

Bank of Canada Monthly Research Update

December 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

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, Vol 35(3): 1118-1130, July 2019

Forthcoming

Feunou, Bruno & Fontaine, Jean-Sébastien & Jin, Jianjian, “[Which Model to Forecast the Target Rate?](#)”, Studies in Nonlinear Dynamics & Econometrics

Davison, Matt & Leadbetter, Darrell & Lu, Bin & Voll, Jane, “[Are Counterparty Arrangements in Reinsurance a Threat to Financial Stability?](#)”, Risk Management and Insurance

Chen, Heng & Chiang, Harold D. & Sasaki, Yuya, “[Quantile Treatment Effects in the Regression Kink Design](#)”, Econometric Theory

Li, Fuchun, “[Testing for the Diffusion Matrix in a Continuous-Time Markov Process Model with Applications to the Term Structure of Interest Rates](#)”, Journal of Financial Econometrics

Gungor, Sermin & Luger, Richard, “[Exact Inference in Long-Horizon Predictive Quantile Regressions with an Application to Stock Returns](#)”, Journal of Financial Econometrics

Johnston, Craig & Siebel-McKenna, Alexandra & van Kooten, G. Cornelis, “[Knock on wood: managing forests for carbon in the presence of natural disturbance risk](#)”, Spatial Economic Analysis, December 2019

STAFF WORKING PAPERS

- Bhandari, Anmol & Birinci, Serdar & McGrattan, Ellen & See, Kurt, “What Do Survey Data Tell Us About US Businesses?”, Bank of Canada Staff Working Paper 2019-45
- Ergun, Lerby, “Extreme Downside Risk in Asset Returns”, Bank of Canada Staff Working Paper 2019-46
- Ahnert, Toni & Küncl, Martin, “Loan Insurance, Market Liquidity, and Lending Standards”, Bank of Canada Staff Working Paper 2019-47
- Djeutem, Edouard & Xu, Shaofeng, “Model Uncertainty and Wealth Distribution”, Bank of Canada Staff Working Paper 2019-48
- Kostyshyna, Olena & Lalé, Etienne, “On the Evolution of Multiple Jobholding in Canada”, Bank of Canada Staff Working Paper 2019-49
- Xie, Erhao, “Monetary Payoff and Utility Function in Adaptive Learning Models”, Bank of Canada Staff Working Paper 2019-50
- Han, Xintong & Xu, Lei, “Technology Adoption in Input-Output Networks”, Bank of Canada Staff Working Paper 2019-51
- Matveev, Dmitry, “Monetary Policy and Government Debt Dynamics Without Commitment”, Bank of Canada Staff Working Paper 2019-52
- Amano, Robert & Carter, Thomas J. & Leduc, Sylvain, “Precautionary Pricing: The Disinflationary Effects of ELB Risk”, Federal Reserve Bank of San Francisco Staff Working Paper 2019-26

STAFF DISCUSSION PAPERS

- Poloz, Stephen S., “Changing Fortunes: Long-Termism—G-Zero, Artificial Intelligence and Debt”, Bank of Canada Staff Discussion Paper 2019-12

ABSTRACTS

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.

Which Model to Forecast the Target Rate?

Specifications of the Federal Reserve target rate that have more realistic features mitigate in-sample over-fitting and are favored in the data. Imposing a positivity constraint and discrete increments significantly increases the accuracy of model out-of-sample forecasts for the level and volatility of the Federal Reserve target rates. In addition, imposing the constraints produces different estimates of the response coefficients. In particular, a new and simple specification, where the target rate is the maximum between zero and the prediction of an ordered-choice Probit model, is more accurate and has higher response coefficients to information about inflation and unemployment.

Are Counterparty Arrangements in Reinsurance a Threat to Financial Stability?

Interconnectedness among insurers and reinsurers at a global level is not well understood and may pose a significant risk to the sector, with implications for the macroeconomy. Models of the complex

interactions among reinsurers and with other participants in the financial system and the real economy are at a very early stage of development. Parts of the market remain opaque to both regulators and market participants, particularly the counterparty arrangements among reinsurers through retrocession agreements. The authors create several plausible networks to model these relationships, each consistent with the financial statement data of the reinsurer. These networks are stress-tested under a series of severe but plausible catastrophic-loss scenarios. This analysis contributes to the literature by (i) applying a network-model approach common in the banking literature to the insurance industry; (ii) assessing the interconnections among reinsurers through potential claims rather than premiums; and (iii) investigating the most opaque part of the global insurance market, namely, counterparty arrangements among global reinsurers (retrocession). The authors find that contagion in the global reinsurance market is plausible and that the size of the potential market disruption is sensitive to (i) the distribution of risk among counterparties, (ii) the trigger for financial distress, (iii) the time horizon for claims resolution and (iv) the degree of loss netting. The findings suggest that further study of industry practices in these four areas would improve our ability to assess risk in the insurance sector and promote financial stability.

Quantile Treatment Effects in the Regression Kink Design

The practical importance of inference with robustness against large bandwidths for causal effects in regression discontinuity and kink designs is widely recognized. Existing robust methods cover many cases, but do not handle uniform inference for CDF and quantile processes in fuzzy designs. In this light, this paper extends the literature by developing a unified framework of inference with robustness against large bandwidths that applies to uniform inference for quantile treatment effects in fuzzy designs, as well as all the other cases. We present Monte Carlo simulation studies and an empirical application for evaluations of the Oklahoma pre-K program.

Testing for the Diffusion Matrix in a Continuous-Time Markov Process Model with Applications to the Term Structure of Interest Rates

The author proposes a test for the parametric specification of each component in the diffusion matrix of a d -dimensional diffusion process. Overall, $d(d-1)/2$ test statistics are constructed for the off-diagonal components, while d test statistics are constructed for the

main diagonal components. Using theories of degenerate U-statistics, each of these test statistics is shown to follow an asymptotic standard normal distribution under null hypothesis, while diverging to infinity if the component is misspecified over a significant range. Our tests strongly reject the specification of diffusion functions in a variety of popular univariate interest rate models for daily 7-day eurodollar spot rates, and the specification of the diffusion matrix in some popular multivariate affine term-structure models for monthly U.S. Treasury yields.

Exact Inference in Long-Horizon Predictive Quantile Regressions with an Application to Stock Returns

We develop an exact and distribution-free procedure to test for quantile predictability at several prediction horizons and quantile levels jointly, while allowing for an endogenous predictive regressor with any degree of persistence. The approach proceeds by combining together the quantile regression t-statistics from each considered prediction horizon and quantile level, and uses Monte-Carlo resampling techniques to control the familywise error rate in finite samples. A simulation study confirms that the proposed inference procedure is indeed level-correct and that testing several quantile levels jointly can deliver more power to detect predictability. In an empirical application to excess stock returns, we find that the default yield spread predicts the right tail while the short-term interest rate predicts the center of the return distribution. This predictability evidence is stronger at shorter rather than longer horizons.

Knock on wood: managing forests for carbon in the presence of natural disturbance risk

Carbon prices are used to induce forest managers to adopt longer rotation periods, leading to higher carbon sequestration in the ecosystem and storage in harvested wood products. However, national governments can choose whether or not to include emissions from natural disturbances in carbon accounting schemes. Using a stochastic dynamic programming model, we study optimal forest manager behaviour in the presence of natural disturbance risk and under a range of carbon prices, which we then use to calculate the carbon offsets so generated. Excluding such risk results in a reduced ability to use carbon prices to influence forest manager behaviour.

What Do Survey Data Tell Us About US Businesses?

This paper examines the reliability of survey data on business incomes, valuations, and rates of return, which are key inputs for studies of wealth inequality and entrepreneurial choice. We compare survey responses of business owners with available data from administrative tax records, brokered private business sales, and publicly traded company filings and document problems due to nonrepresentative samples and measurement errors across all surveys, subsamples, and years. We find that the discrepancies are economically relevant for the statistics of interest. We investigate reasons for these discrepancies and propose corrections for future survey designs.

Extreme Downside Risk in Asset Returns

Financial markets can experience sudden and extreme downward movements. Investors are highly concerned about the performance of their assets in such scenarios. Some assets perform badly in a downturn in the market; others have milder reactions. The assets that react mildly are desirable and should sell at a premium. But determining how reactive individual stocks are to extreme market downturns is a difficult task given the small sample of these events.

This paper uses a simple methodology to measure the sensitivity of individual stocks to extreme market movements. I count the number of times the market and the individual stock simultaneously pass their individual extreme threshold. I divide the number of these occurrences by the number of times the market is extreme. This measure can be seen as the probability that the asset value will have an extremely negative reaction when the market experiences an extremely negative episode.

By sorting individual stocks based on this measure and analyzing the direction and increase in the average return of the sorted stocks, I measure the compensation investors demand for exposure to this risk. I find that investors demand a 3.5 percent risk premium for investing in a stock with high sensitivity to the market relative to one with low sensitivity. This measure characterizes the riskiness of a stock not captured by existing risk factors.

Loan Insurance, Market Liquidity, and Lending Standards

Third parties often assume default risk at loan origination in return for a fee. Insurance, various guarantees and external credit

enhancements protect the owner of the loan against borrower default. Governments often assume such default risk through guarantees for various types of loans, including mortgages, student loans and small business loans. The widespread use of loan default insurance raises important questions: What is the impact of loan insurance on secondary market liquidity and on lending standards in primary markets? And is there a role for government intervention?

We propose a simple model of lending where borrowers are screened at loan origination and lenders can learn about loan quality over time. Lenders can transfer the loan default risk to outside financiers at loan origination through loan insurance. Alternatively, they can transfer the default risk after a liquidity shock or after learning about loan quality by selling the loan in the secondary market. The model features a trade-off between secondary market liquidity and lending standards. The timing of risk transfer affects this trade-off.

Loan insurance lowers the lending standards but improves the liquidity in secondary markets with a net improvement in welfare. Since lenders do not take into account the positive benefit of insurance on the liquidity in the market for uninsured loans, there is insufficient loan insurance in equilibrium. This implies that a regulator can improve welfare by subsidizing loan default insurance. We also consider a policy of outright loan purchases and show that while it is optimal to have it as an option to rule out inferior equilibria, only a policy of insurance subsidy is optimally used in equilibrium.

Model Uncertainty and Wealth Distribution

This paper studies the implications of model uncertainty for wealth distribution in a tractable general equilibrium model with a borrowing constraint and robustness à la Hansen and Sargent (2008). Households confront model uncertainty about the process driving the return of the risky asset, and they choose robust policies. We find that in the presence of a borrowing constraint, model distortion varies non-monotonically with wealth. Robustness generates two forces that amplify wealth inequality. On the one hand, it increases the speed at which the wealth of unlucky households hits the borrowing constraint. On the other hand, it leads richer households to invest a disproportionately larger share of wealth in the higher yielding asset. Our study also shows that model uncertainty results in an aggregate welfare loss unevenly distributed across households.

On the Evolution of Multiple Jobholding in Canada

The number of workers who hold more than one job (a.k.a. multiple jobholders) has increased recently in Canada. While this seems to echo the view that non-standard work arrangements are becoming pervasive, the increase has in fact been trivial compared with the long-run rise of multiple jobholding that has occurred since the mid-1970s. In this paper, we document this historical evolution and provide a comprehensive account of its underlying dynamics. To this end, we use restricted-access panel micro-data from the Canadian Labour Force Survey to construct transition probabilities into and out of multiple jobholding. We analyze these data through the lens of a trend decomposition that separates out the role of labor market inflows and outflows. The picture that emerges from our analysis is one of continued increases in the propensity of workers to take on second jobs. We argue that changes in technology and in preferences could both be responsible for this evolution.

Monetary Payoff and Utility Function in Adaptive Learning Models

When players repeatedly face an identical or similar game (e.g., coordination game, technology adoption game, or product choice game), they may learn through experience to perform better in the future. This learning behaviour has important economic implications. It determines which economic outcome a game will reach and how fast it will get there.

Given the importance of players' learning behaviours, economists have proposed various adaptive models to study them. These models are usually estimated and tested using experimental data. Moreover, economists usually assume that individuals' preference—their utility—is equal to the monetary reward they obtain. However, such an assumption can be wrong since players are not necessarily risk neutral. They could be risk averse or risk loving.

I study the consequences of this false assumption and propose a method to deal with it. I then apply the method to an existing experimental dataset. The estimation results show that utility does not necessarily equal monetary reward. Imposing such a false assumption leads researchers to draw incorrect conclusions about players' learning behaviours. For instance, we may incorrectly estimate the speed of learning and wrongly predict the final outcome of a game. In contrast, the method I propose in this paper allows researchers to achieve more accurate estimates.

Technology Adoption in Input-Output Networks

We study how input-output networks affect the speed of technology adoption. In particular, we model the decision to adopt the programming language Python 3 by software packages. Python 3 provides advanced features but is not backward compatible with Python 2, which implies it comes with adoption costs. Moreover, packages are dependent on other packages, meaning one package's adoption decision is affected by the adoption decisions of other packages because many packages are linked to each other.

We build a dynamic model of technology adoption that incorporates an input-output network and estimate it using a complete dataset of Python packages. We are among the first to link the literature of dynamic discrete choice models to network analysis. We also contribute to the literature on technology adoption by showing the adverse effects that input-output networks can have on how technology is adopted in a dynamic setting.

We show that a package's adoption decision is significantly affected by the adoption decisions of its dependency packages. We conduct counterfactual analyses of cost subsidies that target a community level and show that network structure is crucial to determining an optimal policy of cost subsidy.

Monetary Policy and Government Debt Dynamics Without Commitment

I show that maturity considerations affect the optimal conduct of monetary and fiscal policy during a period of government debt reduction. I consider a New Keynesian model and study a dynamic game of monetary and fiscal policy authorities without commitment, characterizing the incentives that drive the choice of interest rate. The presence of long-term bonds makes government budgets less sensitive to changes in interest rates. As a result, a reduction of government debt induced by a lack of policy commitment is associated with tight monetary policy. Furthermore, the long maturity of bonds slows down the speed of debt reduction up to the rate consistent with existing empirical evidence on the persistence of government debt. Finally, the long maturity of bonds brings down the welfare loss associated with debt reduction.

Precautionary Pricing: The Disinflationary Effects of ELB Risk

We construct a model to evaluate the role that the risk of future effective lower bound (ELB) episodes plays as a factor behind the persistently weak inflation witnessed in many advanced economies since the Great Recession. In our model, a range of precautionary channels cause ELB risk to affect inflation and other macroeconomic outcomes even during “normal times” when nominal rates are far away from the ELB. This behavior is enhanced through a growth channel that captures possible long-lasting output declines at the ELB. We show that ELB risk substantially weighs on inflation even when the policy rate is above the ELB. Our model also predicts substantially below-target inflation expectations and negative inflation risk premia.

Changing Fortunes: Long-Termism—G-Zero, Artificial Intelligence and Debt

This paper discusses three long-term forces that are acting on the global economy and their implications for companies and policy-makers:

1. the transition in geopolitics away from a global order based on international co-operation, or “deglobalization”;
2. the spread of new technology, particularly artificial intelligence, through the “fourth industrial revolution”; and
3. the steady buildup of debt—public and private—in most countries.

Deglobalization leads to reduced investment and the deconstruction of global value chains, which will reduce global potential economic growth and living standards. The fourth industrial revolution will foster a period of stronger productivity growth and low inflation, accompanied by significant labour market disruptions. High and growing debt levels raise a range of risks associated with financial vulnerabilities. As well, the coincident rise in populism with doubts about the value of central bank independence risks an alignment of incentives between governments and highly indebted households, favouring a return to inflationary policies in the future. The paper concludes with a list of inferences and long-term policy implications. It was developed from a talk first delivered at the Spruce Meadows Changing Fortunes Round Table in Calgary, Alberta, in September 2019.

UPCOMING EVENTS

Raphael Schoenle (Brandeis University, Department of Economics)
Organizer: Daniela Hauser (CEA)
Date: 6 March 2020

Karen Kopecky (Federal Reserve Bank of Atlanta)
Organizer: Youngmin Park (CEA)
Date: 13 March 2020

Todd Clark (Federal Reserve Bank of Cleveland)
Organizer: Luis Uzeda (CEA)
Date: 3 April 2020

Todd Schoellman (Federal Reserve Bank of Minneapolis)
Organizer: Youngmin Park (CEA)
Date: 17 April 2020

Matthias Kehrig (Duke University, Department of Economics)
Organizer: Dmitry Matveev (CEA)
Date: 24 April 2020

Nicolas Crouzet (Northwestern University, Kellogg School of
Management)
Organizer: Romanos Priftis (CEA)
Date: 1 May 2020

Edouard Challe (CREST & École Polytechnique, Department of
Economics)
Organizer: Dmitry Matveev (CEA)
Date: 8 May 2020

Raquel Fernandez (New York University, Department of Economics)
Organizer: Gabriela Galassi (CEA)
Date: 15 May 2020

Ufuk Akcigit (University of Chicago, Department of Economics)
Organizer: Martin Kuncl (CEA)
Date: 28 May 2020

Karel Mertens (Federal Reserve Bank of Dallas)
Organizer: Daniela Hauser (CEA)
Date: 12 June 2020

Dirk Krueger (University of Pennsylvania, Department of Economics)
Organizer: Katya Kartashova (CEA)
Date: 28 August 2020

Arlene Wong (Princeton University, Department of Economics)
Organizer: Julien Champagne (CEA)
Date: 11 September 2020

Johannes Wieland (University of California San Diego, Department of
Economics)
Organizer: Julien Champagne (CEA)
Date: 25 September 2020

Leonardo Melosi (Federal Reserve Bank of Chicago)
Organizer: Romanos Priftis (CEA)
Date: 6 November 2020