Potential drivers of a snapback in long-term yields

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1 Key Messages

- Concerns that long-term yields may snapback emerged as MP normalization after a long period of secular decline in yields.
- Snapbacks are infrequent. The frequency of a 100 bps increase over a 1-year period is less than 3% since YYYY. Snap-backs were more frequent in the 1970s and 80s, 13 and 26 percent of the time, respectively, when inflation was high and counter-cyclical.
- Large international portfolio rebalancing could trigger a snapback in the real risk premium in Canada. Potential triggers include faster MP normalization and rapid fiscal deterioration. These events seem remote but surrounded by wide uncertainty.
- Other components of yields are unlikely to snapback in the near future. Inflation expectations are well-anchored. Real rates are driven by slow-moving r*. The inflation risk premium will remain low or negative unless inflation shocks become counter-cyclical, more persistent, and more volatile.

2 Measuring the frequency and likelihood of snapbacks

Large increases in Canadian 10-year yields are infrequent. Historically (from 1938 through early 2018), 10-year yields have increased by 100 basis points over a one-year period, what we define as a snapback, less than 10% of the time (**Chart 1 and 2**). [1] A sharper, 100 basis point increase over a three-month period has occurred less than 3% of the time. Larger, 150 bps or 200 bps jumps in 10-year yields, occur rarely, less than 1% of the time.

These snapbacks (of 100 bps in one year) occurred mostly during the 1970s and 1980s (**Chart 1**). Since these were periods with high and volatile inflation (chart x: on inflation, as far back as possible), it suggests that unanchored inflation expectations and/or increases in the inflation risk premium are responsible for these movements. This 20-year period was also the only period during our 80-year sample when nominal ten-year yields were relatively high. Ten-year yields above 5% occur in 50% percent of the sample. Yields above 7% occur in 32% part of the sample, and yields above 10% in only 10% of the sample. Since 2000, there have only been two 100-bps snapbacks in a year. The first was the taper tantrum, and the second occurred around the 2016 U.S. election.

The predicted probability of a snapback is also currently low at around 3% (**Chart 3**). This predicted probability increases with the level of interest rates, and decreases with the slope of the yield curve. These

[1] The frequency of snapbacks is measured using daily data. Each day, we measure whether the ten-year yield is 100 bps higher a year in the future, so our sample is overlapping. The frequency is simply the proportion of rolling (by a day) one-year periods in our sample where a snapback occurred.

predicted probabilities are based on a logit regression based on daily data starting in 1938 until May 2018, where the dependent variable is a dummy indicating whether ten-year yields increase by 100 bps over the next year, and includes the current ten-year yield and 10-year – 2-year yield curve slope as independent variables. Given high 10-year yields are largely observed during periods of high inflation, this suggests that high inflation is a strong predictor of rate increases. The slope reaches its minimum (typically negative) right before recessions and begin increasing as the recession subsides and as growth resumes. As yield curve normalises after a recession, 10-year yields tend to rise substantially, increasing likelihood of a snap back as we have defined it.

3 Drivers of a snapback in long-term yields

A sharp increase in long-term government yields could be driven by an increase in any of its underlying components:

$$\text{Ten-year yield} = \underbrace{\text{E[real short rate]} + \text{E[inflation]}}_{\text{Average nominal short rate expectations}^{2}} + \underbrace{\text{inflation risk premium} + \text{real risk premium}}_{\text{Term premium}} \qquad (1)$$

We consider potential drivers of an increase in each of these components. The first two components reflect the average of the expected nominal short rate over the next ten years. The first component is the expected path of the real short rate, while the second part represents average inflation expectations over the next ten years. The last two components represent the term premium, which is the average expected returns of holding long-term bonds versus holding a short-term bond over a short holding period (e.g., one year). The real risk premium is the expected return of holding long-term real bond versus holding a short-term real bond over a short holding period, whereas the inflation risk premium is the expected excess return for exposure to inflation risk.

A long-term nominal yield increase would be more likely if some of these 4 components are positively correlated. However, some components are likely negatively correlated given that term premia are counter-cyclical and increase when rate expectations decrease (Bauer and Diez de los Rios 2012).

***Long-term real rate expectations* are driven by the neutral rate (r*) and long-run growth expectations (Bauer and Rudebusch 2017), which should not increase sharply over a short period of time (first component in equation 1).** Both have been slowly trending down in the post-crisis period (**Chart 4**). There are various underlying fundamental economic forces that have contributed to the slow decline in r* in Canada (and elsewhere) shown in Chart 4 (see for example, Mendes 2014). These include lower

[2] Where $\text{E[real short rate]} = \frac{1}{n}\boldsymbol{E_t}(\sum_{k=0}^{n-1} \boldsymbol{r_{t+k}})$ and $\text{E[inflation]} = \frac{1}{n}\boldsymbol{E_t}(\sum_{k=0}^{n-1} \boldsymbol{\pi_{t+k}})$

productivity growth and an aging population, which appear to have slowly altered global saving and investment and, in turn, pushed down the steady-state real interest rate. All the drivers for the decline in r* and long-run growth expectations are unlikely to change substantially or rapidly in the near future.[3]

A shift up in *long-run inflation expectations* is not likely (second component in equation 1). Long-run inflation expectations in Canada, as measured by Consensus Economics Surveys, have been anchored around 2% since just after inflation targeting was established (**Chart 5**). An increase in long-run inflation expectations would have a one-to-one impact on long-term yields. It is unlikely, in the era of inflation targeting, that long-run inflation expectations would change sufficiently to generate the snapback in yield we are considering (e.g., 100 bps or more in 1 year).[4]

An increase in the *inflation risk premium* is not likely, unless investors become concerned that we have entered a period of low growth and high inflation (similar to stagflation). Currently, various measures of the inflation risk premium indicate that it is low or negative in the United States and Canada (**Chart 7**) (Feunou et al., 2017). The period before 2000 was a period where inflation dynamics were countercyclical (**Chart 8**), and investors needed compensation (a positive inflation risk premium) to bear this risk of holding bonds (Piazzesi and Schneider, 2007) given it was positively correlated with drops in consumption (i.e., lower future growth).[5] Since 2000 inflation switched from being counter -cyclical with growth to pro -cyclical. Since unexpected inflation lowers real payments of nominal bonds, the current pro-cyclical inflation dynamic makes nominal bonds a hedge against economic downturns, and investors pay more (i.e., a negative inflation risk premium) to hold bonds.

One way for inflation risk premiums to rise is if inflation once again became counter-cyclical. This could occur, if, for example a series of large (negative) aggregate supply shocks, perhaps driven by an oil (commodity) shocks, led to rising inflation in a persistent manner. Alternatively, inflation risk premiums could rise if market participants feared or expected a return of stagflation. If this were the case, the decrease in r* (given lower expected growth) would (partially) offset an increase in inflation expectations and/or the inflation risk premium. It is not clear a priori which effect would dominate.

Second, inflation shocks need to negatively impact GDP growth in long run to generate a sizeable inflation risk premium for long maturity nominal bonds. Neither GDP nor inflation shocks are very persistent (**Chart 5 and Chart 6**) over recent history, so the nature of these shocks would need to become more persistent to significantly increase the inflation risk premium and, as a result, bond yields.

Third, inflation volatility would need to increase. Inflation volatility amplifies the magnitude of inflation risk premium (for both positive and negative values of the risk premium). However, an increase in the

[3] We use code from Bauer and Rudebusch (2017) to estimate r* for Canada, which is an average of three macroeconomic estimates of r* from Laubach and Williams (2003), Lubik and Mathes (2015), and Kiley (2015). These estimates are model-based with one large decrease during periods of financial crisis. However, it's clear that the trend in r* and long run GDP growth expectations are both declining for post crisis periods.

[4] The inflation expectations embedded in long-maturity nominal bonds are mainly driven by the shifting long-run trend component (Kozicki and Tinsley (2001), Cieslak and Povala (2015), and Bauer and Rudebusch (2017)). Learning about the long run inflation is a slow process (Kozicki and Tinsley (2001)).

[5] Song (2017) and Zhao (2018) discuss this regime change in the correlation between inflation and growth in the US.

volatility of expected inflation would suggest an un-anchoring of inflation expectations (**Chart 9** shows inflation volatility is currently low).

Large international portfolio rebalancing could trigger a snapback in the real risk premium (fourth component in equation 1). Faster MP normalization in US would increase the expected supply of US safe assets (nominal bonds), which increases real risk premia in Canada through portfolio rebalancing (Abrahams et al., 2016).[6] A sharp increase in Canada long term yields would need an abrupt change in expectations of central bank balance sheet normalization (like during taper tantrum).

A debt-financed fiscal expansion in the U.S. would increase the supply of US safe assets, which increase long term yields in Canada through real risk premia (portfolio rebalancing) and higher GDP growth expectations (see Diez de los Rios and Shamloo 2017 for discussion of global term premia).

Canadian bond, could also increase if it loses its mature economy or safe-haven status in the eyes of investors. For example, for foreign investors that view the CAD as a reserve currency and invest in Government of Canada bonds, a rise in sovereign risk in Canada would lead to a sharp rise in real risk premia (all else equal). These events seem remote but surrounded by wide uncertainty.

On the other hand, real (or nominal) bonds could command a negative real risk premium if investors view the bond as a good hedge for GDP growth shocks/uncertainty. This would be the case if a positive shock to growth increased future growth expectation, or if investors demand more bonds at the time of high future growth uncertainty (precautionary savings). Volatility in GDP growth is currently low (**Chart 10**), suggesting there is currently little hedging demand for the real bond. Should uncertainty (and risk aversion) increase, this could put downward pressure on the real risk premium (e.g., during a flight-to-safety). Uncertainty due to geopolitical concerns could thus result in lower risk premia on government bonds.

An increase in the *real risk premium* is the most likely of the four components to be a driver of an increase in Canadian long-term bond yields (fourth component in equation 1). As well known risk premia increase either because the relative price of risk increases (due to a rise in relative risk aversion), or because the quantity of risk increases.[7]

The real term premium could increase due to an increase in the quantity of risk (i.e., an increase in the supply of nominal bonds). Specifically, (the announcement of) QE decreases the expected supply of safe assets (nominal bonds), which decreases real risk premia (Abrahams et al., 2016).[8] Although the

[6] Also, because it is a form of monetary stimulus it could support inflation expectations and, potentially, inflation risk premia, depending on the economic backdrop when QE surprise happens.

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[8] Also, because it is a form of monetary stimulus it could support inflation expectations and, potentially, inflation risk premia, depending on the economic backdrop when QE is introduced.

normalization of the Fed's balance sheets should result in an increase in the outstanding supply of government bonds in the US, these expectations are already factored into long-term yields (Kirby et al., 2017). As such should have already affected the real risk premium for US yields. This rise in US yields (a global yield proxy) would be expected to be partial pass along to CDN yields. A sharp increase would need an abrupt change in expectations of central bank balance sheet normalization (like during taper tantrum).

A debt-financed fiscal expansion in the U.S. would increase the global supply of safe assets, which would have a direct effect on real risk premia in other countries since term premia are largely global in nature (Diez de los Rios and Shamloo 2017). It could also increase GDP growth expectations, which could also lead to higher long-term real yields through an increase in the expectation of real interest rates as monetary policy needs to offset these. However, like QE unwind, the expectations of a fiscal expansion should be already factored into current yields, so an increase would have to be due to a change in these expectations or further expansion.

Canadian bonds, however, could increase if it loses its mature economy or safe-haven status in the eyes of investors. For example, for foreign investors that view the CAD as a reserve currency and invest in Government of Canada bonds, a rise in sovereign risk in Canada would lead to a sharp rise in real risk premia (all else equal).

Conclusion

Most plausible driver of snap back to be real risk premium

But in this case, Snap back still likely to be low probability event: a tail risk

4 References

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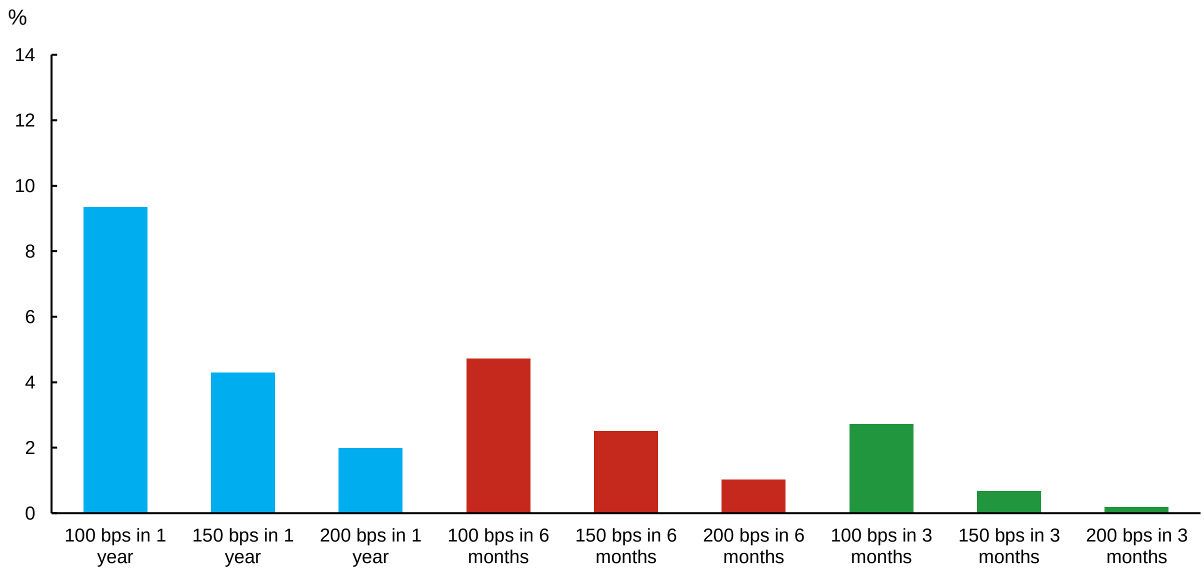
5 Figures

Chart 1: **Frequency of Large Increases in the Government of Canada Zero-Coupon Ten Year Yield**

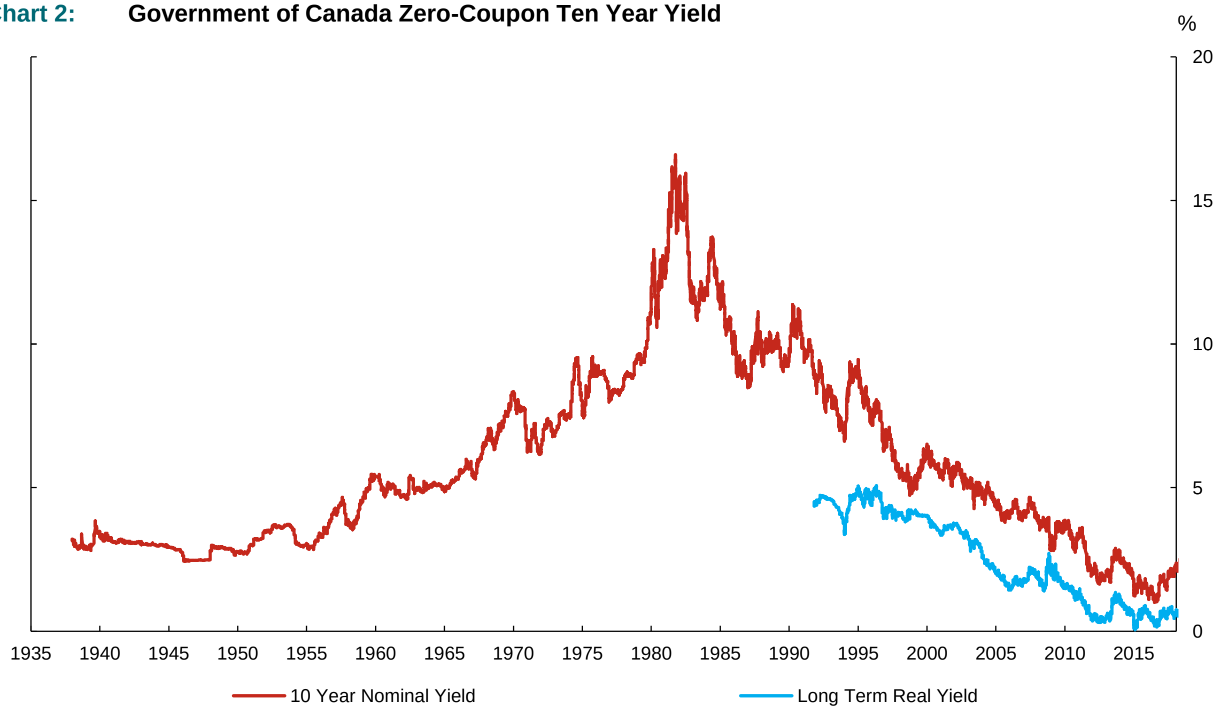


Notes: Daily data between January 3, 1938 until February 8, 2018. 252 business days in a year is used.

Source: Bank of Canada calculations

Last observation: 8 February 2018

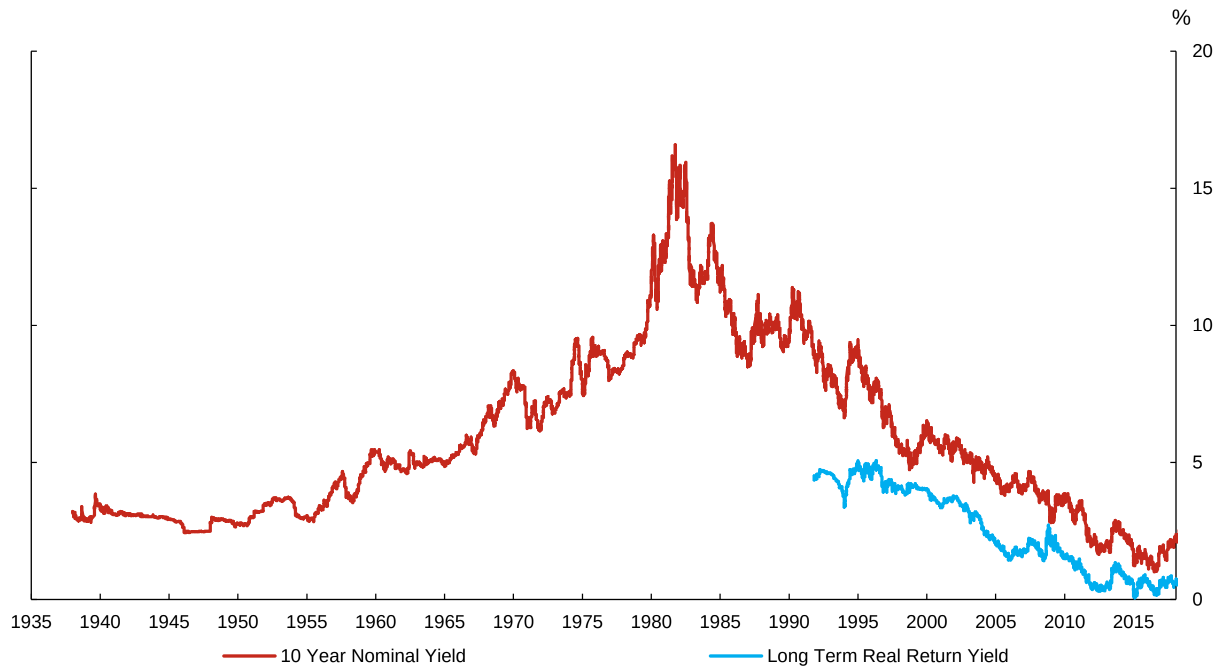
Chart 2: **Government of Canada Zero-Coupon Ten Year Yield**



Source: Bank of Canada calculations

Last observation: 8 February 2018

Chart 1: Government of Canada 10 Year Zero Coupon Yield

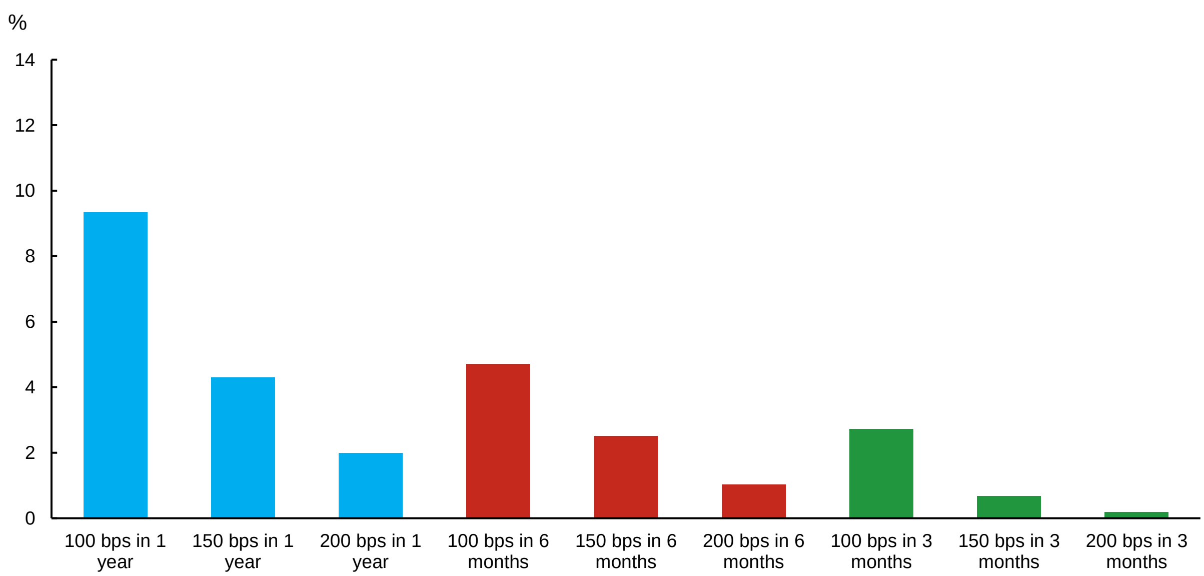


Notes: Daily data between January 3, 1938 until February 8, 2018. 252 business days in a year is used. Government of Canada long term real return bond yield is used as the long term real return yield.

Source: Bank of Canada calculations

Last observation: 8 February 2018

Chart 2: Frequency of Large Increases in the Government of Canada 10 Year Zero Coupon Yield

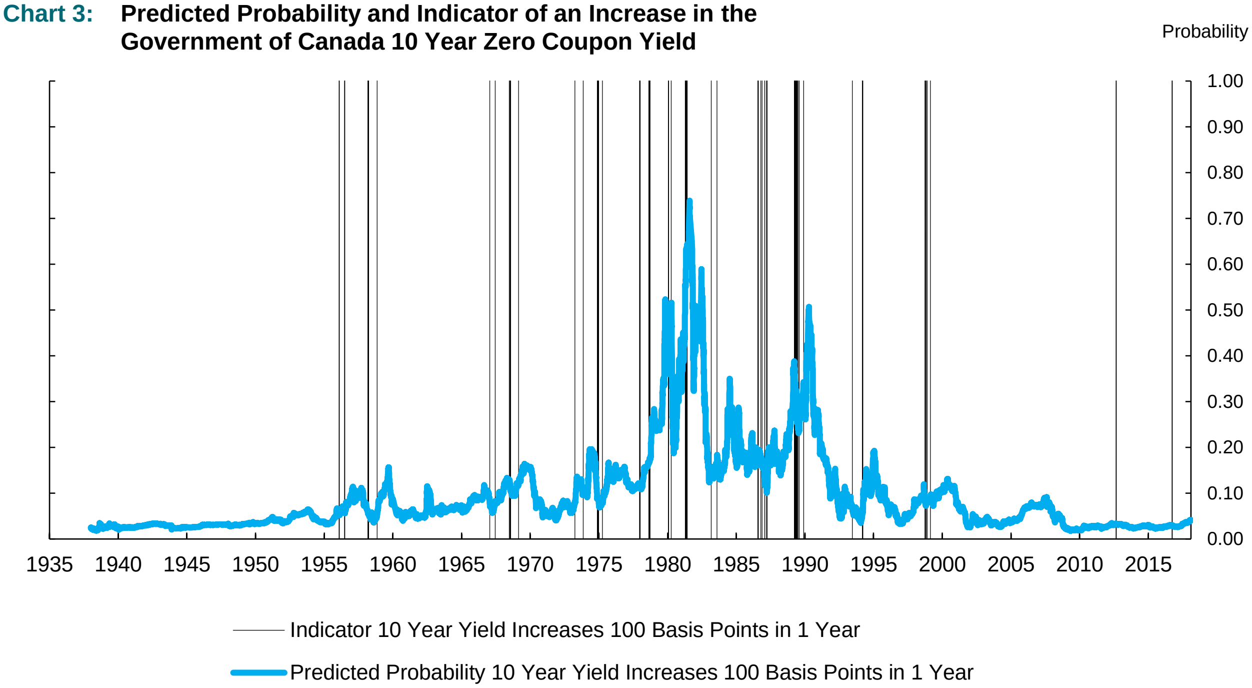


Notes: Daily data between January 3, 1938 until February 8, 2018. 252 business days in a year is used.

Source: Bank of Canada calculations

Last observation: 8 February 2018

Chart 3: Predicted Probability and Indicator of an Increase in the Government of Canada 10 Year Zero Coupon Yield

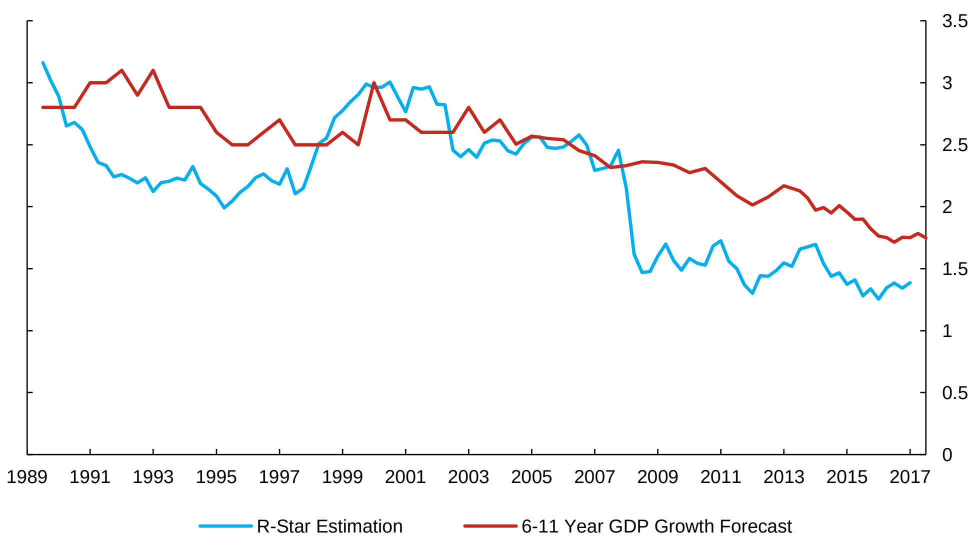


Note: Predicted probability is estimate from a logit regression of indicator of increase of at least 100 Basis Points in one year of 10 year yield on the Level of 10 year yield and Slope of 10 year yield = 10 year yield - 2 year yield.

Source: Bank of Canada calculations

Last observation: 8 February 2018

Chart 4: Long Run GDP Estimation and R-Star



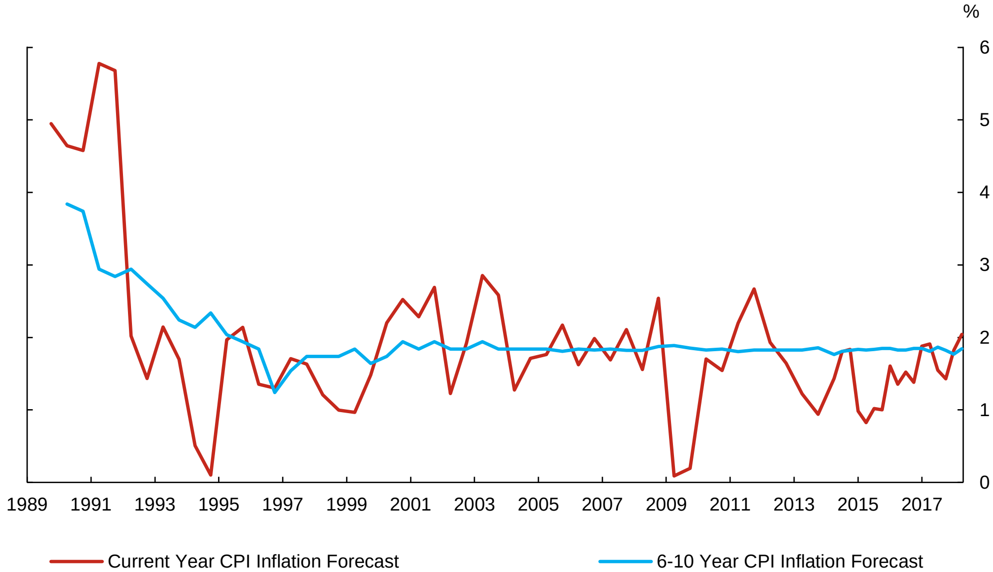
Note: R Star estimation is based on Bauer and Rudebusch (2017).

Source: Consensus Economics and Bank of Canada Calculations

Last observation: 1 April 2018

Chart 5: **Inflation Forecasts**

Long vs. Short Run

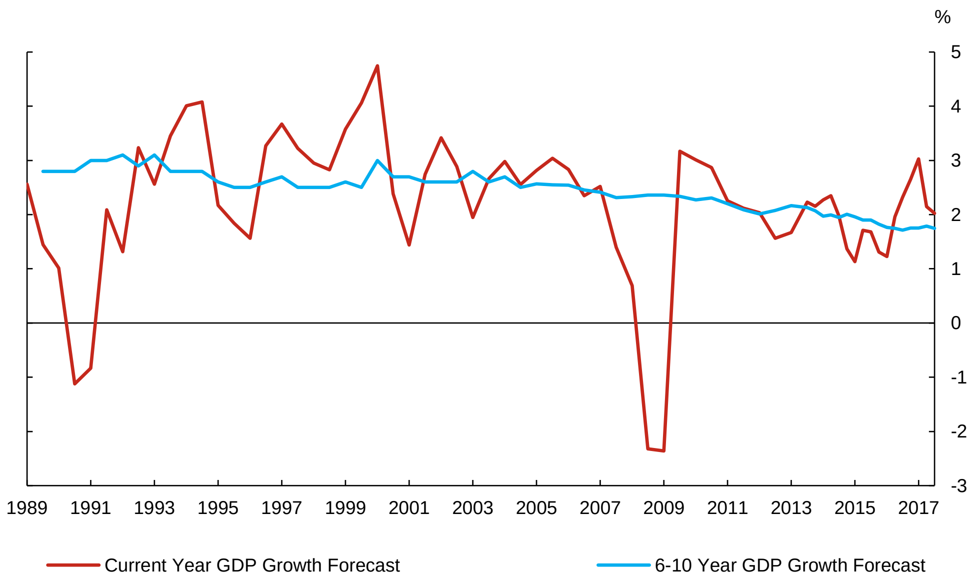


Source: Consensus Economics

Last observation: 1 April 2018

Chart 6: **GDP Growth Forecasts**

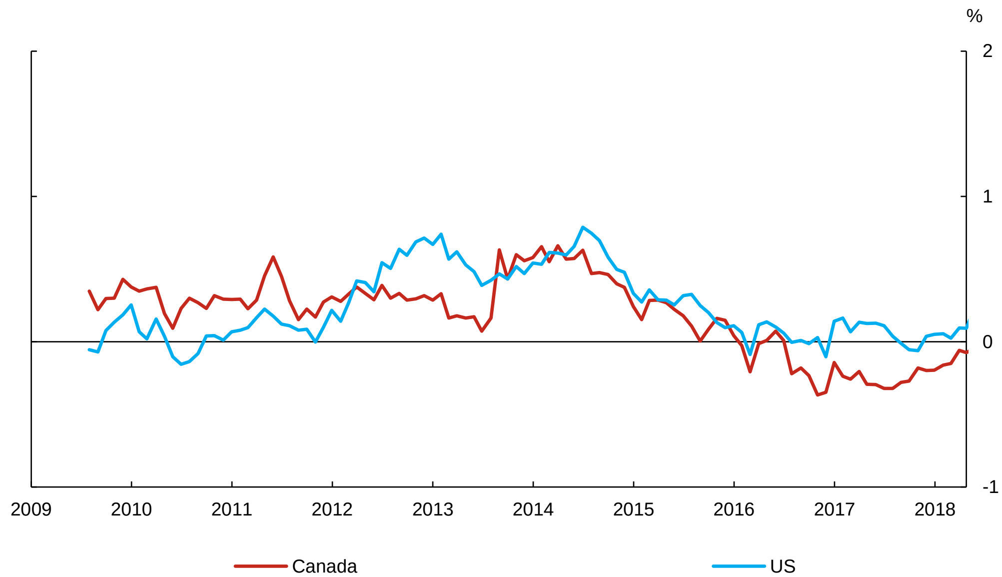
Long vs. Short Run



Source: Consensus Canada

Last observation: 1 April 2018

Chart 7: Inflation Risk Premium Estimation



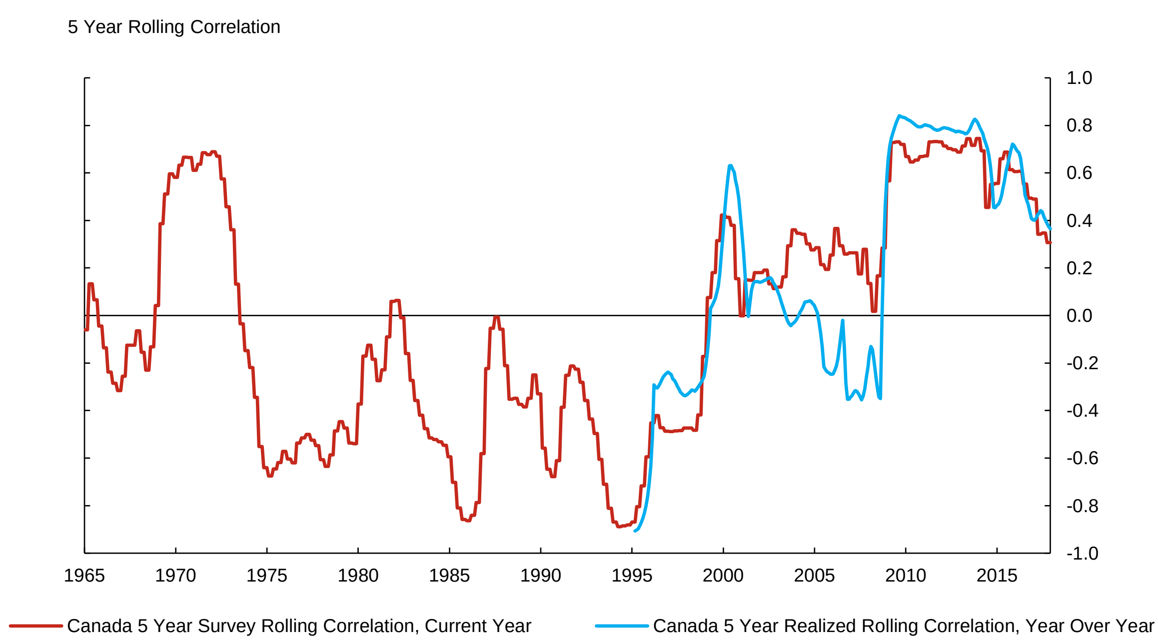
Note: Estimation is based on Fenou et. al. (2017).

Last observation: 31 April 2018

Source: Bloomberg, Consensus Economics and Bank of Canada calculations

Chart 8: Correlations Between Canadian Inflation and Growth

5 Year Rolling Correlation

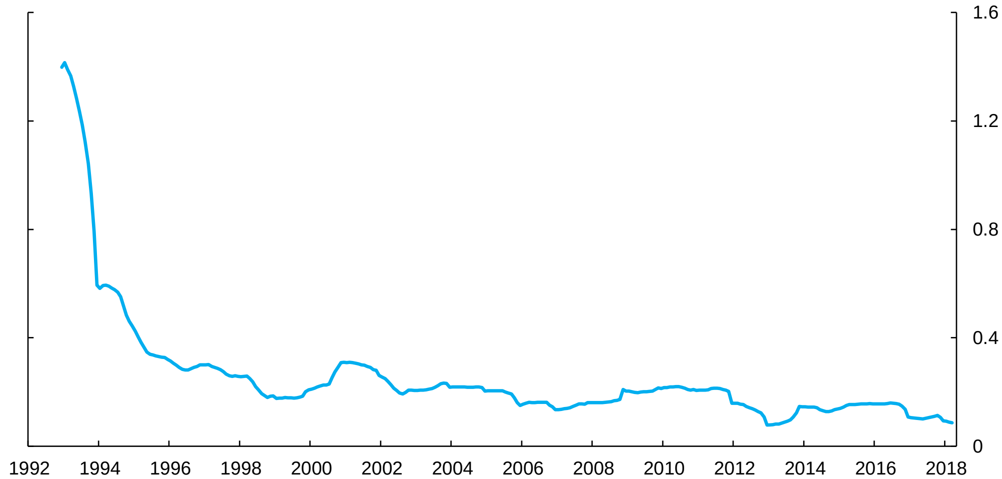


Source: Bank of Canada calculations

Last observation: 31 December 2017

Chart 9: **CPI Inflation Forecasted Volatility**

Next Year Forecasted Volatility

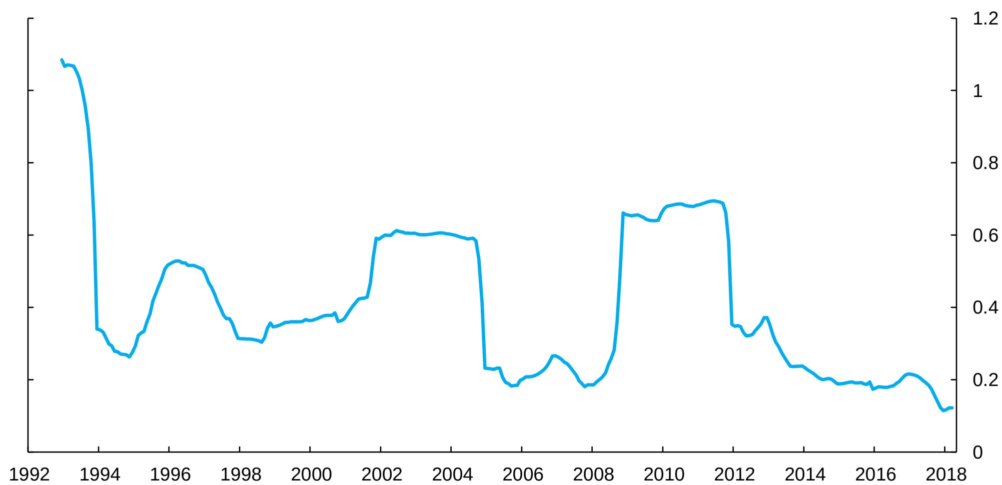


Source: Consensus Economics and Bank of Canada Calculations

Last observation: 1 April 2018

Chart 10: **GDP Growth Forecasted Volatility**

Next Year Forecasted Volatility



Source: Consensus Economics and Bank of Canada Calculations

Last observation: 1 April 2018