Volume 40
Special Issue 2
2019

Energy Economics Education Foundation, Inc.

ISSN 0195-6574
E-ISSN 1944-9089

The Energy Journal

Executive Summaries

IAEE
www.iaee.org
International Association for Energy Economics

On the Oil Price Uncertainty

Zied Ftiti[a] *and Fredj Jawadi*[b]

This study investigates the dynamics of oil price volatility and uncertainty over the period January 1986–December 2018, covering the different phases that witnessed oil price increases and slumps. Both volatility and uncertainty must be analyzed to understand and explain the important changes in oil prices over the last few decades. This is relevant because oil price changes affect households, investors, companies, and the entire economy. Interestingly, while previous studies have analyzed oil volatility, the focus on oil price uncertainty and its effects is rather limited, and this may be explained by the complexity and difficulty in measuring and modeling oil price uncertainty. This is also why related previous studies provide inconclusive results about oil price uncertainty. Accordingly, in line with Poon and Granger (2003) and Teräsvirta and Zhao (2011), we propose three different specifications of stochastic oil volatility: standard stochastic volatility, stochastic volatility moving average, and leverage stochastic volatility models. The class of stochastic volatility is recommended because unlike other methodologies in the family of conditional variance models (ARCH, GARCH, etc.), it offers a more flexible and less restrictive framework to model oil volatility. Furthermore, with these three different specifications of stochastic volatility models, it is possible to capture the different observed stylized facts in oil data: asymmetry, leptokurtic excess, outliers, extreme values, and nonmorality. Besides, this study proposes an innovative exercise for oil price uncertainty forecasting. We compute the out-of-sample forecasts of oil price uncertainty using the estimates of these three stochastic oil price volatility models. Our findings show that the standard stochastic volatility model outperforms the other two models when focusing on oil price uncertainty. This finding is particularly relevant to better forecast and understand the effects of oil price uncertainty on the entire real economy.

Location Basis Differentials in Crude Oil Prices

Phat Luong,[c] *Bruce Mizrach,*[d] *and Yoichi Otsubo*[e]

Crude oil is delivered in a variety of locations, but two of the most important are the U.S. market in Cushing, Oklahoma, which determines the West Texas Intermediate price, and the Brent price for delivery in the North Sea, offshore from the U.K. The difference in the two prices, which is called the basis, was very stable historically, with Brent trading at a small discount to WTI.

New production technologies contributed to a massive increase in U.S. crude oil production which reached a record high of more than 10 million barrels per day in 2017. The infra-structure in the U.S. was temporarily overwhelmed, and the Brent and WTI prices disconnected for a period of six years, from January 2010 to December 2015. This breakdown coincided with the decision of Saudi Arabia to stop using WTI for its pricing in the U.S. and ended with the lifting of the crude oil export ban. Brent at one point in 2011 traded at $27 premium to the WTI price in September 2017.

a Corresponding author: EDC Paris Business School, OCRE, Paris (France). E-mail: Zied.Ftiti@edcparis.edu

b University of Lille, Lille, France.

c College of Business Management

d SUNY Polytechnic Institute Department of Economics

e Rutgers University Alliance Manchester Business School, University of Manchester

We measure this basis change statistically through cointegration and causality analysis of the two benchmark prices. Cointegration tests for a long-run equilibrium between two prices, and our tests confirm that Brent and WTI were not cointegrated between January 2010 and December 2015. Granger causality analysis also shows that inventory levels were no longer a causal factor in the spread during the period in which prices detached. U.S. retail gasoline prices also lost their connection to WTI prices.

New pipelines were built and transport capacity increased so that by the end of 2015, more than 90% of crude oil heading into the Gulf Coast was by pipeline, resolving the inventory build-up in Cushing. With the ending of the 40 year ban on crude oil exports in December 2015, crude exports from the Gulf surged to 50 million barrels per month. With the route to international markets fully restored, the WTI price resumed its long run pricing relationship with Brent.

Drilling Down: The Impact of Oil Price Shocks on Housing Markets

Valerie Grossman,[a] Enrique Martínez-García,[b] Luis Bernardo Torres,[c] and Yongzhi Sun[d]

Texas is the United States' top oil producer, so oil price fluctuations have a considerable impact on the state's economy, including real estate markets. Texas has led many of the advances that have shaped the oil and gas industry, such as hydraulic fracturing ("fracking") and multi-stage drilling, in recent years. The state is, therefore, a good lab for investigating the impact of exogenous fluctuations in real oil prices on the economic outcomes of oil-producing regions/countries.

Typically, housing is one of the largest assets on a household's balance sheet, yet the economically significant relationship between house prices and oil prices has received only limited attention in the literature thus far. Using a novel panel of quarterly data, we investigate empirically the impact of oil price shocks on Texas' metropolitan housing and rural land markets. We estimate a panel vector autoregression (VAR) model from 1975:Q1 to 2016:Q2 to capture the dynamic empirical relationship between real oil prices and real house prices. We account for the endogenous effects of demand-side housing fundamentals, such as real personal disposable income (per capita) and long-term real interest rates, on real estate markets. We also incorporate supply-side housing fundamentals with real rural land prices and model the cross-sectional oil-dependence heterogeneity across metropolitan areas with data on adjacent proved crude oil reserves.

We find evidence that spillovers from oil prices play a significant role in local housing and rural land markets. We show that the response of real house prices (and to a larger extent of real rural land prices) is comparable in magnitude to that of a real income shock even among MSAs that are not heavily oil-dependent. We also argue that confounding real oil price shocks with discretionary real income shocks in oil producing regions bias our empirical inferences and tends to overestimate the effect of real income shocks. Moreover, our findings suggest this empirical relationship is stable

a Valerie Grossman, Federal Reserve Bank of Dallas, 2200 N. Pearl Street, Dallas, TX 75201. 214-922-6367. Valerie.Grossman@dal.frb.org.

b Corresponding author. Enrique Martínez-García, Federal Reserve Bank of Dallas, 2200 N. Pearl Street, Dallas, TX 75201. 214-922-5262. emg.economics@gmail.com. https://sites.google.com/view/emgeconomics.

c Luis B. Torres, Real Estate Center at Texas A&M University, Mays Business School (1700 Research Parkway. Suite 200), College Station, Texas 77843-2115. 979-845-7972. lbtorresruiz@gmail.com.

d Yongzhi Sun, Southwestern University of Finance and Economics, 226 RIEM Bldg., Chengdu, China. yzsun@swufe.edu.cn.

over the full sample in spite of the significant changes in oil production that have unfolded from the shale revolution since the 2000s.

Oil Prices and Banking Instability: A Jump-Diffusion Model of Bank Capital Structure

Willi Semmler[a] and Samar Issa[b]

Over the past two decades, an increasing level of bank leveraging has occurred, which was one of the main causes behind the financial market meltdown of the years 2008-9. This trend in the banking industry was accompanied by another trend in the real estate sector, where the subprime mortgage crisis originated. For example, the home price-to-rent ratio began to increase rapidly in 2001 (Finicelli 2007), and American households accrued debt at an unprecedented level (Hudson 2006). Interestingly, 90% of this increase in debt since the 1990s consisted of mortgage loans, which roughly constituted 50% of total bank loans in general. This increase in mortgage loans was caused by the low interest rate, which stimulated home buyer borrowing capabilities. In addition, leveraging increased due to the expanding role of financial intermediaries, which acted in the middle and hedged risk by outsourcing loans. Risk was transferred through the securitization of risky loans, banks increased their risk-taking behaviors and neglected sufficiently screening borrowers' risk. To account for this we develop a measure of bank overleveraging and examine banks' past leveraging experiences to determine how the excessive leverage contributed to their failures and to the instability of the overall banking sector.

To turn this issue into an empirical question, this paper presents a model of bank capital structure, which easily lends itself to capture and measure the mechanism driving a wedge between the optimal or sustainable leverage of a bank, as measured by the Stein model (2012) and actual debt. We apply this method to test whether various oil-related, politically related, and regulation-related events have magnified the excess debt observable in the balance sheets of banks. Our focus includes banks in oil-producing countries and Western countries. Though the work builds on the Stein (2012) model we add a jump-diffusion component that captures the jump size and intensity of oil prices and political instability predictors. The optimal debt is derived and then estimated for a sample of six banks in three countries using Markov Chain Monte Carlo, for the time span from 2006-2016.

This paper contributes to recent academic research on the topic of overleveraging and the effects of large oil and political instability shocks on asset prices, financial markets, and the balance sheets of banks. We show that those shocks might be destabilizing rather than mean reverting. In our paper, we are dealing with the oil market and the volatility of oil prices in terms of a jump-diffusion process that not only helps one understand and stylize how the commodity market is affected, but also how the stability of the banking system is impacted.

Our findings show that most of the banks in this context had a high optimal debt around 2008, overlapping with the oil price shock. In addition, most of the predictors, namely oil prices and political instability factors proxied by terrorism, corruption, and military expenses, regularly appeared in volatility and jump intensity factors. This is in line with the assumption that they serve as significant risk drivers for businesses and the macroeconomy. The oil price had a negative effect

a Dept of Economics, New School for Social Research.

b Corresponding author. Dept of Economics and Finance, Saint Peter's University

on drift and jump intensity for four banks in the U.S. and the U.K., while exhibiting a different drift effect for the oil-exporting country such as for example Bahrain.

The optimal debt ratio estimation presented in this paper is an important measure that can help banks detect a sustainable debt level above which it becomes risky to leverage. This is a key financial metric in that it allows banks to avoid instability and/or risk of insolvency when they take this metric seriously. However, banks do not accurately assess optimal debt, and in most cases, when the optimal debt moves down, excess leverage increases for a given level of actual leverage.

We add to the previously referenced academic studies the role of rapid changes of oil prices and political stability, and their impact on the stability of the banking system. We use the oil price change as an example of a rare but large event, and model it as the jump-diffusion process with its impact on banks' portfolios, their asset prices, and balance sheets. Here, too, the banks' vulnerability and exposure to insolvency risk can become an important threat to macroeconomic stability and performance.

Given our results from the jump-diffusion component built into the Stein model of optimal bank debt, we can spell out some policy implications. The main one for all countries is to reduce overall risky debt, and develop an optimal debt structure which needs to be followed in order to avoid the risk of financial instability and default. The first challenge in designing an effective policy is to make optimal debt a fixed ratio based on the net worth of a financial corporation, which should be a regulatory one. High risk implies high return, therefore, decreasing the risk by providing secured lending will be a challenging task. One has observed that a risky portfolio that is driven by commodity prices, such as oil prices, props up the lending to dangerous levels. We have tried to distinguish between optimal and actual leveraging of financial institutions.

We could observe that what has been called optimal debt is even rising with the oil price spikes, and so is the actual level of debt. A further policy challenge is to introduce and strengthen risk weighted capital buffers and the use of collaterals that can quickly turn into liquidity. Collaterals are a powerful tool for achieving stability, despite the repossession cost they impose on the banks. Policymakers should impose higher collaterals on riskier borrowers, and also for financial institutions exposed to such shocks as oil price shocks. In addition, monetary policy that increases the interest rate will prompt a greater collateral, closer to optimal leverage level, which affects borrower's investments' opportunities and risks, hence its effect on the bank's portfolio risk and choice. Thus, policymakers should also be aware that the value of collaterals are also endogenously determined, for example based on the level and volatility of the oil price.

Oil Prices and the Stock Markets: Evidence from High Frequency Data

By Sajjadur Rahman[a] and Apostolos Serletis[b]

The relationship between the price of crude oil and the stock markets has gained considerable attention among researchers in recent years, as cashflows generated by firms in different industries greatly depend on crude oil prices. They primarily use monthly data and apply empirical models that range from simple linear regressions to structural vector autoregressions, which are

a Department of Accounting and Finance, Texas A and M – San Antonio, USA.
b Corresponding author. Department of Economics, University of Calgary, Canada. Email: serletis@ucalgary.ca

identified mostly through exclusion restrictions. Their findings suggest that oil price shocks in general have significant negative effects on stock returns.

In this study, we focus on the relationship between crude oil prices and stock market returns using the highest frequency data that have ever been studied. This is of critical importance, since in making their investment decisions investors frequently update their information set after considering the content as well as variations of the high frequency data points. We utilize these variations in a structural model in order to identify the shocks to the price of crude oil.

We use daily data that span the period from January, 1987 to October, 2016 on the changes in the spot price of West Texas Intermediate (WTI) crude oil and S&P 500 market returns. We apply a bivariate structural VAR that is identified through heteroscedasticity of our high frequency dataset, as detailed in Rigobon and Sack (2003) and Wright (2012). Based on our estimated model, we produce responses of U.S. market returns to a one standard deviation shock to the price of crude oil and find empirical evidence that unanticipated increases in the price of crude oil have negative effects on U.S. market returns.

We extend our analysis by replacing the S&P 500 market returns with U.S. industry returns, returns on the GICS energy sector, and returns of major energy companies. We also examine the cross-county evidence on the effects of oil price shocks on the stock market by including returns data of selected emerging and industrialized countries. Finally, we check the robustness of our results by including aggregate and disaggregate U.S. excess returns. All of these empirical results support our main finding that the stock market responds negatively to oil price shocks.

Do Jumps and Co-jumps Improve Volatility Forecasting of Oil and Currency Markets?

Fredj Jawadi, [a] *Waël Louhichi,* [b] *Hachmi Ben Ameur,*[c] *and Zied Ftiti*[d]

This study models and forecasts oil and USD exchange rate volatilities using high-frequency data. Intraday data are obtained from Bloomberg database and cover the period from September 1, 2014, to April 30, 2018. During this period, we compute 5-minute logarithm returns for the West Texas Intermediate (WTI), the DXY index and for the six exchange rates included in the DXY: euro, jpy gbp, cad, chf and sek. Accordingly, we use this recent intraday data to investigate how jumps, both bivariate and multivariate co-jumps between the oil and USD markets, and news improve forecasting of their realized volatility (RV). The originality of this paper is twofold: i. We specify the intraday relationship between the two markets in terms of intraday jumps, ii. We test their effects on volatility.

Accordingly, on the one hand, instead of detecting the trading days that contain jumps, we propose rather to identify intraday jumps. To this end, we apply the most well-known intraday jump tests proposed by Andersen el al. (2007) and Lee and Mykland (2008). After detecting intraday jumps in the two markets, we estimate a TOBIT model and we show that the existence of a significant contemporaneous relationship between jumps in the exchange and the oil markets. This

a University of Lille, France

b Corresponding author: ESSCA School of Management, 55 Quai Alphonse Le Gallo 92513 Boulogne-Billancourt, France. Tél. : +33 (0)6 98 89 71 25. Fax : +33 (0)1 41 86 04 86. E-mail: wael.louhichi@essca.fr

c INSEEC Business School, France

d EDC Paris Business School, France

finding suggests that jumps occur simultaneously in foreign exchange and oil markets, which raises the hypothesis of co-jumps between the two markets. We confirm this hypothesis by applying the co-jump test of Andersen et al. (2008). Moreover, we propose to investigate the connection between the information flow arrival and co-jumps occurred simultaneously in the oil and the exchange rate markets. Specifically, we propose to test whether simultaneous jumps (co-jumps) occurring in the oil and the exchange rate markets might coincide with information flow arrival. Our information arrival proxy is based on unanticipated US macroeconomic news headlines recorded by Bloomberg database. To test the association between public information releases and violent price changes (jumps) occurring simultaneously in both markets, we regress co-jumps against the number of unanticipated macroeconomic news announcements published through Bloomberg terminals. Our results show that the coefficient measuring the impact of news is statistically significant, confirming the assumption for which co-jumps between the two markets do coincide with the timing of macroeconomic news announcements. This finding confirms the hypothesis according to which co-jumps are subordinated to macroeconomics news, which is in line with the MDH hypothesis.

On the other hand, we extend the Heterogeneous Autoregressive (HAR)-RV model of Corsi (2009) through the consideration of jumps and co-jumps to forecast the dynamics of oil price and USD exchange rate RV. We find that both the oil and USD exchange rate markets co-move during shocks through common abrupt price jumps that are always driven by news. Further, we find that our extended HAR-RV outperforms Corsi (2009)'s model in forecasting volatility while showing a significant contribution of co-jumps and unexpected news to forecasting the future dynamics of RV. In particular, while unexpected news drives USD exchange-rate volatility, the co-jumps–HAR-RV model produces more accurate forecasts for the oil market.

Total, asymmetric and frequency connectedness between oil and forex markets

Jozef Baruník[a] and Evžen Kočenda[b]

Volatility connectedness quantifies the dynamic and directional characterization of volatility spillovers among various assets or across markets. We analyze connectedness between oil and forex markets. Knowledge and quantification of the volatility connectedness, or volatility spillovers, between oil and forex markets is important for number of reasons. Most crude oil production and sales is quoted and invoiced in US dollars. Subsequently, oil prices in domestic currencies depend substantially on the dollar exchange rate and payments for the oil sold on the market represent massive financial flows entering the forex market. In addition, large financial flows come from financial players with no interest in oil as a physical commodity. There is also empirical evidence showing that oil prices possess predictive power with respect to the exchange rates of the oil-exporting countries.

Because of substantial links between oil and forex markets, there is considerable potential for the uncertainty (i.e., volatility) in oil prices to transfer into the uncertainty of foreign currencies on the forex market and vice versa. As such, large volatility spillovers are likely to emerge between the two markets with practical implications related to risk management, portfolio allocation, and

a Institute of Economic Studies, Charles University, Opletalova 26, 110 00, Prague, Czech Republic. Institute of Information Theory and Automation, The Czech Academy of Sciences, Pod Vodarenskou Vezi 4, 182 00, Prague, Czech Republic.
b Institute of Economic Studies, Charles University, Opletalova 26, 110 00, Prague, Czech Republic.s

business cycle analysis. Hence, our goal and contribution is a comprehensive analysis of the volatility connectedness between the oil and forex markets.

We analyze three types of connectedness. First, total connectedness makes it possible to quantify the aggregate extent of volatility spillovers between the two markets. Second, we account for potential asymmetries in connectedness that might arise from asymmetric shocks either to oil or to foreign currencies. Third, we assess frequency connectedness to distinguish whether connectedness is formed at shorter or longer frequencies, i.e., shorter or longer investment horizons. In sum, we analyze total, asymmetric and frequency connectedness on the oil and forex markets using high-frequency intra-day data over the period 2007–2017.

Our results show that high forex connectedness decreases when both forex and oil markets are assessed jointly. The increased volatility and spillovers among currencies from 2013 onward are chiefly rooted in different monetary policy regimes. Since oil market development seems to be detached from monetary policy regimes, we might argue that a mixed oil and forex portfolio, with its lower connectedness in general, represents more stable investment option. This is true despite that shocks to crude oil do transfer to currencies to a lesser extent than vice versa. A practical implication emerges that total connectedness of the mixed forex and oil portfolio might be reduced by selecting currencies that transfer their volatility to oil to the smallest extent.

Asymmetries in forex volatility connectedness are dominated by negative shocks in general. Connectedness between both oil and forex markets is dominated by positive shocks, however. A direct implication is that adding oil to form a mixed oil and forex portfolio has the potential to alter the asymmetry in the connectedness between the two classes of assets. Asymmetries in connectedness are also relatively small. The massive volume of transactions involving both types of assets represents enormous information flows on both markets. We conjecture that ample information is likely behind the limited extent of asymmetries in volatility spillovers.

The dynamics of frequency connectedness differs dramatically across various investment horizons and should be credited to differences in investment preference formation. Frequency connectedness is to an extent driven by both liquidity and uncertainty shocks, and uncertainty shocks always exert a stronger impact irrespective of frequency. Both types of shocks suppress short-term connectedness but substantially raise long-term connectedness. This finding helps to explain frequency connectedness behavior, in that long-term connectedness reflects substantive features of economic development and investors' concerns. Hence, frequency connectedness can also serve as a sensitive indicator of the investment horizon at which markets feel uncertainty the most.

The above findings and implications underline the significance of understanding oil price volatility that represents risk to producers and industrial consumers in terms of production, inventories, and transportation. It also affects the decisions of purely financial investors and decisions on strategic investments.