Digging into Oil Price Uncertainty and Real Economic Activities

Changes in oil prices are closely related to macroeconomic fluctuations. It is well known that two oil shocks in the 1970s preceded two recessions, and recent research suggests that the Great Recession of 2008 may be, in part, explained by the oil price hikes in 2007 to 2008 (Hamilton, 2009).

Traditionally, oil prices have been deemed as exogenous to developed economies because events such as geopolitical shocks or OPEC's supply decisions determine the prices. However, recent empirical evidence has revealed that oil prices may be determined endogenously by supply and demand (Kilian, 2014). Consequently, it is natural to ask which financial/macroeconomic variables are the determinants of oil price uncertainty.

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The finance literature has proposed scientific methodologies for accurately quantifying the magnitude of price uncertainty of a financial asset (Andersen, Bollerslev, and Diebold, 2007). Such methodologies use high-frequency tick-by-tick price data; these are available to researchers due to the deep liquidity of the commodity futures market. Using these methodologies, we can not only calculate the high-frequency realized variance ("RV"), our measure of oil price uncertainty, but we can also decompose it into the expected change in oil price ("the continuous part") and the sudden, unexpected change ("the jump part"). Then, we investigate a large cross-section of financial/macroeconomic indicators to understand which variables drive the continuous and jump parts of oil price uncertainty.

Using a cutting-edge dimension reduction technique called the three-pass regression filter ("3PRF") (Kelly and Pruitt, 2015), we document interesting stylized facts. The continuous and jump parts of oil price uncertainty contain distinct information. The continuous part is closely related to proxies for economy-wide uncertainty, such as Ludvigson's index (Jurado, Ludvigson, and Ng, 2015). The jump part, however, reflects the commodity/oil market-specific demand and supply proxied by, for example, the Baltic Dry index and the monthly change of the world oil supply. The overall findings are consistent with the view that oil prices are endogenously determined.

Economic theory claims that oil price uncertainty slows down economic activities. The literature provides several explanations. Some economists argue that, in the presence of oil price uncertainty, economic agents delay investment in fixed assets. Others maintain that precautionary motives deter energy-related consumption. Yet, according to other economists, in the case of high oil price uncertainty, the labor market reallocates resources, which is costly and recessionary. All of these explanations are certainly appealing, but empirical support for the negative relation between oil price uncertainty and real economic activities ("REA") is mixed.

Related to oil price uncertainty and REA, we must ask two questions. First, is the continuous part a cleaner predictor of REA than the jump part? The answer to this question is clearly yes. We find that the continuous part strongly predicts many different proxies for REA, such as real GDP, real GNP, real personal consumption of durable goods, and real investment, etc.; however, the results with the J-part are weak. Second, if the continuous part of oil price uncertainty is endogenously determined by macroeconomic uncertainty, does the continuous part still predict REA, even after controlling for macro uncertainty? Our dataset supports the view that the oil RV still has unique information to predict REA not subsumed by macro uncertainty. The results are particularly strong with real investment and real personal consumption of durable goods.

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BIOGRAPHY

SANG BAUM "SOLOMON" KANG is an assistant professor of finance at Stuart School of Business, Illinois Institute of Technology. He holds a B.S. in Applied Statistics from Yonsei University, an M.S. in Actuarial Science from the University of Wisconsin at Madison, an M.S. in Computational Finance from Carnegie Mellon University, and a Ph.D. in Finance from McGill University. Dr. Kang's research focuses on energy finance, commodities, financial derivatives, and asset pricing. Specifically, he is interested in oil markets, electricity markets, real options, government policy risk in energy markets, Monte-Carlo simulation, financial risk management, and index options. His works have been presented at various conferences including the AEA Annual Meeting, the SoFiE conference, and FDIC Derivatives and Risk Management Conference. He published in Energy Economics, Economics Letters, Journal of Energy Markets, and Energy Risk, and his working papers received the 2010 NFA Best PhD Student Paper Award and the 2012 FMA Asian Conference Best Paper Award. Prior to starting his PhD, Professor Kang worked for nine years in the energy sector doing financial modeling and analysis for commodity traders and risk managers; he assumed managerial positions in his private sector experience. He is also a Financial Risk Manager certified by GARP.

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Given the financial support from the Canadian Securities Institute Research Foundation ("CSIRF"), I was able to enjoy relative financial freedom during my PhD program. I believe that CSIRF's support strengthened my CV because several interviewers noted the award during interviews. My current school, Illinois Institute of Technology, is located in Chicago, a center of commodity derivatives and high-frequency trading. Because of its location, my institution is very much interested in financial derivatives. Some colleagues at my school have the impression that Canadian schools, including McGill University and the University of Toronto, are strong in derivatives research. The financial support from CSIRF has contributed a strong positive signal of support for work on derivatives.

With Xuhui Pan (Tulane University) and Jianlin Zhao (Illinois Institute of Technology), I am writing a paper titled "*The Economic Drivers and Effects of Oil Price Uncertainty*" on the topic outlined in this article.[1] By proposing a new measure for oil price uncertainty, our article will contribute to growing literature investigating why and how financial asset return volatility arises, and its implications on real economy and financial markets.

[1] The draft will be available on the authors' webpages or SSRN.

Reference:

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