BANK OF CANADA
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# Bank of Canada
# Monthly Research Update

May 2019

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

Arifovic, Jasmina & Hommes, Cars & Salle, Isabelle, "Learning to believe in simple equilibria in a complex OLG economy - evidence from the lab", Journal of Economic Theory (2019).

Bailliu, Jeannine & Han, Xinfen & Kruger, Mark & Liu, Yu-Hsien & Thanabalasingam, Sri, "Can media and text analytics provide insights into labour market conditions in China?", International Journal of Forecasting (2019).

Witmer, Jonathan "Strategic complementarities and money market fund liquidity management", Journal of Financial Intermediation, Vol 38: 58-68, April 2019.

## Forthcoming

Chen, Heng & Fan, Yanqin, "Identification and Wavelet Estimation of Weighted ATE in a Class of Switching Regime Models", Journal of Econometrics

Fontaine, Jean-Sébastien & Nolin, Guillaume, "Measuring Limits of Arbitrage in Fixed-Income Markets", Journal of Financial Research

# STAFF WORKING PAPERS

Mayer, Thierry & Steingress, Walter, "Estimating the Effect of Exchange Rate Changes on Total Exports", Bank of Canada Staff Working Paper 2019-17

Garratt, Rod & van Oordt, Maarten, "Entrepreneurial Incentives and the Role of Initial Coin Offerings", Bank of Canada Staff Working Paper 2019-18

Imura, Yuko, "Reassessing Trade Barriers with Global Value Chains", Bank of Canada Staff Working Paper 2019-19

Chiu, Jonathan & Davoodalhosseini, Mohammad & Jiang, Janet Hua & Zhu, Yu, "Central Bank Digital Currency and Banking", Bank of Canada Staff Working Paper 2019-20

# ABSTRACTS

## *Learning to believe in simple equilibria in a complex OLG economy - evidence from the lab*

We set up a laboratory experiment to empirically investigate equilibrium selection in a complex economic environment. We use the overlapping-generation model of Grandmont (1985), which displays multiple perfect-foresight equilibria, including periodic and chaotic dynamics. The equilibrium selection problem is not solved under learning, as each outcome is predicted by at least one existing learning theory. We find that subjects in the lab systematically coordinate on an equilibrium despite the complexity of the environment. Coordination only happens on simple equilibria, in this case the steady state or the period-two cycle, a result which is predicted only if the subjects follow simple learning rules. This suggests that relevant perfect-foresight equilibria should be robust to the use of simple rules.

## *Can media and text analytics provide insights into labour market conditions in China?*

The official Chinese labour market indicators have been seen as problematic given their small cyclical movement and their only partial capture of the labour force. In our paper, we build a monthly Chinese labour market conditions index (LMCI) using text analytics applied to Mainland Chinese-language newspapers over the period from 2003 to 2017. We use a supervised machine learning approach by training a support vector machine classification model.
The information content and the forecast ability of our LMCI are tested against official labour market activity measures in wage and credit growth estimations. Surprisingly, one of our findings is that the much-maligned official labour market indicators do contain information. However, their information content is not robust and, in many cases, our LMCI can provide forecasts that are significantly superior. Moreover, regional disaggregation of the LMCI illustrates that labour conditions in the export-oriented coastal region are sensitive to export growth, while those in inland regions are not. This suggests that text analytics can, indeed, be used to extract useful labour market information from Chinese newspaper articles.

## *Strategic complementarities and money market fund liquidity management*

I use a unique institutional feature of money market funds to identify whether funds hold additional liquidity to guard against and prevent potential investor runs. Specifically, some funds are used as a cash management vehicle for related entities, such as other funds in the fund family. These “internal” funds should experience less outflows during market stress, and should thus have less need to hold this additional liquidity. Indeed, these “internal” prime money market funds do hold lower liquidity than other prime funds. This effect is most pronounced at quarter ends, when there is an exogenous reduction in cash demand from non-US bank dealers.

### *Identification and Wavelet Estimation of Weighted ATE in a Class of Switching Regime Models*

This paper studies identification, estimation, and inference of a weighted average treatment effect (W-ATE) parameter in a class of switching regime models, where the agent's selection of treatment is affected by either a discontinuous or kink incentive assignment mechanism and some unobservable characteristic. For each assignment mechanism, we (i) establish identification and propose a local wavelet estimator of the W-ATE; (ii) establish asymptotic properties of the local wavelet estimator including optimal convergence rate and asymptotic normality; and (iii) investigate the finite sample performance of the local wavelet estimators and compare them with local polynomial estimators via an extensive simulation study. We also propose an identification-robust wavelet estimator of the W-ATE.

### *Measuring Limits of Arbitrage in Fixed-Income Markets*

We use relative value to measure limits to arbitrage in fixed-income markets. Relative value captures apparent deviations from no-arbitrage relationships. It is simple, intuitive and can be computed model-free for any bond. A pseudo-trading strategy based on relative value generates higher returns than one based on the well-known noise measure. The relative value is therefore a better proxy for limits to arbitrage. We construct relative value indices for the US, UK, Japan, Germany, Italy, France, Switzerland and Canada. Limits to arbitrage increase with the scarcity of capital: we find that each index is correlated with local volatility and funding costs. Limits to arbitrage also exhibit strong commonality across countries, consistent with the international mobility of capital. The relative value indices are updated regularly and available publicly.

### *Estimating the Effect of Exchange Rate Changes on Total Exports*

This paper shows that real effective exchange rate (REER) regressions, the standard approach for estimating the response of aggregate exports to exchange rate changes, imply biased estimates of the underlying elasticities. We provide a new aggregate regression specification that is consistent with bilateral trade flows micro-founded by the gravity equation. This theory-consistent aggregation leads to unbiased estimates when prices are set in an international currency as postulated by the dominant currency paradigm. We use Monte-Carlo simulations to compare elasticity estimates based on this new "ideal-REER" regression against typical regression specifications found in the REER literature. The results show that the biases are small (around 1 percent) for the exchange rate and large (around 10 percent) for the demand elasticity. We find empirical support for this prediction from annual trade flow data. The difference between elasticities estimated on the bilateral and aggregate levels reduces significantly when applying an ideal-REER regression rather than a standard REER approach.

### *Entrepreneurial Incentives and the Role of Initial Coin Offerings*

Initial coin offerings (ICOs) are a new mode of financing start-ups that saw an explosion in popularity in 2017 but declined in popularity in the second half of 2018 as regulatory pressure, instances of fraud and reports of poor performance began to undermine their reputation. We examine whether ICOs are a passing fad or a worthwhile form of financing with beneficial economic properties. We do so by examining how financing a start-up through an ICO changes the incentives of an entrepreneur relative to debt and venture capital financing. Depending on market characteristics, an ICO can result in a better or worse alignment of the interests of the entrepreneur and the investors compared with conventional modes of financing. Notably, an ICO can be the only form of financing that induces optimal effort and hence maximizes the net present value of the start-up, and there are projects that should not take place at all unless they can be financed through an ICO.

### *Reassessing Trade Barriers with Global Value Chains*

"This paper provides a systematic, quantitative analysis of the short-run and long-run effects of various trade-restricting policies in the presence of global value chains and multinational production. Using a two-country dynamic stochastic general equilibrium model with

endogenous firm entry and exit in both exporting and multinational production, I compare the effects of (i) tariffs on final-good imports, (ii) tariffs on intermediate-input imports, and (iii) barriers to accessing foreign markets.

I show that, in the long run, all three policies lead to a recession in both countries, but the relative effects on the GDP of the two countries vary across policies. At the firm level, less productive exporters exit from the destination market while the most productive few find it profitable to locate production in the foreign country as multinationals, thereby partially recovering the loss from exporting. In the short run, the dynamics differ across policies and from their long-run outcomes. Final-good tariffs and market-access barriers lead to a temporary production boom in the policy-imposing country, while intermediate-input tariffs result in an immediate recession in both countries. The latter also discourages multinational operation over the short run when the input tariffs dominate the declining costs of labor and capital."

### *Central Bank Digital Currency and Banking*

"Many central banks are considering whether to issue a new form of electronic money that would be accessible to the public. This new form is usually called a central bank digital currency (CBDC). Issuing a CBDC would have implications on the financial system and more broadly on the wider economy.

The effects of a CBDC on the banking sector, output and welfare depend crucially on the level of competition in the market for bank deposits. We show that when banks have no market power, issuing a deposit-like CBDC (that people can use like a debit card in transactions) would crowd out private banking. It would shift deposits away from the banking system, reducing bank lending.

However, in a more realistic scenario, when banks have market power in the deposit market, issuing a deposit-like CBDC with a proper interest rate would encourage banks to pay higher interest or offer better services to keep their customers. They can do so because they earn a positive profit. As a result, banks would attract more deposits and extend more loans. In this case, issuing a CBDC would not necessarily crowd out private banking. In fact, the CBDC would serve as an outside option for households, thus limiting banks' market power, and improve the efficiency of bank intermediation.

We show quantitatively that the effects of a CBDC on lending, deposits, output and welfare can be sizable. We also analyze how different designs of a CBDC affect our results, including whether the CBDC is deposit-like or cash-like and whether the CBDC can be used to satisfy banks' reserve requirements."

## UPCOMING EVENTS

Agostino Capponi (Columbia University, Department of Industrial Engineering and Operations Research)
Organizer: Alper Odabasioglu (FBD/FSD)
Date: 3 June 2019

Cedric Tille (The Graduate Institute Geneva)
Organizer: Gurnain Pasricha (INT)
Date: 7 June 2019

David M. Arseneau (Federal Reserve Board)
Organizer: Corey Garriott & Jason Allen (FMD)
Date: 9 June 2019

Adriana Z. Robertson (University of Toronto, Rotman School of Management),
Organizer: Corey Garriott & Jason Allen (FMD)
Date: 13 June 2019

Tomasz Piskorski (Columbia University, Columbia Business School)
Organizer: Xiaoqing Zhou (FSD)
Date: 20 June 2019

Linda Tesar (University of Michigan, Department of Economics)
Organizer: Daniela Hauser (CEA)
Date: 21 June 2019

Harald Fadinger (University of Mannheim, Department of Economics)
Organizer: Walter Steingress (CEA/INT)
Date: 25 June 2019

Charles Leung (City University of Hong Kong, Department of Economics and Finance)
Organizer: Anson Ho (FSD)
Date: 27 June 2019

Bernabe Lopez-Martin (Central Bank of Chile)
Organizer: Christopher Hajzler (INT)
Date: 2 July 2019

Falko Fecht (Frankfurt School of Finance and Management)
Organizer: Sofia Priazhkina (FSD)

Date: 28 August 2019

Charles Martineau (University of Toronto, Rotman School of Management)
Organizer: Rodrigo Sekkel (FMD)
Date: 5 September 2019

Marc Giannoni (Federal Reserve Bank of Dallas)
Organizer: José Dorich (CEA)
Date: 6 September 2019

Ben Lester (Federal Reserve Bank of Philadelphia)
Organizer: Jean-Sébastien Fontaine (FMD)
Date: 12 September 2019

David Berger (Northwestern University, Department of Economics)
Organizer: Anthony Landry (CEA)
Date: 12 September 2019

Lucian (Luke) Taylor (University of Pennsylvania, Wharton Business School)
Organizer: Jon Witmer (FMD)
Date: 26 September 2019

Giorgio Primiceri (Northwestern University, Department of Economics)
Organizer: Joel Wagner (CEA)
Date: 27 September 2019

Domenico Giannone (Federal Reserve Bank of New York)
Organizer: Rodrigo Sekkel (FMD)
Date: 2 October 2019

Michael Koetter (Halle Institute for Economic Research)
Organizer: Radoslav Raykov (FSD)
Date: 3 October 2019

Patrick Augustin (McGill University, Desautels Faculty of Management)
Organizer: Corey Garriott (FMD)
Date: 10 October 2019

Ufuk Akcigit (University of Chicago, Department of Economics)

Organizer: Ben Tomlin (CEA)
Date: 11 October 2019

James Cloyne (University of California Davis, Department of Economics)
Organizer: Nuno Marques da Paixao (FSD)
Date: 15 October 2019

Robert Marquez (University of California Davis, Graduate School of Management)
Organizer: Thibaut Duprey (FSD)
Date: 24 October 2019

Virgiliu Midrigan (New York University, Department of Economics)
Organizer: Katsiaryna Kartashova (CEA)
Date: 25 October 2019

Haelim Anderson (Federal Deposit Insurance Corporation)
Organizer: Jason Allen (FMD)
Date: 31 October 2019

Morten Ravn (University College London, Department of Economics)
Organizer: Martin Kuncl (CEA)
Date: 15 November 2019

Catherine Tucker (Massachusetts Institute of Technology, Sloan School of Management)
Organizer: Shota Ichihashi (CEA)
Date: 19 November 2019