The Potential Opportunities in International Portfolio Diversification

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Abstract

This study aims to investigate potential opportunities in international portfolio diversification. The study searches the opportunities for Egyptian investors in the Middle East and North Africa (MENA), European, Asian and United States stock markets. The study investigates the relationship of the Egyptian's stock market equity indices with world markets through examining the co-integrating behaviour, Granger causality tests, Variance Decompositions and Impulse Responses. A domestic portfolio has been composed to be used as a benchmark in comparing the benefit of international portfolio diversification using the mean-variance Portfolio Optimization (PO) approach. The results reveal that however the Egyptian market is integrated to the world market, there are still some gains could be achieved from international diversification.

Keywords: *Egyptian stock markets; portfolio diversification; Johansen co-integration test; causality; impulse response; variance decomposition.*

Introduction

The benefit of international equity diversification has been studied extensively from early financial literature. Solnik (1974) and Watson (1978) refer to the benefits of international diversification and how that spreading investment across several independent countries may significantly improve portfolio performance to a level which cannot be attained within a domestic portfolio as a result of the low correlation among international assets compared to domestic assets. The low correlation among international assets led to substantial gain from diversification (De Fusco et al., 1996 ; Cheol et al., 2008).

In other words, the benefits from international diversification depend on the relationships among stock markets and the degree of their independence. During last decades, this topic attracted considerable attention to measure the international market integration and the benefit of international diversification.

Longin and Solnik (1995) argue that the gain from international diversification decreases as the level of markets integration increases. Many literatures argue that the global stock markets become more integrated. Therefore, recently the benefit from integration fad up and no reason for diversified internationally. For example, De Jong and De Roon (2005) found that equity markets of emerging countries have become more integrated with international equity markets. Kim et al. (2005) found similar results in the Euro zone as they argued that the level of market integration increased in the post-Euro era. Bley (2007) find that MENA stock markets have become more integrated overtime. Similar results were found by (Carrier et al. :2007; Kazi et al. :2013).

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On other hand, some studies have indicated that MENA stock markets are segmented from the world markets, and not integrated with each other (e.g. Al-Kulaib, et al., 2009; Girard, et al., 2003)

Li et al. (2003) argue that although the global markets have become more integrated, it does not negate the benefits of international diversification in emerging markets.

Thus the study tries to answer the following questions

- Is the Egyptian market integrated or segmented with the global market?
- Is there any benefit that the Egyptian investor can gain from diversifying internationally?

The Study Objective

The objective of the study is to investigate the relationship of the Egyptian's stock market equity indices with world markets through examining the co-integrating behaviour, Granger causality tests, Variance Decompositions and Impulse Responses. A domestic portfolio has been composed as benchmarks to compare the benefit of international portfolio diversification using the mean-variance portfolio optimization (PO) approach. The study investigates potential opportunities in international portfolio diversification for Egyptian` investors in the Middle East and North Africa (MENA), European, Asian and the United States equity markets. The study includes sixteen markets: ten from MENA region (Jordan- Tunisia – Morocco and seven Gulf Cooperation Council (GCC)), three European (France – Germany – UK), two Asian (China-Japan) and United States.

Importance of the Study

The main contributions of this study are in the areas of international diversification from Egyptian investors point of view. While there are some literatures studied the diversification in the MENA region. All of these studies investigate the benefits that the developed markets can gain from adding emerging markets to their portfolio, this is the first study which examines the benefits for the Egyptian investors in particular. The study adds and supports the existing literature on the benefits of diversifying internationally, and should have significant implications for investors (individual or institutions) and for fund managers who want to diversify internationally.

Literature Review

Different countries have different economic conditions. They differ in their fiscal and monetary policy cycles, and they differ of return-generating mechanisms. It is rare to find a market that perfectly correlated with other markets or regions. This is why international diversification makes sense. Therefore, investor could gain from holding a portfolio that is diversified across a number of countries or regions (Gregg, 2012).

Complete stock markets integration would mean that stocks in the studied markets are exposed to the same risk factors and thus the risk premium on each factor is the same in all markets. Co-integration means that, however many developments can cause permanent changes in each of the individual series, there are some long-run equilibrium relations tying the individual series together. If stock prices are co-integrated, prices in different markets cannot move far away from each other, and there is some adjustment mechanism bringing the prices back towards the long-run relationship. On other hand, no co-integration means that stock markets have no long-run link and stock prices in different markets can diverge without bound. The co-movements of stock prices and co-integration reflect the integration of stock markets. In other words, one would expect stock prices to be co-integrated if stock markets are integrated (Ahlgren and Antell, 2002). Once markets become fully integrated, they are treated as a single market. Therefore, markets are completely integrated when assets with the same risk have the same expected returns, irrespective of the market they have been sold in. The hypothesis of integration among countries means the situation when all barriers (capital controls and other institutional barriers) to the internal trade liberalisation among those countries are eliminated. The elimination of the barriers will mean no more arbitrage among those countries and if there were price differences, then arbitrage would occur until the differences disappeared. Assets with the same risk will have the same expected returns. The opposite situation is segmentation, where some countries have barriers in the capital markets such as the movement of finance/funds between one country and capital controls. This is because such restrictions induce market segmentation. In practice, the relationships between most markets are located somewhere between complete integration and complete segmentation. In other words, when integration is not full and complete, the state of affairs might very well be such that it shows neither integration nor segmentation, and then we can speak about the degree of integration. In fact, there is a difficulty in determining the degrees of segmentation or of integration, since segmentation and integration are on a continuum – that is, a partially integrated market could be one with a degree of segmentation. It can also be that some parts of the market are integrated (between countries) and others not.

Co-integration estimation techniques developed by Engle and Granger (1987) and Johansen (1988) widely applied by scholars of finance. Recently, a number of papers have used co-integration to study the long-run co-movements of international stock prices and stock market integration. Numerous of these recent studies have explored the co-integration relations in the developed stock markets. Phengpis and Apilado (2003) found that the stock market price index for the major five EMU countries were co-integrated over the period from January 1979 until June 2002 and the co-integration relations became stronger over the passage of time. Bessler& Yang (2003) used co-integration test and suggested that US has a consistent long run effects on Australia, France, Germany, UK, Switzerland, Japan, Hong Kong, and Canada.

A number of financial literatures have focused on emerging stock markets in the MENA region. Darrat et al. (2000) investigated degree of integration among Morocco, Jordan and Egypt for the period from October 1996 through August 1999 and found that the Egyptian market has a dominant force in the region, they also found that the three markets are segmented internationally, but appear highly integrated within the region which implies that these markets offer potential gains from diversification to international investors.

Neaime (2002) found weak integration among Egypt, Jordan, Morocco and Turkey during the nineties while the integration between these markets and US, UK and France is strong.

Parsva and Lean (2011) investigated six MENA countries (Egypt, Jordan, Saudi Arabia, Oman, Kuwait, and Iran) before and during the global financial crisis. They found that as the bidirectional causal relation is found for all countries except Iran, the interactions between the markets have increased during the crisis.

On other hand, some studies have indicated that MENA stock markets are segmented from the world markets, and not integrated with each other (e.g. Al-Kulaib, et al., 2009; Girard, et al., 2003).

Al-Kulaib et al. (2009) investigated the linkage between stock market returns for twelve different countries' indices in the MENA region. These countries include: Egypt, Bahrain, Jordan, Kuwait, Oman, Morocco, Lebanon, Qatar, Saudi Arabia, UAE, Tunisia and Turkey. From January 3, 1999 to December 31, 2004. They found that the Egyptian stock market is auto-correlated and it does not influenced by lagged returns of Morocco or Tunisia markets. They also deduced that no causality or return spillover from one country to another in the North Africa region. The results for the GCC region show that there is more interaction and linkage in the GCC region than North Africa and Levant regions.

Yu and Hassan (2008) reported long-run equilibrium relation between the four markets (Egypt, Morocco, Jordan, and Turkey) and US stock markets. They also deduced that the interdependence among MENA stock markets is growing but still weak.

Guesmi and Teulon (2014) investigated the evolution of the process of integration in Middle East equity markets. Their estimated of the integration indices suggests that there are wide ranges in the degree of integration. Egypt has the highest market integration over the whole sample and Jordan is the most segmented.

Data and Methodology

The data used in this study were weekly closing stock market index from 27th of March 2011 to Jun 2016.This is to exclude the effect of the 25th of January 2011 in the Egyptian stock market. The Egyptian stock exchange closed at the end of trading on the 27thJanuary after the benchmark EGX 30 Index dropped 16 %. The drop of that week was from 6723.2 points on 24th of January to 5646.5 points on 27th of January. The exchange reopened on Wednesday 23rd of March after closing for about eight weeks.

Ezzat (2012) found that during the revolution period, all market indices exhibited high standard deviations – implying high volatility of stock returns.

The data include nine MENA countries, six of them are Gulf Cooperation Council (GCC), three other Middle East (Jordan- Tunisia – Morocco), three European Markets (France – Germany – UK), two Asian markets (China- Japan) and United States. The sample consists of 4352 observations (272 weeks x 16 markets = 4352)

The following share price indices were used:

- EGX30 for Egypt
- Gulf Cooperation Council (GCC)
- Bahrain All Share (BAX) for Bahrain.
- DFM General (DFMGI) for Dubai.
- MSM 30 (MSI) for Oman.
- S&P 500 (SPX)for U.S.
- Tadawul All Share (TASI) for Saudi Arabia.
- QE General (QSI) for Qatar.
- ADX General (ADI) for Abu Dhabi
- (KWSE) Main Market for Kuwait.

Other Middle East Markets

- Amman SE General (AMGNRLX) for Jordan.
- Moroccan All Shares (MASI) for Casablanca.
- Tunindex (TUNINDEX) for Tunis.

European Markets

- CAC 40 (FCHI) for France
- DAX (GDAXI) for Germany
- FTSE 100 (FTSE) for UK.

Asian Pacific

- Nikkei 225 (N225) for Japan.
- FTSE China A50 (FTXIN9) for China.

The data of the price index collected from (Investing.com).

1- The Unit Root Test

The data of the study are time series. Therefore, there is a possibility that the data series is a non-stationary series. A non-stationary data series is defined as one which has a different mean at different point in time and its variance increases with the sample size. Using the Ordinary Least Square (OLS) with non-stationary data can lead to spurious regression. This implies that there is a problem of falsely concluding that a relationship exists between two non-stationary data series, when such relationship does not exist. Therefore, testing for the stationary or non-stationary of the data is important. Thus the Augmented Dickey- Fuller (ADF) and Phillip Perron (1988) unit root tests are used. The following ADF model was employed.

$$\Delta y_t = \mu + \gamma_t + (\rho_a - 1)\ y_{t-1}\ + \Sigma p_{j=1}\ \psi_j \Delta y_t j + \mu_t \text{..........................(1)}$$

2- Co-integration Test

Co-integration estimation techniques developed by Engle and Granger (1987) and Johansen (1988) widely applied by scholars of finance. Recently, numbers of papers have used co-integration to study the long-run co-movements of international stock prices and stock market integration.

Engle and Granger (1987) suggested the use of the ADF tests to estimate the long-run relationship in single equations, for example, estimating the long-run relationship between x and y where:

$x = a + b\,y$ .... (2)

Assuming that the two series are both I(d)[1] according to the definition of co-integration the two series would be co-integrated of order CI(d, b) if there exists a parameter (b) such that a linear combination of the two series is I(d-b). This implies that we can estimate equation (2) by using the OLS. The null hypothesis of no co-integration will test whether the residuals are I (1) versus the alternative that they are I (0).

With multivariate systems when there is a possibility of several co-integration relationships among variables, another approach called the Johansen procedure (Johansen, 1988) is used.

The simplest form of the Johansen test for co-integration is:

$Z_t = A_1 Z_{t-1} + \ldots + A_k Z_{t-k} + \varepsilon_t$....................................(3)

1 The series yt is said to be integrated of order one, denoted I (1), because taking a first difference produces a stationary process. A non–stationary series is integrated of order d, denoted I(d), if it become a stationary after being differenced d times.

where Z_t is a vector of p*1 potentially endogenous variables and could include up to k- lags. ε_t is an independent and identically distributed (i.i.d.). This model can be rewritten in the Vector Error Correction Model (VECM) form:

$$\Delta Z_t = \Pi Z_{t-k} + \Gamma_1 \Delta Z_{t-1} + \ldots + \Gamma_{k-1} \Delta Z_{t-k+1} + \varepsilon_t \quad \ldots\ldots(4)$$

where $\Delta = (1 - L)$ and L is the lag operator. The reason for doing this is that now all the long run information in the Z_t process is summarized by the 'long-run impact matrix', II, and it is the rank of this matrix that determines the number of co-integrating vectors.The matrix Π is decomposed as $\Pi = \alpha \beta$, where α and β are both $p*r$ matrices. Rank can range from zero to the number of variables in (p) minus one. Thus, a system of two variables may have at most one co-integrating vector. The rank of Π is equal to the number of its statistically significant characteristic roots. If $r = 0$ (r = the number of co-integrating vectors), the variables in Z_t are not co-integrated and the traditional VAR may be estimated. If $r = 1$, the co-integrating vector is unique. The number of co-integrating vectors can range up to p -1.

3- Granger Causality test

The study uses Granger Causality test to determine whether one market is useful in forecasting another. The Granger (1969) approach to the question of whether X causes Y is to see how much of the current can be explained by past values of and then to see whether adding lagged values can improve the explanation. Or, the ability to predict the future values of Y using the histories of both X and Y better than it can be predicted using the history of Y alone. When time series X Granger-causes time series Y, the patterns in X are approximately repeated in Y after some time lag. Thus, past values of X can be used for the prediction of future values of Y. The bivariate regressions as the following equations:

$$y_t = \alpha_0 + \alpha_1 y_{t-1} + \ldots + \alpha_i y_{t-1} + \beta_1 x_{t-1} + \ldots + \beta_i x_{t-1} + \varepsilon_t \quad \ldots\ldots(5)$$

$$x_t = \alpha_0 + \alpha_1 x_{t-1} + \ldots + \alpha_i x_{t-1} + \beta_1 y_{t-1} + \ldots + \beta_i y_{t-1} + \mu_t \quad \ldots\ldots(6)$$

4- Variance Decompositions and Impulse Responses

The study uses the variance decompositions and impulse responses to examine the relationship between the Egyptian market and international markets over time.

The variance decomposition allows the relative importance of each market in generating unexpected variations in the price of its own equity market and the other markets to be measured over different time horizons (Dekker et al., 2001). The variance decomposition breakdowns the variance to show the proportion of the movements in the dependent variables that are due to their 'own' shocks, versus shocks to the other variables.

The impulse response function measures the speed of transmission of the pricing shocks information and its persistence from one market to another. In other words, it measures the time profile of the effect of shocks on the future states of a dynamic system (Koop et al., 1996).

5- Portfolio Optimization

The study uses the Mean-Variance (MV) portfolio optimization (PO) model introduced by Markowitz (1952). Markowitz argues that by spreading the investment across a wide array of stocks, the investors could benefit from diversification. He shows that the return of a portfolio is weighted average of the component stocks' return. The formulation of Markowitz's mean-variance analysis (1952) is:

Maximize $E(R_p) = \Sigma_{i=1} W_i R_i$ **subject to** ....(7)

where R_p is the return on the portfolio, R_i is the return on stock i, and Wi is the weight attached to (proportion of total investment in) stock i. its variance s_p^2 and s_{ij} is the covariance.

The portfolio risk determined by two characteristics: the weighted risk of individual assets (standard deviations) and the weighted relationships between the assets (covariance). Efficient Frontier (or portfolio *frontier*) represents set of optimal portfolios that offers the highest expected return for a defined level of standard deviations or the lowest standard deviations for a given level of expected return. It is usually exhibited as a curve on a graph comparing risk against the expected return of a portfolio to describe the relationship between expected portfolio returns and the riskiness or volatility of the portfolio.

Empirical Analysis

Descriptive Statistics

Some summary statistics for the stock price index series are given in Table (1). Skewness and kurtosis results indicate that the share prices for all the countries included in the sample do not follow the normal distribution as the skewness is far away from zero. This indicates that the distributions of the data do not look the same to the left and right of the centre point. The skewness was negative for five markets (Abu Dhabi, Jordan, U.K, France, Germany, and U.S) which imply that the distribution has a long left tail. The rest of markets with positive skewness for means as the distribution has a long right tail. The kurtosis for a standard normal distribution is three. China kurtosis is 4.265 that exceed 3 as its distribution is peaked (leptokurtic) relative to the normal. The rest of markets the kurtosis is less than 3, and the distribution is flat (platykurtic) relative to the normal.

Table (1)

Descriptive Statistics for Stock Price Index.

	Mean	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Prob.
Egypt	6547.295	1709.304	0.341732	1.85824	20.36329	0.0000
GCC Markets						
Kuwait	6485.882	829.8371	0.457	2.071	18.971	0.0001
Saudi	7724.702	1326.21	0.634	2.332	22.958	0.0000
Qatar	10169.530	1741.481	0.583	2.030	25.696	0.0000
Oman	6164.766	576.0099	0.390	2.216	13.655	0.0011
Abu Dhabi	3718.572	966.901	-0.112	1.399	29.171	0.0000
Bahrain	1247.911	133.1382	0.323	1.733	22.606	0.0000
Dubai	2835.059	1198.683	0.269	1.738	21.019	0.0000

	Mean	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Prob.
Other Middle East Markets						
Jordan	2059.309	97.50865	-0.38021	2.11409	15.61856	0.0004
Morocco	9843.326	903.1492	0.880209	2.91714	35.58883	0.0000
Tunisia	4865.552	394.383	0.433705	2.20391	15.88302	0.0003
European Markets						
U.K.	6237.362	585.1467	-0.36748	2.22094	13.19177	0.0013
France	4047.002		-0.10995	2.19109	8.08102	0.0175
Germany	8642.008	1714.733	-0.01053	2.04466	10.50097	0.0052
Asian Pacific						
Japan	13860.33	3887.743	0.010435	1.701479	19.11472	0.0000
China	8636.03	1735.766	1.232499	4.265093	87.00234	0.0000
U.S.	1711.464	313.9302	-0.22757	1.532539	26.75338	0.0000

For Jarque-Bera normality test, the results reported in last column show that the small probability value leads to the rejection of the null hypothesis of a normal distribution for all studied markets.

A simple test for the relationship between stock markets is to consider the correlation coefficients across the data. The results in table (2) show that the Egyptian market has an uphill linear relationship with the GCC markets.

The relation range from weak relationship with Kuwait, moderate with Oman, and strong with other GCC markets. For the other MENA markets, the relation was strong with Jordan, weak with Tunisia, and negative with Morocco. Also Egyptian market has strong positive relation with the European and US markets and weak positive relation with Chinese market.

As expected, the correlation between Abu Dhabi and Dubai appears to be the strongest one with value of 97.8%. The weakest positive correlation among these markets is between Saudi and Tunisia, only 6.29%. For the Egyptian market the strongest correlation relation was with Qatar 92.25% followed by the correlation with Dubai 91.8% and the weakest correlation was with Kuwait 20.4%. Egypt has one negative correlation with Morocco – 25.7% which may indicate good opportunity for diversification.

This result goes with most of recent studies that show increased correlations in recent decades. Goetzmann et al. (2005) found that over the past few decades, the correlation structure of the world equity markets has increased. Bowman et al. (2010) documented that correlations across markets returns increased gradually.

Many researchers examined the correlation to deduced the advantages of international diversification (Phylaktis and Ravazzolo: 2002: 2005; Lehkonen: 2015; and Bae and Zhang :2015; Bowman et al :2010). Some literatures consider that correlations are poor measure of integration (Forbes and Rigobon :2002 ; Bekaert et al., :2009;and Pukthuanthong and Roll :2009), while, Pukthuanthong and Roll (2009) argue that two markets can be perfectly integrated, and yet still be imperfectly correlated.

Other literatures found that equity diversification are still substantial despite the growing market correlations (Bouslama and Ouda, 2014). Therefore, the study will extend to investigate the co-integrating behavior of the Egyptian stock market with other markets and study the causalities using Granger causality tests.

Table (2)

Correlation Coefficient for Share Price Index

	Abu Dhabi	Bahrain	Dubai	Egypt	Kuwait	Oman	Qatar	Saudi	Jordan	Morocco	Tunisia	.U.K	France	Germany	Russia	Japan	China	.U.S
Abu Dhabi	1																	
Bahrain	0.633994	1																
Dubai	0.978582	0.6999	1															
Egypt	0.893897	0.7272	0.9184	1														
Kuwait	0.321041	0.3614	0.3357	0.2044	1													
Oman	0.623304	0.6657	0.6679	0.5871	0.8362	1												
Qatar	0.917149	0.7804	0.9623	0.9225	0.3469	0.6928	1											
Saudi	0.736538	0.7389	0.8162	0.791	0.6126	0.8533	0.87213	1										
Jordan	0.615248	0.6993	0.6121	0.6509	0.071	0.4039	0.57559	0.4119	1									
Morocco	-0.48184	0.1835	-0.406	-0.257	-0.31	-0.208	-0.2883	-0.256	0.1258	1								
Tunisia	0.329599	-0.039	0.2921	0.3911	-0.534	-0.294	0.26643	0.0629	0.1183	-0.2241	1							
.U.K	0.807634	0.567	0.7951	0.7713	0.5712	0.7448	0.76505	0.7935	0.496	-0.4881	0.1327	1						
France	0.852685	0.5874	0.8065	0.8109	0.1432	0.4371	0.75077	0.5841	0.6331	-0.3671	0.41679	0.82	1					
Germany	0.880351	0.516	0.8309	0.8482	0.1043	0.3969	0.77211	0.5941	0.582	-0.4612	0.52872	0.8121	0.9722	1				
Russia	0.2198	0.0614	0.1378	0.2506	-0.575	-0.294	0.06898	-0.24	0.4348	0.1429	0.48201	0.078	0.4939	0.45807	1			
Japan	0.873066	0.474	0.8048	0.7898	0.1068	0.3605	0.75072	0.5392	0.5413	-0.4951	0.5456	0.7525	0.9277	0.96087	0.4312	1		
China	0.221597	0.2618	0.1801	0.3561	-0.422	-0.201	0.20381	0.0493	0.3947	0.12359	0.64086	0.219	0.5531	0.54439	0.6212	0.5558	1	
.U.S	0.929997	0.4745	0.8818	0.869	0.1073	0.4099	0.81616	0.5945	0.5455	-0.5258	0.54977	0.7798	0.9049	0.9599	0.4141	0.9557	0.4327	1

Unit Root Results

Graphing the share price index in figure (1) suggests that all the data of share price are non-stationary, having intercepts and deterministic trends. The existence of the intercept is concluded from the fact that y_t does not seem to be 0 when $y_{t-1} = 0$ and the mean of the variables is not zero.

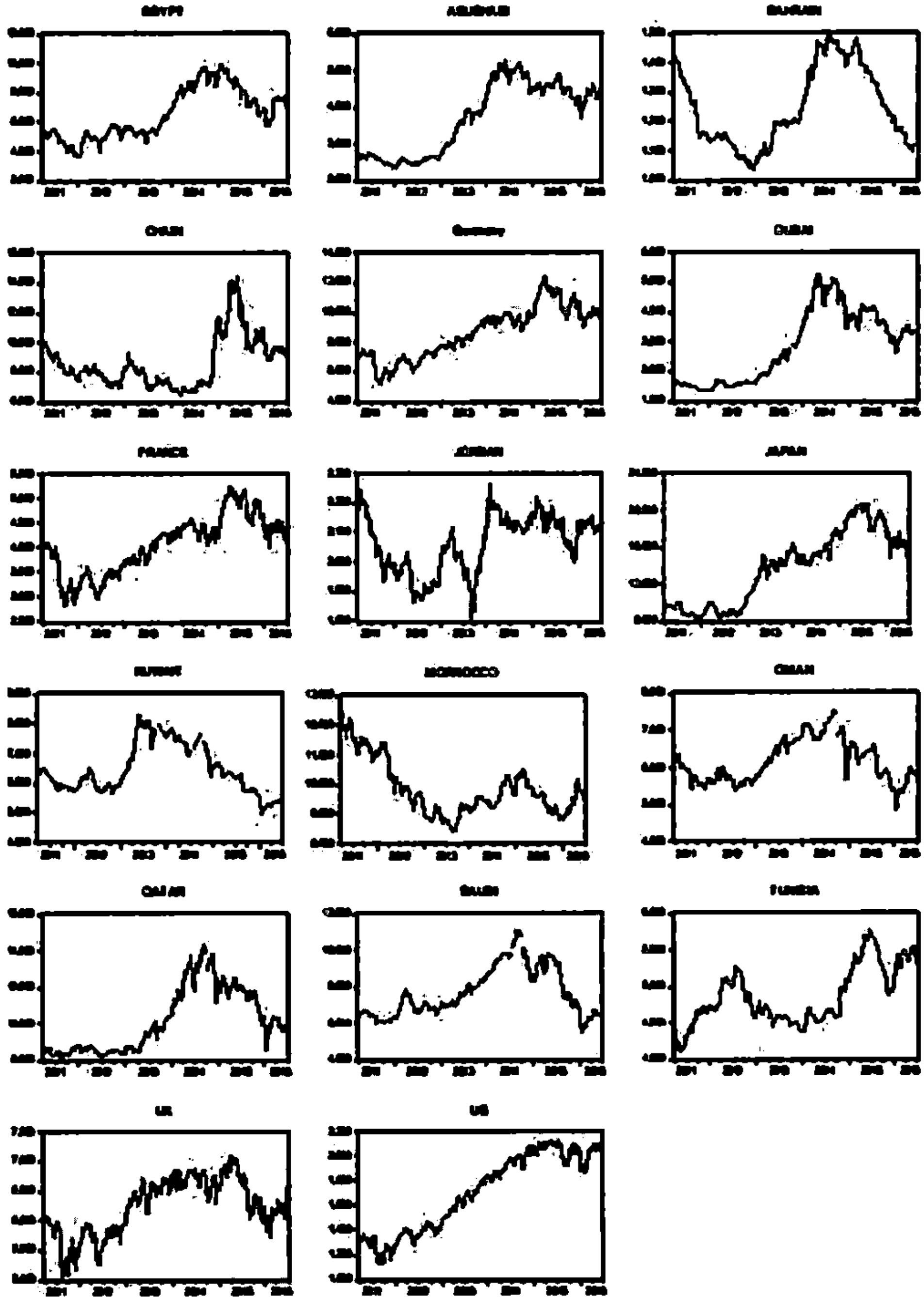

Figure (1) Share Price Index

The results of applying the ADF and PP tests to reveal the presence of the unit root in the series are reported in table (3) and these suggest that the data are time series data which suffer from the existence of a unit root. These results imply that it is not possible to use OLS regression analysis to examine the relationship among markets.

Table (3)

Unit Root Tests (The Augmented Dickey-Fuller Regressions)

		ADF Unit Root Test		PP Unit Root Test	
		t-Statistic	Prob.*	t-Statistic	Prob.*
1	Egypt	-1.483357	0.8332	-1.542177	0.8127
	GCC Markets				
2	Kuwait	-0.972452	0.9447	-1.067202	0.9314
3	Saudi	-0.929863	0.9499	-0.321138	0.9897
4	Qatar	-0.717212	0.9702	-0.474643	0.9842
5	Oman	-1.743388	0.7292	-1.214978	0.9048
6	Abu Dhabi	-1.204432	0.9070	-1.239626	0.8996
7	Bahrain	-1.207303	0.9064	-1.390817	0.8618
8	Dubai	-0.977941	0.9441	-1.054932	0.9333
	Other Middle East Markets				
9	Jordan	-2.830009	0.1878	-2.770711	0.2095
10	Morocco	-2.254720	0.4569	-2.342616	0.4091
11	Tunisia	-1.639938	0.7747	-1.942686	0.6293
	European Markets				
12	U.K.	-2.801077	0.1982		
13	France	-2.818348	0.1919	-2.769661	0.2099
14	Germany	-2.396016	0.3808	-2.543256	-2.54326
	Asian Pacific				
15	Japan	-1.491959	0.8303	-1.594884	0.7928
16	China	-2.022949	0.5857	-2.242881	0.4634
17	US	-2.746410	0.2189	-2.746410	0.2189

The next step is to select the order of the Vector Autoregressive model (VAR) .The lag order of the original VAR model determined by using the sequential modified LR test statistic (LR), Akaike Information Criterion (AIC), Final Prediction Error (FPE), Schwarz Information Criterion (SIC), and Hannan-Quinn information criterion (HQ). The results in Table (4) show that the estimated VAR includes two lags of each variable. This implies that each variable value is affected by the current and the past realizations of the other variables till two lags.

Table (4)

Maximum Lag Length Results

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-21730.09	NA	5.09e+81	236.3814	236.6785	236.5018
1	-18207.53	6355.928	2.80e+66*	201.2340	206.5806*	203.4011*
2	-18016.79	308.9216	8.73e+66	202.3020	212.6981	206.5157
3	-17777.47	343.3656	1.81e+67	202.8421	218.2877	209.1024
4	-17537.59	299.8513	4.54e+67	203.3760	223.8712	211.6829
5	-17217.24	341.2399	6.40e+67	203.0352	228.5800	213.3889

Lag	LogL	LR	FPE	AIC	SC	HQ
6	-16838.43	333.5158	7.50e+67	202.0591	232.6534	214.4593

* indicates lag order selected by the criterion

LR: sequential modified LR test statistic (each test at 5% level)

FPE: Final Prediction Error

AIC: Akaike Information Criterion

SC: Schwarz Information Criterion

HQ: Hannan-Quinn information criterion

Both Johansen`s trace and maximum eigenvalue tests are used to test whether the stock markets share price are co-integrated. The maximum possible number of co-integrating vector is equal to the number of variables in the system (p) minus one. Therefore, the minimum possible number of co-integrating vectors is 0 and the maximum will be sixteen (seventeen markets minus one). The maximum eigenvalue statistics and the trace statistics did not reject r=16 at the 95 per cent significance level or at the 90 per cent significance level.

The same results deduced when with bivariate co-integration method. Bivariate co-integration method was used to identify the relationship between the Egyptian market and other markets. For the sake of brevity, the results of the bivariate co-integration of each studied market have been omitted. The results in table (6) show that, using the maximum eigenvalue criteria and the trace criteria, suggest an existence of at least one co-integration relation for all the studied markets.

Table (5)

Co-integration Test Results Based on Johansen Approach.

Number of Co-integrating vectors	Trace Statistics	Max-Eigen Statistics
None	913.7480	156.7318
At most 1	757.0163	118.2870
At most 2	638.7293	100.7353
At most 3	537.9940	93.34690
At most 4	444.6471**	87.10957**
At most 5	357.5375**	67.61916**
At most 6	289.9184**	63.83867**
At most 7	226.0797**	51.69011**
At most 8	174.3896**	46.31152**
At most 9	128.0781**	40.93547**
At most 10	87.14259**	26.57739**
At most 11	60.56520**	25.04851**
At most 12	35.51669**	14.06114**
At most 13	21.45556**	10.57348**
At most 14	10.88208**	6.729615**
At most 15	4.152465**	3.635946**
At most 16	0.516520**	0.516520**

Table (6)

Co-integration Tests for the Share Price

Number of Co- integrating vectors	Trace Statistics	Max-Eigen Statistics	Trace Statistics	Max-Eigen Statistics
Egypt- Abu Dhabi			Egypt- Morocco	
None	7.893879**	7.079561**	10.40047**	6.527968**
At most 1	0.814317**	0.814317**	3.872504	3.872504
Egypt- Bahrain			Egypt- Tunisia	
None	8.174328**	7.018911**	8.007058**	5.774647**
At most 1	1.155416**	1.155416**	2.232412**	2.232412**
Egypt- Dubai			Egypt- U.K.	
None	16.09720*	12.84278**	8.490102**	6.523529**
At most 1	3.254417**	3.254417**	1.966573**	1.966573**
Egypt- Kuwait			Egypt- France	
None	6.848926**	4.511176**	8.259966**	6.370772**
At most 1	2.337750**	2.337750**	1.889194**	1.889194**
Egypt- Oman			Egypt- Germany	
None	7.546024**	5.470934**	7.275457**	7.275457**
At most 1	2.075091**	2.075091**	1.700132**	1.700132**
Egypt- Qatar			Egypt- Japan	
None	10.11244**	8.852647**	8.405244**	6.816885**
At most 1	1.259793**	1.259793**	1.588360**	1.588360**
Egypt- Saudi			Egypt- China	
None	6.066022**	4.127507**	16.09720	12.84278**
At most 1	1.938515**	1.938515**	3.25441**	3.25441**
Egypt- Jordan			Egypt- U.S	
None	16.07197**	13.71541**	4.049781**	3.628640**
At most 1	2.356560**	2.356560**	0.421140**	0.421140**

Granger-causality test is a strong empirical instrument to determine the direction of interrelationships between variables. Table (7) represents the Granger-causality test the first column represents the dependent variable used in each test and each subsequent column represents independent variables. For example, the p-value of 0 .0745 implies rejection the null hypothesis that the change in the Abu Dhabi index (ΔAbu Dhabi) does not Granger cause changes in the China index (ΔChina).

The results reveal strong bidirectional Granger causalities between changes in equity indices in (1) Egypt and Bahrain (2) Egypt and France (3) Dubai and Qatar (4) Qatar and France. Marginal causality exists between (1) Egypt and China.

Bidirectional Granger causalities where the causality from the first country is stronger than the reverse direction exist between (1) Qatar to Abu Dhabi (2) Kuwait to Bahrain (3) Germany to Egypt (4) France to Japan (5) Germany to Egypt (6) Us to Germany (7) Oman to Bahrain (8) Qatar and Dubai (9) Qatar and France.

The results reveal strong unidirectional granger causality from six markets (Abu Dhabi, Bahrain, Qatar, Saudi, Japan, UK, US) to the Egyptian market, while there is strong unidirectional granger causality from

Egyptian markets to Jordan. The US market has unidirectional granger causality to all of the studied markets except Abu Dhabi, China, Morocco, and Tunisia. The second dominated market was the UK market as it has unidirectional granger causality to all the GCC markets, Jordan, Egypt, and Japan.

Saudi which has largest market capitalization in the GCC and Middle East with ($580 billion) has strong unidirectional Granger causality to all the GCC markets except UAE. Also it has strong unidirectional Granger causality to Jordan. United Arab Emirates (UAE) followed Saudi Arabia by cumulated market capitalization of Dubai and Abu Dhabi is around $245 billion. The Abu Dhabi market has strong unidirectional Granger causality to Dubai, Bahrain, Kuwait, and France.

The results reveal existence of strong unidirectional Granger causality from the first to the second markets of the following pairs: (1) France to Bahrain (2) France to Jordan (3) France to Kuwait (4) France to Oman (5) France to Saudi (6) Germany to Bahrain(7) Germany to Japan (8) Germany to Jordan (9) Germany to Kuwait (10) Germany to Saudi (11) Japan to Jordan (12) Japan to Kuwait (13) Kuwait to Oman (14) Morocco to Bahrain (15) Oman to Bahrain (16) Qatar to Bahrain (17) Qatar to Germany (18) Qatar to Japan.

Weak causality deduced from (1) Abu Dhabi to China (2) Abu Dhabi to Oman (3) Abu Dhabi to Qatar (4) Bahrain to Kuwait (5) China to Bahrain (6) Germany to Dubai (7) Germany to France (8) Germany to Oman (9) Morocco to Abu Dhabi (10) Oman to Egypt (11) Qatar to Kuwait (12) Saudi to Dubai (13) Tunisia to Bahrain (14) US to Qatar.

Variance decomposition gives the proportion of the movements in the dependent variables that are due to their «own» shocks, versus shocks to the other variables. Table (8) summarizes the results of the variance decomposition of the Egyptian market. These results show that mostly the variation in the Egyptian market is due to its own changing behavior and the other small change is due to changes in other markets, at the first time horizon 99% of the Egyptian stock index variance can be attributed to its own movements. The percent gradually declines to 40.5% and after 10 weeks the Egyptian stock index accounts for its own changes, as this effect from other markets increased as the time period passes A substantial fraction of the EGX variance is associated with Abu Dhabi and Saudi innovations, meaning that these stock markets actively influenced the Egyptian stock market.

The results of the impulse response function are represented in Figures (2). The row data display the time path and the columns display the response of the Egyptian market had on the introduction of a shock in one of the international markets. For example, a one percent increase in standard error of the Abu Dhabi market leads, within ten days, to a 67 percent increase in the standard error of the Egyptian market. It is evident from the figures that there is a persistent effect of shocks on volatility for all countries. It can also be observed that many shock responses tend to arise in a time period of 1-2 days after the shock then persist in this level for very long time.

These results match with Billmeier and Massa (2007) who found that the GCC markets influence the Egyptian stock market. Reportedly during the Saudi stock crisis in 2006, the Cairo and Alexandria Stock Exchange index (CASE 30) index lost about 33 percent between February and June 2006 as a result of the sell-off by GCC investors who faceing margin calls in their home country and had to liquidate some of the foreign equity positions.

Figures (3) shows the response of world markets to the Egyptian market. It seems that the response to the Egyptian shock is very small except of China which is surprisingly, China seems to response the Egyptian shocks.

Table (7)
Granger Causality Test Results

	Δ Abu Dhabi	Δ Bahrain	Δ China	Δ Dubai	Δ Egypt	Δ France	Δ Germany	Δ Japan	Δ Jordan	Δ Kuwait	Δ Morocco	Δ Oman	Δ Qatar	Δ Saudi	Δ Tunisia	Δ U.K.	Δ U.S.
Δ Abu Dhabi		0.2438	0.4838	0.5934	0.8321	0.1133	0.2568	0.754	0.9157	0.2647	0.0685	0.4174	0.0331	0.125	0.5175	0.0074	0.1207
Δ Bahrain	9E-05		0.0637	8.00E-05	0.061	0.0032	0.022	0.2447	0.3128	2.00E-06	0.0313	2.00E-07	0.0003	9.0E-06	0.0902	5.00E-08	0.0003
Δ China	0.0745	0.3027		0.344	0.0954	0.2983	0.1078	0.1879	0.8586	0.5471	0.7097	0.5483	0.1372	0.6799	0.3581	0.3419	0.1523
Δ Dubai	0.025	0.6238	0.3263		0.4643	0.0335	0.0954	0.8222	0.8258	0.3188	0.1388	0.3519	0.0065	0.0627	0.5723	0.0023	0.0425
Δ Egypt	0.0008	0.0169	0.0726	0.0002		2.0E-05	0.0001	0.0096	0.8259	0.4557	0.1107	0.0754	0.0005	0.0001	0.3053	5.00E-05	0.0002
Δ France	0.0319	0.3866	0.9304	0.1431	0.0325		0.0738	0.0778	0.5565	0.6843	0.3215	0.3914	0.0176	0.2917	0.5554	0.2896	0.0158
Δ Germany	0.1574	0.5378	0.7185	0.3119	0.078	0.5414		0.3338	0.6339	0.7792	0.7469	0.3779	0.0239	0.4154	0.688	0.3691	0.0108
Δ Japan	0.1569	0.1483	0.2059	0.0994	0.1728	0.0159	0.004		0.943	0.2398	0.8011	0.2481	0.0239	0.1232	0.747	0.0369	0.0166
Δ Jordan	0.1027	0.5807	0.3252	0.0816	0.0145	0.0007	0.0017	0.0253		0.9743	0.483	0.4285	0.2035	0.0064	0.8969	4.00E-05	0.0002
Δ Kuwait	0.0422	0.081	0.4525	0.1097	0.2881	0.0001	0.0006	0.0485	0.6523		0.7811	0.2393	0.0559	0.0237	0.2004	0.0003	0.0038
Δ Morocco	0.6306	0.4453	0.9124	0.5427	0.2464	0.6316	0.896	0.8949	0.385	0.4728		0.6306	0.699	0.6754	0.7257	0.9659	0.9687
Δ Oman	0.0942	0.545	0.3902	0.3116	0.8425	0.0088	0.0814	0.8068	0.3263	0.0447	0.3211		0.6269	0.0088	0.4951	0.0007	0.007
Δ Qatar	0.0703	0.5079	0.3321	0.0019	0.3909	0.0406	0.191	0.9968	0.5009	0.2271	0.5807	0.0961		0.0106	0.5881	0.0016	0.0875
Δ Saudi	0.9864	0.9666	0.2735	0.9009	0.7978	0.0008	0.0074	0.4109	0.7134	0.1255	0.9521	0.1783	0.3478		0.1217	0.0002	0.0085
Δ Tunisia	0.3482	0.221	0.0299	0.6013	0.2893	0.847	0.591	0.4281	0.4384	0.178	0.6282	0.6019	0.3786	0.4194		0.954	0.4845
Δ U.K.	0.1559	0.5394	0.5109	0.2249	0.3571	0.6421	0.8628	0.7641	0.6141	0.7208	0.1575	0.5464	0.2475	0.4894	0.8455		0.405
Δ U.S.	0.3566	0.6339	0.0868	0.4493	0.5156	0.1167	0.0655	0.5392	0.4255	0.9764	0.4213	0.8802	0.5389	0.3363	0.9966	0.7825	

Table (8)
Variance Decomposition of EGYPT

Period	.S.E	ABUDABI	BAHREN	CHAIN	DUBI	EGYPT	FRANCE	GERMANY	JAPAN	JORDAN	KWAIT	MORROCCO	OMAN	QATER	SAUDI	SP500	TUNISIA	UK
1	225.3765	2.429490	1.760317	1.121020	2.640960	92.04821	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
2	323.8755	8.009739	4.318342	2.012677	2.787830	78.15774	2.672877	0.011505	0.010479	7.00E-05	0.544011	0.165910	0.068929	0.014514	1.194599	0.002874	0.003252	0.024658
3	383.7921	11.61462	3.953425	2.404286	2.265985	69.79072	4.083475	0.014217	0.247967	0.024193	0.809528	0.241471	0.052011	0.125111	2.796177	0.743704	0.491270	0.341843
4	428.8255	14.52312	3.707660	3.059196	1.815076	62.78335	4.022638	0.084091	0.654287	0.068242	1.057877	0.334156	0.042186	0.281282	4.050803	1.566358	1.080828	0.868844
5	467.5637	16.43824	3.641136	3.472734	1.538606	56.88994	3.846682	0.218589	1.155303	0.098514	1.224590	0.376014	0.035914	0.465137	4.712061	2.670217	1.686263	1.530066
6	501.1850	17.68641	3.749244	3.631079	1.351392	52.09105	3.692897	0.421912	1.643302	0.120318	1.349508	0.391347	0.034269	0.577855	5.065518	3.848740	2.150353	2.194806
7	530.6333	18.39068	3.961045	3.584041	1.207447	48.26062	3.589924	0.653211	2.091354	0.128947	1.443069	0.392083	0.033452	0.621293	5.253119	5.108309	2.501933	2.779472
8	556.7070	18.72130	4.232129	3.433386	1.099166	45.18429	3.514320	0.893511	2.477914	0.127277	1.514485	0.387798	0.031063	0.615851	5.361301	6.398972	2.759340	3.247897
9	580.2020	18.79991	4.519988	3.241194	1.033802	42.65733	3.454839	1.128402	2.804407	0.119494	1.568235	0.381685	0.028671	0.585876	5.426284	7.699243	2.953572	3.597071
10	601.7524	18.72296	4.792896	3.043360	1.022142	40.51873	3.401630	1.349226	3.078506	0.111105	1.609347	0.375595	0.027981	0.548199	5.467217	8.983741	3.106361	3.841008

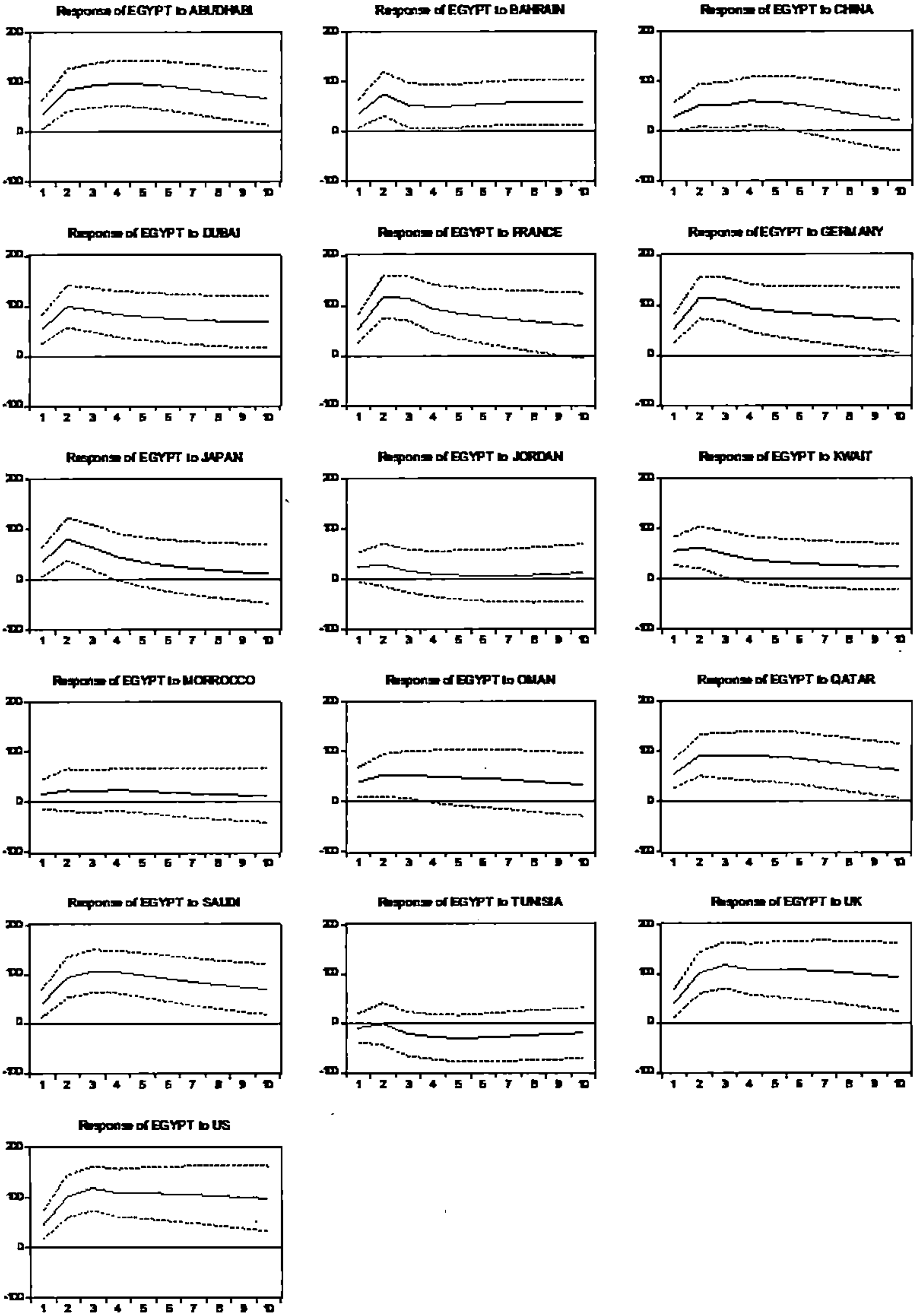

Figure (2) Impulse Response Function for the Egyptian Markets to World Markets

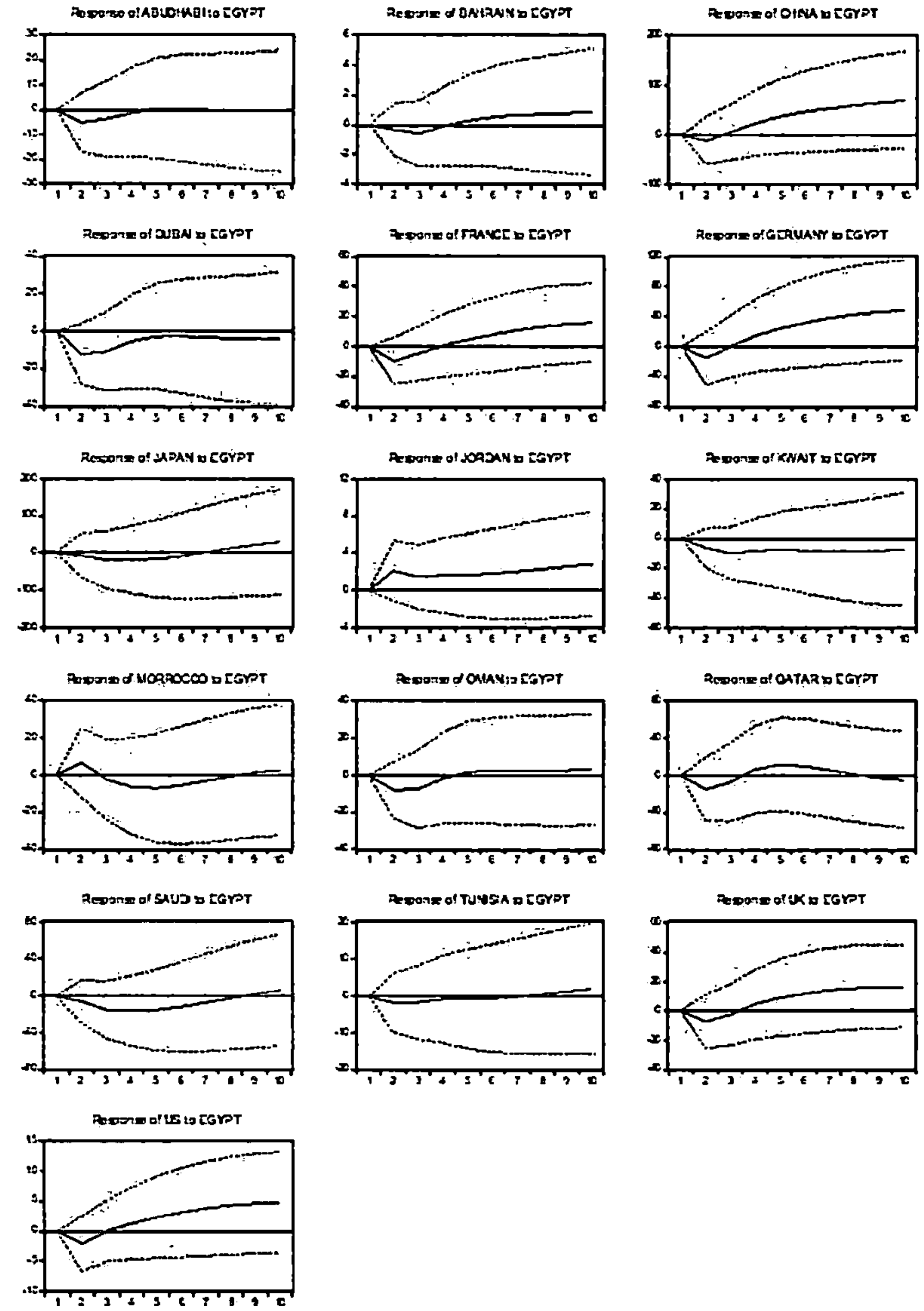

Figure (3) Impulse Response Function for the World Markets to Egyptian Markets

Portfolio Optimization

This study adopts the portfolio optimization approach to examine the preferences of different internationally diversified portfolios and domestic portfolio for risk-averse investors. The weekly return used to compose the portfolios. The weekly returns calculated as the natural logarithmic differences in price, (R_i = ln[Pt/Pt-1]). Summary statistics for the stock price index series are given in Table (9). It can be seen that eleven markets have negative average returns, which reflect in negative means. Egypt, Abu Dhabi, Dubai, Qatar, Japan and US have positive average return. On other hand, these countries have the highest standard deviation which denotes the highest market volatility. None of the markets proves to have normally distributed returns as the probability that a Jarque-Bera statistic exceeds (in absolute value) the observed value under the null hypothesis.

Table (9)

Descriptive Statistics for Stock Indices Weakly Return

	Mean	Std. dev.	Skewness	Kurtosis	Jarque-Bera	Prob.
Egypt	0.000871	0.047511	-0.47776	2.785161	86.38606	0.0000
GCC Markets						
Kuwait	-0.0010	0.029083	-0.399	2.125985	49.21538	0.0000
Saudi	-0.00048	0.034247	-0.65154	2.343245	67.63518	0.0000
Qatar	0.000193	0.03452	-0.29517	2.294776	50.95133	0.0000
Oman	-0.00016	0.032253	-0.22638	4.511912	185.1944	0.0000
Abu Dhabi	0.001363	0.033326	-0.34707	1.470882	26.47031	0.0000
Bahrain	-0.00118	0.027016	-0.6956	2.66417	20.24806	0.0000
Dubai	0.002334	0.04448	-0.34312	1.37604	13.91301	0.0000
Other Middle East Markets						
Jordan	-0.00045	0.027669	-0.27857	2.769593	78.60457	0.0000
Morocco	-0.00194	0.029274	-0.81843	2.525617	96.12201	0.0000
Tunisia	-0.00042	0.026868	-0.49421	2.169376	58.87690	0.0000
European Markets						
U.K.	-0.00112	0.03194	-0.54829	2.486997	80.95330	0.0000
France	-0.00129	0.036039	-0.56332	1.725636	41.40585	0.0000
Germany	-0.00021	0.037509	-0.69781	2.154658	63.72671	0.0000
Asian Pacific						
Japan	0.000756	0.041246	-0.45042	0.926084	15.73959	0.0000
China	-0.00014	0.040957	0.10354	1.61136	25.09330	0.0000
U.S.	0.00043	0.031013	-0.71462	3.135537	118.8666	0.0000

Figure (4) exhibit the average weekly returns versus standard deviation, it shows that EGX30 return does not dominated according to the mean-variance efficient. The results match with the results of AlKulaib et al. (2009) how found that the UAE's stock market leads all the markets in the region. They attribute this to the tremendous growth of the UAE's equity market in recent year.

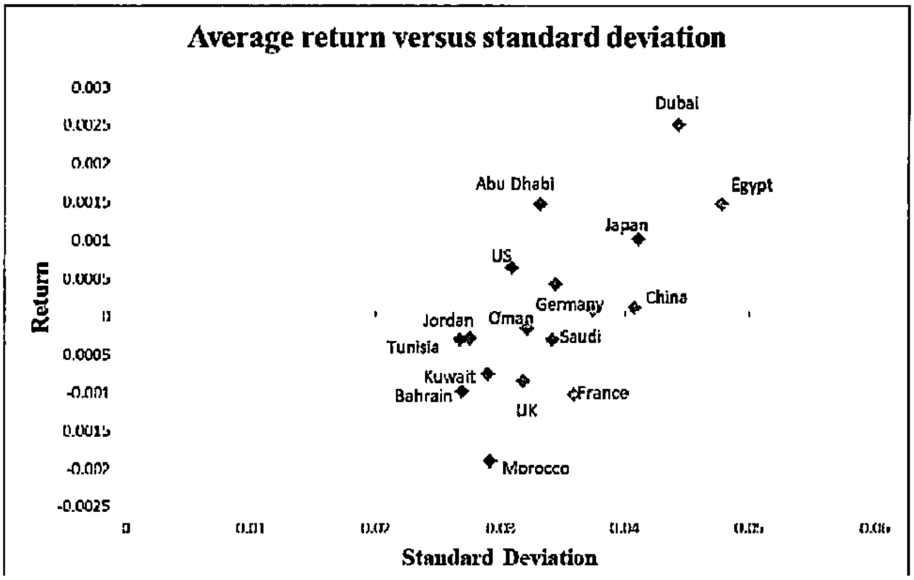

Figure (4) Average Weekly Returns Versus Standard Deviation

The portfolio was imposed the constraints of no short sales meaning investment positions of each sector spans between 0% and 100% of the portfolio. From figure (5) it can be concluded that when applying the mean-variance optimization approach to different efficient frontiers, the internationally diversified portfolios dominate domestic portfolio performance in the entire risk-return range.

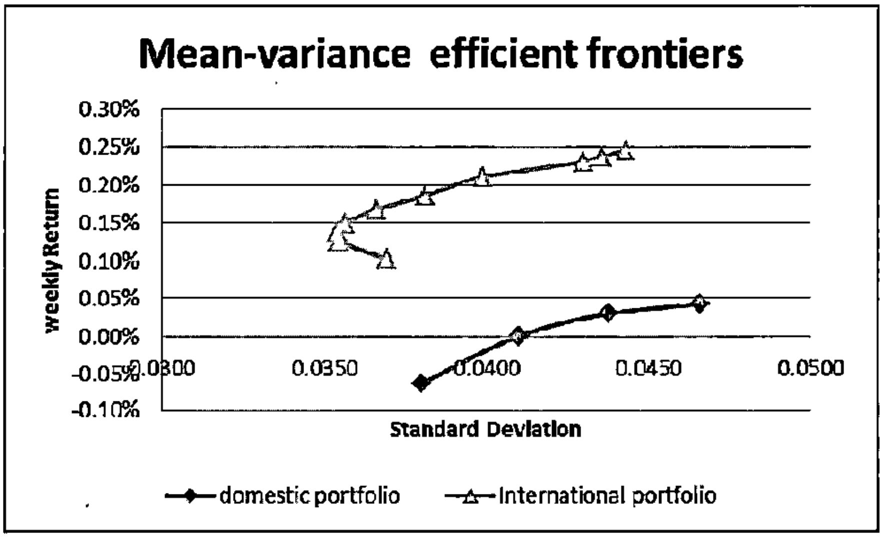

Figure (5) Mean Variance Efficient Frontiers

Figure (6) shows a comparison between different composed portfolios. The first portfolios start with the domestic portfolio then international equities was added respectively as following: GCC equities, the three remaining MENA equities, the European equities, then the Asian equities, and finally the US`s equities. The results concluding that notable gain achieved when adding GCC equities to the domestic portfolio. However the small linkage with Tunisia, Jordon, and morocco no significant gains have been achieved by adding them to the internationally diversified portfolios. As expected, a notable gains achieved from adding the Asian markets to the international portfolio.

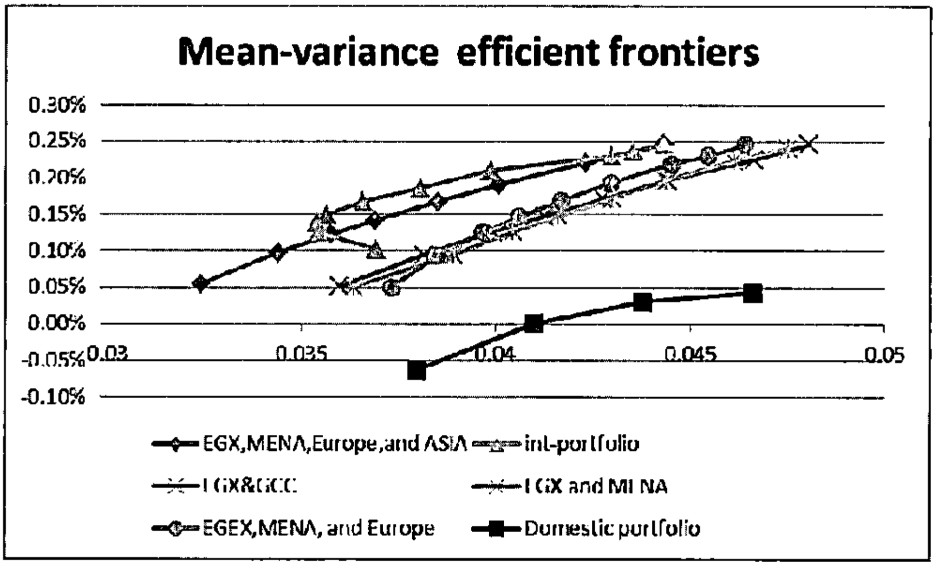

Figure (6) Mean Variance Efficient Frontiers for Different International Portfolios.

Figure (7) exhibits the suggested international portfolio which minimizes the risk. The domestic component weights 31%. However the high degree of linkage with the UAE market, it is dominated in the portfolio with weights around 44% (35% for Dubai and 9% for Abu Dhabi), Followed by Japan with 13%. All other MENA markets did not exceed 1% for each.

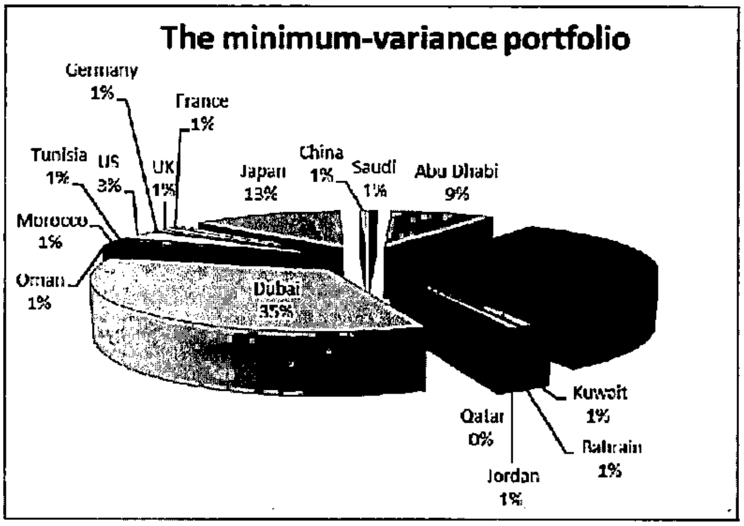

Figure (7) Weights of the Minimum-variance International Portfolio

Result Interpretation

In 2008, Rim & Setaputra argue that financial integration is thought to be the result of the openness of markets to foreign investors and as financial markets become more open, it is expected the degree of integration to increases. The results show that the Egyptian market is significantly integrated to the world market. This fact could be interpreted as a result of the foreign capital flowing in the Egyptian market. For example, as shown in table (10) in 2015 among more than 18 thousands new investors who registered to the market 15% of which are foreigner.

Foreigners accounted for about 29% of the total value traded in 2011, of which more than 24% was captured by non-Arab foreign investors, while the remaining 5% was captured by Arab investors and increased to 8% by 2015, after excluding deals and bonds, which interpret the significant integration of the Egyptian market with the GCC markets.

The foreign participation by region, Europe has dominated foreign investments on EGX its participation range from capturing around 49% in 2011 to around 39% in 2015of the total foreign investments, after excluding deals and bonds. Arab investments increased from 18% in 2011 to 30% of the foreign investments, while 19% were owed to USA & Canada in 2015 compared to 27% in 2011.At the country level, the USA and the United Kingdom have represented 18% and 17%, respectively, of the total foreign investments on EGX in 2015, followed by Saudi Arabia constituting around 14% the total foreign investments, after excluding deals and bonds.

Table (10)

Foreign Participation in the Egyptian Exchange

Years	Number of Newly Coded Investors			Value Traded%		
	Egyptians	Arabs	Non-Arab Foreigners	Egyptians	Arabs	Non-Arab Foreigners
2011	33569	886	1597	71%	5%	24%
2012	20082	742	1398	79%	6%	15%
2013	14693	538	1076	79.8%	6.1%	14.1%
2014	19621	571	1480	79.1%	8.1%	12.8%
2015	15219	733	2046	72.4%	8.2%	19.4%

Years	Foreign Participation by Region				Foreign Participation by Country			
	US & Canada	Europe	Arabs	Others	USA	UK	Saudi	Others
2011	27%	49%	18%	6%	27%	41%	8%	23%
2012	23%	41%	29%	7%	23%	32%	15%	31%
2013	20%	43%	30%	7%	19%	32%	14%	35%
2014	16%	36%	39%	9%	15%	22%	20%	43%
2015	19%	39%	30%	12%	18%	17%	14%	51%

Source: the Annual Report of the Egyptian Stock Exchange, various issues.

Conclusion

The study investigates the potential benefits of the Egyptian investors that may be gained from international portfolio diversification across different markets. Previous literatures argue that the benefits from international diversification depend on the relationships among stock markets and the degree of their independence. Hence, firstly long-run relationship has been investigated both bilaterally and between different markets. Correlation, Johansen co-integration, Granger causality test, variance decompositions and impulse responses have been applied. Secondly, the mean-variance portfolio optimization approach applied to investigate the preferences for international diversification. The results indicate that the Egyptian market and the studied markets are interdependent and highly integrated.

Performing correlation coefficients, reveal strong relation with most of the GCC, European and US markets. For the MENA markets, the relation was strong with Jordan, and weak with Tunisia, and negative with Morocco. Egypt has weak positive relation with China.

Performing co-integration analysis, according to Engle and Granger (1987) and Johansen (1988) reveal that markets have a long-run relationship as sixteen co-integrating vectors have been founded. The bivariate co-integration results suggest an existence of co-integration relation for the Egyptian market with all the studied markets.

Performing, Granger-causality test deduced strong bidirectional Granger causalities between changes in equity indices in Egypt and two markets; Bahrain and France. Marginal causality exists between Egypt and China. The results deduced strong unidirectional granger causality from six markets (Abu Dhabi, Bahrain, Qatar, Saudi, Japan, UK, US) to the Egyptian market, while there is strong unidirectional granger causality from the Egyptian markets to Jordan. The existence of Granger causality implies that the differences between the markets are insufficient for Egyptian investors to achieve gains by diversifying internationally. Similar results deduced when applying variance decomposition and impulse response.

The general conclusion of this study is that the Egyptian stock market tends to display stronger linkages with GCC markets and MENA more than the linkage with the world markets.

The mean-variance optimization approach deduced that however, the high degree of integration Egyptian investors, they still can gain some benefits from international diversification.

These results match with the results if Li et al. (2003) who argue that even that global markets have become more integrated, it does not negate the benefits of international diversification in emerging markets.

Future Research

This research could be expanded in the several ways. The stock markets could be tested for diversification opportunities during a financial crisis as the markets usually tend to move together more closely during turbulent periods. It also, could be expanded by investigating Egyptian market volatility with GARCH approach.

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