

# Bank of Canada Monthly Research Update

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December 2017

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

### Forthcoming

Wright, Randall & Xiao, Xiaolin & Zhu, Yu, “Frictional Capital Reallocation I: Ex-Ante Heterogeneity”, *Journal of Economic Dynamics and Control*

## STAFF WORKING PAPERS

Cavallo, Michele & Landry, Anthony, “Capital-Goods Imports and US Growth”, Bank of Canada Staff Working Paper 2018-01

Feunou, Bruno & Aliouchkin, Ricardo Lopez & Tedongap, Roméo & Xi, Lai, “Variance Premium, Downside Risk and Expected Stock Returns”, Bank of Canada Staff Working Paper 2017-58

Feunou, Bruno & Fontaine, Jean-Sébastien & Jin, Jianjian, “Which Model to Forecast the Target Rate?”, Bank of Canada Staff Working Paper 2017-60

Feunou, Bruno & Okou, Cédric, “Good Volatility, Bad Volatility and Option Pricing”, Bank of Canada Staff Working Paper 2017-52

Feunou, Bruno & Okou, Cédric, “Risk-Neutral Moment-Based Estimation of Affine Option Pricing Models”, Bank of Canada Staff Working Paper 2017-55

Fontaine, Jean-Sébastien & Pinnington, James & Walton, Adrian, “What Drives Episodes of Settlement Fails in the Government of Canada Bond Market?”, Bank of Canada Staff Working Paper 2017-54

Henry, Christopher & Huynh, Kim & Nicholls, Gradon, “Bitcoin Awareness and Usage in Canada”, Bank of Canada Staff Working Paper 2017-56

Holden, Tom D. & Levine, Paul & Swarbrick, Jonathan M., “Credit Crunches from Occasionally Binding Bank Borrowing Constraints”, Bank of Canada Staff Working Paper 2017-57

Jiang, Janet Hua & Zhang, Cathy, “Competing Currencies in the Laboratory”, Bank of Canada Staff Working Paper 2017-53

Lochner, Lance & Park, Youngmin & Shin, Youngki, “Wage Dynamics and Returns to Unobserved Skill”, Bank of Canada Staff Working Paper 2017-61

Oordt, Maarten van, “Credit Risk Transfer and Bank Insolvency Risk”, Bank of Canada Staff Working Paper 2017-59

Somnath, Chatterjee & Ching-Wai, Chiu & Thibaut, Duprey & Sinem, Hacıoglu Hoke, “[A financial stress index for the United Kingdom](#)”, Bank of England Working Paper in December 2017

## STAFF DISCUSSION PAPERS

Holden, Tom & Levine, Paul & Swarbrick, Jonathan, “[Reconciling Jaimovich-Rebello Preferences, Habit in Consumption and Labor Supply](#)”, University of Surrey, School of Economics, Discussion Paper 10/17

Lopez, Jorge Cruz & Manning, Mark, “[Who Pays? CCP Resource Provision in the Post-Pittsburgh World](#)”, Bank of Canada Staff Discussion Paper 2017-17

## ABSTRACTS

### *Frictional Capital Reallocation I: Ex-Ante Heterogeneity*

We study dynamic general equilibrium models where capital is traded in frictional markets featuring liquidity considerations. Gains from trade arise here from ex ante heterogeneity: some firms are better at investment, so they build capital in the primary market, while others acquire it in the secondary market. We consider specifications with random search and bargaining, as well as those with directed search and posting, and provide strong results for both on existence, uniqueness, efficiency and comparative statics. Monetary and fiscal policy are discussed in detail. Among other advantages, the framework is tractable enough to analyze using simple diagrams.

### *Capital-Goods Imports and US Growth*

Capital-goods imports have become an increasing source of growth for the U.S. economy. To understand this phenomenon, we build a neoclassical growth model with international trade in capital goods in which agents face exogenous paths of total factor and investment-specific productivity measures. Investment-specific productivity measures are reflected by the price of capital-goods imports, the price of domestic-equipment investment, and the price of IP products relative to the price of consumption. We use observed prices to solve for optimal investment decisions, and understand the underlying sources of output growth in the U.S. economy. Our findings suggest

that the model allocation decisions coming from changes in relative prices explain well the dynamics of investment and U.S. output. Using the model economy, we show that: (i) capital-goods imports have contributed 14 percent to growth in U.S. output per hour since 1975, (ii) capital-goods imports played a small role in the recent weakness in equipment investment, (iii) U.S. output-per-hour growth could have been 18 percent lower without the capital-goods imports technology since 1975, and (iv) in the long run, the implementation of additional tariffs on capital-goods imports would have little impact on the expenditure share of capital-goods imports in equipment investment.

### *Variance Premium, Downside Risk and Expected Stock Returns*

We decompose total variance into its bad and good components and measure the premia associated with their fluctuations using stock and option data from a large cross-section of firms. The total variance risk premium (VRP) represents the premium paid to insure against fluctuations in bad variance (called bad VRP), net of the premium received to compensate for fluctuations in good variance (called good VRP). Bad VRP provides a direct assessment of the degree to which asset downside risk may become extreme, while good VRP proxies for the degree to which asset upside potential may shrink. We find that bad VRP is important economically; in the cross-section, a one-standard-deviation increase is associated with an increase of up to 13% in annualized expected excess returns. Simultaneously going long on stocks with high bad VRP and short on stocks with low bad VRP yields an annualized risk-adjusted expected excess return of 18%. This result remains significant in double-sort strategies and cross-sectional regressions controlling for a host of firm characteristics and exposures to regular and downside risk factors.

### *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.

### *Good Volatility, Bad Volatility and Option Pricing*

Advances in variance analysis permit the splitting of the total quadratic variation of a jump diffusion process into upside and downside components. Recent studies establish that this decomposition enhances volatility predictions, and highlight the upside/downside variance spread as a driver of the asymmetry in stock price distributions. To appraise the economic gain of this decomposition, we design a new and flexible option pricing model in which the underlying asset price exhibits distinct upside and downside semi-variance dynamics driven by their model-free proxies. The new model outperforms common benchmarks, especially the alternative that splits the quadratic variation into diffusive and jump components.

### *Risk-Neutral Moment-Based Estimation of Affine Option Pricing Models*

This paper provides a novel methodology for estimating option pricing models based on risk-neutral moments. We synthesize the distribution extracted from a panel of option prices and exploit linear relationships between risk-neutral cumulants and latent factors within the continuous time affine stochastic volatility framework. We find that fitting the Andersen, Fusari, and Todorov (2015b) option valuation model to risk-neutral moments captures the bulk of the information in option prices. Our estimation strategy is effective, easy to implement, and robust, as it allows for a direct linear filtering of the latent factors and a quasi-maximum likelihood estimation of model parameters. From a practical perspective, employing risk-neutral moments instead of option prices also helps circumvent several sources of numerical errors and substantially lessens the computational burden inherent in working with a large panel of option contracts.

### *What Drives Episodes of Settlement Fails in the Government of Canada Bond Market?*

We study settlement fails for trades in the Government of Canada bond market. We find that settlement fails do not occur independently. Using a novel and comprehensive dataset, we examine three drivers of fails. First, we find that fails are more likely following the release of surprise macroeconomic news. Second, settlement fails are more likely for bonds with greater trading activity in the borrowing market. These findings suggest that the recirculation of bonds through long settlement chains is important for understanding fails. Third, fails are more likely when interest rates are

low and when the cost for borrowing a bond is high, which is likely because of frictions acting as constraints on the price to borrow a bond. Together, the evidence suggests that improvements to the price mechanism in the borrowing market could improve the recirculation of scarce bonds and may improve the functioning of the bond market.

### *Bitcoin Awareness and Usage in Canada*

There has been tremendous discussion of Bitcoin, digital currencies and FinTech. However, there is limited empirical evidence of Bitcoin's adoption and usage. We propose a methodology to collect a nationally representative sample using the Bitcoin Omnibus Survey (BTCOS) to track the ubiquity and usage of Bitcoin in Canada. We find that about 64 percent of Canadians have heard of Bitcoin, but only 2.9 percent own it. We also find that awareness of Bitcoin is strongly associated with men and those with college or university education: additionally, Bitcoin awareness is more concentrated among unemployed individuals. On the other hand, Bitcoin ownership is associated with younger age groups and a high-school education. Furthermore, we construct a test of Bitcoin characteristics to gauge the level of knowledge held by respondents who were aware of Bitcoin, including actual owners. We find that knowledge is positively correlated with Bitcoin adoption. We attempt to reconcile the difference in awareness and ownership by decomposing the transactional and store-of-value motives for holding Bitcoin. Finally, we conclude with some suggestions to improve future surveys on digital currency, in particular, to achieve precise estimates from the hard-to-reach population of digital currency users.

### *Credit Crunches from Occasionally Binding Bank Borrowing Constraints*

We present a model in which banks and other financial intermediaries face both occasionally binding borrowing constraints and costs of equity issuance. Near the steady state, these intermediaries can raise equity finance at no cost through retained earnings. However, even moderately large shocks cause their borrowing constraints to bind, leading to contractions in credit offered to firms, and requiring the intermediaries to raise further funds by paying the cost to issue equity. This leads to the occasional sharp increases in interest spreads and the countercyclical, positively skewed equity issuance that are characteristic of the credit crunches observed in the data.

### *Competing Currencies in the Laboratory*

We investigate competition between two intrinsically worthless currencies as a result of decentralized interactions between human subjects. We design a laboratory experiment based on a simple two-country, two-currency search model to study factors that affect circulation patterns and equilibrium selection. Experimental results indicate foreign currency acceptance rates decrease with relative country size but are not significantly affected by the degree of integration. The laboratory economies tend to converge to a unified currency regime where both currencies circulate at home and abroad, even if other regimes are theoretical possibilities. Introducing government transaction policies biased towards domestic currency significantly reduces the acceptability of foreign currency. These findings suggest government policies can serve as a coordination device when multiple currencies are available.

### *Wage Dynamics and Returns to Unobserved Skill*

Economists disagree about the factors driving the substantial increase in residual wage inequality in the U.S. over the past few decades. We identify and estimate a general model of log wage residuals that incorporates: (i) changing returns to unobserved skills, (ii) a changing distribution of unobserved skills, and (iii) changing volatility in wages due to factors unrelated to skills. Using data from the Panel Study of Income Dynamics, we estimate that the returns to unobserved skills have declined by as much as 50% since the mid-1980s despite a sizeable increase in residual inequality. Instead, the variance of skills rose over this period because of increasing variability in lifecycle skill growth. Finally, we develop an assignment model of the labor market and show that both demand and supply factors contributed to the downward trend in the returns to skills over time, with demand factors dominating for non-college men.

### *Credit Risk Transfer and Bank Insolvency Risk*

The present paper shows that, everything else equal, some transactions to transfer portfolio credit risk to third-party investors increase the insolvency risk of banks. This is particularly likely if a bank sells the senior tranche and retains a sufficiently large first-loss position. The results do not rely on banks increasing leverage after the risk transfer, nor on banks taking on new risks, although these could aggravate the effect. High leverage and concentrated business models increase the vulnerability to the mechanism. These results are useful for risk managers and banking regulation. The literature on

credit risk transfers and information asymmetries generally tends to advocate the retention of 'information-sensitive' first-loss positions. The present study shows that, under certain conditions, such an approach may harm financial stability, and thus calls for further reflection on the structure of securitization transactions and portfolio insurance.

### *Reconciling Jaimovich-Rebello Preferences, Habit in Consumption and Labor Supply*

This note studies two forms of a utility function of consumption with habit and leisure that are (a) compatible with long-run balanced growth, (b) hit a steady state observed target for hours worked and (c) are consistent with micro-econometric evidence for the inter-temporal elasticity of substitution and the Frisch elasticity of labor supply. For Jaimovich-Rebello preferences our Theorems 1 and 2 highlight a constraint on the preference parameter needed to target the Frisch elasticity leading to a lower bound for the latter that cannot be reconciled empirically with external habit. Even with internal or no habit, the range of possible values of the Frisch elasticity lie outside empirical results unless we allow for a modest wealth effect. In Theorem 3 we propose a generalized JR utility function that in conjunction with a labor wedge solves the problem.

### *A Financial Stress Index for the United Kingdom*

In this paper, we develop an index to monitor the intensity of financial stress in the UK over a period of 45 years. By aggregating various market-based indicators of financial stress from six major markets, we allow each indicator to be assessed in terms of its systemic importance. This enables the index to capture the interconnectedness of financial markets. The index successfully captures three episodes of heightened stress in UK financial history. We also attempt to determine how much a financial shock to the UK economy is amplified in a period of stress vis-à-vis a tranquil period. It involves exploring the dynamic relationship of the index with the UK real economy by two specifications of threshold vector autoregression models. We find empirical evidence for the existence of feedback loops in the shock propagation between the real and the financial sector in the United Kingdom.



## *Who Pays? CCP Resource Provision in the Post-Pittsburgh World*

At the Pittsburgh Summit in 2009, G20 countries announced their commitment to clear all standardized over-the-counter (OTC) derivatives through central counterparties (CCPs). Since then, CCPs have become increasingly important and there has been an extensive program of regulatory enhancements to both them and OTC derivatives markets. However, as OTC clearing has grown, tensions have emerged among market participants over CCPs' traditional model of resource provision through loss mutualization. We argue that most of these tensions can be explained by a misalignment between the policy goal of enhancing financial stability and the delivery of that goal by mandating clearing through CCPs as they are currently organized. Specifically, the traditional model for resource provision makes most CCPs suitable for managing club goods, whereas financial stability is a public good. The key differences between these two types of goods, driven by the wedge between those who pay for them and those who derive the benefits, create the observed tensions. Thus, we propose a framework to analyze the functional elements of a CCP and examine whether an alternative clearing model might be more effective in supporting financial stability. We conclude that some tensions could perhaps be mitigated by unbundling the functions of a CCP and selecting the ownership and funding structure that best suits their individual characteristics. Functions that are critical for the provision of financial stability might imply some form of public sector involvement, whereas other services might lend themselves to a for-profit or traditional club model.

## **UPCOMING EVENTS**

Todd Walker (Indiana University Bloomington), 23 March 2018  
Organizer: Wataru Miyamoto (CEA)

Jesper Linde (Sveriges Riskbank), 28 March 2018  
Organizer: Thomas Carter (CEA)

Giorgio Primiceri (Northwestern University), 20 April 2018  
Organizer: Joel Wagner (CEA)

Regis Barnichon (Federal Reserve Bank of San Francisco), 18 May 2018  
Organizer: Julien Champagne (CEA)

Fernanda Nechio (Federal Reserve Bank of San Francisco), 25 May  
2018

Organizer: Anthony Landry (CEA)

Martin Ellison (University of Oxford), 15 June 2018

Organizer: Daniela Hauser (CEA), INT