Summary of "A Study on Cross-Boarder Spillover of Price Jumps and Variance Risk Premiums"

Yoshihiko Sugihara

February 2019

The global financial crisis of 2007-09 has prompted renewed academic interest in financial market volatility and its contagion in the global financial market. Asset volatility is not just a measure of risk in the financial markets, but it can be a source of economic downturn. Kiyotaki and Moore [1997] pointed out that, because borrowers use assets to back their debt, decline in asset prices reduces their collateral constraints through higher haircut rates. This could lead to reduced investment in the real economy which would deteriorate the economic condition. If the decline in the asset price is vast, borrowers' credit risk would increase, which could result in a cautious stance from financial intermediaries, and synergistically worsen the economic condition. In several subsequent researches, Shi [2015] found that collateral constraints caused by a negative financial shock, in turn, generate a subsequent equity price boom. This implies that not only asset price itself, but asset price volatility is an important source of large macroeconomic fluctuation. Bloom [2009] and Bloom et al. [2018] investigated how uncertainty affects the real economy and the business cycle. They found that an uncertainty shock induces recession because business leaders would delay investment and hiring decisions in the face of rising uncertainty. This literature strongly supports the hypothesis that an increase in financial uncertainty measured by asset

price volatilities can influence the economic cycle.

Another important feature of asset volatility is that it easily propagates to other economies through cross-border investment/divestment, or through the sentiment channel. This means that cross-border contagion of volatility could easily lead to recession risk propagating globally. Thus, global spillover of asset price volatility is an essential topic for researchers and policy makers (e.g. Beirne et al. [2009], Pericoli and Sbracia [2003]).

The conjecture in this dissertation is that not only price volatility but the variance risk premium (VRP) and price jump are important factors in the global contagion of risk. VRP, a premium required by variance risk takers, is defined in this dissertation as variance of asset price minus option implied variance. This definition is simply an extension of the general risk premium on the first moment, but VRP generally takes negative values under this definition. It should be noted that the definition is opposite to the general definition in the econometric literature, where VRP is defined so that it takes a positive value.

Recently, many articles have pointed out that fluctuations in a measure of option implied volatility, such as the Chicago Board Options Exchange market volatility (in short, the VIX index) are strongly associated with variations in asset prices, leverage, credit provision, capital flows, and, more generally, financial conditions in many countries. Option implied volatility is divided into the volatility of the underlying asset and the VRP on it. Although the global spillover of volatility has been broadly studied, more investigation is needed on the cross-border contagion of VRP, since earlier studies on global contagion of VRP are limited to Londono [2011] and Aït-Sahalia et al. [2015],

as far as I know.

This dissertation consists of three explorations. Before proceeding with the analysis of VRP contagion, I address simultaneity of price jumps in financial stocks in the U.S. market and the global equity markets in Chapter 2. The simultaneity is measured by indicators defined using the probability of jumps occurring simultaneously across assets in a given period of time. The empirical application to individual financial stocks in the U.S. and major worldwide equity indexes reveals that jump simultaneity clearly intensifies when the financial markets are in distress. Although the simultaneous jump in the major equity indexes is largely replaced by the covariance fluctuation after the introduction of stochastic covariance, this does not hold true for U.S. financial stocks. Moreover, marginal contributions to some jump indicators are estimated as higher from equities in a country where the shock originates than those from other countries. I also detected that the degree of jump simultaneity is strongly correlated with the implied volatility index. This becomes the motivation for the analyses in the following chapters.

In Chapter 3, I investigate contagion of VRP. Using VRPs nonparametrically calculated from equity markets in selected major advanced economies (AEs) and emerging market economies (EMEs) over 2007-2015, I document the correlation of VRPs across the markets and examine whether equity fund flows work as a path through which VRPs spill over globally. First, I find that VRPs tend to spike up during market turmoil such as the peak of the global financial crisis and the European debt crisis. Second, I find that all cross-equity market correlations of VRPs are positive, and that some economy pairs exhibit high levels of the correlation. In terms of volatility contagion,

I find that an increase in VRPs in the U.S. significantly reduces equity fund flows to other developed economies, but not those to EMEs, in the period after the global financial crisis. Two-stage least squares estimation results show that equity fund flows are a channel for spillover of VRPs in the U.S. to VRPs in other developed economies.

Lastly in Chapter 4, I estimate VRP more precisely using a model with its decomposition into diffusion-oriented and jump-oriented parts. Using VRP estimates on stock markets in selected major AEs and EMEs, I again examine whether equity fund flows work as a path through which VRPs spill over globally. I first decompose VRP into variance-diffusive risk premium (DRP) and variance-jump risk premium (JRP) and estimate them separately. Simple OLS regression results show that increases in the size of US VRP, DRP and JRP tend to significantly reduce equity fund flows to all other AEs and most EMEs during non-crisis tranquil periods. Two-stage regression results provide supporting evidence that the equity fund flows are a channel of spillover from US VRP, DRP and JRP to major AEs' and a few EMEs' VRP, DRP and JRP. In particular, I find that JRP tends to play a more important role than DRP in the transmission of US VRP to other economies' VRP during the crisis period, but the opposite holds during the tranquil period.

Bibliography

Yacine Aït-Sahalia, Julio Cacho-Diaz, and Roger J.A. Laeven. Modeling financial contagion using mutually exciting jump processes. *Journal of*

Financial Economics, 117:585–606, 2015.

John Beirne, Guglielmo Maria Caporale, Marianne Schulze-Ghattas, and Nicola Spagnolo. Volatility spillovers and contagion from mature to emerging stock markets. ECB Working Paper No. 1113, 2009.

Nicholas Bloom. The impact of uncertainty shocks. *Econometrica*, 77:623–685, 2009.

Nicholas Bloom, Max Floetotto, Nir Jaimovich, Itay Saporta-Eksten, and Stephen J. Terry. Really uncertain business cycles. *Econometrica*, 86: 1031–1065, 2018.

Nobuhiro Kiyotaki and John Moore. Credit cycles. *Journal of Political Economy*, 105:211–248, 1997.

Juan M. Londono. The variance risk premium around the world. International Finance Discussion Papers No. 1035, Board of Governors of the Federal Reserve System, 2011.

Marcello Pericoli and Massimo Sbracia. A primer on financial contagion. *Journal of Economic Surveys*, 17:571–608, 2003.

Shouyong Shi. Liquidity, assets and business cycles. *Journal of Monetary Economics*, 70:116–132, 2015.