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Further Evidence on the Responses of Stock Prices in GCC Countries to Oil Price Shocks

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ABSTRACT

Past studies showed that stock market performance is likely to be affected by oil price movements in international markets since higher oil prices often raise fears and concerns about corporate earnings and economic growth. However, empirical results, especially for emerging markets, are not clear-cut on the possible impacts. This paper therefore aims to investigate whether short- and long-term relationships exist between oil prices and stock markets in GCC countries. On the basis of short-term analyses, strong positive links were found in Qatar, the UAE, and to some extent Saudi Arabia. More interestingly, our results indicate that when causality exists, it generally runs from oil prices to stock markets. Our long-term analysis shows that except for Bahrain, there is no long term link between oil and stock markets in GCC countries. For Bahrain, we find positive long-term relationships and, in particular, the stock markets took their cue from oil prices.

JEL classifications: *G12, F3, Q43*

Keywords: *GCC Stock Markets; Oil Prices; Short and Long Term Analysis*

I. INTRODUCTION

There has been a large volume of studies on linkages between oil prices and macroeconomic variables. Most of these studies have established the significant effects of oil price changes on economic activity for several developed and emerging countries (see, e.g., Cunado and Perez de Garcia, 2005; Balaz and Londarev, 2006; Gronwald, 2008; Cologni and Manera, 2008; Kilian, 2008). Furthermore, some papers have shown that the link between oil and economic activity is not entirely linear and that negative oil price shocks (price increases) tend to have larger impacts on growth than do positive shocks (see, e.g., Hamilton, 2003; Zhang, 2008; Lardic and Mignon, 2008). In sharp contrast to a significant number of works investigating the link between oil price shocks and economic activity, there have been relatively few attempts to study the relationship between oil price variations and stock markets. Moreover most of these efforts have focused on industrial countries such as the United States, Canada, the European community, and Japan. In regards to emerging market economies, our survey of the literature generally indicates that very few studies have been carried out and that they mainly consider the short-term interactions between energy price shocks and equity prices.

One rationale for using oil price fluctuations as a risk factor affecting stock prices is that in theory the fair value of a stock equals the sum of expected future cash-flows discounted at the investor's required rate of return. These cash flows are naturally affected by macroeconomic events that potentially depend on oil shocks. Therefore, oil price changes may influence stock prices. Most previous studies have investigated this relationship within the framework of a macroeconomic model employing data from net oil importing countries obtained at low frequencies (monthly or quarterly). Using weekly data and new asymmetric cointegration tests, this article attempts to investigate both the short- and long term relationships between oil price shocks and stock markets in the Gulf Cooperation Council (GCC) countries.

A study of the possible links between oil prices and stock markets in the GCC countries is interesting for several reasons. First, since these countries are major suppliers of oil in today's world energy markets, their stock markets are more likely to be susceptible to changes in response to oil price fluctuations. Second, the specific characteristics shared by the GCC stock markets, as compared to those of markets in developed and other emerging countries, indicate a need for in-depth analysis of the oil-equity market relations. In effect, they are largely independent of the international markets and are overly sensitive to regional political events. Finally, GCC markets represent a very promising area for regional and international portfolio diversification. For this reason the empirical results of studies centered on the GCC countries are of great importance for investors seeking to make judicious investment decisions, and for policymakers attempting to regulate stock markets more effectively.

In the related literature, Jones and Kaul (1996) perform pioneer work in testing the reaction of international stock markets (Canada, UK, Japan, and USA) to oil price shocks, based on the standard cash-flow dividend valuation model. They find that for the US and Canada this reaction can be entirely accounted for by the impact of the oil shocks on cash flows. The results for Japan and the UK were inconclusive. Using an unrestricted vector autoregressive (VAR) model, Huang *et al.* (1996) show a significant link between the stock returns of certain American oil companies and oil price changes. There is however no evidence of a relationship between oil prices and market indices

such as the S&P 500. In contrast, Sadorsky (1999) applies an unrestricted VAR with GARCH effects to American monthly data and shows a significant relationship between oil price changes and aggregate stock returns in the US. In particular, he proved that the effects of oil price shocks are asymmetric in the sense that positive oil shocks have a greater impact on stock returns and economic activity than do negative oil price shocks. Relying on nonlinear causality tests, Ciner (2001) provides empirical evidence that oil shocks significantly affect stock index returns in the US in a non linear manner, and that the returns also have impacts on crude oil futures.

Some papers have recently turned their attention to major European, Asian, and Latin American emerging markets. Their results indicate a significant short-run linkage between oil price changes and emerging stock markets. For instance, using a VAR model, Papapetrou (2001) finds a significant relationship in Greece while Basher and Sadorsky (2006) reach the same conclusion for the other emerging stock markets using an international multifactor model. We observe however that less attention has been given to smaller emerging markets, especially those of the GCC countries where share dealing is a recent phenomena. Significant contributions include the works of Hammoudeh and Aleisa (2004), Bashar (2006), and Hammoudeh and Choi (2006). More concretely, Hammoudeh and Aleisa (2004), using VAR models and cointegration tests, find evidence of a bidirectional relationship between Saudi stock returns and oil prices changes. Their findings also suggest that the other GCC markets are not directly linked to oil prices and are less dependent on oil exports, but are more sensitive to domestic factors. Bashar (2006) employs a VAR analysis to study the effect of oil price changes on GCC stock markets, and concludes that only the Saudi and Oman markets reflect the increase in oil prices. By looking at long-term relationships among the GCC stock markets in the light of the US oil market, the S&P 500 index, and the US Treasury bill rate, Hammoudeh and Choi (2006) demonstrate that the Treasury bill rate exerts direct impacts on these markets while oil and the S&P 500 have indirect effects.

Overall, results from the available studies on the GCC countries are very heterogeneous. This is puzzling because the GCC countries are important oil exporters and are very similar in their economic structures. Moreover, the GCC national economies are oil-dependent and thus are sensitive to oil price changes. In our opinion, the divergence of the conclusions reported by previous work could be due to the fact that the tests they rely on may not be powerful enough to detect possible non-linear linkages. Thus the asymmetries in causal relationships between oil prices and stock markets might be overlooked. Accordingly, this article will extend the understanding of the relationship between oil prices and stock markets in the GCC countries by testing for asymmetries in long-term linkages, in addition to linear linkages.

The remainder of the paper is organized as follows. Section II provides a brief review of the GCC markets and the role of oil. The methodology is introduced in Section III. Section IV describes the data used and discusses the empirical results. Summary conclusions and policy implications are presented in Section V.

II. GCC STOCK MARKETS AND OIL

The Gulf Corporation Council was established in 1981; it includes six countries: Barain, Oman, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates (UAE). The GCC countries display several common patterns. Taken together, they produce about 20% of

all world oil, control 36% of world oil exports, and possess 47% of proven world oil reserves. Oil exports are the primary determinants of earnings, government budget revenues, expenditures, and aggregate demand. Table 1 presents some key financial indicators for stock markets in GCC countries. The contributions of oil to GDP range from 22% in Bahrain to 44% in Saudi Arabia. Moreover, we observe that for the three largest economies in the GCC countries, Saudi Arabia, the UAE, and Kuwait, the stock market's size indicator (market capitalization/GDP) is positively correlated with the importance of oil in their economies.

Table 1
Stock markets in GCC countries in 2007

Market	Number of listed companies*	Market capitalization ($ billions)	Market capitalization (% GDP)*	Oil (% GDP)
Bahrain	50	21.22	158	22
Kuwait	175	193.50	190	35
Oman	119	22.70	40	41
Qatar	40	95.50	222	42
UAE	99	240.80	177	32
Saudi Arabia	81	522.70	202	44

Notes: All figures were obtained from the Arab Monetary Fund and Emerging Markets Database. * indicates numbers in 2006.

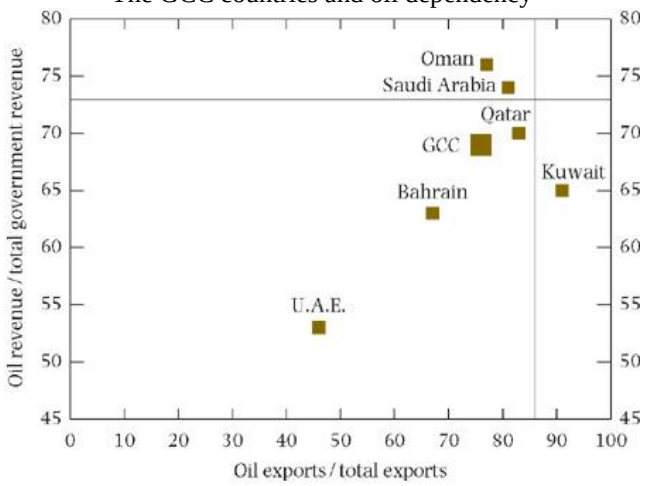
It should be noted, however, that the GCC countries are importers of manufactured products from developed and emerging countries. Oil price fluctuations can therefore indirectly impact the GCC markets through their influence on the prices of imported products. A rise in oil prices is often indicative of inflationary pressure in the GCC economies, which in turn could lead to important changes in interest rates and investment of all types. As a result, corporate output and earnings as well as domestic price levels and stock market share prices in the GCC countries are affected by oil price movements. But unlike countries that are net importers of oil, where the expected link between oil prices and stock markets is negative, the mechanisms for transmitting oil price shocks to stock market returns in the GCC countries are ambiguous, and the total impact of oil price shocks on stock returns depends on which of the positive and negative effects outweighs the other.

Another interesting fact is that Saudi Arabia leads the region in terms of market capitalization. Qatar is the leader according to aggregate market capitalization as a share of GDP. Stock market capitalization exceeds GDP for all the countries except Oman. In terms of the number of listed companies, Kuwait is the leading market followed by Oman. Overall, GCC stock markets are limited by several structural and regulatory weaknesses such as relatively small numbers of listed firms, large institutional holdings, low sectoral diversification, and other continuing deficiencies in their financial and banking systems. In recent years, a broad range of legal, regulatory, and supervisory changes has been made to increase market transparency. More importantly, the

GCC markets have begun to improve their liquidity and are opening their operations to foreign investors. For example, in March 2006 the Saudi authorities removed the restriction that limited foreign residents to trading only in mutual investment funds, and the other markets have progressively followed suit[1].

Finally, although the GCC countries have several economic and political characteristics in common, they differ in their levels of dependency on oil and in their efforts to diversify and liberalize their economies. For example, the UAE and Bahrain are less oil-dependent than Saudi Arabia and Qatar, as indicated by Figure 1. Comparative studies among the GCC stock markets thus constitute an intriguing subject.

Figure 1
The GCC countries and oil dependency



Source: International Monetary Fund, 2004.

III. DATA AND STOCHASTIC PROPERTIES

Our objective is to examine the short and long-term relationships between oil prices and stock markets in the GCC countries. Unlike previous studies that used low-frequency data (yearly, quarterly, or monthly), we use weekly data, which can more adequately capture the interactions between oil and stock prices in the region. We do not use daily data, in order to avoid time-difference problems with international markets. Equity markets are generally closed on Thursdays and Fridays in GCC countries, while the developed and international oil markets close for trading on Saturdays and Sundays. Notice also that, on the common open days, the GCC markets close just before the US stock and commodity markets open. Accordingly, we opt to use weekly data and choose Tuesday as the weekday for all variables because it falls in the middle of the three common trading days for all markets.

The data used in almost all other analyses predate the end of 2005, and as a result they missed the spectacular variations that have occurred in the GCC and oil markets over the last three years. Our sample period therefore extends from June 2005 to October 2008 for the six GCC members and the world stock market as measured by the

MSCI world market index. Stock market indices are obtained from the MSCI (Morgan Stanley Capital International) database. For oil, we use the weekly Brent spot price obtained from the Energy Information Administration (EIA). Brent oil prices are often used as reference prices for crude oil, including oil produced by the GCC countries. All prices are denominated in US dollars.

Figure 2 depicts the historical time-paths of the log prices of crude oil and stocks in the GCC countries. Their evolutions are broadly indicative of the long-term dependencies that may exist between them. Accordingly, standard unit root tests such as the Augmented Dickey-Fuller (ADF), Phillips-Perron (PP), and Kwaitowski-Phillips-Schmidt-Shin (KPSS) tests are useful for examining the stationary properties of the above-mentioned series. Recall that the ADF and PP tests are based on the null hypothesis of a unit root, while the KPSS test considers the null of no unit root. The results obtained are reported in Table 2. All the series appear to be integrated of order one, which is a standard result in the literature for such series.

Figure 2
Oil prices and stock market indices (in logarithms)

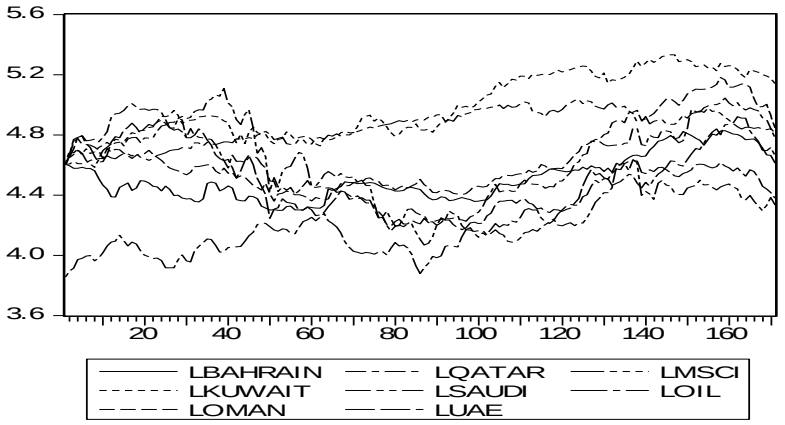


Table 2
Unit root tests

	Levels			First difference		
	ADF	PP	KPSS	ADF	PP	KPSS
LOil	0.73[a]	0.52[a]	1.24[*b]	-8.32[*a]	-8.35[*a]	0.16[b]
LStock Bahrain	-0.33[a]	-0.42[a]	0.94[*b]	-10.77[*a]	-10.81[*a]	0.18[b]
LStock Kuwait	1.06[a]	-1.93[b]	1.39[*b]	-14.04[*a]	-14.01[*a]	0.30[b]
LStock Oman	-0.55[a]	-0.04[a]	0.84[*b]	-2.72[**a]	-10.80[*a]	0.20[b]
LStock Qatar	-0.23[a]	-0.14[a]	0.38[***b]	-11.74[*a]	-11.89[*a]	0.15[b]
LStock Saudi	-0.72[a]	-0.72[a]	0.90[*b]	-11.73[*a]	-11.72[*a]	0.12[b]
LStock UAE	-1.04[a]	-0.90[a]	0.53[**b]	-10.95[*a]	-10.95[*a]	0.18[b]
LStock MSCI	-0.23[a]	0.23[a]		-13.31[*c]	-13.33[*c]	

Notes: All variables are in natural logs. ([a]): model with neither constant nor deterministic trend; ([b]): model with constant but without deterministic trend; ([c]): model with constant and deterministic trend. [*], [**] and [***] denote rejection of the null hypothesis at the 1%, 5%, and 10% levels respectively.

Table 3
Descriptive statistics of return series

Panel A: Basic statistics

	Bahrain	Kuwait	Oman	Qatar	Saudi A.	UAE	MSCI	Oil
Mean	0.0004	0.0032	0.0014	0.0012	-0.0015	-0.0013	0.0010	0.0047
Std. Dev.	0.0246	0.0268	0.0274	0.0362	0.0492	0.0350	0.0185	0.0311
Skewness	0.7884	-0.0934	-0.1347	0.1911	-1.3440	-0.3865	-0.6323	-0.2571
Kurtosis	6.6975	3.2524	4.3106	4.4806	7.8225	5.0094	3.7703	2.6373
JB	114.27*	0.69	12.68*	16.56*	215.92*	32.84*	15.53*	2.80

Panel B: Unconditional correlations

	Bahrain	Kuwait	Oman	Qatar	Saudi A.	UAE	MSCI	Oil
Oil	-0.017	-0.072	0.126	0.300	0.110	0.147	0.058	----
MSCI	-0.005	-0.073	0.079	-0.085	0.032	-0.005	----	0.058

Notes: The test for the kurtosis coefficient has been normalized to zero. JB is the Jarque-Bera test for normality based on excess skewness and kurtosis. *, ** and *** indicate the significance of coefficients at the 1%, 5% and 10% levels respectively.

The results displayed in Table 2 lead us to use series in levels when examining the long-term dependencies between variables, and series in first difference (or return series) when studying the short-term linkages. Further statistical properties for return series are summarized in Table 3.

Compared to the World market, the GCC stock markets have higher volatility, but not necessarily high returns. Kuwait has the highest weekly returns followed by Oman and Qatar. Saudi Arabia experiences the highest risk level followed by Qatar and the UAE. On average, oil price changes are more volatile than all GCC stock market returns over our sample period. Skewness is negative in most cases and the Jarque-Bera test statistic (JB) strongly rejects the hypothesis of normality, except for Kuwait.

Panel B reports the unconditional correlations between the GCC markets, MSCI index, and oil returns. As we can see, cross-market correlations of GCC stock and oil returns are not high, but they are higher than correlations between oil price changes and MSCI. Bahrain and Kuwait are two countries exhibiting a negative correlation with oil price changes. Correlations between the GCC markets and the world market are in general low and negative, except for Oman and Saudi Arabia. This is indicative of the fact that the GCC stock markets are generally disconnected from world market trends, and that global investors can still get substantial benefits by adding financial assets from the Gulf region to their internationally diversified portfolios.

IV. SHORT-TERM ANALYSIS BASED ON RETURN SERIES

This section examines the short-term linkages between oil price changes and stock market returns using the first logarithmic differences. We begin our analysis with an international asset pricing model to investigate the sensitivities of the GCC stock market returns to oil price and world market changes, and then perform a Granger causality test to examine their causal linkages; finally we study their cyclical comovements.

A. Returns in the GCC stock markets, oil price changes, and world market sensitivities

The international multifactor model we employ to examine whether the GCC stock markets are sensitive to oil price and world market changes takes the following form:

$$r_{it} = a + b \times roil_t + c \times rmsci_{it} + \varepsilon_{it} \quad (1)$$
$$\varepsilon_{it} \to N(0, h_{it}), \; h_{it}^2 = \alpha + \beta \times \varepsilon_{i,t-1}^2 + \gamma \times h_{i,t-1}^2$$

where r_{it} is the weekly stock return in country i, $roil_{it}$ the weekly Brent oil price change, and $rmsci_{it}$ the weekly return on the world stock market. The return innovations are assumed to be normally distributed with a zero mean and a conditional variance governed by a standard GARCH (1,1) process. The model is estimated using the quasi-maximum likelihood (QML) method and the results are presented in Table 4.

The coefficients relating the return series to the world returns are insignificant except for Saudi Arabia. This indicates that the GCC stock markets are segmented from world market, which is consistent with our unconditional analysis based on correlations. More interestingly, the coefficients relating the return series to the oil price changes are positive and statistically significant for Qatar, Saudi Arabia, and the UAE. This means that stock markets in these countries move together with oil price shocks. There is however no short-term relationship between oil price changes and stock returns in Bahrain, Kuwait, and Oman.

The proposed model seems to fit the data satisfactorily since the ARCH and GARCH coefficients are significant in most cases. We further observe that the conditional volatility does not change very sharply, since the ARCH coefficients are relatively small in size. By contrast, it tends to fluctuate gradually over time because of the large GARCH coefficients. Note finally that the estimated coefficients γ and β satisfy the stationary conditions.

Table 4
Estimated results of the international multifactor model

	Bahrain	Kuwait	Oman	Qatar	Saudi A.	UAE
a	-0.001	0.004**	0.001	-0.001	-0.001	-0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.003)	(0.002)
b	0.005	-0.051	0.060	0.354*	0.228*	0.149**
	(0.055)	(0.054)	(0.056)	(0.085)	(0.086)	(0.068)
c	-0.008	-0.075	0.050	-0.140	0.172***	-0.008
	(0.095)	(0.096)	(0.109)	(0.161)	(0.106)	(0.121)
α	0.001*	0.001***	0.002**	0.001**	0.001**	0.001***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.001)
β	0.006	0.268***	0.105***	0.226**	0.298**	0.223**
	(0.033)	(0.158)	(0.063)	(0.116)	(0.126)	(0.112)
γ	0.754***	0.286	0.740*	0.316	0.661*	0.653*
	(0.454)	(0.318)	(0.134)	(0.267)	(0.116)	(0.169)
$\overline{R^2}$	-0.029	-0.023	-0.009	0.103	0.016	0.015
Log Likelihood	395.046	387.131	385.371	340.563	296.633	345.743
AIC	-4.497	-4.406	-4.385	-3.867	-3.359	-3.927

Notes: *, ** and *** indicate the significance of the coefficients at the 1%, 5%, and 10% levels respectively. Robust standard errors are in parentheses.

Table 5
Results of the Granger causality tests

Lags	1	2	3	4	6	8	10	12
Bahrain								
S→O	0.525	0.238	0.240	0.187	0.217	0.158	0.127	0.147
O→S	0.145	0.317	0.092	0.151	0.255	0.352	0.186	0.184
Kuwait								
S→O	0.100	0.103	0.121	0.172	0.138	0.132	0.136	0.174
O→S	0.542	0.462	0.265	0.291	0.223	0.263	0.468	0.186
Oman								
S→O	0.328	0.344	0.593	0.841	0.791	0.427	0.176	0.170
O→S	0.243	0.568	0.162	0.239	0.445	0.162	0.264	0.245
Qatar								
S→O	0.215	0.334	0.472	0.503	0.339	0.377	0.569	0.693
O→S	0.005	0.014	0.014	0.036	0.045	0.023	0.045	0.030
Saudi A.								
S→O	0.537	0.373	0.627	0.731	0.924	0.876	0.482	0.593
O→S	0.045	0.133	0.250	0.386	0.658	0.470	0.808	0.916
UAE								
S→O	0.470	0.693	0.878	0.897	0.973	0.938	0.894	0.971
O→S	0.030	0.000	0.000	0.000	0.001	0.001	0.001	0.001
MSCI								
S→O	0.114	0.040	0.082	0.128	0.365	0.529	0.599	0.674
O→S	0.753	0.930	0.432	0.562	0.195	0.357	0.478	0.665

Notes: This table provides the P-values of rejection of the null hypothesis considered. S→O is the null hypothesis of no causality from stock market returns to oil price changes. O→S is the null hypothesis of no causality from oil price changes to stock market returns.

B. Causality tests

The dynamics of short-term relationships between oil price changes and stock returns in the GCC countries can be further explored using the Granger causality test. Since some variables as well as their bilateral effects are very sensitive to the selected number of lags in the analysis, we decided to implement this test for various lags. Table 5 reports the results obtained.

The results show that, in the short-run oil price shocks Granger-cause changes in stock market returns in Qatar, the UAE, and to some extent in Saudi Arabia (5%) and Bahrain (10%). They corroborate those of the previous table in that the GCC stock markets are largely influenced by price movements in the world oil market. There is also evidence of causality from the world stock market to oil prices.

C. Cyclical correlations between oil prices and stock markets

We now shift our attention to cyclical correlations as a measure of short-term linkages between oil price changes and stock returns in GCC countries. To this end, we follow the methodology introduced by Serletis and Shahmoradi (2005) and applied in several papers to study the links between energy prices and economic activity[2]. First, the Hodrick-Prescott (HP) filter is employed to decompose each time-series variable in our study into long-term and business-cycle components. Next, we compute the cross-correlations between the cyclical component of oil price changes ($coil_t$) and that of

stock market indices ($cstock_t$). We denote these correlations by $\rho(j)$ and they are computed for $j = 0, \pm1, \pm2, \pm3, \pm4, \pm5$, and ±6. The cyclical correlations then provide an assessment of the linkages that may exist between oil price and stock markets over the business cycle. They enable investigation of the dynamics of the short-term component comovements by providing information on both their strength and their synchronization. Following Serletis and Shahmoradi (2005), and Ewing and Thompson (2007), we consider that the two cyclical components are strongly correlated, weakly correlated, or uncorrelated for a shift j based on $0.23 \leq |\rho(j)| < 1$, $0.10 \leq |\rho(j)| < 0.23$, $0 \leq |\rho(j)| < 0.10$, respectively. If $|\rho(j)|$ is high for a positive, zero, or negative value of j, then the cycle of oil prices is leading the cycle of stock markets by j periods, is synchronous, or is lagging the cycle of stock markets by j periods, respectively.

Table 6
Cyclical correlations of oil prices with stock market indices

j	-6	-5	-4	-3	-2	-1	0	1	2	3	4	5	6
Bahrain	-0.10	-0.13	-0.12	-0.11	-0.08	-0.02	0.07	0.14	0.15	0.18	0.18	0.19	0.14
Kuwait	-0.07	-0.09	-0.11	-0.13	-0.10	-0.09	-0.06	-0.05	-0.06	-0.03	-0.01	-0.00	0.01
Oman	0.02	0.07	0.11	0.14	0.20	0.26	0.33	0.34	0.27	0.26	0.25	0.17	0.10
Qatar	-0.09	-0.00	0.08	0.17	0.28	0.38	0.51	0.55	0.46	0.43	0.41	0.36	0.30
Saudi A.	-0.10	-0.11	-0.10	-0.07	-0.02	0.01	0.05	0.03	-0.01	-0.01	-0.01	-0.01	0.01
UAE	-0.03	-0.03	-0.20	-0.10	-0.02	0.05	0.28	0.29	0.13	0.15	0.20	0.20	0.20
MSCI	0.16	0.22	0.25	0.26	0.29	0.31	0.35	0.32	0.22	0.23	0.19	0.07	-0.00

Note: This table shows the cyclical correlations between oil price changes and stock market returns measured by $\rho(j) = \rho(coil_t, cstock_{t+j})$. *Bold type indicates high absolute value correlations*

The results for leads and lags from 1 to 6 are shown in Table 8. They generally confirm previous results on the short-term linkages between oil prices and stock markets in the GCC countries. Oil prices and stock markets are strongly and contemporaneously correlated for Oman, Qatar, the UAE, and the world stock market. Furthermore, positive high-cyclical correlations are also observed in these countries for positive values of j, indicating that oil prices are pro-cyclical and lead the stock markets in these countries, generally by a few weeks. Surprisingly, cyclical correlations are negative and weak in the case of Saudi Arabia, suggesting that oil prices are countercyclical and lag the Saudi stock market. Weak negative as well as positive cyclical correlations are observed for the Bahrain stock market. However, we find no significant cyclical correlations between oil prices and the Kuwaiti stock market.

In sum, our analysis shows strong positive short-term linkages between oil price changes and stock markets in Qatar, the UAE, and to some extent Saudi Arabia. Weak linkages have been found for Bahrain and Oman, but no short-term relationships between oil prices and the Kuwaiti stock market. More interestingly, the direction of short-term causality runs from oil to stocks in most GCC markets.

V. LONG-TERM ANALYSIS BASED ON PRICE LEVEL SERIES

This section examines the long-term linkages between oil prices and stock markets in the GCC countries. Our empirical procedure is as follows. In the first step we use cointegration methodology to test whether the time-series considered are related to each

other on a long-term basis. If the hypothesis of cointegration cannot be rejected, in the second step we implement the Granger causality test to explore the dynamics of the long-term relationships between series in levels, and investigate their convergence towards the long-term equilibrium.

A. Cointegration tests

Cointegration of unit root variables implies that a linear combination of them yields a stationary variable and that some long-term equilibrium relation ties the individual variables together. To test for cointegration, for each country in the sample data we regress the stock market price index (in logarithms) on the oil price (in logarithms) and an intercept. We then apply three tests named respectively ADF, PP, and Johansen to the residual series of said regression analysis. Note that these statistical tests are based on the null hypothesis of no cointegration. The results are summarized in Table 7.

It is observed that all the residual series are non-stationary, except for Bahrain. Therefore, only the Bahraini stock market appears to be cointegrated with oil prices. Estimation of the long-term relationship between Brent oil prices and stock market prices in Bahrain generates the following cointegrating equation according to which an increase in oil prices of 10% leads to an uptick in the Bahraini stock market of 4.19%.

$$\begin{matrix} LBahrain_t = 2.728 + 0.419 * LOIL_t \\ (0.108) \quad (0.025) \end{matrix} \tag{2}$$

B. Long-term causality test

It is commonly accepted that, in the presence of a cointegrating relationship between two variables, at least one of the two variables Granger-causes the other. For the case of Bahrain, we can perform an in-depth analysis of the long-term linkages between Brent oil prices and equity markets by constructing a vector autoregressive (VAR) model in price levels and testing the causality effects. The results presented in Table 8 clearly indicate a long-term unidirectional causality from oil to stock market in Bahrain.

Table 7
Unit root tests on residual series

	ADF	PP	Johansen
Bahrain	-3.27*** (1)	-3.06***	15.43**
Kuwait	-1.96(0)	-2.14	14.12
Oman	-2.53(2)	-2.02	10.31
Qatar	-1.10(0)	-1.22	6.03
Saudi A.	-1.14(1)	-1.15	4.56
UAE	-0.68(2)	-0.74	5.21
MSCI	0.22(1)	0.09	13.00

Notes: The number of lags used is in parentheses. *, ** and *** indicate rejection of the null hypothesis of no cointegration at the 1%, 5%, and 10% confidence levels.

Table 8
Long term causality test

Lags	1	2	3	4	6	8	10	12
Bahrain								
S→O	0.313	0.195	0.128	0.198	0.181	0.102	0.104	0.245
O→S	0.004	0.024	0.058	0.047	0.045	0.066	0.096	0.036

Notes: This table provides the P-values of rejection of the null hypothesis. S→O is the null hypothesis of no causality from stock market returns to oil price changes. O→S is the null hypothesis of no causality from oil price changes to stock market returns.

C. VECM and convergence to the long-term equilibrium

A vector error correction model (VECM) is a restricted VAR designed for use with non-stationary variables that are known to be cointegrated. This is the case for oil prices and the stock market price index in Bahrain. From a technical point of view, by introducing their cointegration relationship (*cf.* equation 2) into the VAR specification, we can force the long-term behavior of these price variables to converge onto their cointegration relationship while allowing for short-term adjustment dynamics. The estimated results of the VECM are shown in Table 9. Here the short-term adjustment parameter (z_{t-1}) is negative and significant for the stock market price equation (DLBAHRAIN), indicating a mean-reversion process of the Bahraini stock market to its long-term equilibrium. However, it is not significant for the oil price equation (DLOIL). Oil price fluctuations do not converge towards the long-term equilibrium defined by the Bahraini stock market. The findings are consistent with our causality tests.

In summary, our analysis based on price levels suggests that, except for Bahrain, there is no long-term relationship between oil prices and stock markets in the GCC countries. A positive link typically exists between the oil price and the Bahraini stock market and the direction of long-term causal effects runs from oil price to stock market.

Table 9
Convergence to the long-term equilibrium

	DLBAHRAIN	DLOIL
z_{t-1}	-0.061*	0.037
	(0.020)	(0.025)
$DLBahrain_{t-1}$	0.210*	-0.070
	(0.074)	(0.093)
$DLoil_{t-1}$	0.056	0.328*
	(0.059)	(0.074)
Constant	-0.001	0.003
	(0.001)	(0.002)
$\overline{R^2}$	0.083	0.098
Log likelihood	395.229	357.116
AIC	-4.629	-4.178

Notes: *, ** and *** indicate the significance of the coefficients at the 1%, 5%, and 10% levels respectively. Robust standard errors are in parentheses.

VI. CONCLUSION AND POLICY IMPLICATIONS

This paper extends our understanding of the linkages between oil prices and stock markets in the GCC countries. Since these countries are major world energy players, their stock markets are likely to be susceptible to influence from oil price shocks. We test for both short- and long-term dependencies. Concerning the short-term analysis, strong positive linkages between oil price changes and the stock markets have been found in Qatar, the UAE, and to some extent Saudi Arabia. Weak linkages have been found for Bahrain and Oman, but no short-term relationships between oil prices and the Kuwaiti stock market. More interestingly, our results indicate that when causality exists, it generally runs from oil prices to stock markets. Our long-term analysis shows that except for Bahrain, there is no evidence of a long-term link between Brent oil prices and stock markets in the GCC countries. In the Bahraini case, the relationship between oil price and stock market is positive and the direction of long-term causality runs from oil price to stock market.

Our findings should be of great interest to researchers, regulators, and market participants. In particular, the GCC countries as policymakers in OPEC should keep an eye on the effects of oil price fluctuations on their own economies and stock markets. For investors, the significant relationships between oil prices and stock markets imply some degree of predictability in the GCC stock markets.

The study's findings offer several avenues for future research. First, the link between oil and stock markets in the GCC countries can be expected to vary across different economic sectors. A sectoral analysis of this link would be informative. Second, evidence from international equity markets should be obtained to examine the robustness of the findings. Third, the methodology applied in this article could be used to examine the effects of other energy products such as gas and other petroleum-related products. Finally, further research could compare causality between oil and stock markets in the GCC countries and in other oil-exporting countries.

ENDNOTES

1. Further information and discussions concerning market characteristics and financial sector developments in the GCC countries can be found in Creane *et al.* (2004), Neaime (2005), and Naceur and Ghazouani (2007).
2. See, for example, Ewing and Thompson (2007), and Lescaroux and Mignon (2008).

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