Bank of Canada Quarterly Research Update

2024Q4

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.

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Alex Chernoff & Calista Cheung, "An Overview of Indigenous Economies Within Canada", *Canadian Public Policy*, Vol. 50(4), November 2024

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Tatjana Dahlhaus & Luca Gambetti, "Noisy Monetary Policy Announcements", *Journal of Applied Econometrics*, December 2024 (Online Version)

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Tszkin Julian Chan & Juan Estrada & **Kim Huynh** & David Jacho-Chávez & Leonardo Sánchez-Aragón & Chungsang Tom Lam, "Estimating Social Effects with Randomized and Observational Network Data", *Journal of Econometric Methods*, Vol. 13(2), October 2024

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ABSTRACTS

Papers In-Press

Dynamic Competition in Negotiated Price Markets

Using contract-level data for the Canadian mortgage market, this paper provides evidence of an "invest-and-harvest" pricing pattern. We build a dynamic model of price negotiation with search and switching frictions to capture key market features. We estimate the model and use it to investigate the effects of market frictions and the resulting dynamic competition on borrowers' and banks' payoffs. We show that dynamic pricing and the presence of search and switching costs have important implications for public policies.

U.S. Macroeconomic News and Low-Frequency Changes in Bond Yields in Canada, Sweden and the U.K.

This paper investigates the importance of U.S. macroeconomic news in driving low-frequency fluctuations in the term structure of interest rates in Canada, Sweden, and the U.K. We follow two complementary approaches: First, we apply a regression-based framework that aggregates the impact of daily macroeconomic news on bond yields to a lower quarterly frequency. Next, we estimate a macro-finance affine term structure model linking the daily news to lower-frequency changes in bond yields and its expectations and term premia components. Both approaches show that U.S. macroeconomic news is an important source of lower-frequency quarterly fluctuations in bond yields in these open economies, and even more important than their respective domestic macroeconomic news. Furthermore, the macro-finance model shows that U.S. macroeconomic news is particularly important in explaining low-frequency changes in the expectation components of the nominal, real, and break-even inflation rates.

Letting Job Postings Talk: Recent Trends in Digitalization

We construct a novel dataset of Canadian online job postings, classified by occupation. The data, provided by Indeed, an online job board, represents vacancies advertised by employers across Canada. We have classified these job postings into standard occupations using text analytics. This dataset has been used to study changes in the demand for jobs linked to digitalization over the COVID-19 pandemic. To this end, we leverage time-series and cross-sectional variations in COVID-19 containment policies, examining their impact on jobs broadly related to digitalization. Our findings

reveal that vacancies in digital production jobs increased more substantially than in traditional jobs during the reopening phases. However, no substantial differences were observed when considering different types of vacancies according to the use of digital technologies (i.e., occupations at low risk of automation or those that allow remote work). Overall, our results do not support the popular idea that the COVID-19 pandemic marked a significant turning point in digitalization trends, but rather document a modest shift in this direction.

Effects of Shoe-Leather Cost on Consumer Cash Withdrawal Behavior

This paper studies an empirical model of shoe-leather cost applied to consumer cash withdrawal. The unique feature is to estimate the effect of shoe-leather cost from the cash inventory model by filtering out free-type consumers who do not incur shoe-leather costs. When compared to the costly-type consumers, the free-type do not need to go out of their ways from home to visit banks to withdraw cash because they can economise their travel costs by combining withdrawals with other activities, such as, one-stop multi-purpose trip on either their ways to work or shopping. We find that the cash withdrawal frequency significantly decreases with the travel distance; otherwise the estimated shoe-leather cost without distinguishing between free- and costly-types is close to zero and insignificant. This finding suggests that in order to maintain cash accessibility, the policy need not only consider the supply of physical branch infrastructure, but also account for consumer's travel pattern.

An Overview of Indigenous Economies Within Canada

Attempts to measure aspects of Indigenous economies within Canada are limited by data availability and quality. Drawing on the most recent data sources and research, we provide an overview of such economies and their relationship to the economy of Canada. This overview includes a discussion of labour markets and the characteristics of Indigenous-owned businesses. While several measures suggest economic outcomes have improved for Indigenous Peoples in recent decades, some institutional settings and gaps in infrastructure and financing continue to hinder economic progress. The creation of new institutions is helping Indigenous communities to overcome these historic barriers. However, continued progress is needed to improve data on Indigenous economies to enable Indigenous and Canadian policy-makers to make informed decisions.

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.

Noisy Monetary Policy Announcements

We address two main questions. First, do monetary policy announcements contain noise? Second, if yes, what are the effects of policy noise on the economy? The answer to the first question is "yes." The answer to the second is "small," except on federal funds rate expectations. In sum, we find that the bulk of fluctuations in the path factor are driven by noise. The results are obtained using dynamic rotations to identify the monetary policy shock in a VAR estimated with US data. Finally, we show that announcements about future tightening are mainly interpreted as Delphic over our sample period.

Improving the Efficiency of Payments Systems Using Quantum Computing

High-value payment systems (HVPSs) are typically liquidity intensive because payments are settled on a gross basis. State-of-the-art solutions to this problem include algorithms that seek netting sets and allow for ad hoc reordering of submitted payments. This paper introduces a new algorithm that explores the entire space of payments reordering to improve the liquidity efficiency of these systems without significantly increasing payment delays. Finding the optimal payment order among the entire space of reorderings is, however, an NP-hard combinatorial optimization problem. We solve this problem using a hybrid quantum annealing algorithm. Despite the

limitations in size and speed of today's quantum computers, our algorithm provides quantifiable liquidity savings when applied to the Canadian HVPS using a 30-day sample of transaction data. By reordering batches of 70 payments, we achieve an average of Canadian (C) $240 million in daily liquidity savings, with a settlement delay of approximately 90 seconds. For a few days in the sample, the liquidity savings exceed C$1 billion. Compared with classical computing and with current algorithms in HVPS, our quantum algorithm offers larger liquidity savings, and it offers more reliable and consistent solutions, particularly under time constraints.

Intermediary Leverage Shocks and Funding Conditions

The aggregate leverage of broker-dealers responds to demand and supply disturbances that have opposite effects on financial markets. Leverage supply shocks that relax broker-dealers' funding constraints raise leverage, improve liquidity, increase returns and carry a positive price of risk. Leverage demand shocks also raise leverage but worsen liquidity, reduce returns and carry a negative price of risk. Disentangling demand-and supply-like shocks resolves existing puzzles around the price of leverage risk and yields consistent evidence across many markets of a central role for intermediation frictions and dealers' aggregate leverage in asset pricing.

The Intergenerational Correlation of Employment: Mothers as Role Models?

Linking data from the National Longitudinal Survey of Youth 1979 (NLSY79) and the NLSY79 Children and Young Adults, we document a substantial positive correlation of employment status between mothers and their offspring in the United States. After controlling for ability, education, fertility and wealth, offspring of permanently employed mothers have an 11 percentage-point higher probability to be employed in each given year than those of never employed mothers. The intergenerational transmission of maternal employment is stronger to daughters but significant also to sons. Investigating potential mechanisms, we provide suggestive evidence for a role model channel, through which labor force participation may be transmitted. Offspring seem to emulate the example of their mother when they observe her working. By contrast, we are able to rule out alternative candidate explanations such as network effects, occupation-specific human capital and local conditions of the labor market.

CANVAS: A Canadian Behavioral Agent-Based Model for Monetary Policy

We develop the Canadian behavioral Agent-Based Model (CANVAS) that complements traditional macroeconomic models for forecasting and monetary policy analysis. CANVAS represents a next-generation modeling effort featuring enhancements in three dimensions: introducing household and firm heterogeneity, departing from rational expectations, and modeling price and quantity setting heuristics within a production network. The expanded modeling capacity is achieved by harnessing large-scale Canadian micro- and macroeconomic datasets and incorporating adaptive learning and simple heuristics. The out-of-sample forecasting performance of CANVAS is found to be competitive with a benchmark vector auto-regressive (VAR) model and a DSGE model. When applied to analyze the COVID-19 pandemic episode, our model helps explain both the macroeconomic movement and the interplay between expectation formation and cost-push shocks. CANVAS is one of the first macroeconomic agent-based models applied by a central bank to support projection and alternative scenarios, marking an advancement in the toolkit of central banks and enriching monetary policy analysis.

Demand for Payment Services and Consumer Welfare: The Introduction of a Central Bank Digital Currency

In this paper, we study how potential characteristics of the new payment instrument may affect consumer adoption and usage decisions at the point of sale. We do this by developing and estimating a structural model of payment choice, which accounts for rich heterogeneity in consumer preferences and distinguishes between adoption and usage decisions. In the model, consumers face uncertainty about acceptance decisions by merchants, who represent the opposite side of the market. We use parameter estimates to simulate introduction of a new payment instrument and to evaluate the effect of this introduction on the welfare of various demographic groups of consumers.

A Generalized Endogenous Grid Method for Default Risk Models

We extend the endogenous grid method to default risk models, which is faster and more accurate than grid search. Our method is 4 to 27 times faster and provides a more accurate bond price function, resulting in substantial differences in the predictions of the canonical sovereign debt model. When applied to Arellano's (2008) model, our approach predicts a standard deviation of the interest rate spread

one-third lower and defaults 3 to 5 times less frequently than does the conventional approach. Finally, we demonstrate that our method is applicable to a broad class of default risk models by characterizing sufficient conditions.

Estimating Social Effects with Randomized and Observational Network Data

This paper introduces an innovative approach to identifying and estimating the parameters of interest in the widely recognized linear-in-means regression model under conditions where the initial randomization of peers determines the observed network. We assert that peers who are initially randomized do not produce social effects. However, after randomization, agents can endogenously develop significant connections that potentially generate peer influences. We present a moment condition that compiles local heterogeneous identifying information for all agents within the population. Under the assumption of ψ-dependence in the endogenous network space, we propose a Generalized Method of Moments (GMM) estimator, which is proven to be consistent, asymptotically normally distributed, and straightforward to implement using commonly available statistical software due to its closed-form expression. Monte Carlo simulations demonstrate the GMM estimator's strong small-sample performance. An empirical analysis utilizing data from Hong Kong high school students reveals substantial positive spillover effects on math test scores among study partners in our sample, provided that their seatmates were exogenously assigned by their teachers.

Macroprudential Capital Requirements, Monetary Policy, and Financial Crises

How should bank capital requirements be designed in order to reduce the frequency and severity of financial crises? What is the role of monetary policy in this context? To answer these questions, we develop a New-Keynesian dynamic stochastic general equilibrium (DSGE) model in which the economy endogenously switches between normal times and financially turbulent times. Banks do not internalize that lower leverage contributes to the stability of the entire financial system. This creates a role for bank capital regulation. The proposed model replicates many of the dynamics observed during US financial crises. Basel-III-style capital buffers reduce the probability and length of financial crises while also reducing the size of the financial and non-financial sectors. Monetary policies that are more accommodative during financial crises can moderate economic downturns, thereby lowering the durations of financial distress. A

combination of a small countercyclical capital buffer accompanied by a relief measure and an accommodative monetary policy during crises increases welfare.

Learning from Friends in a Pandemic: Social Networks and the Macroeconomic Response of Consumption

Aggregate events often start locally, with households learning about the unfolding of events through social communication. Using plausibly exogenous variation in counties' social network exposure to geographically remote regions during the COVID-19 pandemic, we quantify the propagation of idiosyncratic COVID-19 social network weighted shocks to consumption spending. We present a wide array of tests that directly control for the role of physical mobility, and physical distance, and isolate the role of geographically distant counties to show that the detected consumption responses were primarily through the channel of expectations, rather than physical infection risks or other common economic and policy shocks.

Firm Inattention and the Efficacy of Monetary Policy: A Text-Based Approach

This paper provides empirical evidence of the importance of firm attention to macroeconomic dynamics. We construct a text-based measure of attention to macroeconomic news and document that attention is polarized across firms and countercyclical. Differences in attention lead to asymmetric responses to monetary policy: expansionary monetary shocks raise the market values of attentive firms more than those of inattentive firms, and contractionary shocks lower the values of attentive firms by less. Attention also mitigates the effects of macroeconomic uncertainty on firm performance. In a quantitative rational inattention model that is calibrated with this new text-based measure, inattention drives monetary non-neutrality. As average attention varies over the business cycle, so does the efficacy of monetary policy.

Nonlinear Transmission of International Financial Stress

This paper investigates nonlinear international financial stress spillovers on a small open economy. The literature provides evidence that financial stress may amplify the effects of adverse shocks. Using monthly data from the US and Canada over the period 1983–2019, we estimate a two-country threshold vector autoregressive model, where economies can be in either a financially tranquil or stressful regime. In times of high financial stress, we find macro-financial fragility between the real economy and financial stress in the US that

generates a risk amplification mechanism deepening economic downturns. Additionally, when both countries are in a high-stress regime, US financial shocks are transmitted more strongly to the Canadian financial system and they are more detrimental for a large number of Canadian macro-financial variables. Finally, simulations suggest that our regime-switching model better captures the economic downturn in Canada during the 2007–2008 financial crisis, compared with a linear model.

Forthcoming Papers

A Q-Theory of Banks

This paper develops a dynamic model of banks that emphasizes the slow recognition of losses in accounting values. This feature explains four key empirical facts about banks: the discrepancy between market and book equity movements, especially during crises, the predictive power of the market-to-book ratio, the stability (instability) of the cross-sectional dispersion of book (market) leverage, and the protracted (immediate) response of book (market) leverage after net-worth losses. We argue that because capital requirements, meant to correct market inefficiencies, are based on delayed book accounts, they should be set jointly with accounting standards. Using an estimated version of the model, we show that faster loan-loss recognition can lead to welfare gains at more relaxed capital standards and can be better-targeted instruments for macroprudential policy.

Unconventional Monetary Policy and Fiscal Policy

We build a tractable New Keynesian model to jointly study four types of monetary and fiscal policy. We find quantitative easing (QE) and tax-financed fiscal transfers or government spending have similar effects on the aggregate economy. Compared with these three policies, conventional monetary policy is more inflationary. QE and transfers have redistribution consequences, whereas others do not. Ricardian equivalence breaks: tax-financed fiscal policy is more stimulative than debt-financed policy. Finally, we study optimal policy coordination and find that adjusting two types of policy instruments can stabilize three targets simultaneously: inflation, the aggregate output gap, and cross-sectional consumption dispersion.

Impacts of Border Carbon Adjustments on the Canadian Economy

This paper examines how border carbon adjustments (BCAs) may address the consequences of uncoordinated global climate action, focusing on the economic impacts for Canada. We investigate these impacts under different BCA design features and by considering a coalition of countries and regions that adopt BCAs. We find that when Canada is within a coalition of BCA-implementing countries including the United States, BCA measures in the form of import tariffs reduce Canada's carbon leakage and boost domestic and foreign competitiveness. We show that these results may change if Canada imposes BCAs on a different set of sectors than the rest of the coalition or includes export rebates and free emissions allowances to firms. When Canada remains in the coalition while the United States does not, we show that Canada's carbon leakage increases, domestic competitiveness weakens, and foreign competitiveness improves.

Identifying and Predicting Nascent High-Growth Firms Using Machine Learning

Predicting which firms will grow quickly and why has been the subject of research studies for many decades. Firms that grow rapidly have the potential to usher in new innovations, products or processes (Kogan et al. 2017), become superstar firms (Haltiwanger et al. 2013) and impact the aggregate labour share (Autor et al. 2020; De Loecker et al. 2020). We explore the use of supervised machine learning techniques to identify a population of nascent high-growth firms using Canadian administrative firm-level data. We apply a suite of supervised machine learning algorithms (elastic net model, random forest and neural net) to determine whether a large set of variables on Canadian firm tax filing financial and employment data, state variables (e.g., industry, geography) and indicators of firm complexity (e.g., multiple industrial activities, foreign ownership) can predict which firms will be high-growth firms over the next three years. The results suggest that the machine learning classifiers can select a sub-population of nascent high-growth firms that includes the majority of actual high-growth firms plus a group of firms that shared similar attributes but failed to attain high-growth status.

The Impact of Unemployment Insurance and Unsecured Credit on Business Cycles

How does unsecured consumer credit impact the effectiveness of unemployment insurance (UI) in insuring households against

idiosyncratic and aggregate risk over the business cycle? The answer depends on whether credit and UI act as complementary or substitutable forms of consumption insurance for households. Using a real business cycle model with frictional labor markets and defaultable debt, I find that unsecured credit amplifies the welfare gains of a policy that extends the duration of UI during recessions. UI extensions mitigate the rise in the default-risk premium of unsecured credit during recessions, which allows households to better smooth consumption over the business cycle.

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.

The Distributional Origins of the Canada-US GDP and Labour Productivity Gaps

Gross domestic product (GDP) per adult in Canada fluctuated between 70% and 90% of that of the United States between 1960 and 2020. Behind this gap lie large, systematic differences in relative incomes across the Canadian and US income distributions. There are small differences in average incomes among lower percentiles of the income distribution while large gaps exist for high-income earners, with larger gaps for business owners and the university-educated. Using data from the World Inequality Database, we find that the top 10% of the income distribution accounts for three-quarters of the gap in GDP per adult between Canada and the United States and up to two-thirds of the measured labour productivity gap. While average hours worked per working-age adult in Canada and the United States were similar in 1970 and 2019, persistent shifts in relative hours worked per adult appear to play a significant role in measured labour productivity differences between 1970 and 2019. Our work suggests that selective emigration of high-ability workers— commonly referred to as brain drain—to the United States may play a significant role in accounting for the gaps in GDP per adult and labour productivity. The

lower level of innovative activities in Canada is consistent with larger income gaps for high-income earners.

Aggregate Fluctuations and the Role of Trade Credit

This paper studies the aggregate implications of trade credit in a dynamic, general equilibrium model where heterogeneous entrepreneurs choose their lending and borrowing of trade credit in the presence of financial frictions. Motivated by empirical evidence, the model shows how trade credit flows from less constrained firms to more constrained ones, both in the cross-sectional distribution and in firms' response to heterogeneous financial shocks. In the face of an aggregate financial shock, entrepreneurs reduce their trade credit lending, further tightening their customers' borrowing constraints, resulting in an amplification of the initial shock. In contrast, when the financial shock only affects some, but not all, entrepreneurs, trade credit facilitates the flow of financing to entrepreneurs in financial distress, thereby mitigating its negative impacts. This mechanism, however, is only effective when the shock affects a sufficiently small number of entrepreneurs.

Staff Working Papers

Estimating the Portfolio-Balance Effects of the Bank of Canada's Government of Canada Bond Purchase Program

I propose a novel dynamic portfolio-balance model of the yield curve for Government of Canada bonds to evaluate the portfolio-balance effects of the Bank of Canada's Government of Canada Bond Purchase Program. My results suggest that this program, launched on March 27, 2020, in response to the COVID-19 pandemic, lowered the weighted average maturity of the Government of Canada's debt by approximately 1.4 years. This in turn reduced Canadian 10-year and 5-year zero-coupon yields by 84 and 52 basis points, respectively

Public and Private Money Creation for Distributed Ledgers: Stablecoins, Tokenized Deposits, or Central Bank Digital Currencies?

This paper explores the implications of introducing digital public and private monies (e.g. tokenized central bank digital currency [CBDC] or tokenized deposits) for stablecoins and illicit crypto transactions. When they pay a high interest rate and guarantee a high degree of anonymity, these tokenized currencies crowd out stablecoins as payment methods in the crypto space. Conversely, with low anonymity and low interest rates, tokenized currencies become collateral, promoting the development of stablecoins. CBDCs

dominate tokenized deposits because a central bank can better economize on scarce collateral assets and internalize the social costs of crypto activities. Prohibiting tokenized deposits may be necessary to implement the optimal CBDC design.

Consumer Credit Regulation and Lender Market Power

We investigate the welfare consequences of consumer credit regulation in a dynamic, heterogeneous-agent model with endogenous lender market power. We incorporate a decentralized credit market with search and incomplete information frictions into an off-the-shelf Eaton–Gersovitz model of consumer credit and default. Lenders post credit offers and borrowers apply for credit. Some borrowers are informed and direct their application toward the lowest offers while others are uninformed and apply randomly. Equilibrium features price dispersion—controlling for a borrower's default risk, both high- and low-cost lending exist. Importantly, the distribution of loan prices and the extent of lenders' market power are disciplined by borrowers' outside options. We calibrate the model to match characteristics of the unsecured consumer credit market, including high-cost options such as payday loans. We use the calibrated model to evaluate interest rate ceilings. In a model with a competitive financial market, ceilings can only harm borrower welfare. In contrast, with lender market power, interest rate ceilings can raise borrower welfare by reducing markups, but that requires households to have some degree of financial illiteracy (lack of information about interest rates).

An Anatomy of Firms' Political Speech

We study the distribution of political speech across U.S. firms. We develop a measure of political engagement based on firms' communications (earning calls, regulatory filings, and social media) by training a large language model to identify statements that contain political opinions. Using these data, we document five facts about firms' political engagement: (1) Political engagement is rare among firms; (2) Political engagement is concentrated among large firms; (3) Firms tend to specialize in specific topics and outlets; (4) Large firms tend to engage in a wider set of topics and outlets; (5) The 2020 surge in firms' political engagement was associated with an increase in the engagement of medium-sized firms and a change in the mix of political topics.

Does Unconventional Monetary and Fiscal Policy Contribute to the COVID Inflation Surge in the US?

We assess whether unconventional monetary and fiscal policy implemented in response to the COVID-19 pandemic in the U.S. contribute to the 2021-2023 inflation surge through the lens of several different empirical methodologies—event studies, vector autoregressions, and regional panel regressions using granular data—and establish a null result. The key economic mechanism works through a disinflationary channel in the Phillips curve while monetary and fiscal stimuli put positive pressure on inflation through the usual demand channel. We illustrate this negative supply-side channel both theoretically and empirically.

From Micro to Macro Hysteresis: Long-Run Effects of Monetary Policy

We develop a Heterogeneous Agent New Keynesian model with a three-state frictional labour market that is consistent with the empirical evidence that (i) low-skilled workers are more exposed to the business cycle, (ii) displacement leads to long-lasting earnings losses, and (iii) unemployment is a stepping stone toward exit from the labor force. In this environment, a transient contractionary monetary policy shock induces a very persistent reduction in labour force participation and labour productivity, especially among workers at the bottom of the skill distribution. Despite the negative hysteresis on output, the model does not give rise to protracted deflation.

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. Based on empirical estimates, we find that the predicted contribution of immigration to US shelter price growth is small, around 2%, because the arrival of immigrants accounts for a small share in local population changes. When we

apply our estimates to population movements across counties within the United States, our model can predict 50% to 60% of observed shelter price growth over the past 30 years.

Monetary Policy Transmission to Small Business Loan Performance: Evidence from Loan-Level Data

This paper analyzes the dynamic and heterogeneous responses of loan performance to a monetary-policy shock using loan-level panel data for small-scale private firms in Canada. Our dataset contains detailed loan characteristics information that allows us to distinguish the effects of the aggregate-demand channel, which affects loan performance through general-equilibrium effects, and the cash-flow channel that directly impacts debt service of firms through variable rates. We find that the effects on loan performance through both channels materialize with a delay and are persistent over time. The peak effect of the cash-flow channel is as large as that of the aggregate-demand channel. Moreover, we investigate whether collateral can reduce the sensitivity of variable-rate loan performance to a policy-rate shock through an ex post disciplinary effect that incentivizes loan repayment by small firms. We find that collateral induces repayment incentives of borrowers relative to unsecured loans but only for ex ante safe loans that are used for investment rather than for other purposes such as working capital. This implies that collateral has a limited impact on reducing financial frictions of small firms.

Monetary Policy Transmission Amid Demand Reallocations

Large swings in the expenditure shares of goods and services at the start of the pandemic have contributed to the inflation surge, posing new challenges for monetary policy. Using a multi-sector model featuring upward labor adjustment frictions, we analyze the transmission of monetary policy during a demand reallocation episode, focussing on sectoral heterogeneity in inflation and output responses. Following an unexpected contractionary monetary policy shock, (constrained) expanding sectors respond primarily by lowering prices, while (unconstrained) contracting sectors reduce output more significantly. At the aggregate level, monetary policy is thus more effective at curbing inflation when a larger proportion of sectors are expanding or expected to be expanding in the near future.

Gender Gaps in Time Use and Entrepreneurship

The prevalence of entrepreneurs, particularly low-productivity non-employers, declines as economies develop. This decline is more

pronounced for women. Relative to men, women are more likely to be entrepreneurs in poor economies but less likely in rich economies. We investigate whether gender gaps in time dedicated to non-market activities, which narrow with development, can account for this pattern. We develop a quantitative framework in which selection into occupations depends on one's ability and time and features gender-specific distortions and social norms around market work. When we calibrate the model to match cross-country data, we find that differences in social norms are almost entirely responsible for the patterns of gender gaps in both time use and entrepreneurship. Through affecting time use and entrepreneurship, social norms account for a substantial part of cross-country differences in output per worker and firm size and have significant welfare implications for women.

How Do Households Respond to Expected Inflation? an Investigation of Transmission Mechanisms

We disentangle the channels through which inflation expectations affect household spending. We conduct a survey featuring hypothetical scenarios that generate a controlled increase in inflation expectations. For 74% of households, current spending is unresponsive, typically due to fixed budget plans or irrelevance of inflation expectations. About 20% of households reduce spending, often citing wealth effects, nominal income rigidity, and inflation hedging. Only 6% increase spending, mostly due to intertemporal substitution or stockpiling. Respondents who expect other economic variables to deteriorate are more likely to reduce spending. Our findings suggest manipulating inflation expectations to boost consumer spending may not be an effective policy tool.

Preferences, Monetary Policy and Household Inflation

Household inflation can be decomposed into three terms that reflect nominal expenditure, real quantities and household preferences, using the money pump proposed by Echenique, Lee and Shum (2011). I quantify the importance of changes in household preferences on household inflation rates using 11 years of scanner data for 11,000 US households. I then analyze the effect of monetary policy on household inflation using the monetary policy shocks from Nakamura and Steinsson (2018). I find that monetary policy news shocks affect household inflation through the expenditure and preferences channels for 12 months from the date of the shocks, and that federal funds rate shocks affect inflation through the same channels at a horizon of 13–24 months. The results suggest that

changes in household preferences are an important driver of inflation dynamics at the household level.

Is This Normal? the Cost of Assuming that Derivatives Have Normal Returns

Derivatives exchanges often determine collateral requirements, which are fundamental to market safety, with dated risk models assuming normal returns. However, derivatives returns are heavy-tailed, which leads to the systematic under-collection of collateral (margin). This paper uses extreme value theory (EVT) to evaluate the cost of this margin inadequacy to market participants in the event of default. I find that the Canadian futures market was under-margined by about $1.6 billion during the Great Financial Crisis, and that the default of the highest-impact participant generates a cost of up to $302 million to be absorbed by surviving participants. I show that this cost can consume the market's entire default fund and result in costly risk mutualization. I advocate for the adoption of EVT as a benchmarking tool and argue that the regulation of exchanges should be revised for financial products with heavy tails.

The (Mis)Allocation of Corporate News

This paper studies how the distribution of information supply by the news media affects the macroeconomy. We document three connected facts about the media's reporting of firm news. First, media coverage is highly concentrated, focusing particularly on the largest firms in the economy. Second, firms' equity financing and investment increase after media coverage. Third, these equity and investment responses are largest among small, rarely covered firms. We then develop a heterogeneous-firm model with a media sector that matches these facts. Asymmetric information between firms and investors leads to financial frictions that constrain firms' financing and investment. The media's role in alleviating information frictions is limited by their focus on large and financially unconstrained firms. Reallocating news coverage, or allowing firms to buy coverage from outlets in a competitive market, leads to substantial increases in aggregate investment and output. The aggregate effects of media coverage therefore depend crucially on how that coverage is allocated.

Familiarity with Crypto and Financial Concepts: Cryptoasset Owners, Non-Owners, and Gender Differences

In the rapidly evolving landscape of digital asset markets, measuring cryptoasset knowledge alongside financial knowledge enhances our

understanding of individuals' decisions to purchase cryptoassets. Using microdata from the Bank of Canada's Bitcoin Omnibus Survey, we measure familiarity with crypto concepts using a set of three questions covering basic aspects of Bitcoin. Familiarity with financial concepts is measured using a set of three questions covering basic aspects of conventional finance. We also consider gender differences across these measures. A novel aspect of this paper is an empirical joint analysis that allows us to consider the interrelationship between these two measures of crypto and financial knowledge.

The Distributional Origins of the Canada-US GDP and Labour Productivity Gaps

Gross domestic product (GDP) per adult in Canada fluctuated between 70% and 90% of that of the United States between 1960 and 2020. Behind this gap lie large, systematic differences in relative incomes across the Canadian and US income distributions. There are small differences in average incomes among lower percentiles of the income distribution while large gaps exist for high-income earners, with larger gaps for business owners and the university-educated. Using data from the World Inequality Database, we find that the top 10% of the income distribution accounts for three-quarters of the gap in GDP per adult between Canada and the United States and up to two-thirds of the measured labour productivity gap. While average hours worked per working-age adult in Canada and the United States were similar in 1970 and 2019, persistent shifts in relative hours worked per adult appear to play a significant role in measured labour productivity differences between 1970 and 2019. Our work suggests that selective emigration of high-ability workers—commonly referred to as brain drain—to the United States may play a signifcant role in accounting for the gaps in GDP per adult and labour productivity. The lower level of innovative activities in Canada is consistent with larger income gaps for high-income earners.

Consumer Search, Productivity Heterogeneity, Prices, Markups, and Pass-Through: Theory and Estimation

We develop and estimate a search model in which identical consumers trade with price-setting firms that differ in productivity. In the model, equilibrium distributions of both prices and markups are non-degenerate and continuous with a firm's price decreasing as its productivity increases. Variation in markups across firms is more complicated and depends on the search process and the distribution of productivity, both of which are estimated using firm-level data on retail industries in Canada. We use the estimated model to

characterize the qualitative and quantitative differences in prices and markups across firms. These differences stem from firm-level variation in demand elasticities driven by productivity heterogeneity and by imperfect information about prices. Additionally, we derive analytical expressions to determine how individual firm prices and markups respond to changes in cost and demand. This allows us to empirically analyze the heterogeneity in firms' pass-through of cost and demand shocks to prices and markups. Our findings reveal substantial heterogeneity in pass-through across firms, highlighting the distributional impact of shocks across consumers purchasing at different points of the price distribution. Finally, our analysis underscores the importance of accounting for individual firm price and markup adjustments to fully understand pass-through to average prices.

Bouncing Back: How Mothballing Curbs Prices

We investigate the macroeconomic impacts of mothballed businesses—those that closed temporarily—on sectoral equilibrium prices after a negative demand shock. First, we introduce a new establishment-level dataset derived from Google Places. We confirm the importance of temporary closures during the COVID-19 pandemic. Data on establishment reviews also suggests that preventing productive businesses from permanently exiting could support employment. Second, we embed these findings into a model of heterogeneous firm dynamics. By maintaining productive capacity during downturns, temporary closures initially support employment and subsequently reduce price pressures. Our results suggest that pandemic fiscal support for temporary closures may have eased inflationary pressures.

CBDC in the Market for Payments at the Point of Sale: Equilibrium Impact and Incumbent Responses

We investigate the introduction of a central bank digital currency (CBDC) into the market for payments. Focusing on the point of sale, we develop and estimate a structural model of consumer adoption, merchant acceptance and usage decisions. We counterfactually simulate the introduction of a CBDC, considering a version with debit-like characteristics and one encompassing the best of cash and debit, and characterize outcomes for a range of potential adoption frictions. We show that, in the absence of adoption frictions, CBDC has the potential for material consumer adoption and merchant acceptance, along with moderate usage at the point of sale. However, modest adoption frictions substantially reduce outcomes along all three

dimensions. Incumbent responses required to restore pre-CBDC market shares are moderate to small and further reduce the market penetration of CBDC. Overall, this implies that an introduction of CBDC into the market for payments is by no means guaranteed to be successful.

Staff Discussion Papers

Digital Payments: A Framework for Inclusive Design

We explore how digital payments, which dominate the payment landscape in Canada, can be made more cognitively accessible. In particular, we are focused on removing cognitive barriers present in many digital interfaces and products. We propose an inclusive approach since involving people with cognitive disabilities in design, testing, and refinement is crucial.

The proposed framework centers on system learnability and user workload as the two key measures of cognitive accessibility in digital payment and banking interfaces. System learnability is determined by measuring first use learnability, steepness of the learning curve and efficiency of the ultimate plateau. Workload is determined by the sub-measures mental demand, temporal demand, frustration and performance.

The framework is broadly applicable to digital and electronic payment methods. We develop and test a prototype interface for voice payments, which successfully demonstrates that the framework provides an effective iterative design approach to enhance cognitive accessibility and usability.

The Consumer Value Proposition for a Hypothetical Digital Canadian Dollar

Research into a hypothetical Digital Canadian Dollar has largely focused on public policy, financial technology innovations and public opinion. In this study, we explore the consumer value proposition of a hypothetical Digital Canadian Dollar, considerations for its adoption and the users who would benefit most from this potential new payment method. We employ a design-thinking consultation methodology, allowing participants to interact with research prototypes of increasing complexity to reveal user preferences, constraints, and adoption influences. Qualitative insights are corroborated using quantitative, large-population surveys and

contrasted with results from a Bank of Canada open online public consultation.

We find that most participants would support the issuance of a hypothetical Digital Canadian Dollar, and we identify the segments most likely to be early adopters. However, broad early adoption is unlikely given that available payment methods meet the needs of most users. Financially vulnerable segments often have the most to gain from this new payment method but are most resistant to adoption. Important considerations for appeal and adoption potential include universal merchant acceptance, low costs, easy access, simplified online payments, shared payment features, budgeting tools, and customizable security and privacy settings. Participants cited these features far more often than offline functionality and the ability to make anonymous payments. Our results also show that cash remains an important method of payment and that certain groups may strongly resist a Digital Dollar if they conflate its launch with the end of cash issuance. We find a hypothetical Digital Canadian Dollar requires the support of an information campaign to be understood, valued and adopted.

Seasonal Adjustment of Weekly Data

This paper summarizes and assesses several of the most popular methods to seasonally adjust weekly data. The industry standard approach, known as X-13ARIMA-SEATS, is suitable only for monthly or quarterly data. Given the increased availability and promise of non-traditional data at higher frequencies, alternative approaches are required to extract relevant signals for monitoring and analysis. This paper reviews four such methods for high-frequency seasonal adjustment. We find that tuning the parameters of each method helps deliver a properly adjusted series. We optimize using a grid search and test for residual seasonality in each series. While no method works perfectly for every series, some methods are generally effective at removing seasonality in weekly data, despite the increased difficulty of accounting for the shock of the COVID-19 pandemic. Because seasonally adjusting high-frequency data is typically a difficult task, we recommend closely inspecting each series and comparing results from multiple methods whenever possible.

Interaction of Macroprudential and Monetary Policies: Practice Ahead of Theory

This paper examines how monetary and macroprudential policies interact and possibly complement each other in achieving their

respective price and financial stability objectives. We first review the Canadian experience of housing market cycles and highlight the need to coordinate the two sets of policies. Then, to deepen our understanding of policy interactions, we discuss current research work being done at the Bank of Canada and recent studies in the literature. Finally, for central bank and academic researchers, we emphasize remaining gaps in developing a modelling framework that unifies both price and financial stability objectives with explicit interactions between monetary and macroprudential policies.

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