The Relationship between the Oil Market and the Stock Market: An Empirical Study for 2010 – 2019

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Abstract: Energy prices, which are an important indicator in the world economy, change frequently. Especially crude oil prices have an important place for both the world economy and financial markets. This study analyzes the relationship between commodity markets and the stock market for the United State of America. The weekly data used for Brent oil, West Texas Intermediate (WTI) oil, and stock market (S&P 500) for the period from January 2010 to 30 November 2019. The findings show that after 2008 there is no Granger causality existed between the variables under observation period.

Introduction

In the global economy nowadays, the oil market is becoming a center of attention. Due to the extensive use of oil, its dependency within the equilibrium of supply-demand has been increasing. In return, oil has a great strategic position rather than other sources of energy across the globe. Because of the dependency on oil, producing and consuming related countries appreciated the oil importance that widely impacted the development process and economic growth across the world. Gisser & Goodwin, (1986) found the association of the oil market with the stock market, and the results of their findings presented that the increase in the oil price affects the cash flow to the markets.

Moreover, the association between the oil market and the stock market is not enough strong for the United Kingdom and Japan. Huang et al., (1996) found the relationship among the daily use of oil in the future and the market stock daily return in the United State. The evidence showed that future oil return produces some oil for company stock

return but it has no impact on market indices. Another study of Gjerde & Saettem, (1999) showed that positive response of stock returns and delays in a change of industrial production. They also found that the stock market acts as rational to the oil price changes in the market.

During the last decades, the price of oil and the demand for cars is remarkable in Europe. Oil Price has been steadily increasing since 2001, peaking in June 2009. After the oil price reached around $133.70 billion in 2009, it decreased back to $71 billion which is still high. By observing the demand for vehicles in the same period, we see that the number of vehicle registrations from 2000 to 2003 was constantly decreasing, while the price of oil was increasing. However, after 2004, there was a sharp increase in the record of vehicle registration and the peak was in 2007, after which demand in 2008 and 2009 covered by sufficient supply. At the time financial and credit crises that happened in 2009, the price of oil was at its peaked. The below figures show the lowest level of vehicle production in 1996 by the European Association of Automobile Manufacturers.

There are different studies with different findings of association of oil prices with the performance of stocks. The study of Sadorsky (2004) shows the relation between oil price shocks of the US and the stock market. The study by VAR and GARCH which was conducted from 1947 to 1996 about the interest rate and production of the industry showed that the price of oil and the volatility of oil price has been a major factor in influencing the stock return. Also, the volatility of oil prices has an asymmetric effect on the economy.

Figure 1: Annual Oil Price Trend for Brent spot prices
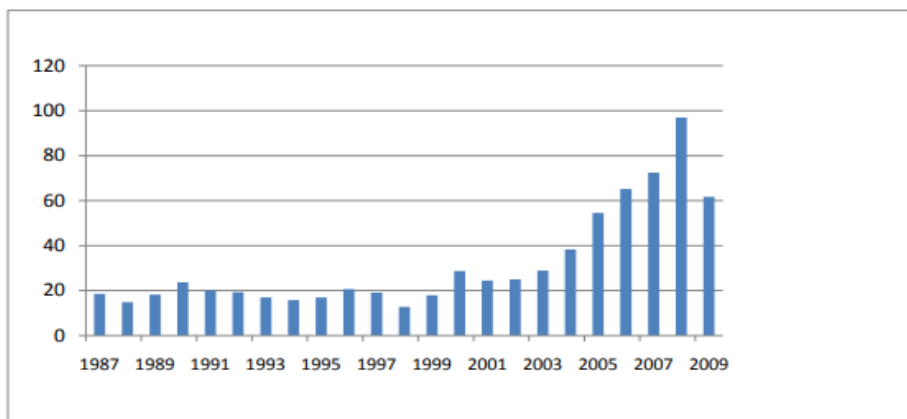
It has been oil revenues for the past two decades. It has also been revealed that oil price volatility had important consequences for a number of economic activities. This vision is well established by the study of different authors like Burbidge & Harrison (1984); Rasche & Tatom (1981), and many others who persuasively claimed that oil price is an important factor in the economic activities of USA and that it was exogenous during the war periods in the past. In 1973, oil crisis war, none of these positions were held in a developed country such as the United States, and not much has been done by the oil-exporting economy, the United States counterparties. Taking the aforementioned factors into consideration, this study examines the influence of the oil market (commodity prices, energy prices, and metal prices) on the United States stock market, and also explores how the stock market can be more effective in managing the oil market. Never studies also indicate that volatility is important in specifying the regime switching mechanism as bear and bull periods in oil market (Koy, 2017). Moreover the market volatility for WTI moves between two different regimes as low volatility and high volatility (Koy, 2018).

Literature Review

There have been sufficient surveys and researches conducted over the past two decades to indicate the relationship among oil market and stock market. The previous studies showed that there is a negative relationship between the oil market and stock market returns (Chen, 2010; Miller & Ratti, 2009; Nandha & Faff, 2008). The study conducted by Mohanty, Nandha, Turkistani, & Alaitani (2011) and Wang, Wu, & Yang (2013) showed that the countries export oil have positive links between oil market and the stock market while the importing countries of oil have negative links. In addition, oil market has a profitable alternative objective in terms of the low relationship among oil price and traditional asset classes and as well as a positive association with Inflation for many investors and financial institutions (Silvennoinen & Thorp, 2013). According to (Sadorsky, 2014; Silvennoinen & Thorp, 2013; Tang & Xiong, 2012), oil market is closely interlinked with the stock market because of high financial investments and hedging funds in this market. A number of studies conducted by Aydoğan, Tunç, & Yelkenci (2017); Boldanov, Degiannakis, & Filis (2016); Miller & Ratti (2009) and Zhu, Su, You, & Ren, (2017) have concentrated on the vigorous relationship among oil and stocks market and indicated that the relationship among these two industries has some vital implications for the allocation of assets and optimize the portfolio.

If companies cannot completely transfer these higher costs to their clients, the profit and dividend of a company which is the most important factor in stock prices will fall (Al-

Fayoumi, 2009). Many studies showed a negative relation between oil prices and stock market like (Jones & Kaul, 1996). Their findings showed that the price of oil is negatively linked with the US, Canada, the UK, and Japan stock. The effected price of the various international index of the stock market and some relevant macroeconomic variables in the Stock Market of Thai are investigated through the GARCH-M model, (Valadkhani, Chancharat, and Havie, 2009). The result of the investigation showed that there is a negative relationship between changes in the oil price and Stock Market of Thai during the crisis of Asia. Another study on the Greek Stock Market conducted by Filis, (2010) showed that oil price is negatively associated with the stock market in Greek.

The increasing oil price is positively affecting the exporting countries stock market with good income. It is because of increasing government revenue and expenditure in infrastructure and other omega projects (Al-Fayoumi, 2009). In addition, high oil price means an instant movement of wealth from net oil importers to net oil exporters. The level of economic activity of a country will be increased if income is used for buying goods and services, in return, a better return on the stock market in these countries. Moreover, rising oil volatility can increase speculation that can increase affect the stock return. Sadorsky (2004) also found a positive relationship among oil price and stock price. Khanna & Sharma (2012); Taiwo, Abayomi, & Damilare (2012); Toraman, Başarır, & Bayramoğlu (2011) concluded that the stock market index has a significant impact on the oil price. Cong et al. (2008) and Sehgal & Kapur (2012) supported that oil prices has no significant impact on real equity returns.

The previous studies showed that the extent of this effect depends on whether the shock is temporary or permanent. In return, the various authors have given weight to supply and demand's channels (Rasche & Tatom, 1977; Rotemberg & Woodford, 1996). Energy prices such as West Texas Intermediate (WTI), Brent, and natural gas are measured as an alternative of oil specifications, in which the nominal price of the world national and real national price is involved. Nominal national price is defined as "it is a product of world price and an exchange rate of the country" while the real national price is "nominal national price deflated by the CPI for each country" (Cuñado et al., 2005). The means of transport for Brent crude oil is by tank ship because it is a shipping oil and its customers are located in Europe or the United States. If arbitration allows transportation costs across the Atlantic (Fattouh, 2011).

Data and Analysis

The sample used in this study is consisting of weekly data about prices from the Standard and Poor's 500 index and West Texas Intermediate Crude Oil (WTI), Brent oil and Natural gas for 2010 to 2019, with a total of 515 observations. The data is obtained from the Investor.com website.

In Table 1 below, descriptive statistics for all variables are presented. The weekly average of S&P index is 1960.620. The maximum return within one week is 3140.98 and the minimum value is 1022.58.

Table 1. Descriptive Statistics

Descriptive	BRENT_OIL	S_P	WTI
Mean	80.18329	1960.620	72.56251
Median	75.82000	2005.550	71.28000
Maximum	126.6500	3140.980	113.9300
Minimum	28.94000	1022.580	29.42000
Std. Dev.	25.78927	583.4122	21.97531
Skewness	0.088862	0.157679	0.035388
Kurtosis	1.604451	1.852619	1.621068
Jarque–Bera	42.63401	30.50158	
Probability	0.000000	0.000000	41.06840
Sum	41454.76	1013640.	0.000000

Table 2 shows the outcomes of the Augmented Dickey–fuller (ADF) results of this study. In the ADF test, rejection of the null hypothesis about non–stationarity observed if t–statistic is lower than the critical value. However, all the values became stationary at the first difference and the null hypothesis is rejected.

Table 2. Unit Root Tests

	Augmented Dickey–Fuller			
	Level		1st difference	
	T statistics	P value**	T statistics	P value**
BRENT_OIL	–1.172440	0.2416	–22.20450	0.0000
Natural Gas	–2.429601	0.0155	–26.27565	0.0000
S&P 500	0.073482	0.9415	–29.34906	0.0000
WIT	–1.380426	0.1681	–21.36388	0.0000
Critical Value				
1%	–3.442869			
10%	–2.866954			
15%	–2.569715			

The result of the Granger causality test shows that the P-value is greater than 0.05, which means the Null hypothesis is accepted.. The Granger findings show the Brent oil does not cause the S&P 500 index or in another way, there is no relationship between the S&P 500 index and Brent oil. The Granger findings show that natural gas does not cause the S&P 500 index or in another way, there is no relationship between the S&P 500 index and Brent oil. The Granger findings show the WTI does not cause the S&P 500 index or in another way, there is no relationship between the S&P 500 index and Brent oil. These entire null hypotheses of metal prices are accepted because they have a significant level above 5%.

Table 3: Granger Causality

Null Hypothesis testing	Obs	F-statistics	Probability
S&P 500 and Brent Oil SPDF does not Granger Cause BRENTDF	514	0.88389	0.4138
BRENTDF does not Granger Cause SPDF		0.39528	0.6737
Natural Gas and S&P index NATURAL_GAS does not Granger Cause SPDF	514	1.81083	0.1646
SPDF does not Granger Cause NATURAL_GAS		0.38035	0.6838
S&P 500 and WTI WTIDF does not Granger Cause SPDF	514	0.17152	0.8424
SPDF does not Granger Cause WTIDF		0.45935	0.6320

Discussion

Therefore, two main outcomes are occurred from the association of the oil market with the stock market. Firstly, the Oil market does not have a significant relationship with the stock market. In general, these results are not supported by previous studies where Jones & Kaul, (2008); Sadorsky (2004), argued that the oil market has an impact on stock return by using different data and estimation methods. This is because of the change in time series selected for analysis, Such as Hamilton, (2009a), which are based on data from the post-1973 data. The treatment of asset-price models in finance by Cochran, (2008) provided evidence on the connection of these two markets. Secondly, the finding showed that there is no relationship between oil prices and the stock index. This finding is in line with (Hooker, 2000), although (Sadorsky, 2004) draws the same assumption from the research on the motivational reactions among the price of oil shocks and the return of the stock market. Hooker examined the connection of oil prices with the stock market of the US by using a linear granger causality test and found oil prices have an impact on the US economy as it is disappeared from 1986. However, Hamilton, (2009a) modified an increase in the price of oil since 1986 for

determining the effect of oil price changes, not just in the previous quarter, but the Oil price also went up in the previous years. Furthermore, (Hamilton, 2009) argued that if the real relationship between oil and the economy is linear, the underlying relationship is stable, but over time the linear approximation may seem unstable. He formally tested the linear relationship against the substitution of nonlinear specifications and provided further evidence for the linear relationship between oil and stock. The current study findings show contradictory results as compared with the Hamiltonian results.

Conclusion

The existing models postulate that the effect of an exogenous increase and decrease in the price of oil is the same, regardless of the causal shock driving up the price of oil. Different methods applied in this study to determine the link between the oil price, metals, and stock returns for the US economy. The existing studies on the subject suffer from different weaknesses. Most of the studies consider the oil prices as exogenous and ignore the global demand and supply factors that could cause different consequences of any oil price change. In this context, the studies also ignore of the importance of slope analyses of this relationship and usually consider it as a linear one. This study attempted to explore these weaknesses. The empirical findings are twofold: a) this study confirms that there is no causality relationship between oil price and stock returns; b) the study finds a breakpoint in the data during September 2008, on the basis of which it was observed that the relationship between oil price and stock returns changed significantly. The findings show that after 2008 there is no Granger causality existed between the variables under observation period. This result implies that though oil prices have a significant impact on economic activity, the nature of this impact can change depending on the overall macroeconomic conditions of the economy. In this regard, the impact of the great recession could be on the back of the break as found in the data. However, this claim needs to be strengthened by further evidence.

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