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For the Record: Assessing the Monetary Policy Stance of the Bank of Canada

Whether monetary policy in Canada is too loose, too tight, or just right, is sensitive to the methodology and underlying assumptions. In this first annual review, the authors assess the Bank of Canada's track record.

Steve Ambler and Jeremy Kronick

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THE STUDY IN BRIEF

This paper sets out to investigate two issues: first, it briefly provides a retrospective look at whether the stance of monetary policy was appropriate for hitting the Bank of Canada's inflation target during 2018 and 2019, and second, it examines how to determine in real time whether monetary policy is too loose or too tight. This is the first edition of an annual assessment of the Bank's monetary policy stance.

The behaviour of inflation and other macroeconomic indicators in 2018 and 2019 supports the hypothesis that the Bank of Canada's monetary policy over the past few years has been appropriate. Headline inflation in both years was very close to the Bank's 2 percent target despite volatile conditions in the world economy. The slowdown in world economic growth in 2019, even before COVID-19, led the Bank to postpone its planned normalization of the overnight rate target toward the neutral rate, where economic output is at potential and inflation is on target.

Our analysis of the real-time stance of monetary policy stops prior to the arrival of COVID-19. With the lack of room the Bank had to lower the overnight rate when the pandemic began, it is very likely any analysis in the middle of the COVID-19 crisis would indicate too tight a monetary policy stance. To establish the validity of our indicators, we thought it more appropriate to look at what they tell us about the monetary policy stance in more normal times.

We find that different methodologies give different results about the stance of the Bank's monetary policy at the end of 2019. Our analysis highlights the fact that measuring the monetary policy stance of a central bank is sensitive to the evaluative methodology. This is an important conclusion by itself, and suggests using an eclectic approach to evaluating monetary policy stances and multiple methodologies as robustness checks. This approach could also give an idea of the sensitivity of measures of the stance of monetary policy to underlying assumptions. By examining different aspects of the transmission mechanism, one could get a clearer picture of how monetary policy operates than through the black box of a general equilibrium forecasting model.

By and large, this is how the Bank of Canada actually conducts its monetary policy: tempering the forecasts of its formal general equilibrium models with data from many sources and a fair degree of judgment.

Evaluating its monetary policy stance next year, where the overnight rate is very likely to still be at the effective lower bound, will necessitate looking at other tools in its toolkit, such as forward guidance and quantitative easing.

Policy Area: Monetary Policy.

Related Topics: Central Banking; Cyclical Policies; Economic Outlook; Financial Stability; Inflation and Inflation Control; Interest Rates and Money Supply.

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In this *Commentary*, we look briefly at the evolution of the Canadian economy and the Bank of Canada's monetary policy in 2018 and 2019.

We then estimate a series of indicators that can be used to determine the current stance of monetary policy, which we plan to update annually in real time. We say that monetary policy is too loose when the Bank's monetary policy instrument (the target overnight rate) is below, and too tight when it is above – as measured by our indicators – what is necessary to achieve the 2 percent inflation target within the Bank's planning horizon of six to eight quarters.

In September 2009, during the Great Recession, Canada's headline inflation rate plunged as low as -0.9 percent.¹ Coming out of the recession, the Bank of Canada, along with quite a few other central banks in industrialized economies, had trouble getting inflation back to its 2 percent target. Between December 2011 and December 2017, headline inflation in Canada averaged only 1.42 percent, but in 2018 it averaged 2.3 percent and in 2019 it was 1.95 percent – almost indistinguishable from the target. This must be considered a success by almost any standard.

Our analysis of the Bank's monetary policy stance shows that different methodologies lead to different evaluations, and suggests that the Bank's success in hitting its target of late can be attributed to its careful use of judgment instead of mechanically relying on its forecasting models.

The analysis in this paper stops prior to the arrival of COVID-19. In a companion piece (Ambler and Kronick 2020), we look at the Bank of Canada's response during the early part of the pandemic. With the mixed results of our measures at the end of 2019, and with the lack of room the Bank had to lower the overnight rate when the pandemic began, it is very likely any analysis in the middle of the COVID-19 crisis would indicate too tight a monetary policy stance. To establish the validity of our indicators, we felt it more appropriate to look at what they tell us about the monetary policy stance in more normal times.

With the overnight rate at its effective lower bound (according to the Bank), this lack of room underscores the importance of unconventional tools such as forward guidance and quantitative easing in fighting this crisis, and likely will be a big part of our future analyses of the Bank's monetary policy stance.

THE GOALS AND OPERATION OF THE BANK OF CANADA'S MONETARY POLICY

The Bank of Canada's monetary policy framework is defined by an agreement with the Government of Canada, which is renewed every five years. The last renewal occurred in October 2016 (See Bank of Canada 2016a, 2016b). The main policy objective

The authors thank Alexandre Laurin, William B.P. Robson, Farah Omran, John Crow, Pierre Duguay, Angelo Melino, Mark Zelmer and anonymous reviewers for comments on an earlier draft. The authors retain responsibility for any errors and the views expressed.

1 This is the monthly value of the year-on-year change in the consumer price index; see Bank of Canada, "Consumer Price Index, 2000 to Present," online at <https://www.bankofcanada.ca/rates/price-indexes/cpi/>.

Key Concept Explainer

The Taylor Rule: Ben Bernanke, former Chair of the US Federal Reserve, has described the Taylor rule as an equation, or “rule of thumb” that is intended to describe the interest rate decisions of the Federal Reserve’s Federal Open Market Committee (FOMC). More broadly, economists apply it to the interest rate decisions of a central bank.

Formulated by Stanford economist John Taylor, the rule relates the central bank’s target overnight rate, which affects other rates in the economy, to the current state of the economy, including the rate of inflation and potential output.

The Taylor rule predicts that the central bank will raise the overnight rate (tighten monetary policy):

- (1) when the inflation rate rises above the Bank’s target of 2 percent; and/or
- (2) when output rises above its potential.

We use the Taylor rule, and variations of it, in this study to ask whether the Bank of Canada’s monetary policy is too loose or too tight based on what the rule would predict.

For further discussion see: <https://www.brookings.edu/blog/ben-bernanke/2015/04/28/the-taylor-rule-a-benchmark-for-monetary-policy/>.

is to keep Canada’s inflation rate low, stable and predictable. Stable and predictable inflation helps individuals (households and firms) make spending and financial decisions with more confidence, and thereby fosters both greater output at a moment in time and higher economic growth in the long run. More specifically, the Bank aims to keep headline inflation close to a target of 2 percent and within a 1 to 3 percent target range. The Bank has had an explicit inflation target since 1991, and has targeted an inflation rate of 2 percent since 1996.

The link between the Bank of Canada’s target overnight rate and inflation is known as the transmission mechanism. The Bank explains its understanding of the transmission mechanism in one of its *Backgrounders* (Bank of Canada 2012).

By setting its overnight rate target, it aims to affect the level of spending in the economy by households and firms. The Bank discusses four main channels through which monetary policy impacts the real economy: commercial interest rates, asset prices, the exchange rate and expectations.

Underpinning this transmission mechanism is a simple aggregate supply/aggregate demand model.² In the short to medium run, when monetary policy is loosened through a fall in the overnight rate – accompanied by a fall in other interest rates – this encourages spending, which shifts the aggregate demand curve up. This, in turn, boosts output and lifts prices. The opposite is true when monetary policy is tightened.³

² See Palley (1997) for a detailed exposition.

³ In the long run, aggregate supply is vertical, meaning that any shift in the aggregate demand curve has no effect on output; it simply causes an increase or decrease in prices.

Table 1: Canada's Economic Performance, Selected Indicators, 2018–19

Indicator	2018:1	2018:2	2018:3	2018:4	2019:1	2019:2	2019:3	2019:4
	<i>(year-over-year percentage change unless noted)</i>							
CPI inflation	2.1	2.3	2.7	2.1	1.6	2.2	1.9	2.1
CPI-trim	1.9	2.0	2.1	2.0	2.0	2.1	2.1	2.1
CPI-median	1.9	1.9	1.9	1.9	2.0	2.1	2.1	2.2
CPI-common	1.9	1.9	1.9	1.9	1.8	1.8	1.9	1.9
Inflation expectations	1.8	1.8	1.7	1.6	1.5	1.4	1.3	1.3
Commodity prices	11.40	22.30	13.50	-8.50	-3.30	-10.10	-7.50	6.50
GDP growth	1.7	2.2	1.6	2.4	1.0	0.8	3.5	1.3
Output gap (integrated)*	-0.2	-0.2	-0.1	-0.3	-0.6	-0.3	-0.4	-0.8
Output gap (extended)*	0.7	0.6	0.6	0.3	0.0	0.2	-0.1	-0.6
Unemployment rate*	5.8	5.9	5.9	5.6	5.8	5.5	5.6	5.7
Labour market indicator*	6.1	6.1	6.1	5.9	5.9	5.6	5.5	5.6
Overnight rate target*	1.25	1.25	1.50	1.75	1.75	1.75	1.75	1.75

Note: CPI-trim excludes 20 percent of the weighted monthly price variations at the bottom and 20 percent at the top of the distribution of price changes. CPI-median corresponds to the price change located at the 50th percentile of the distribution of price changes in a given month, which gives less weight to price changes far from the mean. CPI-common uses a statistical procedure called a factor model to detect price changes common to different categories in the CPI basket.

* End-of-quarter value (level) in percent.

Source: Bank of Canada Indicators, various tables.

It takes time for these effects to work their way through the economy. As a consequence, the Bank of Canada realizes that it cannot keep inflation continuously at target. Instead, it aims to return inflation to target within a planning horizon of six to eight quarters. Its monetary policy is necessarily forward looking. It acts as what Svensson (1997) calls an inflation-forecast targeter: if its forecasts are unbiased, it will be able to hit its inflation target on average.

THE CANADIAN MACROECONOMY, 2018–19

How did the Bank of Canada do over the 2018–19 period in terms of hitting its 2 percent inflation target and keeping the economy at potential – that is, not in an overheated or underperforming state? Table 1 shows various economic indicators, at a quarterly frequency, over that period. CPI inflation (or headline inflation) remained within the target band of 1 to 3 percent over the period. The minimum monthly rate was 1.4 percent (January

2019) and the maximum rate was 3.0 percent (July 2018). This large change over the space of a few months reflects the fact that headline inflation contains volatile components such as oil and other commodity prices whose relative prices fluctuate rapidly on world markets. The Bank's measures of core inflation, however, have fluctuated within a much narrower range: between 1.8 percent and 2.2 percent. These measures are intended to strip out the most extreme price changes in a given month, since such changes can depend on factors specific to individual markets or sectors. Thus, in removing them, core inflation measures can reveal more about longer-term movements in the inflation rate.

At the beginning of 2018, one measure of the output gap, the so-called extended measure, was positive, indicating an economy producing above full capacity, while the other measure of the output gap, the integrated framework measure, was barely negative. Given the uncertainty associated with these measures, we conclude that the Canadian economy was then running at approximately full capacity.⁴

On January 17, 2018, the Bank of Canada announced an increase in its target overnight rate to 1.25 percent (Bank of Canada 2018), after having raised it twice, in July and September, the previous year. The announcement indicated that the Bank thought it was on its way to normalizing its policy rate toward its long-run "neutral" level – the rate compatible with inflation at target and output at full capacity (and with no tendency to increase or decrease). The Bank's estimate of this neutral rate in 2018 was somewhere between 2.5 percent and 3.5 percent (Chen and Dorich 2018). By April 2019, the Bank lowered the neutral rate

range to 2.25–3.25 percent (Carter et al. 2019). Obviously, COVID-19, and the resulting lowering of the overnight rate to 0.25 percent, has changed the Bank's path for bringing its policy rate back to neutral, but alongside the drop in the overnight rate has been a drop in the neutral rate range, with the most recent Bank estimates putting the range between 1.75 and 2.25 percent (Matveev et al. 2020).

The Bank further increased its overnight rate target twice during 2018: in July to 1.5 percent and in October to 1.75 percent. By the end of 2018, the overnight rate target was either two or three 25 basis point hikes from the lower end of the Bank's estimate of the neutral rate range.⁵ This path toward normalization was exactly what we would have expected (and recommended) given the economic context: headline inflation at or above 2 percent, all three measures of core inflation close to the 2 percent target, output gap measures indicating an economy operating close to or slightly above full capacity and a stable unemployment rate close to its historical low.⁶

With these conditions, one might have expected the Bank of Canada already to have set the overnight rate within the neutral range. During this period, however, the Bank made repeated references to economic headwinds that kept the rate below neutral. These can be thought of as persistent negative shocks exerting downward pressure on output and inflation, or asymmetric risks skewed toward the downside. One prominent example was the prospect of negative shocks to the trade environment, either a failure of the new North American trade deal or an escalating trade war between the United States and China (see Wilkins 2018).

4 The extended measure calculates the deviation from an output trend calculated using statistical techniques. The integrated framework calculates trends for labour input and labour productivity separately.

5 Depending on whether the lower end of the neutral rate range was 2.25 or 2.5 percent at this time.

6 The labour market indicator, which aggregates together several different measures of labour-market performance, was also gradually decreasing, and approaching the unemployment rate. See Zimitrowicz and Khan (2014) for more details on the labour market indicator.

Table 2: Annual Real Economic Growth Rates, Selected Economies, 2018–19

Economy	2018	2019
	<i>(annual percent change)</i>	
World	3.6	2.8
Advanced Economies	2.2	1.7
United States	2.9	2.2
Euro Area	1.9	1.3
Japan	0.3	0.7
United Kingdom	1.3	1.5
Canada	2.0	1.7
Emerging and Developing Economies	4.5	3.7
China	6.7	6.1
India	6.1	4.2
World Trade Volume	3.8	1.0
Advanced Economies	3.4	1.5
Emerging and Developing Economies	4.5	0.1

Source: International Monetary Fund, *World Economic Outlook*, October 2020.

At the beginning of 2019, the Bank anticipated a further gradual increase in its policy rate. On January 9, in its first announcement of the year (Bank of Canada 2019a), it declared that “Governing Council continues to judge that the policy interest rate will need to rise over time into a neutral range to achieve the inflation target. The appropriate pace of rate increases will depend on how the outlook evolves, with a particular focus on developments in oil markets, the Canadian housing market, and global trade policy.” As it turned out, even before COVID-19, the outlook did not evolve favourably. The Bank held the overnight target rate constant for the remainder of the year. The

main reason for this was the progressive slowdown in economic growth on a worldwide scale and its subsequent impact on Canada (Table 2).

The realized world growth rate of 2.8 percent in 2019⁷ was, at the time, the weakest since the economic and financial crisis of 2007–9. The slowdown hit advanced economies and emerging and developing economies equally hard. The only major exceptions were the United Kingdom, which boosted growth from 1.3 percent in 2018 to 1.5 percent in 2019, and Japan, which managed an increase in growth, but only because of an extremely weak starting point in 2018 (0.3 percent growth). Trade volume growth slowed down even more

7 This figure is based on the latest available estimate from the International Monetary Fund, *World Economic Outlook*, October 2020, and is still subject to possible revisions.

Table 3: Inflation Rate, Selected Economies, 2018–19

Economy	2018:1	2018:2	2018:3	2018:4	2019:1	2019:2	2019:3	2019:4	Average	Target
	(percent)									
Canada	2.1	2.3	2.7	2.1	1.6	2.2	1.9	2.1	2.1	2.0
United States	2.2	2.7	2.6	2.2	1.7	1.8	1.7	2.1	2.1	2.0*
Eurozone	1.3	1.7	2.1	1.9	1.4	1.4	0.9	1.0	1.5	2.0**
Japan	1.3	0.7	1.1	0.8	0.3	0.7	1.9	0.5	0.9	2.0
United Kingdom	2.7	2.4	2.5	2.3	1.9	2.0	1.8	1.4	2.0	2.0
Sweden	1.7	1.9	2.1	2.1	1.9	2.0	1.5	1.7	1.9	2.0
Switzerland	0.7	1.0	1.1	0.9	0.6	0.6	0.2	-0.1	0.6	2.0

Note: Quarterly averages of monthly year-on-year inflation.

Average: Average inflation rate from 2018:1 to 2019:4.

Target: Target inflation rate.

* Personal consumption expenditure index.

** Ceiling.

Source: International Monetary Fund, *World Economic Outlook*, various issues.

abruptly, especially in emerging and developing economies. In 2018, trade volumes in general grew faster than gross domestic product (GDP), while in 2019, trade growth was substantially less than economic growth in most countries. Trade volumes actually contracted in the last part of 2019 (Bank of Canada 2019b).

Much of the trade slowdown can be attributed to ongoing disputes between the United States and its major trading partners, which led to modest increases in tariffs and to a climate of uncertainty in which firms curtailed expanding their supply chains and foreign direct investment was reduced.

These trade conflicts and uncertainty about their outcome, and the resultant slower economic growth, contributed to weak commodity (and energy) prices starting in the last quarter of 2018 (see Table 1). Because Canada is a net energy and commodity exporter, this had a negative impact on the supply side of the economy. It also meant

a deterioration in Canada's terms of trade (the relative price of imports in terms of exports). Slowing growth in the rest of the world also had a negative impact on demand for Canadian exports. In fact, growth was quite weak in the first two quarters of 2019. The rebound in the third quarter can be explained by a catch-up effect in spending after an extremely weak second quarter, but the year ended with weak growth in the fourth quarter. This provided ample justification for the Bank of Canada to remain on the sidelines during 2019.

In addition, as illustrated in Table 1, the real side of the Canadian economy was sending mixed signals about the state of the labour market and economic capacity. Over the course of 2019, and certainly at the end of that year, the Bank of Canada's output gap measures showed increasing slack in the economy (that is, the economy was producing below potential), while the unemployment rate and the Bank's labour

market indicator showed increasing tightness in Canada's labour market (that is, both metrics were improving).

Table 3 illustrates the Bank of Canada's success in meeting its inflation targets relative to that of other major central banks. Canada, the United States and the United Kingdom were the only economies to meet or exceed their inflation targets on average over the 2018–19 period. Sweden came close, but central banks in the eurozone, Japan and Switzerland struggled to get inflation rates up to or close to their targets. In the case of Japan and Switzerland, their inflation rates have exceeded 2 percent for only brief periods since the 1990s.

Since Canada's average inflation between December 2011 and December 2017 was only 1.42 percent, maintaining an average of 2 percent over 2018–19 must be considered a success for the Bank of Canada, both when graded against the Bank's own record between 2012 and 2017 and when judged against the performance of other major central banks. By remaining on hold during 2019, the Bank reacted appropriately to deteriorating conditions in the world economy and their potential negative impact on the demand for Canadian exports, which could have led to a weaker domestic labour market.

MEASURING THE STANCE OF MONETARY POLICY

With the Bank of Canada having kept inflation essentially at target in 2019, our goal in the remainder of this *Commentary* is to evaluate the stance of monetary policy at year-end 2019, using the Bank's six-to-eight-quarter planning horizon. This is an *ex ante* evaluation, where we use different

measures to estimate whether the Bank should consider tightening or loosening the overnight rate in order to have inflation return to target over the planning horizon. This exercise is about establishing techniques for evaluating the Bank's real-time monetary policy stance, and then to use these techniques on an ongoing basis. We look to establish these techniques in more normal times, as was the case at the end of 2019, and then to adapt them for use in times of major crisis such as the current pandemic.

How, then, can one calculate the stance of monetary policy? Several options are available.

The most rigorous way of assessing whether the Bank of Canada is on track to meet its target would be to use a structural forecasting model of the Canadian economy. The model would be used to simulate whether the policy rate will lead to inflation converging to target within the central bank's planning horizon. This is a complex task, however, that goes beyond the scope of this *Commentary*. Instead, we rely on several alternative measures that use methodological shortcuts.⁸ By examining different aspects of the transmission mechanism through these measures, we arguably can get a clearer picture of how monetary policy operates than through the black box of a general-equilibrium forecasting model.

Is Monetary Policy Stimulative or Contractionary?

Before asking whether monetary policy is too loose or too tight, it is important to be clear about whether policy is stimulative or contractionary in the first place, relative to some baseline. We use "stimulative" to mean monetary policy that leads to an increase in inflation, and "contractionary" for monetary policy

8 Internally, the Bank of Canada uses ToTEM, its main forecasting and policy analysis model, to simulate a path for future aggregates, including real GDP and the headline inflation rate. The path of future inflation in ToTEM depends not only on the current policy rate, but also on the future path of the policy rate. It also depends on shocks that are currently affecting the economy and how long these are estimated to persist.

that leads to a decrease in inflation. We say monetary policy is too loose when it leads inflation to be above target over the planning horizon of six to eight quarters, and too tight when it leads inflation to be below target over that horizon.

One option for determining whether monetary policy is stimulative or contractionary involves comparing the Bank of Canada's overnight target rate to an estimated neutral rate.⁹ The long-run neutral rate is defined as the nominal policy rate compatible with inflation equal to its target rate and full employment, absent any transient shocks.¹⁰

However, monetary policy affects both short-term and longer-term interest rates that households and businesses face, and, as such, the overnight rate itself, as well as its position relative to neutral, is not a great indicator of how stimulative or contractionary monetary policy is.

A better gauge can be found in the work of Culling, Callaghan, and Richardson (2019), who create what they call the Effective Monetary Stimulus (EMS) measure, which looks at the interest rates businesses and households face across the yield curve and compares them to the neutral rate. (See the Appendix for more technical detail on the EMS.) The two panels of Figure 1 are snapshots for Canada at two different points in time: the fourth quarter of 2014 and the fourth quarter of 2019. We use the Bank of Canada's own real-time estimates of the (long-run) value of the neutral rate (middle of range): 3.5 percent at the end of 2014 and 2.75 percent at the end of 2019. We extend the horizon out to thirty years. The forward curve (the cumulative difference between the market outlook

for short-term interest rates and the neutral interest rate from the current period to a given time horizon – see the Appendix for an exact definition) is for federal treasury bills up to one year and government bond yields for longer horizons.

Figure 1 shows that monetary policy was stimulative at the end of 2019, but even more so at the end of 2014. The latter largely reflects the oil price shock happening at that time. The yield curve at the end of 2019 is also much flatter, unlike its more typical upward slope as at the end of 2014. In part, this reflects anxiety about the future, which proved apt.

Figure 2 shows our calculated EMS measure, starting in 2005 and continuing through the end of our sample. The EMS at any point in time, as discussed in the Appendix, is the area between the neutral rate and the forward curve across the maturity spectrum. Culling, Callaghan, and Richardson (2019) use an estimate of the neutral rate that goes back to 1999 based on a suite of models by the Reserve Bank of New Zealand. Since estimates of the neutral rate in the Bank of Canada's Monetary Policy Reports (MPRs) began only in 2014, we take the real natural rate of interest estimate from the Holston, Laubach, and Williams (2017) model, and generate the nominal neutral rate by adding back the Bank of Canada's 2 percent inflation target.¹¹

Figure 2 suggests that monetary policy was fairly neutral in the lead-up to the financial crisis (2005–7). Post-crisis, however, monetary policy has remained stimulative, including at the end of 2019.

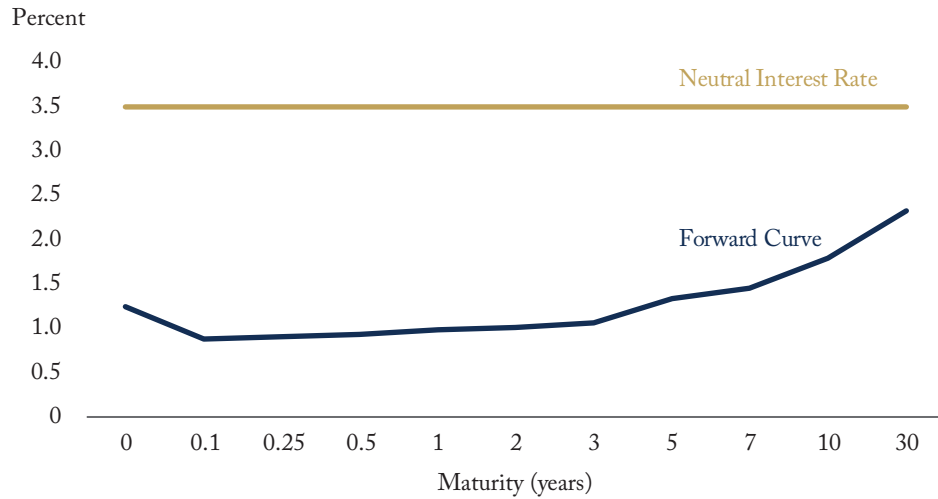
9 We focus on the long-term neutral rate. There is also the concept of a “natural rate” of interest, which is the real rate of interest that equates desired saving to planned investment. This rate of interest is difficult to estimate without using a fully-fledged general equilibrium model. See Laidler (2011) for an explanation of this distinction. However, the terms “natural rate” and “neutral rate” are often used interchangeably in the literature.

10 Mendes (2014) uses a similar definition for his estimate of Canada's neutral rate range.

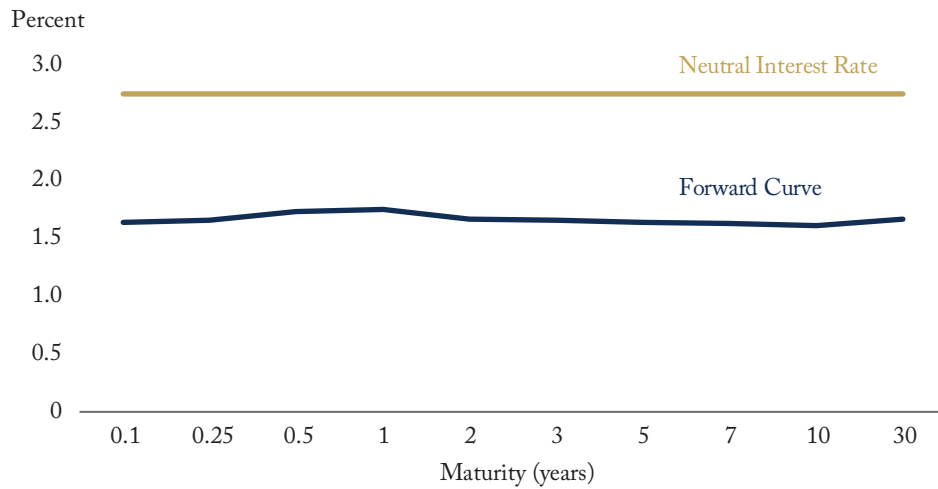
11 What these authors call the natural rate of interest would be more consistent with what we define as the neutral rate, as the estimates are absent any business cycle shocks.

Figure 1: The Forward Curve, Canada, 2014:Q4 and 2019:Q4

A. 2014: Q4

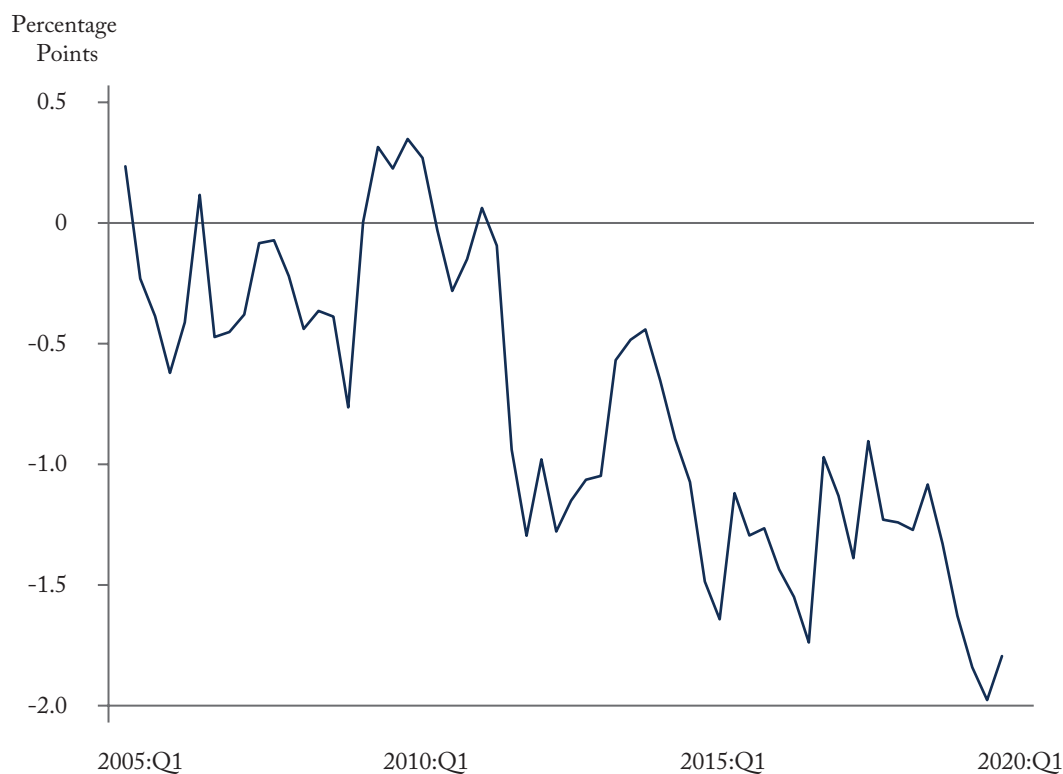


B. 2019: Q4



Sources: Statistics Canada Table 10-10-0122-01 and Bank of Canada Monetary Policy Reports.

Figure 2: Canada's Effective Monetary Stimulus, 2005:Q1–2019:Q4



Sources: Authors' calculations with data from Statistics Canada (Table: 10-10-0122-01) and Holston, Laubach and Williams (2017).

The Current Policy Rate Compared to a Taylor Rule

What the EMS measure cannot tell us is whether stimulative monetary policy at the end of 2019 was too loose, too tight, or neutral with respect to hitting the inflation target over the six-to-eight-quarter planning horizon.

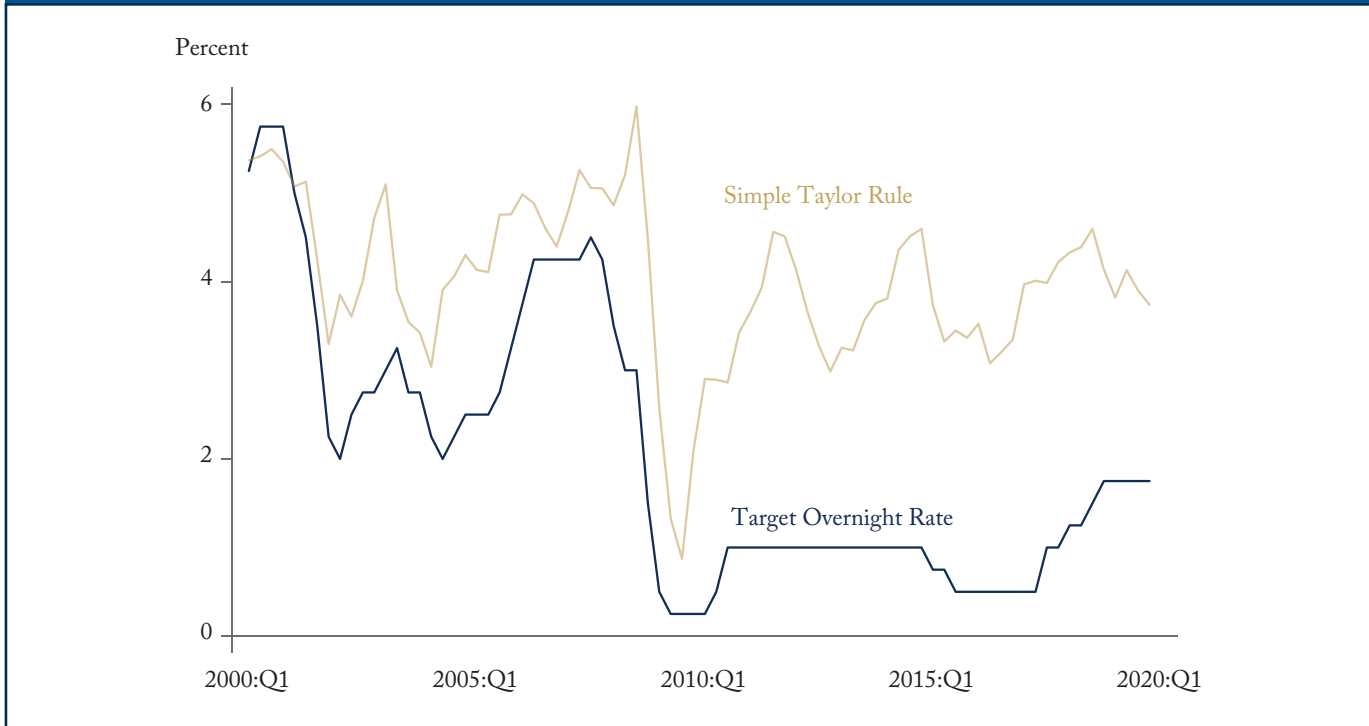
One option for making this determination is to evaluate the overnight rate compared to simple rules, which have done well in approximating the

historical behaviour of central banks. The most famous of these simple rules is the so-called Taylor rule, which relates the policy interest rate to the neutral rate, the deviation of inflation from the inflation target and the output gap. It has been a good empirical predictor of policy rate movements for a number of central banks.¹² (For technical details, see the Appendix.)

Figure 3 compares the Bank of Canada's overnight rate target with the policy rate predicted by the simple Taylor rule and with the coefficient

¹² See Berger and Kempa (2012), Choudhri and Schembri (2013), and Hofmann and Bogdanova (2012).

Figure 3: Bank of Canada’s Overnight Rate Compared with a Simple Taylor Rule Rate, 2000:Q1–2019:Q4



Sources: Authors’ calculations with data from Statistics Canada and the Bank of Canada.

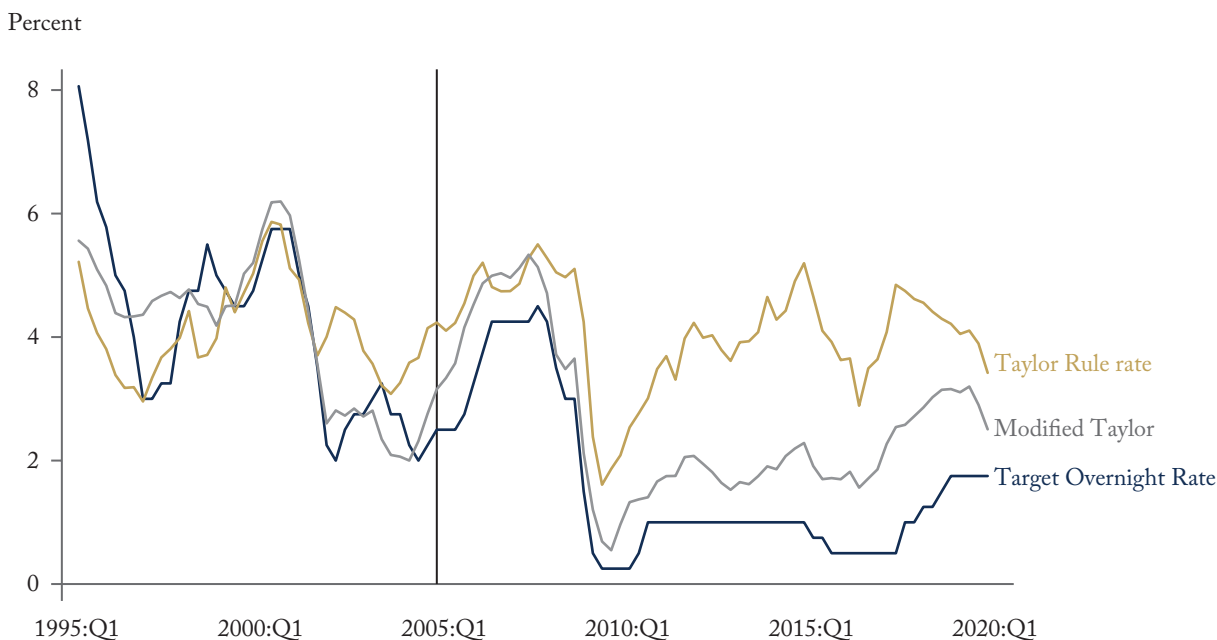
values suggested by Taylor (1993). The figure shows that, according to the simple version of the rule, Canadian monetary policy was too stimulative before the financial crisis and has been much too stimulative since, including at the end of 2019.

This simple measure is misleading, however, for several reasons. First, it uses the coefficient values from Taylor (1993), rather than estimated values for Canada itself over the period we are looking at. Second, the simple rule does not account for the fact that the Bank of Canada’s overnight rate often responds to changes in US monetary policy in order to counteract fluctuations in the bilateral exchange rate with the US dollar that impact domestic inflation. Choudhri and Schembri (2013) modify the simple Taylor rule to include the US policy rate. (Again, technical details are given in the Appendix, as are the coefficients for the regressions related to Figures 4 and 5.)

Figure 4 shows results from estimating the coefficients of the simple and modified Taylor rules using quarterly Canadian data from the first quarter of 1995 to the fourth quarter of 2004. The values from the first quarter of 2005 onward are out-of-sample predictions (as indicated by the vertical line) using these estimated values, which allows us to see how the overnight policy rate in advance of the financial crisis compared to what the Taylor rule suggested the Bank should have done.

We find, as do Choudhri and Schembri (2013), that the correspondence between the actual overnight rate and the one predicted by the modified rule is much closer than with the simple Taylor rule. The out-of-sample predictions suggest that monetary policy was still too loose in 2005–7, but much less so, and the predicted value declines much more quickly during 2008 with the modified rule. This reflects the sharp decreases by

Figure 4: Bank of Canada Overnight Rate Compared to Taylor Rule and Modified Taylor Rule, 1995:Q1–2004:Q4



Sources: Authors' calculations with data from Statistics Canada, the Bank of Canada, and the Federal Reserve.

the Federal Reserve Bank in its Federal Funds Rate target during that year (except for a pause over the summer), which reached its effective lower bound by December.

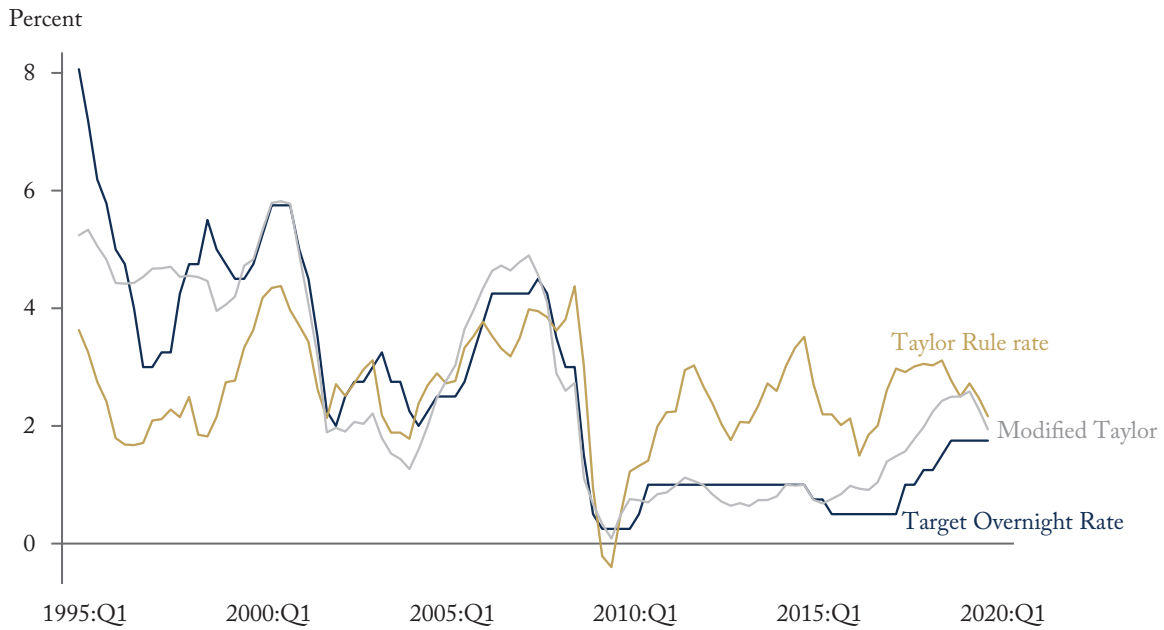
Figure 5 shows the results of estimating the simple and modified Taylor rules using data all the way to the end of our sample, the fourth quarter of 2019. Using the full sample tells us how closely the Bank of Canada set the overnight rate relative to what the Taylor rule would have predicted over this period.

The predicted values from the modified rule appear to do a good job of tracking the actual overnight rate. Since the 2015 oil price crash, however, it appears that monetary policy has been too loose, including at the end of 2019, our period of interest. Except for brief periods, the modified Taylor rule does a much better job of tracking the actual overnight rate over the whole sample.

Moreover, we can test empirically whether the Bank of Canada might have benefited from more closely following the modified Taylor rule. To do that, we follow Rowe and Tulk (2003), who ask whether deviations of the inflation rate from target six to eight quarters ahead are positively correlated with deviations of the current overnight rate from the rate the modified Taylor rule tells us the Bank should have used. If positively correlated, this indicates that, if the modified Taylor rule said monetary policy was too loose, it turned out to be too loose. If there is weak evidence of correlation, the Bank was responding optimally to the rule. A negative correlation would tell us the Bank should have actually put less weight on the rule.

Formally, the regression equation we estimated is $\pi - \pi^* = \alpha_1(\hat{i} - i)_{(t-\beta)}$, where the variable of interest is α_1 .

Figure 5: Bank of Canada Overnight Rate Compared to Taylor Rule and Modified Taylor Rule, 1995:Q1–2019:Q4



Sources: Authors' calculations with data from Statistics Canada, the Bank of Canada, and the Federal Reserve.

We ran two tests of this regression: first, a version where we estimated the modified Taylor rule over the full sample and retroactively looked back at the implementation of monetary policy using the Rowe-Tulk regressions; and, second, a version where we estimated the modified Taylor rule in real time each quarter, using only the information the Bank of Canada would have had at that moment in time. We ran both tests using both a six- and an eight-quarter lag. We also focused the Rowe-Tulk regressions on the period after the financial crisis, since that is our period of interest. The results are shown in Table 4.¹³

We see that, for the most part, the coefficient values are insignificant, suggesting weak correlation and indicating that the Bank optimally followed the modified Taylor rule, despite what we saw in Figures 4 and 5 after the financial crisis. This is especially the case in the real-time modified Taylor rule estimations. However, as evidenced by the full sample modified Taylor rule using a six-quarter lag, there is some evidence that more weight could have been put on the rule and that monetary policy has indeed been too loose since the financial crisis.

13 We note that, if we were to run the Rowe-Tulk regressions over the whole period, instead of just after the financial crisis, we would obtain smaller coefficient values and much higher levels of insignificance.

Table 4: Rowe-Tulk Regressions

Test	Coefficient	p-value
Full sample, 6-quarter lag	0.535	0.068
Full sample, 8-quarter lag	0.415	0.212
Real time, 6-quarter lag	-0.331	0.152
Real time, 8-quarter lag	-0.387	0.121

Source: Authors' calculations.

The Path of Nominal GDP

The Taylor rule is the most popular rule for assessing whether monetary policy is too loose or too tight, and some of the evidence we presented suggests the current stance is too loose. There are, however, other measures we can use to determine the current stance of monetary policy.

Since the transmission mechanism operates via the effects of monetary policy on aggregate demand, a simple way to measure that stance is to look at the rate of growth of total demand in current dollars. A policy-consistent rate of annualized nominal GDP growth would be the Bank of Canada's 2 percent target for inflation plus the estimated growth rate of potential output, which the Bank estimated in 2019 to be in the range of 1.5–2.1 percent (Bank of Canada 2020b).

Figure 6 shows the behaviour (using quarterly data) of annualized nominal GDP growth over 2018 and 2019. The policy-consistent rate of nominal GDP growth is the grey line on the figure, which equals the midpoint of the potential output range (which we take as 1.8 percent) and the 2.0 percent inflation target. The orange line gives the average rate of nominal GDP growth between the first quarter of 2000 and the fourth quarter of 2019.

The figure shows that the rate of growth of nominal GDP in 2018 was consistent with the

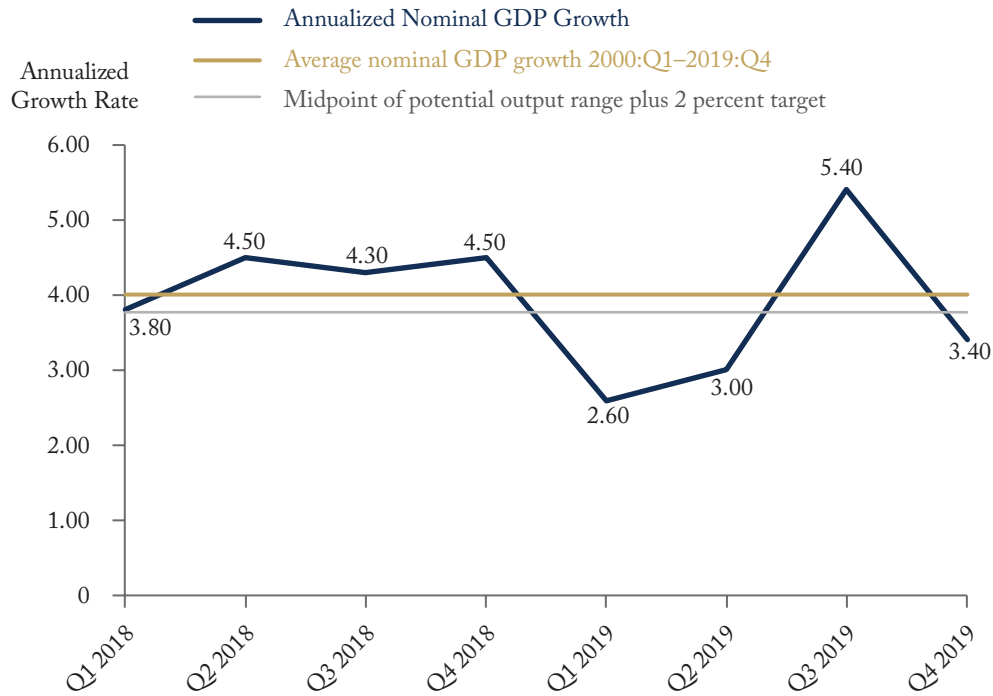
policy-consistent rate. We can infer that the Bank's plan to move toward a neutral policy rate through much of 2017 was justified on this basis. After a volatile first couple of quarters in 2019, spending growth was very close to policy neutral at the end of the year, suggesting neither an accommodative nor a tight monetary policy stance. However, the volatility of nominal GDP growth means one cannot reach a conclusion based on one data point. The average of nominal GDP growth over this two-year period (2018 and 2019) was 3.94 percent, between the policy-consistent growth rate and the longer-run average over the past 20 years, suggesting a neutral monetary policy stance.

Growth in Money and Total Credit

Changes in credit growth associated with changes in the Bank of Canada's overnight rate target are directly accompanied by changes in deposits held by households and firms at financial institutions, and therefore by changes in the money supply, which have knock-on effects on spending and inflation.

Ambler and Kronick (2018) show that, under most circumstances, money and credit grow in tandem and are also positively associated with both inflation and growth in total nominal spending. However, divergences between credit growth and money growth are possible, and have been linked

Figure 6: Nominal GDP Growth, Canada, 2000:Q1–2019:Q4



Sources: Authors’ calculations and data from Statistics Canada (Table: 36-10-0104-01) and the Bank of Canada.

to subsequent declines in real economic activity.¹⁴ For example, Bernanke and Blinder (1988) show, in a simple model that distinguishes between bonds and loans, how an increase in the demand for credit can lead credit to increase and monetary aggregates to decrease, thereby leading to a fall in spending and a downturn in economic activity.

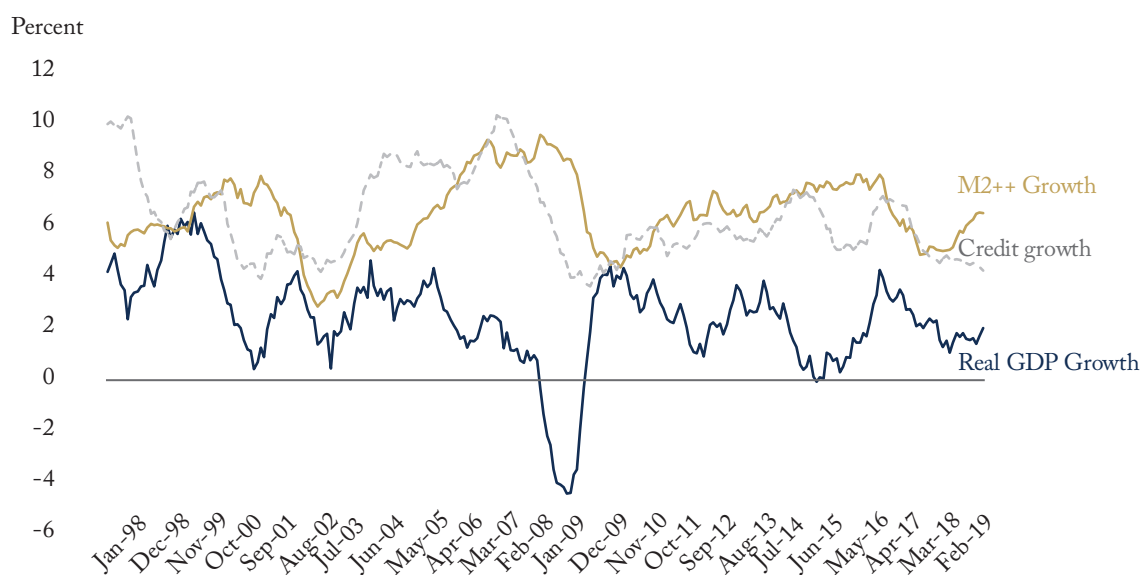
Figure 7 illustrates the behaviour of credit growth (total business and household credit growth), M2++¹⁵ and real GDP growth using monthly data since 1998.

The figure shows that, since 1998 (furthest left-hand point in the graph), there have been two separate episodes when credit growth outstripped

14 The European Central Bank (2012) presents extensive empirical evidence that money growth leads turnarounds in economic activity – although the study finds this is true of narrow money aggregates, rather than M2++, as in Ambler and Kronick (2018), while real domestic credit growth lags behind the business cycle.

15 M2++ is defined as M2+(gross) plus Canada Savings Bonds and other retail instruments plus cumulative net contributions to mutual funds other than Canadian dollar money market mutual funds, which are already included in M2+ (gross). See Bank of Canada, “Monetary Aggregates,” online at <https://www.bankofcanada.ca/rates/indicators/key-variables/monetary-aggregates/>.

Figure 7: Credit Growth, Money Growth, and Real GDP Growth, Canada, 1998–2019



Sources: Authors' calculations using data from Statistics Canada Tables 10-10-0116-01, 10-10-0118-01, and 36-10-0434-01.

money growth. The first was in the late 1990s, and preceded the dot-com bust. The second episode was in the years leading up to the financial crisis and Great Recession. There were also a couple episodes where money growth outpaced credit growth, including, critically for our purposes, the end of 2019. Historically, these episodes did not lead to recession, although they did lead to a drop in the pace of economic growth.

How, then, can the Bank of Canada quickly narrow these disassociations, given their implications for economic activity? According to Bernanke (1988): “If both [credit and money] are growing strongly, then it is a safe bet the economy is growing strongly; if both are growing slowly, then the economy is probably slowing too. But if money and credit are sending conflicting signals, then the Fed should concentrate more on controlling the supply of the aggregate that has shown a closer link to aggregate spending.” In Bernanke’s view,

this is credit. From Figure 7 it is less clear, as both money and credit take turns seemingly linking more tightly with spending. Those who believe money has a tighter link would say monetary policy was too loose at the end of 2019, and would argue for a tightening of monetary policy to bring credit growth and money growth back in line. Those who believe the link is tighter with credit, would say monetary policy was too tight at the end of 2019, and would advocate for looser monetary policy. Given the earlier findings from the modified Taylor rule suggesting monetary policy was too loose, the link between money and spending link might have more support.

Regardless, these episodes are suggestive. They say that monetary aggregates contain useful information for the Bank of Canada, in addition to the credit channel. The last mention of monetary aggregates in a *Monetary Policy Report* was in 2013. This is in keeping with the absence of money in

To TEM and in the Bank's description of the transmission mechanisms of monetary policy.

Summary

We know from the EMS measure that monetary policy was accommodative at the end of 2019. The question is whether that accommodative stance was too loose, too tight or neutral. Using the modified Taylor rule approach, we find that monetary policy has been too loose since the oil price crash and, importantly for us, was loose at the end of 2019. The findings from our secondary measures, however, are less clear. The path of nominal spending was close to the rate of growth of potential output plus the inflation target at the end of 2019, supporting the conclusion that the Bank of Canada's monetary policy stance was close to neutral. Moreover, the data are inconclusive as to whether the link between spending growth is tighter with credit growth or money growth. As a result, it is difficult to tell whether the disassociation between credit and money growth at the end of 2019 is suggestive of too loose or too tight monetary policy. What we can say is the divergence between the two is a strong predictor of future weaker economic growth, and making a call on what it means from a policy perspective is critical. Should the credit growth/money growth gap show evidence of divergence, it can be used as secondary evidence that action is necessary.

Our analysis highlights the fact that measuring the monetary policy stance of a central bank is sensitive to the evaluative methodology. This is an important conclusion by itself, and suggests using an eclectic approach to evaluating monetary policy stances and multiple methodologies as robustness checks. This approach could also give an idea of the sensitivity of measures of the stance of monetary policy to underlying assumptions. By examining different aspects of the transmission mechanism,

one could get a clearer picture of how monetary policy operates than through the black box of a general equilibrium forecasting model.

By and large, this is how the Bank of Canada actually conducts its monetary policy: tempering the forecasts of its formal general equilibrium models with data from many sources and a fair degree of judgment. Our analysis supports the hypothesis that the Bank's success in 2018 and 2019 can be explained at least partly by this eclectic approach.

CONCLUSION

The behaviour of inflation and other macroeconomic indicators in 2018 and 2019 supports the hypothesis that the Bank of Canada's monetary policy over the past few years has been appropriate. Headline inflation in both years was very close to the 2 percent target despite volatile conditions in the world economy. The slowdown in world economic growth in 2019, even before COVID-19, led the Bank to postpone its planned normalization of the overnight rate target toward the neutral rate.

We find that different methodologies give different results about the stance of the Bank's monetary policy at the end of 2019, favouring the use of an eclectic approach and using multiple methodologies as robustness checks.

With the onset of the COVID-19 pandemic, the Bank rapidly cut its overnight rate target to 25 basis points, which it considers to be its effective lower bound. Without the possibility of further cuts, and given our mixed results for the stance of monetary policy at the end of 2019, the overnight rate by itself almost certainly indicates that the Bank's policy as of the end of 2020 was too tight. Evaluating its monetary policy stance in our next edition will necessitate looking at other tools in its toolkit, such as forward guidance and quantitative easing.¹⁶

16 For a preliminary look at the Bank's response to the pandemic, see Ambler and Kronick (2020).

APPENDIX

The Simple Taylor Rule

The simple form of the Taylor rule can be written as follows:

$$i_t = \bar{r} + \pi_t + \alpha(\pi_t - \pi^*) + \beta(GDP_t - GDP_t^*).$$

Here, i_t is the central bank's policy interest rate (the target for the overnight rate in the case of the Bank of Canada), \bar{r} is the long-term real natural rate of interest, π_t is the current inflation rate, π^* is the inflation target, GDP_t is the current level of real GDP (in practice this will be the best now-cast of GDP on the basis of all currently available information), GDP_t^* is the estimated level of full employment or full capacity output (the difference between the current level of GDP and its full capacity level is the output gap), while α and β are positive constants or parameters that weight the contribution both of inflation away from target and of the output gap toward movement in the policy rate.

Following Taylor (1993), we initially set the real natural rate equal to 2.0, the inflation target to 2.0 (which coincides with the Bank of Canada's target) and $\alpha = \beta = 0.5$. Parameters were set such that the policy rate reacts more than one-for-one to changes in the inflation rate. This was necessary for the real interest rate to vary in the same direction as the inflation rate, and is known as the Taylor principle. If it is not satisfied, higher inflation will lead to a lower real interest rate, which will boost aggregate demand and cause inflation to increase even more, leading to instability.

The Modified Taylor Rule

Choudhri and Schembri (2013) modify the Taylor rule to allow the policy rate to respond to the US

policy rate. The modified Taylor rule can be written as follows:

$$i_t = \bar{r} + \pi_t + \alpha(\pi_t - \pi^*) + \beta(GDP_t - GDP_t^*) + \gamma i_t^{US}.$$

They estimate the equation using quarterly data from 1990:Q1 to 2001:Q4, and then generate predicted values for the overnight rate over the 2002–7 period. These out-of-sample forecasts reflect the fact that a central bank will have only historical estimates of α and β when it makes forward-looking monetary policy decisions – that is, when it tries to hit an inflation target over a horizon six to eight quarters out.

We analyse a slightly different period: 1995:Q1 to 2004:Q4. The results from our estimates of simple and modified Taylor rules using quarterly data are shown in Tables A.1 and A.2.

Table A.1: Coefficients of Simple Taylor Rule Rate

Coefficient	Estimate	p-value
α	-0.278	0.260
β	0.847	0.000

Table A.2: Coefficients of Modified Taylor Rule Rate

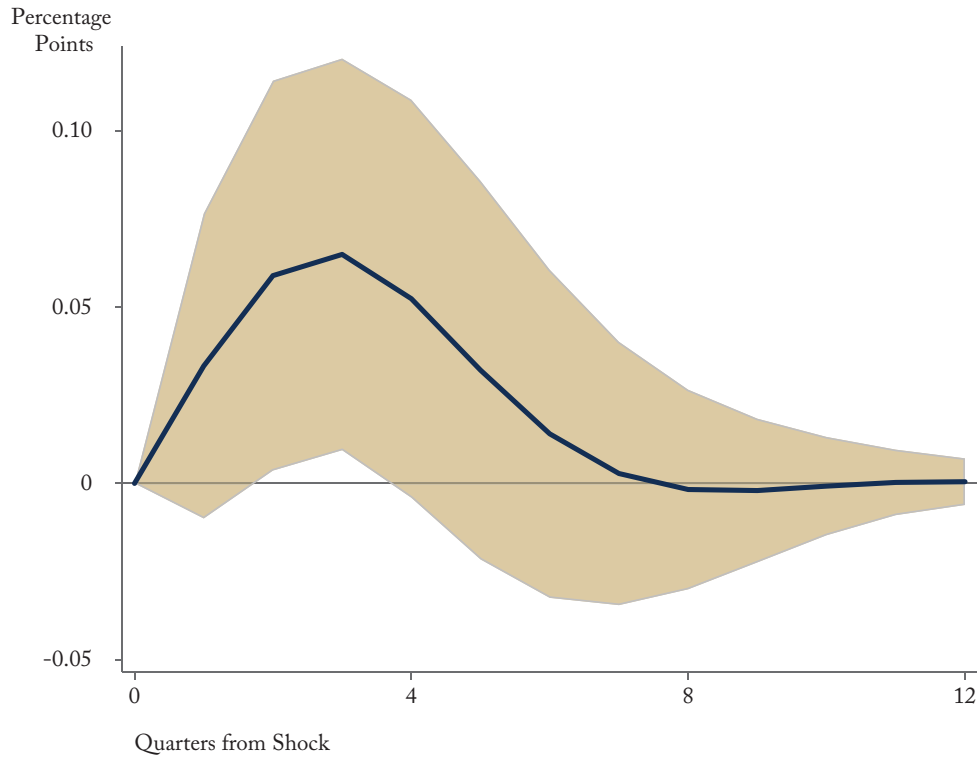
Coefficient	Estimate	p-value
α	0.119	0.440
β	0.299	0.143
γ	0.549	0.000

The results from estimating the two rules using the full sample of data up to 2019:Q4 are shown in Tables A.3 and A.4.

Table A.3: Coefficients of Simple Taylor Rule Rate

Coefficient	Estimate	p-value
α	0.203	0.435
β	0.703	0.000

Figure A1: Impact on Inflation of a Contractionary Monetary Policy Shock Using the Overnight Rate Measure



Sources: Authors' calculations with data from Statistics Canada, the Bank of Canada, and the Federal Reserve.

Table A.4: Coefficients of Modified Taylor Rule Rate

Coefficient	Estimate	p-value
α	0.223	0.070
β	0.071	0.471
γ	0.714	0.000

Effective Monetary Stimulus

EMS is the cumulative difference between the market outlook for short-term interest rates (the forward curve) and the neutral interest rate from the current period to a given time horizon. In continuous time it can be written as follows:

$$EMS_{t,h} = \int_0^h (f_{t,i} - n_t) di.$$

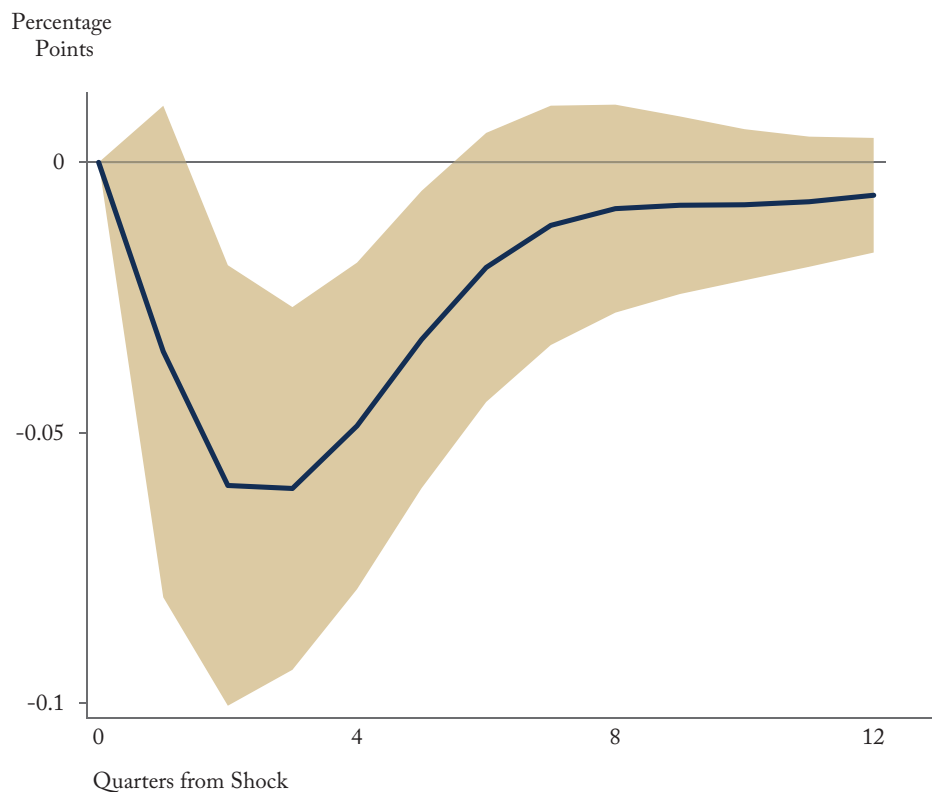
Here, h is the chosen time horizon, $EMS_{t,h}$ is the effective monetary stimulus at time t for that horizon, $f_{t,i}$ is the value of the forward interest rate at time t with a maturity of i periods in the future and n_t is the estimated value of the neutral interest rate at time t , which is assumed to remain constant.

The measure can be normalized by dividing through the horizon h to give an annual average value, as follows:

$$EMS_{t,h} = \frac{1}{h} \int_0^h (f_{t,i} - n_t) di.$$

The suitability of the EMS measure in Canada is supported by some simple econometrics. We estimated dynamic regressions (called vector autoregressions) over the 1995:Q1–2019:Q4

Figure A2: Impact on Inflation of a Contractionary Monetary Policy Shock Using the Effective Monetary Stimulus Measure



Sources: Authors' calculations with data from Statistics Canada, the Bank of Canada, and the Federal Reserve.

period with the following variables: a commodity price index, the US Federal Funds Rate, real output growth, headline inflation and a measure of Canadian monetary policy. We test first with the overnight rate itself, then with our EMS measure.¹⁷

Figure A.1 gives the response of headline inflation over a 12-quarter period to an increase in the overnight rate. Figure A.2 gives the response of

inflation over a 12-quarter period to an increase in our EMS measure.¹⁸

The figures show that the responses of inflation to both the overnight rate and the EMS are significant in the short run (the gold bands give 95 percent confidence intervals), but the directions of the responses differ. The increase in inflation in response to an increase in the overnight rate is an

17 We note that, since the EMS measure, through the term premium, takes into consideration things outside the control of monetary policy, its pure causation of the impact of Canadian monetary policy on the macroeconomy is less well-defined.

18 We identify shocks to monetary policy using the variable ordering described above and a Cholesky decomposition; see Keating (1992).

example of what is known as the “price puzzle” (see, for example, Sims 1992), whereby an increase in the overnight rate is contractionary and should lead to a decrease in inflation, but this is not what the data show. This puzzling result is common across similar econometric studies that use the overnight rate to represent the stance of monetary policy.

The decrease in inflation in response to an increase in the EMS measure is more in line with what both the theory and intuition would predict. This reinforces our confidence that the EMS measure correctly captures how stimulative or contractionary monetary policy is.

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