Lowering the Bar: Estimating the Neutral Rate in Canada

- **We estimate that the current neutral monetary policy rate is closer to 2.5% (0.5% real, chart 1), with a range of 2.0% to 3.0%, 50bps below the Bank of Canada's range of 2.5% to 3.5% (see Chen, Dorich 2018).**

- **Given the overnight rate is currently at 1.75%, only 75bps separate the Bank of Canada (BoC) from a neutral policy stance.**

- **If the Bank of Canada's estimate of the neutral rate is in line with ours, Governor Poloz's multiple references to the policy rate needing to return to neutral suggests markets continue to underprice the possibility of higher interest rates.**

INTRODUCTION

It is widely believed that over the next few years monetary policy rates in the advanced economies will settle at lower levels compared to previous economic cycles. Underlying these beliefs is research, primarily at central banks, that suggests that the neutral policy rates have declined substantially over the past few decades.

What is the neutral rate? By way of analogy, just as when you press on the gas pedal and the car accelerates, so it is with the monetary policy rate when it is below the neutral rate. The neutral rate is the benchmark that allows statements like "the monetary policy is accommodative", determining the amount of monetary stimulus the economy is receiving at any given time. In the current context, when the Bank of Canada (BoC) and the Federal Reserve are moving to normalize their policy stance, the level of the neutral rate is doubly important because it provides an estimate of how far policy rates can rise before they begin to restrict growth.

Being central to the conduct of monetary policy, the neutral rate of interest and its estimates are widely discussed by the policymakers and market participants, both in Canada and the US. While the concept is important, it is purely theoretical and cannot be observed. One can only infer the neutral rate using various methods. A further complication is that it is linked to another important unobserved quantity—the level of potential output.[1]
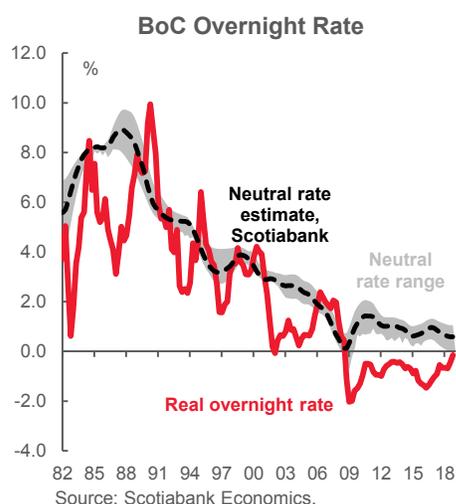
There are various methods that have been used in the literature to estimate the level of the neutral rate for different countries. Kaplan (2018) lists several approaches for the US, and Mendes (2014) uses various methods for Canada. It is argued in both papers that neutral rates are lower now than they were a decade ago. For the US, declining rates of productivity growth, aging population and increased global savings channeled into US Treasury securities are putting downward pressure on equilibrium interest rates, with the most recent median of FOMC participants' estimates of the neutral rate at 3.0%. For Canada, the decline in the rate of growth of potential output and the global neutral rate explain the fall in the estimates of the Canadian neutral rate.

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Chart 1: The real overnight rate and the estimates of the neutral

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[1] In this note we use a more formal definition: the level of the overnight rate at which the level of real GDP equals that of potential output, and inflation remains at the 2% target in a sustainable fashion after all cyclical shocks have dissipated is referred to as the neutral rate (see Mendes, 2014). Potential output is the level of real GDP that is consistent with inflation remaining sustainably at the central bank's target.

Building on these papers, in this note we apply one of the commonly-used methods to produce estimates of the neutral rate in Canada over the 1982–2018 period. In line with previous studies we find that the nominal neutral rate has declined significantly during those years, reaching 2.5% more recently, with a 2.0% to 3.0% range. This suggests that the BoC's estimate of 2.5% to 3.5% is slightly on the high side, while financial markets' expectations for barely one hike in 2019-20, consistent with 2.0% neutral rate, is too low. The 2.5% neutral rate of interest implies that, with the overnight rate currently at 1.75%, only 75bps separate the BoC from reaching "home" and its 10-year odyssey seems almost complete.

OUR APPROACH: MODIFIED HOLSTON, LAUBACH AND WILLIAMS (2016)

In this section we explain the methodology, as set out in Holston, Laubach and Williams (HLW, 2016), we use to estimate the evolution of the neutral rate in Canada since the 1980s. The intuition for the method is as follows: an independently observed measure of economic slack (the output gap) can serve to infer the amount of monetary stimulus the economy must be receiving, once one takes into account other factors that weigh on or support the economy at a given time. Given the estimated amount of monetary stimulus, as summarized by the gap between the real neutral rate and the real overnight rate, conditional on the sensitivity of the economy to the policy rate, an inference on the neutral rate can be made.
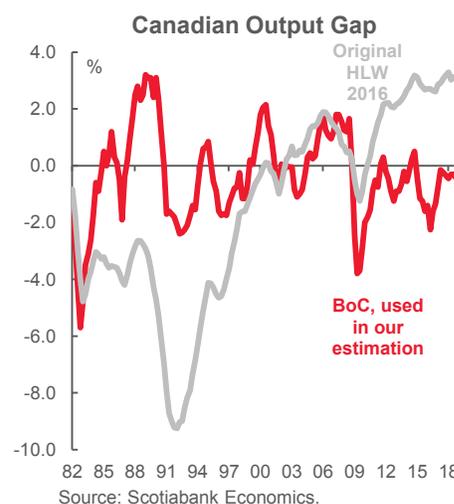
Compared to other methods used for Canada in previous studies, the advantage of the HLW setup is that it occupies the middle ground between purely structural and purely reduced form approaches:

- The approach is more flexible than the purely structural models that can be overly reliant on calibrated or estimated structural parameters in order to compute the steady state level of real interest rate. For example, in the neoclassical growth model the neutral rate is a function of the intertemporal elasticity of substitution, a parameter in the consumer's utility function that is itself difficult to calibrate precisely. Chen *et al* (2018) use an overlapping generations model, as well as a neoclassical growth model to estimate the real neutral rate for Canada.

- HLW can be seen as estimating equations of a structural model (inspired by the New-Keynesian setup), while relaxing some of the parameter restrictions. Thus it is also not a purely reduced-form approach (see Chen *et al* (2018) for several reduced form approaches applied to Canada).
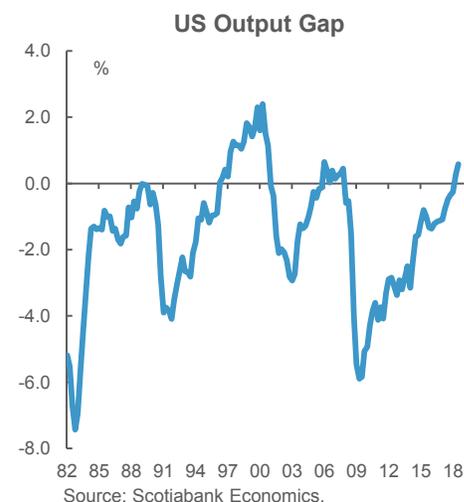
Compared to the original HLW approach for Canada, we introduce the following modifications:

- We use the output gap measure as computed by the Bank of Canada, instead of jointly estimating the output gap and the neutral rate as HLW do. The former measure is more policy-relevant as it reflects the BoC's assessment of the economic slack and appropriate policy stance, and is more consistent with stylized facts about the Canadian economic cycle (see chart 2). This implies that we have no need of estimating the relationship between the output gap and inflation, which is used in the HLW to infer the size of the output gap.

- In addition, HLW do not explicitly include any of the obvious drivers of the Canadian economic cycle, for example the US output gap and oil prices. This implies that the impact of the shocks to oil prices or the state of the US economy are assumed to be captured, on average, in the equation residuals and the dynamic specification of these equations. This assumption might be violated if

Chart 2: The output gap used in estimation versus the original HLW output gap

Canadian Output Gap

Original HLW 2016

BoC, used in our estimation

Source: Scotiabank Economics.

Chart 3: US output gap

US Output Gap

Source: Scotiabank Economics.

one considers the persistent declines of the oil price since 2014, as well as the impact of the persistent excess supply in the US and Canada during the GFC. Thus, relative to HLW we introduce the US output gap, as well as the oil price into the equation for the output gap.

More formally, we estimate[2] the following equations, where the model relies on data for variables in bold to estimate all of the coefficients and the evolution of all of the unobserved variables:

$$\boldsymbol{ygap_t} = \alpha \boldsymbol{ygap_{t-1}} + \frac{\beta}{2}(\boldsymbol{r_{t-1}} - r^*_{t-1} + \boldsymbol{r_{t-2}} - r^*_{t-2}) \dots$$

$$+ \frac{\gamma}{2}(\boldsymbol{ygap^{usa}_{t-1}} + \boldsymbol{ygap^{usa}_{t-2}}) + \delta(\boldsymbol{wti_t} - wti^{trend}_t) + \varepsilon_t$$

$$r^*_t = \boldsymbol{growth^{pot}_t} + Z_t$$

$$Z_t = Z_{t-1} + u_t$$

where $ygap_t$ is the average of the two Canadian output gap measures from the Bank of Canada (chart 2 contrasts the output gap we use in estimation with the original estimate of HLW 2016), $ygap^{usa}_t$ is the US output gap according to the Congressional Budget Office, wti_t is the log of the price per barrel of West Texas Intermediate and $growth^{pot}_t$ is the growth of potential output in Canada, r_t is the real overnight. The unobserved real neutral rate of interest, r_t^*, is a function of the growth rate of potential output, as well as a random walk component, Z. See charts 2–5 for the variables we use in the estimation.

The estimated coefficients, as shown in table 1, all have expected signs and are significantly different from zero. The main result of the estimation is the path of the neutral rate, as shown in chart 1, which also provides a range of estimates (in grey) based on changing various assumptions (e.g. lag specification, the trend oil price, etc.). The base case real neutral rate can be seen declining significantly since the 1980s, and stabilizing somewhat after the GFC.

- Over 2010-18 the real neutral rate declined from 1.0% to the current level of 0.5% (2.5% nominal, table 2). During this period, the slack in the US economy has been completely absorbed, while oil prices, at least prior to 2018Q4, came close to the pre-2014 trend. Together with a still-accommodating stance of monetary policy, with the real overnight rate below the neutral, the fact that the output gap in Canada is stubbornly stuck in small excess supply, suggests that the amount of monetary stimulus had declined over the past few years due to a fall in the neutral rate.
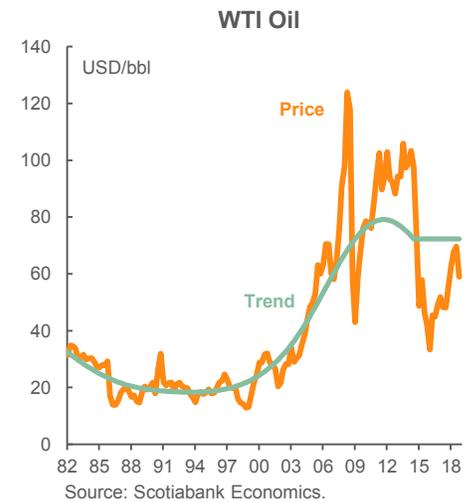
Chart 4: WTI oil price and the trend assumption

WTI Oil

Source: Scotiabank Economics.

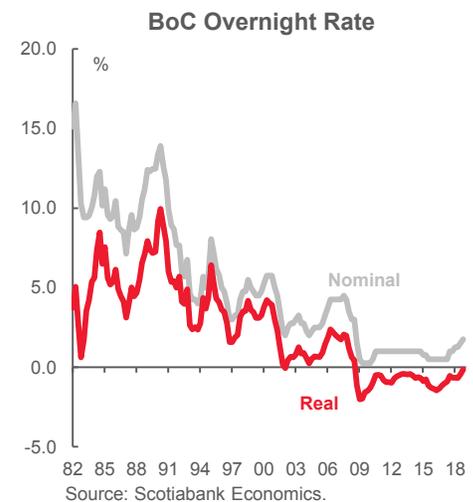Chart 5: The BoC's policy rate has come down

BoC Overnight Rate

Source: Scotiabank Economics.

Table 1: Parameter Estimates

	Coefficient	Standard Error
$ygap_{t-1}$	0.84	0.06
$0.5*(ygap\_usa_{t-1}+ygap\_usa_{t-2})$	0.15	0.05
$wti - wti_{trend}$	0.01	0.00
$0.5*(rate\_gap_{t-1}+rate\_gap_{t-2})$	-0.16	0.05
Log of the variance of residuals	-10.42	0.12

Source: Scotiabank Economics.

[2] The Kalman filter is used to estimate the model. The ratio of variances of innovations to the output gap and the neutral rate equations is estimated as in HLW (2016), which in turn relies on Stock and Watson (1998).

- As of 2018Q4, the medium term level of the nominal neutral rate is about 2.5%, which is about 1.5ppts lower compared to the estimated level at the end of 2005, before the first inklings of the GFC started to show in the state of the US housing market.

SENSITIVITY ANALYSIS AND CAVEATS

The uncertainty in estimating the level of the neutral rate is significant, as the usual parameter uncertainty is magnified by the fact that the unobserved quantity of interest (the neutral rate) depends on another unobserved quantity (the output gap). *All else being equal*, the neutral rate may currently be lower than estimated if there is more slack in the Canadian economy than the BoC estimates, the elasticity of the economy to interest rates is higher, there is less slack in the US economy, or the trend for the WTI is lower. In addition, if there are other factors currently supporting the Canadian economy, which we have not taken into account, it would imply that much less implied monetary stimulus, i.e. a lower neutral rate, all else being equal. The opposite also holds. For example, the latest estimate of the output gap for Canada from HLW was +3.1% in Q3-2018, which explains why the real neutral rate for Canada was at a relatively high level of 1.4% in the same quarter, according to HLW.

Table 2: Estimates of the Neutral Rate in Canada		
	2018Q4	Medium term
Persistent real neutral rate component, Z, as of 2018Q4	-1.3	-1.3
Growth rate of potential output	1.9	1.8
Real neutral rate	0.6	0.5
Add: Inflation		2.0
Nominal neutral rate		2.5
Source: Scotiabank Economics.		

As sensitivity analysis, the range of estimates as presented in chart 1 shows where the neutral rate would be over time when we vary some of the assumptions underlying the model. As of 2018Q4 the real neutral rate is estimated to be between 0.0% and 1.0%. This range results from changing the following assumptions:

- A decline in the trend for the WTI oil price since 2014, which is plausible given the adjustment in the Canadian oil industry, implies a neutral rate in the bottom of the range;

- Changing the measure of the Canadian output gap to the BoC's extended multivariate filter, compared to the average of the latter and the integrated framework we use in the base case, results in the neutral rate being closer to the top of the range;

- A 25% reduction in the elasticity of the economy to the policy rate in the last decade, based on the standard error of the estimated coefficient, leaves the neutral rate closer to the top of the range; and

- Changing lag specifications, testing inclusion of other variables such as the Canadian dollar and the stock market and others which have various effects on the level of the neutral rate.

Beyond the current estimate, going forward the neutral rate can move higher if trade protectionism further cuts the flow of savings into the advanced economies' financial markets, household savings declines as ageing baby boomers retire and begin to dis-save, or government deficits rise on the back of rising health, pension and social security outlays. On the other hand, lingering impacts of the decline in the price of oil, which weakened investment demand, higher burdens of debt, pre-retirement savings (e.g. from pension funds), as well as increased income inequality and rising corporate savings can imply a lower neutral rate going forward (see Dorich and Reza, 2017).

CONCLUSION

In this note we provided an estimate of the neutral rate in Canada over time. We find that the real neutral rate has declined significantly since the 1980s, being currently estimated at 2.5% nominal (0.5% real), with a range of 2.0% and 3.0% depending on model assumptions.

This range is bound by the BoC's latest estimate of 3.0% (see Chen, Dorich, 2018) at the top, and the current financial markets expectations of 2.0% rate expected to be reached over the course of the next few years.

Note that there is a high degree of uncertainty around these estimates which extends beyond the range we provided. Further work can focus on explaining the evolution of the random walk component of the neutral rate.

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