International CAPM and Oil price: Evidence from selected OPEC countries

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I. Introduction

This study contributes to the existing literature on dynamic international capital asset pricing model (ICAPM) allowing for smooth transition between different integration regimes and taking into account changes in oil price, for the major OPEC countries. In our model, expected returns may move from a perfectly-segmented regime to a perfectly-integrated one, or vice versa, depending on a certain number of national and international factors that are likely to drive the process of financial integration. The proposed model is developed in the spirit of that presented by Bekaert and Harvey (1995) and allows for dynamic conditional correlations between stock returns by using the multivariate DCC-GJR-GARCH model of Tse and Tsui (2002). This method also enables to test the relevance of dynamic measures of financial integration with respect to conditional correlations, which are frequently used in the literature when referring to the level of integration.

Our study differs from past ones in that we investigate the integration of oil-exporting countries into the world market using oil price as a common source of risk. In fact, oil-dependent economies are particularly exposed to large and volatile shocks associated with oil price fluctuations. The impact of these shocks is pervasive, encompassing the government's budget process and balance sheet, as well as private-sector production and consumption decisions (Burger et *al.* 2010). Volatility of oil price could undermine stability of countries whose economy highly depends on oil exports (Yang et *al.*, 2002). However, the negative impact of oil price instability can be counterbalanced by the (short-term) low elasticity of world oil demand, which guarantees income and wealth to OPEC countries. Therefore, in addition to world and local sources of risk which are commonly used in previous studies, as for instance in Bekaert and Harvey (1995), Hardouvelis et *al.* (2006), Carrieri et *al.* (2007), Arouri et *al.* (2012b), Guesmi and Nguyen (2011, 2014), we analyze the impact of oil as a potential driver of financial integration. Investigating market integration and oil risk in OPEC countries is an intriguing issue. On one side, OPEC countries, given their role of major world oil exporters, are subject to international macroeconomic trends that in turn drive oil market demand and therefore their supply decisions. However, beside these fundamentals drivers, oil price is also impacted by a context of progressive financialization of raw materials, which implies a comovement between oil and stock prices. Hence, if fundamentals would tend to foster OPEC market integration, oil financialization could bias this trend. Moreover, both market integration and oil financialization are very dynamic phenomena, changing over time, therefore a priori each of these forces can counteract the other one depending on their relative strength. The objective of this paper is therefore twofold: first, to test OPEC countries market integration, and secondly to analyse how the oil market reinforces or weakens this macroeconomic phenomenon in a time horizon which encompasses some important macro-economic events such as the financial and economic crisis. To this end, we bring together two streams of literature: on one hand, works on capital asset pricing, and on the other, models on the relationship between oil price and stock markets.

We investigate the links between financial integration and oil price in the four major oil-exporting countries, that is Saudi Arabia, Kuwait, Venezuela and United Arab Emirates. These countries represent 64% of the total OPEC offer[1] (OPEC, 2012) and also provide easy access to their stock market data (see Charts A in the Appendix). Venezuela is the most dense country in terms of population, but the less rich in terms of GDP per capita. All the four countries analyzed have a positive trade balance, due to oil export importance, this latter representing roughly 95% of the export value. The major producer and exporter is Saudi Arabia; followed by the United Arab Emirates, Kuwait and then Venezuela, whose oil proven reserves are slightly bigger than those of Saudi Arabia. Over the period we investigate, revenue of oil minus production costs represents between 40 and 60 percent of GDP in Kuwait.

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All the other countries remain below the 60% threshold, with the United Arab Emirates stabilizing around 20%. Oil revenue is rather cyclical and has declined in all countries during the 2009 financial crisis, due to falling demand. Oil consumption is also relatively high in Saudi Arabia compared to other countries, and in particular Kuwait. All these four OPEC countries are also well endowed in terms of gas production and reserves, but only the United Arab Emirates export it, therefore our analysis focuses on oil. The exchange rate with the dollar is quite homogeneous except for the case of Kuwait, whose currency is very weak with respect to the dollar.

On the financial side, stock market capitalization in percentage of the GDP has peaked in all countries between 2004 and 2007, reaching an historical maximum of nearly 200% in 2005 in Saudi Arabia. Venezuela lags behind the other countries, with a percentage being steadily below 10%. The number of companies listed in the stock exchange has been growing over time, up to a maximum of 210 in Kuwait, in 2010, followed by a slow decline until 2012. The United Arab Emirates has experienced an inflexion in the number of listed companies in 2001 and then a constant rise. The number of listed companies in Venezuela is around sixty on average, with a decline in the latest years of the sample.

Interestingly enough, in the time frame we analyze, our sample displays similar trends as for the dynamic pattern of oil revenues, stock market capitalization, number of listed companies, with some heterogeneity regarding the strength of oil dependence and the importance of financial markets in each of the economies under investigation. This allows us to study both common features and country-specific differences among the largest OPEC oil exporters.

Our analysis shows that, over the period August 2000 to June 2012, the integration degree of the four major OPEC oil-exporting countries varies widely through time. This phenomenon is explained by the interest rate spread, the level of market openness and the return of world market index. Although the general trend is towards increasing financial integration, oil-exporting countries seem to be still significantly segmented from the global market. A breakdown of the total risk premium confirms this finding, in that it underlines the dominant role of the local risk factor in explaining variations in the expected returns for the four countries studied. We find that the "revenue effect" of oil exports protects OPEC countries: oil risk represents a small fraction of the global risk for all the countries in our sample. The most exposed country is the United Arab Emirates, the biggest OPEC exporter, where oil risk represents 11% of total risk.

Overall, we show that conditional correlations underestimate the level of oil-exporting markets integration. At the same time, we find an increase in the level of market integration during crisis periods, and a rising trend as from the end 2009. This result echoes the conclusions reached by Arouri *et al.* (2012) and Awartani and Maghyereh (2013) for case of the Gulf Cooperation Council countries. Financial integration in crisis periods could be driven by the positive relationship between oil and stock markets in oil-exporting countries, as documented for instance by Arouri and Rault (2011) and Filis (2011).

Among the four countries analyzed, Venezuela exhibits some peculiar characteristics. Local risks play a more important role than the international ones, contrarily to the other oil-exporting countries. Venezuela economic integration is mainly driven by trade openness. Moreover, dynamic correlations of its stock market with world and oil are quite weak or not significant. These results illustrate the impact of oil in an emerging country where financial markets are still underdeveloped.

The paper is organized as follows. Section 2 presents the literature review related to our study. Section 3 describes the conditional version of the International Capital Asset Pricing Model, where world market risk, oil risk, currency risk and local risk are priced. The data is described in Section 4. Results are reported and discussed in Section 5. Section 6 briefly concludes.

II. Literature review

Our model relies on two different strand of literature. On one side, we refer to models that test the integration of emerging countries in the world market, using several version of the CAPM model. On the other, we add to the debate on the links between oil and stock markets.

As for the first strand of the literature, partial integration of emerging markets has first been investigated and tested using Stehle (1977)'s methodology.[2] Claessens and Rhee (1994) use this methodology to examine the risk-return linkages in 16 emerging markets over the period from 1989 to 1992. The empirical results obtained contradict the hypothesis of integration in most of the markets. By combining the two tests, the authors show that emerging countries under consideration (Brazil, Greece, South Korea, Mexico, Pakistan, the Philippines, Taiwan, and Thailand) were segmented from the world market.

In a different way, the empirical evidence documented in studies such as Stulz (1981), Errunza and Losq (1985), and Wheatley (1988) supports the partial segmentation hypothesis in light of significant effects of legal barriers on asset pricing rules in emerging markets.

Bekaert and Harvey (1995) agree with the idea of a partial integration, but are against a static measure of the degree of market integration. Accordingly, they develop an alternative model that combines the two extreme cases of perfect segmentation and integration so that at each point in time expected return on an asset (or a market) depends simultaneously on a global risk factor weighted by an integration coefficient, and a local risk factor weighted by a segmentation coefficient. This model is reduced to a domestic CAPM for strictly segmented markets, and to an international CAPM for perfectly integrated markets. Bekaert and Harvey (1995) apply their nested model to 12 emerging markets and show that their level of integration changes over time. On the same line, Guesmi and Nguyen (2011) study the dynamics of the global integration process of four emerging market regions into the world market with DCC-GARCH process. They find that the level of market integration varies widely over time and is satisfactorily explained by the degree of trade openness and variation in the US term premium. Even though market integration reaches fairly high values during several periods, and exhibits an upward trend towards the end of the estimation period, the emerging market regions under consideration still remain segmented from the world market.

None of the aforementioned models has studied the role of oil for specific countries. Nevertheless, oil represents a peculiar asset, in particular for emerging economies that export much of their natural resources. The literature so far has analyzed this phenomenon mainly by looking at the comovements between stock and oil markets. Most of this literature offers substantial evidence on the impact of oil on stock prices, putting forward a negative relationship between oil price and stock market returns.[3] For instance, Jones and Kaul (1996), using a standard cash-flow dividend valuation model, find a significant negative impact of oil price shocks on US and Canadian quarterly stock prices in the postwar period. Several models, relying on some variants of Vector Autoregressive Analysis, highlight similar findings (Park and Ratti 2008, Sadorsky 1999, Papapetrou, 2001).

Shifting from the study of comovements to volatility analysis, the most recent literature focuses on volatility spillovers between oil/industrial commodity and stock markets. Hammoudeh et *al.* (2004) investigate the spillover effects, day effects, and dynamic relationships among five daily S&P oil sector stock indices and five daily oil prices for the US oil markets using cointegration techniques as well as ARCH-type models. They find that there are two-way interactions between the S&P Oil Composite index, and oil spot and futures prices. Chiou and Lee (2009) examine the asymmetric effects of WTI daily oil prices on S&P 500 stock returns. Using the Autoregressive Conditional Jump Intensity model with expected, unexpected and negative unexpected oil price fluctuations, they find that high fluctuations in oil prices have asymmetric unexpected effects on stock returns. Malik and Ewing (2009) rely on bivariate GARCH models to estimate the volatility transmission between weekly WTI oil prices and equity sector returns and find evidence of spillover mechanisms. Choi and Hammoudeh (2010) and Creti et *al.* (2013) extend the time-varying correlations analysis between the prices of oil and several other commodities with stock market indexes. Both the studies show that commodity correlations increase since 2003, limiting hedging substitutability in portfolios, and become stronger after the 2008 financial crisis. Using Wavelet analysis, Roboredo and Rivera-Castro (2014) analyse the daily connection between oil price, the aggregate S&P 500, Dow Jones Stoxx Europe indexes and European industrial sectors. They conclude that oil price changes do not display a sizable effect on stock market returns in the period of pre-crisis.

Of particular interest for our study, Filis et *al.* (2011) analyze time-varying correlations between Brent oil prices and stock markets by differentiating oil-importing (USA, Germany, and the Netherlands) and oil-exporting (Canada, Mexico, and Brazil) countries. Using the multivariate DCC-GARCH approach, they find that the conditional variances of oil and stock prices do not differ for oil-importing and oil-exporting economies. Time-varying correlations depend on the origin of the oil shocks: the response from aggregate demand-side shocks is much greater than supply-side shocks originated by OPEC's production cuts. Two other papers document how peculier is the relationship between oil and stock markets in oil-importing and oil-exporting countries. Creti et al. (2014) apply the frequency approach of the evolutionary co-spectral analysis allowing a time-varying dynamic correlation measure between the stock market index and the oil price series. They find that interdependence between the oil price and the stock market is stronger in exporters' markets than in importers' markets. Besides, they conclude that oil does not play a role in counteracting the changing returns of a portfolio of stocks in any of the countries studied. To measure volatility spillover between oil and stock markets, Guesmi and Fattoum (2014) apply the multivariate GJR- DCC-GARCH models. They show that oil price shocks in periods of global turmoil or during global business cycle fluctuations (downturn or expansion) appear to have a significant impact on the relationship between oil and stock market prices, both in oil- importing and oil-exporting countries. In exporting countries, their analysis unveils higher and multiple peaks, which coincide with major events (like the 2008 oil price crisis). In the case of importing countries, the pattern of interaction is far smoother compared to exporting countries.

The relationship between stock markets and oil prices has also been analyzed for the specific case of Gulf Cooperation Council (or GCC) countries. Results seem quite controversial and vary with the sample selection and the time span under investigation. Some studies document positive co-movements,[4] others do not find significant relationships,[5] or asymmetric ones.[6]

To our knowledge, the present study is the first to analyze partial financial integration and the impact of oil as risk factor in a dynamic setting for the 4 major OPEC oil exporters, which include an emerging country as Venezuela, and Middle East countries such as United Arab Emirates, Saudi Arabia and Kuwait. Moreover, on the methodological viewpoint, we add to the previous literature as we estimate the time-varying conditional correlation relationships among different variables by employing the multivariate DCC-GJR-GARCH framework of of Tse and Tsui (2002). The DCC-GJR-GARCH framework has the following advantages: (i) it nests other GARCH process that exists in the literature; (ii) it is relatively parsimonious compared with other multivariate models found in the literature. Additionally, this technique is suitable to account for asymmetries, which are typically observed in stock markets and oil prices.

III. Empirical strategy

Our empirical strategy consists of considering global and local factors (Bekaert and Harvey, 1995, Hardouvelis et *al.*, 2006, Carrieri et *al.*, 2007, Guesmi and Nguyen,

2011) for market integration, oil risk Filis et *al.* (2011), and exchange rate risk (Adler and Dumas, 1988; Carrieri et *al.*, 2007; Tai, 2007).

The excess return $E_{t-1}(R_{it})$ issued in country i, conditionally on a set of information available to investors up to time *t*-1 is given by:

$$E_{t-1}(R_{it}) = \Omega_{t-1}^{i}\Big[\delta_{m,t-1}Cov_{t-1}(R_{it}, R_{mt}) + \delta_{p,t-1}Cov_{t-1}(R_{it}, R_{pt}) + \sum_{k=1}^{L}\delta_{k,t-1}Cov_{t-1}(R_{it}, R_{kt})\Big] + (1-\Omega_{t-1}^{i})\delta_{i,t-1}Var_{t-1}(R_{it}) \quad (1)$$

where $E_{t-1}(R_{it})$ is the excess return issued in country i, conditionally on a set of information available to investors up to time t-1. Ω_{t-1}^{i} is the conditional probability of transition between segmentation and integration states, which falls within the interval [0,1] and can be thus interpreted as a conditional measure of integration of market i into the world market. Cov_{t-1} is the conditional covariance between the security r's return and the returns R_{mt} on the world market portfolio. The variable δ_{mt-1} refers to the conditionally expected world price of covariance risk. The second term $\delta_{p,t-1}Cov_{t-1}(R_{it}, R_{pt})$ has a structure similar the first one in the RHS of equation (1): it takes into account the conditional covariance between the security r return and the rewards for oil prices risk on the world market portfolio, that is R_{pt}. In the third term, the subindex *k* denotes the currencies of four countries that we consider: Emirates United Arab, Saudi Arabia, Kuwait, and Venezuela. This term includes the covariance with the return on the exchange rate of the currency of country k, denoted by the variable R_{kt}, against the currency of the reference country; $\delta_{k,t-1}$ expresses the expected price of the exchange rate risk for currency k, conditionally on the information available up to t-1. L is the number of markets included in the sample, that is 4. We consider the U.S. as the reference country and use bilateral real exchange rates to measure the exchange value of local currencies against the U.S. dollar. Finally, $Var_{t-1}(R_{it})$ is the conditional variance of national market return.

Equation (1) can be written by decomposing the risk premium. More specifically, the total risk market premium (TRM) can be broken down into two components. The first component, called a global risk market premium (GRM), consists of world market risk premium (WRM), oil risk premium (ORM) and exchange rate risk premium (ERM). It is weighted by the level of integration Ω_{t-1}^{i}. The second one, referred to as the local risk premium (LRM), is weighted by the level of market segmentation $(1-\Omega_{t-1}^{i})$.

$$\begin{cases} TRM = GRM + LRM = WRM + ORM + ERM + LRM \\ GRM = \Omega_{t-1}^{i}\begin{bmatrix} \delta_{m,t-1}Cov_{t-1}(R_{it}, R_{mt}) \\ +\delta_{p,t-1}Cov_{t-1}(R_{it}, R_{pt}) \\ +\sum_{k=1}^{L}\delta_{k,t-1}Cov_{t-1}(R_{it}, R_{kt}) \end{bmatrix} \\ LRM = (1-\Omega_{t-1}^{i})\delta_{i,t-1}Var_{t-1}(R_{it}) \end{cases} \quad (2)$$

Let $X_{m,t-1}$, $X_{i,t-1}$ and $F_{i,t-1}$ denote respectively the vector of international information variables, the vector of local information variables and the vector of integration variables, available at time (t-1). The expected prices of risk and the dynamics of market integration can then be modelled as

$$\begin{cases} \delta_{k,t-1} = \delta_k' X_{m,t-1} \\ \delta_{i,t-1} = e^{(\gamma_i' X_{i,t-1})} \\ \delta_{m,t-1} = e^{(\delta_m' X_{m,t-1})} \\ \Omega_{t-1}^{i} = e^{-|g_i' F_{i,t-1}|} \end{cases} \quad (3)$$

Under the hypothesis of rational expectations, the econometric specification of equation (1) is characterized by the following system of equations:

$$\begin{aligned} \tilde{r}_{r,t}^{c} &= \delta_{t-1}^{r}h_{rr,t} + \varepsilon_{r,t} \\ \tilde{r}_{k,t}^{c} &= \delta_{t-1}^{k}h_{kk,t} + \varepsilon_{k,t} \\ \tilde{r}_{p,t}^{c} &= \delta_{t-1}^{k}h_{pp,t} + \varepsilon_{p,t} \\ \tilde{r}_{i,t}^{c} &= \Omega_{t-1}^{i}\left(\delta_{t-1}^{r}h_{ir,t} + \delta_{t-1}^{p}h_{ip,t} + \sum_{k=1}^{l}\delta_{t-1}^{k}h_{ik,t}\right) \\ &\quad + (1-\Omega_{i-1}^{i})\delta_{i,t-1}^{d}h_{ii,t} + \varepsilon_{i,t};\ \varepsilon_t \,|\, \psi_{t-1} \sim N(0, H_t) \end{aligned} \quad (4)$$

i = E (United Arab Emirates), S (Saudi Arabia), K (Kuweit), and V (Venezuela).

where $\tilde{r}_{r,t}^{c}$, $\tilde{r}_{k,t}^{c}$, $\tilde{r}_{p,t}^{c}$ and $\tilde{r}_{i,t}^{c}$ refer to the (10×1) vector of excess returns on regional market, exchange rate, oil price and local market respectively. The variables r_{it} are assumed to be normally distributed and expressed in dollars. $h_{ir,t}$, $h_{ik,t}$, $h_{ip,t}$ and $h_{ii,t}$ are, respectively, the conditional covariance between market i's return and regional market return, the conditional covariance between market i's return and exchange rate k's return, the conditional covariance between market i's return and oil price and the conditional variance of market i, all being issued from the (10×10) variance-covariance matrix H_t (5 equations for excess returns on world market, 4 real exchange rate indices and the Brent crude oil index). We model H_t by using a multivariate DCC-GARCH model as described in Engle (2002) with $H_t = D_t R_t D_t'$. R_t is the (10×10) symmetric matrix of dynamic conditional correlations. D_t is a diagonal matrix of conditional standard deviations for each of the return series, obtained from estimating a univariate GJR-GARCH process of Glosten et *al.* (1993) in the equation of variance expressed as

$$h_{ii,t} = w_i + \alpha_i \varepsilon_{ii,t-1}^2 + \beta_i h_{ii,t-1} + \gamma_i I_{i,t} \varepsilon_{ii,t-1}^2 \qquad (5)$$

where persistence is measured by the coefficients β_i and the indicator variables $I_{i,t}$ captures asymmetry in the estimate of coefficients γ_i. A negative value of γ_i implies that negative residuals increase the variance more than positive residuals.

Following Bollerslev and Wooldridge (1992), the parameters are estimated by quasi-maximum likelihood (QML), assuming conditional normally distributed errors. Given the highly nonlinear structure of the model and the large number of parameters involved in estimation, we estimate the model in two steps. We first estimate a subsystem of five equations for excess returns on world market, four real exchange rate indices and the Brent crude oil index. This stage allows us to obtain the conditional variance of world market, real exchange rate indices and Brent crude oil index, their conditional covariance's as well as the prices of world market, Brent crude oil index and exchange rate risks. In the second stage, we estimate the price of local market risk and the time-varying level of integration for each emerging market in the system (3). This strategy is also used by Bekaert and Harvey (1995), Hardouvelis et *al.* (2006) and Guesmi and Nguyen (2011; 2014).

IV. Data

Our dataset consists of monthly time series related to stock market indices, exchange rates, as well as global, regional and local economic and financial variables. The use of monthly frequency is a common feature among the studies focusing on financial market integration which is a relatively long-run phenomenon. Using monthly data thus allows us not only to have sufficient data points to make reliable statistical inferences, but also to compare our results with those of previous studies. Also, as noted by Harvey (1991), monthly data help reduce potential biases that may arise from emerging market imperfections such as the bid-ask effect and non-synchronous trading days. Data are extracted from MSCI DataStream International.

We can summarize the variables we use as follows:

- *Global instrumental variables*: they are used to explain changes in the prices of international markets, Brent crude oil index and foreign exchange risk. We choose the following variables: the world market portfolio (Morgan Stanley Capital International-MSCI World index) in excess of the 30-day Eurodollar interest rate which is denoted by (IRENT), the variation in the US term premium (USTP) and the return on the S&P's 500 stock market index (RSP).
- *Local instrumental variables:* They are used to infer the changes in the local price of risk, include the return on the local stock market index in excess of the 30-day Eurodollar interest rate (LRENT), and the variation in the trade-weighted average local inflation rate (INFRT).[7]
- *Financial market integration factors:* A set of candidate factors that cause the movements in the degree of regional financial integration is chosen based on the findings of previous studies (e.g., Bekaert and Harvey, 1997, 2000; Bhattacharya and Daouk, 2002).[8]

Since there is a numerical convergence problem at the estimation stage when we have more than three unknown parameters, only three information variables are used to explain the changes in financial integration measure: the interest rate spread (SWAY), the return of world market index (RENT) and the level of market openness (OPEN) of the market under consideration. The specification with these three factors provides best fit to the data as witnessed by the AIC, BIC and Log-likelihood criteria.

Accordingly, the degree of market openness can be a potential factor in promoting financial integration.

The time-varying degree of market integration is thus modeled as follows:[9]

$$\Omega_{t-1}^i = e^{-\left|\alpha_0 + \alpha_1 SWAY_{i,t-1} + \alpha_2 OPEN_{i,t-1} + \alpha_3 RENT_{i,t-1}\right|}.$$

IV.2. MAIN STATISTICS AND STOCHASTIC PROPERTIES

Table 2 reports the main statistics of return series for the stock market, real exchange rate and Brent crude oil indices for all the countries in the sample. All the series depart from normality conditions and conditional heteroscedasticity. The United Arab Emirates stock Market is the most volatile during the studied period in terms of standard deviation (12.67%), while Kuwait is the least volatile (5.96%). The skewness coefficients are positive for United Arab Emirates and Venezuela. They are significantly different from zero for almost all markets, indicating the presence of asymmetry in the return distribution. In addition, all the return series are characterized by a kurtosis coefficient statistically significant and greater than 3, and thus have fatter tails than those of a normal distribution.

Engle (1982)'s test for the 1st order of conditional heteroscedasticity is also performed and we cannot reject the hypothesis of no ARCH effects for all return series considered. This result motivates our choice of GARCH modeling approach for conditional variance processes.

V. Results

V.1. PRICES OF WORLD MARKET, OIL PRICE AND FOREIGN EXCHANGE RISKS

As discussed above, we first estimate the system (4) for excess returns on world market, Brent crude oil and returns on real exchange rates. The estimation results and residual diagnosis are reported in Table 3. Panel A and B present the estimated parameters for the price of oil and world risk respectively. The price of oil risk is negatively correlated with IRENT and positively with RSP (both coefficient being significant at 1% level), confirming the co-movement between oil and stock markets, on one side, and diversification opportunities, on the other. Results of the Wald tests of nullity and constancy restrictions on the price of oil price risk, reported in Panel D, clearly rejects the null hypotheses that the latter is equal to zero and constant, consistently with the literature (Filis and *al.*, 2011).

The price of world market risk also presents a negative relationship both with IRENT and RSP (in the two cases, the coefficient are significant at 1% level). The price of world market therefore increases as capital and stock markets are less efficient. Results of the Wald tests of nullity and constancy restrictions on the price of world market risk, reported in Panel D, clearly reject the null hypotheses that the latter is equal to zero and constant, which confirms findings of previous studies, such as Bekaert and Harvey (1995), and Carrieri et *al.* (2007).

Turning out to the analysis of oil-exporting countries (Panel C), the coefficients associated with the S&P's 500 index, and the coefficients associated with the US term premium have insignificant effect on the evolution of the price of exchange rate risk. This latter is negatively affected by the Eurodollar interest rate IRENT (at 1% level). Venezuela presents a specific pattern: its exchange rate risk is explained (at 1%level) by the US term premium, as the Venezuelan economy is strongly dollarized, and positively with the stock market, indicating a likely relationship between the exchange rate and the stock markets, perhaps induced by the importance of oil exports in this country with respect to all other economic activities.

We calculate the Wald test to investigate the null hypotheses that the price of exchange risk is zero and constant respectively. The obtained results, reported in Panel D and E of Table 3, indicate rejection of these null hypotheses at the 1% level for all markets considered. These findings are coherent with those of previous studies, including Carrieri et *al.* (2007) and Tai (2007), in that the exchange rate risk is a relevant factor of risk for asset pricing in emerging markets, and that they change over time. We finally examine the hypotheses of joint nullity and constancy of all the four prices of exchange rate risk and find evidence against their validity.

Panel F of Table 2 presents a detailed analysis of the model-standardized residuals. Normality is rejected at the 1% level for four currency returns. The departure from normality decreases substantially for world returns, but it remains significant at the 1% level. The Ljung-Box test reveals that the first-order autocorrelations of the standardized residuals are no longer significant, and their values decrease substantially. The Engle (1982)'s test for conditional heteroscedasticity of the standardized residuals indicates that ARCH effects no longer exist in all cases, thus revealing the suitability of the GARCH approach. Although all the coefficients in the multivariate DCC-GJR-GARCH process for conditional variances and covariance are not reported, most of them are significant at the 1% and 5% levels. This result confirms the time-variation in both prices and quantities of risk as we have found based on Wald tests.

Figure 1 to 3 represent dynamic evolution of exchange risk prices for the countries under investigation, world market and oil risk, both for the estimates and the Hodrick–Prescott filtered values.[9] These latter are substantially constant, with variations amplifying in the last three years for all countries but Venezuela, which has recently achieved a strong Real Effective Exchange Rate (REER) stability (World Bank, 2012). Filtered values of world and oil risk prices remain stable over the sample, even though oil risk price estimates show skyrocketing values after 2008.

V.2. TIME-VARYING WORLD MARKET INTEGRATION OF STOCK MARKET

Table 4 reports the descriptive statistics of our time-varying measure of market integration, which is obtained by estimating the whole system (4), while imposing the estimates from the subsystem for world, oil prices and exchange rate returns.[10]

Figure 1 depicts the time-paths of financial integration measure (estimates and Hodrick–Prescott filtered values), showing a cycle with an upward trend starting in 2007 and reaching its maximum in 2012. The degree of international integration differs from one market to another, reflecting the heterogeneity of the economic and monetary policies. Stock markets of the countries in the sample are well integrated into world markets since the integration measures average between 0.712 (Venezuela) and 0.847 (Kuwait). Kuwait, Saudi Arabia and Venezuela integration levels depend on openness and the interest rate spread (at 1% level), this latter variable affecting also market integration of United Arab Emirates (at the same significance level), together with the return of world market index (significant at 5% level). Finally, the statistical significance of the coefficient associated with the degree of trade openness suggests that this is the most important determinant of Venezuela degree of market integration.

The observed changes in the level of regional integration are crucial for the markets under consideration, as increased financial integration may also induce adverse effects, beyond its associated benefits (i.e. greater risk diversification, better capital allocation and higher economic growth potential).[11] Furthermore, the level of international integration serves as the basis of all financial issues relating to asset pricing, determination of market risk premium, and oil price as well as policies for economic cooperation between oil-exporting and oil-importing countries.

V.3. FORMATION OF TOTAL RISK PREMIUM AND MARKET INTEGRATION

Table 5 reports average values of the total, the global, oil and local risk premiums. The two-sided Student-t test indicates that global, oil and local risk premiums are significantly different from zero at the 1% level for all the markets considered. The United Arab Emirates has the highest total risk premium (9.277%), followed by Venezuela (8.362%), Saudi Arabia (7.339%), and Kuwait

(6.132%). World risk premiums are on average greater than local premiums for all markets. The share of local risk premium over the total risk premium ranges from 40% for United Arab Emirates to 88% for Saudi Arabia. Oil risk represents a small part of the global risk for all the countries. The most exposed country is the largest exporter, United Arab Emirates (0.988%). Oil risk represents however only 10% of its total risk.

Looking at the dynamic evolution of market integration, Table 6 presents the results of the DCC-GJR-GARCH estimation between stock markets of the 4 countries and the world market, whose evolution is depicted in Figure 2. The mean correlation is negative, meaning that in these countries stock market can be countercyclical. These results suggest that, in general, conditional correlations overestimate the degree of global integration of stock markets with the world one during certain periods, and underestimate it during others. Conditional correlations also appear to be less stable than the integration measure. The average values of dynamic integration exceed those of market conditional correlation indices for the United Arab Emirates (0.774 versus 0.052), and Venezuela (0.683 versus -0.080).

Overall, our results show that on average conditional correlations underestimate the level of oil-exporting countries market integration. At the same time, we find an increase in the level of market integration during crisis periods, and a rising trend at the end 2009. These results confirm the findings of several recent papers on integration and suggest that oil exports do not counteract general trends observed for other emerging economies.[12]

■ VI. Conclusion

The purpose of this paper is to study the dynamics of the global integration process of stock markets of the biggest OPEC exporters into the world market, while taking into account the role of oil price as a potential source of risk. We develop an international capital asset pricing model suitable for partially integrated markets, with departs from purchasing power parity, in line with Bekaert and Harvey (1995)'s regime-switching approach. We thus explain time-variations in expected returns on stock market indices. In its fully functional form, the model allows the market integration measure as well as global, local and oil risk premiums to vary through time. Future research however should take into account the impact of institutional reforms aimed at removing trade barriers which affect capital movements.

We find that the level of market integration of the four major OPEC oil-exporting countries (United Arab Emirates, Saudi Arabia, Kuwait and Venezuela) varies widely over time and depends by the degree of trade openness and variation in the US term premium. Even though integration reaches fairly high values during several periods, and exhibits an upward trend towards the end of the estimation period, the stock markets under consideration still remain segmented from the world market. These results suggest that diversification into OPEC market assets continue to produce substantial profits and that the asset pricing rules reflects a state of partial integration. Venezuela is the less integrated country, given that the development of the oil sector is deeper than the growth of its financial activities and stock markets. Oil price risk does not affect to a high extent OPEC countries, which remain protected by the earnings due to oil export, still representing the major source of their wealth. ■

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1 According to OPEC (2012), for the latest available statistics, in 2006, production allocated to these countries is respectively (in 1,000 barrel/day): Saudi Arabia (9,099), Venezuela (2,223), United Arab Emirates (2,444) and Kuweit (2,247). Table 1 in the Appendix illustrates the main 2011 facts and figures relative to these countries.

2 Stehle (1977) derives both a pricing model for an integrated state and a model for a segmented state. The first model requires that an asset's expected return is a function of the global systematic risk, and the "adjusted" local systematic risk, which corresponds to the uncorrelated portion between the national and world market portfolios. Under the null hypothesis of perfect integration, the local beta should be zero. The pricing model in case of segmented markets is constructed in a similar fashion, except that the roles of the local and global systematic risks are reversed.

3 For a detailed review of the literature on this topic, see Filis *et al.* (2011).

4 Arouri and Rault (2011) study the impact of oil prices shocks on GCC countries, with a boostrap panel cointegration model, and provide evidence that the stock market performance of the Gulf markets is affected by positive oil price shocks. Similar results were also documented by Bashar (2006). Hammoudeh and Aleisa (2004) ind spillovers from oil markets to the stock indices of oil-exporting countries, including Bahrain, Indonesia, Mexico and Venezuela.

5 Al Janabi *et al.* (2010) use bootstrap test for causality to study non-normal financial data with time-varying volatility. They conclude that oil prices do not tend to affect these stock markets and thus oil prices cannot be used as predictors for the GCC stock markets. Hammoudeh *et al.* (2004) examines the long-run interaction between five GCC stock markets (Bahrain, Kuwait, Oman, Saudi Arabia, and UAE) and three global factors (oil spot price indices, US 3-month Treasury bill rate, and S&P index). They apply cointegration tests and VEC model to weekly data from February 1994 to December 2004. The authors find that oil price movements do not have direct effects on any GCC stock markets.

6 Arouri *et al.* (2012a) study six GCC and, by using a wide range of cointegration techniques, they find that the relationship between oil and stock-prices is positive and evident in the short-term, but not in the long-term. When causality exists, it runs from oil prices to stock markets in most cases. The effects of oil price changes on stock returns in the GCC countries are asymmetric: negative oil price changes have larger impact on stock returns than positive oil price changes. Asymmetric effects are also found by Awartani and Maghyereh (2013), who investigate the dynamic spillover of return and volatility between oil and equities in the GCC countries during the period 2004 to 2012.

7 See previous studies of Bekaert and Harvey (1997, 2000), Bhattacharya and Daouk (2002) and Guesmi and Nguyen (2011, 2014).

8 It encompasses the degree of market openness, the development of the local stock market, industrial production, inflation rate, the short-term interest rate, the interest rate spread, the long-term interest rate, the exchange rate volatility, the economic growth rate, the current account deficit, the local and regional market returns, the local market dividend yield, the regional market dividend yield, the world interest rate, the world market return and the world market dividend yield. It is expected that these factors, being important determinants of cross-border investment flows and international market convergence, have an explanatory power for the non-monotonous process of financial integration. Notice that the currency exchange rate is a proxy for market openness, that is one of the driver of market integration, this latter being one part of our investigation purpose. Oil price is quoted in dollar is used in our analysis as a source of risk as it can be correlated to the stock market.

9 The Hodrick–Prescott filter is a mathematical tool to separate the cyclical component of a time series from raw data. It is used to obtain a smoothed-curve representation of a time series.

10 Most of the estimates of the individual coefficients on the local information variables are significant, which suggests time-variation in the local prices of risk. They are available under request to the corresponding author.

11 For example, Levine and Zervos (1996), Stiglitz (2002), and Bekaert et al. (2002), among others, document the increased financial instability as an important threat for emerging markets, due to external shocks and disparities in trade with developed countries.

12 Longin and Solnik (1995) show that correlations of international stock markets vary over time, while Ang and Bekaert (1999) and Guesmi and Nguyen (2011) detect an increase in correlations during periods of falling markets and a reduction in the correlation in periods of rising markets. Other studies document that correlations between international stock markets are higher during crisis periods than during normal periods (King and Wadhwani, 1990; Calvo and Reinhart, 1995). Pukthuanthong and Roll (2009) demonstrate formally that the correlation among index returns is an imperfect measure of financial integration. Carrieri et al. (2007) and Guesmi and Nguyen (2011) also conclude that the correlation of an emerging market's index returns with the world market significantly underestimates the integration index, whose estimation is conditional on real economic activities.

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Charts A. Financial indicators in the OPEC countries sample

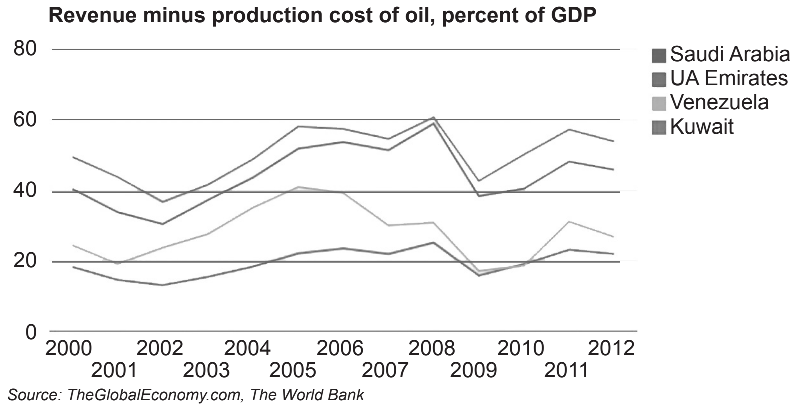
Table 1a. Facts and Figures of the major OPEC countries

Source: OPEC (2012)

	United Arab Emirates	Kuwait	Venezuela	Saudi Arabia	OPEC
Population mil inhab	4.85	9.70	29.07	28.17	415.73
Land area 1,000sq Km	84	18	918	2,160	11,859
GDP per capita $	74,235	47,787	10,664	20,506	6,980
GDP at market prices billion$	360.14	176.67	315.84	577.60	2905,52
Value of exports billion $	252.58	103.49	92	380.09	1,418
Value of import billion $	210.94	26.27	48.44	129.02	721,43
Current account balance billion $	33.31	76.37	27.1	141.06	453.71
Value of oil export billion $	104.64	96.72	88.13	318.48	1,076.27
Proven reserves billion barrels	97.50	101.60	297.7	265.41	1,199.31
Nat gas reserves billion cubic meters	6,091	1,784	6,629	8,161	96,020
Crude oil production 1,000 barrel/day	2,565	2,859	2,81	9,311	30.122
Nat. gas production billion cubic meters	52.31	13.63	20.77	82.26	618.14
Crude oil consumption 1,000 barrel/day	618	361	742	2,714	8.261
Crude oil exports 1,000 barrel/day	2,330	1,818	1,553	7,218	28,457
Natural Gas exports 1,000 barrel/day	5,18	–	-	-	209.818
Exchange rate *national currency/$*	3,7	0.3	4,3	3,8	-

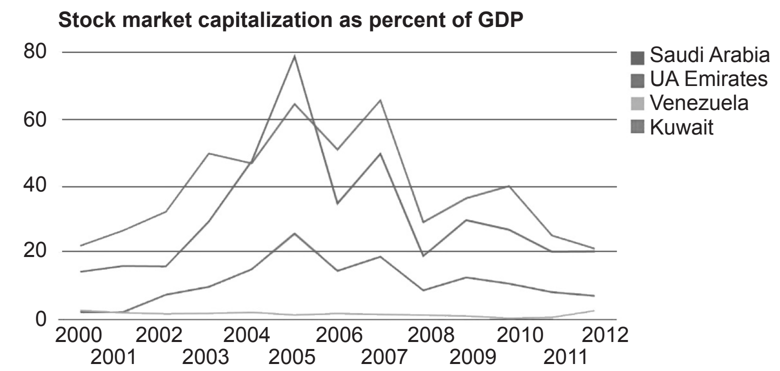
Table 1b. Facts and Figures of the major OPEC countries

Source: The World Bank (2014)



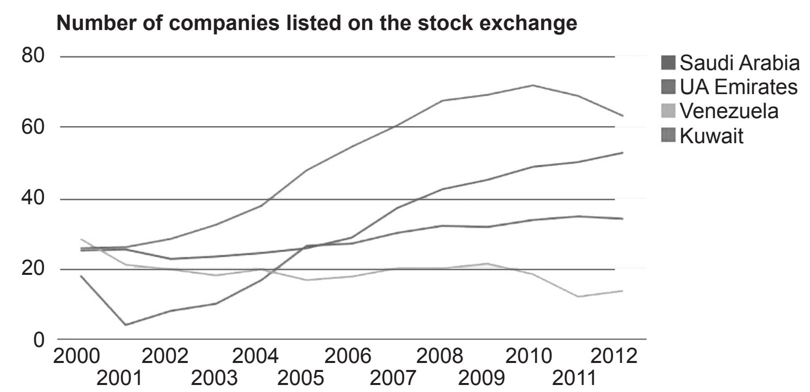
Charts A. Financial indicators in the OPEC countries sample (continued)

Table 1b. Facts and Figures of the major OPEC countries (continued)



Source: TheGlobalEconomy.com, The World Bank

Table 1b. Facts and Figures of the major OPEC countries (continued)



Source: TheGlobalEconomy.com, The World Bank

Charts A. Financial indicators in the OPEC countries sample (continued)

Table 2. Descriptive statistics of return series

	Mean	Std. dev.	Skewness	Kurtosis	ARCH(6)
Panel A: Returns on real exchange rate indices					
United Arab Emirates	-0,0004	0,000884	0,4831360	8,7863850	22.274+++
Kuwait	-0,0019470	0,0094170	0,6029290	5,5475430	32.284+++
Saudi Arabia	-0,0004810	0,0061420	-0,7359380	4,2873720	21.981++
Venezuela	-0,0042410	0,0422160	3,0744430	13,9972800	19.326++
Panel B: Excess returns on stock market indices					
United Arab Emirates	0.020	0.023	0.128	3.454	22.245++
Kuwait	0.025	0.019	-0.244	3.887	20.114+++
Saudi Arabia	0.013	0.023	-0.852	4.998	25.910+++
Venezuela	0.025	0.075	0.549	6.540	19.224+++
World	0.017	0.067	-0.565	8.894	23.194+++
Oil Prices	0.018	0.064	-1.092	6.293	27.106+++

Notes: ARCH(1) is the empirical statistics of the Engle (1982)'s test for the 6^{th} order of ARCH effects. $^{+}$, $^{++}$, and $^{+++}$ indicate that the null hypothesis of no ARCH effects is rejected at the 10%, 5% and 1% levels respectively.

Table 3. Prices of world market, real exchange rate and oil risks

	Constant	IRENT	USTP	RSP
Panel A: Price of oil risk				
Oil	0.026*** (0.015)	-0.203*** (0.001)	0.006 (0.052)	0.234*** (0.063)
Panel B: Price of world market risk				
World	0.0130*** (0.011)	-0.112*** (0.078)	-0.023 (0.022)	-0.788*** (0.065)
Panel C: Price of exchange rate risk				
United Arab Emirates	0.044*** (0.001)	-0.289*** (0.072)	-0.189*** (0.011)	0.244 (0.316)
Kuwait	0.031 (0.022)	-0.524*** (0.046)	-0.0324 (0.023)	0.245 (0.562)
Saudi Arabia	0.022** (0.010)	-0.561* (0.200)	-0.011 (0.034)	0.333 (0.400)
Venezuela	0.032 (0.011)	-0.455 (0.287)	-0.024*** (0.0010)	0.224*** (0.0222)
Panel D: Specification test of oil and world price risk				
		χ^2	*df*	*p-value*
Is the world risk price null? – H_0: $\lambda_i = 0$		20.437***	4	0.000
Is the world risk price constant? – H_0 : $\lambda_i = 1$		500.661***	3	0.000
Is the oil risk price null? – H_0: $\lambda_i = 0$		345.222***	4	0.000
Is the oil risk price constant? – H_0 : $\lambda_i = 1$		568.050***	3	0.000
Panel E – Specification test of prices of exchange rate risk				
Is the price of exchange rate risk in t United Arab Emirates zero? H_0: $\lambda_L = 0$		78.291***	4	0.000

Charts A. Financial indicators in the OPEC countries sample (continued)

Is the price of exchange rate risk in United Arab Emirates constant? $H_0: \lambda_L = 1$	68.238***	3	0.000
Is the price of exchange rate risk in Kuwait zero? $H_0: \lambda_A = 0$	117.600***	4	0.000
Is the price of exchange rate risk in Kuwait constant? $H_0: \lambda_A = 1$	67.779***	3	0.000
Is the price of exchange rate risk in Saudi Arabia zero? $H_0: \lambda_E = 0$	77.291***	4	0.000
Is the price of exchange rate risk in Saudi Arabia constant? $H_0: \lambda_E = 1$	90.098***	3	0.000
Is the price of exchange rate risk in Venezuela zero? $H_0: \lambda_M = 0$	101.977***	4	0.000
Is the price of exchange rate risk in Venezuela constant? $H_0: \lambda_M = 1$	89.296***	3	0.000
Are the prices of the exchange rate risks jointly null? $H_0: \lambda_i = 0$	79.386***	16	0.000
Are the prices of the exchange rate risks jointly constant? $H_0: \lambda_i = 1$	77.211***	12	0.000

Panel F – Analysis of residuals

	United Arab Emirates	Kuwait	Saudi Arabia	Venezuela	Oil
Skewness	3.133	2.783	2.339	2.229	3.097
Kurtosis	10.111	12.067	9.482	11.221	12.800
JB	798.772+++	756.109+++	824.891+++	798.566+++	345.333
Q(12)	0.687	0.763	0.321	0.413	0.770
ARCH(1)	0.678	0.419	0.611	0.360	0.980

Notes: This table presents the estimation results of the system (4) for world market, Brent crude oil and four real exchange index returns. DU, SA, KU, VE, W, US and OI identify the stock market of U. A. Emirates, Saudi Arabia, Kuwait, Venezuela, World and USA. IRENT, USTP and RSP refer respectively to the return on the world market portfolio in excess of the 30-day Eurodollar interest rate, the variation in the US term premium, the return on the S&P's 500 stock market index. Numbers in parenthesis are the associated standard deviations. JB, Q(1), and ARCH(6) are the empirical statistics of the Jarque-Bera test for normality, Ljung-Box test for serial correlation of order 1, and Engle (1982)'s test for conditional heteroscedasticity. *, **, and *** indicate that the coefficients are significant at the 10%, 5% and 1% levels respectively. +, ++, and +++ indicate that the null hypotheses of normality and autocorrelation is rejected at the 10%, 5% and 1% levels respectively.

Table 4. Dynamics of stock market integrat

	United Arab Emirates	Kuwait	Saudi Arabia	Venezuela
Constant	0.289*** (0.022)	0.367*** (0.101)	0.197*** (0.089)	0.189*** (0.011)
OPEN	0.112 (0.215)	-0.102*** 0.213	-0.053*** (0.010)	-0.056*** (0.028)
SWAY	-0.020*** (0.011)	-0.067*** (0.003)	-0.033*** (0.002)	-0.001 (0.011)
RENT	-0.122*** (0.028)	-0.348*** (0.000)	0.290*** (0.000)	-0.141*** (0.002)
Ω mean	0.774+++	0.847+++	0.765+++	0.712+++
Ω median	0.783	0.859	0.781	0.703
Ω max	0.992	0.998	0.996	0.986
Ω min	0.518	0.417	0.418	0.401
Std. dev.	0.102	0.092	0.115	0.120

Notes: this table reports the estimates of the parameters describing the dynamics of integration measure. OPEN, SWAY and RENT refer to the degree of trade openness, the interest rate spread and the return of world index respectively. Numbers in parenthesis are the associated standard deviations. Ω max, Ω min, and Ω mean indicate the maximum, minimum and average values of market integration measure. *, **, and *** indicate that the coefficients are significant at the 10%, 5% and 1% levels respectively. +++ indicates that the average degree of integration is significantly different from zero at the 1% level with respect to the two-sided Student-t test.

Charts A. Financial indicators in the OPEC countries sample (continued)

Table 5. Decomposition of the total risk premiu

	TRM	ORM	LRM	ERM	WRM
United Arab Emirates	9.227+++	0.988+++	3.115+++	-0.008+++	5.132+++
Kuwait	6.132+++	0.679+++	2.185+++	-0.112+++	3.380+++
Saudi Arabia	7.339+++	0.817+++	2.892+++	-0.567+++	4.197+++
Venezuela	8.362+++	0.022+++	3.006+++	-0.891+++	6.225+++

Notes: +++ indicates that the average risk premiums are significantly different from zero at the 1% level with respect to the two-sided Student-t test.

Table 6. Dynamic conditional correlations between Stock markets and world market

	United Arab Emirates	Kuwait	Saudi Arabia	Venezuela
ρ max	0.105	0.078	0.141	0.355
ρ min	0.052	-0.175	-0.265	-0.377
ρ mean	0.052 ***	-0.042 ***	-0.065***	-0.080
Std. dev.	0.001	0.001	0.0093	0.003

Notes: this table reports some statistics of dynamic conditional correlations, estimated from the DCC-GARCH model. ρ max, ρ min, and ρ mean indicate the maximum, minimum and average values of dynamic conditional correlations. *, **, and *** indicate that the average degree of integration is significantly different from zero at the 10%, 5%, and 1% levels with respect to the two-sided Student-t test, respectively.

Charts A. Financial indicators in the OPEC countries sample (continued)

Figure 1. Dynamic integration of stock markets into the world market

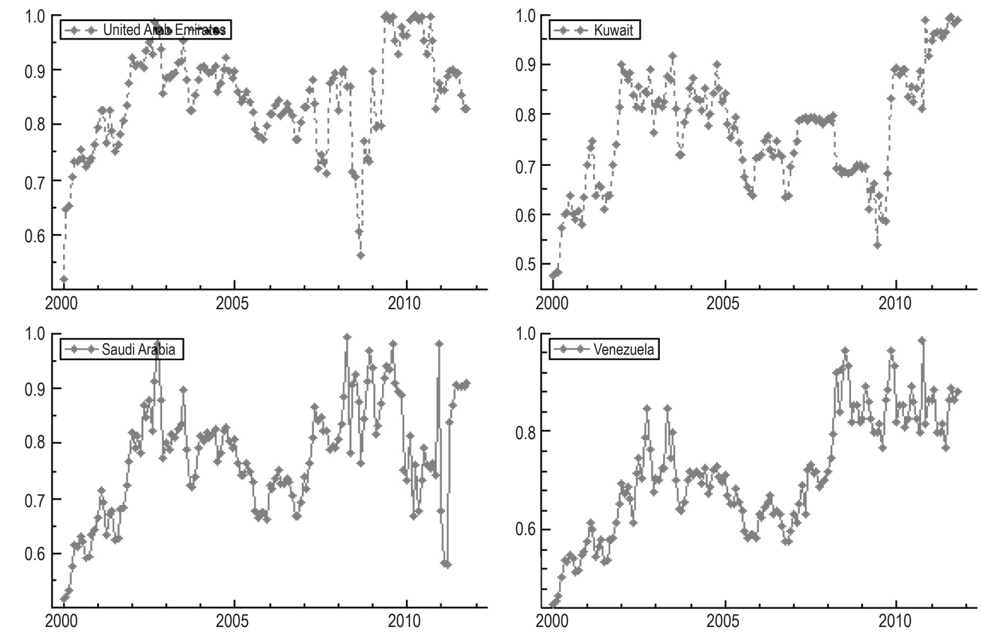


Figure 2. Dynamic conditional correlations with World market