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Impact of oil price uncertainty on Middle East and African stock markets

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ABSTRACT

This paper investigates whether the implied crude oil volatility index (OVX), a forward-looking measure of oil market uncertainty published by Chicago Board Options Exchange (CBOE), impacts the realized volatility of Middle East and African stock markets. Using an extended version of the GARCH model, we show that the oil market uncertainty has substantial effects on the realized volatility of most of the markets under study. Our findings also reveal that, even after controlling for the effect of the implied volatility index of S & P 500 (VIX), the impact of the OVX on the Middle East and African equity markets still holds for almost half of the markets considered. Additionally, the application of the GARCH-jump model shows that stock returns of majority of the sampled markets are sensitive to the fluctuations occurring in the implied oil volatility index and that time-varying jumps do exist in the stock returns. Thus, the market participants' anticipation of the future oil market uncertainty is an important factor explaining the returns and volatilities of the Middle East and African equity markets.

1. Introduction

The recent downturn in crude oil price is substantially affecting the economies all over the world, oil being one of the major production factors in most countries. In oil-depending economies, changes in oil price and volatility can be expected to influence also their equity markets. For example, Ciner [15] argues that oil price shocks can cause changes in expected cash flows, by affecting the overall economy as well as the discount rate used to value equities by changing inflationary expectations. Consequently, large oil price movements tend to increase uncertainty of future equity prices as evidenced, for example, by Bernanke [5] and Pindyck [31]. In this paper, our objective is to examine whether the implied crude oil volatility index (OVX), a forward-looking measure of oil market uncertainty published by Chicago Board Options Exchange (CBOE), impacts the volatility of Middle East and African stock markets.

Over the past years, the relation between oil price changes and stock returns has received an increasing attention in the energy and finance literature. Accordingly, numerous empirical studies have investigated the return and volatility transmission mechanism between oil price and stock returns. Notable contributions include e.g. Sadorsky [32], Papapetrou [30], Killian and Park [22], Malik and Ewing [26], Lee and Chiou [24], Arouri, Jouini and Nguyen [1,2] and Bouri [9,10]. Collectively, the above articles show that oil and stock markets are associated with each other. A unifying feature of these articles is that they use crude oil price series to investigate the volatility.

Our study contributes to the existing literature in two major ways. First, our paper models realized volatilities of emerging stock markets, taking into account the global anticipation of future oil price uncertainty, measured using the implied crude oil volatility index, OVX. This is an advantageous approach, since the implied oil volatility index, which is derived from option prices, is generally considered to be a good indicator of oil market uncertainty (see, e.g., Liu, Ji and Fan [25]). According to Liu et al. [25], this is because implied volatilities not only contain historical volatility information, but also investors' expectation of future market conditions. Additionally, Haugom, Langeland, Molnár and Westgaard [20] find that the day-ahead and week-ahead volatility forecasts can be significantly improved by including information from the OVX. Given the useful properties of the OVX, our paper provides a novel extension to papers such as Sadorsky [32], Papapetrou [30], Killian and Park [22], Malik and Ewing [26], Lee and Chiou [24], Arouri et al. [1,2] and Bouri [9,10] that have used the crude oil price series to model volatility.

Second, many recent studies have used implied volatility

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indices, such as VIX, to assess the uncertainty transmission among the financial markets (Nikkinen and Sahlström [28]; Wang [33]; Bollerslev, Osterrieder, Sizova and Tauchen [8]; Liu et al. [25]). Of these studies, Liu et al. [25], for instance, find that the US stock market uncertainty, measured by VIX, affects oil price uncertainty measured by using OVX. Nonetheless, OVX has received very little attention in the literature which is very surprising for the oil market considering its economic importance (Haugom et al. [20]). Thus, our paper contributes also to the uncertainty transmission literature by examining whether global oil market uncertainty affects the realized volatilities of Middle East and African equity markets.

In our empirical approach, we apply a modified form of the generalized autoregressive conditional heteroskedasticity (GARCH) model to examine the relationship between oil market uncertainty and the volatility of different equity markets under study.[1] Our findings based on the extended model indicate significant links between oil price uncertainty and the realized stock market volatility. We also combine OVX with VIX to observe their joint effects on the selected markets and document that, association between oil price uncertainty and realized stock market volatility mostly hold even after controlling for the effect of VIX. Specifically, after inserting VIX as a regressor in the GARCH process, oil market uncertainty evidently affects the variance of nearly half of the markets considered. We further report that, conditioned on the past information, the volatility in each market is very persistent. This latter outcome suggests that the current volatility of stock returns for a specific market is directly affected by its past volatility. Additionally, we consider the application of the GARCH-Jump mode to assess whether variations in the oil volatility index have any significant influences over the stock returns. The results suggest that such associations hold for majority of the sampled markets and that jumps exist in the returns which are time-varying.

The results of the present study are useful for energy policy makers, investors and researchers in several aspects. For example, the findings can be used for framing sound asset pricing models and making global asset allocation decisions. They are also beneficial for the market participants in understanding the interaction of the stock markets of Middle East and African countries in relation to the crude oil market, as well as the global equity market uncertainties. In addition, our research could receive special attention from those investors who make use of new financial tools to hedge oil price volatility risk and are potentially interested in futures and option trading on OVX (Liu et al. [25]).

The article proceeds along the following lines. The next section reviews the relevant literature. Data and their properties are presented in the third section. Section 4 outlines the research methodology we consider in our empirical investigation. In section 5, we discuss our findings. The last section contains conclusions.

2. Literature review

A growing body of literature has examined the association between oil and stock markets. However, the findings of this literature are somewhat mixed. For example, Kling [23] and Papapetrou [30] find a negative relation between oil price changes and stock returns. Chen, Roll and Ross [12], on the other hand, report that stock returns are not affected by oil price fluctuations. More recently, however, Basher and Sadorsky [4] and Choi and Hammoudeh [14] identify a positive relation between oil price changes and stock returns.

While the relationship between oil prices and stock returns has been extensively analyzed, a strand of literature also examines the persistence and transmission of volatility from oil markets to stock markets. Malik and Hammoudeh [27] employ BEKK–GARCH(1,1) model to study the volatility and shock transmission mechanism among the U.S. equity market, the global crude oil market, and three Gulf equity markets that include Bahrain, Kuwait, and Saudi Arabia. In their empirical analyses, they document that Gulf equity markets are the receivers of volatility from the oil market. In addition, they report a significant volatility transmission from the stock market to the oil market only in Saudi Arabia.

By applying an autoregressive conditional jump intensity model with structure changes, Chiou and Lee [13] report the existence of a negative and statistically significant impact of oil prices on stock returns. They also detect that the asymmetric effect has statistical significance only in a high-fluctuation state for both spot and futures oil price contracts. The authors further find that with changes in oil price dynamics, oil price volatility shocks have asymmetric effects on stock returns. Fowowe [18] also employs the GARCH-jump model to investigate the relationship between oil prices and returns on the Nigerian Stock Exchange. The study reports a negative but insignificant effect of oil prices on stock returns in Nigeria.

More recently, Ewing and Malik [17] use the univariate and bivariate GARCH models to examine the volatility of oil and US stock market prices incorporating structural breaks using daily data from July 1, 1996 to June 30, 2013. The authors do not report any evidence of volatility spillover between oil prices and US stock market when structural breaks in variance are ignored in the model. However, after accounting for structural breaks in the model, they report strong volatility association between the two markets.

Bouri [9] has inspected the return and volatility linkages between oil prices and the Lebanese stock market by applying the VAR-GARCH model to weekly data from 30 January 1998 to 30 May 2014. The author finds some unidirectional return and volatility transmissions from oil prices to the Lebanese stock market. He also adds that the interrelationship between oil prices and Lebanese stocks increase during the crisis and tends to reduce significantly in the post-crisis period.

Additionally, few other studies use sector indices to investigate the volatility transmission between oil and stock prices. Malik and Ewing [26], for example, estimate bivariate BEKK–GARCH (1,1) models to examine the volatility transmission between oil prices and five US sector indices. The sectors considered in their study include Financials, Industrials, Consumer Services, Health Care, and Technology. The paper finds that there exists significant transmission of shocks and volatility between oil prices and different stock market sectors. Moreover, Arouri et al. [2] make use of European equity sector indices to assess the volatility spillovers between oil and stock prices. The authors show that the volatility transmission between oil price and sector stock returns is significant.

3. Data

In this paper, unlike the ones described in previous chapter, we use implied crude oil volatility index, OVX, instead of conventional oil price index, to estimate the effect of oil price uncertainty on the stock market volatilities. This is advantageous, because implied volatilities not only contain historical volatility information, but also investors' expectation of future market conditions.

The CBOE publishes OVX index, from the middle of 2007, as a measure of expected 30-day volatility of crude oil prices. The OVX considers real-time bid/ask quotes of nearby and second nearby options with at least 8 days to expiration, and weights these

[1] Thus, we follow the approach, for example, by Blair et al. [6] and Kambouroudis and McMillan [21] that use VIX as a regressor in the GARCH variance equation.