Bank of Canada Quarterly Research Update

2025Q4

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

Md. Nazmul Ahsan & Jean-Marie Dufour & **Gabriel Rodriguez-Rondon**, "Estimation and Inference for Higher-Order Stochastic Volatility Models with Leverage", *Journal of Time Series Analysis*, Vol. 46(6): 1064-1084, November 2025

Ajit Desai & Anneke Kosse & Jacob Sharples, "Finding a Needle in a Haystack: A Machine Learning Framework for Anomaly Detection in Payment Systems", *Journal of Finance and Data Science*, Vol. 11, December 2025

Patrick Aldrige & **David Cimon** & **Rishi Vala**, "Central Bank Crisis Interventions: A Review of the Recent Literature on Potential Costs", *Journal of Financial Crises*, Vol. 7(4), December 2025

Patrick Alexander & **Abeer Reza**, "The Exchange Rate Elasticity of Exports: A Shock-Dependent Approach", *Imf Economic Review*, Vol. 73: 617-649, June 2025

Jason Allen & Robert Clark & Jean-Francois Houde & **Shaoteng Li** & Anna Trubnikova, "The Role of Intermediaries in Selection Markets: Evidence from Mortgage Lending", *Review of Financial Studies*, Vol. 38(11): 3284-3328, November 2025

James C. MacGee & Simona E. Cociuba, "Sectoral Reallocations with an Aging Population", *European Economic Review*, Vol. 181, January 2026

Chao Gu & **Janet Hua Jiang** & Liang Wang, "Credit Conditions, Inflation, and Unemployment", *Journal of Economic Theory*, Vol. 230, December 2025

Marc Chen & Peter A. Forsyth & Yuying Li & **Mohammad Shirazi**, "Machine Learning and a Hamilton–Jacobi–Bellman Equation for Optimal Decumulation: A Comparison Study", *Journal of Computational Finance*, Vol. 29(1), June 2025

Heng Chen & John Tsang, "Correcting Selection Bias in Non-Probability Two-Phase Payment Survey", *Journal of Survey Statistics and Methodology*, January 2026

Tatjana Dahlhaus & **Angelika Welte**, "Payment Habits During Covid-19: Evidence from High-Frequency Transaction Data", *Jahrbucher Fur Nationalokonomie Und Statistik*, Vol. 245(6), October 2025

Daniela Puzzello & Isabelle Salle & **Janet Jiang** & John Duffy & Luba Petersen, "Introduction to the Special Issue in Honor of Jasmina Arifovic", *Journal of Economic Behavior & Organization*, Vol. 239, November 2025

Lu Han, "What Drives Exporters' Market Dynamics? a New Framework for Disentangling Micro Shocks", *Journal of International Economics*, Vol. 159, January 2026

Yuko Imura & Julia K. Thomas, "Productive Misallocation and International Transmission of Credit Shocks", *International Economic Review*, Vol. 66(4): 1395-1423, October 2025

James Cabral & **Walter Steingress**, "Immigration and US Shelter Prices: The Role of Geographical and Immigrant Heterogeneity", *European Economic Review*, Vol. 182, February 2026

Jonathan Chiu & Thorsten V. Koeppl, "Paytech on Bigtech Platforms", *Journal of Banking and Finance*, Vol. 182, January 2026

Martin Kuncl & **Dmitry Matveev**, "Neutral Rate of Interest in a Small Open Economy: The Case of Canada", *Canadian Journal of Economics*, Vol. 58(3): 990-1016, August 2025

Miguel Santana & Pedro Teles & Sergio Rebelo, "Behavioral Sticky Prices", *Journal of Monetary Economics*, Vol. 155, November 2025

Monica Jain & **Olena Kostyshyna** & **Xu Zhang**, "Expectations of Inflation, Wages and Spending: Evidence from a Consumer Survey", *Economic Letters*, Vol. 256, October 2025

Ming Zeng & **Guihai Zhao**, "Expectation-Driven Term Structure of Equity and Bond Yields", *Journal of Monetary Economics*, Vol. 157, January 2026

Forthcoming

Milian Bachem & **Lerby M Ergun** & Casper G De Vries, "Covariates Hiding in the Tails", *Econometrics Journal*

Eric Benyo & **Reinhard Ellwanger** & Stephen Snudden, "A Reappraisal of Real-Time Forecasts of the Real Price of Oil", *Economic Inquiry*

Jonathan Chiu & Cyril Monnet, "On the Programmability and Uniformity of Digital Currencies", *American Economic Review: Insights*

STAFF WORKING PAPERS

Francesco Amodeo & **Edoardo Briganti**, "High-Frequency Cross-Sectional Identification of Military News Shocks", Bank of Canada Staff Working Paper 2025-27

Kevin Moran & Dalibor Stevanovic & **Stéphane Surprenant**, "Risk Scenarios and Macroeconomic Forecasts", Bank of Canada Staff Working Paper 2025-28

Ingomar Krohn & **Andreas Uthemann** & **Rishi Vala** & **Jun Yang**, "Demand-Driven Risk Premia in Foreign Exchange and Bond Markets", Bank of Canada Staff Working Paper 2025-29

Stephen Murchison, "Non-Homothetic Preferences and the Demand Channel of Inflation", Bank of Canada Staff Working Paper 2025-30

Chenyu Hou & **Tao Wang**, "Uncovering Subjective Models from Survey Expectations", Bank of Canada Staff Working Paper 2025-31

Javier Ojea Ferreiro, "A Market-Based Approach to Reverse Stress Testing the Financial System", Bank of Canada Staff Working Paper 2025-32

Rodrigo Sekkel & Henry Stern & **Xu Zhang**, "Money Talks: How Foreign and Domestic Monetary Policy Communications Move Financial Markets", Bank of Canada Staff Working Paper 2025-33

Ragnar Juelsrud & Plamen Nenov & **Fabienne Schneider** & Olav Syrstad, "Transaction Costs, the Value of Convenience, and the Cross-Section of Safe Asset Returns", Bank of Canada Staff Working Paper 2025-34

Iñaki Aldasoro & **Ajit Desai**, "AI Agents for Cash Management in Payment Systems", Bank of Canada Staff Working Paper 2025-35

Ulrich Roschitsch & **Hannes Twieling**, "United in Booms, Divided in Busts: Regional House Price Cycles and Monetary Policy", Bank of Canada Staff Working Paper 2025-36

Jan David Schneider, "The Sectoral Origins of Post-Pandemic Inflation", Bank of Canada Staff Working Paper 2025-37

Sami Alpanda & **Serdar Kabaca**, "Portfolio Rebalancing Channel and the Effects of Large-Scale Stock and Bond Purchases", Bank of Canada Staff Working Paper 2025-38

STAFF DISCUSSION PAPERS

Virgilio B Pasin & **Anna Wyllie**, "Net Send Limits in the Lynx Payment System: Usage and Implications", Bank of Canada Staff Discussion Paper 2025-13

Greg Adams & Evan Dudley & **Jean-Sébastien Fontaine** & **Sofia Tchamova** & **Andreas Uthemann**, "The Dealer-to-Client Repo Market: A Buoy on a Swaying Sea", Bank of Canada Staff Discussion Paper 2025-14

Owen Gaboury & **Farrukh Suvankulov** & Mathieu Utting, "Do Firms' Sales Expectations Hit the Mark? Evidence from the Business Leaders' Pulse", Bank of Canada Staff Discussion Paper 2025-15

Nicolas Audet & **Adam Epp** & **Jeffrey Gao** & **Joe Ning**, "Modelling the Sovereign Debt Strategy: A Practical Primer", Bank of Canada Staff Discussion Paper 2025-16

Cam Donohoe & **Youming Liu**, "Estimating the Costs of Electronic Retail Payment Networks: A Cross-Country Meta Analysis", Bank of Canada Staff Discussion Paper 2025-17

Naveen Rai & **Hayley Touchburn** & Matt West, "Inflation Expectations in Action: Exploring Agents' Behaviour in a Period of High Inflation", Bank of Canada Staff Discussion Paper 2025-18

ABSTRACTS

Papers In-Press

Estimation and Inference for Higher-Order Stochastic Volatility Models with Leverage

Statistical inference—estimation and testing—for stochastic volatility models is challenging and computationally expensive. This problem is compounded when leverage effects are allowed. We propose efficient, simple estimators for higher-order stochastic volatility models with leverage [SVL (p)], based on a small number of moment equations derived from ARMA representations associated with SVL models, along with the possibility of using "winsorization" to improve stability and efficiency (W-ARMA estimators). The asymptotic distributional theory of the estimators is derived. The computationally simple estimators proposed allow one to easily perform simulation-based (possibly exact) tests, such as Monte Carlo tests (MCTS) or bootstrap procedures. In simulation experiments, we show that: (1) the proposed W-ARMA estimators dominate alternative estimators (including Bayesian estimators) in terms of bias, root-mean-square error, and computation time; (2) local and maximized Monte Carlo tests based on W-ARMA estimators yield good control of the size and power of LR-type tests; (3) taking into account leverage improves volatility forecasting. The methods developed are applied to daily returns for three major stock indices (S&P 500, Dow Jones, Nasdaq), confirming the superiority of SVL (p) models over competing conditional volatility models in terms of forecast accuracy.

Finding a Needle in a Haystack: A Machine Learning Framework for Anomaly Detection in Payment Systems

We propose a flexible machine learning (ML) framework for real-time transaction monitoring in high-value payment systems (HVPS), which are central to a country's financial infrastructure and integral to financial stability. This framework can be used by system operators and overseers to detect anomalous transactions, which—if caused by a cyber attack or an operational outage and left undetected—could have serious implications for the HVPS, its participants and the financial system more broadly. Given the high volume of payments settled each day and the scarcity of actual anomalous transactions in HVPS, detecting anomalies resembles finding a needle in a haystack. Therefore, our framework employs a layered approach to manage the high volume of payments and isolate potential anomalies. In the first layer, a supervised ML

algorithm is used to identify and separate 'typical' payments from 'unusual' payments. In the second layer, only the 'unusual' payments are run through an unsupervised ML algorithm for anomaly detection. We test this framework using artificially manipulated transactions and payments data from the Canadian HVPS. The ML algorithm employed in the first layer achieves a detection rate of 93 %, marking a significant improvement over commonly-used econometric models. The ML algorithm used in the second layer marks the artificially manipulated transactions as nearly twice as suspicious as the original transactions, proving its effectiveness.

Central Bank Crisis Interventions: A Review of the Recent Literature on Potential Costs

Central banks may engage in large-scale lending and asset purchases to stabilize financial markets and implement monetary policy during crises. The ability of these actions to restore financial market functioning is well documented; however, they come with costs. We provide a literature review of the costs associated with these post-Global Financial Crisis central bank actions, without commenting on the net benefits they provide. We find support for the premise that crisis actions may negatively impact market liquidity, distort asset prices, increase rent-seeking and inefficient uses of the liquidity provided by the central bank, create international spillovers, and create distortions in the consolidated government balance sheet. We discuss measures that may mitigate the negative impacts of crisis actions.

The Exchange Rate Elasticity of Exports: A Shock-Dependent Approach

The exchange rate elasticity of exports is often interpreted and estimated as an unconditional structural parameter in the literature. We show that this elasticity, in fact, varies across the structural shocks that generate movements in the exchange rate in the first place. We use a small-open-economy SVAR model, estimated with Canadian data, to derive estimates for the conditional exchange rate elasticity of exports (CEREE) for seven structural shocks used in the literature. Estimates for CEREEs vary in magnitude, sign, and significance across shocks. They are stronger for foreign shocks and weaker than expected by standard economic theory for domestic and exogenous exchange rate shocks. Recent developments from the dominant currency paradigm can potentially explain some, but not all, of our results. Our findings highlight the risk of treating the exchange

rate elasticity as an unconditional structural relationship in forming expectations.

The Role of Intermediaries in Selection Markets: Evidence from Mortgage Lending

We study the role of brokers in selection markets. We find broker-clients in the Canadian mortgage market are observationally different from branch-clients. They finance larger loans with more leverage and longer amortization. We build and estimate a model of mortgage demand to disentangle three possible explanations for these riskier product choices: (1) selection on observables, (2) unobserved borrower preferences for riskier loans, and (3) a causal effect of brokers. Although we find that brokers influence product choices, the main reason borrowers choose high-leverage products is unobserved preferences. Borrowers prefer larger loans and brokers facilitate qualification for them.

Sectoral Reallocations with an Aging Population

Demographic projections show the majority of OECD economies will see declines in their working-age populations in the coming decades. This is potentially problematic, since young workers account for a large share of net labor reallocation between growing and shrinking industries. To examine if sectoral reallocation costs are exacerbated by an aging population, we develop a three-sector perpetual youth search model with sector-specific human capital. Our model features two interconnected frictions: sectoral preference, which implies that only some workers are mobile across sectors, and a wage bargaining distortion, whereby mobile workers' outside option of searching in the growing sector dampens the fall in shrinking sector wages, leading to rest unemployment. In our parametrized model, as population growth declines from 3 to -1 percent, output losses from a one-time reallocation shock of 3 percentage points increase seven-fold to nearly 10 percent of annual GDP, and there are extended periods of high unemployment and low vacancies.

Credit Conditions, Inflation, and Unemployment

We construct a New Monetarist model with labor market search and identify two channels that affect the long-run relationship between inflation and unemployment. First, inflation lowers wages through bargaining because unemployed workers rely more heavily on cash transactions and suffer more from inflation than employed workers; this wage-bargaining channel generates a downward-sloping Phillips curve without assuming nominal rigidity. Second, inflation increases

firms' financing costs, which discourages job creation and increases unemployment; this cash-financing channel leads to an upward-sloping Phillips curve. We calibrate our model to the U.S. economy. The improvement in firm financing conditions can explain the observation that the slope of the long-run Phillips curve has switched from positive to negative post-2000.

Machine Learning and a Hamilton–Jacobi–Bellman Equation for Optimal Decumulation: A Comparison Study

Without resorting to dynamic programming, we determine the decumulation strategy for the holder of a defined contribution pension plan. We formulate this as a constrained stochastic optimal control problem. Our approach is based on data-driven neural network optimization. Customized activation functions for the output layers of the neural network are applied, which permits training via standard unconstrained optimization. The optimal solution yields a multiperiod decumulation and asset allocation strategy, useful for a holder of a defined contribution pension plan. The objective function of the optimal control problem is a weighted measure of the expected wealth withdrawn and the expected shortfall, and it directly targets left-tail risk. The stochastic bound constraints enforce a guaranteed minimum withdrawal each year. We show that in terms of numerical results the neural network approach compares favorably with a Hamilton–Jacobi–Bellman partial differential equation computational framework.

Correcting Selection Bias in Non-Probability Two-Phase Payment Survey

We develop statistical inferences for non-probability two-phase surveys when relevant auxiliary information is available from a probability survey. To reduce selection bias and gain efficiency, both selection probabilities of Phase 1 and Phase 2 are estimated and two-phase calibration is implemented. We discuss both analytical plug-in and pseudo-population bootstrap variance estimation methods that account for the effects of using estimated selection probabilities and calibrated weights. The proposed method is assessed by simulation studies and used to analyze a non-probability two-phase payment survey.

Payment Habits During Covid-19: Evidence from High-Frequency Transaction Data

The Covid-19 pandemic, in Canada and around the world, accelerated trends toward non-cash payments. In this paper, we assess the impact of high-frequency fluctuations in the severity of the pandemic on payment behaviour. These fluctuations are measured by daily changes in restrictions ("stringency") and reported case counts. Our main measures of payment habits are the ratios of the value and transaction counts of cash withdrawals to debit card payments. Econometrically, we use local projections to estimate the effects on payment habits. We find evidence that consumer behaviour adjusted during the pandemic: consumers withdrew less cash relative to card payment and avoided frequent trips for cash withdrawals and point-of-sale purchases through higher transaction amounts. Based on our modelling, once stringency measures eased and case counts receded, cash use partially recovered, although not to pre-pandemic levels.

Introduction to the Special Issue in Honor of Jasmina Arifovic

Jasmina Arifovic was a distinguished economist renowned for her pioneering work at the intersection of computational economics and experimental macroeconomics. Her work significantly advanced our understanding of how agents learn and adapt in complex economic environments, as well as how macroeconomic systems can be implemented and studied in the laboratory.

What Drives Exporters' Market Dynamics? a New Framework for Disentangling Micro Shocks

Exporters frequently change their set of destination markets. This paper proposes a new approach to identifying the underlying drivers of changes in exporters' market decisions over time. The approach exploits information on price and quantity changes in firms' continuing markets to disentangle the micro shocks that drive firms' market changes. Applying the method to customs data from China (2000–2006) and the UK (2010–2016), I find consistent results showing that most firm- and firm-product-level market changes are driven by demand-related shocks, with a nontrivial proportion of these changes being correlated across markets.

Productive Misallocation and International Transmission of Credit Shocks

We study the role of international trade in cross-country financial shock transmission using an equilibrium business cycle model calibrated to the United States and Canada. Heterogeneous firms have differing needs for external finance and face occasionally binding collateral constraints hindering their investments, while input–output linkages drive trade in final goods and intermediate inputs. Transmission of a U.S. financial shock recession into Canada's economy is qualitatively different from productivity shock transmission and asymmetric. We trace the first result to a unique investment channel operating through persistent trade balance adjustments and the second to differences in the two countries' exposure to trade.

Immigration and US Shelter Prices: The Role of Geographical and Immigrant Heterogeneity

The arrival of immigrants increases demand for housing and puts upward pressure on shelter prices. Using instrumental variables based on the ancestry composition of residents in US counties, we estimate the causal impact of immigration on local shelter prices. We show that the impact of immigrants is heterogeneous across locations. The increase in shelter prices is greater in counties where immigrants have higher levels of education and in counties that issue fewer building permits. We also find that the house prices respond more to immigration than rent prices do. The larger issuance of building permits for multi-unit homes than for single-unit homes can reconcile the different price reactions.

Paytech on Bigtech Platforms

Why do BigTech platforms introduce payment services? And do their users benefit? Digital platforms often run business models where activities on the platform generate data that can be monetized off the platform. The platform then trades off the value of such data against the cost that arises from subsidizing activities in order to compensate users for their loss of privacy. The way data interact with payments determines whether payments are introduced and how the introduction impacts users. When data help to provide better payments (data-driven payments), platforms have too little incentives to introduce payments, even though users benefit. Introduction is more likely when payments also generate additional data (payment-driven data), but the adoption of better payments may then hurt users.

Neutral Rate of Interest in a Small Open Economy: The Case of Canada

The neutral rate of interest is an important concept and communication tool for central banks. We develop a structural macroeconomic model to study the determinants of the neutral real rate of interest in a small open economy. The model captures domestic factors such as population aging, declining productivity, rising government debt, and inequality. Foreign factors are captured by changes in the global neutral real rate. We use the model to evaluate secular dynamics of the neutral rate in Canada from 1980–2018 and find that changes in both foreign and domestic factors resulted in a protracted neutral rate decline.

Behavioral Sticky Prices

We develop a model in which households make decisions using a dual-process framework. System 1 relies on fast, intuitive heuristics but is prone to error, while System 2 demands cognitive effort but yields more accurate decisions. Monopolistic firms can influence which system households engage through pricing. This strategic influence creates a novel source of price inertia. The model accounts for the "rockets and feathers" phenomenon (prices rise quickly but fall slowly), explains why firms with unexpectedly high demand often avoid price changes, and why hazard functions are downward sloping. Our model implies that price stability is not optimal.

Expectations of Inflation, Wages and Spending: Evidence from a Consumer Survey

Using household-level data from the Canadian Survey of Consumer Expectations over 2014Q4– 2022Q3, we provide insight into the formation of expectations for inflation, wage and spending growth. The literature has documented that households associate higher expected price inflation with worse economic conditions, but that higher expected wage inflation is linked to better economic outcomes. Our paper finds that these views extend to households' spending decisions: higher expected price inflation is also associated with lower expected household spending, while higher expected wage growth is linked to higher expected spending. These relationships became stronger during the high-inflation period.

Expectation-Driven Term Structure of Equity and Bond Yields

This paper develops a noisy-information equilibrium model to study how subjective expectations shape the joint dynamics of equity and bond yields. In our framework, movements in asset yields are driven by subjective expectations of dividend and GDP growth, rather than time-varying risk premia. A dual-component dividend structure, together with belief distortions, generates key asset-pricing facts: short-term equity yields are more volatile than long-term yields because short-run dividend growth expectations mean-revert to their stable long-run counterpart; the equity yield slope is procyclical due to countercyclical term structure of expected dividend growth; and the bond-stock correlation changes from positive to negative after the late 1990s, reflecting a shift in the correlation between expected GDP and dividend growth. The model also implies predictable dividend strip returns, with predictability declining with maturity due to dividend forecast revisions, and it successfully replicates the observed dynamics of equity yields and some aggregate moments.

Forthcoming Papers

Covariates Hiding in the Tails

Scaling behaviour measured in cross-sectional studies through the tail index of a power law is prone to a bias. This hampers inference; in particular, observed time variation in estimated tail indices may not originate from the data-generating process. In the case of a linear factor model, the factors bias the tail indices in the left and right tail in opposite directions. This fact can be exploited to reduce the bias. We show how this bias arises from factors, how to remedy for the bias, and how to apply our methods to financial data and geographic location data.

A Reappraisal of Real-Time Forecasts of the Real Price of Oil

We replicate Baumeister and Kilian's work done in 2012 to reappraise real-time forecasts of the real price of crude oil against the end-of-month no-change forecast, the equivalent naive benchmark used for asset prices. We find no consistently significant improvements in the predictive accuracy of model-based forecasts over this naive benchmark at short horizons. Only futures-based forecasts consistently outperform the end-of-month no-change forecast, and only at longer horizons. These results challenge the consensus on the predictability of the real price of crude oil and the merits of alternative forecast approaches. Our findings motivate broader

reassessment and replication of forecasting models of temporally aggregated series.

On the Programmability and Uniformity of Digital Currencies

Central bankers argue that programmable digital currencies may compromise the uniformity or singleness of money. We explore this view in a stylized model where programmable money arises endogenously, and differently programmed monies have varying liquidity. Programmability provides private value by easing commitment frictions but imposes social costs under informational frictions. Preserving uniformity is not necessarily socially beneficial. Banning programmable money lowers welfare when informational frictions are mild but improves it when commitment frictions are low. These insights suggest programmable money could be more beneficial on permissionless blockchains, where it is difficult to commit but trades are publicly observable.

Staff Working Papers

High-Frequency Cross-Sectional Identification of Military News Shocks

This study develops a two-step procedure to identify and quantify fiscal news shocks. First, we augment a narrative identification strategy using large language model searches to compile events (2001–2023) that altered the expected path of U.S. defense expenditure. Second, for each event, we estimate market-implied shifts in expected defense spending with cross-sectional regressions of contractors' stock returns on their reliance on military revenues. We show that this approach statistically validates each event; quantifies each shock in an intuitive, model-consistent fashion; and readily generalizes to other macroeconomic contexts. Employing the estimated shocks in a shift-share analysis yields a two-year, metropolitan statistical area–level GDP multiplier of approximately 1 for U.S. military build-ups.

Risk Scenarios and Macroeconomic Forecasts

This paper discusses the usefulness of risk scenarios—forecasts conditional on specific future paths for economic variables and shocks—for monitoring the Canadian economy. To do so, we use a vector autoregressive (VAR) approach to produce macroeconomic forecasts conditional on four risk scenarios: high oil prices, a US recession, a tight labor market, and a restrictive monetary policy. The results show that these scenarios represent significant risk factors for

the evolution of the Canadian economy. In particular, the high-oil-price scenario is beneficial for the Canadian economy, while a US recession induces a significant slowdown. The very tight labor market scenario leads to additional price increases relative to an unconditional forecast, and the restrictive monetary policy scenario increases the unemployment rate while lowering the inflation rate slightly.

Demand-Driven Risk Premia in Foreign Exchange and Bond Markets

We establish an empirical framework that causally identifies how Treasury demand shocks transmit across foreign exchange and global bond markets, providing direct validation of quantity-driven theories of international risk premia. Our identification exploits predetermined auction supply to isolate demand shocks from high-frequency movements in Treasury futures prices around Treasury auctions. A one-standard-deviation increase in Treasury demand causes the U.S. dollar to depreciate by 2 basis points against G9 currencies while generating 10-basis-point increases in foreign bond prices. Effects persist for two weeks, indicating meaningful economic impacts. The transmission mechanism varies systematically across countries: those with lower U.S. short-rate correlations exhibit stronger currency responses but weaker bond effects, while higher-correlation countries show the opposite pattern. This cross-sectional variation provides empirical support for models of segmented markets where global arbitrageurs link exchange rates and bond risk premia.

Non-Homothetic Preferences and the Demand Channel of Inflation

The post-pandemic rise in global inflation has renewed interest in the relative roles played by demand and supply factors in determining prices. Many central banks have stressed the joint role that persistent increases in input costs and excess demand played in boosting inflation in 2021 and 2022. Yet the latter influence plays no independent role in the workhorse New Keynesian models used by many central banks. Under the typical assumption of constant elasticity of substitution (CES) preferences, variations in consumption shift the firm's profit function up and down, but do not influence its curvature. As a result, the optimal markup is not a function of demand. This assumption is contradicted by both evidence about household shopping behaviour and survey evidence about how firms set prices. This paper proposes an alternative structure based on non-homothetic household preferences over varieties of consumption goods. Specifically, the elasticity of substitution between goods is state dependent, declining during periods of strong per-capita

consumption and vice versa. This captures the stylized fact that individual consumers are less price sensitive during economic booms and more price sensitive during downturns. These substitution effects in turn give the firm an incentive to adjust its markup in response to consumption demand. In aggregate, this generates desired markups that increase nonlinearly in consumption demand. When strategic complementarities in pricing are present, these preferences also give rise to state-dependent pass-through of cost shocks.

Uncovering Subjective Models from Survey Expectations

Households may perceive that macroeconomic variables move together in a different way from that implied by their actual realizations and sophisticated models. We use a structural test derived from a multivariate noisy-information framework and additional evidence from survey data and newspaper narratives to show that information friction alone cannot explain households' tendency to associate higher future inflation with a worse labor market outlook. We also show that the subjective model empirically uncovered from survey data implies amplified output responses to supply shocks, but dampened output and price responses to demand shocks.

A Market-Based Approach to Reverse Stress Testing the Financial System

This article investigates market scenarios that lead to extreme losses in international financial markets. We propose two systemic measures: (1) identifying the foreign event among those with equal probability leading to the worst outcome for the domestic financial system; and (2) classifying tail returns of financial institutions into four groups based on whether losses occur alongside domestic institutions only, foreign institutions only, both, or neither. Using 20 years of weekly equity returns from over 150 institutions across four developed financial systems, results highlight the central role of US and European institutions, with growing importance for Canada and non-bank financial intermediaries.

Money Talks: How Foreign and Domestic Monetary Policy Communications Move Financial Markets

We provide novel insights into how foreign and domestic monetary policy communications, beyond rate announcements, affect the financial markets of open economies. We construct a high-frequency dataset that documents the impact of Federal Reserve (Fed) and Bank of Canada (BoC) rate announcements, speeches, press

conferences and minutes releases to Canadian financial markets between 1997 and 2023. We find that non-rate announcements are a significant source of domestic monetary policy surprises and international spillovers. Across event types, Fed communications are particularly influential for long-term interest rates and stock futures while BoC communications matter more to short-term interest rates. Since BoC communications have little effect on U.S. interest rates, Canadian announcements have a greater impact on the CAD/USD exchange rate by inducing larger changes in the cross-country interest rate differential.

Transaction Costs, the Value of Convenience, and the Cross-Section of Safe Asset Returns

In this paper we study the cross-section of equilibrium returns on safe assets using a tractable asset pricing model with a micro-founded demand for liquidity and multiple safe assets with heterogeneous transaction costs. A key feature of our model is the "value of convenience," which is an equilibrium object that measures the level of liquidity risk-sharing in the economy. Changes in asset supply or the transaction cost of a single safe asset affect aggregate liquidity and the returns of all assets. The model features a pecuniary externality, which investors fail to internalize when forming their portfolios and which impacts equilibrium welfare. Therefore, policies that increase the payoff on the most liquid asset improve welfare in the competitive equilibrium. We test the main predictions of our theory using a novel measure of relative (in)convenience yields in the US Treasury market.

AI Agents for Cash Management in Payment Systems

Using prompt-based experiments with ChatGPT's reasoning model, we evaluate whether a generative artificial intelligence (AI) agent can perform high-level intraday liquidity management in a wholesale payment system. We simulate payment scenarios with liquidity shocks and competing priorities to test the agent's ability to maintain precautionary liquidity buffers, dynamically prioritize payments under tight constraints, and optimize the trade-off between settlement speed and liquidity usage. Our results show that even without domain-specific training, the AI agent closely replicates key prudential cash-management practices, issuing calibrated recommendations that preserve liquidity while minimizing delays. These findings suggest that routine cash-management tasks could be automated using general-purpose large language models, potentially reducing operational costs and improving intraday liquidity efficiency. We

conclude with a discussion of the regulatory and policy safeguards that central banks and supervisors may need to consider in an era of AI-driven payment operations.

United in Booms, Divided in Busts: Regional House Price Cycles and Monetary Policy

This paper shows that regional disparities in house price growth are more pronounced during house price busts than during booms. To explain this observation we construct a two-region currency union model incorporating a housing sector and extrapolative belief updating regarding house prices. To solve the model, we propose a new method that efficiently handles extrapolative belief updating in a wide class of structural models. We show that intensified extrapolation in busts and regional housing market heterogeneities jointly explain elevated regional house price growth dispersion in busts and muted dispersion in booms. Consistent with our theory, we provide empirical evidence that house price belief updating is indeed more pronounced in busts and we document that regional heterogeneities on the housing supply side affect regional house prices. Quantitatively, our model can match empirically observed elevated regional house price growth dispersion in busts. Moreover, we demonstrate that a monetary authority targeting house prices may reduce the volatility of output and prices as well as regional house price growth disparities. This policy is welfare-improving relative to an inflation-targeting benchmark.

The Sectoral Origins of Post-Pandemic Inflation

This paper quantifies the contribution of sector-specific supply and demand shocks to personal consumption expenditure (PCE) inflation. It derives identification restrictions that are consistent with a large class of dynamic stochastic general equilibrium models with production networks. It then imposes these restrictions in structural factor augmented vector autoregressive models with sectoral data on PCE inflation and consumption growth. The identification scheme allows the study to remain agnostic on theoretical modeling assumptions yet still gain structural empirical results: sectoral shocks cannot explain the initial inflation increases that followed the COVID-19 pandemic. This changed from the end of 2021 onward when shocks originating in non-services sectors became a major source of the post-pandemic inflation surge.

Portfolio Rebalancing Channel and the Effects of Large-Scale Stock and Bond Purchases

We quantify the effects of large-scale stock purchases by a central bank and compare these to bond purchases, using an estimated dynamic stochastic general equilibrium macro-finance model with nominal and real rigidities and portfolio rebalancing effects. The latter arise from imperfect substitutability between stocks and short- and long-term government bonds in mutual funds' portfolios. Since households' consumption-savings decisions are tied to expected portfolio returns, the required returns on all three assets affect overall demand in the economy. The model shows that the central bank's equity purchases would lower the risk and term premiums on stocks and long-term bonds, respectively, and thereby stimulate economic activity. Since stocks comprise a larger share in asset portfolios and are less substitutable for short-term securities than long-term bonds are, the effects of stock purchases on aggregate demand are larger than those of similar-sized bond purchases.

Staff Discussion Papers

Net Send Limits in the Lynx Payment System: Usage and Implications

The net send limit (NSL) tool allows financial institutions in the Lynx payment system to control their intraday payment outflow levels. While other liquidity management tools and strategies in Lynx have been studied extensively, no prior research has been conducted on how system participants use NSLs. We analyze data on Lynx NSLs, payments and settlement times and find that participants adopt a "set it and forget it" approach to scheduling NSLs. As well, participants have distinct intraday "loosening" and "tightening" behaviours with different timing and impacts on payment delays. We discuss two potential reasons for this behaviour: signalling to counterparties and rational inattention.

The Dealer-to-Client Repo Market: A Buoy on a Swaying Sea

In 2024, the overnight funding market experienced sustained pressure and the benchmark Canadian Overnight Repo Rate Average (CORRA) rose to 7 basis points above the Bank of Canada's target overnight rate. Settlement balances were declining, but hedge fund borrowing also grew by over $30 billion, increasing the client share of total repo volumes. With limited balance sheets and substantial market power, dealers raised clients' rates, which increasingly influenced CORRA. Overall, this episode highlights the

effect that dealers' balance sheet constraints and bargaining power have on where CORRA settles but downplays the role of the settlement balances channel in the dealer-to-client market.

Do Firms' Sales Expectations Hit the Mark? Evidence from the Business Leaders' Pulse

This paper replicates and extends the work of Altig et al. (2022) on firms' subjective sales growth expectations using Canadian survey data from the Bank of Canada's Business Leaders' Pulse. We examine the formation, uncertainty and predictive validity of firm-level sales growth forecasts using subjective probability distributions from business leaders at a one-year-ahead horizon. The replication work performed here confirms several findings from Altig et al. (2022), including that expected sales growth predicts realized sales growth, subjective uncertainty predicts forecast errors and firms frequently revise their expectations, usually by small amounts. We also find that subjective uncertainty predicts the magnitude of forecast revisions and follows a V-shaped relationship with past sales growth. We extend the original analysis by further demonstrating that firms with weaker recent performance assign greater weight to future weak growth scenarios, and subsequently that these firms are more likely to underperform, suggesting expectations are grounded in real conditions. The results presented in this paper reinforce the value of firm-level survey data for macroeconomic forecasting and policy analysis and help validate the Business Leaders' Pulse as a reliable source of firm-level expectations data.

Modelling the Sovereign Debt Strategy: A Practical Primer

This paper provides a primer on the role of debt modelling in developing a sovereign debt issuance strategy, and how the policy objectives of a sovereign debt manager influence design decisions within their models. The insights provided here are supported by current and past uses of the Canadian Debt Strategy Model, which is a key component of Canada's process to set its annual Debt Management Strategy and Medium-Term Debt Strategy. We address specific challenges that issuers of public debt often face. Those challenges include defining an appropriate objective function, specifying a strategy adaptable to an uncertain economic environment, operating within computational limitations and integrating qualitative considerations about liquidity and the needs of the investor base with quantitative assessments of costs and risks.

Estimating the Costs of Electronic Retail Payment Networks: A Cross-Country Meta Analysis

As economies across the world continue to digitize, debates around the design and efficiency of national infrastructures for electronic payments have gained added relevance. Central to these debates is the question of how many electronic funds transfer (EFT) systems can viably coexist within a jurisdiction while achieving scale economies to ensure that average cost is minimized, a threshold that largely depends on the shape of the cost function. In this paper, we conduct a cross-country meta-analysis using data from 13 social cost studies across 9 jurisdictions between 2001 and 2016. We quantitatively estimate a cost function relating the total transaction volume to the per-transaction cost and interpret its parameters in terms of fixed and variable costs. We find a rapidly decreasing, convex cost curve that plateaus quickly at around one billion annual transactions. Additionally, we estimate the marginal cost of an EFT to be approximately $0.55 per transaction, expressed in 2025 Canadian dollars, and the total fixed cost to be approximately $83 million per year.

Inflation Expectations in Action: Exploring Agents' Behaviour in a Period of High Inflation

Inflation expectations are important to monetary policy decision-makers. The period of high inflation after the pandemic provides a useful context for exploring how inflation expectations influence the behaviours of firms and consumers. Using survey evidence, we examine how firms and consumers react to their inflation expectations. We find that firm price- and wage-setting behaviours were positively associated with high inflation expectations over the period. These behaviours could reinforce inflation. Consumers' spending and labour market decisions tend to show increased labour supply and reduced consumption in response to high inflation expectations, which could cool rather than reinforce future inflation.