Scotiabank

GLOBAL ECONOMICS

INFLATION REPORT

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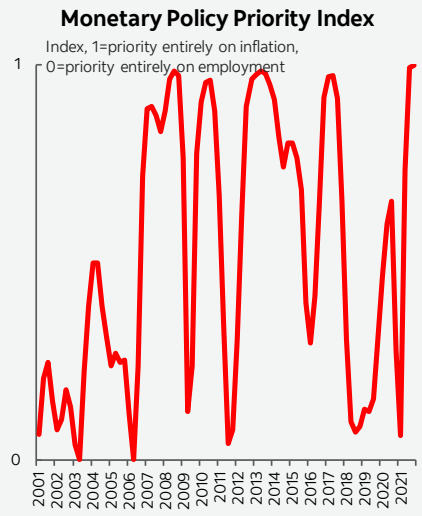
Chart 1



Source: Scotiabank Economics, Haver.

Chart 2

Source: Scotiabank Economics, Haver.

Inflation Expectations Have Become Unanchored

THE BANK OF CANADA CAN NO LONGER AFFORD TO WEIGH GROWTH OR LABOUR MARKET OUTCOMES

- **In light of the Bank of Canada's revised monetary policy framework that takes more explicit account of labour market developments, we estimate a time-varying monetary policy priority index that measures when and how the Bank has shifted its focus between inflation and the unemployment rate over history. We find that there have been large shifts in priority between inflation and labour market outcomes over history.**
- **We also estimate an anchored inflation expectations index to identify when inflation expectations become de-anchored due to persistent deviations of inflation from its target, and how this impacts the Bank's ability to shift its priorities between inflation and labour outcomes.**
- **Our findings indicate that as of late 2021, the Bank's priority should have been squarely on inflation. We also find that inflation expectations have been completely de-anchored from the 2% target since late 2021. This recent de-anchoring of expectations means that the Bank's monetary policy will need to be more aggressive to bring inflation back to target.**

Economies around the world have been experiencing persistent and rising inflation, with rapidly diminishing spare capacities and increasing supply constraints and bottlenecks. This is happening at a time when the COVID-19 pandemic and geopolitical tensions are dominating the global economic outlook.

In Canada, while the labour market fully recovered all its COVID-19 losses, the recovery has been unequal, with employment in high-contact sectors still significantly below pre-pandemic levels. Despite a sharp increase of inflation, the Bank of Canada passed on raising its policy rate in its January meeting and eventually raised its policy rate in March. Throughout the pandemic, as inflationary pressures took hold and proved more persistent, many wondered whether the Bank was prioritizing labour market outcomes over keeping inflation under control. For much of last year, Governor Macklem and his colleagues made it clear that they viewed labour market slack as a factor holding inflation and policy back.

The Bank's newly announced framework more formally asserts that it will use its flexible inflation targeting regime to actively seek and support maximum sustainable employment when conditions warrant. In this report, we propose the theory that the Bank of Canada has indeed been already following this approach in conducting monetary policy, shifting its focus between inflation and unemployment rate over time and given economic conditions. To test this theory, we estimate a time-varying monetary policy priority index, which varies depending on whether the Bank puts more or less weight on inflation or the unemployment rate gap. This index would complement the Bank's commitment to report when and how labour market outcomes have factored into its monetary policy decisions as it can tell us where the weight is at any given point in time.

We also consider the role that inflation expectations play in providing the Bank the necessary flexibility in shifting its priority from one indicator to another. The theory here is when inflation expectations are well anchored to the Bank's target, inflation should react less to demand shocks, giving the Bank more room to shift its focus away from inflation and onto the unemployment rate gap and probing the value of the equilibrium unemployment rate (i.e. NAIRU). Similarly, we test this theory by estimating an anchored inflation expectations index, which varies depending on whether inflation expectations are more anchored to the target or based on inflation's recent and expected behaviour.

METHODOLOGY

I) MONETARY POLICY PRIORITY INDEX

We estimate a forward-looking reaction function that follows a simple Taylor-type rule, where the Bank can react to both an indicator of economic activity (in this case the unemployment rate gap), and the expected inflation gap. As in **Lalonde 2006**, we allow the weights on the two respective gaps to vary over time by adding a non-linear, time-varying monetary policy priority index which varies between 0 and 1. Thus, at any given time, the Bank can decide to prioritize either inflation control or probe for the minimum unemployment rate consistent with stable inflation. Since inflation control is the Bank's primary objective, it determines how to distribute the weight based on the expected inflation gap. The further expected inflation is from target, the more weight will be placed on the inflation gap, and the higher the priority index will be.

We note here two challenges that may hamper our results. First, the complex nature of a non-linear estimation. Second, the overnight rate has been at the effective lower bound for long stretches of time during our estimation period. As such, our dependant variable did not always move in response to inflation and unemployment. This limits the variability that could be captured and explained by the model. Despite these challenges, our results are statistically significant and provide a useful tool to help understand the Bank's priorities and how it conducts monetary policy.

The priority index depends on a key estimated coefficient, which can be interpreted as the Bank's bias towards inflation. The smaller this coefficient is, the faster the Bank will reorient its priority from the unemployment rate gap to the inflation gap in response to deviations of inflation expectations from target. In other words, it will take a smaller deviation to shift the Bank's focus back to the inflation gap—its ultimate objective. The model and key estimated parameters are presented in the appendix.

II) ANCHORED INFLATION EXPECTATIONS INDEX

We estimate a Phillips curve in which inflation expectations are a function of the inflation target, past inflation and future inflation. As in **Lalonde 2005**, we allow the weight on the inflation target to vary by adding a time-varying anchored inflation expectations index which fluctuates between 0 and 1 depending on inflation's recent and expected behaviour. The closer past and future inflation is to target, the closer the index is to 1 and the higher the probability agents assign to the Bank's ability to meet its target in the next couple of years. In other words, the more anchored inflation expectations are to target, the higher the index, and the less sensitive inflation is to demand shocks. Note that the index says nothing about the Bank's long-term credibility and success in bringing inflation to target. This is a time-varying weight on the inflation target in inflation expectations.

Similar to the priority index, the anchored inflation expectations index depends on a key estimated coefficient. The larger this coefficient is, the more agents will tolerate a larger deviation of inflation from the target before de-anchoring the inflation expectation from the target. We noticed that since 2007 this estimated coefficient has increased substantially which means that the Bank's credibility increased over recent history.

III) RESULTS AND MONETARY POLICY IMPLICATIONS

Chart 1 plots the monetary policy priority index. The behaviour of the priority index indicates that the Bank has indeed been shifting its priority between inflation and unemployment rate over the past two decades, placing more weight on the unemployment rate gap during periods when the expected inflation gap was relatively small which allowed the monetary policy to focus on employment and probe for the value of the equilibrium unemployment rate.

The index briefly shifted to inflation in the first half of 2020 when the pandemic first hit and resulting restrictions slowed demand and put downward pressure on prices and increased the expected inflation gap (in absolute terms). As economic activity and inflation expectations quickly rebounded, the priority index shifted back to unemployment before increasing concerns about inflation being persistently above target pushed the index to 1 in late 2021. According to the priority index and historical standards then, the current expected inflation gap should have had the Bank focused squarely on inflation starting in mid 2021. It has been able to wait to do so because there were other tools at its disposal such as the government bonds purchasing program, which the Bank ended in November of last year, and forward guidance.

Chart 2 plots the anchored inflation expectations index. We see a clear inverse relationship between the two indices—when inflation expectations are well anchored to target, inflation is less sensitive to demand shocks, giving the Bank more room to probe the unemployment rate gap. Inflation expectations were well anchored to target in the two years leading up to the pandemic, and during that time the priority index was also tilted towards the unemployment rate gap. But since the pandemic hit, inflation expectations have been gradually de-anchored, as agents put increasingly more weight on inflation's behaviour rather than the 2% target. This is not surprising given inflation's recent behaviour and the Bank's delay in hiking its policy rate. With the anchored expectations index dropping to 0 in 2021-Q3, the Bank should have acted quickly, shifting its focus back to inflation in order to re-anchor expectations.

APPENDIX

MONETARY POLICY PRIORITY INDEX

Our base-case reaction function is:

$$i_t = \alpha + \lambda . i_{t-1} + \beta_1 . inf\_gap_{t+5} + \beta_2 . u\_gap_t$$

where i_t is the Bank of Canada's nominal policy rate in period t, inf_gap_{t+5} represents the average of the expected inflation gap over the next five quarters, and u_gap_t represents the unemployment gap, or the deviation of the unemployment rate from the NAIRU, in period t.

We modify the base-case reaction function to include ψ_{mp} as a time-varying weight on the unemployment gap, and $(1-\psi_{mp})$ as a time-varying weight on the inflation gap:

$$i_t = \alpha + \lambda . i_{t-1} + \beta_1 . \psi_{mp} . u\_gap_t + \beta_2 . \left(1 - \psi_{mp}\right) . inf\_gap_{t+5}$$

Since price stability is the Bank of Canada's primary objective, we assume that it determines the weight it places on the two indicators based on the expected inflation gap. Therefore,

$$\psi_{mp} = \frac{e^{-(mave(inf\_gap_{t+2})^2}}{2\theta_t^2}$$

where $mave(inf\_gap_{t+2})$ is a moving average of the expected inflation gap, and θ_t is the key estimated coefficient that determines the speed at which the Bank will reorient its priority from economic activity towards inflation. The smaller θ_t, the faster the Bank will reorient its policy from probing the NAIRU gap towards the inflation gap when the inflation moves away from the target. Thus, θ_t is inversely proportional to the Bank's bias towards inflation.

We define the monetary policy priority index in terms of the time-varying weight on inflation:

$$\left(1 - \psi_{mp}\right)$$

The resulting modified reaction function is:

$$i_t = \alpha + \lambda . i_{t-1} + \beta_1 . \left[1 - \frac{e^{-(mave(inf\_gap_{t+2})^2}}{2\theta_t^2}\right] . \text{inf\_}gap_{t+5} + \beta_2 . \left[\frac{e^{-(mave(inf\_gap_{t+2})^2}}{2\theta_t^2}\right] . u\_gap_t$$

We estimate our modified reaction function with non-linear least squares using the generalized method of moments (GMM). The estimation results are summarized in Table 1.

Table 1: Reaction Function Estimation Results

	Coefficient	Std. Error	t-Statistic
α	0.00207	0.00058	3.6
λ	0.85939	0.03248	26.5
θ	0.00161	0.00031	5.2
$\beta 1$	0.41448	0.18016	2.3
$\beta 2$	-0.366	0.10631	-3.4

Sample: 2001Q1-2021Q3

ANCHORED INFLATION EXPECTATIONS INDEX

We assume a standard Phillips curve, in which inflation is a function of expected inflation, the output gap, the first difference of the log of the real effective exchange rate and the first difference of the log of the real price of oil:

$$\pi_t = \pi_t^e + \gamma.output\_gap_{t-2} + \xi.\Delta lrer_{t-1} + \delta.\triangle\ lpoil_{t-1}$$

Here, inflation expectations are a combination of backward- and forward-looking agents' expectations. Assuming a constant share of backward-looking agents, ω, and a constant share, $(1-\omega)$, of forward-looking agents, inflation expectations can be rewritten as follows:

$$\pi_t^e = \omega.\pi_b^e + (1-\omega).\pi_f^e$$

Backward-looking agents' expectation are a function of the inflation target and past inflation, while forward-looking agents' expectations are a function of the inflation target and future inflation. In forming their expectations, backward-looking agents assign $\varphi_{\exp}^b$ as a time-varying weight on the inflation target, π_t^*, and $(1-\varphi_{\exp}^b)$ as a time-varying weight on past inflation. Similarly, forward-looking agents assign $\varphi_{\exp}^f$ as a time-varying weight on the inflation target and $(1-\varphi_{\exp}^f)$ as a time-varying weight on future inflation:

$$\pi_t^e = \omega.[\varphi_{exp}^b.\pi_t^* + (1-\varphi_{\exp}^b).\pi_{t-1}] + (1-\omega).[\varphi_{exp}^f.\pi_t^* + (1-\varphi_{\exp}^f).\pi_{t+2}]$$

$\varphi_{\exp}^b$ is a function of the moving average of the gap between recent inflation and the target, while $\varphi_{\exp}^f$ is a function of the moving average of the gap between the expected inflation rate and the target. Therefore, these time-varying weights have the following functional form:

$$\varphi_{\exp}^b = \frac{e^{-(mave(inf\_gap_{t-1})^2}}{2\theta_t^2}$$

$$\varphi_{\exp}^f = \frac{e^{-(mave(inf\_gap_{t+1})^2}}{2\theta_t^2}$$

where θ_t is the key estimated coefficient that determines the speed at which agents will reorient their inflations expectations from the inflation target to recent and future inflation. The larger θ_t, the slower agents will move away from the target when they form expectations if the inflation deviates from the target. Thus, θ_t is proportional to the agents' tolerance of deviations of recent and future inflation from target.

Combining both time-varying expectations creates our total anchored inflation expectations index, which is modelled as follows:

$$\psi_{exp} = \omega.\varphi_{\exp}^b + (1-\omega).\varphi_{\exp}^f$$

$$\psi_{exp} = \omega.\left[\frac{e^{-(mave(inf\_gap_{t-1})^2}}{2\theta_t^2}\right] + (1-\omega).\left[\frac{e^{-(mave(inf\_gap_{t+1})^2}}{2\theta_t^2}\right]$$

The resulting modified Phillips curve is:

$$\pi_t = \omega.\left[\frac{e^{-(mave(inf\_gap_{t-1})^2}}{2\theta_t^2}.\pi_t^* + \left(1 - \frac{e^{-(mave(inf\_gap_{t-1})^2}}{2\theta_t^2}\right).\pi_{t-1}\right] + (1-\omega).\left[\frac{e^{-(mave(inf\_gap_{t+1})^2}}{2\theta_t^2}.\pi_t^* + \left(1 - \frac{e^{-(mave(inf\_gap_{t+1})^2}}{2\theta_t^2}\right).\pi_{t+2}\right] + \gamma.output\_gap_{t-2} + \xi.\Delta lrer_{t-1} + \delta.\triangle lpoil_{t-1}$$

We estimate our modified Phillips curve with non-linear least squares using the generalized method of moments (GMM). The estimation results are summarized in Table 2.

Table 2: Phillips Curve Estimation Results

	Coefficient	Std. Error	t-Statistic
ω	0.59699	0.03221	18.5
θ	0.00146	0.00024	6.0
γ	0.01386	0.00507	2.7
ξ	0.01964	0.00409	4.8
δ	0.00434	0.00121	3.6

Sample: 2007Q1-2021Q3