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Bank of Canada
Quarterly Research Update

2023Q3

This quarterly 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

Sushant Acharya & Edouard Challe & Keshav Dogra, "Optimal Monetary Policy According to Hank", *American Economic Review*, Vol. 113(7), July 2023

Stephen Ayerst & Faisal Ibrahim & **Gaelan Mackenzie** & Swapnika Rachapalli, "Trade and Diffusion of Embodied Technology: An Empirical Analysis", *Journal of Monetary Economics*, Vol. 137: 128-145, July 2023

Siye Bae & **Soojin Jo** & Myungkyu Shim, "United States of Mind Under Uncertainty", *Journal of Economic Behaviour and Organization*, Vol. 213, September 2023

Joel Bruneau & **Madanmohan Ghosh** & Deming Luo & Yunfa Zhu, "Income and Investment, not Energy Policy, are Driving Ghg Emission Intensities", *Economic Systems Research*, Vol. 35(3), July 2023

Felix Brunner & **Ruben Hipp**, "Estimating Large-Dimensional Connectedness Tables: The Great Moderation Through the Lens of Sectoral Spillovers", *Quantitative Economics*, Vol. 14(3): 799-1162, July 2023

Reinhard Ellwanger & Stephen Snudden, "Forecasts of the Real Price of Oil Revisited: Do They Beat the Random Walk?", *Journal of Banking and Finance*, Vol. 154, September 2023

Yunjong Eo & **Luis Uzeda** & Benjamin Wong, "Understanding Trend Inflation Through the Lens of the Goods and Services Sectors", *Journal of Applied Econometrics*, Vol. 38(5), August 2023

Lerby Ergun, "Extreme Downside Risk in the Cross-Section of Asset Returns", *International Review of Financial Analysis*, Vol. 90, November 2023

Marie-Helene Felt & Fumiko Hayashi & Joanna Stavins & **Angelika Welte**, "Regressive Effects of Payment Card Pricing and Merchant Cost Pass-Through in the United States and Canada", *Journal of Banking and Finance*, Vol. 154, September 2023

Kristin Forbes & **Christian Friedrich** & Dennis Reinhardt, "Stress Relief? Funding Structures and Resilience to the Covid Shock", *Journal of Monetary Economics*, Vol. 137: 47-81, July 2023

Forthcoming

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Michelle Alexopoulos & **Xinfen Han** & **Oleksiy Kryvtsov** & **Xu Zhang**, "More than Words: Fed Chairs' Communication During Congressional Testimonies", *Journal of Monetary Economics*

Christian Bustamante, "The Long-Run Redistributive Effects of Monetary Policy", *Journal of Monetary Economics*

Sonali Das & **Wenting Song**, "Monetary Policy Transmission and Policy Coordination in China", *China Economic Review*

John Duffy & **Janet Hua Jiang** & Huan Xie, "Pricing Indefinitely Lived Assets: Experimental Evidence", *Management Science*

Bruno Feunou, "Generalized Autoregressive Positive-Valued Processes", *Journal of Business and Economic Statistics*

Janet Hua Jiang & Peter Norman & Daniela Puzzello & Bruno Sultanum & Randall Wright, "Is Money Essential? an Experimental Approach", *Journal of Political Economy*

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Vivian Chu & **Tatjana Dahlhaus** & **Christopher Hajzler** & **Pierre-Yves Yanni**, "Digitalization: Implications for Monetary Policy", Bank of Canada Staff Discussion Paper 2023-18

Chinara Azizova & **Bruno Feunou** & **James Kyeong**, "Forecasting Risks to the Canadian Economic Outlook at a Daily Frequency", Bank of Canada Staff Discussion Paper 2023-19

Guyllaume Faucher & **Stephanie Houle**, "Digitalization: Definition and Measurement", Bank of Canada Staff Discussion Paper 2023-20

Johan Brannlund & **Helen Lao** & **Maureen Macisaac** & **Jing Yang**, "Predicting Changes in Canadian Housing Markets with Machine Learning", Bank of Canada Staff Discussion Paper 2023-21

ABSTRACTS

In-Press Published Papers

Optimal Monetary Policy According to Hank

We study optimal monetary policy in an analytically tractable heterogeneous agent New Keynesian model with rich cross-sectional heterogeneity. Optimal policy differs from a representative agent benchmark because monetary policy can affect consumption inequality, by stabilizing consumption risk arising from both idiosyncratic shocks and unequal exposures to aggregate shocks. The trade-off between consumption inequality, productive efficiency, and price stability is summarized in a simple linear-quadratic problem yielding interpretable target criteria. Stabilizing consumption inequality requires putting some weight on stabilizing the level of output, and correspondingly reducing the weights on the output gap and price level relative to the representative agent benchmark.

Trade and Diffusion of Embodied Technology: An Empirical Analysis

Using global patents, citations, inter-sectoral sales, and trade data, we examine the international diffusion of technology through imported inputs. We use citations and sales data to characterize knowledge and production input-output tables for individual countries. Using these tables, we construct a measure of the flow of knowledge-weighted and production-weighted technology embodied in inputs imported from the US. We develop an instrumental variable strategy to establish that increases in embodied technology imports lead to increased innovation and knowledge diffusion in sectors within importing countries. Effects are substantially larger for knowledge-weighted imports of embodied technology.

United States of Mind Under Uncertainty

This paper investigates if heightened economic uncertainty raises concerns about mental health in the U.S. We first quantify such concerns by constructing a composite Mental Health Concerns index, using time series of the intensity of Google search queries related to mental disorders and distress. This index i) rises significantly during the three recessionary episodes and ii) comoves negatively with survey responses that reflect views on current consumer sentiment or on future economic conditions. We find that the concerns regarding mental health substantially increase after an unexpected hike in economic uncertainty; uncertainty not only channels through its negative impacts on economic activity, but also directly affects the level of concerns. Our findings suggest that an uncertainty shock can

have a far-reaching impact on overall welfare of economic agents by leaving them more concerned about mental health.

Income and Investment, not Energy Policy, are Driving Ghg Emission Intensities

Global greenhouse gas (GHG) emissions continue to rise but, at the same time, emission intensities associated with domestic consumption and territorial production have declined albeit at vastly different rates across economies. To identify the socioeconomic factors that drive this cross-country variation, we combine input–output modelling with panel data analysis. Using the World Input–Output Database, we estimate GHG intensities separately for domestic consumption and for territorial production. For the regression analysis, we consider several socioeconomic factors that capture development features, exposure to international trade, as well as energy prices and GHG-relevant programmes. Our results show that development-type factors, such as per capita income, capital-labour ratios, and investments, are the primary drivers of cross-country differences. Energy prices and domestic GHG policies are not major drivers. We also find that reductions in intensities are primarily through changes in techniques rather than compositional changes in the structure of economies.

Estimating Large-Dimensional Connectedness Tables: The Great Moderation Through the Lens of Sectoral Spillovers

We estimate sectoral spillovers around the Great Moderation with the help of forecast error variance decomposition tables. Obtaining such tables in high dimensions is challenging because they are functions of the estimated vector autoregressive coefficients and the residual covariance matrix. In a simulation study, we compare various regularization methods on both and conduct a comprehensive analysis of their performance. We show that standard estimators of large connectedness tables lead to biased results and high estimation uncertainty, both of which are mitigated by regularization. To explore possible causes for the Great Moderation, we apply a cross-validated estimator on sectoral spillovers of industrial production in the US from 1972 to 2019. We find that the spillover network has considerably weakened, which hints at structural change, for example, through improved inventory management, as a critical explanation for the Great Moderation.

Forecasts of the Real Price of Oil Revisited: Do They Beat the Random Walk?

In macroeconomic forecasting, the real price of oil is traditionally computed as the monthly average price of oil deflated by the price index. Consequently, the no-change forecast used to benchmark forecasts of the real price of crude oil is a monthly average price. We demonstrate that an alternative no-change forecast which reflects the random walk forecast from daily oil prices – the end-of-month price – is significantly more accurate in predicting the real price of oil up to one year ahead. We find that at the one-step-ahead prediction, all existing forecasts that outperform the monthly average no-change forecast perform worse than the end-of-month no-change forecast. The results call into question the usefulness of existing forecasting approaches for the real price of crude oil relative to naive forecasts.

Understanding Trend Inflation Through the Lens of the Goods and Services Sectors

We distinguish between the goods and services sectors in an unobserved components model of U.S. inflation. We find that prior to the early 1990s, both sectors contributed to volatility of aggregate trend inflation, while since then, this has been predominantly driven by the services sector, with the trend in goods inflation being essentially flat. We document that the large reduction in the volatility of the trend for goods inflation has been the most important driver of the decline in the volatility in aggregate trend inflation reported by Stock and Watson (2007). Our results appear robust to COVID-19 inflation developments.

Extreme Downside Risk in the Cross-Section of Asset Returns

Extreme movements in financial markets are not always reflected equally in individual stocks. Identifying which firms are unable to absorb shocks is a challenge. This paper considers extreme downside risk, an extension to Ang et al.'s (2006) downside risk framework, and the value in separating the sensitivity between extreme and non-extreme downside risk. I find that the cross-sectional average annual excess return between high and low extreme downside exposure stocks is around 3.9%. The extension differentiates itself for young firms or firms that have not experienced a severe crisis, where the risk premium ranges from 2.4% to 10.4%.

Regressive Effects of Payment Card Pricing and Merchant Cost Pass-Through in the United States and Canada

We use novel datasets from multiple sources to quantify US and Canadian consumers' net pecuniary costs of making payments across income cohorts. The net costs include merchants' payment acceptance cost that is passed on to consumers, payment card

rewards, and fees paid to financial institutions. We find that the net costs as the ratio to transaction value is generally the highest for the bottom income cohort and the lowest for the top cohort, indicating regressive distributional effects. In Canada, the difference in the ratio between the bottom and top cohorts remains positive under all combinations of alternative assumptions, ranging from 0.24 percentage points (pps) to 0.85 pps. In contrast, in the US the difference ranges from -0.30 pps to 0.74 pps, suggesting that the regressive effects disappear under some combinations of alternative assumptions. Further research with more detailed data is needed to refine our results for the US.

Stress Relief? Funding Structures and Resilience to the Covid Shock

How did funding structures—the source, instrument, currency, and counterparty location of financing—relate to the financial stress experienced in different countries and sectors during Covid-19? Banks and corporates with a higher share of funding from non-bank financial institutions (NBFIs) or in US dollars experienced significantly greater stress, while more funding in debt instruments (versus loans) or cross-border (versus domestically) did not affect resilience. Policies targeting these structural vulnerabilities (US$ swap lines and NBFI policies) were more effective at mitigating stress than policies supporting banks, even controlling for macroeconomic policies. Macroprudential regulations should prioritize exposures to NBFI and dollar funding.

Forthcoming Published Papers

Government Loan Guarantees, Market Liquidity, and Lending Standards

We study third-party loan guarantees in a model in which lenders can screen and sell loans before maturity when in need of liquidity. Loan guarantees improve market liquidity, reduce lending standards, and can have a positive overall welfare effect. Guarantees improve the average quality of non-guaranteed loans traded and thus the market liquidity of these loans due to selection. This positive pecuniary externality provides a rationale for guarantee subsidies. Our results contribute to a debate about reforming government-sponsored mortgage guarantees by Fannie Mae and Freddie Mac, suggesting that the excessively high subsidies to these guarantees should be reduced but not completely eliminated.

More than Words: Fed Chairs' Communication During Congressional Testimonies

We study soft information contained in congressional testimonies by the Federal Reserve Chairs and analyze its effects on financial markets. Using machine learning, we construct high-frequency measures of Fed Chair's and Congress members' emotions expressed via their words, voice and face. Increases in the Chair's text-, voice-, or face-emotion indices during the testimony generally raise the S&P500 index and lower the VIX. Stock prices are particularly sensitive to the Fed Chair's answers to questions directly related to monetary policy. The effects during the testimony add up and propagate after the testimony, reaching magnitudes comparable to those after a policy rate cut. Our findings resonate with the view in psychology that communication is much more than words and underscore the need for a holistic approach to central bank communication.

The Long-Run Redistributive Effects of Monetary Policy

Using a general equilibrium search-theoretic model of money, I study the long-run distributional effects of monetary policy. In my model, heterogeneous agents trade bilaterally in a frictional market and save using cash and illiquid short-term nominal government bonds. Wealth effects generate slow adjustments in agents' portfolios following their trading activity in decentralized markets, giving rise to a persistent and non-degenerate distribution of assets. The model reproduces the distribution of asset levels and portfolios across households observed in the data. I show that, as wealth inequality increases the incidence of inefficiencies in decentralized trading, policies that improve the ability to self-insure against idiosyncratic shocks are welfare-improving and redistribute resources towards agents that are relatively poor and more liquidity constrained.

Monetary Policy Transmission and Policy Coordination in China

We study the transmission of conventional monetary policy in China, focusing on the interaction between monetary and fiscal policy given the unique institutional set-up for macroeconomic policy making. Our results suggest some progress but also continued difficulties in the transmission of monetary policy. Similar to recent studies, we find evidence of monetary policy pass-through to interest rates. However, the impact of monetary policy measures that are not coordinated with fiscal policy is significantly weaker than that of coordinated measures. This suggests the need for further improvements to the interest-rate based framework.

Pricing Indefinitely Lived Assets: Experimental Evidence

We study indefinitely lived assets in experimental markets and find that the traded prices of these assets are, on average, about 40% of the risk-neutral fundamental value. Neither uncertainty about the value of total dividend payments nor horizon uncertainty about the duration of trade can account for this low traded price. An Epstein and Zin (1989) recursive preference specification that models the dynamic realization of dividend payments and incorporates risk preferences can rationalize the low traded price observed in our indefinitely lived asset market

Generalized Autoregressive Positive-Valued Processes

We introduce generalized autoregressive positive-valued (GARP) processes, a class of autoregressive and moving-average processes that extends the class of existing autoregressive positive-valued (ARP) processes in one important dimension: each conditional moment dynamic is driven by a different and identifiable moving average of the variable of interest. The article provides ergodicity conditions for GARP processes and derives closed-form conditional and unconditional moments. The article also presents estimation and inference methods, illustrated by an application to European option pricing where the daily realized variance follows a GARP dynamic. Our results show that using GARP processes reduces pricing errors by substantially more than using ARP processes.

Is Money Essential? an Experimental Approach

Monetary exchange is deemed essential when better incentive-compatible outcomes can be achieved with money than without it. We study essentiality both theoretically and experimentally, using finite-horizon monetary models that are naturally suited to the lab. We also follow the mechanism design approach and study the effects of strategy recommendations, both when they are incentive-compatible and when they are not. Results show that output and welfare are significantly enhanced by fiat currency when monetary equilibrium exists. Also, recommendations help if they are incentive-compatible but not much otherwise. Sometimes money is used when it should not be and we investigate why, using surveys and measures of social preferences.

Staff Working Papers

Is Climate Transition Risk Priced into Corporate Credit Risk? Evidence from Credit Default Swaps

We study whether the credit default swap (CDS) spreads of firms reflect the risk from climate transition. We first construct a climate

transition risk (CTR) factor by using information on the vulnerability of a firm's value to the transition to a low-carbon economy. We then document how this factor shifts the term structure of the CDS spreads of more vulnerable firms but not of less vulnerable firms. Considering the impact of different climate transition policies on the CTR factor, we find that these policies have asymmetric and significant economic impacts on the credit risk of more vulnerable firms, and negligible effects on other firms.

Is Money Essential? an Experimental Approach

Monetary exchange is deemed essential when better incentive-compatible outcomes can be achieved with money than without it. We study essentiality both theoretically and experimentally, using finite-horizon monetary models that are naturally suited to the lab. We also follow the mechanism design approach and study the effects of strategy recommendations, both when they are incentive-compatible and when they are not. Results show that output and welfare are significantly enhanced by fiat currency when monetary equilibrium exists. Also, recommendations help if they are incentive-compatible but not much otherwise. Sometimes money is used when it should not be and we investigate why, using surveys and measures of social preferences.

Generalized Autoregressive Gamma Processes

We introduce generalized autoregressive gamma (GARG) processes, a class of autoregressive and moving-average processes that extends the class of existing autoregressive gamma (ARG) processes in one important dimension: each conditional moment dynamic is driven by a different and identifiable moving average of the variable of interest. The paper provides ergodicity conditions for GARG processes and derives closed-form conditional and unconditional moments. The paper also presents estimation and inference methods, illustrated by an application to European option pricing where the daily realized variance follows a GARG dynamic. Our results show that using GARG processes reduces pricing errors by substantially more than using ARG processes does.

Flagship Entry in Online Marketplaces

In this paper, we empirically study how flagship entry in an online marketplace affects consumers, the platform, and various sellers on the platform. We find flagship entry may benefit consumers by expanding the choice set, by intensifying price competition within the entry brand, and by improving consumer perception for parts of the platform. In the meantime, flagship entry cannibalizes the sales of

same-brand sellers, while other brands may gain as the buyer base expands on the platform. Counterfactual simulation suggests that flagship entry improves the gross merchandise value of the platform and overall consumer welfare in most cases.

Understanding Defi Through the Lens of a ProductionNetwork Model

Decentralized finance (DeFi) is composed of a variety of heterogeneous sectors that are interconnected through an input-output network of its tokens. We first use a panel data set to empirically document the evolution of the DeFi network across its different sectors. Instead of looking at the misleading measure of total value locked, we then employ a standard, theoretical production-network model to measure the value added and service outputs of the different DeFi sectors. Finally, based on a calibrated version of our model, we study which factors drive DeFi token prices and predict the equilibrium effects when network interconnectedness increases.

Competition for Exclusivity and Customer Lock-In: Evidence from Copyright Enforcement in China

Copyright law grants copyright owners exclusive rights so that they have adequate financial incentives to create and innovate. However, when firms are copyright owners, they can leverage their right to sell or distribute products exclusively and thus obtain excessive financial gains. This paper studies the music streaming industry, where streaming services compete for exclusive licenses from music labels. Service providers use unique content to attract users, tailoring their services to individual preferences to create switching costs that lead to user lock-in. Using theoretical analysis and descriptive empirics, I show that exclusivity confers advantages in competition for a service that can generate larger lock-in effects. I then construct a dynamic structural model in which consumers face switching costs when making subscription decisions. I estimate the model using monthly data from China's music streaming market over 2014–17. Finally, I simulate market outcomes under two alternative policies: a compulsory licensing provision and a mandatory data portability policy. The policy simulation shows that compulsory licensing that enforces non-exclusive distribution would not improve market competition by "leveling the field" between dominant and small services as intended. On the contrary, this policy increases market concentration, enlarging the gap in market share between dominant and small services. In contrast, mandatory data portability that reduces switching costs would decrease market concentration, bringing more users to smaller services.

A Behavioral New Keynesian Model of a Small Open Economy Under Limited Foresight

This paper investigates exchange rate dynamics in open economies by incorporating bounded rationality. We develop a small open-economy New Keynesian model with an incomplete asset market, wherein decision-makers possess limited foresight and can plan for only a finite distance into the future. The equilibrium dynamics depend on the degree of foresight and the decision-makers' belief-updating behaviors that approximate continuation values at the end of their planning horizons. This limited foresight leads to persistent, non-monotonic forecast errors in the real exchange rate across time horizons and distinguishes between short- and long-term expectations. This framework hence provides a micro-foundation for understanding time-horizon variability in uncovered interest parity puzzles.

Combining Large Numbers of Density Predictions with Bayesian Predictive Synthesis

Bayesian predictive synthesis is a flexible method of combining density predictions. The flexibility comes from the ability to choose an arbitrary synthesis function to combine predictions. I study the choice of synthesis function when combining large numbers of predictions— a common occurrence in macroeconomics. Estimating combination weights with many predictions is difficult, so I consider shrinkage priors and factor modelling techniques to address this problem. The dense weights of factor modelling provide an interesting contrast with the sparse weights implied by shrinkage priors. I find that the sparse weights of shrinkage priors perform well across exercises.

International Economic Sanctions and ThirdCountry Effect

This paper studies international trade and macroeconomic dynamics triggered by economic sanctions, and the associated welfare losses, in a calibrated, three-country model of the world economy. We assume that there are two production sectors in each country, and the sanctioned country has a comparative advantage in production of a commodity (for convenience, gas) needed to produce final, differentiated consumption goods. We consider three types of sanctions: sanctions on trade in final goods, financial sanctions, and gas trade sanctions. We calibrate the model to an aggregate of countries currently imposing sanctions on Russia (the European Union, the United Kingdom, and the United States), Russia, and an aggregate of third countries (China, India, and Turkey). We show that, instead of reflecting the success of sanctions, exchange rate

movements reflect the type of sanctions and the direction of the resulting within-country sectoral reallocations. Our welfare analysis demonstrates that the sanctioned country's welfare losses are significantly mitigated, and the sanctioning country's losses are amplified, if the third country does not join the sanctions, but the third country benefits from not joining. These findings highlight the necessity, but also the challenge, of coordinating sanctions internationally.

Labour Supply and Firm Size

Larger firms feature i) longer hours worked, ii) higher wages, and iii) smaller (larger) wage penalties for working long (short) hours. We reconcile these patterns in a general equilibrium model, which features the endogenous interaction of hours, wages, and firm size. In the model, workers willing to work longer hours sort into larger firms that offer a wage premium. Complementarities in hours worked generate wage penalties that increase with the distance from the average firm hours. We use the model to argue about the importance of the interaction between hours, wages, and firm size on inequality.

The Macroeconomic Effects of Debt Relief Policies During Recessions

I study debt relief as a stimulus policy using a dynamic stochastic general equilibrium model that captures the rich heterogeneity in households' balance sheets. In this environment, a large-scale mortgage principal reduction can amplify a recovery, support house prices and lower foreclosures. The nature of the intervention, in terms of its eligibility, liquidity and financing, shapes its macroeconomic impact. This impact rests on how resources are redistributed across households that vary in their marginal propensities to consume. The availability of bankruptcy on unsecured debt quantitatively changes the macroeconomic response to large-scale mortgage relief by reducing precautionary savings.

Should Banks be Worried About Dividend Restrictions?

Countercyclical bank capital requirements have emerged as a popular regulatory tool to help smooth financial cycles. The idea is to reduce capital requirements when exogenous shocks cause aggregate bank capital to decrease so that regulation does not needlessly constrain banks' supply of credit. In the model in this paper, banks are rationally forward-looking and thus ignore short-lived reductions in capital requirements. During a financial crisis, a regulator would want to first impose drastic dividend restrictions to force banks to rebuild capital, but also would want to keep capital

requirements low for a sufficiently long time afterwards. However, such a policy is not time-consistent. Once banks are sufficiently re-capitalized, the regulator would be tempted to immediately raise capital requirements all the way to pre-crisis levels. Optimal time-consistent capital regulation requires that bank capital is rebuilt gradually during financial crises. In particular, banks must be able to pay dividends even when bank equity is still significantly below pre-crisis levels.

Anonymous Credentials: Secret-Free and Quantum-Safe

An anonymous credential mechanism is a set of protocols that allows users to obtain credentials from an organization and demonstrate ownership of these credentials without compromising users' privacy. In this work, we construct the first secret-free and quantum-safe credential mechanism. The scheme is secret-free in the sense that an organization does not need to guard a secret key. The scheme is also lightweight in construction. Security of the scheme relies on the ability of the organization to maintain the integrity of a publicly known data structure—namely, a Merkle tree—that utilizes a quantum-safe, partially homomorphic hash function as a foundational primitive. We also construct a simple, quantum-safe, zero-knowledge argument of knowledge of membership in the Merkle tree. Additionally, we explore a concrete instantiation of the scheme and show it to be practically efficient for the core functions of enrollment and verification.

Staff Discussion Papers

Cryptoasset Ownership and Use in Canada: An Update for 2022

This paper provides an update on cryptoasset ownership in Canada using data from two Bank of Canada surveys conducted in 2022. We find that Bitcoin ownership declined from 13% in 2021 to 10% in 2022, and ownership of other cryptoassets also fell. These drops occurred against a background of steep price declines and an increasingly tight regulatory atmosphere for cryptoassets.

Unmet Payment Needs and a Central Bank Digital Currency

We discuss the payment habits of Canadians both in the current payment environment and in a hypothetical cashless environment. We also consider whether a central bank digital currency (CBDC) would address unmet payment needs in a cashless society. Most adult Canadians do not experience gaps in their access to a range of payment methods, and this would probably continue to be the case in a cashless environment. Some people could, however, face difficulties making payments if merchants no longer generally

accepted cash as a method of payment. For a payment-oriented CBDC to successfully address unmet payment needs, the main consumer groups—who already have access to a range of payment options—would have to widely adopt the CBDC and use it at scale. This is necessary to encourage widespread merchant acceptance of CBDC, which would, in turn, encourage further consumer adoption and use. However, most consumers face few payment gaps or frictions and therefore might have relatively weak incentives to adopt and—especially—to use CBDC at scale. If that were the case, widespread merchant acceptance also would be unlikely. This suggests that addressing unmet payment needs for a minority of consumers by issuing a CBDC could be challenging under the conditions explored in this paper. The minority of consumers with unmet payment needs will only be able to benefit from a CBDC if the majority of consumers experience material benefits and therefore drive its use.

Digitalization: Labour Markets

In this paper, the authors assess the relationship between digitalization and labour demand and supply, and how this relationship affects wages and income inequality. We also explore implications of recent digitalization trends for the future of work.

Digitalization: Productivity

We examine the relationship between digitalization and productivity, the factors that influence this relationship, and how digitalization's effect on productivity could change firm behaviour.

Digitalization: Implications for Monetary Policy

We explore the implications of digitalization for monetary policy, both in terms of how monetary policy affects the economy and in terms of data analysis and communication with the public.

Forecasting Risks to the Canadian Economic Outlook at a Daily Frequency

In this paper, we estimate the distribution of future inflation and growth in real gross domestic product (GDP) for the Canadian economy at a daily frequency. To do this, we model the conditional moments (mean, variance, skewness and kurtosis) of inflation and GDP growth as moving averages of economic and financial conditions. Then, we translate the conditional moments into conditional distributions using a flexible parametric distribution known as the skewed generalized error distribution. We show that the probabilities of inflation and GDP growth derived from the conditional

distributions accurately reflect realized outcomes during the sample period from 2002 to 2022. Our methodology offers daily-frequency forecasts with flexible forecasting horizons. This is highly useful in an environment of elevated uncertainty surrounding the inflation and growth outlook.

Digitalization: Definition and Measurement

This paper provides an overview of digitalization and its economic implications. We assess the scope of digitalization in Canada as well as the challenges related to its measurement.

Predicting Changes in Canadian Housing Markets with Machine Learning

This paper examines whether machine learning (ML) algorithms can outperform a linear model in predicting monthly growth in Canada of both house prices and existing home sales. The aim is to apply two widely used ML techniques (support vector regression and multilayer perceptron) in economic forecasting to understand their scopes and limitations. We find that the two ML algorithms can perform better than a linear model in forecasting house prices and resales. However, the improvement in forecast accuracy is not always statistically significant. Therefore, we cannot systematically conclude using traditional time-series data that the ML models outperform the linear model in a significant way. Future research should explore non-traditional data sets to fully take advantage of ML methods.

UPCOMING EVENTS

Sebastian Merkel (University of Exeter Business School)
Organizer: EFR BAP Visiting Speaker
Date: 3 October 2023

Sebastain Infante (Federal Reserve System)
Organizer: FMD/FSD EFR Seminar Series
Date: 3 October 2023

Kaiji Chen (Emory University)
Organizer: INT Visiting Speaker
Date: 6 October 2023

Zohair Alam (Rotman School of Management)
Organizer: FMD/FSD EFR Seminar Series
Date: 17 October 2023

Ying Feng (National University of Singapore)
Organizer: EFR CEA/INT Speaker
Date: 20 October 2023

Michael D. Bauer (Federal Reserve Bank of San Francisco)
Organizer: FMD Visiting Speaker
Date: 25 October 2023