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Abstract

This paper investigates common cyclical features between crude oil market and stock markets in major oil exporting countries including Saudi Arabia, UAE, and Kuwait. The results of the paper indicate, at low oil prices (below $40 per oil barrel) Saudi and Abu-Dhabi markets share common cyclical feature with oil market, but they digress from the oil market as oil prices rose above $40 per barrel. The decoupling feature indicate the capital markets and oil market respond in different pattern to cycle generating shocks, suggesting as higher oil prices may raise global investment risk, stock markets in these countries deflect from their key fundamental driver.

JEL classification: C10 ;C50 ; G10
Keywords: Common trends; Shared cycles; nonlinear cointegration

1- Introduction:

Among the most important functions of stock exchanges are fair price determination and discounting function. Since stock exchanges facilitate the bringing together of buyers and sellers from all over the country and even from outside the country, it is widely believed that they play the role of matching buy and sell orders to determine price at, or near equilibrium level. On the other hand, the discounting function assume stock prices reflect accurate prediction of future business conditions. However, in reality stock markets can fail to perform neither of these two basic functions. Fair price determination can be violated if sell and buy orders are dominated by speculative effects of powerful manipulators who use every trick in the business to create artificial values of shares far different from their intrinsic values. Also the ability of stock market to forecast correctly business conditions ahead of time depends on fair flow of information to all participants who assumed equally informed about the investment opportunities in the economy.

The purpose of this paper to explore if the crude oil price have a significant role in shaping the dynamics of stock prices in major oil exporting countries including Saudi Arabia, Kuwait, United Arab Emirates. Given that crude oil revenue account, on average, for about 75 percent of total governments revenue, and about 80 percent of total export in these countries, their economic outlook including capital markets performance is supposed to be shaped directly by factors influencing demand for oil and thus oil price changes. Beside the obvious impact on government finances and the balance of payments, change in oil revenues have broader implications for domestic economic activities. Non-oil economic activities also affected by domestic government expenditure, which itself dependent on earnings from oil export. Moreover, most large scale economic activities in the public sector, such as infrastructure investments and oil-based manufacturing industries are closely linked to developments in oil sector[1].

During the past decade extensive research work investigated the links between stock markets and oil markets in developed economies to gauge the spillover effect of oil market shocks on capital markets. Kaul (1996) indicate negative relation between US, Canadian, UK, and Japan stock markets and oil price shocks. Ciner (2001) show evidence of nonlinear causal effect of oil future prices on international stock markets. Nandha and Faff (2007) use global industry indices to show that oil price shocks affect negatively equity returns in all industries except mining and gas industries. However, more recently Chang and Mc Aleer (2010) using conditional correlation analysis show evidence of little dependence

[1] The six member states of Arab Gulf states, which rely heavily on oil exports, have gained nearly $605 billion in fiscal surplus during 2003 – 2008 as a result of strong crude oil prices.

between crude oil market and the major financial markets including FTSE 100, NYSE, S&P500, and Dow &Jones indices. In terms of oil exporting countries Bjornland (2008) indicates that a 10% increase in crude oil price, raise Norway stock returns by 2.5% initially before the oil price effect dies out gradually. Hammoudeh and Aleisa (2004) show Saudi stock returns can be predicted by oil future prices. Onour (2007) show, while the effect of oil price shocks are significant on Gulf Cooperation Countries (GCC) stock returns in the long term, the short term movements of stock returns are affected mainly by non-oil speculative factors[2].

The interactive association between crude oil prices and capital markets performance in these countries is important for investors as well as for policy makers in these countries. Increasing departure of stock prices from their fundamental driver imply increasing risk for investors in these markets, and raise questions about viability of these markets in performing efficient allocation of resources. Results in this paper can help us comprehend the causes behind excess volatility characterizing these markets.

The paper employs a methodology developed by Engle and Kozicki(1993), Vahid and Engle (1993) designed for testing for common trends and common cycles in less persistent stationary processes[3]. The methodology of shared stochastic trends and common cycles has been employed in the past on energy markets by Serletis (1994), Serletis and Herbart (1999), Plourde and Watkin (2000), and Serletis and Ricardo (2004), and on global food market and energy market by Onour (2010).

[2] GCC countries include Saudi Arabia, Kuwait, UAE, Qatar, Bahrain, and Sultanate Oman.

[3] The term cycle in Vahid and Engle methodology refers to the stationary reminder after subtracting the random walk trend.

The paper is divided into four sections. Section two explains the methodology of the research. Section three deals with the estimation results. In the final section we conclude the research findings.

2-Methodology:

2-1: Common trend:

To explain the common feature testing procedure developed by Engle and Kozicki(1993), Vahid and Engle (1993), we decompose each variable into a trend (w_t), a cycle (c_t), and stochastic error term (e_t), so that:

$$y_t = \beta_1 w_t + \delta_1 c_t + e_{1t} \qquad (1)$$
$$x_t = \beta_2 w_t + \delta_2 c_t + e_{2t} \qquad (2)$$

where (y_t) stand for stock indices and (x_t) is the oil price, and $\beta_i \; and \; \delta_i \; (i = 1,2)$ are the corresponding coefficients. Assuming there is a common trend among the two series, then a linear combination of the two price series, $y_t - \lambda x_t$ can be expressed as:

$$y_t - \lambda x_t = (\beta_1 - \beta_2 \lambda) w_t + (\delta_1 - \lambda \delta_2) c_t + (e_{1t} - \lambda e_{2t}) \qquad (3)$$

where λ is the linear combination factor linking the two prices. Given that the parameter, λ is such that $\lambda = \beta_1 / \beta_2$, then there is a unique linear combination of $y_t \; and \; x_t$ such that the common trend between the two series is no longer exist. In such a case w_t is called a common feature. Thus, to test for a common trend between $y_t \; and \; x_t$ in the equations (1) and (2) we test for cointegration (ie., the null of no common trend against the alternative of a significant trend)[4].

2-2: Common cycle analysis:

The test for common cycle follows similar approach as that of the common trend. Given that y_t *and* x_t are non-stationary processes of order one (I(1)), then each series can be reduced to stationary process, I(0), by detrending equations (1) and (2) so that:

$$\Delta y_t = \alpha_1 c_{1t} + \varepsilon_{1t} \qquad (4)$$

$$\Delta x_t = \alpha_2 c_{2t} + \varepsilon_{2t} \qquad (5)$$

where Δ is the first difference, $\alpha_i (i = 1,2)$ are the coefficients corresponding to cyclical components and ε_{it} are stationary error terms.

The common cycle feature test constitutes a common serial correlation test developed by Engle and Kozicki (1993), which extend the notion of common trend test described above. Thus, to test whether there is a common cyclical feature linking the two series we test if there is a linear combination such that:

$$u_t = \Delta y_t - \delta \Delta x_t \qquad (6)$$

which does not have the cyclical component. Thus, the common cyclical feature test includes minimization of equation (6) with respect to δ, or more formally:

$$s(\hat{u}_t) = \min_{\delta} \; s(\Delta y_t - \delta \Delta x_t) \qquad (7)$$

Engle and Kozicki (1993), show that equation (7) can be reduced to[5]:

$$s(\hat{u}_t) = \min_{\delta} \; \hat{u}' M_x \Delta x_t (\Delta x_t' M_x \Delta x_t)^{-1} \Delta x' M_x \hat{u} / \hat{\sigma}_h^2 \qquad (8)$$

where M_x is a projection matrix, such that $M_x = [I - \Delta x (\Delta x' \Delta x)^{-1} \Delta x]$ and

[4] Cointegration imply, although many events can cause permanent effects on the stock price variable, there is some long-run equilibrium relation tying the individual components together, represented by the linear combination $y_t - \lambda x_t$.

[5] See Engle and Kozicki (1993), pages 370-371, for verification of equation (8).

$\hat{\sigma}_h^2 = \hat{u}'M_x\hat{u}' / N$

For N is the number of observations.

Since minimization of equation (8) requires nonlinear procedure because the parameter δ appears in the denominator and the numerator of the equation (8), then the estimation procedure can be carried out using nonlinear estimation approach of Limited Information Maximum Likelihood (LIML) method. However, more simpler and asymptotically equivalent estimator (Engle and Kozicki , 1993) can be obtained by minimizing only the numerator of equation (8), which is equivalent to estimation of equation (6) using Two Stage Least Square (2SLS) after augmenting it with instrumental variables and then testing for legitimacy of the instrumental variables. Such a process involves two steps. First we employ 2SLS in the following:

$$\Delta y_t = \delta_0 + \delta_1 \Delta z_t + \delta_2 \Delta x_t + \mu_t \qquad (9)$$

Where ($z_t = x_{t-1}, y_{t-1}$) stand for instrumental variables[6]. Then using the estimated residuals from equation (9) (that is $\hat{\mu}_t$) we use the OLS to conduct LM test statistic:

$$\hat{\mu}_t = w_0 + \lambda_1 \Delta y_{t-1} + \lambda_2 \Delta x_{t-1} + \varepsilon_+ \qquad (10)$$

With the LM statistic distributed as Chi-square with two degrees of freedom. So, the test of the LM statistic in (10) is a test for the legitimacy of the IV variables used in 2SLS estimates.

The test for a serial correlation can be computed using the LM test, which is NR^2, where R^2 is the coefficient of determination and N is the sample size, so that NR^2 is distributed as chi-square with degrees of freedom equal to the number of lagged variables coefficients in equation (10).

[6] Engle and Kozicki (1993) indicate, the test statistic for a common feature serial correlation is asymptotically equivalent to the test statistic for the legitimacy of the instrumental variables.

3- Results

The analysis in this paper is based on weekly data about stock indices for Kuwait, Saudi Arabia, Dubai, and Abu-Dhabi stock markets, beside Brent crude oil price series. The sample period of the data extend from 1st January 2004 to 6-June 2008.

To investigate presence of stochastic trend (unit root) in each price series we employed the augmented Dickey-Fuller (ADF) and Phillip-Perron (PP) unit root tests which test the null of a random walk. Since the objective is to test for the presence of common trend between stock prices and crude oil price, we need to verify evidence of significant stochastic trend (unit root) in each price level. Table (1) reports the ADF and PP tests results, which indicate all price series exhibit stochastic trend, at levels, but such a trend is removable by first-differencing transformation. Table (2) reports cointegraion test results using the bound test procedure developed by Pesaran et al (2001), and a non-parametric cointegration test developed by Breitung (2001)[7]. Using the bound test, unlike other multivariate conintegration tests, such as that of Johansen and Juselius (1990), does not require the pre-testing of the variables included in the model for unit roots. It is applicable regardless of whether the independent variables are stationary, (I(0), or random walk[8], I(1). However, the bound test fails to detect nonlinear cointegrating relationship associated with nonlinear form of ECM specification. To take into account such possibility we employed the non-parametric cointegration test, beside the bound test. Results in table (2) reveal, while the bound test fails to reject the null hypothesis of no cointegration, the

[7] Since both tests are well documented in the literature we decided not to include details about their methodology. For more details about these two tests we advise readers to refer to the original articles by the two authors.

[8] But inconclusive if the order of integration of the variables of order two, or more.

non-parametric test reflect significant non-linear association between oil market and Kuwait stock market. For the other three markets both tests reject the hypothesis of common trend with the oil market. Inspection of the plots (figures 1 and 2) can also reveal similar result. Systematic digression of stock price from its key fundamental driver has been viewed by some (Bikhchandani and Sharma, 2000) as indication of rational bubbles, which is a phenomena observed in highly liquid and ill-regulated markets[9]. To capture the dynamic effects of oil market on capital markets, in this paper we divided the sample period into two sub-periods. The first period covers from 1/1/2004 to 15/12/2004 when crude oil price was below $40 per oil barrel, for most of this period. The second period start from the end of the first period to June-6 2008, when the crude oil price was above $40 per oil barrel[10]. We will refer to these two periods respectively as low and high oil price periods. Table (3), report the LM test results of common cyclical feature between oil market and the stock markets for each sub-sample period. The LM test statistics reject the null hypothesis of a common serial correlation feature between oil price and stock prices for all markets at the high oil price period, and therefore rejecting the null hypothesis of a common cycle. While Saudi and Abu-Dhabi markets reveal evidence of linkage with oil market at the low price levels, they show departure from the oil market at the high oil price levels. The departure of stock prices from crude oil price at higher levels may be because as oil prices rise to higher levels global investment risk increases, and that in turn weaken the linkage between crude oil market and GCC capital markets.

[9] This is consistent with the findings of Onour (2010) who shows that the effect of speculative, and non-oil factors on daily stock price changes in Saudi stock market constitutes about 90 percent.

[10] The distinction of the two periods based on statement attributed to Saudi Arabia Minister of Finance in 2008, in which he pointed out the difficulties of sustaining their fiscal spending without cutting their savings if crude oil price goes below the $40 level.

Table(1): Unit root tests

series	ADF		PP test	
	Level	1st diff	Level	1st diff
Kuwait	3.18	5.79*	1.01	47.9*
Saudi	2.41	4.93*	3.01	62.9*
Dubai	4.29	4.18	3.59	42.4*
Abu-Dhabi	2.54	8.30*	1.48	40.9*
Crude oil	3.22	6.32*	2.44	73.1*

* Reject the null-hypothesis of a unit root at 5% significance level.
Note: All series are log transformed.

Table (2): Cointegration tests results

Stock Market	Nonparametric test statistic (5% sig level)	Bound test F statistic (5% sig level)
Kuwait (critical values)	0.02* (0.04)	3.31 (5.49/6.59)
Saudi (critical values)	0.099 (0.04)	2.20 (5.49/6.59)
Dubai (critical values)	0.081 (0.04)	3.38 (5.49/6.59)
Abu Dhabi (critical values)	0.065 (0.04)	1.41 (5.49/6.59)

Note: Critical values for the nonparametric test statistics provided in Breitung (2001), table (1), and for the bound test provided in Pesaran et al (2001), table CI(v). In the bound test results, values in parenthesis represent the (lower/upper) bound values.

Table (3): Common cycle test

Stock index	LM test stat (1)	LM test stat (2)
Kuwait		
Before	7.83*	8.66*
after	21.65*	21.03*
Saudi		
Before	4.41	4.18
after	15.25*	15.26*
Dubai		
Before	6.89*	6.47*
after	27.8*	27.05*
A.Dhabi		
Before	4.08	4.19
after	27.7*	27.17*

*At 5% significance level reject the null hypothesis of common cycle.
Note: LM (1) refers to lagged dependent variables as IV estimators, and LM (2) refers to S&P index as IV estimator.

4-Conclusion:

To explore the dynamic links between crude oil market and stock markets in major oil exporting countries in the Middle East, including Saudi, Kuwait, and United Arab Emirates (UAE), the paper employ common features technique that captures common trend and common cyclical features between two sets of related variables. Results in the paper show Kuwait stock market is the only market in the group portraying nonlinear common trend with oil market. No evidence of shared trends is detected between oil market and the other three markets. To explore the effects of governments revenue positions on capital markets we divided the sample period into two sub-periods of high oil price (above $40 per oil barrel) and low oil price (below $40 per barrel) levels. The LM test results of common cyclical feature, reported in table (3) reject the null hypothesis

of a common serial correlation feature between oil price and stock prices for all markets at the high oil price levels, and therefore rejecting the null of a common cycle between these capital markets and oil market.
However, Saudi and Abu-Dhabi markets share common cyclical feature with oil market at low oil prices but they deflect from the oil market at high oil price levels. Digression of stock prices from their key fundamental driver suggest these markets become fundamentally weak and speculatively strong, as rising oil prices may raise global investment risk. Divergence of stock markets from their key fundamental driver also suggest these capital markets and oil market react differently to shocks, and each market respond to different types of shocks. This suggest that at higher oil prices, speculative non-fundamental factors play more important role in shaping price dynamics in these markets.
The interactive association between crude oil prices and capital markets is important for investors as well as for policy makers. Increasing departure of stock prices from their fundamental driver imply increasing risk for investors in these markets, and raise doubts about viability of these markets in performing efficient allocation of resources. Results in this paper can help us comprehend the causes behind excess volatility characterizing these markets in recent years.

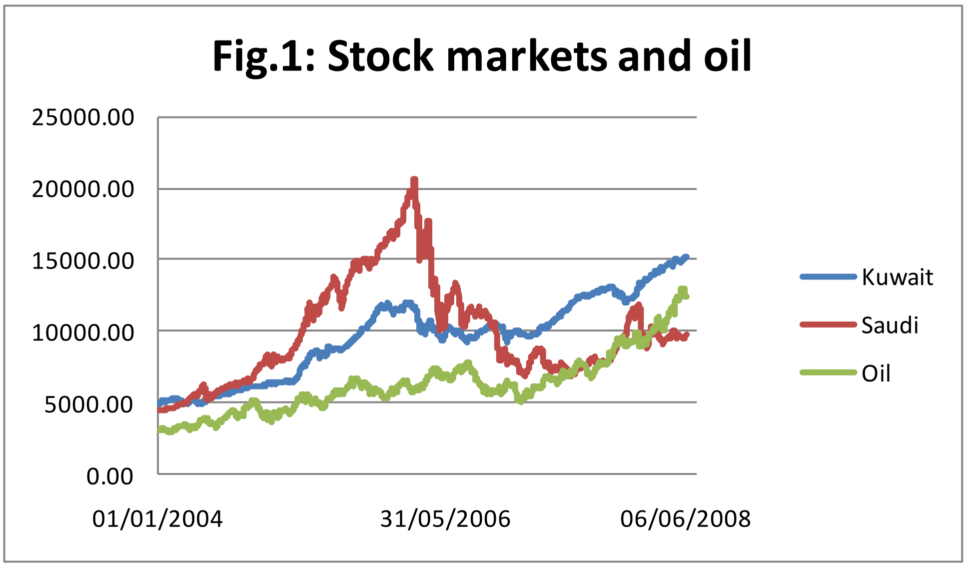
Fig.1: Stock markets and oil
25000.00
20000.00
15000.00
10000.00
5000.00
0.00
01/01/2004
31/05/2006
06/06/2008
Kuwait
Saudi
Oil

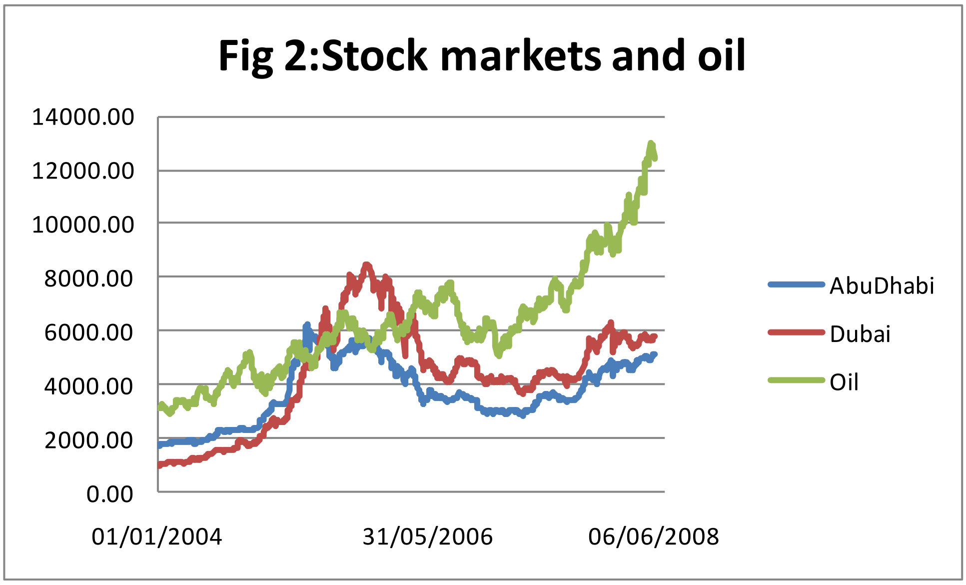
Fig 2:Stock markets and oil
14000.00
12000.00
10000.00
8000.00
6000.00
4000.00
2000.00
0.00
01/01/2004
31/05/2006
06/06/2008
AbuDhabi
Dubai
Oil

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