

Bank of Canada Monthly Research Update

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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

- Feunou, Bruno & Ernest Tafalong, “[Fourier Inversion Formulas for Multiple-Asset Option Pricing](#)”, *Studies in Nonlinear Dynamics & Econometrics*, December 2015, Volume 19, Issue 5, Pages 531-559
- Raykov, Radoslav, “[Catastrophe Insurance Equilibrium with Correlated Claims](#)”, *Theory and Decision*, January 2015, Volume 78, Issue 1, Pages 89-115

STAFF WORKING PAPERS

- Albuquerque, Bruno & Georgi Krustev, “[Debt Overhang and Deleveraging in the US Household Sector: Gauging the Impact on Consumption](#)”, Bank of Canada Staff Working Paper 2015-47
- Bruneau, Gabriel & Kevin Moran, “[Exchange Rate Fluctuations and Labour Market Adjustments in Canadian Manufacturing Industries](#)”, Bank of Canada Staff Working Paper 2015-45
- Duprey, Thibaut, Benjamin Klaus & Tuomas Peltonen, “[Dating Systemic Financial Stress Episodes in the EU Countries](#)”, ECB Working Paper No. 1873
- Fuenou, Bruno, Jean-Sébastien Fontaine, Anh Le & Christian Lundblad, “[Tractable Term-Structure Models and the Zero Lower Bound](#)”, Bank of Canada Staff Working Paper 2015-46
- Gauthier, Céline, Alfred Lehar, Héctor Pérez Saiz & Moez Souissi, “[Emergency Liquidity Facilities, Signalling and Funding Costs](#)”, Bank of Canada Staff Working Paper 2015-44

ABSTRACTS

Fourier Inversion Formulas for Multiple-Asset Option Pricing

Plain vanilla options have a single underlying asset and a single condition on the payoff at the expiration date. For this class of options, a well-known result of Duffie, Pan and Singleton (2000) shows how to invert the characteristic function to obtain a closed-form formula for their prices. However, multiple-asset and multiple-condition derivatives such as rainbow options cannot be priced within this framework. Utilizing inversion of the Fourier transform - and resorting to neither the Black-Scholes framework nor the affine models settings - the authors provide an analytical solution for options

whose payoffs depend on two or more conditions. Numerical experiments based on the multiple-asset and multiple-condition derivatives are provided to illustrate the usefulness of the proposed approach.

Catastrophe insurance equilibrium with correlated claims

Catastrophe insurance differs from regular insurance in that individual claims are correlated and insurers have to pay more clients at once, which creates a liquidity strain. In this paper, I show two related findings: first, that when customers know their claims are correlated, this correlation can cause positive-sloping demand at low prices, and second, that because of this, a catastrophe insurance market can fail. Market failure is a stable equilibrium, which provides a better understanding of the frequent failures in catastrophe insurance markets.

Debt Overhang and Deleveraging in the US Household Sector: Gauging the Impact on Consumption

Using a novel dataset for the US states, this paper examines whether household debt and the protracted debt deleveraging help explain the dismal performance of US consumption since 2007, in the aftermath of the housing bubble. By separating the concepts of deleveraging and debt overhang—a flow and stock effect—we find that excessive indebtedness exerted a meaningful drag on consumption over and beyond income and wealth effects. The overall impact, however, is modest, around one-sixth of the slowdown in consumption between 2000–06 and between 2007–12—and mostly driven by states with particularly large imbalances in the household sector. This might be indicative of non-linearities, whereby indebtedness begins to bite only when misalignments from sustainable debt dynamics become more excessive.

Exchange Rate Fluctuations and Labour Market Adjustments in Canadian Manufacturing Industries

We estimate the link between exchange rate fluctuations and the labour input of Canadian manufacturing industries. The analysis is based on a dynamic model of labour demand, and the econometric strategy employs a panel two-step approach for cointegrating regressions. Our data are drawn from a panel of 20 manufacturing industries from the KLEMS database and cover a long sample period that includes two full cycles of appreciation and depreciation of the Canadian dollar. Our results indicate that exchange rate fluctuations

have significant long-term effects on the labour input of Canada's manufacturing industries, that these effects are stronger for trade-oriented industries, and that these long-term impacts materialize only gradually following shocks.

Dating Systemic Financial Stress Episodes in the EU Countries

This paper introduces a new methodology to date systemic financial stress events in a transparent, objective and reproducible way. The financial cycle is captured by a monthly country-specific financial stress index. Based on a Markov Switching model, high financial stress regimes are identified and a simple algorithm is used to select those episodes of financial stress that are associated with a substantial negative impact on the real economy. By applying this framework to 27 EU countries, the paper is a first attempt to provide a chronology of systemic financial stress episodes in addition to the expert-detected events available so far.

Tractable Term-Structure Models and the Zero Lower Bound

We greatly expand the space of tractable term-structure models. We consider one example that combines positive yields with rich volatility and correlation dynamics. Bond prices are expressed in closed form and estimation is straightforward. We find that the early stages of a recession have distinct effects on yield volatility. Upon entering a recession when yields are far from the lower bound, (i) the volatility term structure becomes flatter, (ii) the level and slope of yields are nearly uncorrelated, and (iii) the second principal component of yields plays a larger role. However, these facts are significantly different when yields are close to the lower bound. Entering a recession in such a setting, (i) the volatility term structure instead steepens, (ii) the level and slope factors are strongly correlated, and (iii) the second principal component of yields plays a smaller role. Existing dynamic term-structure models do not capture the changes in the cyclical responses of the volatility term structure near the lower bound.

Emergency Liquidity Facilities, Signalling and Funding Costs

In the months preceding the failure of Lehman Brothers in September 2008, banks were willing to pay a premium over the Federal Reserve's discount window (DW) rate to participate in the much less flexible Term Auction Facility (TAF). We empirically test the predictions of a new signalling model that offers a rationale for offering two different liquidity facilities. In our model, illiquid yet

solvent banks need to pay a high cost to access the TAF as a way to signal their quality, in exchange for more favourable funding in the future. Less solvent banks access the less costly and more flexible DW in case they experience an unexpected run, paying a higher future funding cost. The existence of two facilities with different characteristics allowed banks to signal their level of solvency, which helped to decrease asymmetric information during the crisis. Using recently disclosed data on access to these facilities, we provide evidence consistent with these results. Banks that accessed TAF in 2008 paid approximately 31 basis points less in the interbank lending market in 2010 and were perceived as less risky than banks that accessed the DW. Our results can contribute to a better design of liquidity facilities during a financial crisis.