How Homogeneous are the Stock Markets of the Middle East and North Africa?

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In light of the changing economic environment in most Middle East and North African (MENA) countries, the objective of this study is to determine the contemporaneous interactions of the stock markets of Bahrain, Egypt, Israel, Jordan, Kuwait, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Tunisia, Turkey, and the United Arab Emirates by (1) determining the degree of market integration, (2) qualifying the return sensitivity among the markets, (3) revealing any lead-lag relationships, (4) analyzing degree and stationarity of relative market co-movements, and (5) investigating the impact of US, UK, and Indian stock market movements on the MENA counterparts. The results indicate that the changing stock market dynamics within the MENA region still yield substantial intraregional diversification benefits and suggest the inclusion of regional equity in a global portfolio.

Introduction

Stock markets in the Middle East widely have been ignored by international investors due to imposed restrictions on foreign stock ownership, the lack of common accounting standards and corporate transparency, and economic and political uncertainty. As a result, recent large scale privatizations and stock market liberalization efforts in several Arab countries went unnoticed by the international investment community that often lumps the stock markets of the Middle East and North Africa (MENA) region together because of geographic proximity and perceived economic or political similarity. By taking a closer look at various MENA subsamples, Omran and Gunduz (2001) and Girard and Ferreira (2004) find the regional stock markets to be segmented. A glance at Table 1 confirms that economic conditions across MENA economies are different. For example, on a purchasing power parity basis, the GDP per capita in the MENA region ranges from $3,710 (Egypt) to $40,800 (Qatar). With the exception of Oman, inflation-adjusted economic growth rates exceed those of most developed economies. The average real

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Table 1—Characteristics of MENA Economies and Stock Markets

	Markets/Economies of:													
Characteristics	Bahrain	Egypt	Israel[7]	Jordan	Kuwait	Lebanon	Morocco	Oman	Palestine	Qatar	Saudi Arabia	Tunisia	Turkey	UAE
Stock Trading Began	1957	1890	1935	1976	1952	1920	1929	1988	1997	1997	1935	1969	1866	1989
Current Market System Established	1987	1994	1993	1978	1983	1996	1994	1998	1997	1997	1985	1989	1985	2000
Electronic Trading Since	1987	1994	1997	1993	1995	1996	1997	1998	1997	2002	1988	1994	1993	2000
Number of Companies Listed	48	787	602	190	114	16	52	128	26	30	72	44	297	49
Market capitalization (US$bn)	12.7	32.6	85.4	13.5	65.9	2.2	15.9	9.3	1.1	34.6	237.6	2.4	91.2	67.1
Average Daily Trading Volume (mil. shares)	1.1	184		7.6	124.6	2.1	2.1	2.2	0.5	0.5	38.9	1.4	2,780	38.9
Average Daily Trading Volume (US$mil.)	1.4	32.3	181	24.3	183.8	0.7	5.7	10.4	1.2	9.9	1931	0.9	615	113.6
Max. % of Foreign Investment[2]	100[1]	100	100	49 - 100	49[1]	100	100	25 - 100	100	25[1]	0	49	100	49
Foreign Investment through Mutual Funds	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes	yes
Regional Cross-listing	yes	yes	yes	yes	yes	yes	no	yes	no	no	no	no	yes	no
Length of Settlement Procedure (days)	2	2-3[3]	1	1	1[4]	2	3	2	3	3	real time	3	2	2
Stock/index Futures Trading	no	no	yes	no	limited	no	no	no	no	no	no	no	yes	no
Geo. Mean Index Return p.a. 2000-2004	4.32	-3.80	5.49	21.43	27.48	-2.45	0.04	6.29	0.82	33.02	29.10	-2.84	6.58	23.03
P/E	16	n/a	n/a	23.3	15	n/a	n/a	11	n/a	29	26	10.8	13.2	27
Dividend Yield	3.8	n/a	n/a	2.3	3.5	n/a	3.8	4.2	n/a	2.1	1.25	5.3	1.4	1.8
Moody's Souvereign Rating	Baa1	Ba1	A2	Ba2	A2	B2	Ba1	Baa2	n/a	A3	Baa2	Baa2	B2	A1
Nominal GDP in 2003 (US$bn)	8.23	70.12	103.1	10.1	41.9	17.99	47.84	21.1	n/a	19.56	210.91	24.77	238	78.48
GDP per Capita in 2003 (PPP - US$)	18,990	3,710	16,020	4,130	22,020	7,570	4,180	12,250	n/a	40,800	10,770	6,900	6,700	14,490
Est. Real GNP Change (%)[5]	5.6	2.7	4.1	5	6.8	3.5	4.4	1.2	n/a	8.7	5.7	4.7	5.8	5.7
Inflation Rate in 2003 (CPI % change)	0.4	5.6	0.7	2.6	1.4	2	0.5	n/a	n/a	1.6	0.3	4.4	18.4	3.1
Est. Inflation Rate (CPI % change)[5]	2	9.5	-0.4	3.3	1.9	1.5	2.5	n/a	n/a	3.8	0.5	3.2	25.3	3.1
Current Account Balance/GDP in %	-3.1	5.1	n/a	9.4	20.6	-15.9	1.6	10.7	n/a	23.4	11.8	-3.1	-1.5	15.9
External Vulnerability Indicator[6]	0.53	0.22	n/a	0.13	1.12	0.21	0.03	0.33	n/a	0.93	0.87	0.25	n/a	0.72

Note: The economic data was provided by SHUAA Capital, Dubai, CIA Factbook, and the Worldbank (December 2004). The stock market related data was provided in part by the Arab Monetary Fund and the individual stock market organizations

[1]GCC nationals only

[2] In Bahrain, seven companies (mostly banks) are open to 100% foreign ownership which is otherwise restricted to 49%. Jordan has restricted foreign stock ownership to 49% in the transportation sector. Kuwait does not allow non-GCC citizens to invest directly in the stock market and Saudi Arabia makes only bank shares available to GCC citizens. In the UAE, non-nationals can buy up to 20% of Emaar and 49% of Tabreed shares, whereas in Qatar, GCC citizens can buy up to 25%. However, while ownership in bank and financial services companies is restricted to Qatar nationals, non-GCC citizens can invest in Qatar Telecom and Salam International

[3]Settlement is t+2 for the most active stocks list that has no 5% price limit, t+3 for dematerialized securities that constitute 90% of trading and t+4 for the remaining physical securities

[4] Balances are available after one day; general settlements between all parties every Saturday

[5]2004 estimates

[6] A ratio used by Moody's that measures a country's ability to cover its maturing debt only through its reserves, computed as: (Short Term Debt + Maturing Portion of Long Term Debt)/ Foreign Exchange Reserves

[7]Economic data provided by the Ministry of Finance of the State of Israel

GDP growth rate of 5.7 percent in the region of the Gulf Cooperation Council (GCC), which includes Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates, is among the highest in the world, with Qatar (8.7 percent) taking the lead.

Regional stock markets differ tremendously in terms of size and liquidity. While Lebanon and Tunisia have market capitalizations of $2.2bn and $2.4bn, respectively, the market value of equity listed at Saudi Arabia's stock exchange reached almost $238bn in 2004. In less than two years, total GCC market capitalization increased 161 percent, from $163.3bn in 2002 to $427.2bn in September 2004. While the highest market growth rates were experienced by Qatar (+230 percent), Bahrain grew only 65 percent. Founded in 2000, the combined market capitalization of Dubai and Abu Dhabi ($67.1bn) have elevated the UAE stock market to the second largest stock market in the GCC region, closely followed by the Kuwaiti stock market ($65.9bn), which was established more than twenty years ago. In contrast, the non-GCC stock markets of the MENA region grew at significantly lower rates or not at all. For example, the market capitalization of the Egyptian and Lebanese stock markets increased only 35 percent and 5 percent since the end of 2000, respectively. Over the same period, stock markets in Tunisia and Morocco lost about 15 percent and 45 percent of their respective capitalizations. The primary markets are most active in Kuwait, where the number of listed companies increased to 114 from 86, and the UAE with 49 listed companies since market inception in 2000. In terms of daily trading volume, stock markets in Saudi Arabia ($1,930m), Kuwait ($184m), Israel ($181m), and the UAE ($113m) are the most active in the region.

With high oil prices financing necessary economic reforms, low interest rates limiting opportunity cost of equity investing, and legal and regulatory stock market reforms reducing required equity risk premium, the region's prospering financial markets seem to be headed for a bright and prosperous future. The developments of functioning capital markets can promote economic reforms even further by more efficiently allocating investments to new industries, widening the investor's base, and ultimately reducing local companies' cost of capital. Stimulated by strong fundamentals and high demand for stocks in the Arab Gulf states, $3.2bn in IPOs were placed in the region in 2004, compared to $808m in 2003.[1] The year 2005 is scheduled not only to witness a further increasing number of IPOs but also the launch of the single biggest equity issue in the history of the MENA region. The IPO of UAE's Addar Properties will raise the equivalent of $102.6bn, an amount that would exceed

[1] In the UAE alone the list of oversubscribed IPOs launched in 2004 is long. For example, the Amlak IPO was oversubscribed 33 times, followed by Finance House (75 times), and Arab Technical Construction Company (65 times). When the national telecommunications company Ettihad Etisalat placed a secondary offer in Saudi Arabia, the opening price exceeded the subscription price by 500 percent; not surprising, however, given that the issue was oversubscribed 125 times.

the country's 2003 GDP by about $25bn. The Addar IPO, which is larger than the country's entire market capitalization, was closed early on November 25, 2004, as it was 448 times oversubscribed.

The benefits of the recent stock market boom are not distributed evenly among investors of different nationality. As foreign investors are given more freedom to invest directly in the shares of local companies, however, the eligible investor base is broadening gradually. GCC stock markets, with the exception of Saudi Arabia, are no longer reserved playing fields for GCC citizens. Foreign investors, who were allowed only stock ownership through mutual funds, today are granted access to on-line trading facilities.[2] Other MENA markets traditionally have been more open to foreign stock ownership.

Early studies on MENA stock markets could not identify significant cross-linkages despite market proximity, i.e., Erb, Harvey, and Viskanta, (1996), Abraham, Seyyed, and Al-Elg (2001), Darrat, Elkhal, and Hakim (2000), and Omran and Gunduz (2001). The tremendous increase in stock market activity in recent years is likely to have impacted return behavior. Harvey (1995a and 1995b) discovers risk/return behavior and volatility clustering of selected MENA markets that differs from emerging market characteristics, e.g., low correlation with Western market returns or high volatility, commonly found in Asia, Latin America, or Eastern Europe. Based on 1994–2001 daily return data, Hammoudeh and Aleisa (2004) found two equilibrium relationships with varying predictive power among GCC stock markets. The study, which did not include the market of Qatar with a capitalization of $34.6bn, identified Saudi Arabia as being most influential on the return behavior of the other GCC markets.

Facing the pressure of ongoing globalization, most MENA governments have opted for stronger economic ties within the region. In January 2003, the GCC customs union was launched, representing an important first step in the process of forming a common market by 2007 and introducing a single currency by 2010.[3] In April 2004, key criteria for economic and fiscal integration (relating to budget deficit, interest, and inflation levels) were set by the six GCC member states. On January 1, 2005, the Arab free trade zone, including Arab countries outside the GCC region, came into effect. The ongoing economic integration already may have altered the dynamic relationships among the MENA stock markets.

By applying a cointegration framework to 14 regional stock markets, this paper provides a first-time, cohesive report on the stock return behavior of all MENA

[2] See Table 1 for details on foreign stock ownership restrictions.

[3] The currencies of the following MENA member states currently are pegged to the US dollar: Bahrain, Jordan, Lebanon, Oman, Qatar, Saudi Arabia, and the UAE. While the Kuwaiti dinar and the Moroccan dirham are pegged to a basket of currencies including a heavily weighted US dollar, the Egyptian pound is tied to the US dollar in the form of a floating peg with ± 3 percent bands.

countries, including all six members of the GCC. A generalized forecast error variance decomposition and impulse response analysis is employed, where the objective is to determine the market dynamics and contemporaneous interactions of the stock markets of Bahrain, Egypt, Israel, Jordan, Kuwait, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Tunisia, Turkey, and the United Arab Emirates.[4] In particular, the attempt is to (1) determine the degree of market integration, (2) qualify the return sensitivity among the markets, (3) reveal any lead-lag relationships, (4) analyze degree and stationarity of relative market co-movements, and (5) investigate the impact of US, UK, and Indian stock market movements on the MENA counterparts.

Data and Methodology

Daily historic prices of SHUAA Capital indices[5] for 14 MENA countries are used in this study. The data range is 1/2000 to 12/2004 for the MENA stock markets of Bahrain, Egypt, Israel, Jordan, Kuwait, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Tunisia, Turkey, and the United Arab Emirates.[6] For each price index, a series of weekly logarithmic differences, $\ln (P_t/P_{t-1})$, is created.[7] The data

[4] A similar analytical framework has been applied to a variety of research questions. For example, Ben-Zion, Choi, and Hauser (1996) analyze price linkages between country funds and national stock markets, Haigh and Bessler (2004) attempt to evaluate the extent to which spatially separated commodity and transportation markets are integrated, and Tong (2001) focuses on currency market efficiency. The cointegration methodology often is employed to reveal stock market linkages, e.g., within the European Union (Yang, Min, and Li, 2003) or Latin America (Chen, Firth, and Rui, 2002), between US and Latin American (Fernandez-Serrano and Sosvilla-Rivero, 2003), among Colombian market indices (Arbelaez, Urrutia, and Abbas, 2001), within the South African Customs Union (Piesse and Hearn, 2002), or among a set of emerging markets (DeJong and DeRoon, 2005). Lead-lag relationships for six major stock markets indices are analyzed by Malliaris and Urrutia (1992), and Ghosh, Saidi, and Johnson (1999) conclude that certain Asia-Pacific stock markets are dominated by movements of the US rather than the Japanese stock market. Cointegration techniques are used to study pre- and post-October 1987 crash periods (Arshanapalli and Doukas, 1993; Masih and Masih, 2004), stock market integration in the wake of the Asian crisis (Yang, Kolari, and Min, 2003), and the long-term behavior of market and target prices (Brav and Lehavy, 2003). Designed to discover long-run commonalities among variables, Hasbrouck (1995) and Eun and Sabherwal (2003) look into issues of price discovery by applying the cointegration framework to intra-day data for the periods of six and three months, respectively.

[5] The data series were provided by SHUAA Capital p.s.c., Dubai, a leading investment banking institution in the GCC region. Its indices are capitalization-weighted market indices, computed in US dollar terms.

[6] The stock market of Algeria was not included in this study, as only three companies are listed on the Algiers Stock Exchange.

[7] The number of trading days across the MENA countries ranges from four (Israel) to six (Saudi Arabia), with markets closed on Thursday/Friday (Kuwait), Saturday/Sunday (Lebanon, Morocco, Tunisia and Turkey), Friday/Saturday (Bahrain, Egypt, Jordan, Oman,

series are divided into two subperiods. The first period includes 130 weekly observations (1/2000 to 6/2002), and the second period covers the subsequent 128 weeks (7/2002 to 12/2004). Three additional market indices are included in the sample: The US stock market (S&P 500), as the largest stock market in the world, the UK stock market (FTSE 100), as the largest European market, and the stock market of India[8] (BSE 30) as the largest neighboring market with strong economic ties to the MENA region.[9] The reasoning is two-fold: first, to determine the impact of these major markets on the emerging stock markets of the MENA region and second, following the reasoning of Janakiramanan and Lamba (1998) and Dekker, Sen, and Young (2001), to prevent any possible distortion of linkage patterns among the MENA markets by allowing for the possible indirect influence of US, UK, or Indian markets.

Before performing a cointegration test, the nonstationarity of the data series has to be established. To this extent, each market index is detrended by undergoing a logarithmic transformation, ln (P_t) and subsequently tested for the presence of unit roots using the augmented Dickey Fuller (ADF) test (Dickey and Fuller, 1979). Assuming the series has a non-zero mean, a constant is included in the regression. The null hypothesis of a unit root is tested against the alternative hypothesis of a stationary autoregressive process with a trend.[10] 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 criterion (SIC) and the presence of no autocorrelation in the residuals. Relaxing the i.i.d. (0, σ^2) assumption and allowing errors to be dependent with heteroscedastic variance, a Phillips-Peron test is conducted to verify the ADF results. Finally, as it is well known that the ADF tests notoriously have lower power against the stationary alternative (Crowder, 1996), a KPSS test (Kwiatkowski, Phillips, Schmidt, and Shin, 1992) under the reversed null hypothesis that the variable is stationary is conducted to ensure the robustness of the test results. Subsequently, the presence of a unit root in the first differences of index prices is tested to verify that the order of integration is 1.

The Johansen (Johansen, 1988) and Johansen and Juselius (Johansen and Juselius, 1990) cointegration procedure is implemented based on a vector autoregression (VAR) model, which Sims (1980) and Dekker et al. (2001) argue gives a realistic description of market linkages, formally:

Palestine, Qatar and UAE), Friday/Saturday/Sunday (Israel), and Friday only (Saudi Arabia). Stock markets in India, the UK, and the US observe a Saturday/Sunday weekend. To ensure consistency and comparability, the weekly index observations used in this analysis are made based on the Wednesday closing prices.

[8] To reflect the mutual economic importance, a framework agreement on economic cooperation (FAEC) between the GCC countries and India was signed on August 25, 2004.

[9] The data series are obtained from Datastream.

[10] Alternative deterministic trend assumptions are evaluated but not reported as they do not seem to provide a fit for price index data.

$$X_t = A_1 y_{t-1} + \ldots + A_p y_{t-p} + \mu + \delta_t + \varepsilon_t \; (t = 1, \ldots, T) \tag{1}$$

where X_t is a n-dimensional vector of MENA markets prices (n = 14); $A_1, \ldots, A_p$ are n x n coefficient matrices; μ is a vector of constants; δ_t is a vector of trend coefficients and ε_t is a vector of innovations that may be contemporaneously correlated but are uncorrelated with their own lag and uncorrelated with any of the right-side variables (white noise). 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 and Granger, 1987):

$$\Delta X_t = \prod X_{t-1} + \sum_{i=1}^{p-1} \Gamma_i \Delta X_{t-1} + \mu + \varepsilon_t \tag{2}$$

where the long-run multiplier matrix $\Pi = \alpha\beta'$, α and β are n x× r matrices (r is the number of cointegrating vectors). 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 ($\Gamma_1, \ldots, \Gamma_{p-1}$) of dimension n × n define the short-run adjustment to changes in the variables, which implies the presence of p – r common trends (Gonzalo and Granger, 1995). The model is structured such that short-run deviations from the long-run equilibrium will be corrected. The trace statistic tests the null hypothesis of at most r cointegrating vectors. The alternative hypothesis is the existence of p (the number of endogenous variables) cointegrating vectors. Formally,

$$\lambda\text{trace}_\gamma = -T \sum_{i=r+1}^{p} \ln(1 - \lambda_i) \tag{3}$$

where λ_i is the largest i^{th} eigenvalue of the long-run multiplier matrix Π. The null hypothesis of r cointegrating vectors against the alternative of r + 1 cointegrating vectors is tested by computing the maximum eigenvalue, formally:

$$\gamma\max_{\gamma|\gamma+1} = — T\ln(1 — \lambda_{\gamma+1}) \tag{4}$$

Lütkepol and Reimers (1992) have argued that the individual coefficients of an ECM are difficult to interpret as a shock to the i^{th} variable may not only affect the variable itself but also be transmitted to other endogenous variables in the system through the dynamic lag structure of the VAR. If the innovation vector ε_t increases by a vector d, the effect upon ΔX_{t+n} is given by $A_p d$, where:

$$A_p = \frac{\Delta X_{t+n}}{\Delta \varepsilon_t} \tag{5}$$

with the elements i, j measuring the effect of a one-unit increase in ε_t . If only the first element ε_{1t} of ε_t changes, the effects are given by the first column of A_p. The elements in the first column and the j^{th} row of $A_1, \ldots, A_p$ trace the dynamic effects of an innovation in the i^{th} market on all the other markets j individually, thereby providing insight into the dynamic interactions among MENA markets. Hamilton (1994) shows that the underlying generalized impulse response function (GIRF) can be determined by simulation methods. Koop, Pesaran, and Lee (1996) derive generalized impulse responses from an orthogonal set of innovations to the j^{th} variable by incorporating a variable-specific Cholesky factor to the j^{th} variable. The relative importance of each random innovation in i^{th} market on market j is determined by the generalized forecast error variance decomposition (GVD) techniques of Pesaran and Shin (1998).[11] While the results of the generalized forecast error variance decomposition qualify the impact dynamics of innovations among MENA stock markets, the impact direction is revealed by the Granger causality test (Granger, 1969). In a bivariate system of jointly stationary time series x_t and y_t, 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). The vector autoregression model can be used to investigate the lead-lag relationship within the co-dependent MENA stock markets. Given

$$\begin{aligned} x_t &= c_1 + \sum_{i=1}^{q} \alpha_{1i}\, x_{t-i} + \sum_{j=1}^{q} \beta_{1j}\, y_{t-j} + \varepsilon_{1t}, \text{ and} \\ y_t &= c_2 + \sum_{i=1}^{q} \alpha_{2i}\, x_{t-i} + \sum_{j=1}^{q} \beta_{2j}\, y_{t-j} + \varepsilon_{2t} \end{aligned} \tag{6}$$

where q is the order of the respective lag variable. An F-test for the joint significance of $\alpha_{2i}, \ldots, \alpha_{2q}$ ($\beta_{1j}, \ldots, \beta_{1q}$) is formulated to test if x Granger causes y (y Granger causes x).

Possible nonstationarity in the degree of relative co-movement among MENA markets and with Indian, UK, and US stock markets is investigated based on a comparison of correlation coefficients between the first period (1/2000 to 6/2002) and the second period (7/2002 to 12/2004). According to Kendall and Stewart (1967), the null hypothesis of correlation coefficient equality, H_0: $r_1 = r_2$, can be tested as follows:

$$Z = \frac{(z_1 - z_2)}{\sqrt{\left[\left(\frac{1}{n_1 - 3}\right) + \left(\frac{1}{n_2 - 3}\right)\right]}} \sim N(0, 1) \text{ provided } |r_1| \text{ and } |r_2| \neq 1;\ n_1 \text{ and } n_3 > 3 \tag{7}$$

[11] An alternative approach would be the Cholesky factorization (Lütkepol, 1991). This procedure, however, is sensitive to the ordering of variables when the covariance matrix of the error terms is non-diagonal.

Table 2—Unit Root Tests

ADF, PP, and KPSS denote the Augmented Dickey-Fuller test, Philips-Perron test, and the Kwiatkowski, Phillips, Schmidt, and Shin test for unit roots, respectively. The optimal number of lags was chosen according to the Schwarz Information Criterion (SIC), provided that the lags yield white-noise residuals

		Levels:			First Differences:		
Markets	Period	ADF	PP	KPSS	ADF	PP	KPSS
Bahrain	1	-2.55	-2.45	0.84***	-8.51***	-8.19***	0.45*
	2	0.68	0.48	2.51***	-10.18***	-10.26***	0.19
Egypt	1	-1.14	-1.21	1.35***	-11.31***	-11.68***	0.17
	2	1.81	1.73	2.47***	-10.74***	-10.80***	0.34
India	1	-1.73	-1.71	1.19***	-11.17***	-11.18***	0.07
	2	-0.12	-0.27	2.35***	-10.49***	-10.60***	0.13
Israel	1	-0.79	-0.83	1.18***	-11.26***	-11.27***	0.10
	2	-0.44	-0.49	2.47***	-5.12***	-12.41***	0.09
Jordan	1	0.03	-0.08	0.73**	-10.51***	-10.52***	0.32
	2	2.20	2.01	2.51***	-10.58***	-10.70***	0.28
Kuwait	1	0.06	0.25	2.61***	-8.84***	-8.83***	0.12
	2	-0.45	-0.53	2.40***	-9.83***	-9.91***	0.13
Lebanon	1	-1.53	-1.49	2.48***	-11.20***	-11.23***	0.07
	2	-0.14	0.07	2.12***	-13.13***	-13.13***	0.18
Morocco	1	-1.26	-1.27	2.59***	-11.00***	-11.01***	0.05
	2	-0.32	-0.39	2.58***	-9.89***	-9.90***	0.12
Oman	1	-2.29*	-2.27	2.14***	-9.62***	-9.62***	0.29
	2	-0.44	-0.46	2.65***	-9.34***	-9.24***	0.18
Palestine	1	-1.10	-1.10	2.03***	-10.24***	-10.18***	0.12
	2	-0.03	-0.38	1.25***	-11.11***	-11.26***	0.26
Qatar	1	1.94	1.39	2.26***	-9.31***	-9.50***	0.35
	2	-0.22	-0.32	2.60***	-9.68***	-9.70***	0.05
Saudi Arabia	1	-1.30	-1.37	1.75***	-10.55***	-10.55***	0.06
	2	1.05	1.23	2.57***	-8.76***	-8.68***	0.39*
Tunisia	1	-0.23	-0.28	2.52***	-11.38***	-11.39***	0.14
	2	-0.80	-0.90	2.26***	-10.82***	-10.82***	0.10
Turkey	1	-2.12	-2.08	1.28***	-12.53***	-12.51***	0.05
	2	-0.82	-0.91	2.44***	-11.22***	-11.25***	0.04
UAE	1	-1.08	-0.90	0.73**	-5.36***	-9.57***	0.24
	2	3.39	2.60	2.54***	-5.13***	-8.68***	0.34
UK	1	-0.34	-0.35	2.48***	-10.10***	-10.04***	0.09
	2	-1.56	-1.75	1.89***	-15.25***	-15.86***	0.22
US	1	-0.57	-0.39	2.45***	-12.37***	-12.39***	0.10
	2	-0.64	-0.66	2.41***	-14.50***	-14.79***	0.15

*, **, and *** denote statistical significance at the 10%, 5% and 1% level, respectively

where:

$$z_1 = 0.5 \ln\left(\frac{1+r_1}{1-r_1}\right), \text{ and } z_2 = 0.5 \ln\left(\frac{1+r_2}{1-r_2}\right).$$

The number of return observations in each period is denoted with n. A higher level of integration between two stock markets would be suggested by a significant increase in the correlation coefficient (Taylor and Tonks, 1989).

Results

The statistics of the initially computed ADF unit root test for both subperiods are reported in Table 2, indicating that the null hypothesis of the existence of a unit root in the levels of each of the 17 index prices series cannot be rejected. These findings are supported by the results of the more robust Philips-Perron test. Similarly, the KPSS test results suggest rejecting the null hypothesis of stationarity for all market indices. Unit root tests of first differences indicate first order integration.

The risk and return characteristics of the individual market indices are presented in Table 3. Several findings are worth mentioning: first, all MENA markets outperform US and UK markets in terms of average weekly returns over the five-year period. Second, with the exception of Egypt, Lebanon, and Tunisia, all MENA market indices have a more advantageous risk/return relationship, as measured by the coefficient of variation (CV), than the US and the UK market index over the full period. The superior performance of the MENA market is marked in the second period where US and UK market indices produced the highest CVs, thus underperforming all others markets in the sample on a risk/return basis. Third, the index return characteristics are not homogeneous among MENA markets. The average weekly returns range from 0.58 percent (Qatar) to -0.01 percent (Egypt) compared to -0.02 percent (US), -0.09 percent (UK), and 0.13 percent (India). The four best performing markets, as measured by average weekly returns, are all members of the GCC: Qatar (0.58 percent), Saudi Arabia (0.52 percent), Kuwait (0.49 percent), and the UAE (0.42 percent). These four stock markets also offer the most beneficial risk/return relationships. The lowest, and thus most beneficial, CV is found in Kuwait (3.57), followed by Qatar (4.07), the UAE (4.10), and Saudi Arabia (4.34). The other two GCC member markets, Bahrain and Oman, rank sixth and seventh behind Jordan with CVs of 14.33 and 14.40, respectively. Magreb stock markets (Morocco and Tunisia) and the markets in Egypt and Lebanon generated the lowest weekly return averages in the MENA region. By far the highest level of absolute risk for the full period, measured by the standard deviation of weekly returns, is presented by Turkey (6.59), followed by Palestine (3.79) and Egypt and India (both 3.50). The return distribution appears to be leptokurtic for all markets and, with the exception of Bahrain, Egypt, and India, displays various degrees of positive skewness. These characteristics are attractive to investors, as the distribution of returns has a greater exposure to outlier events and a bias to the upside.

The multivariate cointegration tests based on the error correction model [Equation (2)] are formulated to incorporate an intercept and allow for the existence of deterministic trends in the price index series. Trace test statistics indicate the existence of three cointegrating vectors among MENA stock markets for the period 1/2000 to 6/2002, as shown in Table 4. As Girard and Ferreira (2004) could not find any common stochastic trends in earlier market data, it seems fair to assume economic reforms and liberalization efforts have imposed a greater level of integration

Table 3—Descriptive Statistics of Weekly Returns

	Bahrain	Egypt	India	Israel	Jordan	Kuwait	Lebanon	Morocco	Oman	Palestine	Qatar	SA	Tunisia	Turkey	UAE	UK	US
Full Period: 1/2000 - 12/2004, n = 258																	
Mean	0.09	-0.01	0.13	0.15	0.40	0.49	0.00	0.02	0.14	0.09	0.58	0.52	-0.04	0.34	0.42	-0.09	-0.02
Median	0.04	0.12	0.40	0.06	0.28	0.46	-0.13	-0.18	0.00	0.00	0.21	0.31	-0.15	0.46	0.18	-0.02	0.08
Maximum	4.12	10.86	14.08	12.68	7.75	6.22	11.69	7.36	12.98	12.68	10.31	7.14	6.86	27.90	10.68	14.55	13.17
Minimum	-4.68	-10.20	-14.02	-10.28	-5.80	-5.05	-9.45	-6.60	-8.01	-12.27	-6.23	-8.08	-5.01	-27.99	-5.73	-9.87	-11.46
Std. Dev.	1.29	3.50	3.50	3.15	2.04	1.74	3.06	2.20	1.98	3.79	2.37	2.26	1.93	6.59	1.71	2.63	2.85
Skewness	-0.14	-0.07	-0.27	0.06	0.36	0.02	0.78	0.31	1.07	0.54	1.01	0.09	0.49	0.20	1.12	0.69	0.42
Kurtosis	4.58	3.49	4.70	4.18	4.02	3.81	5.13	4.02	10.73	4.76	5.85	4.68	3.83	6.42	9.10	9.04	5.91
CV	14.33	-253.16	26.92	20.59	5.14	3.57	-1422.70	88.53	14.40	43.73	4.07	4.34	-51.69	19.38	4.10	-28.87	-162.44
Jarque-Bera	27.89	2.74	34.37	15.04	16.78	7.10	74.95	15.11	691.92	45.89	131.38	30.66	17.87	127.89	453.92	412.19	98.68
First Period: 1/2000 - 6/2002, n = 130																	
Mean	-0.14	-0.87	-0.32	-0.19	0.12	0.45	-0.41	-0.42	-0.21	-0.19	0.43	0.21	-0.23	-0.16	0.05	-0.28	-0.26
Median	-0.08	-0.47	-0.06	-0.35	0.09	0.33	-0.69	-0.57	-0.50	-0.47	0.20	0.12	-0.34	-0.04	-0.08	-0.16	-0.36
Maximum	3.76	10.86	14.08	10.32	5.96	5.02	11.69	7.36	12.98	11.70	9.16	7.09	6.86	27.90	4.85	5.56	9.91
Minimum	-4.68	-10.20	-14.02	-10.28	-5.08	-5.05	-9.45	-6.46	-8.01	-10.13	-4.14	-7.33	-5.01	-27.99	-5.73	-7.01	-6.40
Std. Dev.	1.26	3.76	4.07	3.43	1.76	1.55	3.53	2.20	2.30	3.97	1.93	1.83	2.05	8.02	1.44	2.14	2.76
Skewness	-0.47	0.16	-0.01	-0.09	0.32	0.05	0.93	0.78	1.49	0.61	1.30	0.42	0.54	0.20	0.04	-0.06	0.45
Kurtosis	4.85	3.42	4.55	3.43	4.50	4.58	4.88	5.07	11.69	3.73	7.88	6.61	3.81	5.30	6.59	3.58	3.54
CV	-8.78	-4.31	-11.75	-18.46	14.30	3.46	-8.70	-5.20	-10.78	-21.03	4.54	8.74	-8.96	-49.19	27.33	-7.59	-10.55
Jarque-Bera	23.42	1.49	12.37	1.18	14.29	13.55	37.88	36.48	456.95	10.98	166.04	74.48	9.79	29.58	69.98	1.89	5.93
Second Period: 7/2002 - 12/2004, n = 128																	
Mean	0.33	0.86	0.58	0.50	0.68	0.53	0.41	0.48	0.49	0.37	0.74	0.84	0.16	0.85	0.79	0.10	0.23
Median	0.31	0.79	0.73	0.34	0.77	0.62	0.00	0.46	0.31	0.00	0.22	0.62	-0.03	0.53	0.53	0.31	0.35
Maximum	4.12	9.51	6.76	12.68	7.75	6.22	8.78	5.66	5.05	12.68	10.31	7.14	5.97	18.10	10.68	14.55	13.17
Minimum	-3.74	-8.53	-7.04	-7.68	-5.80	-4.55	-5.61	-6.60	-3.28	-12.27	-6.23	-8.08	-4.16	-9.69	-4.34	-9.87	-11.46
Std. Dev.	1.29	2.98	2.76	2.81	2.27	1.91	2.44	2.10	1.51	3.60	2.74	2.59	1.79	4.70	1.88	3.05	2.93
Skewness	0.11	-0.02	-0.51	0.52	0.24	-0.02	0.82	-0.14	0.47	0.50	0.77	-0.21	0.54	0.74	1.45	0.83	0.38
Kurtosis	4.15	3.68	2.86	5.10	3.53	3.25	4.90	3.82	3.60	6.35	4.55	3.85	3.85	4.70	8.85	9.08	7.85
CV	3.95	3.47	4.76	5.64	3.35	3.64	6.00	4.38	3.06	9.83	3.70	3.10	11.45	5.52	2.39	29.57	12.72
Jarque-Bera	7.32	2.49	5.56	29.39	2.72	0.35	33.64	3.97	6.72	64.93	25.51	4.77	10.00	27.08	226.96	211.81	128.40

onto MENA stock markets at the beginning of the new millennium. This trend has accelerated dramatically in the period 7/2002 to 12/2004, with the trace test statistic identifying eight cointegrating vectors. Thus, the ongoing process of economic integration is clearly reflected in an increasing degree of co-movement among the once-segmented stock markets of the MENA region. Rerunning the cointegration tests with the UK and US added separately to the MENA sample yields a reduction in the number of cointegrating vectors for both subperiods in the case of the UK and the US. These results provide evidence for the segmentation of MENA markets from the largest Western stock markets and underline the potential diversification benefits for the international investor. In contrast, adding the Indian market index to the MENA sample increases the number of cointegrating vectors to nine for the second period, suggesting not only a higher level of stock market integration within the MENA region, but also a greater level of influence of the Indian stock market.[12]

Table 4—Multivariate Cointegration Results

The number of cointegration vectors r is shown as well as critical values for trace (λtrace) and maximum eigenvalue (λmax) statistics. The critical values are taken from Osterwald-Lenum (1992)

	MENA				MENA + India			
H_0	Trace Tests	Λ trace 0.95	Eigenvalue Tests	Λ max 0.95	Trace Tests	Λ trace 0.95	Eigenvalue Tests	Λ max 0.95
First Period: 1/2000 - 6/2002								
r = 0	477.24**	374.91	110.25**	80.87	484.37**	374.91	109.23**	80.87
r ≤ 1	366.99**	322.07	79.26**	74.84	375.15**	322.07	81.46**	74.84
r ≤ 2	287.73**	273.19	68.45	68.81	293.69**	273.19	69.40**	68.81
r ≤ 3	219.27	228.29	56.61	62.75	224.29	228.29	53.49	62.75
Second Period: 7/2002 - 12/2004								
r = 0	466.32**	374.91	87.80**	80.87	462.43**	374.91	89.90**	80.87
r ≤ 1	378.52**	322.07	68.18	74.84	372.53**	322.07	62.46	74.84
r ≤ 2	310.33**	273.19	62.13	68.81	310.07**	273.19	59.09	68.81
r ≤ 3	248.20**	228.29	49.27	62.75	250.98**	228.29	52.57	62.75
r ≤ 4	198.93**	187.47	39.69	56.71	198.41**	187.47	42.88	56.71
r ≤ 5	159.25**	150.56	38.38	50.60	155.52**	150.56	35.35	50.60
r ≤ 6	120.87**	117.71	31.46	44.50	120.17**	117.71	29.06	44.50
r ≤ 7	89.40**	88.80	27.19	38.33	91.11**	88.80	27.23	38.33
r ≤ 8	62.21	63.88	23.07	32.12	63.88**	63.88	26.35	32.12
r ≤ 9	39.14	42.92	18.01	25.82	37.53	42.92	18.33	25.82

** denotes statistical significance at the 5% level

The results of the GVD document that the index return variations in the MENA stock markets depend more on intraregional than interregional shocks, as shown in Table 5. For example, four weeks after the initial shock the average error variance of an individual MENA stock market explained by the sum of index variances of all

[12] Cointegration test results for the MENA stock markets including the UK and the US are not shown here to conserve space.

Table 5—Generalized Forecast Error Variance Decomposition

Each cell entry under "By Innovations in:" denotes the total percentage of forecast error variance of the market in the first column explained by the region (GCC and MENA ex. GCC) or the individual market (India, UK, and US) in the first row

	Number of	GCC		MENAex.GCC		India		UK		US	
	Weeks	1/00-6/02	7/02-12/04	1/00-6/02	7/02-12/04	1/00-6/02	7/02-12/04	1/00-6/02	7/02-12/04	1/00-6/02	7/02-12/04
Bahrain	2	3.30	6.05	10.18	4.89	0.06	0.01	2.47	0.00	0.00	0.41
	4	3.66	7.96	10.73	11.21	0.08	0.45	7.00	0.53	0.85	1.71
Egypt	2	6.92	7.16	3.89	3.66	0.46	0.85	0.15	1.11	2.84	0.74
	4	6.67	14.15	9.58	8.56	0.49	2.02	0.57	1.92	1.94	2.77
Israel	2	11.79	1.81	6.79	6.05	0.00	3.89	0.12	0.10	0.37	1.32
	4	13.19	5.86	10.67	9.92	1.06	2.36	1.18	1.36	0.28	3.36
Jordan	2	5.75	5.50	12.77	13.74	0.54	0.07	0.06	0.32	0.00	0.23
	4	12.92	7.34	21.74	13.49	0.58	0.55	0.05	0.43	1.29	0.19
Kuwait	2	15.72	7.21	5.50	13.74	3.22	0.07	1.36	1.12	0.09	0.33
	4	16.36	7.92	7.03	17.91	3.06	0.26	4.54	1.74	0.27	0.36
Lebanon	2	3.97	8.23	8.18	4.02	0.16	0.11	1.89	1.36	0.00	0.63
	4	7.75	8.98	17.92	10.48	0.47	0.07	1.40	2.97	3.00	1.73
Morocco	2	4.68	1.20	19.76	9.78	2.22	0.95	1.93	0.12	0.37	0.66
	4	6.84	1.84	24.88	9.98	3.42	0.66	2.26	0.14	0.70	0.64
Oman	2	13.50	3.61	6.84	15.42	0.95	0.04	0.66	0.21	0.47	1.81
	4	17.46	4.25	9.80	22.03	1.17	0.78	0.57	0.32	0.36	1.99
Palestine	2	8.06	9.16	10.31	10.29	1.64	0.11	1.71	0.18	0.08	0.02
	4	11.98	11.00	19.85	9.94	1.19	0.51	1.66	0.57	1.70	0.09
Qatar	2	5.25	10.83	9.46	7.62	0.36	0.00	0.93	0.53	0.04	1.28
	4	11.22	10.31	15.84	14.66	0.35	1.27	0.59	0.92	0.72	0.86
Saudi Arabia	2	4.46	8.00	8.88	25.26	0.65	3.32	5.75	0.09	0.05	0.07
	4	6.40	11.32	13.10	29.67	0.67	3.86	6.62	1.19	0.49	0.49
Tunisia	2	7.95	6.78	17.36	15.96	0.06	1.43	0.58	0.19	0.57	3.43
	4	9.54	10.39	17.87	17.68	0.20	1.70	2.97	0.46	0.49	2.51
Turkey	2	19.14	18.96	8.32	13.36	0.21	0.00	0.03	0.35	1.55	1.88
	4	16.19	20.08	9.14	12.80	0.47	0.02	2.23	0.97	1.29	3.65
UAE	2	6.02	5.38	15.41	23.97	0.15	0.04	0.60	0.03	0.07	1.13
	4	7.77	6.48	16.20	26.53	0.12	0.21	1.13	0.07	0.20	1.19
GCC	4	10.48	8.04	12.12	20.34	0.91	1.14	3.41	0.80	0.48	1.10
MENA ex GCC	4	10.63	9.95	16.46	11.61	0.99	0.99	1.54	1.10	1.34	1.87
MENA	4	10.57	9.13	14.60	15.35	0.95	1.05	2.34	0.97	0.97	1.54

[1] Excluded from the decomposition

[2] The three regions at the bottom of the first column marks the average forecast error variance explained in that particular region by the region or individual market in the first row

other stock markets in the region is about 15.4 percent in the second period, compared to 14.6 percent in the first period (last row, fourth column). In contrast, the average individual MENA stock market variation explained by US, UK, or Indian market innovations is only 1.5 percent (up from 1.0 percent), 1.0 percent (down from 2.3 percent), and 1.0 percent (unchanged), respectively (last row, columns 7, 6, and 5 respectively). Market innovations in India, the UK, and the US, however, have a relatively high impact on the stock market in Israel. While US innovations have the highest impact on Israel, Lebanon seems to be most sensitive to UK market innovations in the second period. India's stock market innovations have the greatest impact on Saudi Arabia.

The most interesting result of this analysis is that the traditionally more closed stock markets of the GCC seem to have become more susceptible to intraregional shocks. As a result, the power of other MENA markets to explain GCC market variations rose to 20.3 percent (from 12.1 percent) in the second period (as shown in the third row from the bottom, fourth column). At the same time, the average error variance of the individual GCC stock market explained by GCC market innovations fell from 10.5 percent to only 8.0 percent. MENA stock market innovations impact markets in Saudi Arabia (29.7 percent), the UAE (26.5 percent), and Oman (22.0 percent). Thus, the fact that GCC countries are strengthening their ties with other economies of the greater MENA region and thereby becoming less co-dependent on each other but more dependent on other (non-GCC) MENA markets is already reflected in the stock markets' return behavior.

A more detailed breakdown of the error variance sensitivities is provided in Table 6. Over time, the average impact of stock market innovations in Jordan (i.e., 3.12 percent after 1.88 percent, as shown in the last row, fifth column of each panel), Morocco, Oman, Qatar, and the UAE has increased, while the influence of Bahrain, Egypt, Lebanon, and Saudi Arabia has decreased. MENA market sensitivity to innovations in Israel, Kuwait, Palestine, Tunisia, and Turkey has remained unchanged over the last five years. The tendency of GCC markets to become more sensitive to innovations in non-GCC markets can be detected easily. During the first period, Kuwait was most sensitive to innovations in neighboring Bahrain (13.7 percent, as shown in the fifth row, second column), but Jordan became more influential in the second period (9.1 percent). In the case of Oman, Bahrain was replaced by Egypt as the market with the greatest impact. Among the six GCC members, only the stock market in Qatar still is influenced mostly by another GCC market, Kuwait. Even the stock market of Saudi Arabia, the largest and closest, has come under greater external influence (of Egypt and Jordan). The UAE stock market, only founded in 2000 and already the second largest in the GCC region, also has gained considerable influence on the Saudi market. On the other side of the geographic spectrum, developing economic ties between Turkey and Israel are reflected in an increased market sensitivity level in Turkey to innovations in Israel.

Table 6—Generalized Forecast Error Variance Decomposition

Each cell entry under "By Innovations in:" denotes the total percentage of forecast error variance of the market in the first column explained by the the individual MENA market in the first row

Market	By Innovations in:													
Explained	Bahrain	Egypt	Israel	Jordan	Kuwait	Lebanon	Morocco	Oman	Palestine	Qatar	Saudi Arabia	Tunisia	Turkey	UAE
First Period: 1/2000 - 6/2002, week 4														
Bahrain	77.7	5.3	0.3	0.2	0.3	2.1	0.5	0.8	0.2	0.7	1.3	0.6	1.4	0.6
Egypt	0.6	80.7	1.5	0.3	0.2	2.3	2.7	3.1	0.7	0.9	1.7	1.0	1.1	0.1
Israel	0.7	3.4	78.3	0.7	1.6	0.4	0.4	2.4	2.8	1.3	0.8	0.9	2.1	1.7
Jordan	2.0	4.1	6.1	63.4	2.3	0.6	1.8	0.2	6.7	1.4	6.7	0.8	1.6	0.3
Kuwait	13.7	3.4	0.2	1.0	68.7	1.0	0.4	0.2	0.3	1.0	1.1	0.2	0.4	0.4
Lebanon	2.6	2.3	0.7	6.0	1.1	69.5	0.9	1.3	5.5	0.4	2.1	0.2	2.4	0.3
Morocco	1.0	3.6	1.0	2.3	1.6	11.9	61.9	0.4	3.4	0.3	3.2	1.1	1.6	0.4
Oman	8.5	1.1	2.0	0.1	4.5	0.3	5.1	70.6	0.3	0.3	2.2	0.3	0.5	1.9
Palestine	4.5	2.1	1.2	4.5	3.5	7.0	0.9	1.1	63.6	0.6	2.2	2.6	1.6	0.2
Qatar	0.7	2.8	2.9	1.6	3.0	2.1	0.7	0.7	4.2	71.3	6.1	0.8	0.7	0.7
Saudi Arabia	1.2	3.2	1.5	0.5	1.5	0.8	0.8	2.3	4.1	0.8	72.7	1.8	0.3	0.6
Tunisia	1.5	6.3	1.9	2.6	0.8	0.7	1.9	1.4	4.1	1.5	3.1	68.9	0.4	1.2
Turkey	1.1	2.4	0.4	2.3	1.9	1.6	0.4	4.2	1.0	0.5	7.6	1.0	70.7	0.9
UAE	3.0	4.3	0.4	2.3	0.6	2.0	0.8	3.1	2.1	0.2	0.8	1.1	3.2	74.6
mean	3.17	3.42	1.54	1.88	1.76	2.53	1.35	1.63	2.73	0.75	3.00	0.96	1.32	0.71
Second Period: 7/2002 - 9/2004, week 4														
Bahrain	78.1	0.9	1.5	0.9	1.9	0.4	0.8	2.6	1.8	0.1	0.7	0.6	4.4	2.8
Egypt	6.7	70.6	0.0	0.6	2.3	2.6	0.8	2.1	3.0	1.9	0.6	0.8	0.8	0.5
Israel	0.2	1.0	77.1	1.1	1.0	3.7	1.4	1.5	1.1	0.3	1.2	0.2	1.5	1.6
Jordan	0.1	1.5	2.5	78.0	0.9	0.7	3.4	1.4	3.1	0.2	3.0	1.8	0.5	1.7
Kuwait	1.0	1.0	2.1	9.1	71.8	0.0	1.7	4.3	2.5	0.2	0.6	0.2	1.2	1.9
Lebanon	2.8	1.6	0.3	1.1	1.5	75.8	2.9	2.1	3.1	2.1	0.0	0.6	0.8	0.4
Morocco	0.2	0.2	0.7	1.3	0.4	1.9	86.7	0.6	3.7	0.2	0.1	1.5	0.7	0.3
Oman	2.0	8.8	1.7	2.1	1.0	2.1	2.1	70.6	2.3	0.2	0.6	2.9	0.0	0.4
Palestine	4.1	3.8	1.8	1.2	0.8	1.6	0.5	2.4	77.9	2.4	0.5	0.4	0.6	0.9
Qatar	1.6	3.5	2.6	1.2	6.1	3.2	0.6	2.0	1.4	72.0	0.4	1.7	0.5	0.3
Saudi Arabia	1.0	6.1	1.9	8.1	0.7	1.6	5.3	0.9	3.4	2.2	53.5	0.8	2.4	6.6
Tunisia	3.3	1.8	0.4	6.1	1.1	1.6	4.9	3.0	2.0	0.5	0.7	67.3	0.9	1.8
Turkey	0.9	2.2	4.7	0.5	7.5	0.8	2.1	4.0	1.8	6.6	0.4	0.6	62.5	0.7
UAE	0.9	4.9	3.3	7.1	2.1	0.4	3.2	0.6	3.5	0.4	2.6	3.4	0.7	65.5
mean	1.90	2.87	1.81	3.12	2.11	1.59	2.27	2.11	2.51	1.32	0.87	1.20	1.16	1.53

[1] Forecast error variance decomposition has been standardized for each explained market so that the sum is 100 percent if the UK, US, and Indian innovations shown in Table 5 are added

[2] The mean represents the average impact of an innovation in the market in the first row on the market in the first column

Table 7—Impulse Response Analysis

Market Responding	To one S.D. Impulse in: Bahrain	Egypt	Israel	Jordan	Kuwait	Lebanon	Morocco	Oman	Palestine	Qatar	Saudi Arabia	Tunisia	Turkey	UAE	India	UK
First Period: 1/2000 - 6/2002																
Bahrain	3.86	1.04[1]	0.62	0.53	1.67	0.78	0.81	0.56	-0.47	0.52	0.71	0.89	0.39	0.07	0.93	1.46[1]
Egypt	-0.38	10.11	3.00	0.54	0.70	0.91	0.40	-1.38	0.77	0.75	2.87	1.14	1.84	-1.87	2.12	3.80
Israel	0.90	0.67[1]	8.94	2.27	-0.71	-0.19	0.41	-0.73	-0.83	0.77	1.16	-0.80	-0.33	-0.61	4.50	4.77
Jordan	0.64	1.03	1.47	3.47	0.46	-0.73	0.90	0.03	1.16	0.49	1.08	-0.28	1.08	-1.10	0.49	0.55
Kuwait	1.84	0.98	0.26	-0.17	4.60	0.04	0.44	0.25	0.38	-0.55	0.52	-0.01	0.04	0.69	0.50	0.56
Lebanon	-1.14	-1.52	-0.76	-2.88	-1.02	8.65	1.78	-0.08	3.86	-0.38	0.17	0.69	0.34	0.92	-1.03	0.91
Morocco	0.11	1.06	0.85	0.40	-0.23	2.10	5.13	-0.65	-0.26	0.24	-0.50	0.41	-1.32	0.56	0.22	1.10
Oman	2.23	0.71	0.80	0.43	-0.34	0.00	-1.34	6.57	-0.04	0.01	1.99	-0.22	0.57	-0.39	0.10	-0.76
Palestine	-1.69	-0.97	0.66	1.29	-1.44	2.33	-0.22	-0.10	7.71	-0.02	-2.44	-0.01	-0.78	-0.75	-1.94	0.52
Qatar	0.26	0.73	1.09	-0.34	-0.53	-0.27	0.30	0.00	0.94	4.83	0.89[1]	1.03	0.46[1]	-0.63	0.90	1.09
Saudi Arabia	0.14	0.97	0.89	0.05	-0.09	0.20	-0.10	0.86	-0.85	-0.08	4.80	-0.05	1.37	-0.62	-0.37	0.97[1]
Tunisia	0.68	1.46	0.08	-0.48	0.11	0.17	0.97	0.11[1]	0.93	0.63	-0.84	5.37	-0.95	0.41	0.33	0.33
Turkey	0.52	-1.82[1]	0.23	3.55	-2.70	-0.85	-0.79	-3.23[1]	-0.25	-0.33	4.46	-1.14	19.80	-4.16	1.12	7.55
UAE	0.69	-0.74	-0.12	-0.48	0.50	0.66	-0.19	0.66	0.01	-0.04	-0.16	-0.12	0.23[1]	3.65	-0.12	-0.05
Second Period: 7/2002 - 12/2004																
Bahrain	3.09	0.86	0.23	0.26	0.56	-0.24	0.33	0.43	1.00	0.00	0.42[1]	-0.14	0.72	0.09	0.10	-0.25
Egypt	1.90[1]	6.77	0.15	-0.46	1.30	-0.29	-0.25	0.39	0.17	1.01	1.36	0.78	1.50	0.36	1.66[1]	2.11[1]
Israel	0.27	-0.22	5.99	1.21	1.32	-1.22	-0.23	0.27	0.61	0.74	0.43	-0.61	1.31	1.31	1.85	2.18
Jordan	0.10	0.12	0.82[1]	4.90	1.11	-0.77	-0.22	-0.56	0.62	0.47	2.07[1]	1.48	0.26	1.23	1.10	-0.11
Kuwait	-0.05	0.00	0.80	1.72[1]	4.52	-0.84	0.75	0.50	0.28	0.38	1.57	-0.01	0.91	2.06	1.63	1.04
Lebanon	-0.64	0.54	0.04	-0.48	-0.84	5.63	1.42	-1.03	0.51	1.34	0.02	-0.03	1.09	-0.21	1.12	0.94
Morocco	0.16	0.23	0.28	0.68	-0.18	0.94	6.75	-0.88	0.72	0.75	1.79	1.14	-0.16	1.09	0.77	1.19
Oman	0.50[1]	1.46	0.49	0.37	0.33	-0.53	-0.63	3.96	0.80	0.72	0.94	-0.42	0.22	0.55	0.67	0.16
Palestine	1.95	2.09	0.69	-0.80	-0.56	-0.85	0.04	-0.73	8.38	0.97	0.34	-0.36	0.74	0.88	-0.71	1.09
Qatar	-0.35	1.56	1.41	0.76	2.06	1.28	0.70	0.90	0.94	7.78	0.24	-1.29	3.14	0.86	2.33[1]	1.13
Saudi Arabia	-0.65	1.67	1.08	1.17	0.60	0.67	1.86	0.48	1.29	-0.20	6.10	0.18	-0.72	0.21	2.21	1.75
Tunisia	-0.24	0.64	-0.11	1.09	-0.27	0.64	1.31	0.53	0.42	0.15	0.61	4.77	0.35	-0.79	-0.50	-0.80
Turkey	1.12	2.37	3.00	1.09	4.78	-0.04	1.48	1.70	2.29	4.72	1.61	0.46	13.53	1.40	3.72	1.72
UAE	0.24	1.19	0.93	1.39	0.82	-0.15	1.07	0.29	1.08	0.70	1.72	-0.34	0.59	4.80	1.23	0.34

[1] The superscript indicates Granger Causality at the 5% confidence level
[2] Each cell entry denotes the generalized impulse response of the market in the first column to a generalized one standard deviation impulse to the market in the first row
[3] The responses have been accumulated over four weeks

Subsequent to separating the variation in a particular index return variable into the components shocks to the VAR, effects of a shock to one endogenous index return variable onto the other market indices is traced by impulse response functions. In addition, the impact direction is analyzed based on Granger causality test statistics. In general, GIRF results support the inferences from the GVD analysis. The majority of impulse responses across the 14 MENA markets in this study are positive. Girard and Ferreira (2004) find all endogenous impulse responses to be positive with a slow decay of up to 15 days, implying directional predictability which is consistent with the findings of Omran and Gunduz (2001) and Girard, Omran, and Zaher (2003). The authors offer time-varying risk premia or market microstructure effects such as infrequent or non-synchronous trading which can lead to measurement errors as possible explanations for their findings.

The particular findings are shown in Table 7. For example, a generalized one standard deviation shock to the market of Bahrain triggered the greatest initial response during the first period from the market in Oman (2.23, eighth row, second column of the first panel). The magnitude of the Omani response decreased to (0.50) in the second period. The Granger causality test identifies a lead/lag relationship between Bahraini and Omani stock markets. In the second period, the Egyptian market has become most sensitive to Bahraini impulses (1.90, second row, second column of the second panel). As Bahrain is found to Granger cause Egypt, it is not surprising that a reverse impulse given by Egypt had a more subdued impact on the market in Bahrain (0.86). In both periods, Egypt seems to be relatively sensitive to impulses from India (1.66 after 2.12), the UK (2.11 after 3.80), and the US (1.56 after 3.60). India and the UK also Granger cause Egypt. Similarly, the Israeli stock market responds with the greatest magnitude to impulses from India (4.50), the UK (4.77), and the US (4.02), especially in the first period. The reciprocal impulse responses of Israel and Turkey indicate an increasing level of sensitivity between the two stock markets. At the same time Turkey has become less sensitive to impulses from Saudi Arabia and more sensitive to impulses from India. Granger causality in the second period also is established between India and Qatar, Israel and Jordan, and Saudi Arabia and Jordan.

Finally, the contemporaneous structure of stock market interaction is analyzed by computing the correlation coefficients of all 14 MENA indices as well as the market indices of India, the UK, and the US for both periods, followed by an equality testing procedure. The results are stated in Table 8. Given an average correlation coefficient within the MENA region of 0.08 (indicated in Table 9) in the second period, the high level of relative co-movement between Saudi Arabia and Jordan (0.41), Tunisia (0.21) and the UAE (0.20) is noteworthy, as it has increased significantly from the first period. Interestingly, the high correlation coefficient of Saudi Arabia and Turkey has decreased significantly. An above average coefficient of 0.23 explains the high impulse sensitivity of the stock market of Turkey and Israel. A

relatively high level of correlation also is found between Magreb's stock markets and Morocco and Tunisia (0.28), Morocco and the UAE (0.22), and Tunisia and Jordan (0.25) and Jordan and the UAE (0.33). The MENA stock market with the highest level of co-movement with UK and US market indices is Kuwait; the correlation coefficients have increased significantly in the second to 0.39 and 0.47, respectively.

The overall level of market integration within the MENA region is increasing but is still relatively low (0.08 up from 0.05). The level of relative co-movement among the GCC stock markets is slightly higher (0.10) but has remained unchanged, as shown in Table 9, panel A. The results suggest that MENA markets in general are heterogeneous and offer an enormous diversification potential to the international investor. As the economies of the GCC region are headed for a monetary union, however, the level of market integration can be expected to increase significantly in the near future. The entire MENA region is likely to move closer together as the launch of the Arab Free Trade Zone on January 1, 2005 can be seen only as a first step toward greater economic unity. Two exceptions, however, are worth mentioning in this respect: Israel and Turkey. While Israel's potential for economic integration within the MENA region seems to remain limited for political reasons, Turkey is moving away from the region economically. As Turkey aspires to become a member of the European Union, its macroeconomic environment, including fiscal and monetary policies, as well as its political climate and legal framework, increasingly will conform to EU policies and be dictated by the governing bodies in Brussels. As a result, Istanbul's stock market behavior is likely to form a greater resemblance with its European counterparts, which could translate into a higher level of segmentation from the MENA stock markets. India, however, is developing into a regional economic powerhouse; therefore, a strengthening of its economic ties with MENA countries seems likely and may result in further stock market integration.

Also, the results of the variance decomposition procedure and the impulse response analysis suggest that the stock markets of the MENA region in general, and of the booming GCC region in particular, have developed a return behavior that is unaffected by US or UK stock market movements. From the international investor's point of view, this is a valuable, potentially portfolio-performance-enhancing piece of information.

Conclusion

The objective of this study is to determine the market dynamics and contemporaneous interactions of the 14 MENA stock markets of Bahrain, Egypt, Israel, Jordan, Kuwait, Lebanon, Morocco, Oman, Palestine, Qatar, Saudi Arabia, Tunisia, Turkey, and the United Arab Emirates. These still fairly segmented markets appear to be attractive to investors, as they share a leptokurtic and, with the exception of Bahrain and Egypt, positively skewed return distribution. Multivariate cointegration tests, however, reveal an increasing level of stock market integration in the wake of

Table 8—Test of Equality of Correlation Coefficients

	Bahrain	Egypt	India	Israel	Jordan	Kuwait	Lebanon	Morocco	Oman	Palestine	Qatar	SA	Tunisia	Turkey	UAE	UK
Panel A: Correlation Coefficients of First Period: 1/2000 - 6/2002																
Egypt	0.13															
India	0.18	0.24														
Israel	0.09	0.21	0.43													
Jordan	0.18	0.15	0.07	0.04												
Kuwait	0.35	0.03	0.15	0.00	0.01											
Lebanon	0.03	0.05	0.08	-0.07	0.02	0.01										
Morocco	0.08	0.06	0.06	0.08	0.03	0.19	0.09									
Oman	0.18	0.07	-0.08	-0.07	0.02	0.01	-0.07	-0.10								
Palestine	-0.15	0.09	0.04	0.15	-0.12	0.00	0.06	0.12	-0.01							
Qatar	0.20	0.09	0.11	0.03	0.21	0.01	0.03	-0.05	0.00	-0.02						
SA	0.17	0.09	0.00	0.15	-0.08	0.20	0.02	0.14	0.08	0.02	0.06					
Tunisia	0.14	0.17	0.05	0.11	-0.14	-0.10	0.02	0.07	0.04	0.09	0.04	-0.04				
Turkey	0.01	0.05	0.07	0.24	0.09	-0.07	-0.06	-0.07	-0.04	0.02	-0.09	0.20	-0.05			
UAE	0.11	-0.04	0.11	0.10	0.07	0.16	0.16	-0.02	0.03	-0.04	0.00	-0.05	-0.02	0.04		
UK	0.06	0.15	0.38	0.45	-0.05	-0.12	0.10	0.00	-0.16	0.03	0.02	0.08	0.00	0.39	0.03	
US	0.10	0.11	0.32	0.41	0.06	-0.03	0.07	0.00	-0.16	0.06	0.02	0.15	0.03	0.25	0.17	0.68
Panel B: Correlation Coefficient of Second Period: 7/2002 - 12/2004																
Egypt	0.16															
India	-0.01	0.17														
Israel	0.06	0.07	0.17													
Jordan	0.07	0.07	0.25	0.09												
Kuwait	0.14	0.08	0.23	0.20	0.19											
Lebanon	-0.03	-0.01	0.02	0.12	-0.06	-0.11										
Morocco	0.05	0.02	0.04	0.06	0.09	0.13	0.08									
Oman	0.13	0.16	0.00	0.04	0.01	0.03	-0.04	-0.04								
Palestine	0.15	0.18	0.05	0.19	0.05	0.03	-0.08	-0.03	-0.03							
Qatar	0.06	0.07	0.02	0.05	0.13	-0.05	0.05	0.10	0.18	-0.02						
SA	0.04	0.17	0.15	0.00	0.41	0.08	0.02	0.17	0.04	0.13	0.09					
Tunisia	-0.01	0.20	-0.08	0.00	0.25	0.07	-0.05	0.28	0.00	0.02	-0.06	0.21				
Turkey	0.10	0.18	0.21	0.23	0.02	0.26	0.07	0.03	0.01	0.08	0.13	-0.10	0.04			
UAE	0.11	0.10	0.15	0.07	0.33	0.22	0.03	0.22	0.04	0.10	0.13	0.20	0.01	0.04		
UK	0.01	0.07	0.16	0.39	-0.06	0.10	0.07	0.06	-0.05	0.14	0.05	0.06	-0.19	0.04	-0.06	
US	0.11	0.10	0.21	0.47	0.06	0.19	0.07	0.13	-0.03	0.09	0.07	0.09	-0.12	0.10	-0.03	0.85

Table 8 (cont.)—Test of Equality of Correlation Coefficients

	Bahrain	Egypt	India	Israel	Jordan	Kuwait	Lebanon	Morocco	Oman	Palestine	Qatar	SA	Tunisia	Turkey	UAE	UK
Panel C: Difference in Correlation Coefficients																
Egypt	0.04															
	(0.30)															
India	-0.20	-0.07														
	(-1.54)	(-0.60)														
Israel	-0.03	-0.14	-0.26**													
	(-0.24)	(-1.13)	(-2.23)													
Jordan	-0.11	-0.08	0.17	0.04												
	(-0.87)	(-0.61)	(1.36)	(0.35)												
Kuwait	-0.22*	0.05	0.08	0.21*	0.18											
	(-1.80)	(0.36)	(0.64)	(1.64)	(1.41)											
Lebanon	-0.06	-0.05	-0.06	0.19	-0.08	-0.12										
	(-0.44)	(-0.42)	(-0.45)	(1.49)	(-0.62)	(-0.90)										
Morocco	-0.03	-0.04	-0.02	-0.02	0.06	-0.06	0.00									
	(-0.21)	(-0.31)	(-0.15)	(-0.19)	(0.49)	(-0.47)	(-0.01)									
Oman	-0.05	0.10	0.08	0.10	0.00	0.02	0.02	0.06								
	(-0.44)	(0.78)	(0.62)	(0.81)	(-0.02)	(0.19)	(0.19)	(0.51)								
Palestine	0.30**	0.09	0.01	0.04	0.17	0.04	-0.14	-0.15	-0.02							
	(2.38)	(0.75)	(0.11)	(0.34)	(1.35)	(0.30)	(-1.07)	(-1.17)	(-0.19)							
Qatar	-0.14	-0.01	-0.10	0.02	-0.08	-0.06	0.02	0.15	0.18	0.01						
	(-1.07)	(-0.11)	(-0.75)	(0.15)	(-0.68)	(-0.44)	(0.19)	(1.14)	(1.40)	(0.06)						
SA	-0.13	0.08	0.15	-0.16	0.49***	-0.12	-0.01	0.03	-0.04	0.12	0.03					
	(-1.06)	(0.62)	(1.17)	(-1.22)	(4.05)	(-0.92)	(-0.04)	(0.26)	(-0.32)	(0.92)	(0.25)					
Tunisia	-0.15	0.03	-0.13	-0.11	0.39***	0.17	-0.07	0.22*	-0.04	-0.08	-0.10	0.25**				
	(-1.14)	(0.22)	(1.00)	(-0.85)	(3.08)	(1.32)	(-0.58)	(1.74)	(-0.31)	(-0.61)	(-0.76)	(1.97)				
Turkey	0.09	0.14	0.14	-0.01	-0.08	0.33***	0.14	0.10	0.05	0.07	0.22*	-0.30**	0.09			
	(0.73)	(1.07)	(1.14)	(-0.08)	(-0.61)	(2.62)	(1.06)	(0.80)	(0.41)	(0.52)	(1.73)	(-2.37)	(0.71)			
UAE	0.00	0.14	0.05	-0.03	0.26**	0.06	-0.12	0.24*	0.01	0.14	0.13	0.25*	0.03	0.00		
	(-0.03)	(1.11)	(0.37)	(-0.26)	(2.12)	(0.48)	(-0.96)	(1.90)	(0.10)	(1.10)	(1.03)	(1.93)	(0.23)	(0.04)		
UK	-0.05	-0.08	-0.21*	-0.06	-0.01	0.22*	-0.03	0.05	0.11	0.11	0.03	-0.01	-0.19	-0.35***	-0.10	
	(-0.37)	(-0.63)	(-1.83)	(-0.55)	(-0.07)	(1.73)	(-0.25)	(0.42)	(0.86)	(0.88)	(0.23)	(-0.12)	(-1.48)	(-2.88)	(-0.76)	
US	0.01	-0.02	-0.11	0.05	0.00	0.23*	0.00	0.13	0.13	0.03	0.04	-0.06	-0.15	-0.15	-0.20	
	0.17***															
	(0.04)	(-0.14)	(-0.91)	(0.51)	(-0.01)	(1.79)	(-0.02)	(1.02)	(1.03)	(0.27)	(0.34)	(-0.44)	(-1.15)	(-1.17)	(-1.53)	
	(3.35)															

[1] Test statistics of the changes in correlation coefficients from the first to the second period are shown in parentheses
[2] Statistical significance at the 10%, 5%, and 1% level is indicated by *, **, and ***, respectively

Table 9—Average Correlation Coefficients

	1/00 - 6/02	7/02 - 12/04	Change
Panel A: The values represent average correlation coefficients of stock markets within a particular region			
GCC	0.10	0.10	0.00
Mena	0.05	0.08	0.03
Mena ex GCC	0.04	0.07	0.03
Panel B: The values represent average correlation coefficients of an individual stock market with all other stock markets in the MENA region. Cells relating to individual countries ex IS denote average correlation coefficients of an individual stock markets all other stock markets in the entire MENA region, excluding Israel			
Israel	0.07	0.09	0.03
India	0.09	0.10	0.01
India ex IS	0.06	0.10	0.04
UK	0.07	0.04	-0.03
UK ex IS	0.04	0.02	-0.02
US	0.09	0.09	0.00
US ex IS	0.06	0.06	0.00

increasing economic cooperation and overall market liberalization. As a result, MENA stock markets have become more sensitive to intraregional shocks and less sensitive to interregional shocks. GVD and GIRF results also indicate that the influence of US and UK stock markets on their MENA counterparts has decreased noticeably. This is good news from an international portfolio perspective. The strengthening of economic ties with the booming economy of neighboring India, however, has made the GCC stock markets more susceptible to impulses from the Mumbai stock market. While the Saudi stock market is still dominant in the region, the upstart financial markets in Dubai, striving within the Gulf's most liberal market economy, have the potential to turn the United Arab Emirates into the future financial hub of the Middle East.

Economic conditions in Egypt, Morocco, and Tunisia have been the least promising within the MENA region, resulting in the underperformance of the local stock markets. The extent to which these economies can be integrated regionally is likely to determine the future prospects of its equity markets. Political factors seem to influence Israel's economic integration within the MENA region, leaving its stock market to be largely influenced by international counterparts of the US and UK. Aspiring European Union membership and consequently adjusting its fiscal and monetary policies and changing its political climate and legal framework to mirror EU standards, Turkey is moving away from the region economically. Istanbul's stock market behavior, therefore, is likely to form a greater resemblance with its European counterparts, which could translate into a higher level of segmentation from the MENA stock markets.

The results of this study indicate that the changing dynamics and contemporaneous stock market interactions within the MENA region yield substantial intraregional diversification benefits and suggest the inclusion of regional equity in a global port-

folio. In the future, GCC stock markets are likely to achieve the highest level of homogeneity within the MENA region, as its economies are increasingly synchronized in preparation for an economic union and ultimately the introduction of a common currency. The ongoing formation of an economic union may lead to a greater level of self sufficiency of the regional economies which could translate into the manifestation of the currently low external stock market dependency.

References

1. Arbelaez, H., J. Urrutia, and N. Abbas, "Short-Term and Long-Term Linkages Among the Colombian Capital Market Indexes," *International Review of Financial Analysis,* 10 (2001), pp. 237–273.

2. Abraham, A., F. Seyyed, and A. Al-Elg, "Analysis of Diversification Benefits of Investing in the Emerging Gulf Equity Markets," *Managerial Finance,* 27 (2001), pp. 47–57.

3. Ben-Zion, U., J. Choi, and S. Hauser, "The Price Linkages between Country Funds and National Stock Markets: Evidence from Cointegration and Causality Tests of Germany, Japan, and UK Funds," *Journal of Business Finance and Accounting,* 23 (1996), pp. 1005–1017.

4. Brav, A. and R. Lehavy, "An Empirical Analysis of Analysts' Target Prices: Short-term Informativeness and Long-term Dynamics," *Journal of Finance,* 58 (2003), pp. 1933–1968.

5. Chen, G., M. Firth, and O. Rui. 2002. "Stock Market Linkages: Evidence from Latin America," *Journal of Banking and Finance* 26 (2002), pp. 1116–1141.

6. Crowder, W., "A Reexamination of Long-Run PPP: The Case of Canada, the UK, and the US," *Review of International Economics,* 4, no. 1 (1996), pp. 64–78

7. Darrat, A., K. Elkhal, and S. Hakim, "On the Integration of Emerging Stock Markets in the Middle East," *Journal of Economic Development,* 25 (2002), pp. 61–78.

8. De Jong, F. and F. De Roon, "Time-Varying Market Integration and Expected Returns in Emerging Markets," *Journal of Financial Economics,* 78 (2005), pp. 583–613.

9. Dekker, A., K. Sen, and M. Young, "Equity Markets in the Asia Pacific Region: A Comparison of the Orthogonalized Generalized VAR Approaches," *Global Finance Journal,* 12 (2001), pp. 1–33.

10. Dickey, D., and W. Fuller, "Distribution of the Estimators for Autoregressive Time Series with a Unit Root," *Journal of the American Statistical Association,* 74 (1979), pp. 427–431.

11. Engle, R., and C. Granger, "Co-integration and Error Correction: Representation, Estimation, and Testing," *Econometrica,* 55 (1987), pp. 251–276.

12. Erb, C., C. Harvey, and T. Viskanta, "Expected Returns and Volatility in 135 Countries," *Journal of Portfolio Management* (Spring 1996), pp. 46–58.

13. Eun, C. and S. Sabherwal, "Cross-Border Listings and Price Discovery: Evidence from US-Listed Canadian Stocks," *Journal of Finance* 58 (2003), pp. 549–576.

14. Fernandez-Serrano, J., and S. Sosvilla-Rivero, "Modeling the Linkages Between US and Latin American Stock Markets," *Applied Economics,* 35 (2003), pp. 1423–1434.

15. Ghosh, A., R. Saidi, and K. Johnson, "Who Moves the Asia-Pacific Stock Markets–US or Japan? Empirical Evidence Based on the Theory of Cointegration," *Financial Review,* 34 (1999), pp. 159–170.

16. Girard, E. and E. Ferreira, "On the Evolution of Inter- and Intra-regional Linkages to Middle East and North African Capital Markets," *Quarterly Journal of Business and Economics,* 43 (2004), pp. 21–43.

17. Girard, E., M. Omran, and T. Zaher, "On Risk and Return in MENA Capital Markets," *International Journal of Business,* 8 (2003), pp. 285–314.

18. Gonzalo, J., and C. Granger, "Estimation of Common Long-Memory Components in Cointegrated Systems," *Journal of Business and Economic Statistics,* 13 (1995), pp. 27–35.

19. Granger, C, "Investigating Causal Relations by Econometric Models and Cross Spectral Methods," *Econometrica,* 37 (1969), pp. 424–438.

20. Granger, C, "Some Recent Developments on a Concept of Causality," *Journal of Econometrics,* 39 (1988), pp. 199–211.

21. Haigh, M., and D. Bessler, "Causality and Price Discovery: An Application of Directed Acylic Graphs," *Journal of Business,* 77 (2004), pp. 1099–1122.

22. Hamilton, J., "Time Series Analysis," (Princeton, New Jersey: Princeton University Press, 1994).

23. Hammoudeh, S., and E. Aleisa, "Dynamic Relationships among GCC Stock Markets and NYMEX Oil Futures," *Contemporary Economy Policy,* 22 (2004), pp. 250–269.

24. Harvey, C., "The Cross-Section of Volatility and Autocorrelation in Emerging Markets," *Finanzmarkt und Portfolio Management,* 9 (1995a), pp. 12–34.

25. Harvey, C., "Predictable Risk and Returns in Emerging Markets," *Review of Financial Studies,* 3 (1995b), pp. 773–816.

26. Hasbrouck, J., "One Security, Many Markets: Determining the Contributions to Price Discovery," *Journal of Finance,* 50 (1995), pp. 1175–1199.

27. Janakiramanan, S., and A. Lamba, "An Empirical Examination of Linkages between Pacific-Basin Stock Markets," *Journal of International Financial Markets*, *Institutions and Money*, 8 (1998), pp. 155–173.

28. Johansen, S., "Statistical Analysis of Cointegration Vectors," *Journal of Economic Dynamics and Control,* 12 (1988), pp. 231–254.

29. Johansen, S., and K. Juselius. 1990. "Maximum Likelihood Estimation and Inference from Cointegration—with Applications to the Demand for Money," *Oxford Bulletin of Economics and Statistics,* 52 (1990), pp. 169–210.

30. Kendall, M. and A. Stuart, "The Advanced Theory of Statistics" (Charles Griffin, 1967).

31. Koop, G., M. Pesaran, and S. Potter, "Impulse Response Analysis in Nonlinear Multivariate Models," *Journal of Econometrics,* 74 (1996), pp. 119–147.

32. Kwiatkowski, D., P. Phillips, P. Schmidt, and Y. Shin, "Testing the Null Hypothesis of Stationarity against the Alternative of a Unit Root: How Sure are We the Economic Time Series have a Unit Root?" *Journal of Econometrics,* 54 (1992), pp. 159–178.

33. Lütkepol, H., *Introduction to Multiple Time Series Analysis* (Springer Verlag, 1991).

34. Lütkepol, H., and H. Reimers, "Impulse Response Analysis of Cointegrated Systems," *Journal of Economic Dynamics and Control,* 16 (1992), pp. 53–78.

35. Malliaris, A., and J. Urrutia, "The International Crash of October 1987: Causality Tests," *Journal of Financial and Quantitative Analysis,* 27 (1992), pp. 353–364.

36. Masih, R., and A. Masih, "Common Stochastic Trends and the Dynamic Linkages Driving European Stock Markets: Evidence From Pre-and Post-October 1987 Crash Eras," *European Journal of Finance,* 10 (2004), pp. 81–104.

37. Omran, M., and L. Gunduz, "Stochastic Trends and Stock Prices in Emerging Markets: The Case of Middle East and North Africa Region," *Istanbul Stock Exchange Review,* 5 (2001), pp. 3–16.

38. Osterwald-Lenum, M., "A Note with Quantiles of the Asymtotic Distribution of the Maximum Likelihood Cointegration Rank Test Statistics," *Oxford Bulletin of Economics and Statistics,* 54 (1992), pp. 461–471.

39. Pesaran, M., and Y. Shin, "Generalized Impulse Response Analysis in Linear Multivariate Models," *Economics Letters,* 58 (1998), pp. 17–29.

40. Piesse, J., and B. Hearn, "Equity Market Integration versus Segmentation in Three Dominant Markets of the Southern African Customs Union: Cointegration and Causality Tests," *Applied Economics,* 14 (2002), pp. 1711–1722.

41. Sims, C., "Macroeconomics and Reality," *Econometrica,* 48 (1980), pp. 1–48.

42. Taylor, M., and I. Tonks, "The Internationalization of Stock Markets and the Abolition of U.K. Exchange Control," *Review of Economics and Statistics,* 71 (1989), pp. 332–336.

43. Tong, W., "Cointegration, Efficiency and Forecasting in the Currency Market," *Journal of Business Finance and Accounting,* 28 (2001), pp. 127–150.

44. Yang, J., I. Min, and Q. Li, "European Stock Market Integration: Does EMU Matter?" *Journal of Business Finance and Accounting,* 10 (2003), pp. 1253–1276.

45. Yang, J., J. Kolari, and I. Min, "Stock Market Integration and Financial Crisis: The Case of Asia," *Applied Financial Economics,* 13 (2003), pp. 477–486.