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OIL PRICES AND STOCK MARKETS: WHAT DRIVES WHAT IN THE GULF CORPORATION COUNCIL COUNTRIES?

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Abstract

In the empirical literature, only a few studies have focused on the relationship between oil prices and stock markets in net oil-importing countries. In net oil-exporting countries this relationship has not been widely researched. This paper implements the panel-data approach of Kónya (2006), which is based on SUR systems and Wald tests with country-specific bootstrap critical values to study the sensitivity of stock markets to oil prices in GCC (Gulf Corporation Council) countries. Using a weekly dataset covering the period from June 7 2005 to May 25 2010, we show strong statistical evidence that the causal relationship is consistently bi-directional for Saudi Arabia. Stock market price changes in the other GCC member countries do not Granger cause oil price changes, whereas oil price shocks Granger cause stock price changes. Therefore, investors in GCC stock markets should look at the changes in oil prices, whereas investors in oil markets should look at changes in the Saudi stock market.

ملخص

ركز عدد قليل من الكتابات التجريبية على العلاقة بين أسعار النفط وأسواق الأسهم في البلدان المستوردة الصافية للنفط .في البلدان المصدرة للنفط الصافي لم يتم بحث هذه العلاقة على نطاق واسع .هذه الورقة تطبق منهج البيانات التتبعية من قونية (2006)، الذي يقوم على أساس نظم SUR واختبارات Wald التمهيد مع القيم الخاصة بكل بلد لدراسة حساسية أسواق الأسهم إلى أسعار النفط في مجلس التعاون الخليجي باستخدام مجموعة البيانات الاسبوعية التي تغطي الفترة من 7يونيو 2005 إلى 25مايو 2010، وتبين لنا دليلا إحصائيا قويا على أن العلاقة السببية هى دائما ثنائية الاتجاه للمملكة العربية السعودية .تغيرات سعر السهم في السوق في دول مجلس التعاون الخليجي الأخرى الأعضاء لا يسبب تغيرات سعر النفط (جرانجر)، في حين أن أسعار النفط تسبب في تغيرات (جرانجر) وصدمات أسعار الأسهم .لذا، ينبغي على المستثمرين في أسواق الأسهم الخليجية القاء نظرة على التغيرات في أسعار النفط، في حين أن المستثمرين في أسواق النفط يجب أن ينتبهوا إلى التغيرات في سوق الأسهم السعودية.

1. Introduction

In theory, the value of stock is equal to the discounted sum of expected future cash-flows. Identifying the factors that affect these cash-flows is of utmost relevance and importance to investors and policy makers. As oil price has changed with sequences of very large increases and decreases over recent years, it is now interesting to augment the existing research on its impacts on stock prices. Indeed, corporate cash-flows are affected by macroeconomic events that can be influenced by oil price variations. The present article aims to contribute to the debate about the effects of oil price on economic activity by focusing attention on the causal links between stock market returns and oil price fluctuations.

Unlike most previous papers, which focus on the US, European and major Asian stock markets, our paper analyses the impact of oil price fluctuations on Gulf Corporation Council (GCC) markets. These markets are interesting for several reasons. First, GCC markets have attracted increasing attention in the last decade. In the wake of high oil prices since 2003, they have known high economic growth rates. They have also become important international investors and trade partners, and play a crucial role in world energy markets. Indeed, most GCC countries are major exporters of oil in global energy markets, so their stock markets may interact with changes in oil prices. However, the transmission mechanisms between oil price shocks and stock returns in GCC markets should be different from those in net oil-importing countries. Indeed, oil price increases positively affect earnings, government budget revenues and expenditures and aggregate demand, and thus may positively affect corporate income and stock prices. Nevertheless, oil price increases are also synonyms of high expected inflation pressure and money supply, which in turn affect the discount rate and therefore may negatively affect stock prices in GCC countries. Second, the GCC markets differ from those of developed and from those of major emerging countries in that they are largely segmented from the international markets and are overly sensitive to regional political events. Finally, GCC markets are very promising areas for international portfolio diversification. Studying the influence of oil price shocks on GCC stock market returns can help investors make necessary investment decisions.

A large body of recent work examines the links between oil prices and macroeconomic variables. This work has underscored the significant effects of oil price fluctuations on economic activity in mature and in emerging markets (Brown and Yücel 2002; Cunado and Perez de Garcia 2005; Balaz and Londarev 2006; Gronwald 2008; Cologni and Manera 2008; Kilian 2008; Lardic and Mignon 2006, 2008; and Lescaroux and Mignon 2008). Despite studies showing that oil price shocks have significant effects on the economy, relatively fewer works have looked into the relationship between oil prices and stock markets. Furthermore, most of this research has focused on developed oil importers; very little has looked at emerging markets or exporters. The pioneering paper by Jones and Kaul (1996) examines the reaction of four well-established stock markets to oil shocks based on a standard present value model and find that the latter can be partially accounted for by the negative effect of oil price changes on the current and future cash-flows. Using an unrestricted vector autoregressive (VAR) model, Huang et al. (1996) show a positive significant link between some US oil company stock returns and oil price changes. However, they find no evidence of a relationship between oil prices and market indices such as the S&P500. In contrast, Sadorsky (1999) applies an unrestricted VAR model with GARCH effects to US monthly data and shows a negative significant relationship between oil price changes and aggregate stock returns. More recently, El-Sharif et al. (2005) examine the links between oil price changes and stock returns in the UK oil and gas sector. They establish that the relationship between the two variables is significantly positive.

Some works have more recently focused on major European, Asian and Latin American emerging markets. In general, these studies show significant short- and long-term relationships between oil price changes and emerging stock market returns. Using a VAR model, Papapetrou (2001) shows a significant negative relationship between oil price changes and stock markets in Greece. Basher and Sadorsky (2006) use an international multifactor model and reach the same conclusion for other emerging stock markets. However, less attention has been paid to smaller emerging markets, especially in the GCC countries where share dealing is a relatively recent phenomenon. Using VAR models and cointegration tests, Hammoudeh and Eleisa (2004) show that there is a bidirectional negative relationship between Saudi stock returns and oil price changes. The findings also suggest that the other GCC stock markets are less affected by oil price fluctuations. Bashar (2006) uses VAR analysis to study the effect of oil price changes on GCC stock markets and shows significant links only for the Saudi and Omani markets. More recently, Hammoudeh and Choi (2006) have examined the short- and the long-run relationship among the GCC stock markets by taking in account the effects of three global factors: the oil price, the S&P500 index and the US Treasury bill rate. They find that the T-bill rate has a direct impact on GCC stock markets, while oil price and the S&P500 have indirect positive effects. Finally, Lescaroux and Mignon (2008) have studied the relationships between oil and stock prices for a large panel of developed and emerging countries. They find some evidence of positive causality from oil prices to stock prices in some GCC countries. Their results suggest also stock markets may significantly affect oil prices in some countries.

As we can see, the findings of the little available work on GCC countries are heterogeneous. These findings are puzzling because most GCC countries are heavy oil exporters. Furthermore, the GCC economies are oil dependent and are thus sensitive to oil price changes. But previous results are based on country analysis and use time series data from relatively short periods. Using a weekly dataset covering the period from June 7 2005 to May 25 2010, our paper differs from previous studies by applying a recent panel causality test to examine the relationship between oil and stock markets in GCC countries. The advantages of panel-data methods in the macro-panel setting include the use of data for which the spans of individual time series data are insufficient for the study of many hypotheses.

In addition, in the specific approach we use in this paper that requires no pre-testing for unit roots and cointegration (as in Phillips 1995), we allow for cross-country correlation. This question is crucial and responds to the complex nature of the interactions and dependencies that generally exist over time and across the individual units in the panel. For instance, observations of firms, industries, regions and countries tend to be cross-correlated as well as serially dependent. As pointed out by Breitung and Pesaran (2005), the cross-section dependence can arise for a variety of reasons, including spatial spill-over effects, common unobserved shocks, social interactions, or a combination of these factors. For our paper, cross-dependence can mirror cultural similarities, common financial, economic and social policies in GCC countries, high dependency on the revenues generated from oil exports, herding, contagion, and volatility transmission.

The rest of the paper is organized as follows. Section 2 briefly presents the GCC markets and discusses the role of oil. Section 3 presents the data and discusses the results of the empirical analysis, while Section 4 provides summary conclusions and policy implications.

2. GCC economies, stock markets and the role of oil

The GCC was established in 1981 and it includes six countries: Bahrain, Oman, Kuwait, Qatar, Saudi Arabia and the United Arab Emirates (UAE). GCC countries share several common patterns. In 2007, they produce together about 20% of all world oil, control 36% of world oil exports and possess 47% of proven reserves. Oil exports largely determine earnings, government budget revenues and expenditures and aggregate demand. Table 1 shows some key financial indicators for the GCC economies. The contributions of oil to GDP range from 22% in Bahrain to 44% in Saudi Arabia. Moreover, Table 1 indicates that the ratio market capitalization to GDP is high for all GCC countries, except Oman.

The rationale for using oil price movements as a factor affecting stock valuations is that, in theory, the value of stock equals the discounted sum of expected future cash flows. These cash flows are affected by macroeconomic events that can be influenced by oil shocks. Indeed, oil price affects the main economic variables in GCC countries: earnings, government budget revenues and expenditures and aggregate demand. Thus, oil price changes should directly affect positively corporate output and earnings, and then stock returns in these countries. Moreover, oil prices may have indirect effect on stock prices. In fact, the effect of oil prices on the aggregate demand influences the expected inflation and money supply, which in turn affect the discount rate and therefore may negatively affect stock prices in GGC countries. Furthermore, GCC countries are importers of manufactured goods from developed and emerging countries. So, oil price fluctuations can indirectly impact GCC markets through their influence on the prices of imports, and increases in oil prices are often indicative of inflationary pressure in GCC economies; inflationary pressures, in turn, could dictate the future of interest rates and of investment in securities. Such strong effects of oil prices on GCC economies make these countries primary targets for investigating the relationships between oil price changes and stock market returns. Notice equally that given the active role played by GCC countries and in particular Saudi Arabia in energy international markets, GCC stock market changes may have affects on oil prices.

Table 1 also shows that Saudi Arabia leads the region in terms of market capitalization. The Saudi stock market represents more than 40% of all GCC markets. However, in comparison to each country’s GDP, Qatar is the leader. Stock market capitalization exceeded GDP for all countries except Oman. Kuwait, followed by Oman, has the largest number of listed companies. Overall, GCC stock markets are limited by several structural and regulatory weaknesses: relatively small numbers of listed firms, large institutional holdings, low sector diversification, and several other deficiencies. In recent years, however, legal, regulatory, and supervisory changes have increased market transparency. The liquidity of GCC markets has improved and operations were opened to foreign investors. In March 2006 Saudi authorities lifted the restriction that limited foreign residents to dealing only in mutual funds and the other markets have progressively followed suit.[1]

Finally, even if the GCC countries have several economic and political characteristics in common, they have different oil-dependence degrees and efforts to diversify and liberalize their economies. For example, Bahrain and Qatar are less oil-dependent than Saudi Arabia and Kuwait as suggested by Figure 1. Thus, comparative studies among the GCC stock markets constitute an interesting subject. The panel-data econometric tools we use in this paper take into account these different features.

3. Panel Granger causality test methodology

The panel-data approach developed by Kónya (2006) is based on the following bivariate (here an oil price, *oil*; and a stock market index, *stock*) finite-order vector autoregressive model, with the variables taken in level[2]:

[1] For interested readers, further information and discussions of the market characteristics and financial sector development of these countries can be found in Neaime (2005) and Naceur and Ghazouani (2007).

[2] Larger models including external factors such as interest rate, inflation, and economic growth have led to very similar results. The estimation results for these models are available upon request from authors.

$$\begin{cases} oil_{it} = \alpha_{1,i} + \sum_{j=1}^{p_{1i}} \beta_{1,i,j} oil_{i,t-j} + \sum_{j=1}^{p_{2i}} \gamma_{1,i,j} stock_{i,t-j} + \varepsilon_{1,i,t} \quad t = 1,...,T \quad i = 1,...,N \quad (1a) \\ stock_{it} = \alpha_{2,i} + \sum_{j=1}^{p_{1i}} \beta_{2,i,j} oil_{i,t-j} + \sum_{j=1}^{p_{2i}} \gamma_{2,i,j} stock_{i,t-j} + \varepsilon_{2,j,t} \quad t = 1,...,T \quad i = 1,...,N \quad (1b) \end{cases} \quad (1)$$

where the index i $(i = 1,...,N)$ is the country, the index t $(t = 1,...,T)$ the period, j the lag, and p_{1i}, p_{2i} the longest lags in the system. The error terms, $\varepsilon_{1,i,t}$ and $\varepsilon_{2,i,t}$, are supposed to be white-noise and may be correlated with each other for a given country.

The seemingly unrelated regressions (SUR) procedure (since possible links may exist among individual regressions via contemporaneous correlation[3] within equations (1a) and (1b) of system (1) is used to estimate system (1)). Wald tests for Granger causality are then done with country-specific bootstrap critical values generated by 5000 simulations (see appendix for further details).

With respect to system (1), for instance, in country i there is one-way Granger-causality running from stock to oil if in the first equation not all $\gamma_{1,i}$ are zero but in the second all $\beta_{2,i}$ are zero; there is one-way Granger-causality from oil to stock if in the first equation all $\gamma_{1,i}$ are zero but in the second not all $\beta_{2,i}$ are zero; there is two-way Granger-causality between from oil to stock if neither all $\beta_{2,i}$ nor all $\gamma_{1,i}$ are zero; and there is no Granger-causality between oil to stock if all $\beta_{2,i}$ and $\gamma_{1,i}$ are zero.[4]

This procedure has several advantages. Firstly, it does not assume that the panel is homogeneous, so it is possible to test for Granger-causality on each individual panel member separately. However, since contemporaneous correlation is allowed across countries, it makes it possible to exploit the extra information provided by the panel data setting[5] and therefore country-specific bootstrap critical values are generated. Secondly, this panel approach which generalizes the methodology developed by Phillips (1995)[6] that tests for non-causality in levels VARs, in a time series context, does not also require pretesting for unit roots and co-integration, though it still requires the specification of the lag structure (which is determined here using the Akaike Information Criterion (AIC) and the Schwarz Information Criterion (SIC)). This is an important feature since the unit-root and co-integration tests in general

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[3] This assumption is very likely to be relevant for many macroeconomic time series for GCC countries for which strong economic links exist.

[4] As stressed by Kónya (2006), this definition implies causality for one period ahead.

[5] This would of course not be the case for methods investigating causality using a country by country approach.

[6] As it is now well known the issue of testing for non-causality is addressed in a time series setting, in particular by Phillips (1995) in the context of a VAR in levels estimated using the fully modified (FM) estimator, and also by Toda and Yamamoto (1995) who suggest augmenting the VAR by the maximal order of integration for the process being examined. The former method provides some very interesting results as far as asymptotic inference is concerned. The most important one is that statistical inference in this framework can be conducted by means of standard asymptotics; no unit root limit theory is required. Normal and mixed normal limit theory are applied to the stationary and non-stationary components of the VAR respectively. This implies that optimal inference in levels VARs and Wald test for non-causality can be obtained without prior knowledge of the number of unit roots or the order of cointegration rank in the system, and without the use of reduced rank Johansen-type regressions (which are subject to pre-testing bias, as tests for cointegration ranks are extremely sensitive to the values of the nuisance parameters). The approach by Toda and Yamamoto (1995) also results in a standard Wald statistic for non-causality restrictions, although it does require some pre-testing for determining the lag length of the VAR.

suffer from low power, and different tests often lead to contradictory outcomes. Thirdly, this panel Granger causality approach allows the researcher to detect for how many and for which members of the panel there exists one-way Granger-causality, two-way Granger-causality or no Granger-causality.

4. Econometric investigation

First, we present the dataset we use in our empirical investigation of the link between oil prices and stock returns in GCC countries. Second, we report the results we obtain. Finally, we discuss some implications of our results for portfolio investment. More preciously, we show that a model including oil risk provides superior out-of-sample forecasting results than a model without oil risk.

4.1 Data

Our study makes use of weekly data obtained from MSCI and covered the six GCC members. We think that weekly data may more adequately capture the interaction of oil and stock prices in the region than low-frequency data. We do not use daily data in order to avoid time difference problems with international markets. In fact, the 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. Furthermore, for the common open days, the GCC markets close just before US stocks and commodity markets open. Accordingly, we opt to use weekly data and choose Tuesday as the weekday for all variables because this day lies in the middle of the three common trading days for all markets.

Moreover, the data used in all the analyses predate the end of 2005, so previous studies missed the spectacular evolutions that took place in the GCC and oil markets in the last three years. Therefore, our sample period goes from June 7, 2005 to May 25, 2010 for the six GCC members. More preciously, we make use of weekly stock market indices over the period June 7, 2005 to May 30, 2010 for the in-sample analysis, whereas weekly data running from April 6, 2010 to May 25, 2010 will be employed in our out-of-sample analysis to shed light on forecasting evaluation and some portfolio investment implications of the in-sample results.

As for oil, we use the weekly OPEC spot prices. These prices are weighted by estimated export volume and are obtained from the Energy Information Administration (EIA).7 All prices are in US dollars.

Descriptive statistics for return series are summarized in Table 2. Panel A shows that the GCC stock markets have on average negative returns over our sample period due to the 2007-2009 international financial crisis. The UAE experience highest risk level followed by Saudi Arabia and Qatar. The average OPEC oil price changes are more important than all GCC stock market returns over our sample period. Skewness is negative and the Jarque-Bera test statistic (JB) strongly rejects the hypothesis of normality for all series. There are also significant serial correlations for oil, Bahrain, and Oman.

Panel B reports the unconditional correlations among GCC stock market returns and the average OPEC oil price changes. As we can see, cross-market correlations of GCC stock returns and oil prices are not high but on average positive. Saudi Arabia has the lowest correlation (0.04) and Oman the highest one (0.10).

4.2 Empirical results

[7] Very similar results are obtained with West Texas Intermediate and Brent spot prices. Oil prices are in US dollars per barrel. Note also that GCC currencies have been officially pegged to the US dollar since 2003. However, Kuwait has recently moved back to pegging its currency to a basket currency.

Using the AIC and SIC criteria and a maximal lag parameters of 4, a VAR(1) model is found to describe adequately the dynamics of the series under consideration, the misspecification tests indicating no departure from the underlying assumptions. We then carry out the Breusch and Pagan (1980) test to investigate whether the variance-covariance matrix of the errors is diagonal, and the null hypothesis of no contemporaneous correlation within the different systems can always be rejected at the five percent significance level. This justifies the application of the SUR estimators which is here more efficient[8] than the OLS estimators in the case of the existence of contemporaneous correlation in the system[9].

We report in Tables 3 and 4 the results for the Granger causality tests, using a bivariate model, from stock markets to oil prices, and from to oil prices to stock markets for GCC countries[10].

Table 3 shows the existence of one-way direct Granger causality from the Saudi stock markets to oil prices. In fact, the null hypothesis of absence of causality is strongly rejected. Our empirical results confirm those of Hammoudeh and Aleisa (2004) and Basher (2006) and suggest that changes in the Saudi stock markets, which should reflect changes in the Saudi economy, significantly cause changes in OPEC oil prices. Indeed, Saudi Arabia plays a leading role in worldwide energy markets and estimates show that the country has about 260 billion barrels of oil reserves, some 24% of the world's proven total. Hence, Saudi Arabia is the world's largest exporter of total petroleum liquids and is currently the world's second largest crude oil producer behind Russia. The political and economic evolution in Saudi Arabia may then have implications for the stability of oil prices. For the other GCC countries, changes in national stock indices do not significantly cause changes in oil prices.

Tables 4 shows that oil price significantly affect stock prices in all GCC countries. These findings are not surprising given the role played by oil revenues in all GCC economies (cf. Figure 1). In fact, oil price increases raise national and corporate revenues; stock market prices are affected. However, according to our empirical results the links between oil price changes and stock market returns is positive for all countries, expect Saudi Arabia.

Several economic and institutional differences between the Saudi market and the other GCC markets could explain this result. In fact, the Saudi stock market is highly concentrated and largely dominated by financial industry which is highly sensitive to changes in American and European financial markets. This lack of diversification and sensitivity to western financial markets may explain the negative links between oil price and the Saudi market index.[11] Indeed, the negative effect the oil has on western financial markets is partly transferred to Saudi market. Furthermore, Saudi Arabia is the largest GCC market, but its economy is overly dependent on oil-importing countries and suffers more than other GCC countries from imported inflation and economic pressures. Moreover, the annual turnover in Saudi Arabia is low and the Saudi stock market is considered shallow when compared to other GCC markets.

[8] *i.e* its Mean Square Error (MSE) is smaller than the OLS one.

[9] Notice that we have also run a simple VAR in Panel without SUR and Bootstrap as well as a country by country approach based on the estimation of a specific VAR model for each country without SUR and Boostratp. Our results are totally different from those obtained with the panel approach of Konya (2006), which is actually not very surprising since GCC countries are, as expected, interdependent (and hence bootstrap critical values are required to take it into account). This interdependence can indeed reflect here the presence of similar regulations in various fields (such as economy, finance, trade, customs, tourism, legislation, and administration), high economic, fiscal and political corporation and increasing financial integration.

[10] Note that a sensitivity analysis reveals that the Granger causality results reported in Tables 3 and 4 are actually not very sensitive to the number on lags included in the estimated VARs. Indeed, the specifications of VARs incorporating 2 or 3 lags instead of 1, lead to the same test outcomes about non-causality.

[11] Over our sample period, the correlation between the Saudi stock market and the US market was 0.15, while the average correlation between the other GCC markets and the US market was only 0.07.

These elements are likely to undermine normal market operations such as arbitrage and speculation in Saudi Arabia.

In short, there is strong bi-directional Granger causality between oil prices and Saudi stock market prices. The Saudi market has a close link to the price of oil and can predict it. In other words, oil prices affect stock prices in Saudi Arabia and political and economic shocks that influence Saudi Arabia can have an impact on oil prices. For the other GCC countries, significant Granger causalities are obtained from oil price changes to stock market returns, results that suggest that oil price changes affect stock markets in these countries but that changes in these markets do not significantly affect oil prices. In conclusion, traders in the GCC stock markets should look at the changes in oil prices, whereas investors in oil markets should look at changes in the Saudi stock market and economy.

4.3 Out-of-sample forecasts of stock market returns

In this sub-section, we examine some of the out-of-sample implications of our results. Indeed, among the many issues involving portfolio investment and management, modelling and forecasting stock returns are one of the most intriguing topics that attract great interests from investors and researchers. Our analysis of causality shows significant interactions between oil and stock returns in GCC countries as well as some predictability in stock price dynamics based on oil price changes. Recall that the aim of forecasting evaluation is to minimize the expected loss, i.e. the difference between the predicted and actual returns. There is, up to date, a wide range of standard statistical loss functions that can be used to evaluate such a deviation in forecasting tasks. In this paper, we retain the most commonly used loss functions, namely Root Mean Squared Error (RMSE), Mean Absolute Error (MAE), and Mean of Absolute Percent Error (MAPE). They are defined as:

$$RMSE_i = \sqrt{h^{-1} \sum_{t=T+1}^{T+h} (r_{it} - \hat{r}_{it})^2}$$

$$MAE_i = h^{-1} \sum_{t=T+1}^{T+h} \left| r_{it} - \hat{r}_{it} \right|$$

$$MAPE_i = h^{-1} \sum_{t=T+1}^{T+h} \left| \frac{r_{it} - \hat{r}_{it}}{r_{it}} \right|$$

where t denotes time period of the forecast sample, t = T+1, T+2,…, T+h. r_{it} and $\hat{r}_{it}$ stand for the actual and forecasted returns respectively.

In Table 5, we provide out-of-sample forecast results for two competitive models: a model where returns in country i are explained by a constant term and previous stock returns (Model 1) and a model where returns in country i are explained by a constant term, previous stock returns and previous oil price returns (Model 2). Model 2 shows better forecasting results than Model 1 in most cases according to the three criteria. We thus conclude that augmenting Model 1 with previous oil price changes leads to better forecasting of stock returns in GCC countries. Consequently, our out-of-sample analysis based on the paper’s results lead to conclude that investors in GCC stock markets have interests to keep an eye on crude oil market movements in their investment decision-making process.

5. Conclusion

This paper studied the relationship between oil prices and stock markets in GCC countries. Most GCC members are major net oil-exporters and important OPEC members and their economies are excessively dependent on oil prices. Thus, their actions as decision makers in OPEC may take into account their impact on GCC stock markets and economic activities.

Using the panel-data approach of Kónya (2006), which is based on SUR systems and Wald tests with country-specific bootstrap critical values, and a weekly dataset covering the period from June 7 2005 to May 2 25 010, we show strong statistical evidence that the causal relationship is consistently bi-directional for Saudi Arabia. In the other GCC countries, stock market price changes do not Granger cause oil price changes, whereas oil price shocks Granger cause stock price changes. Our out-of-sample analysis reveals that models with oil price changes as a factor of risk provide better forecasts of stock returns, and are thus more useful for portfolio investment decisions. Therefore, investors and policy makers in the GCC stock markets should keep an eye on changes in oil prices because these changes significantly affect stock returns. On the other hand, investors in world oil markets should look at changes in the Saudi stock market because these changes significantly affect oil prices.

Our findings offer several avenues for future research on the linkages between energy product prices and stock markets. First, the link between oil and stock markets in GCC countries can be expected to vary across different economic sectors. A sector analysis of this link would be informative. In particular, this sector analysis should offer better explanations for the bidirectional causality obtained for Saudi Arabia. Second, exploring empirically the channels through which high oil prices affect the stock markets would offer some contribution to the existing literature. Finally, the methodology applied in this article could be extended to include non linear effects and used to examine the effects of other energy products such as gas.

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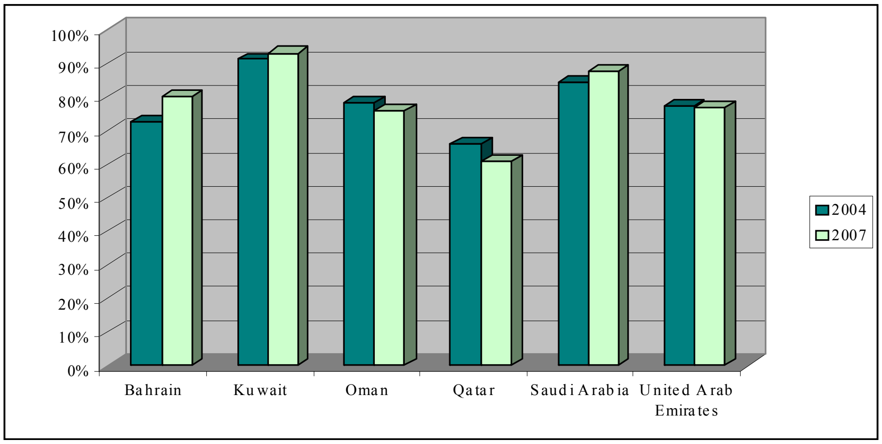
Figure 1: GCC oil and gas revenues as share of total government revenues: 2004 versus 2007



Source: Data are obtained from the Economic and Social Commission for Western Asia (ESCWA)-2009

Table 1: GCC economies, stock markets and oil in 2007

Market	Number of companies	Market Capitalization ($ billion)	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
S. Arabia	81	522.70	202	44

Notes: * Numbers in 2006.
Sources: Arab Monetary Fund and Emerging Markets Database.

Table 2: Descriptive statistics:

Panel A: Descriptive statistics of return series

	OPEC oil price	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE
Mean	0.144	-0.545	-0.001	-0.001	-0.001	-0.002	-0.004
Std. Dev.	4.271	3.327	4.096	3.689	4.472	5.021	5.288
Skewness	-0.074	-0.859	-0.944	-1.403	-0.893	-0.959	-1.397
Kurtosis	5.371	7.752	8.916	10.968	7.151	5.991	9.633
Jarque-Bera	61.164***	227.91***	407.88***	773.28***	221.32***	136.81***	561.21***
Q(6)	40.496***	60.287***	10.157	24.845***	6.479	5.627	5.367

Panel B: Correlations with OPEC oil price

	Bahrain	Kuwait	Oman	Qatar	Saudi	UAE
OPEC oil price	0.083	0.056	0.099	0.074	0.035	0.087

Notes:*, ** and *** denote rejection of the null hypothesis respectively at 10%, 5% and 1%. Q(6) and ARCH(6) test are the Ljung-Box tests for autocorrelations of order 6 and the statistical test for conditional heteroscedasticity of order 6.

Table 3: Granger causality tests from stock markets to oil prices for the Gulf Corporation Countries panel (weekly dataset from June 7, 2005 to Mars 30, 2010 on the 6 GCC countries), bivariate (OIL, STOCK) model

Country	Estimated coefficient	Test Statistic	Bootstrap critical values 1%	5%	10%
Bahrain	0.01613	1.29027	7.51446	4.53205	3.01703
Kuwait	0.01926	0.81534	8.15321	4.77289	3.33099
Oman	0.02903	1.24360	8.44854	5.38236	3.71643
Saudi Arabia	-0.00630	-5.42628**	8.18560	5.15294	4.35687
Qatar	0.01465	0.85849	9.54525	5.55479	3.87242
United Arab Emirates	0.00325	0.28529	9.60721	5.55708	4.07779

Notes: a) ***, ** and * denote significance at the 1%, 5% and 10% levels. b) H_0: STOCK does not cause OIL. OIL – oil prices, and STOCK – stock market indices (taken in logarithms).

Table 4: Granger causality tests from oil prices to stock markets for the Gulf Corporation Countries panel (weekly dataset from June 7, 2005 to Mars 30, 2010 on the 6 GCC countries), bivariate (OIL, STOCK) model

Country	Estimated coefficient	Test Statistic	Bootstrap critical values 1%	5%	10%
Bahrain	0.000498	0.227825**	0.7258	0.21984	0.15430
Kuwait	0.001436	0.731458***	0.42141	0.04900	0.02776
Oman	0.001598	0.635042***	0.51880	0.10002	0.08038
Saudi Arabia	-0.001700	-0.303349**	0.96330	0.24400	0.17321
Qatar	0.000168	0.216589**	0.83942	0.10306	0.06404
United Arab Emirates	0.000248	0.317622**	1.37796	0.28582	0.22715

Notes: a) ***, ** and * denote significance at the 1%, 5% and 10% levels. b) H_0: OIL does not cause STOCK.

Table 5: Forecasting evaluation results (weekly dataset from April 6, 2010 to May 25, 2010 on the 6 GCC countries)

Distribution	Model 1			Model 2		
	RMSE	MAE	MAPE	RMSE	MAE	MAPE
Bahrain	0.03327	0.02256	1.96468	**0.03272**	**0.02249**	**1.90736**
Kuwait	0.04063	0.02788	**1.00518**	**0.04056**	**0.02718**	1.11643
Oman	0.03678	0.02380	1.00550	**0.03677**	**0.02356**	**1.00363**
Qatar	0.04461	0.03075	**0.99153**	**0.04440**	**0.03052**	1.02047
S. Arabia	**0.05268**	0.03642	1.22274	0.05269	**0.03641**	**1.22183**
UAE	0.05012	0.03611	1.11814	**0.05007**	**0.03598**	**1.09494**

Notes: Bold numbers denote the lowest error statistics.

Appendix

Simulation procedure used by Kónya, L. (2006) to compute critical values

It is assumed that equations (1a) and (1b) have already been estimated, and that our aim is to test for Granger causality from Stock to Oil in (1a) performing Wald tests with country specific bootstrap critical values following the following five steps:

Step 1: Estimate (1a) under the null hypothesis that there is no causality from Stock to Oil

(i.e. assuming that $\gamma_{1,i,j} = 0$ restriction for all i and j) and obtain the residuals:

$$e_{Ho,i,j} = oil_{it} - \hat{\alpha}_{1,i} - \sum_{j=1}^{p_{2i}} \hat{\beta}_{i,j,t} oil_{i,t-j}$$

From these residuals develop the $N \times T$ [$e_{Ho,i,j}$] matrix.

Step 2: Re-sample these residuals. In order to preserve the contemporaneous cross-correlation structure of the error terms in (1a), do not the draw the residuals for each country one-by-one, but rather select randomly a full column from the [$e_{Ho,i,j}$] matrix at a time. Denote the selected bootstrap residuals as $e^{*}_{Ho,i,j}$ where t = 1,...,T* and T* can be greater than T.

Step 3: Generate a bootstrap sample of Oil assuming again that Stock does not cause it, i.e. using the following formula:

$$oil_t = \hat{\alpha}_{1,i} + \sum_{j=1}^{p_{2i}} \hat{\beta}_{i,j,t} oil^{*}_{i,t-j} + e^{*}_{H0,i,j} \quad , t = 1, \ldots T^{*}$$

Step 4: Substitute $oil^{*}_{i,t}$ for $oil_{i,t}$ estimate (1a) without imposing any parameter restriction on it, and for each country perform a Wald test implied by the no-causality null hypothesis.

Step 5: Develop the empirical distributions of the Wald test statistics repeating steps 2-4 5000 times, and specify the bootstrap critical values by selecting the appropriate percentiles of these sampling distributions.

Note that a similar procedure is applied for testing for Granger causality from Oil to Stock in (1b).