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Financial Integration Before and During the Financial Crisis of 2008: Evidence from GCC and MENA Stock Market

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This study investigates the impact of 2008 financial crisis on the links within two regions, the GCC markets (Bahrain, Kuwait, Oman, Qatar and United Arab of Emirates) and the MENA markets (Egypt, Jordan, Morocco, Tunisia and Turkey). The study main objective is to capture possible time-variant stock market integration in GCC markets and in MENA countries before and during the crisis 2008 using daily stock market indexes retrieved from MSCI over the period 1st June 2005 to 1st July 2010. The study uses Johansen cointegration theory (1988) to test the existence of long-term relationships within the GCC stock markets and within the MENA stock markets. The Cointegration results suggest that the GCC stock markets and the MENA stock markets are more integrated during the crisis period than prior to it. Further, the vector error correction model (VECM) of Engle and Granger (1987) results suggest that linkages among GCC and among MENA stock markets are also larger during the crisis period than prior to it. These results may require further study, but so far they show that the 2008 financial crisis form a common stochastic trend in both the MENA and the GCC stock markets.

JEL Codes: F36, G15

1. Introduction

Increased globalization and economic integration of international financial markets has brought increased attention given its importance for the portfolio management strategies. As portfolio diversification advantages are obtained through cross-market investment or through a global diversification (Cappiello et al (2003)), strong links between financial markets limit the diversification benefits for international investors.

Over the three last decades a plethora of empirical research has contributed to the knowledge base on integration and information transmission amongst financial markets (Eun and Shim, 1989; Arshanapalli and Masih, 2004; Glezakos et al., 2007; Ahlgren and Antell, 2010; Aloui et al., 2010). The empirical findings of these studies suggest that significant capital market integration exists among major international financial markets hence reducing the potential benefits from international diversification (Meric and Mercic, 1989; Ben Zion et al., 1996). In contrast, linkages between emerging markets and other developed markets appear to be relatively weak (Bakaert and Harvey, 1997; Bailey and Stulz, 1990; Divecha et al., 1992; Harvey, 1995; Errunza, 1994; Ben Zion et al., 1996).

In the past, stock markets in the MENA (Middle East and North Africa) region and in the GCC (Gulf cooperation Council) region have been widely ignored by international investors. In fact the restrictions on foreign stock ownership, the lack of common accounting standards and corporate transparency, or even the economic and political uncertainty have discouraged international investors. However during the last decade the

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MENA and GCC countries' integration with global economy has progressed rapidly as many reforms in laws and regulations are conducted to attract foreign investors. Some studies were conducted on individual stock markets of the Middle East (Erb, Harvey, and Viskanta, 1996). Some others analyze a set of markets of the MENA region but could not find any significant cross-linkages despite market proximity (Abraham, Seyyed, and Al-Elg (2001), Darrat, Elkhal, and Hakim (2000), Omran and Gunduz (2001), Neaime (2002)). Only a few empirical studies have concentrated on the integration of the emerging stock markets in the MENA region and the GCC region after the 2008 financial crisis.

The 2008 banking crisis and the collapse of international financial institutions have generated a massive decline in stock prices in the USA (United States of America) and in developed countries (Longstaff, 2010) and they have a negative impact on international trade, investment and financial flows between the emerging markets and the most developed ones. Moreover the financial crisis has led to higher volatilities in the MENA and in the GCC markets. Regarding all these factors the MENA markets and the GCC markets may focus after the financial crisis on local and regional financial market to invest.

The contribution of this study is twofold: First, it aims to fill the gap in financial literature by focusing on the MENA and the GCC financial markets. Second, it aims to analyze the integration within the MENA markets and within the GCC markets prior and during the financial crisis 2008 using, a bi-variate cointegration and the VEC (Vector Error Correction) model. The results of our research should have significant implications for investors interested in international diversification.

The remainder of this paper is structured as follow: Section 2 presents a summary of the literature while the data and their integration properties are discussed in section 3. Further section 4 provides a conceptual framework and methodology, while section 5 discusses the empirical results followed by a summary and the conclusion.

2. Literature Review

Due to the difficulty of obtaining sufficient and reliable market data from the MENA and the GCC markets, most of the researchers did not focus on regional financial markets. Only few research analyzing the MENA and the GCC financial markets characteristics were conducted on either individual stock markets (for example Harvey, 1995a, b; Harvey and Viskanta, 1996) or on a set of these markets. These studies aim to compare the characteristics of emerging financial markets with the developed financial ones in order to analyze which markets offer the best diversification opportunity to investors.

The first stream of empirical studies analyzing the emerging financial markets integration focuses on the correlations within the regional financial markets and further the correlations between these developing markets and the market worldwide. For example, Abraham et al (2001), Omran and Gunduz (2001) analyzed various MENA markets subsets but could not find any significant cross linkages despite market proximity. Darrat et al (2000) use the cointegration test of Johansen - Juselius (1990) to examine the integration of three emerging stock markets from the MENA region (Egypt, Morocco and Jordan) and the linkages between these markets and the US market. The empirical results show the existence of a long-term equilibrium between the MENA financial markets over the period October 1996 to August 1999 however they reject the presence of a significant long-term relationship between the sample MENA markets and the US market. Neaime (2002) has examined the impact of financial liberalization on the integration of two groups of financial markets. The first group includes Turkey, Egypt, Morocco and Jordan and the

second group the GCC markets. His results show that financial markets in the first group are only integrated with the world market; however the GCC financial markets are integrated with each other but are segmented versus the world market. Hassan and Yu (2008) have focused on seven countries in the MENA region and the GCC region namely Bahrain, Oman, Saudi Arabia, Jordan, Egypt, Morocco, Turkey and three global markets: USA, United Kingdom and France. Their results over the period January 1999 to December 2005 indicate a significant cointegration between the MENA financial markets and the US market for almost all the cases and even a cointegration between these financial markets and the GCC markets. However there is no statistical evidence of cointegration between the GCC stock markets and the USA market. Al Kulaib et al (2009) studied the linkages and interactions between 12 financial markets divided into three groups over the period 3th January 1999 to 31st December 2004. Their results indicate an absence of causality in North African region, the presence of linkages between financial stock markets in Levant region and an increased correlations and interactions between the GCC financial markets.

The early researchers studying the impact of the financial crisis on the integration of financial markets focus on the 1987 crisis. Arshanapalli et al. (1995) studied the extent of Asian stock markets integration prior and after October 1987 crisis. Their study covers the period from 1st January 1986 to 12th May 1992 and it shows an increase of the links between the Asian financial markets (Japan, Hong Kong, Malaysia, Philippines, Singapore and Thailand) and the USA financial market after the 1987 crisis. Masih and Masih (1997) studied the effect of 1987 stock market crash on the co- movements between USA, Japan, Canada, France, Germany and United Kingdom markets over the period January 1979 and June 1994. Based on cointegration techniques, vector error correction and analysis of variance decomposition model, the authors stated that in general the stock market crash of October 1987 has created a stronger interaction between these financial markets.

Researchers have also study the impact of 1998 Asian crisis on the linkages between financial markets. Chen et al. (2002) studied the dynamic interdependencies between major Latin American financial markets (namely Brazil, Mexico, Argentina, Venezuela, Chile and Colombia) during the 1997 Asian crisis and the 1998 Russian crisis. Their results show no significant impact of the crises on the interdependencies between these Latin American financial stock markets. More recently, Huyghebaert and Wang (2010) have examined the integration and causality between seven Asian financial markets over the period July 1992 to June 2003. Using cointegration, causality tests and impulse functions, the authors concluded that Asian crisis increased the links between the Asian financial markets.

After the 2008 financial crisis and its impact on the MENA and the GCC financial markets, some authors focus on the integration of these markets and with the world market. Ravichandran and Maloain (2010) use the error-composition model to examine how a financial crisis may affect the long-run relationship and the short-run linkages among the GCC stock markets. Considering the following markets, Saudi Arabia, Kuwait, Qatar, UAE, Bahrain and Oman over the period January 2007 to December 2009, the empirical results indicate that the long-and short-run relationships among these markets are strengthening and the markets become more integrated regionally and globally after a crisis than before it. However, Marashdehet al. (2012), using autoregressive distributed lag (ARDL) approach found that the GCC markets are not fully integrated and that they are not integrated with the US market and the European markets.

3. Data and Integration Properties

The selection of the sample data frequency is an important consideration of any empirical study that addresses the integration of financial markets. As weekly, monthly and quarterly data may obscure interactions among stock markets that last for only a few days (Eun and Shim, 1989, Karolyi and Stulz, 1996), we use daily data in this study. Daily data seem to be more capable of detecting short-lived market interactions that go on for only a few days and it provide a realistic picture of the information interdependence structure in the financial markets under investigation (Cotter 2004, Narayan and Smyth, 2004). Moreover daily data allow us to implement more powerful tests of cross-country co-movements as it permits to capture speedy transmission of information, both in the long and the short run (Voronkova, 2004; Hassan and Naka, 1996).

Our sample is divided into two groups, the GCC markets (Bahrain, Kuwait, Oman, Qatar and United Arab of Emirates) and the MENA markets (Egypt, Jordan, Morocco, Tunisia, Turkey). The sample data span the period from 1st June 2005 to 1st July 2010 which is divided into two sub-periods to capture possible time-variant stock market integration in the MENA region prior and during the crisis. The first period, the pre-crisis, includes 38 months (from 1st June 2005 to 29th August 2008), the second period, the crisis period, covers the subsequent 22 months (from 1st September 2008 to 1st July 2010).

The daily stock market indexes retrieved from MSCI (Morgan Stanley Capital International) consist of the daily stock market index closing prices. Theses indexes are expressed in US dollar terms in order to ensure comparability.

3.1 Correlation between Financial Markets

First of all, we will examine the co-movements in the behavior of the stock returns over two different time windows, prior to the crisis and during the crisis. This is interesting as a higher degree of stock markets co-movements is suggestive of an increase of financial integration. Moreover it may be worthwhile to examine whether there are breaks in the co-movement of returns that can be associated with changes in investors' perceptions around the crisis period. However, the reported correlations below are only suggestive and do not allow for a proper testing of the above mentioned hypothesis.

This study has started with simple pair-wise correlation between the stock returns of GCC countries and the stock returns of MENA countries. We examine correlations to gauge the degree of using intraregional diversification as a risk management tool in the short term. The correlation coefficients among the GCC markets first and among the MENA markets second over the sample period are displayed in Table 1 and Table 2.

Table 1: Correlations among GCC markets returns

The whole period					
	Bahrain	Kuwait	Oman	UAE	Qatar
Bahrain	1				
Kuwait	0.349895	1			
Oman	0.267367	0.276654	1		
UAE	0.285928	0.326742	0.445352	1	
Qatar	0.258411	0.317436	0.463329	0.477442	1
Pre-crisis period					
	Bahrain	Kuwait	Oman	UAE	Qatar
Bahrain	1				
Kuwait	0.120178	1			
Oman	0.092344	0.132570	1		
UAE	0.084112	0.272841	0.269209	1	
Qatar	0.022611	0.140896	0.291672	0.327058	1
Crisis period					
	Bahrain	Kuwait	Oman	UAE	Qatar
Bahrain	1				
Kuwait	0.442744	1			
Oman	0.350570	0.348301	1		
UAE	0.398535	0.359615	0.577749	1	
Qatar	0.395219	0.425313	0.580983	0.591859	1

During the pre-crisis period, the correlations between the GCC stock markets are relatively low. The highest return correlation is between the UAE and Qatar (0.327058) and the lowest is between Bahrain and Qatar (0.022611).

However, during the crisis period we note an increase of all the correlations. The highest return correlation remains between the UAE and Qatar (0.591859) and the lowest is between the Kuwait and Oman (0.348301). We notice that within the region, Bahrain has the most significant change in the correlations with the other GCC markets during the crisis period.

Table 2: Correlations among MENA markets returns

The whole period					
	Egypt	Jordan	Morocco	Tunisia	Turkey
Egypt	1				
Jordan	0.297760	1			
Morocco	0.191474	0.136076	1		
Tunisia	0.085884	0.112831	0.247955	1	
Turkey	0.225646	0.031696	0.177294	0.167100	1
Pre-crisis period					
	Egypt	Jordan	Morocco	Tunisia	Turkey
Egypt	1				
Jordan	0.145799	1			
Morocco	0.162464	0.073809	1		
Tunisia	0.015209	0.005181	0.146378	1	
Turkey	0.176399	-0.016765	0.090037	0.045740	1
Crisis period					
	Egypt	Jordan	Morocco	Tunisia	Turkey
Egypt	1				
Jordan	0.453035	1			
Morocco	0.213596	0.198802	1		
Tunisia	0.158301	0.250352	0.363683	1	
Turkey	0.275690	0.090552	0.272417	0.318960	1

The MENA markets show much less correlation than the GCC countries. During the pre-crisis period, the highest correlation in this region is between Turkey and Egypt (0.176399) and the lowest correlation is between Tunisia and Jordan (0.005158). However during the crisis period, like for the GCC countries, we notice an increase of the return correlations and the highest correlation is between Egypt and Jordan (0.453035) and the lowest is between Turkey and Jordan (0.090552).

The correlations are relatively more noticeable in GCC region relative to the correlations in MENA area. This is not surprising because GCC countries share not only regional proximity which comes with all its economic and political implications but also high dependency on oil exports and foreign labor. The evidence also shows that the return correlations between the GCC markets and between the MENA markets increased noticeably during the period September 1, 2008-July 1, 2010, compared with the corresponding correlations for the whole sample period.

3.2 Integration Properties

In this section we study the integration properties of the data. In fact, prior to carrying out a cointegration test, the non-stationarity of the data series has to be established. To this extent, each market index is tested for the presence of unit roots using the Augmented Dickey Fuller (ADF) test (Dickey & Fuller, 1979, 1981). Assuming the series have a nonzero mean, a constant is included in the regression. The null hypothesis of a unit root is tested against the alternative hypotheses of a stationary autoregressive process and a stationary autoregressive process with a trend. To ensure that the OLS regression will give an unbiased estimate of the lag coefficients, the number of lags included in the ADF is optimized by minimizing the Schwarz Information Criteria (SIC) and the presence of no autocorrelation in the residuals. Relaxing the i.i.d. (0, σ2) assumption and allowing errors

to be dependent with heteroscedastic variance, a Phillips–Peron test is conducted to verify the ADF results.

So in this study we use the augmented Dickey-Fuller (ADF) test [(Dickey & Fuller, 1979, 1981) and Philips-Perron test to investigate the existence of unit roots in the level variables as well as in their first differences. These tests are based on the following two regressions:

$$\Delta X_{it} = \upsilon + \alpha X_{it-1} + \sum_{j=1}^{m} b_j \Delta X_{it-j} + \varepsilon_{it}$$

And the second unit root test which allows for the existence of a deterministic trend

$$\Delta X_{it} = \upsilon + \beta T + \alpha X_{it-1} + \sum_{j=1}^{m} b_j \Delta X_{it-j} + \varepsilon_{it}$$

Where X_t is the stock market indices, ε_t is the residual term and T is a time trend. The null hypothesis is that the variable under consideration has a unit root.

We subsequently take the natural logarithm of daily closing values and unit tests are employed to examine the random walk hypothesis. The results for random walk hypothesis appear in Table 3. Using 5 percent as cutoff, the Augmented Dickey-Fuller (ADF) tests (Table 3) as well as Phillips-Perron tests (Table 4) suggests that all series in all sub periods (pre-crisis and crisis) even in global period are non-stationary in the level. Subsequently, the presence of a unit root in the first differences of index prices is tested to verify that the order of integration is one and ADF test and Phillips –Perron test confirm that the first difference of the series are stationary and integrated of order one I(1).

Given these results, we examine the long-run equilibrium relationships among MENA stocks markets for the whole period and the sub periods.

Table 3: ADF Test

Country	All the period		Pre-crisis Period		Crisis Period	
	Level	First differences	Level	First differences	Level	First differences
Bahrain	-2.43342 (0)	-34.21014** (0)	-0.177679 (1)	-25.71937** (0)	-3.285810 (0)	-21.20270** (0)
Kuwait	-0.31284 (0)	-34.04878** (0)	1.399634 (0)	-27.72708** (0)	-2.994756 (0)	-20.03946** (0)
Oman	-0.39657 (1)	-32.16642** (0)	0.640736 (0)	-27.18925** (0)	-2.925308 (1)	-18.50691** (0)
UAE	-1.306265 (1)	-31.93242** (0)	-0.549203 (0)	-28.16193** (0)	-3.138608 (2)	-12.14208** (1)
Qatar	-0.442498 (0)	-33.93127** (0)	0.273525 (0)	-28.77517** (0)	-2.953904 (1)	-19.21327** (0)
Egypt	0.552774 (1)	-31.90365** (0)	1.577026 (0)	-26.74095** (0)	-3.325073 (1)	-18.25787** (0)
Jordan	-1.32965 (0)	-33.84252** (0)	0.068307 (0)	-27.83104** (0)	-3.335402 (0)	-19.46475** (0)
Morocco	1.217307 (1)	-28.65790** (0)	2.661023 (1)	-22.70131** (0)	-3.328898 (1)	-17.41042** (0)
Tunisia	1.262589 (1)	-32.84711** (0)	1.303383 (2)	-17.06808** (1)	0.277063 (0)	-21.04075** (0)
Turkey	0.399464 (0)	-34.04020** (0)	0.595703 (0)	-28.45297** (0)	-3.465594 (0)	-19.22844** (0)

Note: ** denote rejection of the null hypothesis of non-stationarity at the 1 percent level of significance.
Note: Numbers in parentheses represent the number l (truncation Newey and West (1987)) required for the calculation of the variance of long-term residue with $l \approx \left(4\frac{T}{100}\right)^{2/9}$

Table 4: Phillips-Perron Test

Country	All the period		Pre-crisis		Crisis	
	Level	First differences	Level	First differences	Level	First differences
Bahrain	-2.30855 (12)	-34.60866** (12)	-0.17444 (12)	-26.18229** (11)	-3.427677 (8)	-21.20252** (3)
Kuwait	-0.30691 (1)	-34.07926** (2)	1.368141 (1)	-27.72719** (1)	-2.972089 (4)	-20.10109** (4)
Oman	-0.44921 (17)	-32.01183** (19)	0.596566 (7)	-27.20203** (6)	-3.870453 (21)	-18.33139** (19)
UAE	-1.25567 (8)	-32.13257** (6)	-0.47341 (12)	-28.60016** (11)	-3.080387 (3)	-17.69879** (5)
Qatar	-0.42068 (3)	-33.93127** (0)	0.235573 (9)	-28.97112** (9)	-3.017048 (5)	-19.17728** (8)
Egypt	0.560355 (2)	-31.90035** (2)	1.379970 (8)	-26.93444** (8)	-3.441606 (3)	-18.30387** (3)
Jordan	-1.31255 (11)	-33.78528** (12)	0.067047 (6)	-27.80570** (5)	-3.042094 (16)	-19.40830** (12)
Morocco	-2.39589 (8)	-28.43430** (13)	2.984939 (2)	-22.49159** (7)	-3.391819 (2)	-17.32774** (5)
Tunisia	1.284325 (7)	-32.82068** (9)	1.468954 (8)	-24.80953** (11)	0.285646 (3)	-21.02704** (3)
Turkey	0.375544 (10)	-34.01778** (11)	0.578592 (5)	-28.45868** (5)	-3.455634 (3)	-19.22105** (3)

Note: ** denote rejection of the null hypothesis of non-stationarity at the 1 percent level of significance.
Notes: Numbers in parentheses represent the optimal number of lags determined according to the Schwarz Information Criterion (SIC) and provided that the lags yield white-noise residuals. The SIC is estimated as follow: $SIC(p) = Log\left[\det\left|\Sigma_e\right|\right] + \frac{k^2 pLog(T)}{T}$ where Σ_e is the variance-covariance matrix of residuals of the model.

4. Methodology and Empirical Results

In this section, we first examine the long- term equilibrium relationships among stock markets in our sample by means co-integration tests. Thereafter, we implement Granger causality tests to decide on the stock market interdependencies.

The assessment of the GCC and the MENA stock market interdependencies is based on the joint testing for the presence and number of cointegrating vectors as well as on reviewing the relevant error correction model for causal relationship between these stock markets. Cointegration allows for the description of stable long-run stationary relationships between integrated stock market indices, and is defined as independent linear combinations of these non-stationary variables achieving stationarity. It implies that the series do not drift apart but are moving together by some long-run equilibrium relationship.

As we are particularly interested in the effects of the 2008 international crisis, we henceforth examine the dynamic linkages among the GCC and the MENA stock markets before the crisis (1st July 2005 to 29th August 2008) and during the crisis (1st September 2008 to 1st July 2010).

4.1 Long –Run Equilibrium Relationships: Co-Integration Test Results

Time-series non-stationary variables can lead to spurious regressions unless at least one cointegration vector is present. Co-integration refers to the case that the linear combination of two-non stationary time series generated a stationary time series. According to Engle and Granger (1987) and Stock and Watson (1988), co-integrated variables share common stochastic trends and co-integration vectors purge these trends from the linear combination of the variables. The more co-integrating vectors there are the more stable the system (Dickey et al, 1994). Co-integration relationship among stock market indexes means the existence of a long-term economic equilibrium and indirectly implies that the two time series move in the same direction.

After establishing that the GCC and the MENA stock market indexes time series are I(1) processes, this study uses Johansen (1988) and Johansen and Juselius (1990) multivariate test to estimate the cointegration process.

The Johansen (1988) and Johansen and Juselius (1990) cointegration procedure is implemented based on a vector autoregressive (VAR) model, which Sims (1980) and Dekker et al. (2001) argued gives a realistic description of market linkages.
Consider the p −dimensional vector autoregressive model of order k:

$$X_t = A_1 X_{t-1} + ... + A_p X_{t-p} + \mu \ + \delta_t + \varepsilon_t \qquad \text{(Equation1)}$$

Where X_t is a sequence of random vectors of MENA stock market prices with components (X_{1t} ……,X_{pt}); A1,…, Ap are n×n coefficient matrices; μ is a vector of constants; δt is a vector of trend coefficients and εt is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lagged and uncorrelated with any of the right-hand side variables. So ε_t is a sequence of zero-mean p dimensional white noise vectors. The minimum lag length to eliminate autocorrelation in the residuals is denoted with p. Within the framework of cointegration, the data generating process of X_t should be modeled into an error correction model (ECM) with p-1 lags to avoid variable misspecifications (Engle & Granger, 1987). Let Δ represent the first difference operator, following Johansen and Juselius (1990), equation (1) can be written as:

$$\Delta X_t = \Pi X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-i} + \delta_t + \varepsilon_t \qquad \text{(Equation2)}$$

Where

$$\Pi = -I + \sum_{i=1}^{p} A_i$$

And

$$\Gamma_i = -I + \sum_{j=1}^{i} A_j$$

Testing for cointegration is related to the consideration of the rank of the long –run multiplier matrix ∏=αβ' matrix; the β can be interpreted as matrix of co-integrating vectors and α is a matrix of error correction parameters. The error correction coefficients contained in α measure the extent to which each variable responds to disturbances in the long-run equilibrium, while the parameters (Γ1,…, Γp−1) of dimension n×n define the short-run adjustment to changes in the variables, which implies the presence of p−r common trends (Gonzalo & Granger, 1995). The model is structured such that short-run deviations from

the long-run equilibrium will be corrected. If the rank (r) of the *p*×*p* matrix ∏ is zero then all elements of X_t have unit roots and first differencing might be recommended. If r=p meaning that ∏ is full of rank p, then all elements in X_t are stationary in levels. More interestingly, 0<r<p suggests the existence of r cointegrating relations among the elements of X_t with p-r common stochastic trends. Therefore, it is known that the rank of matrix ∏ is equal to the number of characteristics roots that are different from zero. Two statistic tests can be used to validate the existence of r cointegrating vectors. These tests are based on two likelihood ratio (LR) statistics: trace statistics and maximum eigenvalue statistics.
First, the 'trace' test, the likelihood statistic test for the hypothesis that there are at most r distinct cointegrating vectors against a general alternative, is given by:

$$\lambda_{trace}(r) = -2\log(Q) = -T\sum_{i=r+1}^{n}\log(1-\hat{\lambda}_i)$$

Where i=r+1,…….,n, are the (n-r) smallest squared canonical correlations, r=0,1,2,….,n-1 and $\lambda_{trace}(r)=0$, when all $\lambda_i=0$.
Alternatively, the 'maximum eigenvalue test can be used to compare the null hypothesis of r cointegrating vectors against the alternative of (r+1) cointegrating vectors. The LR test statistic for this hypothesis is given by:

$$\lambda_{\max}(r, r+1) = -2\log(Q) = -T\log(1-\hat{\lambda}_{r+1})$$

Where *r*=0,1,2,…,n-1.

If the t statistic is higher than the critical value, we reject the null hypothesis of existence of r co-integrating vectors and accept the alternative hypothesis of existence of r+1 vector (for trace test) or at most one vector (for max-eigen value). These two tests may lead to different and contradictory results. In this study we referred to the trace statistics according to Johansen and Juselius (1990), Cheung and Lai (1993) and Harris (1995).

The co-integration analyses for the pre-crisis and the crisis period are implemented by means of the Johansen Test (Johansen, 1991) and after determining the appropriate structure of the VAR model. This study relies on the optimization of information criteria and among these, the most popular are: the Akaike Information Criterion, the Schwarz Information Criterion and the Hannan-Quinn Criterion. Estimation results of bilateral co-integration tests for GCC stock market indices and MENA stock market indexes are reported respectively in Table 5 and Table 6.

Table 5: Co-integration test results for GCC stock markets

	Pre-crisis		Crisis	
	None	At most one	None	At most one
Bahrain vs Kuwait				
γ_{max}	0.015534	0.003871	0.042582	0.011468
γ_{trace}	16.52580	3.281200	25.04760**	5.248168
Bahrain vs Oman				
γ_{max}	0.024655	0.000479	0.046318	0.013265
γ_{trace}	21.52505	0.45443	27.65417**	6.075830
Bahrain vs UAE				
γ_{max}	0.004087	0.002418	0.041350	0.018151
γ_{trace}	5.486707	2.038154	27.48855**	8.316411
Bahrain vs Qatar				
γ_{max}	0.007238	0.001224	0.043525	0.012556
γ_{trace}	7.181758	1.035907	25.99729**	5.74913
Kuwait vs Oman				
γ_{max}	0.008195	0.003655	0.026353	0.012103
γ_{trace}	10.05945	3.097795	17.69205	5.540413
Kuwait vs UAE				
γ_{max}	0.003906	0.002919	0.026187	0.014455
γ_{trace}	5.756853	2.461373	18.69907	6.625152
Kuwait vs Qatar				
γ_{max}	0.006367	0.002585	0.024549	0.010880
γ_{trace}	7.592905	2.189505	16.2872	4.977700
Oman vs UAE				
γ_{max}	0.005199	0.001316	0.024203	0.015005
γ_{trace}	5.497384	1.108790	18.02680	6.879119
Oman vs Qatar				
γ_{max}	0.008489	0.001635	0.032938	0.020399
γ_{trace}	8.596454	1.384132	24.61654**	9.377456
Qatar vs UAE				
γ_{max}	0.004130	0.001503	0.024587	0.018773
γ_{trace}	4.750613	1.26607	19.95001	8.622928

Note: ** denote rejection of the null hypothesis at the 1 percent level of significance

The multivariate cointegration test results of the error correction model (Equation 2), as reported in Table 5, suggest the absence of any co integrating vectors among the GCC stock markets for the pre-crisis period. Johansen's trace statistic and maximum eigenvalue statistic of the bi-variate co-integration tests show the segmentation of the GCC markets during the pre-crisis period. During 3 years and two months period before the crisis, no significant cointegration is found between two GCC stock market indexes at the level of 1 %. These results suggest that the GCC emerging stock markets are relatively independent from each other during the earlier period (the pre-crisis period) and there may be significant potential benefits from investing in the GCC markets during this period.

This picture of heterogeneity in the price behavior changed dramatically during the subsequent period. During the crisis period, significant bi-variate cointegration is found among these countries {Bahrain-Oman}, {Bahrain - Kuwait}, {Bahrain UAE}, {Bahrain - Qatar} and {Oman - Qatar}. In 5 out of the 10 possible cases, the significant co-integration is found. The increase of the cointegrating relationships may require further study, but the

results so far show that 2008 financial crisis form a common stochastic trend in the stock markets of 5 countries.

An overview of the GCC markets show that on 1st January 2008, GCC Common market was formed to allow a closer economic coordination and to remove all barriers (tariff and non-tariff barriers) to cross border investment and services trade within the GCC countries. The creation of a single regional currency was also discussed in order to provide greater combined leverage in monetary policy, and better regional management of inflationary pressures. This common market can explain the increase of the bilateral co-integration relationships between the GCC markets. According to our results, it appears that Bahrain financial market is fully integrated with the other GCC markets and it didn't offer any opportunity to regional investors for diversification benefits. This result can be explained by the high diversification of Bahrain economy. Bahrain enjoys one of the most diversified sources of income compared to the other GCC countries and it is also fortunate in being less susceptible to energy prices fluctusations. Bahrain also liberalize its economy by allowing foreign companies to participate up to 100% in Bahraini companies without being forced to resort to a partner local. The liberalization process combined with the boom in Islamic banking enable Bahrain to strengthen its status as a regional financial and business center.

The integration results also show that Oman and Qatar are financially cointegrated in the second sub-period. This result may be explained by the trade agreement implemented on October 2008 by which Qatar will export natural gas to Oman who has limited hydrocarbon reserves.

Table 6 : Co-integration test results for MENA stock markets

	Pre-Crisis Period		Crisis Period	
	None	At most one	None	At most one
Egypt-Jordan				
γ_{max}	0.010045	0.002305	0.016830	0.001824
γ_{trace}	10.49299	1.951926	15.90447	1.544720
Egypt-Morocco				
γ_{max}	0.021159	0.005887	0.036119	0.004527
γ_{trace}	23.03339	4.983182	18.80277	2.064564
Egypt-Tunisia				
γ_{max}	0.011567	0.006193	0.049657	0.002260
γ_{trace}	15.09854	5.255693	24.20366	1.029426
Egypt-Turkey				
γ_{max}	0.007355	0.006311	0.034695	0.002462
γ_{trace}	11.56025	5.337446	17.07506	1.114363
Jordan-Morocco				
γ_{max}	0.013440	0.001975	0.044842	0.025285
γ_{trace}	13.10484	1.670719	32.52772**	11.65277
Jordan-Tunisia				
γ_{max}	0.003960	0.002277	0.045440	0.007938
γ_{trace}	5.273182	1.924189	24.54896	3.594391
Jordan-Turkey				
γ_{max}	0.007802	0.002139	0.053077	0.011186
γ_{trace}	8.437796	1.811825	29.93269**	5.118330
Morocco-Tunisia				
γ_{max}	0.014059	0.009520	0.035960	0.002732
γ_{trace}	20.07091	8.092527	17.90792	1.244916
Morocco-Turkey				
γ_{max}	0.016777	0.006364	0.037753	0.002354
γ_{trace}	19.71430	5.400846	18.58234	1.072236
Tunisia-Turkey				
γ_{max}	0.009087	0.006043	0.039874	0.001575
γ_{trace}	12.83587	5.122248	19.23161	0.717202

Note: ** denote rejection of the null hypothesis at the 1 percent level of significance

Johansen's trace statistic and maximum eigenvalue statistic suggest the absence of the cointegrating vector between the MENA markets during the pre-crisis period. These findings imply that the MENA markets are segmented and allow the investors to improve their portfolio performance by investing in less correlated assets. These markets offer to investor potential gains from regional diversification. After the outbreak of the crisis, long-term relationships between some MENA stock markets have been modified. Indeed, the pairs {Jordan, Morocco}, {Jordan, Turkey}, which were segmented before the crisis appear to be integrated after. The findings suggest a long-term tendency for these pairs of countries to converge with each other. A potential reason for the co-integration during the crisis between Jordan and Turkey is the announcement in November 2009 of the implementation of a trade agreement. Therefore the cointegration during the crisis period between Morocco and Jordan stock markets indexes can be explained by the establishment of an agreement to create gradually a free trade area between these two countries. Overall, our results for the crisis period are consistent with the Gelos and Sahay

(2000) findings. Their results suggest that trade linkages and economic coordination between two countries may lead to a cointegration between the stock markets indexes.

4.2 Granger Causality Test Results

Cointegration can be seen as a two-step process: First, any long-run equilibrium relationship between stock market indexes is established; then, a dynamic correlation model of returns, the error correction model (ECM), is estimated. The ECM depicts the feedback process of deviations adjusting towards long-run equilibrium, and reveals the mechanism which ties cointegrated series together in the sense of Granger causality (Granger, 1988). Short-run deviations from the long-run equilibrium will feed back on the changes in the dependent variable, in order to force the movement towards the long-run equilibrium. The VECM is a dynamic model describing how the system is adjusting in each time period toward its long-run equilibrium state. The cointegrating vectors from which the error-correction terms are derived, indicate an independent direction where a stable long-term equilibrium state. However the coefficients of the error-correction terms represent the proportion by which the long –run disequilibrium in the dependent variables is corrected in each short-term period.

The cointegration methodology pioneered by Granger, 1986, Hendry, 1986, and Engle and Granger, 1986, 1988, implies that a Granger-causality must exist in at least one direction if two variables are cointegrated. The impact direction of the causality meaning the lead–lag behavior between the co-dependent stock markets is revealed by using the Granger causality test (Granger, 1969). Considering two cointegrated stock market indices x_t and Y_t, the ECM specification can take the following form:

$$Y_t = \delta_1 + \alpha_{11} X_{t-1} + ... + \alpha_{1m} X_{t-m} + \beta_{11} Y_{t-1} + ... + \beta_{1m} Y_{t-m} + \varepsilon_{1t}$$

$$Y_t = \delta_1 + \sum_{i=1}^{m} \alpha_{1i} X_{t-i} + \sum_{j=1}^{m} \beta_{1j} Y_{t-j} + \varepsilon_{1t}$$

Where, m is the order of the respective lag variable.

If null hypothesis H_0: $\sum_{i=1}^{m} \alpha_{1i} = 0$ is rejected $\{x_t\}$ is said to Granger-cause $\{y_t\}$.

Like this,

$$X_t = \delta_2 + \alpha_{21} Y_{t-1} + ... + \alpha_{2m} Y_{t-m} + \beta_{21} X_{t-1} + ... + \beta_{2m} X_{t-m} + \varepsilon_{2t}$$

$$X_t = \delta_2 + \sum_{i=1}^{m} \alpha_{2i} X_{t-i} + \sum_{j=1}^{m} \beta_{2j} Y_{t-j} + \varepsilon_{2t}$$

If null hypothesis H_0: $\sum_{j=1}^{m} \beta_{2j} = 0$ is rejected $\{y_t\}$ is said to Granger-cause $\{x_t\}$.

The temporal Granger-causality between the variables can be investigated by applying an F-test for the joint significance of α2i,…,α2m (β1j,…, β1m) in order to test if X Granger causes Y (Y Granger causes X).

To estimate the coefficients of above equations, we try to get the error sum of squares of the restricted model and full model, respectively.

$$F = \frac{(SSR_R - SSF_F)/m}{SSE_F/(T-2m-1)}$$

Where SSE_R, SSE_F are the error sum of the restricted model and full model respectively. T is the sample period; m the length of the lag; F is known to have a χ^2 distribution with m degree of freedom.

In a bivariate system of jointly stationary time series X and Y, the variable X is said to Granger cause Y if lagged X improves the predictions of Y, even after lagged Y variables have been excluded as explanatory variables (Granger, 1988).

In order to test whether variables are related in the short–run, we present the Granger-causality test in table 7. The flow of causality in this table is going from the variables in the first row to the variables in the first column.

Table 7: Causality Test for GCC stock markets before and during the crisis.

Null Hypothesis	X^2 Statistic	
	Pre-Crisis period	Crisis Period
Bahrain doesn't cause Kuwait	0.240878	8.503773**
Kuwait doesn't cause Bahrain	0.756911	0.008074
Bahrain doesn't cause Oman	0.901142	8.921832**
Oman doesn't cause Bahrain	6.020707	4.908173
Bahrain doesn't cause UAE	11.41504	3.546096
UAE doesn't cause Bahrain	5.800422	0.822085
Bahrain doesn't cause Qatar	0.878239	1.652569
Qatar doesn't cause Bahrain	2.513993	0.004043
Kuwait doesn't cause Oman	6.363832	0.478301
Oman doesn't cause Kuwait	0.143964	0.672719
Kuwait doesn't cause UAE	7.274943	1.994284
UAE doesn't cause Kuwait	10.01019	1.179111
Kuwait doesn't cause Qatar	6.735964	5.813326
Qatar doesn't cause Kuwait	2.100798	0.278567
Oman doesn't cause UAE	4.112005	0.174667
UAE doesn't cause Oman	13.54377	0.016877
Oman doesn't cause Qatar	1.166927	0.848084
Qatar doesn't cause Oman	0.001915	9.787989**
Qatar doesn't cause UAE	8.207641	0.316611
UAE doesn't cause Qatar	6.781947**	9.665839**

** denote rejection of the null hypothesis at the 1 percent level of significance

For the pre-crisis period the variables representing the GCC stock market indexes do not Granger-cause each other in the short-term, except for the case of United Arab of Emirates, which causes Qatar. This result may be explained by the trade linkages in gas activity. An agreement has been established since 2007 to deliver natural gas from U.A.E to a processing plant in Qatar and exported it again to the UAE. Given the result that all the GCC markets are segmented and there is no significant short-term relationship between them, except UAE-Qatar, portfolio diversification during this period may generate potential benefits to investors.

For the crisis-period, Granger causality test results suggest four causal relationships. Our findings reveal that Bahrain stock market causes Kuwait stock market and Oman stock market and these markets are also cointegrated. We find also evidence of Granger causality from Qatari stock market to Oman stock market. Finally, when considering the UAE market in the analyses, we observe that it leads the Qatari stock markets. These

results could be attributed to the economic and trade agreements between these countries including the gas project connecting UAE and Qatar. Our results further suggest that the linkages among the GCC stock markets are generally larger during the crisis period than before.

Next, we test the Granger causality during each sub-period for the second panel of the MENA stock markets.

Table 8: Causality Test for MENA stock markets before and during the crisis.

Null Hypothesis	X^2 Statistics	
	Pre-Crisis Period	Crisis Period
Egypt doesn't cause Jordan	1.774018	10.15772
Jordan doesn't cause Egypt	0.001844	12.96662
Egypt doesn't cause Morocco	2.996611	0.037847
Morocco doesn't cause Egypt	8.110039	5.567136
Egypt doesn't cause Tunisia	2.251328	3.982818
Tunisia doesn't cause Egypt	0.914204	5.603942
Egypt doesn't cause Turkey	7.056492	10.3924
Turkey doesn't cause Egypt	37.29546**	72.59024**
Jordan doesn't cause Morocco	0.451660	1.012803
Morocco doesn't cause Jordan	3.932869	3.847820
Jordan doesn't cause Tunisia	3.848730	1.810481
Tunisia doesn't cause Jordan	7.965339	5.131599
Jordan doesn't cause Turkey	3.703672	0.320806
Turkey doesn't cause Jordan	1.508256	27.77418**
Morocco doesn't cause Tunisia	0.616180	0.306483
Tunisia n doesn't cause Morocco	1.984925	2.648786
Morocco doesn't cause Turkey	3.189818	1.350701
Turkey doesn't cause Morocco	5.153453	0.005816
Tunisia doesn't cause Turkey	1.245184	1.735723
Turkey doesn't cause Tunisia	1.447921	1.150270

** denote rejection of the null hypothesis at the 1 percent level of significance

According to our results in Table 8, MENA markets are segmented during the pre-crisis period. We find only one Granger causality from Turkey to Egyptian stock market. This result could be attributed to the free trade agreement signed between these countries since 2005. During the crisis period, the Granger causality test results reveal that Turkey stock market Granger causes Egyptian and Jordan stock market, which is probably reflecting the emergence of Turkey as the most important financial center in the region,

and the largest market capitalization. Our results further suggest that the linkages among the MENA stock markets are larger during the crisis than before.

5. Conclusion

The MENA region is home of some of the oldest stock exchanges in the world: Turkey, Egypt and Morocco. Nevertheless, stock exchanges within the MENA region are classified as emerging markets. The MENA and the GCC countries are trying to launch and fasten reforms toward the deregulation and liberalization of their financial markets to attract international investors. This paper comes within this framework and examines the stock market integration between five GCC stock markets, namely Bahrain, Kuwait, Oman, Qatar and the United Arab of Emirates and between five MENA stock markets namely Egypt, Jordan, Morocco, Tunisia and Turkey before and during the crisis of 2008. Our results suggest a segmentation of the MENA and the GCC stock markets during the pre-crisis period. Under this market segmentation there would be potential gains from investing in the MENA markets and in the GCC markets through a regional diversification. However after the financial crisis of 2008, the co-integration analysis indicates an increase in the number of co-integrating vectors. Moreover Granger causality test results support the findings of a short term relationship within the GCC and within the MENA financial markets. These results may be explained by trade linkages relationships and economic coordination ties between MENA countries and between GCC markets. Indeed the economic and trade agreements between these countries play an important role in this integration, the cointegration during crisis period may be linked to synchronized actions. For GCC markets, this is likely to be the reflection of ongoing attempts to synchronize the economic policies in preparation for an economic union and ultimately for the introduction of a single currency. Moreover during a crisis period, investors from emerging markets may seek to invest in regional markets rather than in international markets in order to reduce risk. Finally and for more significant conclusion extension, we need to report our results to the post-crisis period. This should help us to ascertain whether the increased stock market integration after the financial crisis was permanent or transient.

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