Bank of Canada
Monthly Research Update

January 2021

This monthly newsletter features the latest research publications by Bank of Canada economists. The report includes papers appearing in external publications and staff working papers published on the Bank of Canada's website.

PUBLISHED PAPERS

In-Press

Benedict, Craig & Crucini, Mario J. & Landry, Anthony, "On What States Do Prices Depend? Answers From Ecuador", Journal of Money, Credit and Banking, Vol 52(8): 1909-1935, December 2020

Xiao, Hongu & Wu, Andy & Kim, Jaeho, "Commuting and innovation: Are closer inventors more productive?", Journal of Urban Economics, Vol 121: 103300, January 2021

Hommes, Cars & Makarewicz, Tomasz, "Price level versus inflation targeting under heterogeneous expectations: a laboratory experiment", Journal of Economic Behavior & Organization, Vol 182: 39-82, February 2021

Forthcoming

Kitamura, Tomiyuki & Takamura, Tamon, "Output Comovement and Inflation Dynamics in a Two-Sector Model with Durable Goods: The Role of Sticky Information and Heterogeneous Factor Markets", Journal of Money, Credit and Banking

Leiva-León, Danilo & Uzeda, Luis, "Endogenous Time Variation in Vector Autoregressions", Review of Economics and Statistics

Garratt, Rodney & van Oordt, Maarten, "Privacy as a Public Good: A Case for Electronic Cash", Journal of Political Economy

STAFF WORKING PAPERS

Shao, Lin & Tang, Rongsheng, "Allocative Efficiency and Aggregate Productivity Growth in Canada and the United States", Bank of Canada Staff Working Paper 2021-1

Chapman, James & Desai, Ajit, "Using Payments Data to Nowcast Macroeconomic Variables During the Onset of COVID-19", Bank of Canada Staff Working Paper 2021-2

Bailliu, Jeannine & Han, Xinfen & Sadaba, Barbara & Kruger, Mark, "Chinese Monetary Policy and Text Analytics: Connecting Words and Deeds", Bank of Canada Staff Working Paper 2021-3

Dalhaus, Tatjana & Schaumburg, Julia & Sekhposyan, Tatevik, "Networking the Yield Curve: Implications for Monetary Policy", Bank of Canada Staff Working Paper 2021-4

Chafwehé, Boris & Oikonomou, Rigas & Priftis, Romanos & Vogel, Lukas, "(Optimal) Monetary Policy with and without Debt", Bank of Canada Staff Working Paper 2021-5

Kahn, Charles M. & Rivadeneyra, Francisco & Wong, Tsz-Nga, "Eggs in One Basket: Security and Convenience of Digital Currencies", Bank of Canada Staff Working Paper 2021-6

Castro, Pablo S. & Desai, Ajit & Du, Han & Garratt, Rodney & Rivadeneyra, Francisco, "Estimating Policy Functions in Payments Systems Using Reinforcement Learning", Bank of Canada Staff Working Paper 2021-7

STAFF DISCUSSION PAPERS

D'Souza, Chris & Voll, Jane, "Qualitative Field Research in Monetary Policy Making", Bank of Canada Staff Discussion Paper 2021-1

ABSTRACTS

On What States Do Prices Depend? Answers From Ecuador, Journal of Money, Credit and Banking

The frequency of retail price adjustment differs across goods, both in low inflationary environments, such has the United States, and in high inflationary environments typical of less developed countries. We develop a multishock menu cost model in which retailers intermediate trade between producers and consumers. Since the cost share of intermediate inputs varies across goods, the model produces a cross-sectional distribution of frequency of price adjustment even though firms face a common menu cost. The model is evaluated using a rich micropanel of retail prices in Ecuador in a period spanning a financial crisis and subsequent dollarization.

Commuting and innovation: Are closer inventors more productive?

We estimate the causal effect of workplace–home commuting distance on inventor productivity. We construct a novel panel of U.S. inventors with precisely measured workplace–home distances and inventor-level productivity. Our identification strategy exploits firm office relocations as exogenous variation in the commuting distance of inventors at the firms. We find a significant negative effect from commuting distance on inventor productivity: every 10 km increase in distance is associated with a 5% decrease in patents per inventor–firm pair per year and an even greater 7% decrease in patent quality. The highest-performing inventors suffer more from increased commuting distance. We discuss the implications of our findings in the light of recent trends around telecommuting and remote work during the COVID-19 pandemic.

Price level versus inflation targeting under heterogeneous expectations: a laboratory experiment

Since the 2007 crisis, macroeconomists have been interested in monetary policies that could help with stabilizing inflation and output (Honkapohja, 2015). Two ideas gained particular attention: (i) that inflation should be replaced by the nominal price level (PLT) as the target for the central bank; and (ii) that the central bank should provide explicit guidance about its interest rate rule. We conduct a laboratory experiment to test the validity of these two hypotheses.

Our experiment uses a Learning-to-Forecast design based on a simple DSGE economy. Subjects are given a qualitative description of the economy and are asked to predict inflation and output gap two-periods ahead for 50 periods. There are five treatments. Baseline treatment (1) incorporates a standard inflation targeting rule. The other four treatments utilize a PLT Taylor rule and are based on a two-by-two design: a 'weak' PLT rule (2) with guidance and (3) without guidance; and a 'strong' PLT rule (4) with guidance and (5) without guidance. By guidance we mean that the central bank informs subjects about the price level deviation from its target.

We find that subjects within each treatment coordinate on similar behavior, but large differences between the treatments prevail. Guidance has a negligible effect, whereas a weak or strong Taylor rule specification turns out to be crucial for stability. PLT can be a robust monetary policy, but only if it is sufficiently responsive to the deviations of output and prices.

Output Comovement and Inflation Dynamics in a Two-Sector Model with Durable Goods: The Role of Sticky Information and Heterogeneous Factor Markets

In a simple two-sector New Keynesian model, sticky prices generate a counterfactual negative comovement between the output of durable and nondurable goods following a monetary policy shock. We show that heterogeneous factor markets allow any combination of strictly positive price stickiness to generate positive output comovement. Even if the prices of durable goods are flexible, adding sticky information ensures that the output of both sectors moves in the same direction. Furthermore, we find that the combination of sticky information and heterogeneous factor markets produces hump shaped responses in both sectoral output and inflation, as observed in a vector autoregression analysis. In contrast to backward indexation to past inflation, which is often assumed in the literature, sticky information leads to a hump-shaped response in the inflation of flexibly priced goods. Finally, the estimated information stickiness through the minimum-distance estimation method suggests that information rigidity is stronger in residential investment than nondurable goods and services.

Endogenous Time Variation in Vector Autoregressions

We introduce a new class of time-varying parameter vector autoregressions (TVP-VARs) where the identified structural innovations are allowed to influence — contemporaneously and with

a lag — the dynamics of the intercept and autoregressive coefficients in these models. An estimation algorithm and a parametrization conducive to model comparison are also provided. We apply our framework to the US economy. Scenario analysis suggests that the effects of monetary policy on economic activity are larger and more persistent in the proposed models than in an otherwise standard TVP-VAR. Our results also indicate that costpush shocks play an important role in understanding historical changes in inflation persistence.

Privacy as a Public Good: A Case for Electronic Cash

Privacy is a feature inherent to the use of cash for payments. With steadily increasing market shares of commercial digital payments platforms, privacy in payments may no longer be attainable in the future. In this paper, we explore the potential welfare impact of reductions in privacy in payments in a dynamic framework. In our framework, firms may use data collected through payments to price discriminate among future customers. A public good aspect of privacy in payments arises because individual customers do not bear the full cost of failing to protect their privacy. As a consequence, they may suboptimally choose not to preserve their privacy in payments. When left to market forces alone, the use of privacy-preserving means of payments, such as cash, may decline faster than is optimal.

Allocative Efficiency and Aggregate Productivity Growth in Canada and the United States

This paper evaluates the contribution of allocative efficiency to the aggregate productivity growth in Canada and the US. In particular, we are interested in explaining two puzzling facts: 1) the slowdown in productivity growth during the 1970s and the 2000s in the US, and 2) the widening Canada-US productivity gap since the middle of the 1980s. We extend the framework of Oberfield (2013) to derive sufficient statistics for allocative efficiency and decompose aggregate productivity in an input-output economy à la Jones (2013). The lack of improvement in allocative efficiency can explain two-thirds of the US's productivity slowdown and more than one-third of the widening Canada-US productivity gap. The allocation of capital, rather than labor, was the main driver behind the overall movement in allocative efficiency. Resources allocated to service sectors were significantly lower than the optimal level. It improved markedly over time, especially in the US before the 2000s.

Using Payments Data to Nowcast Macroeconomic Variables During the Onset of COVID-19

The COVID-19 pandemic and the resulting public health mitigation have caused large-scale economic disruptions globally. During this time, there is an increased need to predict the macroeconomy's short-term dynamics to ensure the effective implementation of fiscal and monetary policy. However, economic prediction during a crisis is challenging because of the unprecedented economic impact, which increases the unreliability of traditionally used linear models that use lagged data. We help address these challenges by using timely retail payments system data in linear and nonlinear machine learning models. We find that compared to a benchmark, our model has a roughly 15 to 45% reduction in Root Mean Square Error when used for macroeconomic nowcasting during the global financial crisis. For nowcasting during the COVID-19 shock, our model predictions are much closer to the official estimates.

Chinese Monetary Policy and Text Analytics: Connecting Words and Deeds

Given China's complex monetary policy framework, the People's Bank of China's (PBOC) monetary policy rule is difficult to infer from its observed behaviour. In this paper, we adopt a novel approach, using text analytics to estimate and interpret the unknown component in the PBOC's reaction function. We extract the unknown component in a McCallum-type monetary policy rule for China through a state-space model framework using a set of summary topics extracted from official PBOC documents. Then, using a set of sectional topics extracted from the same set of PBOC documents, we provide this component with its rightful interpretation. Our results show that this unknown component is related to the Chinese government's agenda of supply-side structural reforms, suggesting that monetary policy is used as a tool to achieve structural reform objectives. Structural vector autoregression (SVAR) results confirm these findings by providing evidence of the importance of the government's supply-side reform objectives for the conduct of monetary policy.

Networking the Yield Curve: Implications for Monetary Policy

We introduce a flexible, time-varying network model to trace the propagation of interest rate surprises across different maturities. First, we develop a novel econometric framework that allows for unknown, potentially asymmetric contemporaneous spillovers across panel units and establish the finite sample properties of the model via

simulations. Second, we employ this innovative framework to jointly model the dynamics of interest rate surprises and to assess how various monetary policy actions—for example, short-term, long-term interest rate targeting and forward guidance—propagate across the yield curve. We find that the network of interest rate surprises is indeed asymmetric and defined by spillovers between adjacent maturities. Spillover intensity is high on average but shows strong time variation. Forward guidance is an important driver of the spillover intensity. Pass-through from short-term interest rate surprises to longer maturities is muted, yet there are stronger spillovers associated with surprises at medium- and long-term maturities. We illustrate how our proposed framework helps our understanding of the ways various dimensions of monetary policy propagate through the yield curve and interact with each other.

(Optimal) Monetary Policy with and without Debt

We propose a framework of optimal monetary policy where debt sustainability may, or may not, be a relevant constraint for the central bank. We show analytically that in each environment the optimal interest rate path consists of a Taylor rule augmented with forward guidance terms. These terms arise either i) from "twisting interest rates" when the central bank ensures debt sustainability, or ii) under no debt concerns, from committing to keep interest rates low at the exit of the liquidity trap. The optimal policy is isomorphic to Leeper's (1991) "passive monetary/active fiscal policy" regime in the first instance, or "active monetary/passive fiscal policy" regime in the second. We insert our framework into a standard medium scale DSGE model calibrated to the US. Optimal passive monetary policy with debt concerns is ineffective in stabilizing inflation, whereas under no debt concerns, monetary policy is very effective in stabilizing the macroeconomy.

Eggs in One Basket: Security and Convenience of Digital Currencies

Digital currencies store balances in anonymous electronic addresses. We analyze the tradeoffs between the safety and convenience of aggregating balances in addresses, electronic wallets and banks. In our model, agents balance the risk of theft of a large account with the cost to safeguarding a large number of passwords for many small accounts. Account custodians (banks, wallets and other payment service providers) have different objectives and trade-offs along these dimensions; we analyze the welfare effects of differing industry

structures and interdependencies. In particular, we examine, the consequences of "password aggregation" programs, which, in effect, consolidate risks across accounts.

Estimating Policy Functions in Payments Systems Using Reinforcement Learning

This paper uses reinforcement learning (RL) to approximate the policy rules of banks participating in a high-value payments system. The objective of the agents is to learn a policy function for the choice of amount of liquidity provided to the system at the beginning of the day. Individual choices have complex strategic effects precluding a closed form solution of the optimal policy, except in simple cases. We show that in a simplified two-agent setting, agents using reinforcement learning do learn the optimal policy that minimizes the cost of processing their individual payments. We also show that in more complex settings, both agents learn to reduce their liquidity costs. Our results show the applicability of RL to estimate best-response functions in real-world strategic games.

Qualitative Field Research in Monetary Policy Making

Many central banks conduct economic field research involving in-depth interviews with external parties. But very little is known about how this information is used and its importance in the formation of monetary policy. We address this gap in the literature through a thematic analysis of open-ended interviews with senior central bank economic and policy staff who work closely with policy decision-makers. We find that these central bankers consider information from field research programs not just useful but also an essential input for monetary policy making. They use this information in conjunction with quantitative tools primarily to inform their near-term forecasts. The information is considered most valuable at potential turning points in the economy when uncertainty about the pace of economic growth is heightened (in the advent of large shocks to the economy) and when timely official data are not available or are viewed as unreliable. Senior staff also place a high value on maintaining a reliable and credible sample of representative economic agents that can be accessed on an ongoing basis and very quickly when required.

UPCOMING EVENTS

* All onsite conferences and events are suspended until further notice. All events listed below will take place virtually.

John Grigsby (Northwestern)
Organizer: EFR CEA/INT Speaker Series
Date: 5 March 2021

Jens Christensen (Federal Reserve Bank of San Francisco)
Organizer: FMD / FSD EFR Seminar Series
Date: 11 March 2021

Philipp Schnabl (NYU Stern)
Organizer: FMD / FSD EFR Seminar Series
Date: 18 March 2021

Greg Howard (University of Illinois, Urbana-Champagne)
Organizer: FMD / FSD EFR Seminar Series
Date: 25 March 2021

Garth Heutel (Georgia State University)
Organizer: FMD / FSD EFR Seminar Series
Date: 15 April 2021

Michael Weber (University of Chicago)
Organizer: EFR CEA/INT Speaker Series
Date: 30 April 2021