Stock Prices, Exchange Rates, and Oil:
Evidence from Middle East Oil-Exporting Countries.

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This version: March 2008

Abstract

We consider the linkage between stock prices and exchange rates in four Middle East emerging markets. The existing evidence on stock prices and exchange rates typically relies on introduction of a global market index. On the contrary, we find that for the countries of our sample oil prices emerge as the dominant factor in the above relationship. When we focus on the extended sample we do not detect evidence of cointegration between stock prices and real exchange rates, or of cointegration among stock prices, real exchange rates and other exogenous variables such as the US stock price or the oil price. To address the possibility that this finding may be due to the presence of regime shifts we, first, divide the sample into two subperiods based on the oil price shock in March 1999. The Johansen trace statistics reveals evidence of cointegration only for the second sub-sample, among stock prices, real exchange rates and oil prices in Egypt, Oman and Saudi Arabia, and between stock prices and oil prices in Kuwait. Utilizing the full sample and including deterministic dummies in the VECM we attempt to capture the regime shifts. The FIML estimation results corroborate the finings from splitting the sample, indicating that the oil prices have a long-run positive effect on stock market in each country. Readjustment towards the long-run equilibrium in each stock market occurs via oil price changes. Finally, we produce persistence profiles showing that convergence to the long run equilibrium takes 17 and 14 months in Egypt and Saudi Arabia respectively, while it takes 22 and 24 moths in Oman and Kuwait.

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1. Introduction

Given the increasing trend toward globalization in financial markets, a substantial amount of research has been devoted to the investigation of the correlation of stock returns across international markets. Eun and Shim (1989), Hamao et al. (1990), and Bekaert and Harvey (1996), among others, investigate the dynamics of international stock movements, and find significant cross-market interactions. These empirical findings are of interest for two reasons. First, portfolio theory suggests that if the stock returns between markets are less than perfectly correlated, investors should be able to reduce their risk through international diversification. If countries' stock returns are positively related, however, it is possible to use the information in one market to predict the movement in the other market. Second, the emerging markets implemented policy and regulatory reforms in recent years to facilitate cross-border investing. The expected returns from the investment in foreign stocks are determined by changes in local stock price and currency values. If the effect of exchange risk does not vanish in well-diversified portfolios, exposure to this risk should command a risk premium. Therefore, the interaction between currency value and stock price is an important determinant of global investment returns (e.g., Doong et. al., 2005).

Establishing the relationship between stock prices and exchange rates is important for a number of reasons. First, the link between those two markets may be used to predict the path of the exchange rate. This can have implications for the ability of multinational corporations to manage their exposure to foreign contracts and the exchange rate they face. Second, currency is more often being included as an asset in investment funds' portfolio. Knowledge about the link between currency rates and other assets in a portfolio is vital for the performance of the fund. The mean-variance approach to portfolio analysis suggests that the expected return depends on the variance of the portfolio. Therefore, an accurate estimate of the variability of a given portfolio is needed. This, in turn, requires estimates of the correlation between stock prices and exchange rates. Third, the understanding of the stock price- exchange rate relationship may prove helpful to foresee a crisis. Khalid and Kawai (2003) as well as Ito and Yuko (2004) among others, claim that the link between the stock and currency markets contributed in the propagation of the 1997 Asian financial crisis. It is believed that the sharp depreciation of the Thai baht triggered depreciation of the other currencies in the region, which led to the collapse of the stock market as well. Awareness about such a relationship between the two markets could enable preventive measures before the spread of a crisis.

Traditional models of the open economy suggest that a relationship between the stock market performance and the exchange rate behaviour may exist. For instance, goods market approaches (Dornbusch and Fischer, 1980) suggest that changes in exchange rates affect the competitiveness of firms as fluctuations in exchange rate affect the value of the earnings as well as

the cost of its funds (as many companies borrow in foreign currencies to fund their operations and hence its stock price). A depreciation of the local currency makes exporting goods attractive and leads to an increase in foreign demand and hence revenue for the firm and its value would appreciate and hence the stock prices. On the other hand, an appreciation of the local currency decreases/increases the exporting/importing firms' profits because it leads to a decrease in foreign demand of its products (e.g., see Gavin, 1989).

Portfolio balance models provide an alternative rational for the relation between exchange rates and stock prices, stressing the role of capital account transactions. Blooming stock market would attract capital flows from foreign investors, which increase the demand for its currency. The reverse would happen in the case of falling stock prices where the investors would try to sell their stocks to avoid further losses and would convert their money into foreign currency to move out of the country. Such a scenario would lead to local currency depreciation. As a result, rising (declining) stock prices would lead to an appreciation (depreciation) in exchange rates. Moreover, foreign investment in domestic equities could increase over time due to benefits of international diversification that foreign investors would gain. Movements in stock prices may influence exchange rates and money demand because investors' wealth and liquidity demand could depend on the performance of the stock market (Mishra, 2004).

The existing literature typically utilises a two-variable framework to investigate the relationship between exchange rates and stock prices. A number of recent studies, however, points out that such a system can be incomplete because of the omission of an important variables. If that is the case, inferences about the long-run relationship of variables and the causality structure are invalid. Lutkepohl (1982) and more recently Caporale and Pittis (1997) show that the omitted variable in the extended system is the only determining factor for the sensitivity of causality inference between the variables of the incomplete system.

The role of oil as an omitted variable

In this paper we use oil prices to the system because all of the sample countries are oil exporters. The impact of rising oil prices on stock market and exchange rates will different from importer to exporter countries. In fuel importers countries, the rise in world oil prices worsens the trade balance, leading to a higher current account deficit and a deteriorating net foreign asset position. At the same time, higher oil prices tend to decrease private disposable income and corporate profitability, reducing domestic demand and stock prices; along with a depreciation of the exchange rate, this acts to bring the current account back into equilibrium over time. The speed and output cost of adjustment depends on factors such as the degree of trade openness, structural flexibility, and central bank credibility, as well as the shock's expected persistence and the speed

with which it is allowed to feed through into domestic fuel prices. Among other things, these determine the extent to which rising oil prices raise inflationary pressures, necessitating a monetary tightening that could lead to a more pronounced slowing in growth. In fuel exporters (such as OPEC countries), the process works broadly in reverse: trade surpluses are offset by stronger growth and, over time, real exchange rate appreciation and stock prices increasing.[1]

Oil is the main product in the most of Middle East countries -especially in the Gulf area- such as Kuwait, Oman and Saudi Arabia. We can say that, without exaggeration, the oil is the main product that these countries export to the world, so that the oil price shocks have a crucial effect on the economy of these countries. Kubarych (2005) points out that there are five major oil shocks since 70s, the first one was in 1973; the proximate cause was the October War in the fall of 1973, followed by the Arab boycott of countries judged to be supporting Israel against Egypt. The second was in 1979-81 because Iranian revolution and Iran Iraq war, in this period OPEC decided to exploit its pricing power after a period of restraint by announcing a 15 percent price rise for 1979. The third was in 1990-91 corresponding to the Iraqi invasion in Kuwait and the first Gulf war, which resulted to a substantial price spike -within weeks of August 1990, Saudi light crude oil had jumped from about 15 dollar per barrel to over 33 dollar per barrel. The fourth was in 1999-2000 after OPEC meeting in March, in the wake of the Asian financial crisis and a pick-up of Iraqi oil sales under the United Nations oil for- food program, oil prices plummeted to $10 per barrel in late 1998. Then oil prices began to head sharply higher—but this time, unlike the three previous episodes, without any geopolitical trigger. Rather, global demand began to swell as the high-tech bubble encouraged a big investment boom in North America and Europe and as the Asian economies began to recover. OPEC was either unable or unwilling to match increased demand by raising output. By the middle of 2000, oil prices tripled. The last one was in 2002 when USA invaded Iraq.

We treat oil prices as endogenous variable rather than exogenous because the changes in spot oil prices may reflect shocks to other parts of the economy that create an imbalance in oil supply and demand. Such oil price changes may simply be endogenous responses to other kinds of structural shocks -the fourth oil shock is an evidence of that. Barsky and Kilian (2004) suggest that the 1999-2000 oil shock was endogenous rather than exogenous because, producers trade off the immediate gains from abandoning the cartel against the present value of the future cartel rents foregone. This logic suggests that, all else equal, unusually low real interest rates as in the 1970s should be conducive to the formation of cartels and that high real interest rates should be detrimental. Furthermore, the ability of cartels to keep prices high will be procyclical if producers

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[1] IMF's World Economic Outlook, April 2006.

are unable to tell whether other cartel members are cheating by exceeding their production quota. More specifically, in times of unexpectedly low demand, when prices fall below a trigger point, cartel members will choose to flood the market with their output. The assumption of imperfectly observable output is particularly appealing for crude oil producers. Thus, strong economic expansions, all else equal, should strengthen oil cartels and major recessions weaken them. This model helps to explain the surplus production of oil following the Asian crisis of 1997–1998 as well as the apparent success of OPEC during 1999–2000, the turning point for oil prices indeed occurred as the first signs of a possible U.S. recession emerged in late 2000. Within weeks the oil price began to slip, and its fall accelerated throughout 2001. Shortly thereafter, the *New York Times* referred to the prospect of a devastating price war, as OPEC was unable to enforce its goal of a major cut in oil production in the face of falling demand. This analysis does not deny the importance of political efforts aimed at strengthening or sustaining the oil cartel; rather, the point is that such activities— unlike wars—are not exogenous and that the sustainability of cartels will be determined to an important extent by the macroeconomic environment.

We also consider the possible role of a global market indicator (the proxy we use is the US stock market as Phylaktis and Ravazzolo, 2005) in the system which can be through of as representing the influence of world market. As foreign capital restrictions are lifted in the most countries will be an increase in the degree of correlation between the local market and other financial markets around the world, as well as an increase in the link between the foreign exchange and stock markets.

Our focus is on the long-run equilibrium (cointegrating) relationship between stock prices and the real exchange rate in a number of Middle East oil producer countries, and it contributes to the literature in the following ways. Firstly, in line with Phylaktis-Ravazzolo (2005), we consider the possibility that the lack of relationship between the stock and foreign exchange markets in a country might be due to the omission of an important variable from the system, which acts as a conduit through which the real exchange rate affects the stock market, and possibly invalidates the results of some of the previous studies. However, contrary with Phylaktis-Ravazzolo (2005), we find that the variable establishing a causal link (in the long-run) between stock price and real exchange rate is not the US stock price, but the oil price. Secondly, given the non normality and heteroscedasticity in the residuals of the full system of equations described through a Vector Error Correction Model, VECM, we use not only the reduced rank regression technique, advocated by Johansen (1988), but also a Quasi Maximum Likelihood estimation method. Finally, we use the persistence profile technique (Pesaran and Shin, 1996) to examine the speed through which the stock market returns to its long-run equilibrium state, once it is shocked away. The organization of the paper is as follows: section 2 introduces the literature review, section 3 describes the data and

the methodology, section 4 discusses the empirical results, and section 5 provides the summary and conclusions.

2. Literature review

For the past few decades, the relationship between exchange rates and stock markets has been given much attention in the academic literature. Studies have attempted to determine how one financial market can predict the others and vice versa. Early studies (Aggarwal, 1981); Solnik. 1987; Soenen and Hennigar, 1988) considered only the correlation between the two variables. Aggarwal (1981) finds that stock returns and U.S. exchange rates are positively correlated. Solnik (1987) observes a weak but positive relationship between the two variables. Soenen and Aggarwal (1989) re-assess the Solnik model using 1980-1987 data for the same eight industrial countries. They report a positive correlation between stock return and exchange rates for three countries and negative correlation for five. Soenen and Hennigar (1988) conclude that the value of the U.S. dollar is negatively correlated, that is, depreciation of the U.S. dollar increases the U.S. stock price indexes. Roll (1992) finds a positively relationship between market indices and exchange rate. Smith (1992) uses a Portfolio Balance Model to examine the determinants of exchange rates. The results show that equity values have a significant influence on exchange rates but the stock of money and bond has little impact on exchange rates.

Bahmani-Oskooee and Sohrabian (1992) are among the first to use cointegration and Granger causality to explain the direction of movement between exchange rates and stock prices. Since then various other papers have appeared covering both industrial and developing countries (for example, Ajayi et al. 1998, Granger et al, 2000; Ibrahim, 2000). The direction of causality in the short run, similar to earlier correlation studies, appears mixed. Adrangi and Ghazanfari (1996) test for causality relationship between the dollar exchange rate and the stock return in Germany and US. They found that stock returns cause the changes in the exchange rate of the dollar. Ajayi, Friedman, and Mehdian (1998) investigate causal relations between stock returns and changes in exchange rates in 16 advanced and emerging countries, they found unidirectional causality between the stock and currency market in all the advanced economies while no consistent causal relations are observed in the emerging economies. Huang, Granger and Yang (2000) use daily data for Hong Kong, Indonesia, Japan, South Korea, Malaysia, Philippines, Singapore, Thailand and Taiwan. The results showed that most markets exhibit bidirectional causality between the two variables. Nagayasu (2001) analyses empirically the recent Asian financial crisis using the time series data of exchange rates and stock indices for Philippines and Thailand which were the first two countries confronted by massive movements in financial asset prices. He found unidirectional causality runs from the financial sector index to the exchange rate, contagion effects running from Thailand to the Philippines. Hatemi and Irandoust (2002) also find that Granger causality is unidirectional running

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from stock prices to exchange rates in Sweden. Hatemi, and Roca (2005) examine the link between exchange rates and stock prices before and during the 1997 Asian crisis, for Indonesia, Malaysia, Philippines, and Thailand. They find that with the exception of the Philippines, during the period before the Asian crisis, there was a significant causal relationship between exchange rates and stock prices in each of the four Asian countries. Causality ran from the former to the latter in the case of Indonesia and Thailand, while the direction of causality is reversed in the case of Malaysia. During the Asian crisis period, however, the relationship between those two variables ceased across the all countries.

Most researchers are interested in testing for not only the short-run but also the long-run relationship between exchange rates and stock prices. Oskooee and Sohrabian (1992) test for the relationship between the S&P price index and the effective exchange rate of the dollar, finding bidirectional causality relationship between the two markets at least in the short-run, the cointegration analysis reveals that no long-run relationship between the two variables. Ratner (1993) tests whether the US dollar exchange rate affects US stock prices; he concludes that in the long-run they are not related. Ajayi and Mougoue (1996) find a negative short-run and long-run feedback relation between the two financial markets. Abdala and Murinde (1997) examine exchange rate and stock prices interactions in some emerging financial markets namely, India, Korea, Pakistan and Philippines. The results showed that the long-run relationship found only in India and the Philippines. In the short-run, they found unidirectional causality from the exchange rates to stock prices in all the sample countries except the Philippines. Wu (2000) explores the existence of an equilibrium relationship between stock prices and exchange rates in Singapore asset market and its sensitive to different currencies. He concludes that Granger causality runs only one way from exchange rates to stock prices, the cointegration analysis suggest that Indonesia Rupiah has a positive long run effect on stock prices. Morley and Pentecost (2000) investigate the nature of the relationship between stock prices and spot exchange rates for Canada, France, Germany, Italy, Japan, UK and USA. They find that the lack of correlation between the level of stock prices index and the level of the exchange rates is due to the fact that exchange rates and stock prices do not exhibit common trends, but rather exhibit common cycles. Thus the statistical relationship is a short-run rather than long-run or trend relationship. Lee and Nieh (2001) examine both short-run comovements and long-run equilibrium relationships between stock prices and exchange rates for each G-7 country: Canada, France, Germany, Italy, Japan, the United Kingdom (U.K.) and the US. Their findings suggest that no long run equilibrium relationship exists between the two variables. However, in the short-run the causality runs from exchange rates to stock prices in Germany, Canada and the UK, and runs from the later to the former in Italy and Japan. Doong, Yang, and Wang (2005) examine the dynamic relationship and pricing of stock and exchange rate, using Weekly data for Indonesia, Korea, Malaysia, Philippines, Thailand and Taiwan. They find that

stock prices and exchange rates are not cointegrated, using Granger causality test, bidirectional causality can be detected in all countries except Thailand.

Several researchers consider the question of what other macroeconomic factors they might include in the exposure regression. Different macroeconomics factors including interest rates, money reserve, inflation, different monetary policies, etc., have been applied to the exchange rate exposure model by various researchers. Ibrahim (2000) extends the existing studies on the stock prices- exchange rates causal relationship by investigating the issue for Malaysia. He used three exchange rates, namely, nominal effective exchange rate, real effective exchange rate and bilateral exchange rate. Using Monthly data from January 1979 to June 1996, applying cointegration and Granger causality tests he found that, in the bivariate models, no long run relationship between the stock market index and any of the exchange rates. In the multivariate tests (exchange rates, stock prices, money supply and reserves) there is a unidirectional causality from the stock market to the exchange rates, a feedback effect from the bilateral rate to the stock market, both the exchange rates and the stock index are Granger causality by the money supply and reserves. Patro, Wald and Wu (2002) examine the determinants of foreign exchange rate risk exposures for equity index returns of 16 OECD countries for the period 1980-1997. Using weekly observations and GARCH specification, they find significant time-varying foreign exchange risk exposure. An important issue is what determines this exposure. Using panel data which allow them to pool data across countries and thus improve estimation efficiency, they found that several macroeconomic variables can help explain foreign exchange exposure. These variables include exports, credit rating, and tax revenue. Phylakits, and Ravazzolo (2005) examine the long run relationship between stock prices and exchange rates and the channels through which exogenous shocks impact on these markets, using monthly data from January 1980 to December 1998 for Hong Kong, Indonesia, Malaysia, Philippines, Singapore, Thailand, conducting Cointegration and multivariate Granger causality tests, they found that stock prices and exchange rates are positively related, , the financial crisis had temporary effect on the long run comovements of these markets, and the US stock market is an important (causing) variable, which acts as a conduit through which the foreign exchange rates and the local stock markets are linked.

The above studies clearly indicate a strong interest on the relationship between the exchange rate and stock prices with the use of different methodologies and data sets. There is no consensus among researchers on the empirical validity of the relationship between stock prices and exchange rates; however, suggesting that further research is needed to shed light on this issue. This interest on whether stock prices and exchange rates are related has become more pronounced especially after the East Asian crisis. During the crises the countries affected saw turmoil in both currency and stock markets. If stock prices and exchange rates are related and the causation runs from exchange

rates to stock prices then crises in the stock markets can be prevented by controlling the exchange rates. Moreover, countries can exploit such a link to attract/stimulate foreign portfolio investment in their own countries. Alternatively, if the causation runs from stock prices to exchange rates then authorities can focus on domestic economic policies to stabilize the stock market. If the two markets/prices are related then investors can use this information to predict the behaviour of one market using the information on other market.

3. Data and Methodology

We focus on four Middle East countries, namely Egypt, Kuwait, Oman and Saudi Arabia. The sample period at monthly frequency varies for each country depending on the availability of data. For Egypt the sample period is 1994:12-2006:06; for Kuwait 1992:09-2006:02; for Oman 1996:05-2006:05; and for Saudi Arabia 1994:01-2006:04. The data consist of monthly local stock market index of each country, local bilateral spot exchange rates as domestic currency per US dollar, consumer price index CPI, OPEC basket oil prices and S&P 500 index. All observations were obtained from DataStream and International Financial statistics (IFS); the observations are end of the month. All the series are expressed in logarithmic form. The real exchange rate is defined as:

$$InRER_t^{MEC} = InCPI_t^{MEC} - Ine_t^{MEC} - InCPI_t^{US} , \tag{1}$$

where CPI_t^{MEC}, is the consumer price index for the Middle East Country, e_t^{MEC} is the nominal exchange rate and CPI_t^{US} is the consumer price index for US.

3.1 Unit root tests

We employ two procedures, namely the augment Dickey- Fuller (1979) (ADF) test and Kwiatkowski, Phillips, Schmidt, and Shin (1992) (KPSS), to determine whether the univariate time series contain a unit root. The ADF test is based on the regression,

$$\Delta y_t = \alpha + \beta y_{t-1} + \sum_{j=1}^{p} \gamma_j \Delta y_{t-j} + \varepsilon_t , \tag{2}$$

where y_t is the series being tested and p is the number of lags differenced included to capture any autocorrelation, the null hypothesis is that $\beta = 0$ for the unit root process. If $\beta < 0$, we accept the alternative hypothesis that the series is a stationary series.

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In the Dickey-Fuller type unit root tests the presence of unit root is the null hypothesis to be tested. This test is criticized on the ground that their failure to reject a unit root may be attributed to their low power. Therefore, we use also the (KPSS) test (Kwiatkowski et al., 1992); which tests null hypothesis of this test is stationary for each series in levels. This test is implemented as a complementary procedure to the ADF test. The KPSS statistic is based on the residuals from the OLS regression of y_t on the exogenous variables x_t :

$$y_t = x_t \delta + u_t \tag{3}$$

The KPSS test statistic is being defined as:

$$LM = \sum_t S_t^2 / \left(T^2 f_0 \right) , \tag{4}$$

where f_0 is an estimator of the residual spectrum at frequency zero, T is the number of observations and S_t is a cumulative residual function:

$$S_t = \sum_{t=1}^{T} \hat{u}_t \tag{5}$$

The relationship between real exchange rates and domestic stock prices can be represented by,

$$SP_t^{MEC} = \beta_0 + \beta_1 RER_t^{MEC} + v_t, \tag{6}$$

where SP_t^{MEC} is the domestic stock price, RER_t^{MEC} is the real exchange rate defined as domestic price level relative to foreign prices multiplied by nominal exchange rate and v_t is a disturbance term. All data are transformed by natural logarithms. We will use the real exchange rate instead of the nominal for two reasons. Firstly, following Chow et al (1997) the real exchange rate reflects better the competitive position of an economy with the rest of the world, and secondly the nominal exchange rate of our sample countries has not varied substantially during the period of study. Although we cast the discussion in nominal terms, it should be noted that due to the short-run rigidity of prices, the effect would be similar in real terms.

3.2 Cointegration

In order to test for cointegration we use the Johansen (1988) and Johansen and Juselius (1990) full information maximum likelihood of a Vector Error Correction Model,

$$\Delta Y_t = \Pi Y_{t-p} + \Gamma_1 \Delta Y_{t-1} + \Gamma_2 \Delta Y_{t-2} + \ldots + \Gamma_{p-1} \Delta Y_{t-p+1} + \varepsilon_t \tag{7}$$

where ε_t are white noise Gaussian residuals, Γ's are the lagged of first differences coefficients which capture the short-run effect, Π is the long-run multiplier matrix of coefficients, and in the

case of cointegration, is such that $\Pi = \alpha\beta'$, where α represents the speed of adjustment to disequilibrium, while β is a matrix of cointegrating vectors.

Testing for cointegration, using the Johansen's reduced rank regression approach, centres on estimating the matrix Π in an unrestricted form, and then testing whether the restriction implied by the reduced rank of Π can be rejected. In particular, the number of the independent cointegrating vectors depends on the rank of Π, which in turn is determined by the number of its characteristic roots that different from zero. The test for nonzero characteristic roots is conducted using the λ_{trace} and λ_{max} statistics:

$$\lambda_{trace}(r) = -T \sum_{i=r+1}^{k} \ln(1 - \hat{\lambda}_i) \tag{8}$$

$$\lambda_{max}(r, r+1) = -T(1 - \hat{\lambda}_{r+1}) \ , \tag{9}$$

where $\hat{\lambda}$'s are the eigenvalues of Π, T is the number of usable observations. While the λ_{trace} statistic tests the null hypothesis that the number of distinct cointegrating vectors is less than or equal to r against a general alternative, and the λ_{max} statistic tests the null that the number of distinct cointegrating vectors is r against the alternative hypothesis of $r+1$ cointegrating vectors. Cheung and Lai (1993) show that, the trace test is more robust to both skewness and excess kurtosis in the residuals than the maximum eigenvalues test, therefore we rely on the λ_{trace} to test for cointegrating rank, we also corrected for small sample bias (see Reimers, 1992, and Phylaktis and Ravazzolo, 2005). Thus we use (T- nk) in Eq. (8) instead of T. Also Rahbek et al. (2002) have shown that the cointegration rank trace test is robust against moderate residual ARCH effects (Juselius, 2006). The lag length of the VECM has been selected using SBC criteria,

$$\log|\hat{\Sigma}| + \frac{k'}{T}\log(T) , \tag{10}$$

where $\hat{\Sigma}$ is the variance-covariance matrix of residuals, T is the number of observations, and k' is the total number of regressors in all equations.

3.3 Vector error correction model:

We explore the presence of regime shifts in the cointegrating relationship in two ways. Firstly we spill the sample in two sub periods and apply Johansen cointegration method. Secondly

we use the whole sample and include slope dummies in the VECM which describes the cointegration relationship among stock prices, real exchange rates and oil prices as follows:

$$\Delta SP_t = \omega_1 \Delta SP_{t-1} + \eta_1 \Delta RER_{t-1} + \eta_2 \Delta OIL_{t-1} + \alpha_{11}(SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1})$$
$$+ \alpha_{21}D_1(SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1}) + \varepsilon_t \tag{11}$$

$$\Delta RER_t = \eta_3 \Delta SP_{t-1} + \omega_2 \Delta RER_{t-1} + \eta_4 \Delta OIL_{t-1} + \alpha_{12}(SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1})$$
$$+ \alpha_{22}D_1(SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1}) + v_t \tag{12}$$

$$\Delta OIL_t = \eta_5 \Delta SP_{t-1} + \eta_6 \Delta RER_{t-1} + \omega_3 \Delta OIL_{t-1} + \alpha_{13}(SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1})$$
$$+ \alpha_{23}D_1(SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1}) + \psi_t \tag{13}$$

where Δ is the first order difference operator, SP_t is domestic stock prices, RER_t is real exchange rate, OIL_t is oil prices and D_1 is dummy variable takes value 0 before Mar. 1999 and value 1 from Mar. 1999 onwards. This dummy specification allows capturing the regime shift due to the oil prices shock in March 1999 after OPEC meeting. Furthermore, the coefficients α_{1i}'s and α_{2i}'s in each equation capture the speed of adjustment towards to the long-run relationship in the pre oil shock and post oil shock regime, γ_1 and γ_2 capture the cointegrating vector coefficients; and ε_t, v_t and ψ_t are stationary residuals.

Given non-normality and heteroscedasticity in the residuals of the VECM and given also the presence of slope dummies, we cannot use the reduced rank regression technique (equivalent to Full Information Maximum Likelihood) suggested by Johansen (1990). Therefore, all the parameters of the full system given by the equations described by (11), (12) and (13) are estimated by maximising the log-likelihood function assuming normality in the residuals:

$$-\frac{Tg}{2}\log(2\pi) + T\log|\det\Gamma| - \frac{T}{2}\log|\Sigma| - \frac{1}{2}\sum_{t=1}^{T}(Y_t\Gamma - X_tB)\Sigma^{-1}(Y_t\Gamma - X_tB)' \tag{14}$$

where T the number of observations, g the endogenous variables, Y denotes $1xg$ matrix of endogenous variables, X denotes an $1xk$ matrix of exogenous or predetermined variables, Γ denotes a gxg matrix of coefficients, B denotes kxg matrix of coefficients, k is the number of exogenous or predetermined variables, Σ denotes gxg matrix of covariance.

In a second stage, we use a robust estimator of the covariance matrix of the parameters, using the following equation:

$$\sum_{k=-L}^{L} \sum_{t} w_t \left(Y_t ' u_t u_{t-k} Y_{t-k} \right) \tag{15}$$

where L is the number of lags of autocorrelation in the form of moving average term, Y a list of variables, u_t is a single series of residuals, and w_t is a set of window weights which defined as:

$$w_t = \left\{ \frac{L+1-|k|}{L+1} \right\} \quad k = -L, -L+1, \ldots, 0, 1 \ldots, L-1, L \tag{16}$$

3.4 Persistence profiles:

In order to measure, within a system of equations, the speed through which the system reverts to its long-run equilibrium once it is shocked away, we use the persistence profile which has been proposed by Pesaran and Shin (1996). Specifically, the persistence profile at horizon s, $P(s)$, measures the (dynamic) response of a cointegrating relationship to system wide shocks (occurred in t-s) and it is given by:

$$P(s) = \beta' H_s \Sigma H_s ' \beta / \beta' \Sigma \beta \quad \text{for } s = 0,1,2\ldots\ldots \tag{17}$$

where Σ is the variance-covariance matrix of the VAR innovations, and $H_s = C(1) + C_s^*$ is the *nxn* coefficients matrix of the Moving Average, MA representation of the VECM. In the long-run H_s tends to the long-run multiplier matrix $C(1)$, while at time zero (e.g., on impact) we have $H_0 = I_m$. The C_s^* matrix contains the transitory components of the system, whose values converge toward zero while s goes to infinity. This implies that the ratio given in (17) converges towards zero as s grows, since in presence of cointegration the following orthogonal condition holds: $\beta' C(1) = 0$. The smaller is the horizon s for which *P(s)* converges to zero, the faster is the re-adjustment towards the long-run equilibrium. The persistence profiles are derived from the FIML estimation of the vector error correction models used in the previous section for the cointegration analysis.

4. Empirical results

4.1 Unit root tests

Using ADF and KPSS the results in table 1 clearly show that all the variables are not stationary in the levels; we also find that all the series are stationary in the first differences at 5% level of significance.

4.2 Bivariate Cointegration results

Having established the order of integration of the individual series, we are further interested in determining whether there exists a long-run equilibrium relationship between stock prices and real exchange rates, the Johansen cointegration test is used for this purpose.

As one can observe from Table 2 using the whole sample the empirical findings from the Johansen method for the long-run relationship at 5% significance level, we find evidence of no cointegration between stock prices and real exchange rates in Egypt, Kuwait, Oman and Saudi Arabia. These preliminary findings seems to be in line with the following studies, Oskooee and Sohrabian (1992) using Engle and Granger method they found no cointegration between the two variables. Ratner (1993) also did not find a cointegration relationship between the two variables and argued this to the rational expectation theory which does not support a strong relationship between exchange rates and stock prices. Abdala and Murinde (1997) find no long-run relationship between the two variables in India and Philippines. Morley and Pentecost (2000) using the EG method conclude that no cointegration relationship between the two variables, the reason of that is due to the fact that exchange rates and stock prices do not exhibit common trends, but rather exhibit common cycle. Ibrahim (2000) using EG and Johansen methods finds no cointegration between exchange rates and stock prices, he suggests that the lack of cointegration may be due to the omission of important and theoretically sound variables from the models. Lee and Nieh (2001) find no cointegration between the two variables in the G-7 countries, they conclude that these two financial assets share no common trend in their economy system and hence they will move apart in the long-run. Nandha and Smyth (2003) conclude that there is no cointegration between foreign exchange and domestic stock prices because the changes in the exchange rates influence firms' exports and ultimately affect stock prices. Phylakits, and Ravazzolo (2001) also find no cointegration between the two variables, the reason was the omission of an important variable, namely the US stock market.

However, in line with Ibrahim (2000) and Phylakits, and Ravazzolo (2005), we consider the possibility that the lack of cointegration might be due to the omission of important variables. Therefore, in Table 3 we report the results for a system which includes, as additional endogenous variables, either the oil prices or the US stock prices, in order to examine whether these variables affect stock prices and real exchange rates in long-run relationship. The λ_{trace} test statistics shows that we can not reject the null hypothesis of no cointegrating vector among *SP, RER* and P^{US} in

Egypt, Oman and Saudi Arabia, while there is a long-run relationship between the aforementioned variables in Kuwait at 5% level of significance. When testing for a zero exclusion restriction (using the reduced rank regression algorithm developed by Johansen and Juselius, 1990) for each coefficient of the cointegrating vector describing the long run relationship among *SP, RER* and P^{US} in Kuwait, we find (see Table 4) that we can exclude domestic stock price index from the cointegration space. This implies that, for the whole sample, the stock price index in Kuwait does not have a long-run equilibrium relationship with other variables in the system. It is important to observe that the reduced rank regression algorithm developed by Johansen and Juselius (1990) relies upon Gaussian and iid residual in the VECM. Consequently, for the reasons given above, the inference results should be taken with caution.

We also argue that the absence of long-run equilibrium relationship might be due to the existence of a regime shift, corresponding to the oil shock in March 1999 consequent to an OPEC meeting. Using the λ_{trace}, Table 5 shows that, at 5% significance level, we can not reject the null hypothesis of no cointegration between *SP* and *RER* or among *SP, RER* and P^{US} for each sub-sample. However, the Johansen λ_{trace} suggests, at 5% significance level, the existence of cointegration among *SP, RER* and *OIL*, in Egypt, Kuwait, Oman and Saudi Arabia in the second sub sample. We also test for zero exclusion restrictions for each variable included in the cointegrating vector among the triplet SP, RER and OIL. For this purpose we, again, use the reduced rank regression algorithm developed by Johansen and Juselius (1990). From Table 6 we can observe that the null hypothesis of exclusion was rejected in all countries (with exception of Kuwait). These findings confirm the previous results obtained through the λ_{trace} test suggesting the existence of a unique cointegration relationship among stock prices, real exchange rates and oil prices. Finally, when concentrating on a simple bivariate system with only stock and oil prices for Kuwait, we can reject the null hypothesis of no cointegration (given a λ_{trace} equal to 28.82), and this finding suggests that there is a long-run relationship between stock and oil prices.

4.3 Cointegration analysis based upon Quasi Maximum Likelihood

We use Maximum Likelihood to estimate jointly all the coefficients in the VECM described by equations 10, 11 and 12; the parameter standard errors have been obtained using a robust covariance matrix estimator[2]. From Table 7 we can observe that the speed of adjustment coefficients, regarding the first regime, that is the α_{1i}'s are not statistically significant. This finding

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[2] We used the RATS program for estimating the VECM using full information maximum likelihood method which estimates the likelihood function under the assumption that the contemporaneous errors have a joint normal distribution. Using the robust errors option we corrected the covariance matrix estimate to allow for more complex behaviour of the residuals, this option corrects the heteroscedasticity and serial correlation, this is some times known as the HAC (Heteroscedasticity and Autocorrelation Consistent) covariance matrix.

confirms that no long-run co-movement exists among RER, SP and OIL in the first regime (pre 1999 oil shock). The speed of adjustment coefficients regarding the second regime, e.g. the α_{2i}' is statistically significant and with the correct sign in Egypt, Oman and Saudi Arabia. More specifically, the results in Table 7 show that the oil prices play an important role in bringing back the stock prices to their long-run equilibrium level. Furthermore, we also find that in Egypt the real exchange rate plays a role in re-establishing the long-run equilibrium for the stock prices. Furthermore, the QML results confirm our findings for Kuwait obtained through the reduced rank regression technique.

In the case of Kuwait, there is no long-run relationship among stock prices, real exchange rates and oil prices, so that we estimated the VECM for the stock prices and oil prices. At the 1% level of significant we can reject the null hypothesis of no cointegration between the two variables (the speed of adjustment is significant at 1% level of significance in the oil prices equation), and oil prices coefficient in the cointegrating vector (1.67) is significant at 1% and positively related with stock prices.

Table 8 presents the long-run cointegrating vectors, in every case the oil prices are positively related to the domestic stock market, we can explain this positive relationship as follows; the rise in world oil prices improves the trade balance, leading to a higher current account surplus and improving net foreign asset position. At the same time, higher oil prices tend to increase private disposable income and corporate profitability, increasing domestic demand and stock prices.

In Egypt and Oman the real exchange rates are positively related to stock price indices, while in Saudi Arabia it is negatively related. One explanations of the positive comovement between real exchange rates and stock market indexes in Egypt and Oman may be explained as follows: an increase in the oil prices conveys information about an improved performance of Egypt and Oman economy and implies an increase in their exports. That leads on the one hand, to an appreciation in their currencies and a rise in their real exchange rate, and on the other hand, to an increase in their domestic economic activity, which causes the local stock market to rise. Thus, a rise in real exchange rate may increase stock prices through its effect on economic activity.

In contrast, a negative relationship between stock prices and real exchange rates in Saudi Arabia can be explained as follows: The fall in the real exchange rate in Saudi Arabia make the Saudi stocks more attractive for the domestic investors[3] so they sell their foreign currency to buy the domestic stocks which leads to boost domestic stock price index. The real exchange rate continue falling because the nominal exchange rate is fixed against the dollar in that case the real

exchange rate can only change due to variations in the price levels, looking at the CPI variations between the Saudi CPI and US CPI (see figure 1) we can note that it is going downward in the entire sample period, for that reason the real exchange rate keep going downward whereas the domestic stock index going upward.

4.4 Persistence Profiles

After estimating the parameters of the VECM using the Quasi Maximum Likelihood approach described in section 4.3, we examine the persistence profiles following Pesaran and Shin (1996)[4]. As explained before, these profiles measure the speed through which a system of variables reverts back to the long-run equilibrium once it is shocked away. From Figures 2, 3, 4 and 5, the convergence to the long run equilibrium appears go faster in Egypt and Saudi Arabia than Oman and Kuwait. Specifically, on the one hand the system of variables given by SP, RER and OIL takes 17, 14 and 22 months to revert back to the long run equilibrium value in Egypt and Saudi Arabia, and in Oman; on the other hand, it takes 24 months for the Kuwait stock price to revert to its long run relationship with the oil price.

5. Summary and conclusion

This paper analyses the long-run interaction among stock prices and the real exchange rate in four oil exporting Middle East countries using cointegration analysis. We start from applying the reduced rank regression technique (equivalent to FIML) to estimate a VECM for the whole sample period. This exercise does not produce any evidence of cointegration between stock prices and real exchange rate in the countries under investigation. In line with Phylaktis and Ravazzolo (2005) we argue that this result may be due to the omission of an important variable, which acts as a conduit through which the two markets are linked. Therefore we incorporate additional variables to the system such as oil prices and a global market index (using the US stock prices as a proxy). Again the analysis that focuses on the full sample does not point to any evidence of cointegration. We therefore, shift attention to the possible existence of a regime shift and divide the sample into two subperiods according to the major oil price shock in March 1999 consequent to an OPEC meeting. Both the reduced rank regression technique and the Quasi Maximum Likelihood approach (robust to non normality and heteroscedasticity in the residuals of the VECM) suggest the existence, in the second sub period, of a long-run equilibrium relationship among the stock prices, the real exchange rates and oil prices for three countries: Egypt, Oman and Saudi Arabia. As for Kuwait both econometric techniques (employed to estimate the VECM coefficients) suggest the existence of a long-run equilibrium relationship between stock and oil prices. We find that, in each country, oil prices have a long-run positive effect on stock prices. We also found that, in Egypt and Oman the

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[3] Saudi government imposes a number of barriers preventing foreign investors from entering the Saudi stock market.

real exchange rates are positively related to stock price, while in Saudi Arabia it is negatively related. The persistence profiles show that the convergence to the long run equilibrium takes 17 and 14 months in Egypt and Saudi Arabia respectively, while it takes 22 and 24 moths in Oman and Kuwait.

Our results indicate that, firstly, the oil price is an important variable, which acts as a conduit through which the real exchange rates and domestic stock prices are linked, so that the oil-exporting countries as policy makers in OPEC should keep an eye on the effects of changes in oil prices levels on their own economies and stock markets. Secondly, government policy makers may play a role in influencing real exchange rates and stock prices through the use of oil prices, as the countries in our sample are among the biggest oil producers in the world. Thirdly, the relationship between real exchange rates and stock prices may be useful for portfolio managers interested in global asset allocation or investors trying to hedge against foreign exchange risk. Also the no cointegration among real exchange rates, stock prices and US stock market give the foreign investors an opportunity to benefit from that in diversifying their portfolio between the major stock markets like US stock exchange and the emerging markets in the Middle East region.

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[4] The persistence profiles have been obtained by a program written on Gauss.

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Appendix

Table (1): unit root tests:
For stock prices, real exchange rates, US stock prices and oil prices.
Panel (1): unit root tests for real exchange rates

	ADF				KPSS			
	levels		1st difference		levels		1st difference	
	No trend	trend	No trend	trend	No trend	trend	No trend	trend
Egypt	-0.54	-1.51	-9.10*	-9.06*	1.05*	0.23*	0.27	0.21
Kuwait	-2.40	-2.55	-13.07*	-13.13*	0.75*	0.27*	0.15	0.06
Oman	-0.90	-1.28	-8.62*	-8.62*	1.28*	0.15*	0.22	0.17
Saudi Arabia	0.62	-2.67	-10.83*	-10.87*	1.43*	0.17**	0.24	0.13
Panel (2): unit root tests for stock prices								
Egypt	0.024	-0.83	-8.98*	-9.05*	0.69*	0.24*	0.23	0.12
Kuwait	1.10	-0.27	-7.32*	-7.60*	0.88*	0.30*	0.53	0.17
Oman	-1.79	-1.91	-8.17*	-8.14*	0.32	0.23*	0.15	0.13
Saudi Arabia	0.29	-1.92	-7.80*	-7.93*	1.18*	0.30*	0.41	0.06
Panel (3): unit root tests for Oil prices and US stock prices								
Oil prices	-0.41	-2.05	-12.67*	-12.74*	1.11*	0.19*	0.17	0.05
US stock	-2.87	-2.10	-11.72*	-11.99*	0.73**	0.28*	0.55	0.18

- *, **, ** indicate Significance at 1%, 5% and 10% levels .respectively
- The 1%, 5% and 10% ADF critical values for the model without time trend are -3.479, -2.883 and -2.578 respectively, while the same critical values for the model with time trend are -4.027, -3.443 and -3.146 respectively.
- The 1%, 5% and 10% KPSS critical values for the model without time trend are 0.739, 0.463 and 0.347 respectively, while the same critical values for the model with time trend are 0.216, 0.146 and 0.119 respectively.
- The critical values for ADF tests are provided by Mackinnon (1996), while critical values for KPSS tests are provided by Kwiatkowski, Phillips, Schmidt, and Shin (1992).
- The table shows that all variables are not stationary in the levels but however, stationary in the first differences.

Table (2)
Johansen cointegration tests:
For stock prices and real exchange rates in the entire period

	H_0	H_1	Statistics
Egypt			
λ_{trace}	r =0	r>0	13.24
	r≤1	r>1	2.55
Kuwait			
λ_{trace}	r =0	r>0	14.85
	r≤1	r>1	6.02
Oman			
λ_{trace}	r =0	r>0	9.55
	r≤1	r>1	1.58
Saudi Arabia			
λ_{trace}	r =0	r>0	18.08
	r≤1	r>1	2.90

Sample periods: Egypt Dec. 1994 - Jun 2006, Kuwait Sep.1992-Feb. 2006, Oman Jun.1996-May 2006, Saudi Arabia Jan.1994-Apr.2006, if r denotes the number of significant vectors, then the Johansen trace statistics test the hypotheses of at most one and zero cointegrating vectors, respectively. The critical values introduced by Mackinnon, Haug and Michelis (1999) were used. The statistics include a finite sample correction (see Reimers (1992)). The table shows that there is no long-run relationship between stock prices and exchange rates in the all countries.

Table (3)
Multivariate cointegration results:
For stock prices, real exchange rates, US stock prices and oil prices in the entire period.

		Ho	H1	Statistics
Egypt		r =0	r>0	33.68
$SP^{Egy}, RER^{Egy}, P^{US}$	λ_{trace}	r≤1	r>1	18.81
		r≤2	r>2	6.21
SP^{Egy}, RER^{Egy}, OIL	λ_{trace}	r =0	r>0	27.45
		r≤1	r>1	11.79
		r≤2	r>2	1.22
Kuwait	λ_{trace}	r =0	r>0	39.70**
		r≤1	r>1	19.46
$SP^{Ku}, RER^{Ku}, P^{US}$		r≤2	r>2	0.97
	λ_{trace}	r =0	r>0	24.89
SP^{Ku}, RER^{Ku}, OIL		r≤1	r>1	8.79
		r≤2	r>2	2.28
Oman				
$SP^{Om}, RER^{Om}, P^{US}$	λ_{trace}	r =0	r>0	31.47
		r≤1	r>1	14.93
		r≤2	r>2	7.19
SP^{Om}, RER^{Om}, OIL	λ_{trace}	r =0	r>0	16.42
		r≤1	r>1	7.81
		r≤2	r>2	2.64
Saudi Arabia				
$SP^{Sa}, RER^{Sa}, P^{US}$	λ_{trace}	r =0	r>0	22.12
		r≤1	r>1	9.65
		r≤2	r>2	0.11
SP^{Sa}, RER^{Sa}, OIL	λ_{trace}	r =0	r>0	29.40
		r≤1	r>1	11.52
		r≤2	r>2	2.53

If r denotes the number of significant vectors, then the Johansen trace statistics test the hypotheses of at most two, one and zero cointegrating vectors, respectively. The critical values introduced by Mackinnon, Haug and Michelis (1999) were used. The statistics include a finite sample correction (see Reimers (1992)). *, **, ** indicate Significance at 1%, 5% and 10% levels respectively, the table shows there is no cointegration relationship among stock prices, real exchange rates and US stock prices, or among stock prices, real exchange rates and oil prices in the all countries with exception of Kuwait during the entire period.

Table (4)
Test of exclusion restriction for $SP^{Ku}, RER^{Ku}, P^{US}$ in Kuwait

Kuwait	P^{MEC}	S^{MEC}	P^{US}
$SP^{Ku}, RER^{KU}, P^{US}$	0.41	5.75**	3.45***

*, **, *** denote significance at 1%, 5% and 10% respectively, Figures are χ^2 (1) statistics.
The table shows that we can exclude the stock prices from the cointegration relationship.

Table (5):
Multivariate cointegration results of subperiods:
For stock prices, real exchange rates, US stock prices and oil prices in the two subperiods.

Panel (1): Cointegration between stock prices and real exchange rates

	Ho: r = 0	r≤1
Egypt		
Dec.1994- Feb.1999.	13.38	2.63
Mar.1999-Jun.2006.	17.99	6.99
Kuwait		
Sep. 1992- Feb. 1999	13.37	2.56
Mar.1999- Feb. 2006	15.62	5.18
Oman		
Jun. 1996- Feb. 1999	14.92	1.58
Mar. 1999- May. 2006	15.50	4.98
Saudi Arabia		
Jan. 1994- Feb. 1999	7.97	1.50
Mar. 1999- Apr. 2006	6.42	0.81

Panel (2): Multivariate cointegration among stock prices, real exchange rates and US stock prices

	Ho: r = 0	r≤1	r≤2
Egypt			
Dec.1994- Feb.1999.	32.66	10.26	2.76
Mar.1999-Jun.2006.	27.64	12.89	4.56
Kuwait			
Sep. 1992- Feb. 1999	32.83	11.19	2.94
Mar.1999- Feb. 2006	27.09	10.84	2.32
Oman			
Jun. 1996- Feb. 1999	24.27	9.86	2.84
Mar. 1999- May. 2006	30.39	15.14	5.82
Saudi Arabia			
Jan. 1994- Feb. 1999	29.67	14.42	3.27
Mar. 1999- Apr. 2006	30.25	14.21	3.67

Panel (3): Multivariate cointegration among stock prices, real exchange rates and oil prices

Egypt			
Dec.1994- Feb.1999.	21.08	10.05	2.09
Mar.1999-Jun.2006.	47.86*	19.32	8.37
Kuwait			
Sep. 1992- Feb. 1999	24.83	11.82	2.52
Mar.1999- Feb. 2006	42.78*	16.40	6.19
Oman			
Jun. 1996- Feb. 1999	30.08	10.72	2.02
Mar. 1999- May. 2006	51.24*	16.76	6.02
Saudi Arabia			
Jan. 1994- Feb. 1999	24.30	10.05	2.22
Mar. 1999- Apr. 2006.	30.31**	6.20	0.84

*, **, *** denote significance at 1%, 5% and 10% respectively, Figures are λ_{trace} statistics, there is no cointegration between stock prices and real exchange rates, also there is no cointegration between stock prices, real exchange rates and US stock prices in the all countries in the two sub periods, however, the table shows a cointegration relationship between stock prices, real exchange rates and oil prices in the all countries during the second sub period.

Table (6)
Test of exclusion restriction for stock prices, real exchange rates and oil prices.

	SP	*RER*	*OIL^{OPIC}*
Egypt	14.93*	3.68***	17.86*
Kuwait	8.65*	2.41	12.86*
Oman	18.29*	5.76**	21.94*
Saudi Arabia	18.47*	3.27***	15.41*

*, **, *** denote significance at 1%, 5% and 10% respectively, Figures are χ² (1) statistics. The cointegration relationship verified between stock prices, real exchange rates and oil prices in the all countries with exception of Kuwait.

Table (7)
Vector Error Correction results:
For stock prices, real exchange rates and oil prices in the entire period.

$$\Delta SP_t = \omega_1 \Delta SP_{t-1} + \eta_1 \Delta RER_{t-1} + \eta_2 \Delta OIL_{t-1} + \alpha_{11}(SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1})$$
$$+ \alpha_{21} D_1 (SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1}) + \varepsilon_t$$

ΔSP_t	α_{11}	α_{21}
Egypt	-0.014	0.032
Kuwait	-0.023	0.016
Oman	-0.019	0.035
Saudi Arabia	-0.023	0.031

$$\Delta RER_t = \eta_3 \Delta SP_{t-1} + \omega_2 \Delta RER_{t-1} + \eta_4 \Delta OIL_{t-1} + \alpha_{12}(SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1})$$
$$+ \alpha_{22} D_1 (SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1}) + v_t$$

ΔRER_t	α_{12}	α_{21}
Egypt	0.0003	0.013***
Kuwait	0.001	-0.001
Oman	-0.001	0.0006
Saudi Arabia	0.001	0.0002

$$\Delta OIL_t = \eta_5 \Delta SP_{t-1} + \eta_6 \Delta RER_{t-1} + \omega_3 \Delta OIL_{t-1} + \alpha_{13}(SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1})$$
$$+ \alpha_{23} D_1 (SP_{t-1} - \delta - \gamma_1 RER_{t-1} - \gamma_2 OIL_{t-1}) + \psi_t$$

ΔOIL_t	α_{13}	α_{23}
Egypt	-0.017	0.125*
Kuwait	0.016	-0.019
Oman	-0.032	0.252*
Saudi Arabia	0.008	0.189*

*, **, ** indicate Significance at 1%, 5% and 10% levels .respectively

Where SP_t is domestic stock prices, RER_t is real exchange rate, OIL_t is oil prices and D_1 is dummy variable takes value 0 before Mar. 1999, and value 1 from Mar. 1999, to capture the regime shift (second regime) based on the oil prices shock in March 1999 after OPEC meeting,, α_{1i} capture the long-run relationship in the first regime, while α_{2i} capture the long-run relationship in the second regime, γ_1 and γ_2 capture the cointegrating vector, ε_t, v_t and ψ_t are stationary random processes intended to capture other pertinent information not contained in lagged values of SP_t, RER_t and OIL_t .We estimate the system for each country using the full information maximum likelihood (FIML) approach to gain efficiency, we corrected the covariance matrix estimate to allow for more complex behaviour of the residuals, this option corrects the heteroscedasticity and serial correlation. The table shows that, there is long-run relationship between stock prices, real exchange rates and oil prices in the second regime captured by α_{23} in the all countries with exception of Kuwait. In the first regime there is no cointegration among stock prices, real exchange rates and oil prices, while there is a cointegration relationship among the three variables in the second regime in the all countries with exception of Kuwait.

Table (8)

The long-run cointegration vector for $SP_t = \delta + \gamma_1 RER_{t-1} + \gamma_2 OIL_{t-1}$

	δ	γ_1	γ_2
Egypt	-0.433	1.375*	2.339*
Oman	-0.374	3.571**	1.454*
Saudi Arabia	-3.354***	-4.375**	1.590*

*, **, *** denote significance at 1%, 5% and 10% respectively, where SP is the stock prices, δ is the constant, RER is the real exchange rate

and OIL is the oil prices. The real exchange rates and oil prices are significant in the cointegrating vector equation of the second regime.

Figure (1)
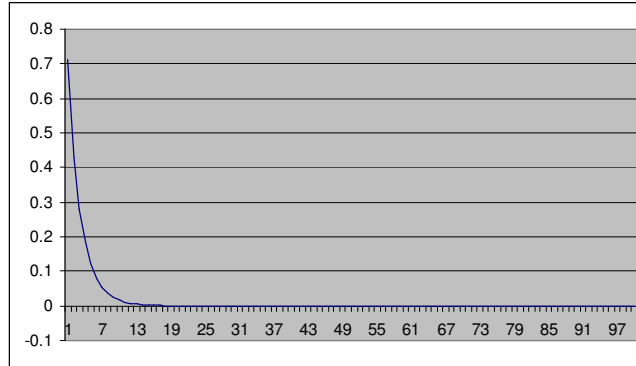**CPI variations between Saudi Arabia and USA**
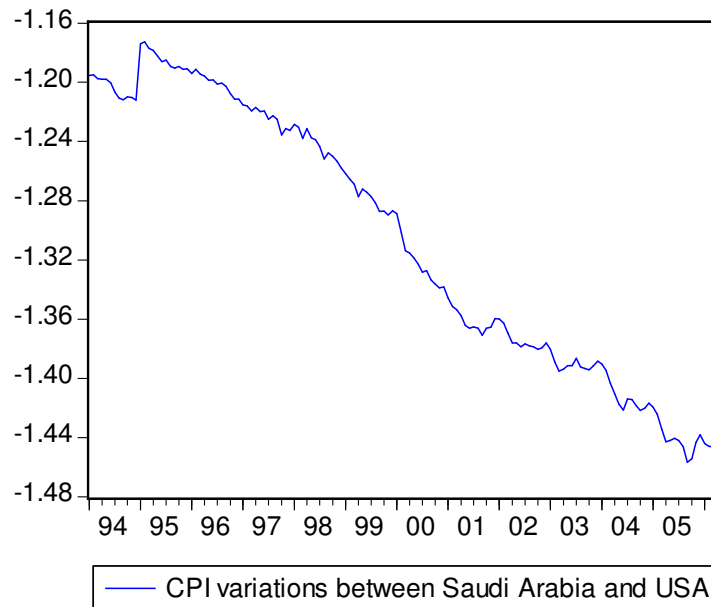
Figure (2)
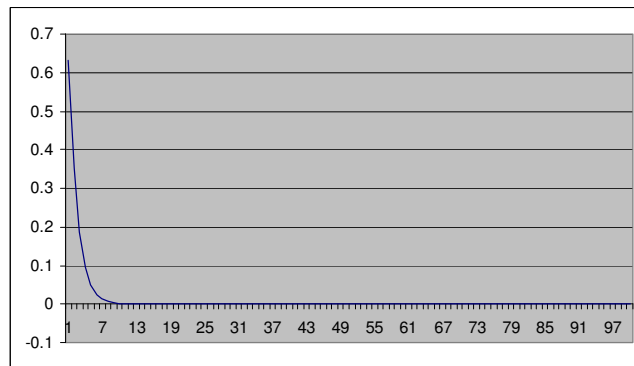**Persistence profiles for Egypt after the oil shock at March 1999**
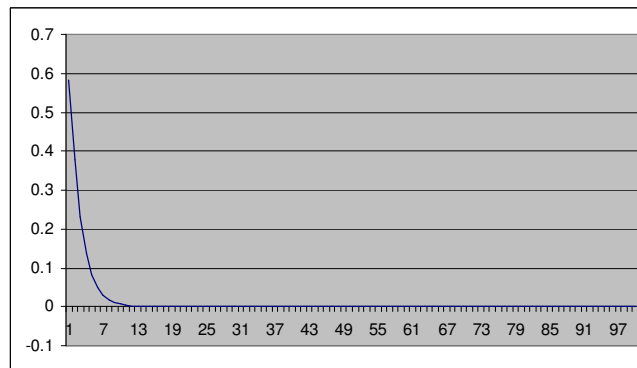
The system restored to the equilibrium after 17 months

Figure (3)
Persistence profiles for Oman after the oil shock at March 1999
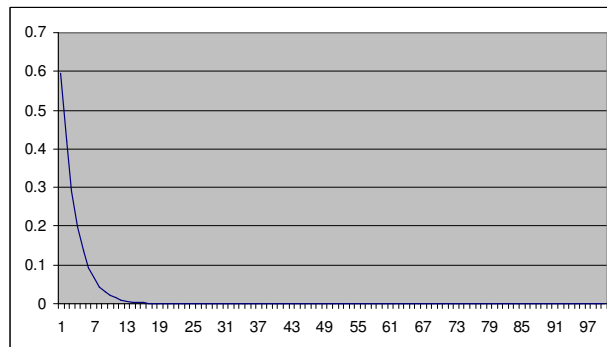

The system restored to the equilibrium after 22 months

Figure (4)
Persistence profiles for Saudi Arabia after the oil shock at March 1999

The system restored to the equilibrium after 14 months

Figure (5)
Persistence profiles for Kuwait after the oil shock at March 1999

The system restored to the equilibrium after 24 months

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