Investigating Volatility in Saudi Arabia Crude Oil Prices and its Impact on Oil Stock Market

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ABSTRACT

This study is the evidence of a research that was carried out to investigate the impact of oil price volatility on oil stock markets in the context of Saudi Arabia. Prior studies have measured the impact of crude oil price (COP) volatility on stock market performance but not much attention has been paid on Saudi Arabia. This study was an attempt to fill this research gap by finding any linkages between crude oil price and Saudi stock market performance. The study also aimed to identify such structural changes in the crude oil market during a given time period caused by varying factors such as old and new financial investors, emergence of new markets, socio-political events and fluctuation in demand-supply ratios causing changes in the crude oil price significantly. Often it has been observed that when new participants enter the oil market, there are structural changes in the process of crude oil price setting, much similar to the process in any kind of financial markets. The role of OPEC in setting oil prices shall also be studied during the course of this study. Prior studies have revealed that lack of OPEC spare capacity has caused serious large imbalances in the crude oil prices worldwide as OPEC historically has been a major policy maker on the supply side. In order to carry out such a study, different models/methods can be used including Markov Regime Switch Method and GARCH and Granger Causality Method. However, the choice of model will depend on properties/variables.

Keywords: Oil Price, Demand Supply Ratios, Volatility, Stock Market
JEL Classifications: E39, J20, R53

1. INTRODUCTION

Crude oil is one of the most important raw materials of most industrialized nations. It generates heat, drives machinery, vehicles and airplanes. Almost all chemical products, such as plastics, detergents, paints, and even medicines can be produced by the components of crude oil. Hence, oil has a great impact on the world economy and therefore oil price is the most important concern of world economists. There was a drastic change in crude oil prices (COPs) after the 1973 oil sanctions imposed by the Organization of Arab petroleum exporting countries. Until that time, the US oil prices had started showing low volatility across big time intervals due to an indigenous regulatory structure of the oil industry (Hamilton, 1983). However, after 1973, a nonlinearity and unprecedented volatility could be seen which was characteristic of the demand-supply disruptions caused by various factors like growth of the Asian markets and increase in energy consumptions, competition among the oil exporting nations resulting in a decline in oil prices to maintain their position and attempt to bring stability in their oil revenues.

A good example of the decline in oil prices and how the oil prices affect the country's terms of trade can be seen in the case of Canadian economy. Canada is among the net oil exporter nations, with oil being its major source of domestic income. Though oil and gas extraction in Canada accounts for only 6% of Canadian gross domestic product (GDP), it amounts to about 30% of its total business investment. But in 2014, with the decline in the oil price, and in the absence of any alternative fiscal remedy, the Canadian GDP fell down by 2%. As a remedial measure, the Bank of Canada decreased interest rates twice in 2015 to help the economy adjust to lower oil prices.

This example shows that there are several such structural factors that can potentially change the direction of the oil based economy. A positive direction is however taken in US by introducing technological innovation in the shale oil extraction. The novel techniques adopted in the US would slowly spread in other parts of the world which could boost oil production and contribute to bring stability in oil prices. However, there are two principal

channels by which volatility in oil prices can affect stock market prices (Narayan and Narayan, 2010). First, oil volatility can make an impact on production costs, affecting both earnings and stock dividends. Second, oil prices can also make an impact on inflation rate and the real interest rate (Huang et al., 1996). Gogineni (2010) reported a positive effect on stock prices when there is a change in aggregate demand for crude oil, but a negative affect when there is a change in aggregate supply.

In net oil importing countries, e.g., Canada, an increase in oil price also affects exchange rates and inflation which may cause central banks to raise interest rates. However, once the capacity of producing crude oil increases, the competitive fringe enters in among the nations which have no relation with its capacity to produce crude oil. The competitive fringe is mainly for commercial reasons and for keeping a control of the oil market. This can happen in two ways: First, by reducing the production costs; second, by reducing the gap between oil price volatility. Both these elements play a major role in the oil price decline and will be discussed in this study. Evidence will be drawn that when a nation depends on crude oil revenue there are bound to be price fluctuations leading to high instabilities to the nation's economy. Likewise, with the emergence of new technologically advanced resources such as shale oil in the United States and ecofriendly policies has further led to depreciations in COPs. This will also be discussed in this study.

1.1. Crude Oil Situation in Saudi Arabia
Historically, Saudi Arabia has relied heavily on crude oil as a main source of revenue, which accounts for nearly 70% of the country's budget revenues. However, with the collapse in crude oil prices resulting in budget deficit in 2013, the Saudi government has set several measures to revamp the economy. One of the alternatives is also to reorient the economy and break its dependence on oil revenues. The crude oil situation has so weakened in Saudi Arabia that the government is seriously contemplating to partially privatize state-owned oil and gas major, Saudi Aramco with a minimum of 5% of its shares listed in the *Tadawul* Saudi Stock exchange (Walid, 2018).

The year 2017 for Saudi Arabia was an economic nightmare. The economy was in decline with GDP deteriorated to a mere 0.7% consumer inflation on its worst ever negative figure (Alekhina and Yoshino, 2018); credit growth on decline for the whole year, and like – all partly due to the lower oil prices and the government's subsequent decision to cut off salaries and government expenditures. The drop in crude oil prices also proved kingdom's worst economic slowdown since global financial crisis. However, with oil markets improving in last few months of 2017, and government spending in Q4 2017, few demand indicators have started to improve. The PMI Index started to move up consistently, while non-oil GDP growth also was on the up move. The year 2018 has begun on a positive note, with the International Monetary Fund (IMF) increasing its estimate of GDP growth to 1.6% from 1.1% earlier.

In energy context, the term volatility is defined as "the pace at which prices rise or fall sharply within a period of time" (Ogiri et al., 2013). Another aspect of Price Volatility is that there occur huge losses or gains to oil producing, oil importing and oil exporting nations, particularly when their economies are dependent on the oil leading to economic instability. Similarly, oil volatility also results in huge losses or gains to independent investors when they are confronted with greater uncertainty of the oil stock market (Salisu and Fasanya, 2012).

During the last two decades, oil prices have fluctuated sharply with up to 60% decrease in prices. Such a sharp decline has also affected the macro-economic variables such as the energy and stock market. The developing countries have in the past faced huge disasters such as what happened after the Second World War when oil volatility played a major role in the US recession because the sharp increase in crude oil prices had a negative correlation with the US real GNP growth (Hamilton, 1983). Moreover, the crash of the stock market in 1987, the invasion of Kuwait by Iraq in 1992, the currency disaster in East Asia in 1997 are a few other examples of world's financial crises which are directly or indirectly linked with oil prices. Recently the Gulf unrest can also be attributed to volatility of oil prices and its impact on oil stock market.

Moreover, the volatility in oil price is also responsible for extra space storage (EXR) affecting the stock market. Recently, the global financial markets are facing severe crises related to asset value loss and share price fluctuations leading to stock market declines. A need is therefore felt to investigate and estimate factors of COP volatility and the impact on oil stock market performance in Saudi Arabia. The rational of taking a study of this nature is that no due attention has been given to Saudi Arabia crude oil price situation and its impact on Saudi Stock Market.

1.2. Saudi Oil Stock Exchange (Tadawul)
The Saudi Stock Exchange, or Tadawul as it is called, has 180 listed companies including merely four oil companies, despite being the dominant sector. The Tadawul All Share Index (TASI) determines the stock market index tracking the performance of all companies listed on the Saudi Stock Exchange. *Tadawul* is currently open only to domestic investors and GCC-nationals. Direct foreign access is unavailable and investors can invest only through exchange-traded funds and swaps via member trading firms. In 2015, Capital Market Authority (CMA), the regulator of the Saudi capital market, permitted foreign institutional investors to invest in Saudi stocks and a regulatory framework would be finalized to facilitate foreign presence in Saudi stock exchange. The conditions for such foreign investors who wanted to participate in the Saudi Stock Exchange were kept very stringent, e.g., only established institutional foreign investors were allowed to invest provided they have been in business for at least 5 years and possess assets worth value at least $5 billion. The door was closed for individual investors. After the inclusion of Saudi Arabia in MSCI and FTSE indices later in 2018, foreign institutional investments would be on rise in Saudi equity markets. Another landmark event would be the Aramco IPO in 2018.

The reason for taking such policy initiative was that TASI had been facing a consistent volatility every year having fallen by 15%, and a negative average annual return of −3.7% ever since

2014 when oil prices started to fall. Saudi Arabia's Tadawul index is not only the region's largest equities market, but it is also one of the most diverse, consisting of close to 180 stocks across a range of sectors. While financials and materials combine to comprise over half the market, listed companies span a variety of sectors, such as telecom services and real estate, making it more representative of the real economy compared to regional peers. While Saudi Arabia constitutes more than 50% of the S and P Pan Arab Composite Large MidCap Index with an average daily liquidity of US$885 million, sell-side coverage remains low and is limited to approximately 55% of listed entities Saudi Arabia's stock market is retail investor dominated, constituting over 70% of daily trading activity.

One of the key pillars of the Saudi Arabian government's plan is the privatization of state assets, the proceeds of which it would use to fund non-oil investments. For instance, the government is set to partially privatize Aramco-Saudi Arabia's national oil company-this year, in what could be the world's biggest initial public offering. A dual listing in Riyadh and an international stock exchange is currently expected. Additionally Tadawul All Share Index (TASI) TASI's possible inclusion to FTSE and MSCI indices would also help the index to improve. In 2017, TASI performed better than most of its GCC peers, except Kuwait and Bahrain. While oil price volatility played a part in affecting equity market performance, the rise in geopolitical tensions also played a significant role in stock performance.

One of the major landmark events for Saudi Arabian equity market to look forward to in 2018 would be its possible inclusion in FTSE and MSCI Emerging Market benchmark indices. The formal inclusion in these indices would lead to global asset management firms to increase their exposure to Saudi Arabian equities in order to align their portfolios to these benchmarks. While the possible inclusion of Saudi Arabia in the benchmark indices has been on the cards since 2015, it is only now that the developments are accelerating towards actual inclusion. In case of FTSE indices, during its review in September 2017 country classification annual review, the index provider refrained from adding Saudi Arabia, while also expecting that it expects the country to soon meet the criteria to be promoted from unclassified status to secondary emerging market. The inclusion of Saudi Arabia is expected to lead to passive fund inflows, presuming Saudi Arabia has 2.7% weight in the index, as per analyst estimates. The estimated weight is excluding possible Aramco listing, which could increase Saudi Arabia's weight in the index to close to 5%.

With respect to MSCI, in June 2017, Saudi Arabia was added to its watch list for a potential upgrade in June 2018. If the upgrade materializes, the actual inclusion of Saudi Arabia in the MSCI Emerging Market Index would happen in two phases – in May 2019 and August 2019. The inclusion of Saudi Arabia is expected to lead to active fund inflows in to its equity market up to an estimated USD 9 billion; presuming Saudi Arabia has 2.4% weight in the index, as per MSCI indications. The weight would be distributed across 32 Saudi stocks, excluding Aramco. With Aramco, Saudi Arabia's weightage would nearly double to close to 5% in the benchmark index.

Saudi Arabia has been vying for inclusion in benchmark indices since 2015, as part of larger plan of diversification of the economy and ensuring a vibrant capital market as a key feature of the economy. It has taken a series of steps to pursue its goals. The market was opened to Qualified Financial Investors (QFIs) to directly take stake in listed equities, in 2015. The permitted stake, in individual companies and in the market as whole, has been gradually increased. The qualification criteria, such as minimum assets under management (AUM), have also been progressively relaxed. QFIs have been now allowed to participate in IPOs. While QFIs have been allowed to take stakes in Saudi Arabian listed companies up to 49% of equity, the actual percentage holding has been quite low so far. The inclusion in benchmark indices would lead to net inflows of funds in to Saudi equities, similar to the inflows witnessed in case of UAE and other GCC countries at the time of their inclusion in benchmark indices. Last, but not the least, steady oil prices are seen as critical to the share sale. Saudi Arabia is spearheading production cuts among OPEC and other oil exporters in order to shrink global crude stockpiles, which supports prices.

1.3. Oil Price Volatility and Risk Factors

During past few decades energy and oil sectors have contributed drastically in the economic growth of oil exporting and importing countries. It is not the oil reserves or the number of oil wells under the possession by an oil producing nation, but the oil prices that now are the determining risk factors to minimize or maximize the economic stature of any country. The oil price volatility also affects macroeconomic factors such as direct earnings and growth rates, equity risk premiums, inflation, transportation polices and discount rates which concurrently affect cash flows in stock valuation models. This phenomenon is aptly supported by capital asset pricing model theory which postulates a positive relation between risk and the oil prices and its impact in the stock market behavior (Al Shubiri and Jamil, 2018). The main argument of this theory is that volatility in oil prices affects oil importers as well as oil exporters. In the case of oil importers, the oil price shocks affect only the production costs; but oil exporter countries not only have to face the oil price fluctuations directly on their revenues but suffer indirectly over their overall government budget revenues (Mohanty et al., 2013). Thus energy price volatility not only causes macro-economic fluctuations, but also affects the fiscal and monetary matters of a country's economy.
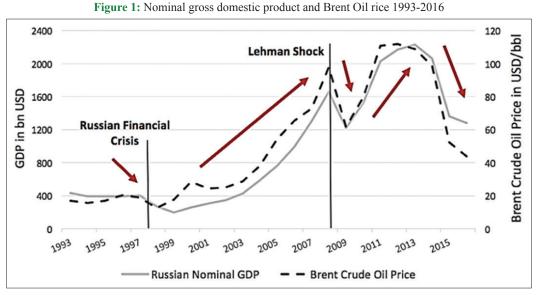
Owing to high energy density and convenience of extraction, transportation and refining, oil has been a major source of energy of many nations. Until the 1990s, OPEC was playing a major role in determining oil pricing, which was mainly dependent on supply factors. But gradually, because of the rapid economic growth in Asia, the energy sector multiplied and began to be controlled by non-OPEC oil suppliers in countries like India and China which had maximum energy consumption. Due to an increased demand in oil there was a diversification in the supply side. Eventually OPEC lost control in price determination as well as in keeping a control on oil exports.

With this change in demand-supply coordination, there also arose a risk of oil price volatility (Yoshino and Alekhina, 2016),

particularly in those oil exporting nations where oil occupied a significant share in total export and contributed to the government budget. Moreover, the oil market volatility is much more grievous than other commodities due to low price elasticity in oil supply and demand. This results in a wider fluctuation in the oil prices, directly impacting the oil exporters' economies, as they depend much on oil export revenues. Any untoward happening becomes a major factor of deterioration of economy as was in the case of Brent crude oil prices that resulted in the fall of the GDP of an energy exporting country (Figure 1). This shows how the country's GDP is affected with the rise and fall in the Brent Oil Price during the period 1993-2016.

Similarly, Figure 2 shows how socio-political events worldwide were responsible for oil price fluctuations. The illustration is an evidence to show how prices of three different oil grades (OPEC, Brent and Urals) are highly correlated and face the same impact of the events (Figure 2). This is also an indication how a decline in oil prices can put severe pressure on any government's budget and macro-economy of an energy exporting country. In such a situation, risk management becomes more imperative. It becomes

necessary to identify such means that allow nations to regain their economy by bringing in coordination between risk factors and oil prices.

2. LITERATURE REVIEW

There are studies that have examined the oil price volatility and its impact on stock markets of Nigeria, Vietnam, Oman, Malaysia, Indonesia, Russia, India and other European and American countries (Jones and Kaul,1996; Sadorsky,1999; Papapetrou, 2001; Maghyereh, 2004; Olomola and Adejumo, 2006; Park and Ratti, 2008; Yoshino and Alekhina, 2016; Narayan and Narayan, 2012; Arouri and Nguyen, 2010; Asaolu and Ilo, 2012; Cong et al., 2008; Ito, 2012; Ono, 2011; Berk and Aydogan, 2012; Ogiri et al., 2013; Al Shubiri and Jamil, 2018; Abidin, and Haseeb, 2018). All these studies have utilized simple regression models and reported that the stock returns for major countries of the world were negatively impacted by oil prices. Their findings suggest that oil prices and stock returns have a negative relationship in short-term. In other words, these studies are the evidence of the phenomenon that higher oil prices lead to lower stock returns. In order to study the

Figure 1: Nominal gross domestic product and Brent Oil rice 1993-2016

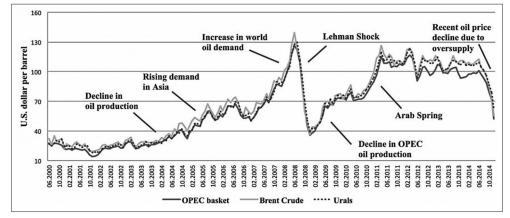Source: Federal Reserve Economic Data

Figure 2: OPEC Basket, Brent Crude, and Urals Oil Prices, 2000-2014 showing impact of the worldwide events

Data Source: US Energy Information Administration and Institute of Energy Economics, Japan IEEJ

causality from the stock market returns to the oil market and vice versa, these studies also used various models such as VAR model, regime-switching model, Johansen test and vector-error-correction model. These studies have also not used the Methods identified for the current study, which is another rational for carrying out an empirical study of this nature.

The relationship between oil prices and stock markets is although a much researched area but not much attention has been paid on oil price volatilities and the stock market returns. In the Saudi context, the reason was that prior studies did not differentiate oil-exporting countries from oil-importing countries when volatility in oil prices was discussed (Hammoudeh and Aleisa, 2004). Had that difference been maintained, the impact scenario of oil stock markets in terms of profitability too would have been different. Hence, the main focus in the current study will be to investigate the effect of oil price volatility on stock prices and profits in developing economies (Basher, 2006). However, there is a contrary view too (Park and Ratti, 2008) which suggests that both consumers' and the oil firms' behaviors affect the oil price changes which subsequently also affect the oil stock market. Such issues will also be discussed in the study appropriately.

Hamilton (1983) significantly drew attention to energy price changes and its impact on the US economy on a number of occasions including recessions during the period 1948-1972. The relationship of oil price shocks and US stock markets is also reported by Sadorsky (1999), Papapetrou (2001), Guo and Kliesen (2005), Ekong and Ebong (2016), Eze, (2016) and Hsu and Chin-Chang (2017) who unanimously seem to agree that there is a negative impact of oil prices on stock market prices. However, Huang et al. (1996) supported a causal impact of oil prices on stock prices and so did Narayan and Narayan (2010) who reported a positive long-term impact of oil prices on stock prices. Hence, there exists a difference of opinion among the authors and critics as findings of one study would be refuted by the findings of the other.

For this reason, a few of these studies about relationship between oil and stock market prices seem to be inconclusive and debatable. For instance, studies (Prajitno, 2011; Kaul and Seyhun, 1990; Sadorsky, 1999; Sawyer and Nandha, 2006; Katircioglu, 2017 and Okere and Ndubuisi, 2017) show that high oil price volatility is responsible for creating unstable economic conditions and lowering the stock market prices. On the contrary, various other studies, for instance, Jones and Kaul (1996) have found evidence that international stock prices would not be affected by oil price volatility. Other studies (Ferderer, 1997; Huang et al., 1996) have contended that in the event of oil price rise, there may be an inflation and economic recession in oil-importing countries whereas Yang et al. (2002) assert that in oil-exporting countries the fall in the oil prices might be a result of political and social instability.

The Lehman crisis of 2008 and subsequent impact of it once again resulted in a renewed interest in oil price fluctuations and their role in macro-economic issues (Hamilton 2009; Hamilton 2013; Yoshino and Taghizadeh-Hesary, 2014) and its linkages with oil shocks and price volatility. Other studies (Peersman and

Van Robays, 2012; Taghizadeh-Hesary et al., 2016; Aydoğan et al., 2017; Okere and Ndubuisi, 2017; Ullah, et.al. 2017) found evidences of linkages between oil prices and stock markets and identified such economies that witnessed both good and bad results of oil price shocks. These studies reiterated the fact that the correlation between oil volatility and its impact on stock market depends much on the fact whether the country is an oil-exporter or an oil-importer. Other studies like Nguyen and Bhatti (2012) and Olamide et al. (2017) that examined the nexus between oil prices and stock market performance in Nigeria; Khai et al. (2017) that studied the impact of world crude oil prices on the Vietnamese stock market have used annual time series data using the regression analysis methods. Although Vietnam is a crude oil exporter and a refined-oil importer, it never witnessed any shocks on its stock market until 2008, but rather grew rapidly despite regression felt in other parts of the globe. However, during the economic crisis of 2008-2012, the Vietnamese oil stock market also crashed and exposed the nexus between oil prices and stock market prices.

Hammoudeh and Aleisa (2004), in another empirical study, examined the nexus between oil prices and stock markets in GCC countries and concluded that the Saudi market is the only market in the region that is predictable about future oil prices. Similarly, Bashar (2006) had also studied the impact of oil price change on GCC stock markets and found the Saudi and Omani markets enjoying the predictive power in the increase of oil price. Studies on Saudi Arabia were found in much less number except a few that scantily discussed the issue of oil volatility and its regressive impact on oil stocks. Exceptionally a study by Aleisa and Dibooğlu (2002) attempted to study the shocks due to oil price fluctuations in Saudi Arabia. Their findings revealed the varying impact of real and nominal shocks. The real shocks, it was found, made a stronger influence on exchange rates in Saudi Arabia while nominal shocks managed the price level movement. In a similar study on GCC countries, Abdelaziz et al. (2008) found that net exporting countries experienced a positive impact in the form of price rise which resulted in the increase of real national income and higher export earnings. On the contrary, this study found a negative impact in the form of high oil prices, inflation, higher input costs and reduced demand in net importing countries.

These studies are the evidence that a rising volatility in crude oil prices (COPs) has proved a challenge to policy makers across countries. These studies however measured the impact of COP volatility on stock market performance, but remained confined to a limited geographical region and failed to make any generalization. These are also a few studies based on oil exporting countries like Saudi Arabia. Hence, this study aims to fill this gap in the existing literature by trying to establish the linkages between oil price and stock market performance in Saudi Arabia. This section on previous studies was only suggestive in order to provide evidence of the work already carried out in the subject of the current study. The main objective of this review was to prepare platform for the study.

3. THEORETICAL FRAMEWORK

The aim of this study is to empirically examine the relationships between crude oil prices, its volatility and the oil stock market.

Figure 3 is a technical roadmap to illustrate the theoretical framework that would be ideally suitable to this kind of study. The framework shows the key objectives along with the proposed constructs and properties for this study, as well as the methods that may be used for the study and their functions.
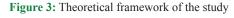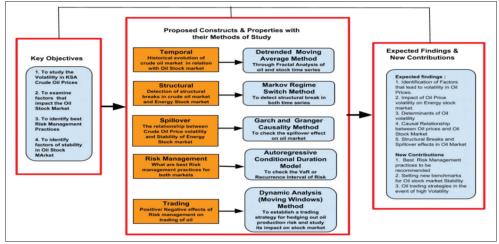
4. DATA SOURCES AND METHODOLOGY

For this study, annual time series panel data over the period ranging from 2007 to 2017 was used. The study eventually converted the data into a natural logarithmic equation so as to obtain elasticity of oil prices with respect to the other variables such as the volatility and the oil stock market. These variables suggested in this study were also used by some previous studies including Syed and Sadorsky (2006), Narayan and Narayan (2012); Aydoğan et al., 2017 and Taghizadeh-Hesary et al. (2016) who have examined the relationship between crude oil prices, volatility and oil stock markets. The analytical method for this study was the regression analysis because it used 10 year time series variables. Therefore, to avoid a spurious regression and study their properties and model the relationship between non-stationary series, it was necessary to examine all variables through their time plots, unit root tests and co-integration analysis. The methods suggested to be used in this study were mentioned in the theoretical framework (Figure 3) and also listed in the Table 1.

These methods are also used in various studies including Syed and Sadorsky (2006), who investigated the impact of oil price volatility on emerging stock market; Narayan and Narayan (2012) who employed the GARCH method to testify COPs and found that oil shocks are influenced by a long-term volatility; Ciner (2001) who used Granger causality test and the VAR model and found a statistically significant but nonlinear relationship between real stock returns and oil prices; Abdalla (2012) too used the bivariate VAR-GARCH model to examine the impact of oil price fluctuations on stock market returns in Saudi Arabia. Last, but not the least, Taiwo et al. (2012) used co-integration, unit root test and error correction model (ECM) to examine the relationship between COP, stock price and macroeconomic growth to include that growth rate of GDP was significantly affected by growth rate in both oil prices and stock prices.

5. RESULTS AND DISCUSSIONS

This study has used weekly data on crude oil prices obtained from data stream 2007/01/07 to 2017/12/25. The methods used for this study were fully tested and relevant to such studies including Markov switching model based, detrended moving average method, Garch and Granger Causality method, autoregressive conditional duration model and dynamic analysis (moving windows) method. The variety of methods was used with the purpose to triangulate the data and verify their validity. This also

Figure 3: Theoretical framework of the study

Table 1: Methods/models and their functions

Testing method	Functions and objectives
Detrended moving average method	Fractal analysis of oil and stock time series
	Temporal historical evolution of crude oil market in relation with oil stock market
Markov regime switch method	To detect structural break in both time series structural
	Detection of structural breaks in crude oil market and energy stock market
Garch and Granger causality method	To check the spillover effect on oil market
	Spillover the relationship between crude oil price volatility and stability of energy stock market
Autoregressive conditional duration model	To check the VAR or recurrence interval of risk
	Risk management what are best risk management practices for both markets
Dynamic analysis (moving windows) method	To establish a trading strategy for hedging out oil production risk and study its impact on stock market
	Trading positive/negative effects of risk management on trading of oil

enabled to check the responses reaction of one model by the other and assisted in examining the dynamic behaviour of the financial and economic variables.

The Markov switching nonlinear model is amongst all the most popular time series models. One of the qualities of this type of model is that it involves multiple equations to characterize the time series patterns in different regimes. Furthermore, the switching features of this model are governed by an unobservable state variable. This model is also different from the structural change models because it can adjust frequent changes occurring at random point of time while the structural changes models only adjust occasional and exogenous changes. Therefore, Markov Switching model was found to be suitable to describe the correlated data that exhibit distinctive dynamic time series patterns. Moreover, the weekly time series data about the variables of the crude oil sector under study exhibited a nonlinear associationas a result of which the switching regression was seen as:

$$r_t = \tau_{st} + \sum_{g=1}^{j} \delta_{st} gr_{t-g}^{oil} + \sum_{f=1}^{k} \varphi_{st} fdv_{t-h}^{global.F} + \varepsilon_t \qquad (1)$$

Where $\varepsilon_t \sim N(0, \delta_{st}^2)$,

The term τ_{st} represents the crude oil sector specific intercepts while δ_{st}^2 is the variance of error term for each regression. Whereas, δ_{st} g represents the impact of crude oil impact on the stock market. Moreover, the term st is unobserved latent variable that takes the value 1 to 2. Following the empirical literature on the issue, two regimes have been specified for the state of the economy. The first regime can be considered as a stable regime while second regime is in the state of recession.

The probability matrix for the unobserved latent state variable adopts the

following Markov chain process

$$P = \begin{vmatrix} p11 & 1-p22 \\ 1-p11 & p22 \end{vmatrix} \qquad (2)$$

While the $P11 = P\left(\dfrac{1}{st-1} = 1\right); And\ P22 = P\left(S_t = \dfrac{2}{st-1} = 2\right)$

To examine the effect of changes in the oil prices on the probabilities of different regimes while taking global factors as a constant, the transition probability matrix was assumed to be taken initially constant and then time-varying following the Hamilton specification. The likelihood function of unobserved latent variables, therefore, could be specified as follows.

$$F(r_t/s_t) = i, \Omega_{t-1} : N_t = \frac{1}{\sqrt{2\pi\sigma i}} \left[-\frac{1}{2} \left(\frac{r_t - C_{st} - \sum_{g=1}^{j} \delta_{st} gr_{t-g}^{oil} - \sum_{f=1}^{k} \varphi_{st} fdv_{t-h}^{global.F}}{\sigma i} \right)^2 \right]$$

(3)

Where the parameters of the models are $Ni = (\sigma i, \delta i, \varphi i, \varphi i\sigma i)$ while is the σi can be interpreted as information available at time (t). Therefore, the volatile probabilities matrix in the regression is specified as follows

$$P(t) = \begin{vmatrix} P11_t & 1-P22_t \\ 1-P11_t & 1P22_t \end{vmatrix} \qquad (4)$$

Furthermore, the regime switching possibilities are time-varying while global factors and oil prices are given. In that case, the transition probabilities can be specified as in equation (5) and in equation (6).

$$P11_t = \frac{exp\left\{\gamma_1 + \mu r_{t-1}^{oil} + \omega_1 v_{t-1}^{global.F}\right\}}{1 + exp\left\{\gamma_1 + \mu_1 r_{t-1}^{oil} + \omega_1 v_{t-1}^{global.F}\right\}} \qquad (5)$$

$$P22_t = \frac{exp\left\{\gamma_2 + \mu_2 r_{t-1}^{oil} + \omega_2 v_{t-1}^{global.F}\right\}}{1 + exp\left\{\gamma_2 + \mu_2 r_{t-1}^{oil} + \omega_2 v_{t-1}^{global.F}\right\}} \qquad (6)$$

The results of constant Markov switching model indicate that oil price shocks have been impacted greatly with different degrees of significance at different intervals. The weekly stock indices in the crude all prices are computed on continuously compounded basis

$r_{ij} = ln\left(\dfrac{P_{ij,t}}{P_{ij,t-1}}\right)*100$ While $P_{ij,t}$ and $P_{ij,t-1}$ are weekly closing stock

prices in sector i in week j.

The results in Table 2 indicate that oil prices are significantly positive in the stable regime one as wel las in regime two, which is considered to be a recessionary regime. The impact of global factors is also found significantly negative for both regimes. It implies that the crude oil stock returns are significantly influenced by the uncertainties generated by global factors. Therefore, the volatility in both regimes tends to be high and significant. Moreover, the significant probabilities of the values of P11 and P22 indicate that transition between specified regimes for KSA economy is stable and persistent.

The results obtained and presented above partially contradict Kilian and Park (2009), Apergis and Miller (2009), Basher et al. (2012), Lin et al. (2014), but are consistent with those of Wang et al. (2013). This phenomenon existed probably due to similar data timespan but the researcher noted a relatively low length of significant responses in the results obtained. This leads to the argument that this phenomenon might have existed because of capturing a recent year data in the sample.

The present research findings would be helpful for forecasting future performance of stock market returns. This study has analysed country-specific characteristics in the crude oil market, therefore one could infer information and intuition about future market trends. The study would also assist individual firms in the decision-making process, to decide whether they should hedge the risks or not. For the investors, this study would provide useful information about how to make a diversified portfolio., it

Table 2: The results of constant Markov switching model

Crude oil sector	Parameters	Prob.
Regime one		
T	−0.024	0.880
δ1	0.138*	0.001
φ1	−0.021**	0.041
σ1	0.586*	0.004
Regime two		
T	−0.067	0.678
δ1	0.340**	0.012
φ1	−0.074**	0.078
σ1	1.569*	0.006
P11	0.786	7.67[d]
P22	0.876	17.9[d]
Log-likelihood	−1104.47	
Q10	7.567	0.567
Q2 10	5.234	0.789

τi is the constant term, the δi is the coefficients of the crude oil, φi is the global factors while σi is the volatility. The P11and P22 is the switching probabilities and [d]is constant expected regime duration. The **indicate the significance at 1%, 5% and 10% respectively. The Q10 and Q²10 are the tests of autocorrelation

is also expected that such factors could be identified that lead to volatility in oil prices and make a significant impact on energy stock market. These factors will be considered as determinants of oil volatility and said to have a causal relationship between oil prices and oil stock markets. The future studies will also reveal results like structural breaks and spillover effects in oil market. However, to obtain the desired results, the stationarity of the time series will be needed to be tested before the required estimation. The tests suggested and models suggested in Table 1 should be ably supported by 'panel unit root tests' to examine all hypotheses of the study. It is also estimated that such a study will also help to recommend best risk management practices and setting new benchmarks for oil stock market stability as well as oil trading strategies in the event of high volatility.

6. CONCLUSION AND RECOMMENDATIONS

Saudi Arabia is contemplating a massive public share offering for Aramco, the world's biggest oil company, on a big international stock exchange. Aramco is now expected to move forward with a listing on the Saudi stock exchange, with plans for an international listing boosting the market capitalization of the entire Saudi stock exchange. A rebound in oil prices following the 2014 collapse of the crude market has somewhat curbed the need for such a large IPO is a positive step towards brining stability in oil market. Moreover, the Saudi government has extended the Fiscal Balance Program to 2023 with the aim of balancing the budget by 2020 and focus on reviving near term economic growth. Even IMF has suggested to the Saudi government to recalibrate the pace of fiscal reforms, so as to allow the economy to adjust to the changes introduced. Accordingly, the government has revised the program with gradual movement to fiscal rebalancing by 2023. The fuel price related reforms have also been spread out over 2018 to 2023 period, with only jet fuel, benzene, diesel and electricity price revisions expected in 2018. Also, as part of the program, the government has put a cap on debt-to-GDP ratio of 30% and total reserves drawdown to USD 250 bn.

The Saudis framed the purge as a crackdown on corruption, though some analysts said it was likely a move by bin Salman to consolidate power as he embarks on an ambitious effort to reshape Saudi Arabia's economy. Following 3 years of soft oil prices, the Saudis have drained budget surpluses and now need to return to economic growth. Saudi Arabia has been making a push to attract foreign investors by opening up its capital markets as the kingdom attempts to diversify the economy and reduce its dependence on oil revenue. Foreign ownership has languished, however, as investors have focused on the government's austerity push and recent domestic political changes rather than market reforms. Announcements from MSCI and FTSE Russell suggest the country could be promoted to emerging markets status this year, something that will likely draw global investors.

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