THE JOURNAL OF
# DERIVATIVES

VOLUME 27, NUMBER 4 SUMMER 2020



## SPECIAL ISSUE: PHYSICS AND FINANCIAL DERIVATIVES!

I'm pleased to write that *The Journal of Derivatives* will publish its special issue in the next quarter: Fall 2020. Speaking for our publisher, the guest editors, and myself, we're proud to bring this fusion of two great fields to our readers.

The guest editors for the "Physics and Financial Derivatives" special issue are Andrey Itkin (also a JOD board member), Alexander Bogdanov, and Alex Lipton. When this issue arrives next quarter, you'll learn and appreciate the fine work of these experts in both finance and physics.

## ALL CORONAVIRUS, ALL THE TIME

As I write this letter in mid-April 2020 from a location near New York City, we are deeply immersed in the Coronavirus pandemic. The impact to global society begins with the direct risk to health and life. Beyond health, the impacts on economies, liberty, and financial and monetary systems are stupefying. Last, and likely least, is the lopsided victory for Coronavirus in the battle to win our undivided attention. In the current time, there's little point in marketing products, such as new cars or swaption models, that do not have a COVID-19 theme.

Health is more important than wealth. Nonetheless, I will raise the (non-health) question that all financial professionals are pondering. What does this virus and the world's counter-measures portend for global derivatives, debt, equity, currencies, and money? The stock markets, "equity" in my list of the preceding sentence, get all the headlines. But the roiling turmoil we see in stock markets exists with derivatives, debt, currencies, and money as well.

For example, will the new sovereign debt of various countries' fiscal stimulus plans ever be repaid? For that matter, will *existing* sovereign debt be repaid? Further, instead of *normalizing* the balance sheet it pumped to $4+ trillion for the 2008 Great Financial Crisis, the US Federal Reserve will now kick it up to $8+ trillion! What does this action do for confidence in "money" now and in the future?

Voltaire reputedly stated: "Judge a person by his/her questions rather than his/her answers." Here I disagree with the literal meaning of that statement. I find it much easier to ask the vague, essentially rhetorical questions I posed in the preceding paragraph than to answer them. A wonderful aspect of markets is that people construct answers with their investments and actions rather than with their words. I look forward to reading the tea leaves of the market for these answers concerning debt and money.

## COVID-19 AS THE ULTIMATE STRESS TEST

The coronavirus pandemic is the metaphorical asteroid from deep space that we perceive only when it is upon us. The jolting disruption to lives and livelihoods does not stem from financial causes, but creates immediate financial havoc. When debtors cannot conduct business, they cannot repay their debt obligations. Neither can leveraged investors pay their loans when their pledged collateral suffers crippling losses.

Current events are truly a "stress test" for the banking industry and all of us. The question leaps to one's mind: should "Global Pandemic" have been one stress test that banking regulators impose on large banks? Even in the midst of crisis, it strikes me as "unfair" that we ask banks to survive a seemingly rare scenario in which so many borrowers (may or will) fail simultaneously. Banking regulators appear to share this view. The mega-bailouts the world is now preparing for corporate and individual borrowers are bailouts for the banks as well. Whether a conscious choice or not, society does not ask large banks to hold sufficient capital to survive a global pandemic.

Yet here's a related question. The pandemic really is "a war" in many respects. Why do the banking regulators not have a "Large-Scale War" stress test? The probability of war between two large military powers is likely greater than that of a pandemic on the scale of the devastating 1918 Spanish Influenza. As a hastily conceived answer, the stress test is not necessary since society would consent to bailouts of borrowers and banks just as it now does with COVID-19.

■ ■ ■

The six articles of this issue begin with a new treatment of the longstanding and "rich" problem of determining the risk-neutral probability density for equity prices from traded option values. Fumio Hayashi of the Graduate Institute for Policy Studies (Tokyo) employs both the volatility smile, dependence on option strike, and the impact on option delta values in his derivation. The author assesses valuation errors and claims this method is especially suited for practitioners.

Marc Bohmann and Vinay Patel, both of the University of Technology Sydney, examine option-implied volatility of crude oil and natural gas futures for "information leakage" in advance of news announcements. The authors claim to find statistically significant relationships between announcement date returns and pre-announcement implied volatility spreads and skew. Bohmann and Patel also compare their findings to alleged information leakage in equity options markets

Hideharu Funahashi of Mizuho Securities Co. Ltd. provides an analytical approximation for swaption prices when the forward rate obeys the Heath-Jarrow-Morton (HJM) model. The author employs a chaos expansion approximation with a semi-closed form solution. Funahashi then adds an efficient numerical algorithm implementation with calibration to market data.

Panha Heng, Scott Niblock, and Jennifer Harrison, all of Southern Cross University, and Hansi Hu, University of Wollongong, examine the impact of high-frequency trading (HFT) co-location (of servers and communication equipment) for the Australian futures market. In studying four specific futures contracts, the authors find HFT's impact to be increasing trading activity and liquidity. With HFT, these contracts absorb information from major announcements efficiently. The authors conclude that abnormal trading profits from HFT are unlikely in this market.

Haibin Xie, Mo Zhou, and Tinghui Ruan, all of the University of International Business and Economics (Beijing), create a Glosten-Jagannathan-Runkle (GJR)-GARCH model for the VIX volatility index and then adapt this model to VIX futures. The authors derive analytical approximation formulas, which they claim to be the first under a non-affine GJR-GARCH process. Xie, Zhou, and Ruan confirm the quality of this approximation with empirical studies. They further compare GJR-GARCH to Heston-Nandi and find dominance of the former model.

Yuan Wen of the State University of New York at New Paltz studies the impact of the introduction of new options on equity volatility and crash risk. The author finds the null result of no impact following the introduction of weekly options. In this study, Wen attempts to find non-linear and high-order interactions between introduction of options and crash risk employing the regression tree model and random forest model machine learning methods.

**Joseph M. Pimbley**
**Editor**