Bank of Canada Monthly Research Update

September 2020

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

PUBLISHED PAPERS

In-Press

in't Veld, Daan & van der Leij, Marco & Hommes, Cars, "The formation of a core-periphery structure in heterogeneous financial networks", Journal of Economic Dynamics and Control, Vol 119: 103972, October 2020

Forthcoming

Schroth, Josef, "On the Distributional Effects of Bank Bailouts", Review of Economic Dynamics

Handel, Danielle V. & Ho, Anson T.Y. & Huynh, Kim P. & Jacho-Chavez, David T. & Rea, Carson H. , "Econometrics Pedagogy and Cloud Computing: Training the Next Generation of Economists and Data Scientists", Journal of Econometric Methods

Henry, Christopher S & Huynh, Kim P & Nicholls, Gradon & Nicholson, Mitchell W, "Benchmarking Bitcoin Adoption in Canada: Awareness, Ownership and Usage in 2018", Ledger

van Oordt, Maarten, "Calibrating the Magnitude of the Countercyclical Capital Buffer Using Market-Based Stress Tests", Journal of Money, Credit and Banking

Letendre, Marc-André & Obaid, Sabreena, "Emerging economy business cycles: Interest rate shocks vs trend shocks", Economic Modelling

Raykov, Radoslav, "Systemic Risk and Collateral Adequacy: Evidence from the Futures Market", Journal of Financial and Quantitative Analysis

Raykov, Radoslav & Silva-Buston, Consuelo, "Holding Affiliation and Bank Stability: Evidence from the US Banking Sector", Journal of Corporate Finance

Blattner, Tobias & Swarbrick, Jonathan, "Monetary policy and cross-border interbank market fragmentation: lessons from the crisis", B.E. Journal of Macroeconomics

STAFF WORKING PAPERS

Bulusu, Narayan, "Why Do Central Banks Make Public Announcements of Open Market Operations?", Bank of Canada Staff Working Paper 2020-35

Caucutt, Elizabeth & Lochner, Lance & Mullins, Joseph & Park, Youngmin, "Child Skill Production: Accounting for Parental and Market-Based Time and Goods Investments", Bank of Canada Staff Working Paper 2020-36

Kosse, Anneke & Lu, Zhentong & Xerri, Gabriel, "Predicting Payment Migration in Canada", Bank of Canada Staff Working Paper 2020-37

Sadaba, Barbara & Vujič, Sunčica & Maier, Sofia, "Cyclicality of Schooling: New Evidence from Unobserved Components Models", Bank of Canada Staff Working Paper 2020-38

Benmoussa, Amor Aniss & Ellwanger, Reinhard & Snudden, Stephen, "The New Benchmark for Forecasts of the Real Price of Crude Oil", Bank of Canada Staff Working Paper 2020-39

Sutherland, Christopher S., "Forward Guidance and Expectation Formation: A Narrative Approach", Bank of Canada Staff Working Paper 2020-40

Feinstein, Zachary & Halaj, Grzegor, "Interbank Asset-Liability Networks with Fire Sale Management", Bank of Canada Staff Working Paper 2020-41

STAFF DISCUSSION PAPERS

Huynh, Kim & Nicholls, Gradon & Nicholson, Mitchell "2019 Cash Alternative Survey Results", Bank of Canada Staff Discussion Paper 2020-8

Rivadeneyra, Francisco & Zhang, Nellie, "Liquidity Usage and Payment Delay Estimates of the New Canadian High Value Payments System", Bank of Canada Discussion Paper 2020-9

ABSTRACTS

The formation of a core-periphery structure in heterogeneous financial networks

Recent empirical evidence suggests that financial networks exhibit a core-periphery network structure. This paper aims at giving an explanation for the emergence of such a structure using network formation theory. We propose a general, stylized model of the interbank trading market, in which banks compete for intermediation benefits. Focusing on the role of bank heterogeneity, we find that a core-periphery network cannot be unilaterally stable when banks are homogeneous. A core-periphery network structure can form endogenously, however, if we allow for heterogeneity among banks in size. Moreover, size heterogeneity may arise endogenously if payoffs feed back into bank size.

On the Distributional Effects of Bank Bailouts

This paper studies distributional consequences of equity injections that are funded with financial-sector levies. In the model economy, financial intermediation supports both productive investment and individual consumption smoothing, subject to an equity requirement. When intermediary equity is low, then an equity injection involves a trade-off between increasing credit supply immediately and distortive levies that reduce credit supply in the future. I find that equity injections redistribute from poor to wealthy households, even though average welfare increases. While wealthy savers benefit greatly from an increased return on savings, poor households suffer from lower future wages.

Econometrics Pedagogy and Cloud Computing: Training the Next Generation of Economists and Data Scientists

As cloud computing services are becoming mainstream and the tool of choice of many private companies, universities, and government agencies, there is an industry need for students in economics to acquire the associated skills earlier on in their undergraduate training in higher education institutions. This paper describes how industry standards such as version control, cloud computing services, as well as open-source web applications for data science can be taught in most undergraduate programs in economics. This framework re-defines the `computer lab' component in econometric instruction from the traditional idea of a physical space on campus, where students

meet synchronously, to a `virtual lab' with servers hosted on the internet (also known as the cloud) that students and instructors can connect from anywhere. Using their own personal computing equipment, students and instructors can simulate a lab setting during a synchronous lecture on a video conference platform, or connect to the cloud service asynchronously across different time zones to complete and submit assignments.

Benchmarking Bitcoin Adoption in Canada: Awareness, Ownership and Usage in 2018

The Bank of Canada commissioned the Bitcoin Omnibus Survey in 2016 to monitor trends in the adoption and use of Bitcoin and other cryptoassets (Henry, Huynh and Nicholls 2018, 2019). This report presents findings from the latest iteration of the survey, which was conducted in 2018. We find that between 2016 and 2018 the share of Canadians who were aware of Bitcoin increased from 62 percent to 89 percent and those who owned Bitcoin increased from 3 percent to 5 percent. However, the share of past owners also increased, suggesting an influx of Bitcoin owners who subsequently divested after the steep rise of prices in 2017. The main reason for owning Bitcoin remains speculation, though this share decreased slightly since 2017. On the other hand, the share of Canadians who reported using Bitcoin for transactions a few times a month or more increased. Finally, we discuss how Bitcoin adopters differ from overall Canadians with respect to their financial literacy, preferences over payment methods, and cash holdings.

Calibrating the Magnitude of the Countercyclical Capital Buffer Using Market-Based Stress Tests

This paper proposes a novel methodology to calibrate the magnitude of the countercyclical capital buffer (CCyB) using market-based stress tests. The macroprudential authority in our paper aims to contain the possibility of a breach of a minimum capital ratio in the event of a severe system-wide shock within a certain permissible failure probability. We apply the methodology by stress-testing major banks in six advanced economies on a quarterly basis over a period of 27 years. The estimates suggest that the cap on the CCyB should not be less than around 1.7 percent of total assets. Its potential normal-times level is estimated at approximately 0.8 percent of total assets.

Emerging economy business cycles: Interest rate shocks vs trend shocks

The recent literature studying the source of business cycles in emerging market economies (EMEs) has debated the relative importance of productivity trend shocks versus interest rate shocks coupled with financial frictions. The studies in which an important role is assigned to interest rate shocks do not force their models to match the historical paths of the world or country interest rate. We show that this leads to poorly identified interest rate shocks and inaccurate measures of contributions of shocks to EME business cycles. To address this issue, we estimate a small open economy model for Argentina and Mexico using Bayesian methods where the world and country interest rate series in the model are forced to match their data counterparts. This estimation strategy results in larger variations in interest rate shock and, therefore, shifts explanatory power away from trend shocks towards interest rate shocks, although both shocks remain important.

Systemic Risk and Collateral Adequacy: Evidence from the Futures Market

Conventional collateral requirements are highly conservative but are not explicitly designed to deal with systemic risk. This paper explores the adequacy of conventional collateral levels against systemic risk in the Canadian futures market during the 2008 crisis. Our results show that conventional collateral levels adequately absorb crisis-level systemic risk, even allowing for an implausibly large margin of error. However, this occurs at the expense of unequal buffering of systemic risk across banks. We document that the largest systemic risk contributors are buffered relatively less than the rest and that there is a large cross-country difference in the behavior of US and Canadian institutions. Nonetheless, even this does not result in meaningful risk spillovers. The maximum expected market shortfall in excess of collateral comes up to at most 1% of the banks' market capitalization, and hence the added systemic risk does not exceed the effect of a 1% downward stock price move.

Holding Affiliation and Bank Stability: Evidence from the US Banking Sector

Is affiliation with a multibank holding company beneficial for bank stability? We revisit this question by examining the response of market-based risk measures of independent and multibank-holding-

company banks to an exogenous negative shock (the 2005 US hurricane season). We find evidence consistent with bank holding companies playing an important role in mitigating negative shocks, with affiliates of more liquid holdings remaining more stable in terms of both systemic and individual stability. We also conduct an event study showing that markets perceive multibank-holding-company banks' dynamics after the shock as value-enhancing.

Monetary policy and cross-border interbank market fragmentation: lessons from the crisis

We present a two-country model featuring risky lending and cross-border interbank market frictions. We find that (i) the strength of the financial accelerator, when applied to banks operating under uncertainty in an interbank market, will critically depend on the economic and financial structure of the economy; (ii) adverse shocks to the real economy can be the source of banking crisis, causing an increase in interbank funding costs, aggravating the initial shock; and (iii) asset purchases and central bank long-term refinancing operations can be effective substitutes for, or supplements to, conventional monetary policy.

Why Do Central Banks Make Public Announcements of Open Market Operations?

Central banks make public the results of open market operations (OMOs), which they use to adjust the liquidity available to the financial system to maintain the short-term borrowing rate in the range compatible with achieving their monetary policy objectives. This paper shows that such announcements are costly because they moderate the impact of changes in supply achieved through OMOs. Nevertheless, communication of OMOs is desirable because it improves the transparency of the funding market, which makes the price of liquidity—a key input into economic decision making—more reflective of underlying demand and supply of liquidity.

Child Skill Production: Accounting for Parental and Market-Based Time and Goods Investments

This paper studies the multidimensional nature of investments in children within a dynamic framework. In particular, we examine the roles of parental time investments, purchased home goods/services inputs, and market-based child care services. We first document strong increases in total investment expenditures by maternal education; yet expenditure shares, which skew heavily towards

parental time, vary little with parental schooling. Second, we develop an intergenerational lifecycle model with multiple child investment inputs to study these patterns and the impacts of policies that alter the prices of different inputs. We analytically characterize investment behavior, focusing on the substitutability of different investment inputs and the way parental skills affect the productivity of family-based inputs. Third, we develop an estimation strategy that exploits intratemporal optimality conditions based on relative demand to estimate substitutability between inputs, the relative productivity of different inputs, and the role played by parental education. This approach requires no assumptions about the dynamics of skill investment, preferences, or credit markets. We also account for mismeasured inputs and wages, as well as unobserved heterogeneity in parenting skills. We further show how noisy measures of child achievement (measured several years apart) can also be incorporated in a generalized method of moments approach to additionally identify the dynamics of skill accumulation. Fourth, we use data from the Child Development Supplement of the Panel Study of Income Dynamics to estimate the skill production technology for children ages 12 and younger. Our estimates suggest complementarity between parental time and home goods/services inputs as well as between these family-based inputs and market-based child care, with elasticities of substitution ranging from 0.2 to 0.5. We find no systematic effects of parental education on the relative productivity of parental time and other home inputs. Finally, we use counterfactual simulations to explore the extent and sources of variation in investments across families, as well as investment responses to changes in input prices. We find that variation in prices explains 48% of the overall variance in investment expenditures, and differences in wages explain more than half of the investment expenditure gap between college-educated and non-college-educated parents. We further show that accounting for the degree of input complementarity implied by our estimates has important implications for the responses of individual inputs to any price change and for the responses in total investments and skill accumulation to large (but not small) price changes.

Predicting Payment Migration in Canada

Canada currently has two core payment systems for processing funds transfers between financial institutions: the Large Value Transfer System (LVTS) and the Automated Clearing Settlement System (ACSS). These systems will be replaced over the next years by three new systems: Lynx, the Settlement Optimization Engine (SOE) and

the Real-Time Rail (RTR). We employ historical LVTS and ACSS data to predict the demand for the future systems. The results show that small-value LVTS payments will likely migrate to SOE. Also, in the short run, about CAD 10,000 billion of LVTS and ACSS payments (per year) is anticipated to migrate to the RTR if not subject to maximum transaction values. These migration patterns raise important policy questions, such as whether the future systems should be subject to value caps and/or higher collateral requirements.

Cyclicality of Schooling: New Evidence from Unobserved Components Models

In this paper, we present new evidence from unobserved components time-series models on the cyclical behavior of the demand for education relative to economic cycles. We investigate the cyclical properties of schooling decisions, the time-varying exposure of these decisions to changes in the state of the macro economy, and the relative importance of shocks that drive economic fluctuations on the demand for schooling. To this end, we perform a trend-cycle decomposition of enrollment ratios for the United Kingdom over the period 1995Q1 to 2019Q4. We first establish the presence of a persistent cyclical process in the demand for schooling independent of a slow-moving trend. We then show that the direction of the effect of the economic cycle on schooling decisions (i.e., pro-cyclical, counter-cyclical, a-cyclical) is largely time-dependent, together with the degree of synchronization. Importantly, we find that changes in the demand for schooling are largely explained by economic cycles. We note, however, that the effects are different for different subsamples based on demographic characteristics.

The New Benchmark for Forecasts of the Real Price of Crude Oil

We propose a new no-change benchmark to evaluate forecasts of series that are temporally aggregated. The new benchmark is the last high-frequency observation and reflects the null hypothesis that the underlying series, rather than the aggregated series, is unpredictable. Under the random walk null hypothesis, using the last high-frequency observation improves the mean squared prediction errors of the no-change forecast constructed from average monthly or quarterly data by up to 45 percent. We apply this insight to forecasts of the real price of crude oil and show that a new benchmark that relies on monthly closing prices dominates the conventional no-change forecast in terms of forecast accuracy. Although model-based forecasts also

improve when models are estimated using closing prices, only the futures-based forecast significantly outperforms the new benchmark. Introducing a more suitable benchmark changes the assessments of different forecasting approaches and of the general predictability of real oil prices.

Forward Guidance and Expectation Formation: A Narrative Approach

How forward guidance influences expectations is not yet fully understood. To study this issue, I construct central bank data that includes forward guidance and its attributes, central bank projections, and quantitative easing, which I combine with survey data. I find that, in response to a change in forward guidance, forecasters revise their interest rate forecasts in the intended direction by five basis points on average. The effect is not attributable to central bank information effects. Instead, when forming rate expectations, forecasters place full weight on their own inflation and growth forecasts and zero weight on those of the central bank.

Interbank Asset-Liability Networks with Fire Sale Management

Interconnectedness is an inherent feature of the modern financial system. While it contributes to efficiency of financial services, it also creates structural vulnerabilities: pernicious shock transmission and amplification impacting banks' capitalization. This has recently been seen during the Global Financial Crisis. Post-crisis reforms addressed many of the causes of the problems. But contagion effects may not be fully eliminated. One reason for this may be related to financial institutions' incentives and strategic behaviours. We propose a model to study contagion effects in a banking system, capturing network effects of direct exposures and indirect effects of market behaviour that may impact asset valuation. By doing so, we can embed a well-established fire sale channel into our model. Unlike in related literature, we relax an assumption of an exogenous pecking order of how banks would sell their assets. Instead, banks act rationally in our model; they optimally construct a portfolio subject to budget constraints to raise cash to satisfy creditors (interbank and external). We assume that the guiding principle for banks is to maximize risk-adjusted returns generated by their balance sheets. We parameterize the theoretical model with confidential supervisory data for banks in Canada under the supervision of the Office of the Superintendent of Financial Institutions, which allows us to run simulations of bank valuations and asset prices under a set of stress scenarios.

2019 Cash Alternative Survey Results

The role of cash in Canadians' lives has evolved over the past decade. During this period, two diverging trends have emerged in Canada: the use of cash for transactions at the point of sale has declined, but overall demand for cash has increased. The 2019 Cash Alternative Survey was designed to study these trends and update the Bank of Canada's understanding of Canadians' use of cash. We asked Canadians about their cash holdings, planned future use of cash and views on how they would be affected if cash were to disappear. In addition to declining cash use, the emergence of privately issued digital currencies has motivated many central banks to conduct research into central bank digital currencies (CBDCs). We contribute to the Bank of Canada's research on CBDC by monitoring Canadians' use of cash and their adoption of digital payment methods. We find that Canadians' cash holdings are stable and the adoption of cryptocurrencies remains limited and concentrated in a few sub-demographics. Moreover, we find that few Canadians plan to stop using cash entirely and that a considerable share of them would find the disappearance of cash problematic.

Liquidity Usage and Payment Delay Estimates of the New Canadian High Value Payments System

This paper presents simulation results for Canada's new large-value payments system: Lynx. We simulate the settlement process of Lynx using a large sample of payments observed in the current system (LVTS), taking the initial level of liquidity as given. We calculate the resulting liquidity usage, the payment delay and the shares of payments settled on a gross or net basis. The behaviour of participants (timing of payment submission) is assumed to remain the same as in LVTS. With an initial liquidity comparable to the collateral amount currently pledged in LVTS ($14.6 billion), Lynx FIFO Bypass would result in 28 minutes of average weighted delay and $17.3 billion of liquidity usage (the sum of intraday maximum net debit positions). Given this configuration, on average, $1.9 billion would be needed to clear nonurgent payments delayed until the end of the day, equivalent to 4.1 percent of payment value and 0.06 percent of volume. Doubling the amount of initial liquidity (to $29.3 billion) would result in 12 minutes of weighted delay. This basic configuration of Lynx requires a higher level of liquidity than LVTS and a plain-vanilla RTGS with pooled liquidity.

UPCOMING EVENTS

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

Workshop on the Economics of Digital Currencies
Organizer: Jonathan Chiu (FBD)
Dates: 7 October 2020 – 9 October 2020

Raquel Fernández (New York University)
Organizer: CEA/INT EFR Speaker Series
Date: 9 October 2020

Nicholas Bloom (Stanford University)
Organizer: CEA/INT EFR Speaker Series
Date: 16 October 2020

Òscar Jordà (Federal Reserve Bank of San Francisco & University of California, Davis)
Organizer: FMD / FSD EFR Seminar Series
Date: 22 October 2020

Leonardo Melosi (Chicago Fed)
Organizer: EFR CEA/INT Speaker Series
Date: 6 November 2020