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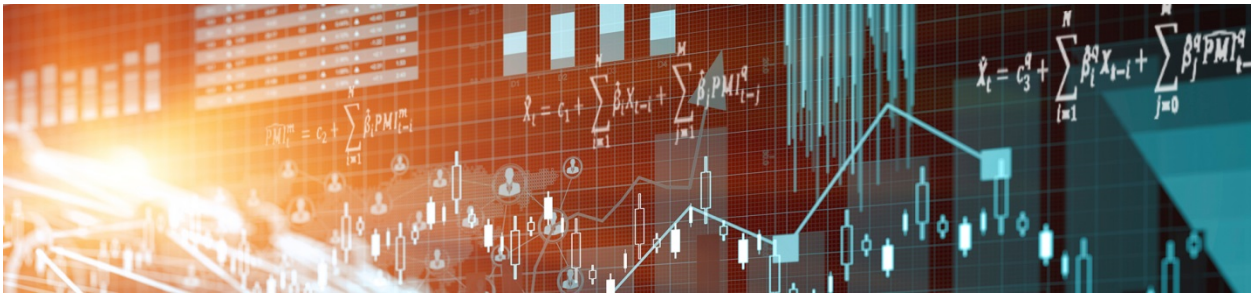
How to Manage Macroeconomic and Financial Stability Risks: A New Framework



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Abstract

Monetary policy decisions need to consider all potential outcomes, not just the most likely path for the economy. This is especially true in the presence of elevated financial system vulnerabilities, which lead to increased downside risks for future growth. In a novel risk-management framework, we decompose the outlook for the *distribution* of future gross domestic product (GDP) growth into macroeconomic and financial stability risks. When analyzing the efficacy of policy tools, we find that macroprudential tightening is substantially more effective than monetary policy at reducing downside risks to future GDP growth.

Bank topics: Central bank research; Economic model; Financial stability; Financial system regulation and policies; Interest rates; Monetary policy; Monetary policy framework
JEL codes: E44, E52, E58, G01

Résumé

Au moment de prendre ses décisions de politique monétaire, la Banque du Canada doit considérer toutes les trajectoires économiques possibles, pas seulement le scénario le plus probable. C'est particulièrement vrai lorsque les vulnérabilités du système financier sont élevées, car les risques de détérioration de la croissance économique sont alors accrus. À l'aide d'un cadre original de gestion des risques, nous décomposons la *distribution* de la croissance future du produit intérieur brut (PIB) selon deux facteurs sous-jacents : le risque macroéconomique et le risque financier. En analysant l'efficacité des instruments d'intervention, nous constatons que le renforcement des politiques macroprudentielles permet nettement mieux que la politique monétaire de limiter les risques à la baisse pour les perspectives de croissance du PIB.

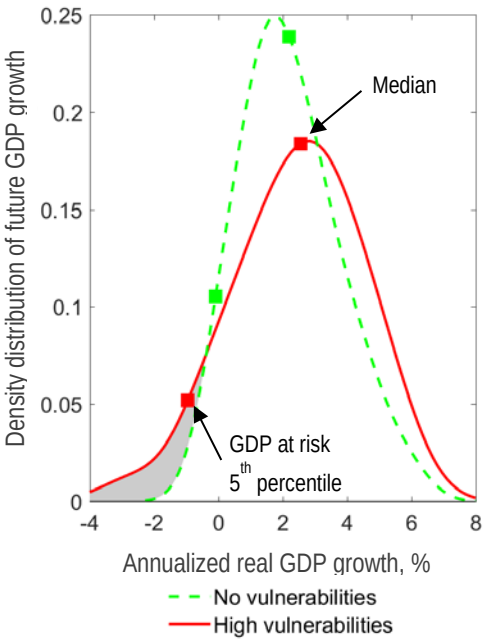
Sujets : Recherches menées par les banques centrales; Modèles économiques; Stabilité financière; Réglementation et politiques relatives au système financier; Taux d'intérêt; Politique monétaire; Cadre de la politique monétaire
Codes JEL : E44, E52, E58, G01

1. Managing risks around GDP growth

The Canadian economy faces two interrelated financial system vulnerabilities: high levels of household indebtedness and housing market imbalances (Bank of Canada 2017a). These vulnerabilities have supported economic activity—seen in the median path of future gross domestic product (GDP)—through debt accumulation. But elevated vulnerabilities also imply a larger downside risk to future growth (**Chart 1,** grey area).

Building on this insight, our novel risk-management approach uses the distribution of future GDP growth to assess macroeconomic and financial stability risks in a unified framework. Technical details are presented in the **Appendix.**

Chart 1: **Financial system vulnerabilities increase downside GDP risks in Canada**



Source: Duprey (2018)

2. The distribution of future GDP growth can be decomposed into macroeconomic and financial stability risks

Macroeconomic stability risk is defined by the evolution of median GDP growth relative to the growth rate of potential output.[1] To set monetary policy, an inflation-targeting central bank focuses on the most likely path for the economy, i.e., median GDP growth relative to potential. When the consequences of a policy rate change are assessed, typical models imply that the distribution of future GDP growth moves symmetrically (**Chart 2a**), retaining the same shape (the shift from the solid to the dotted red distribution).

Chart 2a: If financial vulnerabilities do not change, monetary policy tightening shifts the distribution of future GDP growth symmetrically

The distribution shifts to the left but the distance between the median and the tail does not change

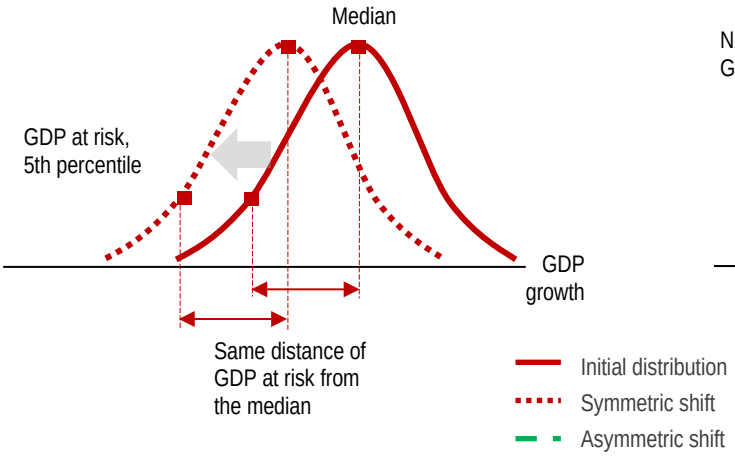
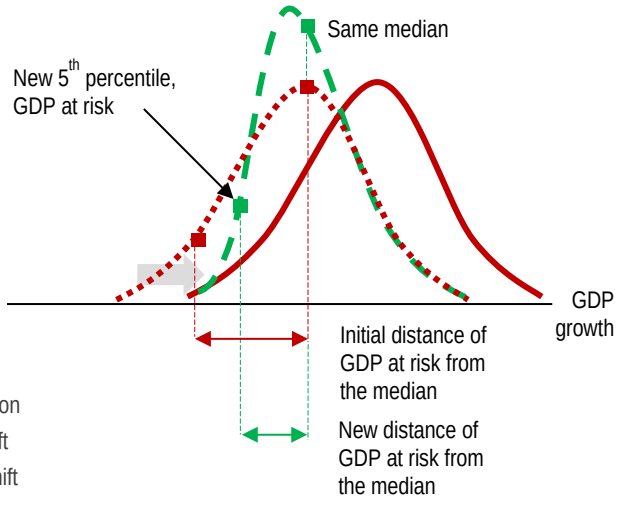


Chart 2b: If monetary policy tightening decreases financial vulnerabilities, the distribution of future GDP growth shifts asymmetrically

The left tail is smaller and the distance between the median and the tail decreases



[1] Macroeconomic stability risk is measured by the absolute value of the gap between median GDP growth and the growth rate of potential output (1.6 per cent in the January 2018 *Monetary Policy Report*). In this note, the growth rate of potential output is assumed to be constant over time. Other measures of macroeconomic stability risk frequently use either a loss function combining both median GDP and inflation gaps, or the deviation of the level of GDP from its potential. Although quantitative results may vary, our qualitative results would not change with these alternative loss functions. For simplicity, we focus on only GDP growth to ensure that our measures of macroeconomic and financial stability risks are in the same unit.

To capture the effects of monetary policy on financial stability, we look at changes in the *tail* of the GDP distribution. We start with GDP at risk, which measures the growth rate of GDP that should be exceeded in all but the worst 5 per cent of expected outcomes (the 5th percentile of the year-ahead GDP growth distribution). Financial stability risk is then defined as the distance of GDP at risk from the expected median GDP growth. Our definition thus focuses on changes to the shape of the lower tail that are not already captured by our definition of macroeconomic stability risk. For example, the financial stability effect of tighter monetary policy will come from a reduction of vulnerabilities (**Chart 1**), ultimately leading to improved tail GDP risk *relative to the median* (**Chart 2b**). The distance of GDP at risk from median GDP growth changes only if the shape of the distribution changes (the shift from the dotted red to the dashed green distribution).

Both our new financial stability risk metric and the macroeconomic stability risk metric are expressed in percentage points of GDP growth. This allows for cost-benefit analyses of macroeconomic stability against financial stability.

3. Faster normalization of monetary policy results in lower financial stability risks but higher macroeconomic risks

Similar in spirit to Poloz (2014), we measure the trade-off between macroeconomic and financial stability risks implied by different paths of interest rate normalization (**Chart 3** and **Chart 4**).[2] The base-case policy rate profile (solid green line) is obtained from the projections of Canadian commercial banks.[3] The faster (red dashed) and slower (blue dotted) policy paths are extreme hypothetical scenarios. Household vulnerabilities respond slowly to interest rate changes. To capture all costs and benefits over time, macroeconomic and financial stability risks are averaged over the 2018–22 period.

Starting with the base-case profile of interest rates, the solid green line in **Chart 3**, a more gradual normalization corresponds to a shift toward the dotted blue line. The trade-off is shown in **Chart 4** as the movement

Chart 3: **Alternative scenarios with faster or slower normalization around the base case**

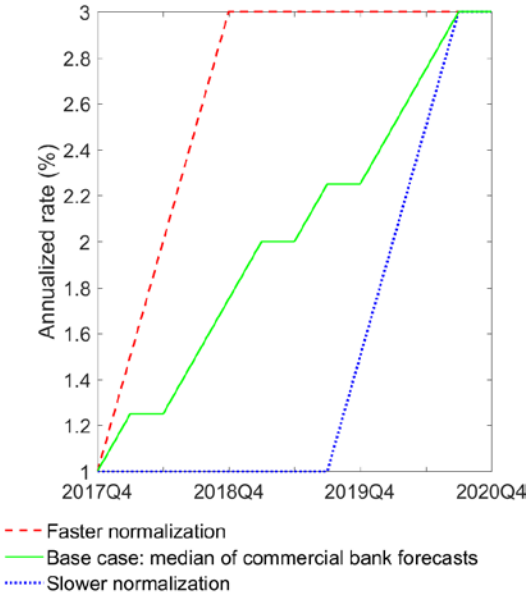
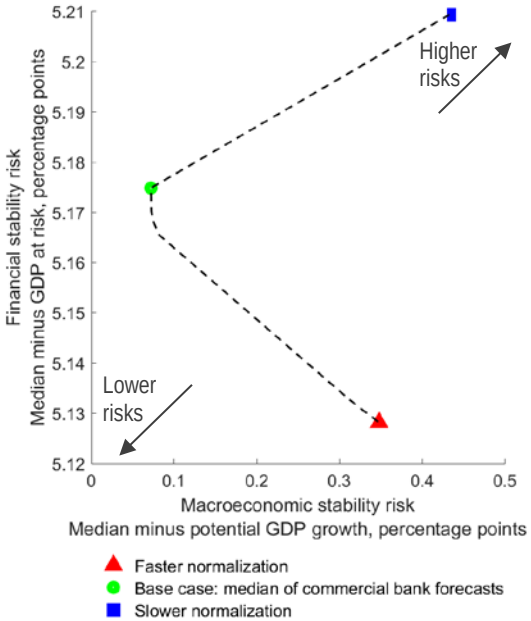


Chart 4: **The base-case monetary policy scenario minimizes macroeconomic risks**



Notes: The median path of the interest rate in Chart 3 is the average of the forecasts realized by Canadian commercial banks over 2018–19. We assume that the interest rate reaches the neutral rate of 3 per cent in 2020. The circle/triangle/square in Chart 4 correspond to the economy simulated with the policy path of the same colour in Chart 3. Moving along the black line in Chart 4 corresponds to picking an interest rate path closer to the red dashed or to the blue dotted lines in Chart 3. Financial stability and macroeconomic risks use quarterly annualized input and are averaged until 2022.

[2] Our model considers the feedback between vulnerabilities, the expected tail risks to GDP, and monetary and macroprudential policies (**Appendix**).

[3] We take the median forecast of the policy rate, GDP growth and inflation from the Bank of Montreal, Canadian Imperial Bank of Commerce, National Bank of Canada, Bank of Nova Scotia, Royal Bank of Canada, Toronto-Dominion Bank and Desjardins Group.

along the dashed black line from the green dot toward the blue square. A slower normalization increases financial system vulnerabilities leading to a higher financial stability risk. While in the base case growth remains close to potential, a slower pace of normalization leads to a deviation of growth from potential, and macroeconomic stability (measured as the average absolute deviation of GDP growth from its potential) deteriorates. Compared with the green dot, the blue square is riskier in terms of both macroeconomic and financial stability.

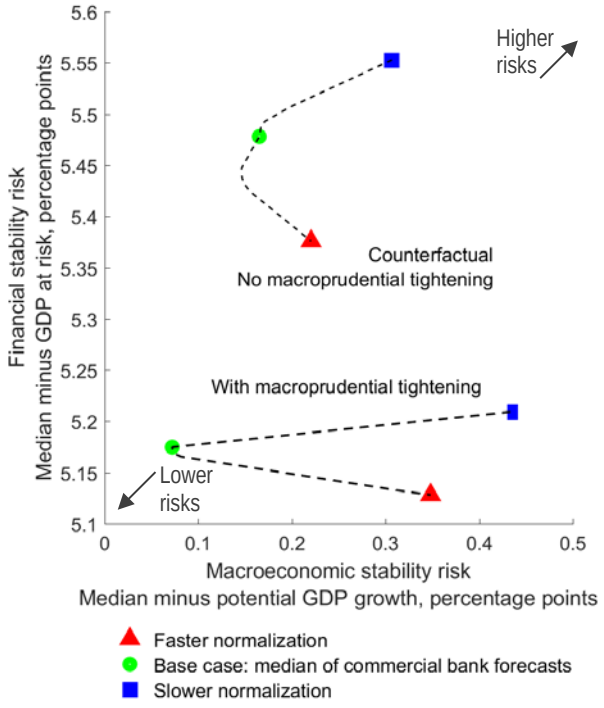
A normalization of the policy rate faster than the base case corresponds to a shift toward the dashed red line in **Chart 3**. The economic outcome is shown in **Chart 4** as the movement along the dashed black line from the green dot toward the red triangle. Raising rates faster reduces financial stability risks by progressively curbing elevated financial system vulnerabilities. The average financial stability risk over 2018–22 decreases by about 0.05 percentage points of GDP growth (the vertical difference between the green dot and the red triangle). The decline in financial stability risk comes at the cost of slower GDP growth over most of the projection horizon. This implies a 0.25-percentage-point increase in macroeconomic risk over 2018–22 (the horizontal difference between the green dot and the red triangle). However, these numbers might underestimate the financial stability benefits of tighter monetary policy. In a high debt environment, changes in interest rates likely have a stronger impact on debt growth, implying that the response of tail GDP risk to interest rate changes might be amplified.

4. Macroprudential tightening is more effective than monetary policy at reducing downside risks to future GDP growth

We now analyze the ability of macroprudential policy to reduce downside risks to GDP. So far, our results incorporate the effects of the macroprudential tightening that has taken place in Canada. We also want to consider what the economy would have looked like if the recent change in mortgage underwriting guidelines implemented from January 2018 onward had not occurred.

Chart 5 contrasts the monetary policy trade-off from the previous section, which takes macroprudential tightening into account, with the similar trade-off obtained in a counterfactual environment without macroprudential tightening. As we would anticipate, macroprudential tightening reduces financial stability risk. For the base-case policy rate scenario anticipated by Canadian commercial banks (green dots), the introduction of macroprudential tightening reduces the average financial stability risk over 2018–22 by 0.30 percentage points of GDP growth (vertical shift). This is significantly larger than the financial stability effects from tighter monetary policy, showing that macroprudential policy is substantially more effective than monetary policy at reducing downside risks to GDP.

Chart 5: Macroprudential tightening is more effective at mitigating financial stability risks



Notes: The circles/triangles/squares correspond to the economy simulated with the policy path of the same colour in Chart 3. Moving along the black line corresponds to picking an interest rate path closer to the dashed red or to the dotted blue lines in Chart 3. Financial stability and macroeconomic risks use quarterly annualized input and are averaged until 2022.

In addition, when macroprudential policy is tighter, variations in monetary policy have larger effects on macroeconomic risk and smaller effects on financial stability risk. With macroprudential tightening, a faster increase in the policy rate (moving from the green dot to the red triangle) increases macroeconomic risks four times faster than it decreases financial stability risks. Without macroprudential tightening, the trade-off would have been about one to one. This suggests that, in the current environment, the ability of monetary

policy to stabilize the macroeconomy is reinforced by the presence of an active macroprudential policy that targets financial stability risks.[4]

Appendix: Risk-management framework for the analysis of macroeconomic and financial stability risks

1. Estimate the connection between financial system vulnerabilities and GDP at risk using cross-country data

Just as value-at-risk in the financial sector maps the probability of a stock market correction into a monetary loss, GDP at risk maps the probability of negative macroeconomic shock into the GDP space. Building on Adrian, Boyarchenko and Giannone (2016) and IMF (2017), we estimate a quarterly quantile regression model of annualized real GDP growth over a panel of 16 advanced economies with country fixed effects. The level of vulnerabilities is captured across economies by the vulnerabilities barometer from Duprey and Roberts (2017).[5] The intensity of financial market stress is captured by the country-level indexes of financial market stress from Duprey, Klaus and Peltonen (2017), adjusted to make the relative magnitudes comparable across economies. Monetary policy is included as the cumulative change in the policy rate within a year.[6] We focus on the 5th percentile of the distribution of future GDP growth to strike a balance between estimation challenges and the need to quantify tail risks. Financial market stress is an important driver of tail GDP forecasts from one to four quarters ahead while vulnerabilities are informative for forecasts of four quarters ahead or more.[7] We use the four-quarter-ahead projection of GDP at risk to strike a balance between the importance of vulnerabilities and prediction accuracy.[8]

2. Include the GDP at risk for Canada in a risk-augmented vector autoregressive model (R-VAR)

We estimate a vector autoregressive model on quarterly Canadian data since 1981. It is composed of the following variables: We start with GDP at risk. We add an index of macroprudential measures capturing 25 actions implemented since 1992.[9] We then include GDP growth, CPI inflation and the overnight policy rate. Finally, we add macrofinancial variables that capture both the buildup of vulnerabilities (the vulnerabilities barometer) and the realization of a financial risk (the financial stress index for Canada). Changes in the price of oil and the world interest rate are included as exogenous variables. Shocks are identified with a Cholesky decomposition of the variables.[10] Since GDP at risk is a combination of some variables included in the vector autoregressive model, we integrate the GDP-at-risk equation directly into the vector autoregressive model without re-estimation. The dynamics of GDP at risk are restricted to be fully consistent with the more robust cross-country estimation. In addition, we assume that past expectations of future tail GDP growth do not affect the current variables beyond one lag, since previous expectations are already indirectly included in the current variables.

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[4] The macroeconomic stability gains associated with the macroprudential measure largely depend on our calibration (see Appendix).

[5] The vulnerabilities metric of Duprey and Roberts (2017) provides a broad overview of the evolution of financial system vulnerabilities by combining several aggregate variables that can provide useful early warning signals. It is constructed over a long historical period, making it convenient for time-series analysis. However, it does not include the micro-distributional aspect of household vulnerabilities.

[6] We use cumulative changes in the policy rate instead of the level of the policy rate (not stationary) or the deviation from the neutral rate (not available for long horizons).

[7] Bauer and Granziera (2017) show that, following a monetary policy shock, the ratio of household debt to GDP increases in the short run and decreases only after several quarters: the stock (numerator) takes more time to adjust than the flow (denominator).

[8] Projections for the next year that rely on the whole distribution of future GDP growth perform relatively well compared with forecasts from *Monetary Policy Report*s. Compared with actual realizations since 1997, forecasts using the quantile model have, on average, the correct sign of the change in GDP growth two-thirds of the time, similar to the ratio obtained for forecasts from *Monetary Policy Report*s by Binette and Tchebotarev (2017).

[9] Canada has implemented many regulatory changes (e.g., restrictions on loan-to-value ratios, debt-service ratios, insurance) that could qualify as macroprudential policies. Macroprudential shocks are defined as changes to a Canadian macroprudential index (combines data from Cheung 2014; Kuttner and Shim 2016; and Allen et al. 2017). The macroprudential index captures 13 easing measures implemented in 12 different quarters, starting in 1992, mostly until 2008. It also captures 12 tightening measures implemented in 8 different quarters after 2008, including the changes to the B-20 Guideline implemented in the first quarter of 2018.

[10] GDP at risk is ranked first so that it is not affected by shocks to other variables.

3. Generate the base case over 2018–22 by restricting the R-VAR to be consistent with the median expectations from Canadian commercial banks

We use a scenario consistent with market expectations to anchor the base-case projection until 2022. For GDP growth, inflation and the policy rate path over 2018–19, we take the median forecast of Canadian commercial banks. After the third quarter of 2020, we assume that the economy returns to its steady state with a neutral rate of 3 per cent. This coincides with inflation reaching its 2 per cent target and GDP growing in line with potential at 1.6 per cent (Bank of Canada 2018). The index of financial system vulnerabilities and the index of financial market stress remain constant at their 2017Q4 values.[11]

4. Perform counterfactual scenarios with alternative monetary and macroprudential policies

Alternative monetary policy scenarios are implemented with interest rate shocks around the base case. The macroprudential policy change in January 2018 is already included in the base case. The counterfactual without macroprudential policy is introduced as follows. We set the index of macroprudential changes to zero for January 2018.[12] But the macroprudential index captures the average effect of the various macroprudential measures implemented in Canada since 1992. So, we need an additional assumption to calibrate the magnitude of the effect of the new B-20 Guideline on median GDP growth. Without the latest macroprudential measure, it is estimated that median GDP growth would be 0.2 per cent higher over 2018–19 (Bank of Canada 2017b), which we match using demand shocks.

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[11] Although not considered in this note, elevated vulnerabilities imply that small variations around the base case could trigger heightened financial market stress with the potential to significantly amplify tail GDP risks.

[12] Macroprudential policy is introduced with a simple index. A cross-country analysis of macroprudential policy and GDP at risk would help strengthen our quantitative results.

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