

# PERSPECTIVES

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## The effect of macroeconomic uncertainty on public finances

Empirical evidence for Canada and Quebec

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Over the past few decades, the Canadian economy has faced a series of macroeconomic shocks of various origins and types: the 2008–2009 global financial crisis, commodity price fluctuations, the COVID-19 pandemic, periods of high geopolitical uncertainty, and rapid monetary tightening aimed at containing inflation. These episodes have profoundly affected macroeconomic conditions and posed significant challenges to public finances. In a CIRANO study (Moran and Stevanovic, 2025), the authors provide an empirical assessment of the effects of a series of macroeconomic shocks on key economic and fiscal aggregates in Canada. Their analyses highlight the need for a fiscal management strategy that is sensitive to external macroeconomic conditions and sources of uncertainty.

The macroeconomic shocks that cause fluctuations in economic activity, prices and employment have direct repercussions on tax revenues and public spending. Understanding the dynamics of these effects is essential for policymakers, particularly in the current context of heightened uncertainty, global monetary tightening and volatile commodity prices.

We sought to quantify the effects of five types of macroeconomic shocks on key economic and fiscal aggregates in Canada: 1. Monetary policy shock; 2. Domestic technology shock; 3. Foreign technology shock; 4. Oil shock; and 5. Financial market shock.

We looked at the effects of these shocks on the following economic aggregates: 1. Nominal and real gross domestic product (GDP); 2. Household final consumption expenditure; 3. Business gross fixed capital formation; 4. Total employment; 5. Consumer price index; 6. Household wages and salaries; 7. Corporate profits; 8. General government final consumption expenditure; and 9. General government final investment expenditure.

In the context of economic modelling, the notion of a “shock” refers to an event causing an unanticipated change in one of the variables of a model, an exogenous event (originating externally) that may have subsequent effects on the other variables of the model. In addition to the impact on economic aggregates, we have paid particular attention to the implications for public finances.

## The local projection method

Our empirical work is conducted with the method of local projections. This method is a macroeconomic analytical tool used to estimate the dynamic effects of a shock—or an intervention—on the evolution of a variable of interest. Developed over the last two decades, this method has become an important part of the macroeconomist’s toolkit.

Local projections originated in the work of Dufour and Renault (1998), but their specific ability in analyzing the causal effects of shocks was popularized by Jordà (2005). This methodology has since been the subject of numerous contributions and the literature has recently been reviewed by Jordà and Taylor (2025).

An estimation exercise in local projections begins with the following expression:

$$y_{t+h} - y_{t-1} = \alpha + \beta_h s_t + \delta x_{t-1} + u_{t+h}$$

where  $y_t$  denotes the variable of interest,  $s_t$  is the shock whose causal effects on  $y_t$  are being studied, and the vector  $x_{t-1}$  includes control variables dated  $t-1$  or earlier. The expression is estimated separately for each

value of  $h = 0, \dots, H$ . In each of these estimates, the parameter  $\beta_h$  represents the impact of  $s_t$  on the value of the variable of interest at time  $t+h$  relative to its control value at time  $t-1$ . By collating all the estimated values of  $\beta_h$ , we obtain the trajectory that variable  $y$  will follow in response to shock  $s$ . This trajectory is often referred to as the impulse response function.

Since local projections consist of a series of separate univariate regressions for each time horizon  $h = 0, \dots, H$ , estimation is straightforward and is performed using ordinary least squares (OLS). Furthermore, estimating a regression for each horizon  $h$  allows for the consideration of non-linear effects of  $s$  on  $y_{t+h}$ , where applicable. This simplicity and flexibility make local projections an interesting complementary approach to the vector autoregressive models commonly used by macroeconomists. While results obtained by the two approaches can be shown to be asymptotically equivalent, Montiel Olea et al. (2025) provides guidance on how to choose between these two methods for practical applications.

## **Exogenous and unanticipated increases in the key interest rate lead to a gradual and persistent contraction in economic activity**

Monetary policy shocks occur when the central bank makes an unexpected change to the interest rate it controls. In the Canadian context, this would be the Bank of Canada's target for the overnight rate. Analyzing the effects of a monetary shock is relevant for several reasons. On the one hand, unexpected changes in interest rates directly influence government financing conditions, particularly through the cost of servicing public debt. On the other hand, adjustments to monetary policy have indirect effects on tax revenues and discretionary spending by affecting economic activity, employment and inflation. Studying the effects of a monetary shock provides a better understanding of the extent to which public finances respond to monetary conditions, whether that's by passive means, through economic activity, or active means, through budgetary choices.

The main empirical challenge in estimating the effect of monetary shocks lies in identifying the unanticipated and exogenous component of monetary policy. In other words, the challenge is to pinpoint changes in the policy rate that are not reactions to contemporary macroeconomic conditions, but rather reflect decisions made by the central bank to depart from its usual reactions to these conditions. We use the shock measure proposed by Champagne and Sekkel (2018) for Canada.

Our estimates indicate that following an increase in the target for the overnight rate—i.e., a tightening of monetary policy—Canada's real GDP declines significantly. The decline is seen after a few quarters, hitting its bottom about two years after the initial shock. Consumption and employment follow a similar path, albeit to a lesser extent, while private investment reacts more sharply and quickly, confirming its sensitivity to changes in financing conditions. The components of aggregate income, particularly total compensation and corporate profits, also contract significantly. This reflects a combination of lower employment, slower wage growth and lower profit margins.

This unfavourable trend in macroeconomic aggregates is reflected in a worsening of public finances. Government tax revenues begin to fall because of the shrinking tax base, with public expenditure showing little response in the short term. In a deflationary environment they will even decline slightly, significantly deteriorating the budget balance.

**These findings illustrate the vulnerability of public finances to monetary tightening and highlight the implicit countercyclical role of fiscal policy, even in the absence of discretionary measures.**

## **Increased productivity in Canada is a significant source of economic and budgetary gains**

Technological shocks correspond to unexpected variations in an economy's production capacity. A concept commonly used to quantify these variations is that of total factor productivity (TFP), a concept reflecting the efficiency with which inputs are transformed into outputs in a production function.

As with estimating the effects of monetary shocks, estimating the effects of TFP shocks is challenging since productivity gains can be influenced by cyclical variations, regardless of any technological innovations taking place. We apply Fernald's (2014) method to Canadian data to do so and identify actual technological innovations while excluding cyclical fluctuations in worker effort or capital intensity (Moran et al., 2025).

Our results indicate that productivity gains specific to Canada spur economic activity, while exerting limited pressure on public spending. At the national level, this translates to a rapid and steady growth in real GDP and employment. Meanwhile, in the early quarters, private investment responds strongly, reflecting the expectations of future returns and the speed with which shock transmission takes place. In turn, consumption responds positively as well, albeit gradually, supported by rising incomes. Productivity shocks thus produce marked and lasting expansionary effects, thereby helping in the medium term to fiscally strengthen the room to manoeuvre.

Wages and profits rise significantly, fuelling consumption growth and boosting tax revenues. However, public consumption and investment expenditure are slow to respond in the short term, likely due to a certain degree of institutional inertia. In the medium term, they do increase, but at a slower rate than revenues, leading to a net improvement in the budget balance.

**These findings highlight the positive budgetary impact of innovation and support the importance of federal policies aimed at stimulating productivity growth.**

## **The initial effects of productivity growth in the United States are more modest**

Productivity shocks originating in the United States provide a means of assessing the international transmission of technological gains to a small open economy such as Canada. Compared with a specifically Canadian productivity increase, our analyses show that the initial effects of a productivity increase in the United States are more modest and materialize gradually. Real Canadian GDP increases gradually, with the maximum impact observed approximately three years after the shock.

Private investment's swift reactions suggest that the impact occurs by affecting expectations as well as financial and trade markets, rather than through a direct improvement in the productivity of Canadian businesses. Consumption and employment react more slowly, but eventually show significant increases.

Public consumption and investment expenditure also respond gradually, with the full effects observed in the longer term. This dynamic can be interpreted as an endogenous response by public finances to an improvement in economic conditions, brought about by the external shock. The gradual upturn in activity and tax revenues allows for an upward adjustment in expenditure, which helps to support growth.

**These findings highlight the importance of indirect channels in the international transmission of real shocks.**

## **Increased oil prices and a higher global demand for raw materials have positive effects on the Canadian economy as a whole**

Oil shocks are major determinants of Canada's macroeconomic environment, since energy plays a central role in the national economy. Fluctuations in world oil prices produce significant macroeconomic effects. As a producer and net exporter of oil, Canada is particularly sensitive to fluctuations in those prices.

We have selected two measures of oil shocks. The first uses the price of a barrel of West Texas Intermediate (WTI) crude oil, a widely used international benchmark. This price is generally considered exogenous to the Canadian economy because of the country's relatively small size in the global oil market. The use of WTI price changes as a measure of oil shocks provides a direct and intuitive way of capturing how changes in energy prices affect the Canadian economy. However, it does not distinguish between fluctuations in oil prices that result from supply shocks, which reflect exogenous changes in global production, and demand shocks, which reflect changes in global economic activity.

In order to better understand the impact of aggregate demand, we use another measure for oil shocks, namely the Global Real Economic Activity Index (GREAI). This index was developed by Kilian (2009) and is regularly updated by the Federal Reserve Bank of Dallas. The effects of oil shocks based on the GREAI index are broadly similar to those based on the WTI price, supporting the hypothesis of a transmission channel based on global demand for commodities.

Our estimates show that an exogenous change in the price of crude oil initially generates a strong, positive effect on Canadian real GDP. This is followed by a gradual decline in the medium and long term. That short-term expansion followed by a prolonged slowdown is also observed in the trajectories of employment, investment, consumption and corporate profits. Nominal aggregates follow a similar pattern: nominal GDP and profits increase sharply at the national level; employment, wages and public spending also show growth, albeit in a more staggered way.

In this scenario, public finances increase, mainly through higher tax revenues generated by natural resource-related sectors and global demand. At the same time, public spending remains relatively stable, leading to a temporary improvement in the budget balance. The Canadian economy responds strongly to increases in global demand for oil and raw materials, but the effects vary by region.

**These findings highlight the importance of incorporating regional sectoral composition when assessing the impacts of natural resource shocks.**

## **An exogenous tightening of credit conditions is one of the most adverse shocks for the economy and public finances**

The 2007–2008 financial crisis highlighted the importance of financial shocks as an autonomous source of macroeconomic fluctuations. The acute tensions observed during this episode, particularly in credit markets, the tightening of financing conditions and the deterioration in balance sheet liquidity had a major impact on investment, employment and output—not counting the effects induced by real or monetary policy shocks.

We estimated the effects of a financial shock corresponding to an exogenous tightening of credit conditions. This was measured by an increase in the excess bond premium (EBP), which was a tool developed by Gilchrist and Zakrajšek (2012). The excess bond premium quantifies the portion of the yield spread between corporate bonds that cannot be explained by observable credit-risk fundamentals. This indicator captures two sources of fluctuations: those whose degree of stress potentially relates to investors' risk aversion and those that arise from financial constraints in the economy and are potentially linked to challenges in credit markets.

We find that an exogenous tightening of credit conditions leads to a rapid and significant contraction in GDP, investment and employment. Consumption also declines, reflecting deteriorating financial conditions and rising uncertainty. Aggregate income, including wages and profits, falls sharply, directly affecting tax revenues. On the other hand, public spending tends to increase, particularly in the medium term, as a result of automatic stabilizers. This combination of falling revenues and rising expenditures leads to a marked deterioration in the budget balance in both Canada and Quebec.

**These findings illustrate the crucial role that financial shocks play in episodes of fiscal stress. It also underscores that absorbing this type of disruption requires sufficient room to manoeuvre.**

## The need for detailed regional analyses

Our analyses highlight significant regional asymmetry. Although monetary policy is uniform across the country, its economic and fiscal effects tend to present differently depending on regional characteristics such as sectoral structure, the relative weight of cyclical industries, and credit behaviour. Our results indicate that the responses in the Quebec economy to monetary shocks are comparable, qualitatively, to those of Canada as a whole. However, certain variables, notably investment, do show more pronounced reactions. Consumption appears to react more quickly than its national counterpart, while the effects on corporate profits are more moderate. This increased sensitivity can be explained by differences in sectoral structure or by greater dependence on bank credit.

With regard to the effects of specifically Canadian technological shocks, Quebec exhibits dynamics very similar to those seen in Canada as a whole—though the magnitude of the responses is slightly lower. This difference could reflect an unevenness of productivity gains or lower sectoral exposure to technology-intensive industries. Nevertheless, the synchronization of responses remains high, reflecting the close integration of the economies of Quebec and Canada, as a whole. With regard to the effects of technological shocks originating in the United States, provinces that are more exposed to exports to the United States or have a large manufacturing sector experience a greater response, while others, such as Quebec, are more limited in the spillover effect.

It was expected—and our results confirm this—that the effects of oil shocks would vary significantly from province to province. Alberta benefits greatly from oil shocks, while energy-consuming provinces such as Quebec see more limited gains or even ambiguous effects. Energy-price increases can even exert negative pressure on purchasing power and production costs in Quebec, mitigating the positive effects observed at the national level.

As for the effects of tighter credit conditions, the impact on the Quebec economy is broadly similar to that observed across Canada, but to a lesser extent. Real GDP, employment and investment, also to a lesser extent, respond negatively, which could reflect Quebec's lower exposure to international financial markets or a sectoral specialization that is more oriented towards less cyclical activities.

In short, while Canada benefits fully from positive shocks (technology, external demand, oil), Quebec is more exposed to its adverse effects, particularly during periods of monetary tightening or rising energy prices. This asymmetry can be explained by distinct economic structures: integration into the global market, sectoral exposure and differentiated fiscal room to manoeuvre.

**These findings suggest that stabilization policies should be tailored to regional realities, taking into account the nature of the shock and the specific sensitivity of each local economy.**

## What are the implications for public finances?

The induced effects of various macroeconomic shocks on public finances are substantial but varied. The table on the next page summarizes these effects and illustrates the vulnerability of public finances to macroeconomic uncertainties.

Type of shocks	Fiscal variable	Short term	Medium term	Interpretation
<b>Monetary</b>	Fiscal revenues	↓	↓	Economic slowdown
	Public spending	↓ / stable	↓	Deflationary impact
	Budget balance	↓	↓	Deterioration
<b>Technological (CAN)</b>	Fiscal revenues	↑	↑	Broadening tax base
	Public spending	stable	stable / ↓	Moderate impact
	Budget balance	↑	↑	Net improvement
<b>Technological (US.)</b>	Fiscal revenues	↑	↑	Through trade and foreign channels
	Public spending	stable	stable	Modest reaction
	Budget balance	↑	↑	Improvement
<b>Oil price</b>	Fiscal revenues	↑	↑ / stable	Revenues from related sectors
	Public spending	stable	stable	Little impact
	Budget balance	↑	stable	Temporary improvement
<b>Global demand</b>	Fiscal revenues	↑	↑	External transmission
	Public spending	stable	stable	Modest impact
	Budget balance	↑	↑	Net improvement
<b>Financial</b>	Fiscal revenues	↓	↓	Credit and activity slowdown
	Public spending	stable / ↑	↑	Stabilizing motive
	Budget balance	↓	↓	Deterioration

### The effect of macroeconomic shocks on public finances

Our approach based on local projections provides a valuable empirical basis for guiding budget planning in an uncertain macroeconomic environment. Overall, our findings support a budget forecasting and management

strategy that is sensitive to external macroeconomic conditions and sources of uncertainty, with a particular focus on automatic stabilization mechanisms and a budget that has room to manoeuvre in stressful times.

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