Optimal Mix of Monetary, Macroprudential and Fiscal Policies

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INTRODUCTION

Motivation

- Recent global financial crisis was a reminder that economic and financial stability are inextricably linked.
- Although the crisis did not originate in Canada, we are still facing challenges in achieving both economic and financial stability:
  - Downside risks to the real economy due to external headwinds
  - Household debt has reached historically high levels; the biggest domestic risk to both economic and financial stability
- Policies prescribed in Canada were to keep the nominal interest rate low for extended periods to stimulate the economy while tightening mortgage lending standards to limit risks in the housing sector. Is this a good policy mix? Should monetary policy instead lean against financial instability?

What we do in this project

- To answer these questions, we examine *quantitatively* how the policy rate, regulatory LTV ratio and government-spending should be coordinated to mitigate the effects of anticipated risks associated with high levels of household debt and persistent downside risks to the real economy. In particular, we derive the optimal mix of policies in this particular set-up.
  - Bank of Canada's MP2 model (Alpanda, Cateau and Meh, 2014) features the nexus between real and financial sectors in Canada. We use MP2 as a simulation model for conducting policy experiments.
  - The financial stability concern is captured by considering a financial shock that occurs six years from the starting point of simulation. The severity of the shock depends on the level of household debt at the time of the shock.
  - We derive the optimal mix of policies by minimizing a loss function that penalizes deviations of inflation from target and the output gap.

Main results

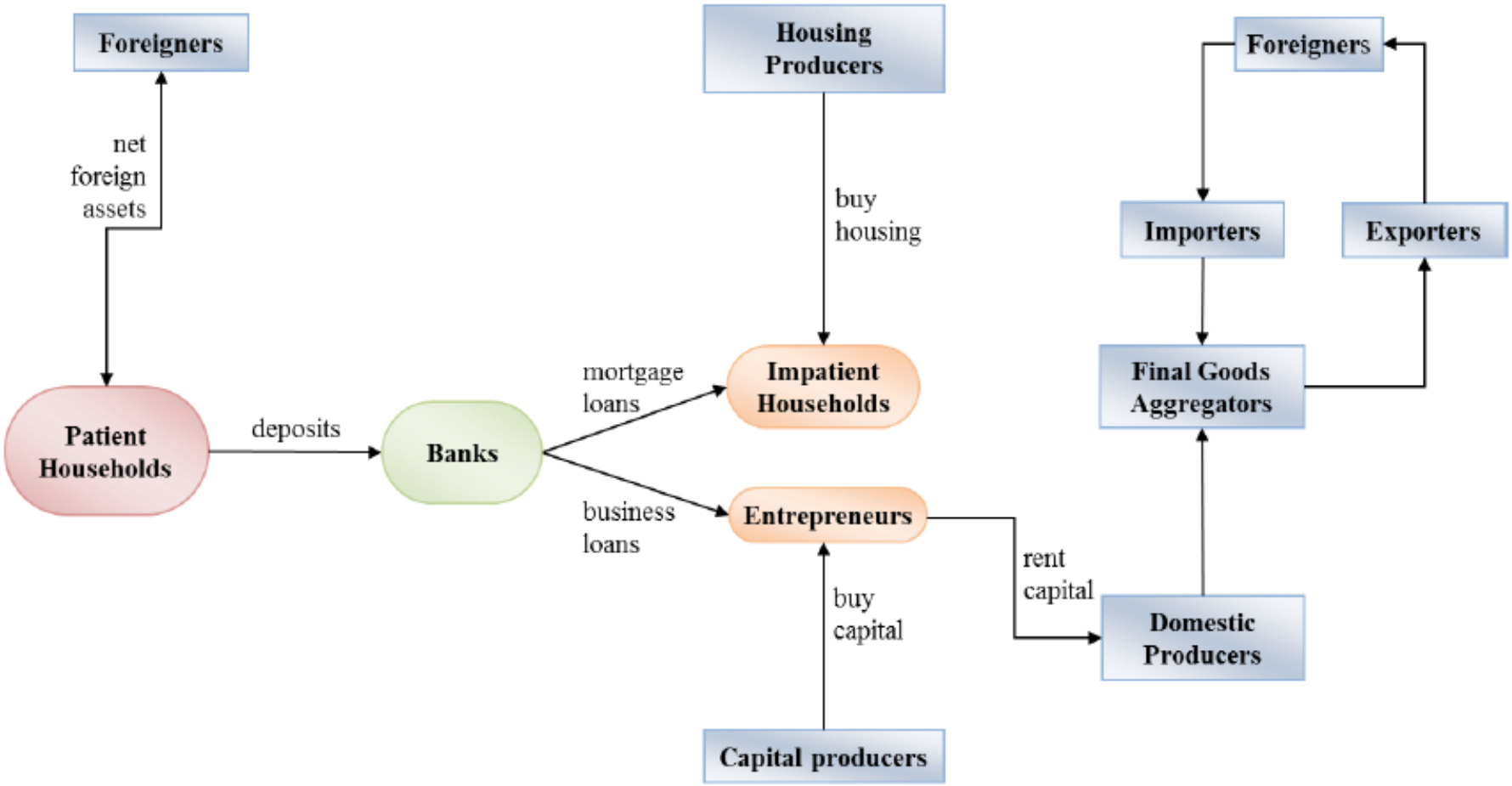
- The optimal policy mix prescribes:
  - a reduction of the policy rate
  - a reduction in the LTV ratio;
  - a temporary but persistent increase in the government expenditure-to-GDP ratio.
- When the policy choice is limited to monetary and macroprudential policies, the optimal paths of policy rate and LTV ratio are quantitatively similar to those in the fully optimal case.
  - However, without additional fiscal policy stimulus, inflation goes back to the target, and output gap closes more slowly than in the fully optimal policy mix.

THE MP2 MODEL IN BRIEF

Key features of MP2

- Medium scale, small-open-economy DSGE model
- Heterogeneous agents:
  - patient households (savers)
  - impatient households and entrepreneurs (borrowers)
  - banks (intermediaries)
- Housing plays multiple roles: consumption, investment and collateral
- Policies: monetary, macro-prudential and fiscal policies
- Model is calibrated to match averages in Canadian National Accounts and Financial Flow Accounts

Overview of the model



Financial frictions

- Monitoring costs generate spreads between:
  - bank's funding rate and risk-free rate
  - mortgage rate and bank funding rate
  - business loan rate and bank funding rate
- Monitoring costs increase with borrower leverage, generating lending spreads similar to financial accelerator model of BGG.
- These effects are not internalized by agents and are the sources of pecuniary externalities.

Amplification through financial frictions

- *Financial accelerator*: Spreads increase when borrowers are not well-capitalized. Asset prices fall as larger spreads make borrowers demand less assets. This increases borrowers' leverage, which, in turn, increases spreads further. This two-way interactions amplify the effects of structural shocks.
- *Adverse feedback loop*: Suppose that banks' costs of monitoring borrowers increase due to a decline in asset prices, which increases the leverage of borrowers. These costs immediately lead to increases in bank lending rates. Moreover, the increase in monitoring costs reduces the amount of retained earnings that could be added to bank capital. This leads to an increase in banks' funding rates, which further deteriorates the terms of bank lending.

Other frictions

- Nominal frictions: price and wage stickiness
- Real frictions:
  - habit formation
  - variable utilization capacity
  - investment adjustment costs
- Partial pass-through of exchange rate movements to import and export prices

Macro-prudential policy

- The model does not feature borrowing constraints on impatient households. Instead, borrowers of mortgage loans face spreads that are increasing in the ratio of regulatory minimum capital, $(1 - m_l)\, q_h h_l$, to the amount of their net worth, n_l:

$$\Upsilon_l = f\left(\frac{(1 - m_l)\, q_h h_l}{n_l}\right),$$

  where $q_h h_l$ is the market value of houses, m_l is the regulatory LTV ratio, Υ_l is the spread and f is an increasing function.

- In spirit, this captures the shadow cost of capital implied by the tightness of borrowing constraints in the collateral model (Iacoviello, 2005). Note that, in MP2, $(1 - m_l)\, q_h h_l / n_l$ can exceed 1 at the cost of higher spread.

- A tightening of LTV policy ($m_l \downarrow$) induces impatient households to demand less houses by raising Υ_l. LTV policy can be designed to address inefficiencies in the housing sector caused by the pecuniary externalities and exuberance shocks affecting house prices as well as the probability and impact of future financial crises.

Monetary and fiscal policies

Monetary policy

- The nominal interest rate is set according to a Taylor rule to address inefficiencies due to nominal rigidities.
- As the nominal interest rate is an instrument affecting all sectors in the economy, it can also be used to address issues in a specific sector. However, it might come at the cost of exacerbating inefficiencies in other sectors.

Fiscal policy

- Government expenditure follows an AR(1) process:

$$\log g_t = \left(1 - \rho_g\right) \log g + \rho_g \log g_{t-1} + \varepsilon_{g,t}$$

- Changes in government expenditure are primarily financed by debt in the short run, but are fully offset by lower transfer payments to households in the future.

THE OPTIMAL POLICY MIX

Outline

- The optimal mix consists of paths for three policy tools: a) the policy rate, b) regulatory LTV ratio on mortgage loans, c) government spending on goods and services
- Our approach to find the optimal mix:
  - We build a simulation scenario of the Canadian economy going forward. The baseline scenario assumes a) high levels of household debt, b) weakening of foreign economy and capital inflows into Canada, and c) decreases in exports, GDP and inflation.
  - We assume that credit risk premiums on bank loans will increase in the 6th year, but the extent to which they increase depend on the degree of over-indebtedness of households. As a result, there is a benefit to moderating household debt before the occurrence of the financial shock.
  - We perturb the paths of polices around the baseline and evaluate welfare of the economy in each perturbation. The welfare-maximizing perturbation of policy paths is regarded as the optimal mix of policies.

Financial crisis

- The financial crisis is triggered in the 6th year of simulation. It induces patient households to rebalance their asset portfolios away from risky assets (e.g. bank deposits) and toward safe assets (e.g. government bonds). This flight-to-quality will increase spreads on mortgage and business loans.
- The severity of financial crisis depends on the size of household debt gap, $\widehat{b}_{l,t}$. More specifically, the financial shocks are added to innovations to the risk-premium shock, $\varepsilon_{\varkappa,t}$, as follows:

$$\varepsilon_{x,21} = \alpha_{\varkappa} \max\left\{\widehat{b}_{l,20}, 0\right\}, \text{ and } \varepsilon_{\varkappa,t} = 0.9\varepsilon_{\varkappa,t-1} \text{ for } t = 22, \ldots, 24,$$

  where $\alpha_{\varkappa}$ is the elasticity of risk premium w.r.t. household debt, which is inferred from the US data during the recent financial crisis.
- Because the magnitude of financial turmoil depends on the size of household debt, the government has an incentive to moderate household debt.

Welfare criterion

- The optimal policy mix is determined by minimizing a loss function that takes into account the discounted sum of squared deviations of inflation from its target rate of 2 per cent, and the output gap over the first 100 quarters of simulation.

$$L_t = \sum_{t=1}^{100} \beta^{t-1} \left\{ (\pi_t - \pi^*)^2 + \lambda \hat{y}_t^2 \right\}$$

- The loss function could be derived from the model using a second-order approximation to economic agents' welfare as in Woodford (2005). We do not take that approach as it is difficult to determine the weights on welfare of heterogeneous agents. Moreover, the traditional loss function may be more robust to possible mis-specification of the model.

Procedures to find the optimal policies

- Structural model is linearized around the steady state.[1] However, there are nonlinearities due to financial shocks and the lower bound of nominal interest rate.
- The structural shocks in the baseline paths are held constant in all simulations. We allow for additional policy shocks to generate perturbations, and simulate the paths of all variables under perfect foresight using a nonlinear solution method. This allows us to compute the loss for a particular set of policy profiles.
- We search for the optimal mix of policies among the set of perturbed policies.

[1] Structural parameter values and the details of calibration are described in ACM (2013).

Computationally feasible approach

- It is very challenging to search optimal policy paths in an entirely unrestricted way given the dimensionality problem associated with the length of simulation.
- We adopt an initial guess for each of the three policy profiles, and then consider perturbations around these initial guesses. In particular, the optimization searches over the extent to which each initial policy profile is scaled up or down. The optimization problem reduces to a problem of finding three scalars that minimize the loss.

Initial guesses for policy paths

- Relative to the baseline policy profile, our initial guesses for the policy paths imply that
  - the policy rate cumulatively increases by 100 bps over four quarters
  - the LTV ratio permanently decreases by 5 p.p.
  - there is a persistent increase in government expenditure by 5%.
- Note that scalars on the initial guesses can be negative. For example, if the scalar on monetary policy is -1, the policy rate will decline by 100 bps. from the baseline profile. In this case, the policy rate can hit the lower bound, which we explicitly take into account. If the scalar is positive, the policy rate will rise faster than the baseline to lean against financial imbalances. In this way, our computational approach allows us to compare policies with different implications even though the range of policy profiles is restricted.

Results: optimal policy paths

Changes from the baseline (in percentage points)

Year	1st	2nd	3rd	4th	5th
Policy rate					
Optimal mix	-0.6	-0.06	+0.4	+0.6	+0.7
Optimal excl. fiscal	-0.6	-0.15	+0.25	+0.47	+0.52
Regulatory LTV ratio					
Optimal mix	-3.5	-5.6	-5.6	-5.6	-5.5
Optimal excl. fiscal	-3.3	-5.3	-5.3	-5.3	-5.3
Government expenditure to GDP ratio					
Optimal	+0.9	+1.4	+1.3	+1.1	+0.9

Results: key variables

Changes from the baseline (in percentage points)

Year	1st	2nd	3rd	4th	5th
Inflation rate					
Optimal mix	+0.10	+0.17	+0.25	+0.30	+0.27
Optimal excl. fiscal	+0.06	+0.10	+0.18	+0.23	+0.22
Output					
Optimal mix	+0.78	+0.90	+0.79	+1.06	+1.36
Optimal excl. fiscal	-0.03	-0.05	+0.18	+0.67	+1.13
Household debt					
Optimal	-0.71	-2.33	-3.79	-4.83	-5.44
Optimal excl. fiscal	-0.75	-2.31	-3.78	-4.85	-5.45

Findings

- The optimal policy mix prescribes (a) a reduction of the policy rate, (b) a reduction in the LTV ratio, and (c) a temporary but persistent increase in the government expenditure-to-GDP ratio.
- The tightening in macro-prudential policy induces household debt to decline, which helps alleviate the impact of the crisis in the sixth year. The optimal monetary and fiscal policies offset the contractionary effects of the lower LTV ratio on output and inflation, as well as provide stimulus against external headwinds.
- When the policy choice is limited to monetary and macro-prudential policies, the optimal paths of policy rate and LTV ratio are quantitatively similar to those in the fully optimal case. However, without additional fiscal policy stimulus, inflation goes back to the target, and output recovers, more slowly than in the fully optimal policy mix.

Conclusion

- Given the benefits of reducing household debt, the optimal policy mix calls for a tightening in the regulatory LTV ratio, while offsetting its inflation and output effects through monetary and fiscal stimulus.
- This result suggests that monetary authority may have to be cautious about leaning against financial imbalances if there are other policy instruments such as regulatory LTV policy that can directly and more efficiently address risks in the financial sector.
- In the future, more research needs to be done to improve our understanding of optimal policy mix. This includes re-examining of our result in an extended model which has a more elaborate endogenous channel to generate financial crises. Furthermore, it may be useful to compare our result with that of Ramsey rule, which takes into account heterogeneity of agents.