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Return and volatility transmission between oil prices and oil-exporting and oil-importing countries

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ABSTRACT

This paper provides further evidence of the comovements and dynamic volatility spillovers between stock markets and oil prices for a sample of five oil-importing countries (USA, Italy, Germany, Netherland and France) and four oil-exporting countries (United Arab Emirates, Kuwait, Saudi Arabia and Venezuela). We make use of a multivariate GJR-DCC-GARCH approach developed by Glosten et al. (1993). The results show that: i) dynamic correlations do not differ for oil-importing and oil-exporting economies; ii) cross-market comovements as measured by conditional correlation coefficients increase positively in response to significant aggregate demand (precautionary demand) and oil price shocks due to global business cycle fluctuations or world turmoil; iii) oil prices exhibit positive correlation with stock markets; and iv) oil assets are not a good 'safe haven' for protection against stock market losses during periods of turmoil.

1. Introduction

Our paper explores models that provide evidence of volatility transmission between crude oil prices and stock markets. Our objective is to complement this line of research by addressing the dynamics of volatility transmission using multivariate GJR-GARCH-class models which can detect the volatility asymmetry and spillover. (See Table 1.)

There have already been a few attempts to address the aforementioned topic, but none of the existing papers has approached the issue within a multivariate framework. The recent literature on volatility transmission and measurement has been developed through models that link the oil and stock market by investigating their comovements.[1] Hammoudeh et al. (2004) investigated spillover effects and dynamic relationships of five daily S&P oil sector stock indices and five daily oil prices for the US oil markets using cointegration techniques as well as ARCH-type models. They show evidence of some volatility spillover from the oil futures market and the stock returns of some oil sectors.

Accioly and Aiube (2008) analyze the dependence of extreme events in energy markets. They estimate and model both the overall and the tail dependence of crude oil and natural gas returns. After adjusting auto regressive GARCH models to filter the linear and the nonlinear time dependence in the series of returns, the authors fit various copulas to the residuals of GARCH models. Their results show strong dependence between oil and gasoline prices.

Chiou and Lee (2009) examined the asymmetric effects of daily WTI oil prices on S&P 500 stock returns. Using the autoregressive conditional jump intensity model with expected, unexpected and negative unexpected oil price fluctuations, they found that high fluctuations in oil prices have unexpected asymmetric effects on stock returns. Malik and Ewing (2009) relied on bivariate GARCH models to estimate the volatility transmission between weekly WTI oil prices and equity sector returns and found evidence of spillover mechanisms.

Choi and Hammoudeh (2010) extended the time-varying correlations analysis by considering the commodity prices of Brent oil, WTI oil, copper, gold and silver, and the S&P 500 index. They showed that commodity correlations have increased since 2003, limiting hedging substitutability in portfolios. More recently, Arouri and Nguyen (2010) examined the relationship between oil prices and 12 stock sectors in European countries. The authors showed that the reaction of sector returns to changes in oil prices differs considerably across sectors and that the inclusion of oil assets in a portfolio of sector stocks helps to improve the portfolio's risk–return characteristics. Choi and Hammoudeh (2010) extended the time-varying correlations analysis by considering the commodity prices of Brent oil, WTI oil, copper, gold and silver, and

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[1] Most of this literature offers substantial evidence of the impact of oil on stock prices, suggesting a negative relationship between oil price and stock market returns. For instance, Jones and Kaul (1996) used a standard cash-flow dividend valuation model and found a significant negative impact of oil price shocks on US and Canadian quarterly stock prices in the post-war period. Models relying on some variants of vector autoregressive analysis show similar findings (Papapetrou, 2001; Park and Ratti, 2008; Sadorsky, 1999).

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Table 1
Descriptive statistics of return series.

	Mean	Std. dev.	Skewness	Kurtosis	ARCH (1)
United Arab Emirates	0.013107	0.126709	0.118074	3.354331	17.145++
Kuwait	0.015864	0.059667	−0.284409	3.587228	24.044+++
Saudi Arabia	0.008233	0.083340	−0.822876	4.298505	23.696+++
Venezuela	0.018655	0.083850	0.449107	6.660345	17.174+++
USA	0.003945	0.061376	−0.867876	7.874304	20.294+++
France	0.004031	0.005572	−0.998552	3.529250	28.966+++
Germany	0.003945	0.005591	−0.695120	3.597867	27.126+++
Italy	0.001543	0.064840	0.706611	3.592523	33.158+++
Netherlands	0.003876	0.056325	−1.290798	6.326385	26.221+++

Notes: ARCH(1) are the empirical statistics of the Engle (1982) test for the 1st order of ARCH effects. +, ++, and +++ indicate that the null hypothesis of no ARCH effects is rejected at the 10%, 5% and 1% levels respectively.

the S&P 500 index. They showed that commodity correlations have increased since 2003, limiting hedging substitutability in portfolios.

Aloui et al. (2010) examines the extent of the current global crisis and the contagion effects it induces by conducting an empirical investigation of the extreme financial interdependences of some selected emerging markets with the US. They use a copula process capturing the dynamic patterns of fat tail as well as linear and nonlinear interdependences. Using daily return data from Brazil, Russia, India, China (BRIC) and the US, their empirical results show strong evidence of time-varying dependence between each of the BRIC markets and the US markets, but the dependency is stronger for commodity-price dependent markets than for finished-product export-oriented markets.

Filis et al. (2011) investigated time-varying correlations between Brent oil prices and stock markets on both oil-importing and oil-exporting countries. Using a multivariate asymmetric DCC-GARCH approach, they found that the conditional variance of oil and stock prices remains the same for oil-importing and oil-exporting economies. However, time-varying correlations depend on the origin of the oil shocks: the response from aggregate demand-related shocks is much greater than supply-related shocks originating from OPEC's production cuts.

Using weekly data from January 2, 1990 to December 28, 2009, Wu et al. (2012) examine the economic value of co-movement between WTI oil price and U.S. dollar index futures. They use Copula-GARCH models and they conclude that the dependence structure between oil and exchange-rate returns becomes negative and decreases continuously after 2003.

Awartani and Maghyereh (2013) investigated return and volatility spillover effects between the oil market and the Gulf Cooperation Council (GCC) stock markets using indices proposed by Diebold and Yilmaz (2009, 2012), and revealed transmission in both directions between 2004 and 2012. They identified a significant flow of information from oil returns and volatilities to the GCC stock exchanges, while the flow in the opposite direction was found to be marginal. Moreover, the oil market appears to give other markets more than it receives in terms of both returns and volatilities. The empirical evidence from the sample is consistent with a system in which oil plays the dominant role in the information transmission mechanism between oil and equities in the GCC countries.

Our study also looks at models on volatility transmission and thus contagion among stock markets of oil-exporting and oil-importing countries. The first empirical paper on financial contagion was the simple comparative analysis of Pearson's correlation coefficients between stock markets in periods of calm and periods of crisis. Contagion is found when significant increases in correlations occur in crisis periods. King and Wadhwani (1990), and Lee and Kim (1993) used the correlation coefficient between stock returns to test for the impact of the 1987 US stock crash on the equity markets of several countries. The empirical findings show that the correlation coefficients between several markets increased significantly during the crash. Hamao et al. (1990) found statistically significant correlations across stock markets during the 1987 crisis by estimating conditional variance under a GARCH model. Using a switching ARCH model, Edwards and Susmel (2001) found that many Latin American equity markets are significantly correlated during times of high market volatility, which proves contagion effects. Forbes (2004) studied the impact of the Asian and Russian crises on stock returns for a sample of over 10,000 companies worldwide, arguing that trade linkages are a vector of volatility transmission.

However, evidence on financial contagion is not really conclusive. Bordo and Murshid (2001) found that after accounting for heteroscedasticity, there was no significant increase in correlation between asset returns in pairs of crisis-hit countries. They concluded that there was no contagion but only interdependence. This is somewhat in contrast with Corsetti et al. (2005) who tested for financial contagion on a single-factor model and found some contagion and some interdependence. Further, focusing on different transmission channels, Froot et al. (2001) confirmed the existence of the contagion effect. Guesmi et al. (2013) investigated the co-movements between monthly US stock markets and those of the other sixteen OECD countries over the period 2002–2009 in order to study the contagion effect in the case of the recent global financial crisis. Using a multivariate DCC-GARCH, their results show the presence of shift-contagion effects arising from the financial crisis to most of the OECD stock markets, apart from Germany, Italy, the UK and, to a certain extent, Japan, where only interdependencies were detected. The other OECD stock markets were significantly impacted by shift-contagion during the financial crisis (2007–2009).

Our current work extends the method used to measure volatility spillover between oil and stock markets by applying multivariate GJR-DCC-GARCH models. Our study thus differs from previous ones in at least two respects. First of all, it identifies two main findings. Oil price shocks in periods of global turmoil or during global business cycle fluctuations (downturn or expansion) appear to have a significant impact on the relationship between oil and stock market prices, both in oil-importing and oil-exporting countries. In exporting countries, our analysis unveils higher and multiple peaks which coincide with major events (like the 2008 oil price crisis). In the case of importing countries, the pattern of interaction is far smoother compared to exporting countries. Other oil price shocks originating from events such as OPEC's production cuts, hurricanes and so on, do not seem to have a significant impact on the correlation between oil and stock markets in importing countries.

The rest of the paper is organized as follows. Sec. 2 describes the data and methodology model. Sec. 3 reports the empirical results. Sec. 4 concludes.

2. Data and methodology

2.1. Data description

In this study, we use monthly data for oil prices and stock market indices. The sample consists of oil-importing (US, Italy, Germany, Netherlands and France) and exporting countries (United Arab Emirates, Kuwait, Saudi Arabia and Venezuela). The following criteria had to be satisfied for inclusion in the sample: (i) the countries studied