes during the post-pandemic era.

Introduction

In 1991, the Bank of Canada adopted an inflation-targeting framework with the primary objective of maintaining low and stable inflation over time. Since the fourth quarter of 1995 (1995Q4), the inflation target has been set at 2 percent, with a target range of 1 to 3 percent.[1] Over the last 28 years, the inflation rate, – measured as the

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1 Laidler and Robson (2004) and Ambler and Kronick (2018) provide in-depth discussions of the institutional and political background and development of the Canadian monetary policy regime, especially during the early phase of inflation targeting, and during the Global Financial Crisis.

12-month rate of change in the consumer price index (CPI) – has been outside its target range just under a third of the time, with the most notable misses occurring after the 2008 Global Financial Crisis (GFC) and the COVID-19 pandemic. The record improves when looking at core inflation, as it breached its target range less than an eighth of the time over the same period.

Between March 2021 and July 2024, the inflation rate in Canada was above the 2 percent target set by the Bank. While inflation returned to 2 percent in August 2024, the CPI inflation rate is expected to remain above the 2 percent target for at least one more year according to the Bank.[2] The inflation deviations from target have ignited criticism of the Bank's ability to control inflation.

This paper builds on, and complements, our previous work (see Pang and Shiamptanis 2024). We look at the Bank's behaviour in its setting of the overnight rate over the inflation-targeting period, specifically comparing its response to deviations of inflation from target and deviations in the economy from potential, i.e., the output gap.[3] We use a novel dataset to estimate monetary policy rules for the Bank. The new Bank of Canada Staff Economic Projections (SEP) dataset contains historical real-time data and forecasts; that is, the data available to policymakers at the time monetary policy decisions were made. Estimating these monetary policy rules using real-time data allows us to analyze whether, and how, the Bank's policy responses evolved over time, examine how truly symmetric the Bank was in its implementation of the inflation-targeting policy, and also investigate whether the Bank's historical behaviour contributed to it falling behind in raising the policy rate during the post-Covid period. Last, we use the Bank's latest Monetary Policy Report forecasts to "nowcast" the overnight rate, determining whether the policy rate is at the appropriate level or whether the Bank is now falling behind in lowering its policy rate.

The first takeaway is that the Bank has shifted its response from temporary to persistent expected future inflation deviations from target, and increased its response to the state of the economy, i.e., the output gap. Second, the Bank responded asymmetrically to positive and negative future inflation deviations. The Bank responded to positive future inflation deviations up until the mid-2000s, and then the Bank's response shifted to negative future inflation deviations. Third, the Bank delayed raising the interest rate after the pandemic, partly due to this asymmetric behaviour.[4]

The Context

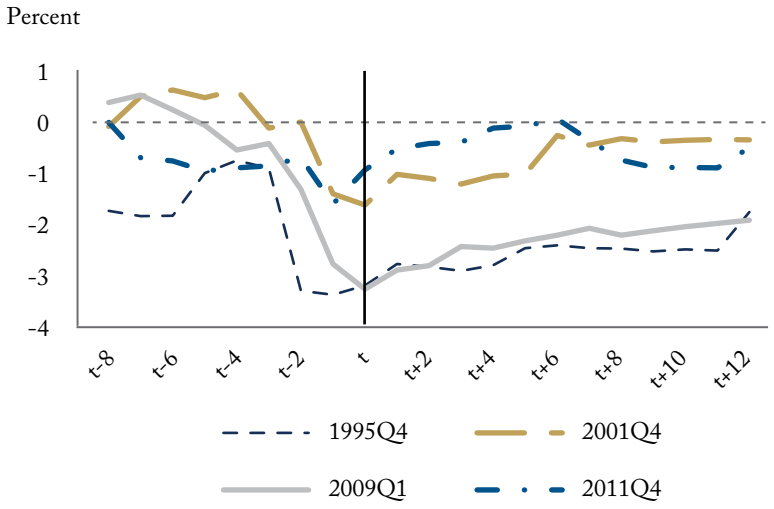
In Canada, prior to the release of the SEP dataset, the estimation of monetary policy rules had been plagued by the absence of historical real-time data and forecasts. When estimating monetary policy rules for Canada, researchers have had to rely on revised data – the data available today – (Curtis 2005), constructed forecasts (Nikolsko-Rzhevskyy 2011), or used proxies for the historical forecasts (Hayo and Neuenkirch 2011). As a result, they often obtained mixed results about the Bank's responses to inflation and the real economy. Studies in other countries, including the US (see Orphanides 2001, 2002, 2003), have found that monetary policy rules – estimated using revised data – yield misleading results; this is because revised data contain information that was not available to

2 Monetary Policy Report published in July 2024.

3 This is the well-known Taylor rule (Taylor 1993), which calculates how the overnight rate could change based on these two deviations.

4 It is important to note that in this paper we mainly use the overnight rate, as it is the key tool used by the Bank. We account for the unconventional monetary policy employed during the GFC period by using the Canadian shadow rates constructed by MacDonald and Ksawery Popiel (2020). Shadow rates can be negative, illustrating the additional stimulus by the Bank via unconventional policies.

Figure 1: Output Gap Forecasts, Nowcast and Revisions



Note: t = time, plus or minus quarters.

Source: Authors' calculations.

policymakers at the time the interest rate decisions were made.

Figure 1 illustrates how the output gap has evolved over time for four data points (1995Q4, 2001Q4, 2009Q1, 2011Q4), based on data from the SEP dataset.[5] Each line presents the evolution of one data point, starting with the forecast generated eight quarters in advance and ending with the revised value twelve quarters later.[6] If the forecasts are always correct and there are no data revisions after the initial release, the lines should be straight and horizontal. We do not see that in practice.

Consider the gray line, which represents the evolution of the 2009Q1 data point. Back in 2007Q1, the eight-quarter-ahead output gap forecast for 2009Q1 was 0.38 percent. Four quarters later, in 2008Q1, the output gap forecast for 2009Q1 was revised to -0.54 percent. In 2009Q1, the reported value was -3.26 percent. Fast forward to 2012Q1 (twelve quarters later), and the 2009Q1 output gap was revised to -1.91 percent.[7]

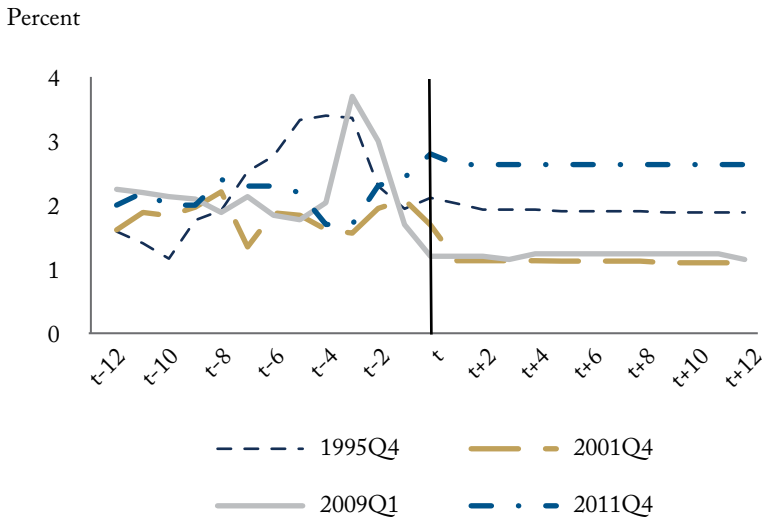
Figure 2 shows the evolution of the four data points for the CPI inflation rate, starting with the forecast from twelve quarters ago and ending with the revised value twelve quarters later. There are again notable changes in historical forecasts for inflation, as there were for the output gap. While not as pronounced as in the case of the output gap,

5 The four dates were selected to illustrate the forecasts and data revisions around the post-disinflation, the dot-com bubble burst, the GFC, and post-GFC periods. Output gap forecasts are based on estimates of the potential output, which is not directly observable.

6 In the SEP dataset, the Bank staff output gap forecasts are available eight quarters in advance, while the Bank staff inflation forecasts are available twelve quarters in advance.

7 The revised output gap values are still estimated, as the potential output is not directly observable. See Champagne et al. (2018) for the real-time properties of the SEP output gap estimates.

Figure 2: CPI Inflation Rate Forecasts, Nowcast and Revisions



Note: t = time, plus or minus quarters.

Source: Authors' calculations.

data revisions following the initial release are also present.[8]

All of this reinforces the notion that when estimating monetary policy rules – and the behaviour of the central bank by extension – it is important to use historical forecasts, as this was the data that policymakers had access to when policy decisions were made. The Bank staff forecasts only recently became available, enabling us to now conduct an in-depth analysis of the Bank's behaviour. The SEP dataset is released with a five-year lag and is equivalent to the US Tealbook (formerly Greenbook) dataset. Champagne et al. (2020) introduced the new SEP dataset and evaluated the Bank staff forecasts. While the Bank is sometimes under intense scrutiny for the quality of its forecasts, Champagne et al. (2018) found that the errors of the Bank staff forecasts have declined over time and that staff forecasts outperform forecasts from other sources and time series econometrics techniques. Champagne and Sekkel (2018) use the new SEP dataset to construct monetary policy shocks and find that the monetary policy effects have not changed much after inflation targeting. This paper uses the new SEP data to estimate monetary policy rules.[9]

8 Note that the small revisions apply to seasonally adjusted CPI series. The unseasonally adjusted CPI data are not revised.

9 The Bank staff forecasts are provided to Governing Council in preparation for monetary policy decisions. The Governing Council uses the forecasts as one input of many into its monetary policy decisions. The Monetary Policy Report (MPR) forecasts represent the more complete view of the Governing Council. However, Champagne et al. (2020) found that MPR forecasts and SEP forecasts are highly correlated. Moreover, the MPR forecasts are available for a shorter horizon with MPR forecasts for inflation and output first published in 2003 and 2004, respectively. Within that short horizon, the MPR forecasts are also not available for every quarter over the forecast horizon. To study the behaviour of the Bank since inflation targeting, the SEP data serves better in terms of data availability.

Estimating Monetary Policy Rules

Monetary policy rules that describe how the policy rate responds to inflation and the real economy are widely used to investigate central bank behaviour and their effects. Policymakers also use economic models with these types of monetary policy rules when conducting their own analyses.[10] The most popular monetary policy rule is the Taylor rule (Taylor 1993). Variants of this rule have been shown to describe quite well the behaviour of many central banks over many different periods, including the US, Germany, France, Italy, Japan, and the UK (Judd and Rudebusch 1997; Clarida et al. 1997, 2000; Orphanides 2001, 2002, and 2003, Yellen 2012, and Bernanke 2015).[11] Although early papers assumed that the interest rate responded to lagged or contemporaneous inflation and output gap, it has now become common practice to estimate forward-looking Taylor rules because it takes time for monetary policy to affect the real economy and inflation (Coibion and Goldstein 2012; Coibion and Gorodnichenko 2011, 2012). In Canada, the absence of Canadian historical real-time data and central bank forecasts had limited our capacity to conduct this analysis. This paper fills this gap.

Our approach to estimating forward-looking monetary policy rules allows us to identify the time-varying behaviour of the Bank, and determine whether, and how, it systematically responded to future inflation and the output gap.[12] While central banks consider a much wider set of information and data, ultimately these other variables have an effect on supply and demand in the economy such that it eventually leads to changes in future inflation and the output gap. By focusing on these two important variables, the Bank has effectively considered a comprehensive set of information about the economy.

The Bank Responds to: Inflation or the Economy?

Unlike the Federal Reserve, the Bank does not have a dual mandate targeting both inflation and employment. The Bank focuses on price stability and its main objective is to maintain low and stable inflation over time. Although the Bank does not have an explicit objective to stabilize the economy, it supports maximum employment and economic growth (BoC 2021). This naturally raises the question of whether the Bank responds more to inflation deviations – as part of its primary objective – or the output gap as part of its support of economic growth.[13]

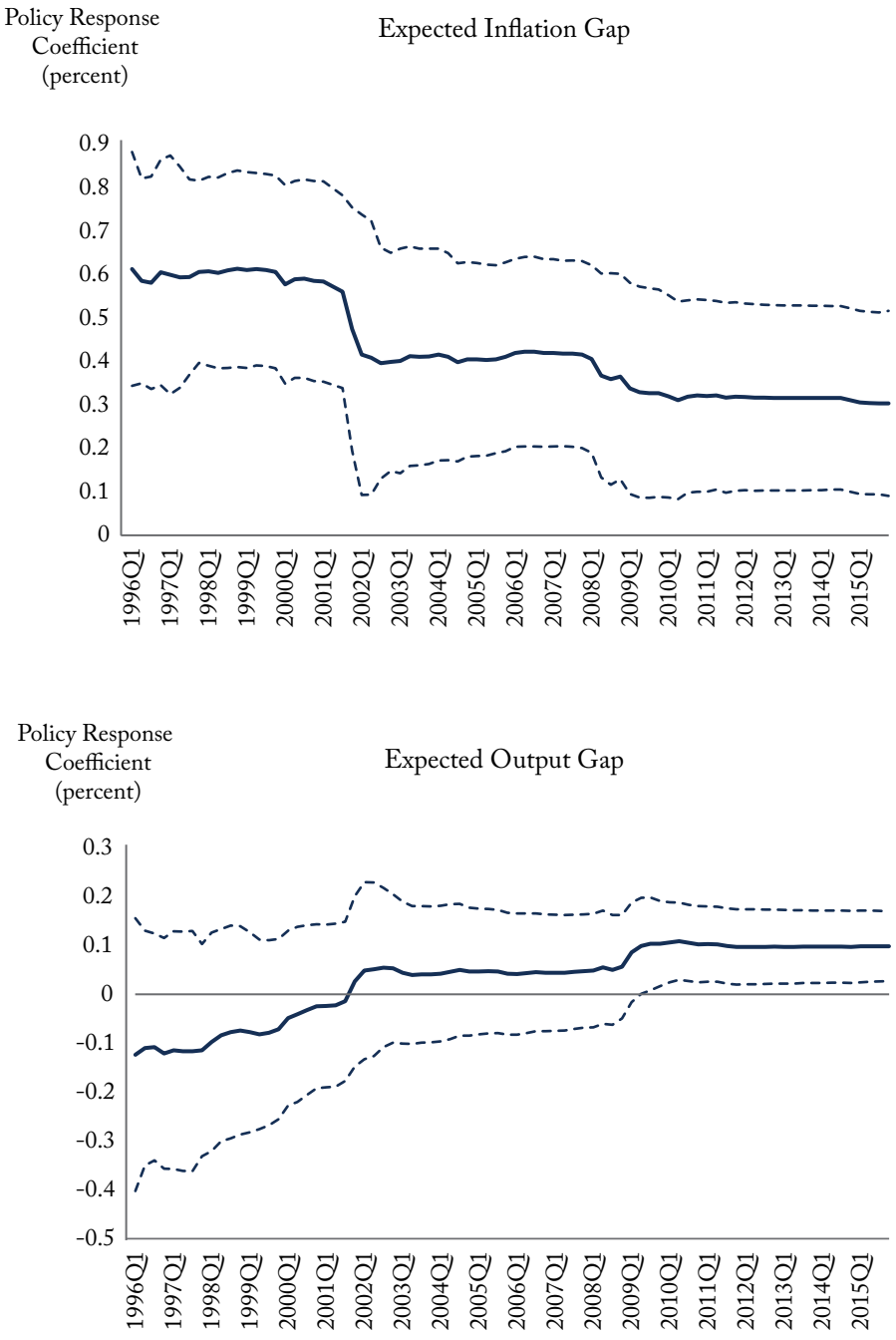
10 The Bank's LENS model uses an estimated historical forward-looking Taylor rule (Gervais and Gosselin 2014). The Bank's original ToTEM model uses a theoretically optimized monetary policy rule, as well as a historically estimated forward-looking Taylor rule that replicates the average behaviour of the Bank over the 1980-2004 period (Murchison and Rennison 2006). The original ToTEM model is updated to ToTEM II in 2011, in which the monetary policy rule is modeled as a forward-looking Taylor rule. Dorich et al. (2013) provide the details of the ToTEM II model and report the estimated monetary policy rule using data from 1980 to 2012.

11 The Taylor rule has been recognized in the literature as a good description of central banks' behaviour in many countries since the late 1980s. It also proxies the optimal monetary policy in the New Keynesian framework used in central banks' own economic and projection models. The importance and relevance of the Taylor rule is acknowledged in the 2023 Hoover Institution Monetary Policy Conference: Marking Thirty Years Of The Taylor Rule https://www.hoover.org/news/hoover-institution-hosts-monetary-policy-conference-marking-thirty-years-taylor-rule.

12 See the **online Appendix** for the empirical specifications.

13 Stabilizing inflation and stabilizing the output gap are complementary when dealing with demand shocks – what Blanchard and Gali (2007) called a '*divine coincidence.*' Central banks, however, face trade-offs in the context of supply shocks. Moreover, inflation-targeting central banks have some flexibility in how quickly they will return inflation to target. This extra flexibility contributes to their ability to consider the real economy in addition to the inflation target.

Figure 3: Monetary Policy Response to Expected Inflation and Output Gap – Recursive Regression (Anchor in 1991Q1)



Note: dashed lines are the 95 percent confidence intervals of the estimated coefficients.

Source: Authors' calculations.

We find that the Bank's response has evolved since it adopted inflation targeting in 1991. Specifically, the Bank's response gradually shifted from inflation to the output gap, as shown in Figure 3.[14] A declining coefficient indicates that the response of the central bank shifts away from the corresponding variable and vice versa.[15] In the early part of the sample, as inflation-targeting was taking hold, the Bank responded mainly to inflation and not to the output gap. As time evolved, the Bank's response to inflation started weakening, and the response to the output gap started strengthening. We find that, following economic slowdowns or recessions such as the one in the early 2000s and the GFC, the Bank further increased its response to the output gap and decreased its response to inflation.

These results could suggest a shift in the Bank's focus, especially in a low and stable inflation rate environment. Komlan (2013) argues that when inflation is near its target, policymakers could be more averse to recessions than expansions and thus put more effort into stabilizing the economy. Cukierman and Muscatelli (2008) refer to central banks that exhibit this type of behaviour as having recession-avoidance preferences.[16] Alternatively, these results could reflect the fact that the inflation-targeting framework in Canada is designed to be flexible. It allows the Bank to tailor its responses to better manage risks and achieve its mandate. Initially, the Bank responded to inflation more heavily as it brought inflation down to a low and stable level and tried to establish its credibility. Once satisfied that Canadians understood what it was trying to achieve, and expectations were anchored, the Bank shifted its response to the real economy with confidence that it would not affect its ability to hit its inflation target.

A Different Inflation Measure: Persistent Inflation Deviations

An inflation-targeting central bank is expected to react to an inflation measure.[17] We have shown in Figure 3 the declining response to inflation and an increasing response to the output gap. We ask here whether there are alternative measures of inflation that the Bank might have responded to during the period that inflation was well anchored.

We construct a new inflation measure, which uses the SEP data and averages expected future inflation deviations over the next two to three years. This new measure also captures the notion that small deviations may be tolerated as they fall within

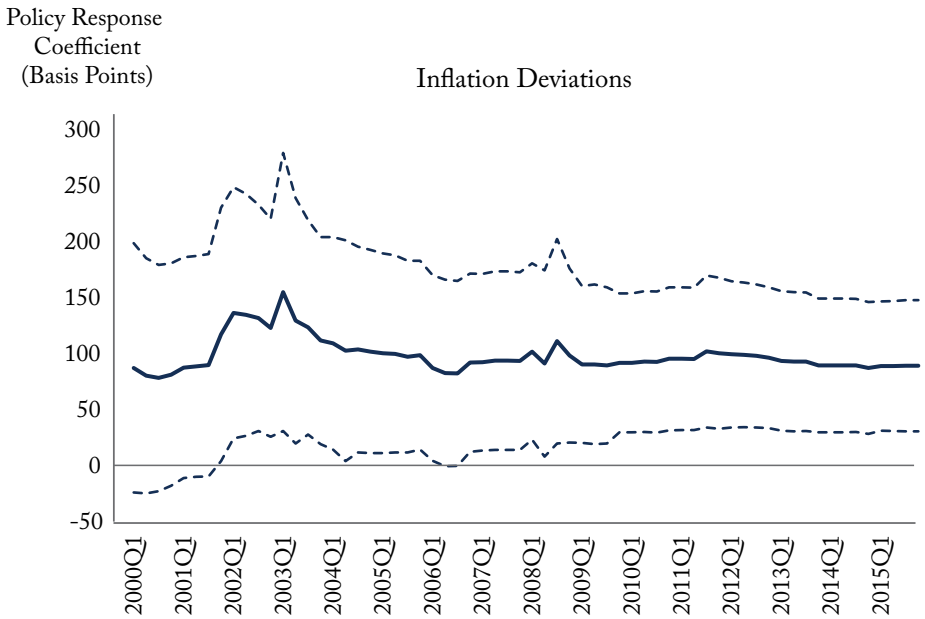
14 The solid lines are the point estimate of the policy response coefficients, and the dashed lines are the 95 percent confidence intervals of the estimated coefficients. We anchor the starting date in 1991Q1 and increase the window size by a quarter each time until the entire sample is used. The date on the horizontal axis shows the end of each recursive window. The first observation shows the estimated coefficient on the expected inflation gap (left graph) and output gap (right graph) using 1991Q1-1996Q1 data. The vertical axis is in percentage points.

15 In this paper we present the results from the recursive regressions (starting date is anchored and the ending date moves by a quarter) to both illustrate the effect on the coefficients as more data become available, and also shed some light on certain periods (such as the economic slowdown in the early 2000s and the 2008 GFC). Our results are robust if we use fixed window rolling regressions, reverse recursive regressions (ending date is anchored and the starting date moves by a quarter from the beginning of the sample towards the end), divide the sample into the disinflation period and the post-disinflation period, divide the sample by the tenure of the Bank's Governors, and if we use the Bai and Perron (1998) structural break test to endogenously determine the break dates. All the approaches reveal the same conclusion: there is a change in the inflation and output gap coefficients.

16 The 2021 Monetary Policy Renewal Framework alluded to an increased emphasis on the state of the economy with references to "supporting maximum sustainable level of employment", without explicitly proposing a dual mandate.

17 Kiley (2007), Ascari and Ropele (2009), and Coibion and Gorodnichenko (2011) show that the combination of a large output gap coefficient and a small inflation coefficient in a Taylor rule could induce indeterminacy.

Figure 4: Monetary Policy Reaction Function with Symmetric Response to Persistent Future Inflation Deviations – Recursive Regression (Anchor in 1995Q1)



Note: dashed lines are the 95 percent confidence intervals of the estimated coefficients.

Source: Authors' calculations.

a central bank's "comfort zone" (Mishkin 2008), but large deviations will prompt policy responses. We follow Neuenkirch and Tillmann (2014) and Paloviita et al. (2021) and add the new inflation measure to the standard monetary policy rules.[18]

Figure 4[19] reveals that after 1995, (i.e., after the disinflation period) inflation deviations that are more persistent – meaning inflation that is expected to remain away from its target for an extended period of time – elicited policy responses by the

18 See online Appendix for more details.

19 The solid line is the point estimate of the policy response coefficient, and the dashed lines are the 95 percent confidence intervals of the estimated coefficient. We anchor the starting date in 1995Q1 and increase the window size by a quarter each time until the entire sample is used. The date on the horizontal axis shows the end of each recursive window. The first observations show the estimated responses using 1995Q1-2000Q1 data. The last observations show the estimated responses using 1995Q1-2015Q4 data. The vertical axis is in basis points, which differs from the percentage points used in Figure 3. The estimated coefficient between 1995Q1 and 2015Q4 on the persistent inflation deviation term is 90.294, which suggests that the interest rate will change by 0.90294 percentage points (or 90.294 basis points) if the average inflation over the current and the next nine quarters is expected to be 1 percentage point away from its target (0.01 × 0.01 × 90.294 × 100 = 0.90294).

Bank.[20] The results reveal that the Bank shifted its response from temporary inflation deviations (as we saw above) towards persistent inflation deviations.

How Far Ahead?

One of the key characteristics of the Bank's inflation-targeting framework is that it is forward-looking. Indeed, our results indicate that the Bank was always responding to a forward-looking inflation measure. How far ahead does the Bank look? Initially, it was the expected inflation gap one year ahead, but later it was the average of expected inflation deviations about two to three years ahead. On the real economy side, we find that the Bank is responding to the expected output gap half-a-year ahead. These findings align with the Bank's communication that monetary policy first affects the real economy and then the inflation rate.[21]

How About the Past?

Neuenkirch and Tillmann (2014), Svensson (2015), and Paloviita et al. (2021) find evidence that some central banks are responding to past inflation misses. The Federal Reserve's average inflation-targeting framework (adopted in August 2020) is history-dependent; that is to say it aims to keep the average inflation rate at the target such that periods of below-target inflation could be offset with periods of above-target inflation, making up for past misses. We follow the Neuenkirch and Tillmann (2014) approach and include a backward-looking term in the monetary policy rule that averages past inflation deviations over various periods. We do not find any evidence that the Bank makes up for past inflation misses.[22] Our results suggest that the Bank follows a strategy in which bygones are bygones, as would be expected of an inflation-targeting regime, which is consistent with the above on the Bank's communication – that it is always conducting monetary policy in a forward-looking manner.

Symmetric or Asymmetric?

Another key feature of the Bank's inflation-targeting framework is symmetry. Is the Bank equally concerned with inflation rising above target as it is with inflation falling below target? As shown in Figure 4, the Bank appears to respond in a symmetric way to persistent future inflation deviations. However, upon further investigation, we find evidence of asymmetric and time-varying behaviour by the Bank. We separate the persistent inflation deviations into positive (i.e., overshoots) and negative (i.e., undershoots) deviations, and we also examine whether the Bank's responses to the positive and negative deviations have changed.[23] We find that the Bank responded differently to positive and negative future inflation deviations, and these

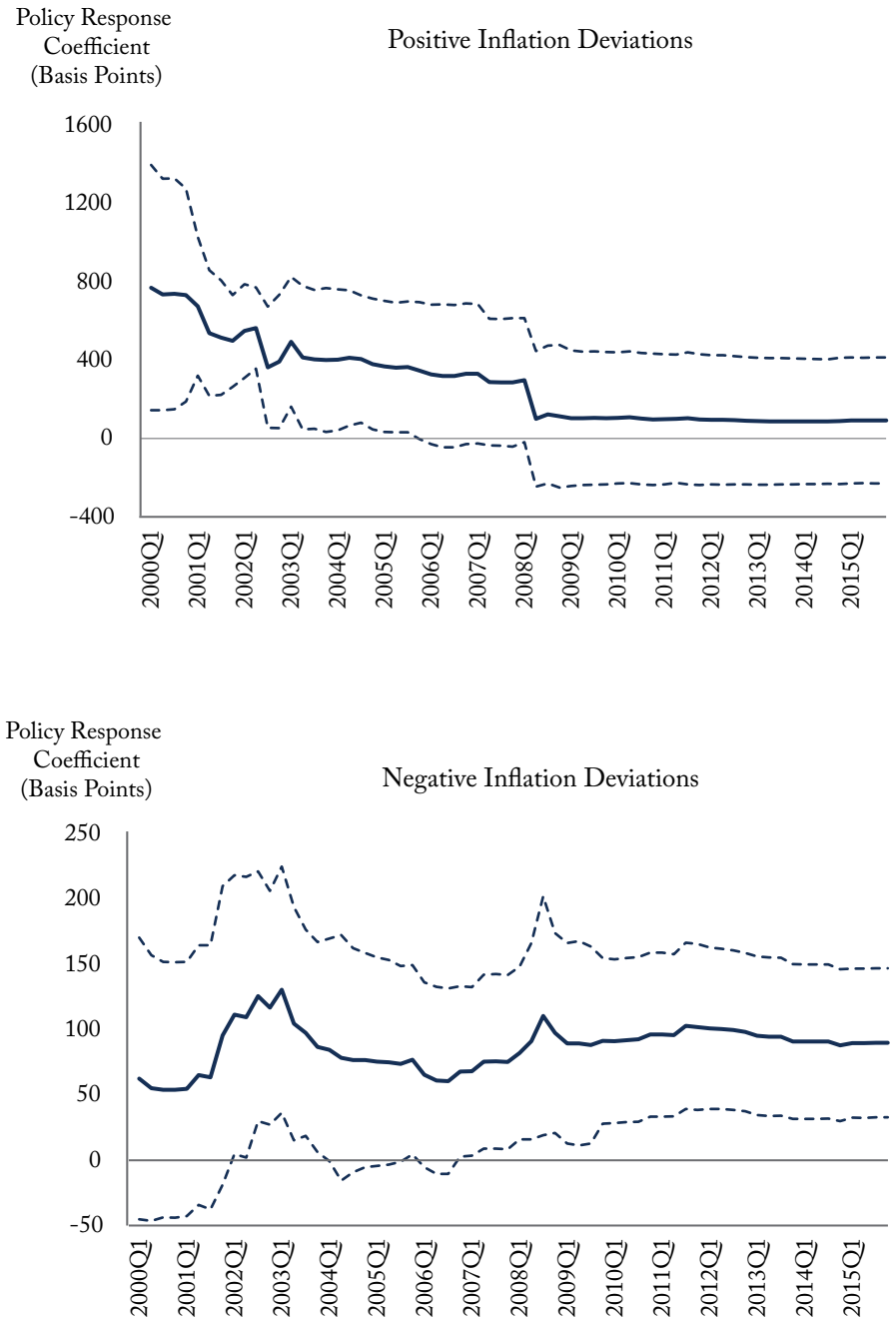
20 Our results are robust to alternative approaches that investigate the time-varying response to temporary and persistent inflation deviations. See Section 4.2 in Pang and Shiamptanis (2024).

21 As the Bank explains in its Core Functions "Monetary policy actions take time - usually between six and eight quarters - to work their way through the economy and have their full effect on inflation. For this reason, monetary policy is always forward-looking, and the policy rate setting is based on the Bank's judgment of where inflation is likely to be in the future, not what it is today." https://www.bankofcanada.ca/core-functions/monetary-policy/

22 We find that the estimated coefficients for the past inflation deviations are always statistically insignificant. See the online Appendix and Pang and Shiamptanis (2024) for more details.

23 See online Appendix for additional information.

Figure 5: Monetary Policy Reaction Function with Asymmetric Response to Persistent Future Inflation Deviations – Recursive Regression (Anchor in 1995Q1)



Note: dashed lines are the 95 percent confidence intervals of the estimated coefficients.

Source: Authors' calculations.

differences evolved over time (see Figure 5[24]). In particular, the Bank's response gradually shifted from positive to negative future inflation deviations.

As illustrated in the left chart of Figure 5, at the beginning of the post-disinflation period (1995Q1-2001Q4), we find that the Bank is responding only (and strongly) to future inflation overshoots.[25] The estimated responses to overshoots (top chart) are substantially larger – more than five times larger – than the responses to undershoots (bottom chart). Although this period is dominated by large expected future inflation undershoots – partly due to the lingering effect of past monetary policy tightening, fiscal restraint in Canada, the Asian Financial Crisis, crises in other emerging markets (Russia, Latin America, etc.), and lower commodity prices – we do not find that the Bank was responding to the expected undershoots. This behaviour could be driven by monetary authority preferences in a period when it was establishing credibility and stabilizing inflation (Ruge-Murcia 2003, Surico 2007, Komlan 2013).

Over time, however, we find that the strong response to future inflation overshoots (top chart of Figure 5) disappears, and the Bank eventually only responds to future inflation undershoots (bottom chart of Figure 5). Bianchi et al. (2021), Maih et al. (2021) and Clarida (2022) argue that it is optimal for a monetary authority to respond more aggressively to negative inflation deviations (undershoots) than to positive inflation deviations (overshoots) in an environment where the policy rate is near the zero lower bound (ZLB) and the neutral real rate is low, as it did (and was) during this period. The asymmetry arises because the ZLB and the low neutral real rate reduce the policy space available to counteract recessionary shocks, while central banks have plenty of policy space to counteract inflationary shocks.

How About other Variables?

Our findings in the previous sections indicate that the Bank's response to the output gap was strengthening, and its response was shifting towards persistent inflation deviations that were asymmetric and time-varying. These results remain robust when we replace the output gap with the unemployment rate or the real GDP growth rate, and when we use core inflation instead of headline inflation. Our results are robust even when we use the Canadian shadow rates constructed by MacDonald and Ksawery Popiel (2020) that account for unconventional monetary policies. Our estimation sample period includes the GFC. During this period, the Bank engaged in unconventional monetary policy to further stimulate the economy. While the Bank did not engage in quantitative

24 The solid lines are the point estimates of the policy response coefficients, and the dashed lines are the 95 percent confidence intervals of the estimated coefficients. We anchor the starting date in 1995Q1 and increase the estimation window size by a quarter each time until the entire sample is used. The date on the horizontal axis shows the end of each recursive rolling window. The first observations show the estimated responses using 1995Q1-2000Q1 data. The last observations show the estimated responses using 1995Q1-2015Q4 data. The y-axis is in basis points. The large magnitude is due to the non-linearity in the calculation of the persistent future inflation deviation variable. For instance, the estimated coefficient between 1995Q1 and 2001Q4 on the persistent positive inflation deviation term is 498.704 (left chart), which suggests that the interest rate will increase by 4.98704 percentage points (or 498.704 basis points) if the average inflation over the current and the next nine quarters is expected to overshoot the target by 1 percentage point ($0.01 \times 0.01 \times 498.704 \times 100 = 4.98704$). The estimated coefficient between 1995Q1 and 2015Q4 on the persistent negative inflation deviation term is 89.991 (right chart), which suggests that the interest rate will decrease by 0.89991 percentage points (or 89.991 basis points) if the average inflation during the current and the next nine quarters is expected to undershoot the target by 1 percentage point ($0.01 \times 0.01 \times 89.991 \times 100 = 0.89991$).

25 We say "only" because the solid line on the right-hand side figure sits within the confidence intervals (the two dashed lines), meaning the point estimate (the solid line) is not statistically significant or significantly different from zero.

easing (QE), it used forward guidance and credit easing. Therefore, the true policy stance during the GFC was more accommodative than what the actual policy rate demonstrated. The Canadian shadow rates are slightly lower than the actual policy rate during the 2009-2010 period, yet our key findings and conclusions do not change.

We also find no evidence of the Bank responding to other variables often mentioned as potential considerations by central banks, e.g., the exchange rates and financial market conditions (Clarida et al. 1997, 2000; Curtis 2005; Nikolsko-Rzhevskyy 2011; Coibion and Gorodnichenko 2012).[26]

Delayed Interest-rate Hikes During the Post-pandemic Era?

In this section, we use the monetary policy rule that best encapsulates the time-varying characteristics and forward-looking behaviour of the Bank during the period for which we have data (1991Q1-2015Q4), and we aim to determine whether this explains the Bank's delay in raising the policy rate when the economy recovered from the pandemic, and inflation accelerated to a three-decade high.

To determine where the policy rate should have been, we need the forecasts that were available to policymakers in each quarter between 2019 and 2024. The Bank staff forecasts during this period are not publicly available. They will be released with a five-year lag. Therefore, to get a glimpse of what the Bank was expecting about inflation and the economy during this period, we turn to the nowcasts and forecasts published in the Bank's quarterly Monetary Policy Reports (MPR).

MPR forecasts reflect the views of the Governing Council and are not identical to the Bank staff forecasts, but Champagne et al. (2020) found that they are highly correlated. Figure 6 shows the average inflation rate forecast over the current and next nine quarters, and the two-quarters ahead output gap forecast, as these appear to be the main timeframes for the Bank's decisions – based on our earlier findings. The horizontal axis in Figure 6 represents the time that the forecasts were made.[27] We can see that in 2019Q4, the Bank was expecting the inflation rate over the current and next nine quarters to be at its 2 percent target and was anticipating the economy two quarters ahead to be just below its full-employment level and thus a very small negative output gap of less than 0.3 percent. Given the unprecedented uncertainty of the pandemic, neither nowcasts nor forecasts for inflation and output gap were provided for 2020Q1.

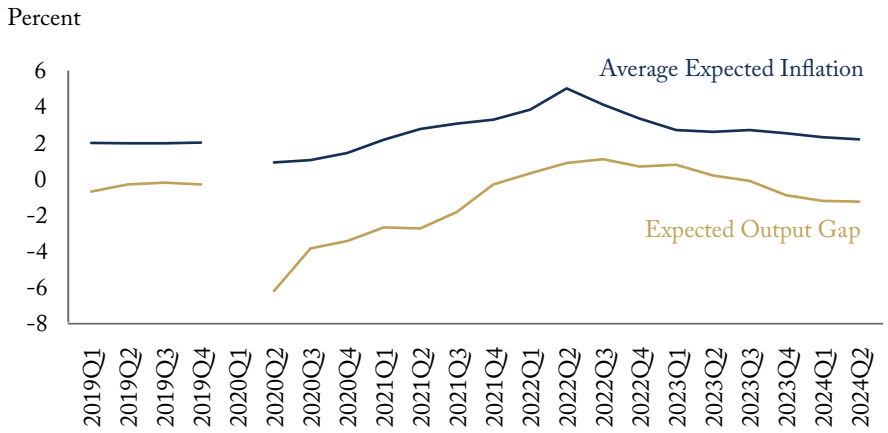
Using the MPR forecasts (from Figure 6), we investigate the timing and the changes of the policy rate since 2019. Figure 5 has shown that the Bank's response gradually shifted from positive inflation deviations to negative inflation deviations, and eventually the Bank's response to positive inflation deviations disappeared. In Figure 7, we plot two scenarios: negative deviations and symmetric.[28] The negative deviations scenario represents where the interest rate should have been if the monetary authority had continued focusing on the negative future inflation deviations and the real economy, while ignoring the positive inflation deviations. The symmetric scenario shows where the interest rate should have been if the monetary authority had followed a more symmetric approach that considers both the positive and negative future inflation

26 See Pang and Shiamptanis (2024) for details.

27 The MPR forecasts are not available for every quarter over the forecast horizon. We use linear interpolation to construct the missing values of expected inflation. We use the nowcast of output gap and the forecasts of the growth rates of output and potential output reported in the MPRs to construct the values of expected output gap. We report the values used for the 2019Q1-2024Q2 period in the online Appendix. The horizontal axis corresponds to the time that the forecasts were made.

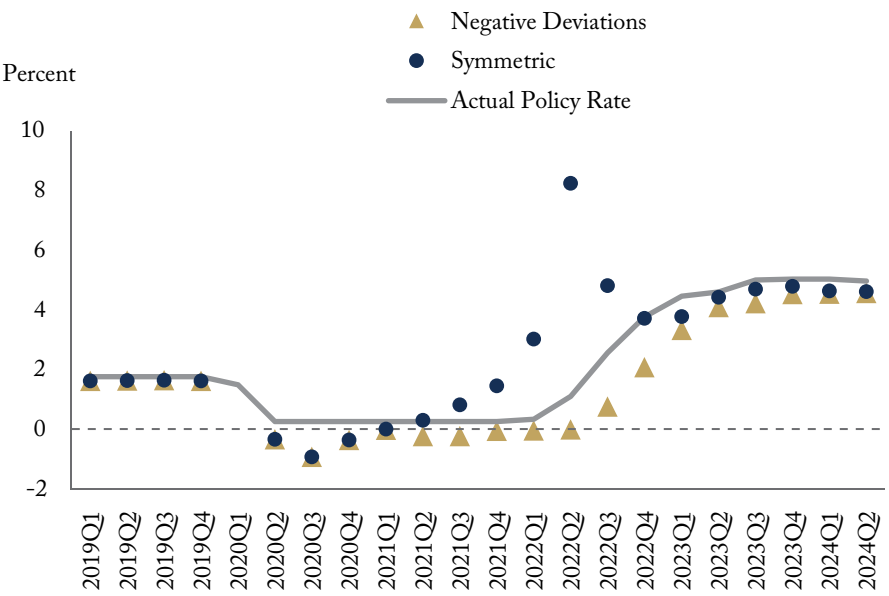
28 See online Appendix for the coefficients used to construct the two paths.

Figure 6: MPR Forecasts



Source: Bank of Canada's Monetary Policy Reports and authors' calculations.

Figure 7: Estimated vs Actual Policy Rate



Source: Authors' calculations.

deviations in addition to the real economy. Figure 7 also includes the actual quarterly policy rate.

2019Q1-2021Q1

We find that up to 2019Q4, both scenarios yield nearly identical interest rate estimates and closely match the actual policy rate, which suggests consistency in what different rules tell us was the appropriate policy rate at the end of 2019 and prior to the global pandemic. However, between 2020Q2 and 2021Q1, both scenarios, driven mainly by the large pandemic-induced negative shock to the real economy, suggest that the policy rate should have been below the actual policy rate at the time, which was set at 25 basis points, considered to be the ZLB. In other words, our results suggest the need for more accommodative monetary policy than just keeping the policy rate at the ZLB.

A disclaimer is necessary. Our approach mainly considers the conventional monetary policy tool, i.e., the policy rate. It abstracts from unconventional monetary policy tools, such as QE. In the absence of QE, our results imply that the policy rate should have dropped into negative territory. Instead, the Bank kept the policy rate at the ZLB and provided further monetary stimulus through QE, beginning in March 2020. Whether QE was effective or sufficient, or where the shadow rate was during this period, is beyond this study; it is however clear that additional monetary stimulus was needed, and it is plausible that the combination of conventional and unconventional monetary policy was appropriately stimulative during the early part of the global pandemic.

2021Q2-2022Q4

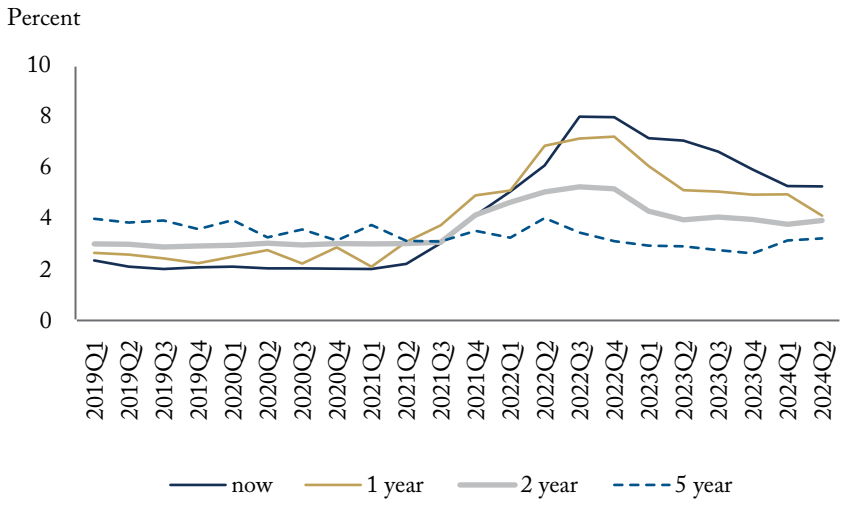
In 2021Q2, the two estimated rates begin to diverge. The reopening of economies led to faster recoveries in advanced countries and a stronger outlook for global growth. The forecasts in 2021Q2 revealed that inflation was expected to remain above its 2 percent target for at least two years. A quarter later, in 2021Q3, the Bank expected the average inflation over the next two-and-a-half years to be higher than previously forecasted and was going to remain above the 3 percent upper bound of the target range (Figure 6). The symmetric scenario calls for monetary tightening, with the first interest rate hike occurring by 2021Q3. In contrast, the negative deviations scenario suggests that the policy rate should remain unchanged. At this point, it appears that the Bank was still focusing on the real economy and perceived the higher-than-normal inflation rate forecast as temporary, and thus resisted raising the policy rate.[29]

Although the Bank slowed down QE as the economy emerged from the pandemic, monetary policy kept adding incremental stimulus to the economy until October 2021 with weekly new purchases of Canadian government bonds. That is, monetary policy became increasingly accommodative (loose) until the fall of 2021. In November 2021, the Bank switched to the reinvestment phase of QE, meaning no further net new purchases and no additional monetary stimulus. But all the existing significant monetary stimulus injected through QE remained in place.

As we know from our lived inflation experience – and as the symmetric scenario makes clear – the Bank increasingly fell behind the curve by not

29 The post-Covid inflation surge turned out to be neither temporary nor driven only by supply-side factors. As Chen and Tombe (2023) pointed out, a considerable amount of inflation, starting in early 2021, was demand driven. Figure 6 shows that the Bank's own average inflation rate forecast over the current and next nine quarters was rising since the beginning of 2021. Treating inflation as primarily driven by temporary and supply-side shocks proved to be costly. That said, although the Bank's own two-quarters-ahead output gap forecast was rising at the time (Figure 6) and the negative output gap was expected to close by the end of 2021 and keep improving thereafter, increased uncertainties about the real economy may have made the Bank more reluctant to tighten monetary policy.

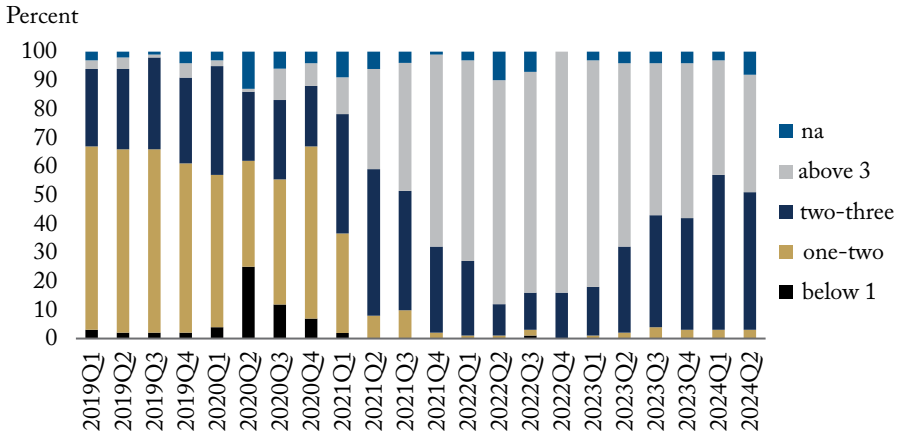
Figure 8: Canadian Survey of Consumer Expectations – Expected Inflation



Note: Perceived rate of inflation over the past 12 months (now), the short-term (1-year ahead), the medium-term (2-years ahead), and the long-term (5-years ahead) expected annual inflation rate.

Source: Bank of Canada Survey of Consumer Expectations.

Figure 9: Business Outlook Survey – Expected Inflation



Note: Percentage of firms expecting the annual rate of inflation over the next two years to be below 1 percent, between 1 and 2 percent, between 2 and 3 percent, above 3 percent, or no response.

Source: Bank of Canada Business Outlook Survey.

tightening monetary policy. The delay was costly as it jeopardized the Bank's credibility and most likely fueled both consumer and business inflation expectations (Figures 8 and 9, respectively). The delay also meant sharper rate hikes down the road, as we subsequently experienced. The largest difference between the actual policy rate and the estimated rate for the symmetric scenario occurred in 2022Q2 (Figure 7), as the Bank's own forecasts at that time unveiled that the average annual inflation rate over the next two-and-a-half years was expected to remain above 5 percent and the economy two quarters ahead was expected to be above its full employment level, with an expected positive output gap of 0.9 percent.[30]

In March 2022, the Bank began its interest rate hiking cycle, and in April 2022 it started Quantitative Tightening (QT) in which maturing Canadian government bonds on the Bank's balance sheet were no longer replaced. As a result, the size of the Bank's balance sheet started to decline and past monetary stimulus through QE was being withdrawn. The Bank continued its aggressive interest rate hikes, with the policy rate reaching a 15-year high by the end of 2022. Inflation expectations and forecasts eventually declined, bringing the estimated rate in the symmetric scenario almost in line with the actual policy rate by the end of 2022.

In contrast, the estimated rate under the negative deviations scenario (the monetary policy rule that focuses on negative future inflation deviations and the real economy) mimics the shape of the actual policy rate path, though with an even longer delay and fewer hikes. The Bank appears to be following the post-Global Financial Crisis approach – focused on concerns over a sluggish recovery and deflationary pressures.

2023Q1-2024Q2

Throughout 2023, the estimated rate in the symmetric scenario was similar to the actual policy rate, and the remaining interest rate hikes by the Bank during this period seemed warranted based on the inflationary pressures still lingering in the economy.

By the beginning of 2024, the Bank's rate hiking cycle had tamed inflation and cooled the economy. The Bank's forecasts in 2024Q1 (Figure 6) revealed that the Bank expected average inflation over the next two-and-a-half years to be about 2.3 percent and the output gap two quarters ahead was expected to be -1.2 percent; i.e., the Canadian economy was expected to be in excess supply providing more downward pressure on inflation. With expected inflation within the target range, close to the 2 percent target, and a negative output gap, it is natural to ask whether the Bank should have already pivoted to rate cuts in the first quarter of 2024. The answer is yes. Both the symmetric and negative deviations scenarios for 2024Q1 yielded a rate of about 50 basis points below the actual policy rate, calling for policy rate cuts in 2024Q1.

Despite the delay, the Bank eventually cut its policy rate by 25 basis points in June 2024, followed by another 25-basis-point cut in July 2024. The Bank's most recent forecasts in July had average inflation over the next two-and-a-half years continuing to decline, approaching the 2 percent target, and the two-quarters-ahead output gap was expected to further worsen to -1.25 percent (last point on Figure 6). Using these forecasts, both scenarios yield estimated rates for 2024Q2 that are still about 25-50 basis points below the actual policy rate, suggesting that the rate cuts could have been introduced earlier in the second quarter of 2024. The Bank subsequently announced another 25-basis-point cut in early September 2024,

30 If the Bank had raised rates earlier (i.e., responded in a more symmetric way), then its inflation forecasts in 2022Q2 would most likely have been lower and so would the spike in the estimated symmetric scenario.

recognizing softening economic growth and labour market data.

Conclusion

The post-pandemic interest rate hiking cycle was one of the most aggressive monetary policy tightening campaigns on record. It was, of course, justified given the inflation Canada faced. It was also clear from the evidence we present in this paper that the Bank falling behind the curve was predictable based on a shift in its response towards the output gap and negative inflation deviations. The delay, however, was costly, as it most likely fueled inflation expectations that kept actual inflation higher for longer, negatively impacting the Bank's credibility. Had the Bank raised interest rates earlier, we would not have seen excess demand build up as much as it did. We most likely would have avoided inflation climbing to, and remaining for so long, at levels not seen since the early 1980s.

To the Bank's credit, it was the first advanced country central bank to start tightening, and as a result inflation has gradually come back down to 2 percent as of August 2024. Although price increases in shelter, food, health, and transportation are still key contributors to inflation, concerns about soft economic activity and stalled employment growth have heightened in recent months. Inflation continues to moderate in Canada, and excess supply weighing on economic growth and wage growth puts further downward pressure on inflation.

The next scheduled policy announcement (October 23, 2024) will be accompanied by the Bank's next full outlook for inflation and the economy, which will help shape the path of the policy rate. Future rate changes will depend on incoming information and the Bank's assessment of both risks and forecasts for inflation and the economy. Any further rate cuts will be gradual if the forecasts of future inflation climb above the 2 percent target and the upside risks to inflation do not fully dissipate. In this scenario, the policy rate might decline but remain in restrictive territory to ensure inflation remains close to its target. If, however, the downside risks to inflation materialize – especially if the labour market softens more than expected – then the policy rate could decline faster.

Policymakers should continue to be forward-looking and base their policy rate decisions on future inflation and the future output gap. The important lessons learned from the recent experience are that a) the Bank should respond when its own forecasts reveal that expected inflation over the next two to three years is going to be persistently away from the 2 percent target, falling outside the inflation target range, and b) they should respond in a symmetric way to these deviations.

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