

DIGITALES ARCHIV

ZBW – Leibniz-Informationszentrum Wirtschaft
ZBW – Leibniz Information Centre for Economics

Rahman, Abdul

Article

Long run association of stock prices and crude oil prices: evidence from Saudi Arabia

Provided in Cooperation with:

International Journal of Energy Economics and Policy (IJEPP)

Reference: Rahman, Abdul (2020). Long run association of stock prices and crude oil prices: evidence from Saudi Arabia. In: International Journal of Energy Economics and Policy 10 (2), S. 124 - 131.

<https://www.econjournals.com/index.php/ijeep/article/download/8881/4873>.

doi:10.32479/ijeep.8881.

This Version is available at:

<http://hdl.handle.net/11159/8274>

Kontakt/Contact

ZBW – Leibniz-Informationszentrum Wirtschaft/Leibniz Information Centre for Economics
Düsternbrooker Weg 120
24105 Kiel (Germany)
E-Mail: [rights\[at\]zbw.eu](mailto:rights[at]zbw.eu)
<https://www.zbw.eu/econis-archiv/>

Standard-Nutzungsbedingungen:

Dieses Dokument darf zu eigenen wissenschaftlichen Zwecken und zum Privatgebrauch gespeichert und kopiert werden. Sie dürfen dieses Dokument nicht für öffentliche oder kommerzielle Zwecke vervielfältigen, öffentlich ausstellen, aufführen, vertreiben oder anderweitig nutzen. Sofern für das Dokument eine Open-Content-Lizenz verwendet wurde, so gelten abweichend von diesen Nutzungsbedingungen die in der Lizenz gewährten Nutzungsrechte.

<https://zbw.eu/econis-archiv/terms-of-use>

Terms of use:

This document may be saved and copied for your personal and scholarly purposes. You are not to copy it for public or commercial purposes, to exhibit the document in public, to perform, distribute or otherwise use the document in public. If the document is made available under a Creative Commons Licence you may exercise further usage rights as specified in the licence.



Long Run Association of Stock Prices and Crude Oil Prices: Evidence from Saudi Arabia

Abdul Rahman*

College of Business Administration, Prince Sattam Bin Abdulaziz University, Al Kharj, Saudi Arabia. *Email: a.shaik@psau.edu.sa

Received: 21 September 2019

Accepted: 13 December 2019

DOI: <https://doi.org/10.32479/ijeeep.8881>

ABSTRACT

An efficient stock market is a sign of a resilient economy. It is also an indicator of investors' confidence in the macroeconomic fundamentals of the economy. The association of oil prices and health of the stock market for a predominantly oil-based economy also serves as an indicator of the attempted diversification going on in the economy since the inception of the National Transformational Program 2020. The current research attempts to investigate the relation of oil price changes with stock market prices of Tadawul for the period from 2000 to 2017 by using the vector auto regression (VAR) methodology framework. The results show a long-run association between crude oil price and stock prices of Tadawul, and no short-run association is found between them.

Keywords: Stock Prices, Crude Oil Prices, Long Run Association, Stock Market

JEL Classifications: C13, G10, G12

1. INTRODUCTION

Stock market prices are a barometer for economic strength. Though only stocks of listed companies are traded here, but it makes the mood and builds the confidence of investors. Foreign investors also look up to the stock market for international investments. Stock markets are an important institution which harbors financial development through capital accumulation, fostering productivity and innovation, risk sharing and promotes good governance and competition (Hsu et al., 2014). Though stock markets are impacted by short-termism and speculative trading leads to detachment between financial sector and real sector, nevertheless there are many studies which have suggested that financial development leads to further economic growth (King and Levine, 1993), Levine and Zevros, 1998; Beck and Levine, 2004; Caporale et al., 2004).

Besides, the world has experienced several oil market recessions in the past, and the changes in oil prices affect the micro and macro-economic factors to a great extent, which made academics, investors, and others to discuss widely on this topic

(Hamilton, 2009). The crude oil price, which is the fundamental energy of industries, plays a focal part in the overall growth of an economy by affecting the growth indicators, and also it influences the revenues and operational costs of the companies. Therefore, the dynamic result of crude oil price fluctuations on expected cash flows of companies might impact the increase or decrease of stock returns subject to the efficiency of the stock market. As the variations in crude oil prices affect the stock markets, the current study proposes to revisit the relationship.

Stock markets take an indication from oil price changes about the future direction of an economy. The association of stock prices and oil prices has an added dimension, as it is different for the countries that import and export oil. An increase in oil price for oil exporting countries leads to additional income. This flows to higher economic growth which in turn leads to an increase in stock indices. Alternately, low oil prices put negative pressure on the economy. This is in sharp contrast to oil importing countries where low oil prices are better for economic growth (Bashar, 2006; Teulon, 2014; Sultan and Haque, 2018). The Kingdom of Saudi

Arabia has achieved significance in the world oil exporting; hence, a dynamic association between stock and oil markets is expected.

Stock trading in Saudi Arabia started in 1935 with the floating of the first joint sector company named Car Arabian. But practically the stock market emerged with the oil boom of 1979s. In 1985, the Saudi Arabian Monetary Agency (SAMA) which is the Central Bank of the country stated supervision of stock trading replacing the broker based trading system. Finally, in 2007, the Saudi Stock Exchange named Tadawul was established as a joint stock company to manage stock trading as its related aspects. Tadawul has 170 companies listed, and is the biggest in terms of its market capitalization and stock trading volume among all the GCC countries, but it trails behind in terms of foreign investments, currently holding 5.9% of shares. The Saudi stock exchange has reported a 10% rise in the foreign investment due to inclusion of shares in the MSCI and FTSE's emerging market index. The stocks of Tadawul shall be included in MSCI emerging market index in two stages (May, 2019 and August, 2019) with 32 companies having a weightage of 2.6%.

Oil was first discovered in the year 1938 in the Kingdom of Saudi Arabia. The Kingdoms proven reserves of crude oil are 266.26 billion barrels and the average daily production of crude oil is 9.95 million barrels in 2017 (SAMA, 2018). And as of now it is the largest exporter of crude oil in the whole world. It depends on the oil sector that accounts for 90% of its total revenue, 88% of exports and 35% of its GDP (Haque and Khan, 2019). Moreover, the reduction in crude oil prices during the year 2013 has resulted in a deficit budget, hence, the government of Saudi Arabia has taken certain measures to transform the kingdom to non-oil dependence economy. Further, the weakening situation of crude oil has led the government of Saudi Arabia to privatize its state-owned oil firm, Saudi Aramco (Foudeh, 2018). Saudi Arabia, like any other country, should keep track of fluctuations in oil price on its stock market. The study of fluctuations in crude oil prices affecting stock returns and market volatility in the Saudi Arabian context is of the great importance to investors, policymakers, hedgers, speculators, etc. The investors can disinvest those stocks where uncertainty is felt due to increase in stock market volatility or they can also hedge their risk by diversifying their funds in case of an increase in expected future stock return.

On a macro perspective, the relationship between oil and stock prices has an added dimension for Saudi Arabia. The reason being that the country has chalked out an ambitious National transformation Program 2020. In line to this, the country which is heavily reliant on oil aims to diversify itself away from oil. Within its ambit, the country wishes to increase its non-oil revenues, increase the role of its private sector, and increase non-oil exports. If the economy keeps on relying only on oil, the stock market would obviously be dominated by oil prices. But as the economy strengthens itself in term of non-oil sectors, then the stock market would be less affected by the fluctuation in the oil prices, particularly short-run fluctuations.

Also, oil price fluctuations are not necessarily due to demand and supply factors of economic nature. Despite increased awareness

about non-oil sectors, the reliance on oil will increase with increasing population and economic growth. An importing country does not simply reduce its demand when there is an increase in crude oil international prices. Oil is needed to run an economy. Rather oil prices are more often impacted by geopolitical factors. Some examples of these are sanctions of exporting countries like Venezuela and Iran; political unrests in Libya, Iraq, to name a few (Escribano and Valdés, 2016). In light of this, the economic strength of a predominantly oil exporting country lies wherein the stock market is not swayed away by fluctuation in oil prices only. This research attempts to contribute to the prevailing body of knowledge by investigating the relation of oil prices changes with stock market prices. More importantly, the study differentiates with the past researches in terms of the period of the study.

The remainder of the paper is arranged as follows: a review of the literature (section II), followed by data and methodology (section III), empirical results (section IV), discussion (section V), and finally conclusion (section VI).

2. REVIEW OF LITERATURE

A substantial volume of research has emanated in studying the association amongst oil price fluctuations and stock return and volatility. Hamilton (1983) is the pioneer in examining the effect of oil price changes in U.S. financial turmoil. He reported a significant correlation between the two in some recessions prior to 1972. A negative association of oil price fluctuations and stock returns has been stated by some authors for different countries (Sadorsky, 1999; Papapetrou, 2001; Miller and Ratti, 2009; Chen, 2010; Goodness, 2015). In contrast, a positive relationship of oil price changes to stock returns has been stated by some authors (Filis et al., 2011). The studies which particularly dealt with the Saudi Arabia is reported below:

Malik and Hammoudeh (2007) examined the process of shock and volatility diffusion amidst US, global crude oil, and GCC markets using multivariate GARCH model with BEKK parameterization. The study found a significant spillover of volatility from the Saudi market to the global oil market, and Saudi market is indirectly influenced by the shocks of US market. This hints at the chance of cross-market hedging done by stock market investors in Saudi Arabia.

Arouri and Rault (2010) examined the association of oil prices and stock prices of GCC markets for the period from June 07, 2005 to May 25, 2010 using weekly data. The researchers applied panel data Granger causality approach in vector auto regression (VAR) framework. Results indicate a bidirectional Granger causality for Saudi Arabia running from stock prices to oil prices, while the opposite do not Granger cause. This result is quite expected, as KSA is the largest exporter of oil. Oil prices are related positively with the revenues of government and corporate. They reported a negative association between oil price and stock prices, since the Saudi Arabian stock market is shallower than others, and concentrated one and is controlled by financial industries.

Arouri et al. (2011) used VAR–GARCH model on daily data from June 07, 2005 to February 21, 2010 and could not find spillover

shocks and volatility diffusion from oil to stock during the study period for Saudi Arabia. This could be because of low annual turnover. The study recommends investors in Saudi Arabia to invest more in oil than stocks in order to minimize the risk without lowering the expected return.

Almohaimeed and Nizar (2013) studied the volatility transmission effect and conditional correlations amidst oil, stock market, and stock indexes for various sectors in Saudi Arabia using VAR-BEKK in Multivariate GARCH framework for the period from 2009 to 2012 using daily data. The results suggest a negative volatility spillovers of crude oil on the stock market, whereas the stock market had a negative shock impact and positive volatility effect on oil prices.

Jouini (2013) studied the association of stock market of Saudi Arabia and world oil price using VAR-GARCH methodology using weekly data. The results report diffusion of volatility and return among stock market and oil price, while the spillover is from oil to some sectors for returns.

Azar and Basmajian (2013) used GARCH (1,1) on the daily data to study the effect of oil price shocks on the stock market of Saudi Arabia from 2008 to 2012 using daily data. The result indicates linear and positive shocks of oil prices on the Saudi stock market, but the opposite is true when further variables are incorporated in the model.

Awartani and Maghyereh (2013) studied the return and volatility spillover among oil and GCC stock markets using simple and dynamic correlation analysis in the VAR framework for the period from January 02, 2004 to March 30, 2012 using daily data. The study found asymmetric and bi-directional diffusion of the return and volatility.

Teulon (2014) studied four countries including Saudi Arabia by using time-varying correlation coefficients in GARCH DCC framework for the period August 31, 2000 to June 31, 2010, using monthly data. The dynamic conditional correlation amidst stock markets and oil prices are positive and significant indicating spillover of volatility among stock and oil prices. There is a decrease in positive correlation for the period 2000-2004 due to precautionary demand resulting from the Iraq war. The study concluded that shocks in oil price are due to global political instability.

Jouini and Harrathi (2014) studied the period from June 24, 2005 to March 25, 2011 using weekly data and finds that stock returns in Saudi Arabia are responsive to their past own values. An important finding is that own past volatility plays greater role in forecasting present conditional volatility as compared to own past shocks. The results further indicate bi-directional causality in conditional variance amidst the two markets.

Salma (2015) studied the volatility spillover in GCC markets from 2005 to 2012 using daily data using VAR (1)-GARCH (1,1) and found that during the subprime crisis (2007) in the long run, future volatility was forecasted through both previous conditional

volatility and cross-market volatility spillover. Nevertheless, after 2007 this shock spillover is non-significant.

Alqattan and Alhayky (2016) considered the association amidst the oil prices and stock market price using ARDL method. They found no long run association but a short run relationship implying that fluctuations in oil price determine stock market prices.

Tong et al. (2018) studied the influence of oil price volatility on the stock market performance of Saudi Arabia for the period from 2007 to 2017 using annual data. The study applied detrended moving average method on weekly data and the results showed a nonlinear association.

Basher et al. (2017) studied the connection between oil and stock prices for oil exporting countries including Saudi Arabia using monthly data using structural VAR model and Markov-switching model. For Saudi Arabia, oil demand shocks influence stock returns significantly. Idiosyncratic oil market shocks impact stock returns but speculative shocks had no significant impact.

Therefore, the current research attempts to contribute to the prevailing body of knowledge by investigating the relation of oil prices changes with returns on the stock market. The significance of this research is to study differentiates from the previous researches in terms of the time period of the study. Oil prices fell drastically after the year 2014. There is no study on this aspect which covers the latest period till the year 2018. The results will be of significance for both investors and policymakers.

3. DATA AND METHODOLOGY

The current study examines the long run association of crude oil prices and prices of Saudi stock market (henceforth Tadawul). We obtain the data on study variables, such as crude oil prices, production of oil, stock prices, etc. from World Bank data base, Tadawul (Saudi Stock Exchange) during 2000 to 2017. Moreover, the sample period selection is based on the availability of data on the above-mentioned study variables. We define the study variables and the data source in Table 1. Further, we examine the long-run association between the variables by following Johansen and Juselius (1990) cointegration test. We report the results of cointegration of variables based on trace and eigenvalue statistics in Table 2. The trace test indicates one cointegrating vector significant at the 5% level, which implies the presence of one long-run relationship between the study variables (oil price and stock price).

We address the research problem of current study by using the VAR methodology framework, which was extensively used in the previous research works to long run and short run association

Table 1: Study variables and data source

Study variables	Definition	Data source
Crude oil price	WTI spot price FOB in US dollars per barrel per day	World Bank data base
Stock price	Daily closing stock price	Tadawul stock exchange

Table 2: Vector auto regression lag order selection

Lag	Log L	LR	FPE	AIC	SC	HQ
0	552.47	NA	0.001104	-1.132656	-1.122617	-1.128835
1	4339.681	7551.042	4.60e-07	-8.917039	-8.886919*	-8.905575*
2	4340.537	1.703775	4.63e-07	-8.910570	-8.860371	-8.891465
3	4346.284	11.41058	4.61e-07	-8.914164	-8.843885	-8.887417
4	4352.653	12.62104*	4.59e-07*	-8.919040*	-8.828681	-8.884650

between different study variables. Following the methodology of Sims (1980), we estimate the VAR model with k variables and p lags in the following manner:

$$Y_t = V_0 + \sum_{i=1}^p V_i Y_{t-i} + \varepsilon_t \quad (1)$$

Where Y_t is the column vector of different study variables included in the equation (crude oil price and stock price); V_i is $k \times k$ matrix; V_0 is a constant column vector; ε_t is an error column vector. The VAR methodology shall be used when both the variables are stationary at the level $I(0)$ and $I(1)$ and not cointegrated, but if the series of variables are stationary at $I(1)$ and cointegrated, then we have to employ the vector error correction model (VECM), which combines the long-run and short-run relationships to reach at the equilibrium. The VECM model is explained in the following manner:

$$\Delta Y_t = V_0 + \phi Y_{t-1} + \sum_{i=1}^p V_i \Delta Y_{t-i} + \varepsilon_t \quad (2)$$

Where ΔY_t is first differenced column vector of different study variables included in the equation (crude oil price and stock price); Y_{t-1} is a vector of error correction mechanism for one period lag; ϕ in the equation is the matrix that represents equilibrium and rank; V_0 is a constant column vector; ε_t is an error column vector. The coefficients on ϕ must be of a negative sign between 0 and 1, which indicates the temporary nature of positive or negative shocks that will be ultimately returned to equilibrium. Furthermore, we also test for short run causality, serial correlation and heteroscedasticity.

4. EMPIRICAL RESULTS

The current study examines the long run association of crude oil prices and prices of Tadawul. This section discusses the empirical results.

4.1. Descriptive Statistics

Table 3 presents the descriptive statistics for crude oil price and stock prices. We observed that the crude oil price has a mean of 4.05, while it is 8.96 for the stock prices. Both the study variables are positively skewed, and have a kurtosis of 2.39 and 2.23. Further, the distribution of data is not normal, since the Jarque-Bera test statistic is significant at <0.05 level.

4.2. Stationary Test

Since the data used by the current study is a time series data, it requires stationary check before empirical investigation. The study variables are expressed in log to test for the presence of unit root. We report the results of stationarity of variables in levels and first difference in Table 4. The reported results show the study variables to be stationary at first difference.

Table 3: Descriptive statistics

Particulars	Crude oil price	Stock prices
Mean	4.05	8.96
Median	3.96	8.93
Maximum	4.68	9.32
Minimum	3.27	8.59
Standard deviation	0.31	0.16
Skewness	0.46	0.16
Kurtosis	2.69	2.23
Jarque-Bera	38.19	28.42
Probability	0.0000	0.0000
Observations	976	976

Table 4: Result of stationary tests

Variable	Without trend and intercept	Intercept	Trend and intercept
Crude oil price			
Level	-0.86	-1.87	-1.69
First difference	-24.37*	-24.37*	-24.39*
Stock price			
Level	-0.13	-2.48	-2.68
First difference	-31.24*	-31.22*	-31.21*

*Significant at the 1% level

4.3. Lag Selection

We report the results of VAR lag order selection criteria in Table 2. The lag length has been selected as per different selection criterion. The lag length should neither be too short (Chen and Patel, 1998) nor too long (DeJong et al., 1992). The study selects four as lag length based on the reported results.

4.4. Cointegration Test

We estimate the long run association between the crude oil price and stock prices by using Johansen (1991) cointegration test, and report the results of trace test and maximum eigen value test in Tables 5-7.

The equation explaining the long run association of stock prices and crude oil price is as follows:

$$STOCK_PRICES = 7.20 + 1.43 CRUDE_OIL_PRICE \quad (3)$$

The results of cointegration tests indicates presence of long run relationship between crude oil price and stock prices of Tadawul, since at most one cointegrating vector is significant. The trace statistic indicates one cointegrating vector significant at the 5% level. Further, the maximum eigen statistic also indicates one cointegrating vector significant at the 5% level. Our results are consistent with the previous research works of Corhay et al. (1993), Jeon and Chiang (1991) and Masih et al. (2011). Since, the series of variables are stationary at $I(1)$ and cointegrated as per the result reported, we employ the VECM, which combines the long-run and

Table 5: Results of cointegration (trace)

Hypothesized number of CEs	Eigen value	Trace statistic	0.05 critical value	Probability
None*	0.014600	17.85314	15.49471	0.0217
At most 1	0.003672	3.571672	3.841466	0.0588

*Trace test indicates 1 cointegrating eqn(s) at the 0.05 level

Table 6: Results of cointegration (maximum eigen value)

Hypothesized number of CEs	Eigen value	Max-Eigen statistic	0.05 critical value	Probability
None*	0.014600	14.28147	14.26460	0.0497
At most 1	0.003672	3.571672	3.841466	0.0588

*Maximum Eigen value test indicates 1 cointegrating eqn(s) at the 0.05 level

short-run relationships to reach at the equilibrium. A significant negative coefficient of the error correction term represents that any short-term changes between the test variables shall lead to an enduring long-term association between the variables.

4.5. VECM

The cointegration between the study variables confirms a long run relationship hence the VECM is applied. The vector error correction equation for the current study is as follows:

$$\begin{aligned}
 D(\text{STOCK PRICES}) = & C(1) \times (\text{STOCK PRICES}) \\
 & (-1) - 0.434322918757 \times \text{CRUDE OIL PRICE} \\
 & (-1) - 7.20199065496 + C(2) \times D(\text{STOCK PRICES}) \\
 & (-1) + C(3) \times D(\text{STOCK PRICES}) (-2) + C(4) \times D(\text{STOCK} \\
 & \text{PRICES}) (-3) + C(5) \times D(\text{STOCK PRICES}) (-4) + C(6) \times \\
 & D(\text{CRUDE OIL PRICE}) (-1) + C(7) \times D(\text{CRUDE OIL} \\
 & \text{PRICE}) (-2) + C(8) \times D(\text{CRUDE OIL PRICE}) (-3) + C(9) \\
 & \times D(\text{CRUDE OIL PRICE}) (-4) + C(10)
 \end{aligned}$$

In the above equation, C(1) explains the long run association between the stock prices and crude oil price, while the other coefficients (C(2) – C(9)) explains the short run association between the variables. We report the results of EC model in Table 8. The result shows that the error term explaining the long run association is negative (–0.028) and significant at the 1% level, which indicates that the crude oil price have long run association with stock prices. To put it another way, crude oil price causes stock prices in long run. The result signifies that the equilibrium conditions shall hold long and that the stock prices and crude oil price shall react to the equilibrium changes accordingly. The estimated results show a negative association between the stock prices and crude oil price, which is expected according to the theory.

Moreover, the short run association of crude oil price and stock prices is examined through the coefficients of crude oil price from C(6) and C(9) in the VECM equation with the help of Wald test. The null hypothesis is that the crude oil price should not affect the stock prices collectively, then it can be inferred that there is no short run association between them. We report the results of Wald test in Table 9. The results shows that, the crude oil price cannot effect the stock prices synchronically, as the sum of coefficients of crude oil is equal to zero, since the Chi-square value is 19.5%, which is more than 5%. Therefore, the null hypothesis of Wald test of no short run association between crude oil price and stock prices is accepted.

Table 7: Result of normalized cointegrating coefficients

Stock_prices	1.000000	
Crude_oil_price	–0.434323	0.09320
C	–7.201991	

Table 8: Results of vector error correction model model

Error correction	DV: Stock prices		
Coefficients	Parameters	t-statistic	Probability
C(1)	–0.028307	–3.7487	0.0075
C(2)	0.006133	0.18899	0.8501
C(3)	–0.037759	–1.16857	0.2429
C(4)	–0.06346	–1.871213	0.0616
C(5)	0.012488	0.386066	0.6995
C(6)	–0.017735	–0.584822	0.5588
C(7)	–0.058412	–1.931126	0.053
C(8)	–0.045382	–1.498806	0.1343
C(9)	–0.019399	–0.639942	0.5224
C(10)	–0.000165	–0.204987	0.8376

Table 9: Results of wald test

Wald test	Dependent variable: Stock prices		
Parameters	Value	Df	Probability
F-statistic	1.513981	4,961	0.1959
Chi-square	6.055924	4	0.1950
H₀: C(6)=C(7)=C(8)=C(9)=0			
Normalized restriction (=0)	Value	Standard error	
C(6)	–0.017735	0.030326	
C(7)	–0.058412	0.030248	
C(8)	–0.045382	0.030279	
C(9)	–0.019399	0.030314	

4.6. Impulse Response Function (IRF)

We crosscheck the results of cointegration following Cholesky adjusted factors with the help of IRF. The IRF shows the impact of shocks in different periods on the variables used in the model. The result shows that the impact of one unit change in the crude oil price is short. The impact of crude oil price on stock prices is negative for a short period and is significantly positive after that. Therefore, we observe an acceleration in equilibrium adjustment process as shown in Figure 1.

4.7. Diagnostic Tests

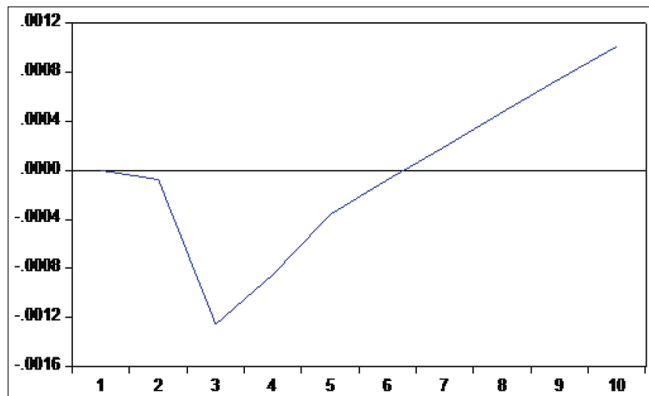
We run different tests of diagnostics to examine the correct specification of model, such as normality test to examine normal distribution of residuals, test for serial correlation, test of heteroscedasticity, and CUSUM test. Firstly, the residuals are

Table 10: Results of serial correlation

Breusch-Godfrey serial correlation test			
Test statistic	Value	Df	Probability
F-statistic	1.974001	4,957	0.0964
Chi-square	7.945956	4	0.0936

Table 11: Results of heteroscedasticity test

Breusch-Godfrey serial correlation test			
Test statistic	Value	Df	Probability
F-statistic	0.036356	4,962	0.9975
Chi-square	0.146157	4	0.9975

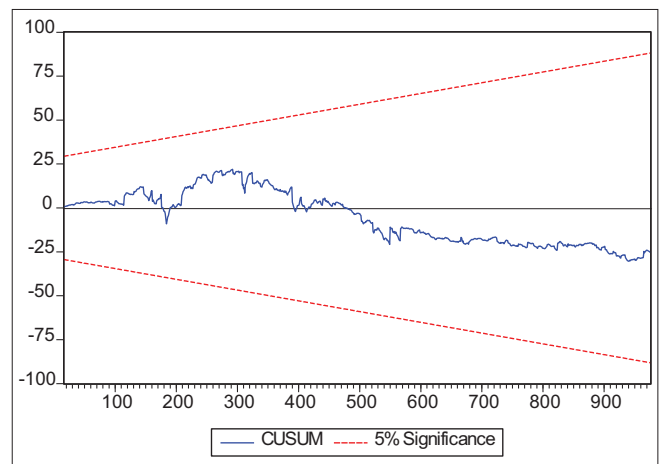
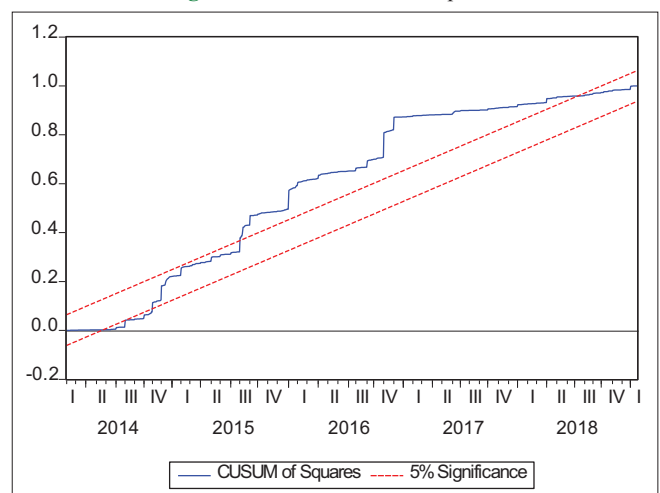
Figure 1: Impulse response function


not normally distributed, since the Jarque-bera test statistic is significant at 1% level as reported in Table 3. Nevertheless, the model can be accepted, since some researchers (Hoxha, 2016; Banumathy and Azhagaiah, 2015) has accepted the model with non-normal distribution of residuals. Secondly, we test for the presence of serial correlation through LM test. We report the results in Table 10, and found no serial correlation among the variables as the observed R^2 is significant at more than 5% level, hence accepting the null hypothesis of no serial correlation. Thirdly, we examine the presence ARCH effect through heteroscedasticity test. We report the results in Table 11, and found no ARCH effect among the residuals as the observed R^2 is significant at more than 5% level, hence accepting the null hypothesis of no ARCH effect.

Finally, we examine the stability of parameters in the model through CUSUM and CUSUM squares tests. We report the result in Figures 2 and 3, and found that the model coefficients are stable, since the cumulative sum (blue line) is in between the critical lines and significant at the 5% level. However, there is a change in the cusum squares, which rejects the null hypothesis of consistent coefficients. The cusum squares test statistic exceeds the bounds in the second quarter of 2014, third quarter of 2015 and third quarter of 2018. This test indicates that there was a significant change in the relationship of stock prices and crude oil price during these three periods.

5. DISCUSSION OF THE RESULTS

The results of cointegration tests indicates a long run association of crude oil price and stock prices of Tadawul, since at most one

Figure 2: CUSUM test

Figure 3: Test of cusum of squares


cointegrating vector is significant. The reported results are in accordance with the previous research works of Corhay et al. (1993), Jeon and Chiang (1991) and Masih et al. (2011). Further, we observe that the error term explaining the long run association is negative (-0.028) and significant at the 1% level, which indicates a long run association of crude oil price with stock prices of Tadawul. The reported results are in accordance with the previous research works of (Miller and Ratti, 2009; Chen, 2010; Teulon, 2014; Banumathy and Azahgaiah, 2015), and contrast with the studies of (Arouri and Rault, 2011; Filis et al., 2011; Alqattan and Alhayky, 2016). Moreover, the short run association of crude oil price and stock prices is examined through the coefficients of crude oil price. The results show that, the crude oil price cannot affect the stock prices synchronically, as the sum of coefficients of crude oil are equal to zero, hence accepting the null hypothesis of no short run association between crude oil price and stock prices. This result is consistent with (Banumathy and Azahgaiah, 2015; Marashdeh and Afandi, 2017; Akomolafe and Danladi, 2014).

The results indicate that in the long run as oil prices increase, the stock prices also increase. This is quite expected for a predominantly oil exporting country like Saudi Arabia. But there is no association between the two variables in the short run. This is good news for long terms investors as they need not worry

about the change in the oil prices as in the long run whatever is the disequilibrium it will be corrected to the tune of 2% in a day as the ECT term in -0.02 and is significant. The absence of a short run relationship also hints at the resilience of the Saudi Arabian economy which is not severely impacted by the change in oil prices. The reason being that change in oil prices are not merely because of supply and demand factors but might be due to geopolitical reasons.

6. CONCLUSION

We examine the long run association of crude oil prices and stock prices of Tadawul, the Saudi Arabian Stock Exchange for the period 2000 to 2017. We address the research problem through VAR methodology framework. Since the series of variables are stationary at $I(1)$ and cointegrated, hence we have employed the VECM Model, which combines the long-run and short-run relationships to reach the equilibrium. The results of cointegration for both the trace and maximum eigenvalue tests suggests a long-run association between crude oil price and stock prices of Tadawul. Moreover, the short run association between crude oil price and stock prices is examined through the coefficients of crude oil price. We found no short-run association between crude oil price and stock prices. Moreover, the result of the IRF shows that the impact of one unit change in the crude oil price is short.

The results of the present study are much significant to the Kingdom of Saudi Arabia, as the stock price movement in the long run and short run is highly complex to crude oil prices. Therefore, the investors of Saudi Arabia should be conscious and advised in selecting the investment portfolios. Moreover, these results are significant to policymakers, as they have to consider the direction of crude oil prices in drafting the policies that influence the financial markets. The fact that this study takes into consideration the prices instead of returns (particularly of stocks) could be a limitation of this study. Also, adding other variables like exchange rate, inflation could be scope of future research.

REFERENCES

- Akomolafe, K.J., Danladi, J.D. (2014), Oil price dynamics and the Nigerian stock market: An industry level analysis. *International Journal of Economics, Finance and Management*, 3, 308-316.
- Almohaimeed, A., Nizar, H. (2013), Volatility transmission and conditional correlation between oil prices, stock market and sector indexes: Empirics for Saudi stock market. *Journal of Applied Finance and Banking*, 3(4), 125-141.
- Alqattan, A.A., Alhayky, A. (2016), Impact of oil prices on stock markets: Evidence from Gulf Cooperation Council (GCC) financial markets. *Amity Journal of Finance*, 1(1), 1-8.
- Arouri, M., Rault, C. (2011), Oil prices and stock markets in GCC countries: Empirical evidence from panel analysis. *International Journal of Finance and Economics*, 17, 243-253.
- Arouri, M.E., Rault, C. (2010), Causal relationships between oil and stock prices: Some new evidence from gulf oil-exporting countries. *Economie Internationale*, 122, 41-56.
- Arouri, M.E.H., Lahiani, A., Nguyen, D.K. (2011), Return and volatility transmission between world oil prices and stock markets of the GCC countries. *Economic Modelling*, 28, 1815-1825.
- Awartani, B., Maghyreh, A.I. (2013), Dynamic spillovers between oil and stock markets in the Gulf Cooperation Council Countries. *Energy Economics*, 36, 28-42.
- Azar, S.A., Basmajian, L. (2013), Oil prices and the Kuwaiti and the Saudi stock markets: The contrast. *International Journal of Economics and Financial Issues*, 3(2), 294-304.
- Banumathy, K., Azahgaiah, R. (2015), Long-run and short-run causality between stock price and gold price: Evidence of VECM analysis from India. *Management Studies and Economic Systems*, 1(4), 247-256.
- Bashar, A.Z. (2006), Wild oil prices, but brave stock markets! The case of GCC stock markets. *Operational Research*, 6(2), 145-162.
- Basher, S.A., Haug, A.A., Sardosky, P. (2017), The Impact of Oil-market Shocks on Stock Returns in Major Oil-exporting Countries: A Markov-switching Approach. *University of Otago Economics Discussion Papers*, No. 1710.
- Beck, T., Levine, R. (2004), Stock markets, banks, and growth: Panel evidence. *Journal of Banking and Finance*, 28(3), 423-442.
- Caporale, G.M., Howells, P.G.A., Soliman, A.M. (2004), Stock market development and economic growth: The causal linkage. *Journal of Economic Development*, 29(1), 33-50.
- Chen, S.S. (2010), Do higher oil prices push the stock market into bear territory? *Energy Economics*, 32(2), 490-495.
- Chen, M.C., Patel, K. (1998), House price dynamics and granger causality: An analysis of Taipei new dwelling market. *Journal of the Asian Real Estate Society*, 1(1), 101-126.
- Corhay, A., Tourani, A., Urbain, J.P. (1993), Common stochastic trends in European stock markets. *Economic Letters*, 42(4), 380-385.
- Dejong, D.N., Nankervis, J.C., Savin, N.E., Whiteman, C.H. (1992), The power problem of unit root tests in time series with autoregressive errors. *Journal of Econometrics*, 53, 323-343.
- Escribano, G., Valdés, J. (2016), Oil prices: Governance failures and geopolitical consequences. *Geopolitics*, 22, 693-718.
- Filis, G., Degiannakis, S., Floros, C. (2011), Dynamic correlation between stock market and oil prices: The case of oil-importing and oil-exporting countries. *International Review of Financial Analysis*, 20(3), 152-164.
- Foudeh, M. (2018), The optimal time to privatize oil public sector in Saudi Arabia. *International Journal of Energy Economics and Policy*, 8(3), 312-320.
- Goodness, C.A. (2015), Does oil price uncertainty matter for stock returns in South Africa? *Investment Management and Financial Innovations*, 12(1-1), 179-188.
- Hamilton, J.D. (1983), Oil and the macro economy since world war II. *Journal Political Economy*, 91(2), 228-248.
- Hamilton, J.D. (2009), Understanding crude oil prices. *Energy Journal*, 30(2), 179-206.
- Haq, M.I., Khan, M.R. (2019), Saudi Arabia: Role of oil production and government expenditure in improving human development index. *International Journal of Energy Economics and Policy*, 9(2), 251-256.
- Hoxha, A. (2016), The switch to near-rational wage-price setting behaviour: The case of United Kingdom. *Euro Economica*, 1(35), 127-148.
- Hsu, P.H., Tian, X., Xu, Y. (2014), Financial development and innovation: Cross-country evidence. *Journal of Financial Economics*, 112(1), 116-135.
- Jeon, B., Chiang, T. (1991), A system of stock prices in world stock exchanges: Common stochastic trends for 1975-1990? *Journal of Economics and Business*, 43(4), 329-338.
- Johansen, S. (1991), Estimation and hypothesis testing of cointegration vectors in gaussian vector autoregressive models. *Econometrica*, 59(6), 1551-1580.
- Johansen, S., Juselius, K. (1990), Maximum likelihood estimation and inference on cointegration-with application to the demand for money.

- Oxford Bulletin of Economics and Statistics, 52, 169-210.
- Jouini, J. (2013), Return and volatility interaction between oil prices and stock markets in Saudi Arabia. *Journal of Policy Modeling*, 35(6), 1124-1144.
- Jouini, J., Harrathi, N. (2014), Revisiting the shock and volatility transmissions among GCC stock and oil markets: A further investigation. *Economic Modelling*, 38C, 486-494.
- King, R.G., Levine, R. (1993), Finance and growth: Schumpeter might be right. *The Quarterly Journal of Economics*, 108(3), 717-737.
- Levine, R., Zevros, S. (1998), Stock markets, banks, and economic growth. *The American Economic Review*, 88(3), 537-558.
- Malik, F., Hammoudeh, S. (2007), Shock and volatility transmission in the oil, US and Gulf equity markets. *International Review of Economics and Finance*, 16(3), 357-368.
- Marashdeh, H., Afandi, A. (2017), Oil price shocks and stock market returns in the three largest oil-producing countries. *International Journal of Energy Economics and Policy*, 7(5), 312-322.
- Masih, R., Peters, S., Mello, L.D. (2011), Oil price volatility and stock price fluctuations in an emerging market: Evidence from South Korea. *Energy Economics*, 33(5), 975-986.
- Miller, J.I., Ratti, R.A. (2009), Crude oil and stock markets: Stability, instability, and bubbles. *Energy Economics*, 31(4), 559-568.
- Papapetrou, E. (2001), Oil price shocks, stock market, economic activity and employment in Greece. *Energy Economics*, 23(5), 511-532.
- Sadorsky, P. (1999), Oil price shocks and stock market activity. *Energy Economics*, 21(5), 449-469.
- Salma, J. (2015), Crude oil price uncertainty and stock markets in Gulf corporation countries: A VAR-GARCH copula model. *Global Journal of Management and Business Research*, 15(10), 29-38.
- SAMA. (2018), Fifty fourth Annual Report. Saudi Arabian Monetary Agency. Available from: <http://www.sama.gov.sa/en-US/EconomicReports/AnnualReport/Fifty%20Fourth%20Annual%20Report.pdf>.
- Sims, C.A. (1980), Macroeconomics and reality. *Econometrica*, 48, 1-48.
- Sultan, Z.S., Haque, M.I., (2018), Oil exports and economic growth: An empirical evidence from Saudi Arabia. *International Journal of Energy Economics and Policy*, 8(5), 281-287.
- Teulon, F. (2014), Dynamic spillover between the oil and stock markets of emerging oil-exporting countries. *The Journal of Applied Business Research*, 30(1), 51-58.
- Tong, S., Baslom, M.M.M., Alsharif, H.Z.H. (2018), Investigating volatility in Saudi Arabia crude oil prices and its impact on oil stock market. *International Journal of Energy Economics and Policy*, 8(4), 338-346.