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The Dynamic Behaviour and Determinants of Linkages among Middle Eastern and North African Stock Markets

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ABSTRACT

The purpose of this paper is to study the time-varying conditional correlation across 12 MENA stock markets over the period July 2005 to January 2013, while taking into account the impact of two downturn periods. Methodologically, we use a multivariate framework which allows for both return asymmetry and leptokurtic distribution. The empirical results demonstrate that both the Israeli-Hezbollah war of 2006 and the financial crisis of 2008 generate substantial similarities in return linkage patterns among MENA stock markets. Most importantly, the results imply that there are still potential benefits for portfolio diversification, even in downturn periods when they are the most needed. Also, we find that conditional correlation depends on levels of stock market liquidity and financial development.

1. INTRODUCTION

AS EMPHASISED BY FINANCIAL THEORY, it is crucial to understand the behaviour of the volatility and the correlations of asset returns for pricing, asset allocation, risk management and hedging purposes (Manganelli 2004). In particular, with ample evidence of time-varying volatility and correlation (Boudt and Croux 2010), incorporating these features into the estimation of the conditional covariance matrix of equity returns can lead to better decisions on portfolio maximisation. This can also make the portfolio better resist periods of market stress (Campbell et al 2000; Pantaleo *et al* 2010), often characterised by high turbulence in the dependency of equity markets. If the risk reduction is not effective in stress periods, then the benefits of diversification are reduced in times when they are crucial (Baur and Lucey 2006).

Recent trends of globalisation, as well as the occurrence of economic and financial crises around the world (the US stock market crash in 1987, the East Asian crisis in 1997, and the global financial crisis in 2008, among others), were the main catalyst to study the linkages between national equity markets (Forbes and Rigobon 2002). Economic ties, cross-border trade, and capital flows are among the main factors that can interlink national equity prices (Forbes and Chinn 2004).

During stress periods, earlier studies infer that market linkages increase significantly (see Longin and Solnik 1995; Ang and Bekaert 2002; Ang and Chen 2002, among others), reducing the benefits of diversification. Recently, attention has shifted to emerging markets, supported by better relative growth prospects, abundant global liquidity (Institute of International Finance 2011) and safe haven status, as was the case during the financial crisis of 2008 (Neaime 2012). Unlike developed countries, scant empirical studies have focused on the dynamic linkage of MENA stock markets. The question of whether MENA stock markets respond in the same way to global and regional stress periods remains unanswered. Hence, the purpose of this paper is to fill the void in the literature in several ways. First, we estimate time-varying conditional variances and correlations across MENA equity markets, including Israel, and show that these variances and correlations change significantly within relatively short time periods. Second, we examine the impact of two stress periods (the Israeli-Hezbollah war of 2006 and the financial crisis of 2008) on equity return linkages and thus on regional portfolio diversification. Third, we explain the time-varying conditional correlations between MENA time series. Fourth, in term of econometric methodology, we build upon the work of Lee (2009) in an extension of the Engle and Kroner (1995) model, and use the asymmetric Multivariate Generalised Autoregressive Conditional Heteroskedasticity (MGARCH) model with General Errors Distribution (GED), which not only allows for both asymmetry and leptokurtic distribution, but also models several return series simultaneously, by allowing the conditional variances and co-variances of series to influence each other.

To our knowledge no previous research has addressed the above issues. Based on a wide variety of methodologies, several studies have focused on the issue of efficiency, as well as the international integration of MENA financial markets (Domowitz *et al* 1998; Abraham *et al* 2001; Assaf 2003; Bailey *et al* 2005; Neaime 2012; Neaime and Colton 2005; Bley and Chen 2006; Lagoarde-Segot and Lucey 2008; Yu and Hassan 2008). Others have examined returns and the univariate analysis of its volatility in selective stock markets in the MENA region (Al-Rjoub and Azzam 2012; Alsybaie and Najad 2009; Bekaert and Harvey 1997; Domowitz *et al* 1998; Hammoudeh and Choi 2007; Neaime 2006; Brooks 2007; Nikkinen *et al* 2008; Khedhiri and Muhammad 2008). Few studies have explored the interdependence of volatility of returns between MENA stock markets and developed markets or oil markets (Hammoudeh and Li 2008; Haque *et al* 2004; Yu and Hassan 2008, Malik and Hammoudeh 2007; Maghyereh and AL-Kandari 2007; Rao, 2008; Khallouli and Sandretto 2012). Hammoudeh *et al* (2009), meanwhile, have examined volatility spillovers between three equity sectors (service, banking and industry) in Kuwait, Qatar, Saudi Arabia, and UAE.

While Khallouli and Sandretto (2012) have tested for mean and volatility contagion effects of the crisis (the US subprime) on MENA stock markets using a Markov switching exponential GARCH approach, we aim to address the impact of two stress periods on the dynamic conditional volatility and correlation, using a larger sample and different methodology which models all MENA equity returns at once. We also complement the study of Khallouli and Sandretto (2012) by addressing diversification possibilities and explaining the time varying conditional correlations between MENA equity time series (Kim et al 2005).

Since the early 2000s the MENA region has witnessed remarkable economic growth and has evolved into a vibrant and important economic and financial block consequent to the liberalisation and globalisation. In various MENA markets, foreign capital controls have been relaxed to a certain extent. The openness of these markets to local and foreign investment increased with the sale of governments' assets to private funds, and the number of companies going public also soared. As a result, the dynamics of equity returns volatilities and correlations are likely to be affected.

This study is also motivated by the fact that equity markets in the MENA region differ from their counterparts in the developed countries in many ways. First, they are typically much smaller, less liquid than world financial markets (Domowitz *et al* 1998), and short selling is illegal. Second, they exhibit weak-form efficiency and capital market fragmentation (Lagoarde-Segot and Lucey 2008) as a result of poor-quality information, high trading costs, and low competition (Assaf 2009). Third, several MENA countries have relatively common economic, institutional, regulatory, political and cultural links, that often function differently to those of developed counterparts. Fourth, to some extent, the industrial organisation found in MENA markets also is quite distinct from that in developed economies (Assaf 2009). The present paper involves a heterogeneous sample of national equity markets of various size, liquidity, and different phases of economic development. Such characteristics may contribute to a different behaviour of volatility and correlation than observed in purely developed economies.

Our results indicate that conditional volatility exhibited a positive time-trend following turbulent periods, and that the pair-wise conditional correlation showed signs of downward patterns during both regional and global stress periods. Although these results contradict previous findings (Longin and Solnik 2001; Ang and Chen 2002; Khallouli and Sandretto 2012), they imply that periods of market stress and high volatility did not eliminate the benefits of portfolio diversification. We also find that conditional correlations in MENA stock returns are sensitive to both the existing level of financial development and liquidity.

Besides portfolio implications, our results are important for regulators and policymakers in this politically disturbed region of the world. In the quest for financial stability, policy makers need to response in a timely manner to cross borders shocks. One potential shock could result from a possible confrontation between Israel and the Lebanese Hezbollah in response to any military resolution of the Iranian Nuclear file.

The rest of the paper is organised as follows. Section two presents the institutional context. Section three discusses the methodology, including model development. Section four presents the empirical results, including the sample data. Section five investigates further the role of various determinants of the stock market unconditional correlation process. Finally, Section six presents our conclusions.

2. Institutional setting

Alongside the rising importance of stock markets in the context of financial liberalisation, economic development, and global integration, most of the MENA countries have undertaken economic and financial reforms. Some countries have revived existing stock markets by updating legislation, including the adaptation of national corporate governance codes that aim to improve financial disclosure, corporate transparency, and investor protection, as well as easing foreign access to these markets. Other countries have established stock markets along with the needed structural programmes. In fact, Egypt has two of the oldest exchanges in the world (Alexandria and Cairo stock exchanges, established in 1883 and 1903, respectively). Conversely, the UAE established its own exchanges only in 2000.

The phenomenal regional economic growth in the recent past, driven by rising oil and gas prices, has led to a sizeable increase in the number of listed firms. Most of the MENA countries experienced a privatisation wave, with hundreds of companies being privatised. The main objective was to cut government debt and develop capital markets. Such a process may be important in explaining whether the recent financial market liberalisation of some of these markets has indeed paved the way for greater vulnerability to external financial shocks.

Most MENA stock markets, however, are hindered by numerous structural weaknesses. The MENA context, which provides a bank-centric financial system, involves relatively small, illiquid, and poorly diversified stock markets. Local banks continue to dominate financing, as shallow and underdeveloped capital markets do not provide the best setting for firms to access capital easily. Overall, MENA stock markets suffer occasionally from lack of transparency and reliable market information. They also suffer from continuing weaknesses in terms of supervision and regulation, despite the adoption of several reforms to open up markets and increase transparency. High and concentrated levels of ownership and the lack of institutional support clearly differentiate MENA markets from those in developed countries. Overall, legal and regulatory institutions, external take-over markets, and product market competition are still relatively ineffective. Besides economic and political instability, which distinguish most MENA stock markets, the GCC (Gulf Cooperation Council - Bahrain, Qatar, Saudi Arabia, Oman and the UAE) stock markets, in particular, experience significant restrictions on capital mobility and foreign ownership. From this perspective, MENA countries provide unique information on the reaction of local stock market return to regional and global events. The effects of regional and global events on stock market linkages may differ according to the types of institutional arrangements and recent financial market developments.

In 2012, the MENA countries (including Israel) had a combined Gross Domestic Product (GDP) of almost $2.9 trillion and a population of about 320 million. On average, real GDP growth is expected to decrease from 4.7 percent in 2012 to 3.7 percent in 2014. Our sample countries exported $977 billion of goods and services. However, intraregional exports as a percentage of total MENA exports account for 11 percent, up from just eight percent in 2000. Furthermore, economic conditions across MENA economies vary enormously. For example, GDP per capita ranges from $2,925 (Morocco) to $99,731 (Qatar).

Table 1. Characteristics of MENA stock markets

	Year of establishment	*Trading hours*	*MC*	*MC/ GDP %*	*Number of listed companies*	*Turnover ratio %*
MOROCCO	1929	10:30-14:30	52.633	60.612	73	6.221
TUNISIA	1969	08:00-13:10	8.888	20.859	56	13.598
EGYPT	1883	08:30-12:30	58.00	20.679	331	37.809
ISRAEL	1935	09:30-16:30	148.436	59.721	622	45.903
LEBANON	1920	07:30-10:30	10.295	25.335	10	4.095
JORDAN	1999	08:30-11:00	26.998	94.302	277	10.302
KUWAIT	1984	06:00-09:30	97.091	57.179	208	23.223
BAHRAIN	1987	06:45-09:30	16.064	89.095	59	1.989
QATAR	1997	06:30-10:00	126.371	72.590	57	12.205
UAE	2000	06:00-10:00	67.950	19.827	140	25.309
SAUDI ARABIA	1984	08:00-12:30	373.379	58.707	159	144.408
OMAN	1988	08:00-11:00	20.107	27.592	148	13.325

Notes: Trading hours are in GMT, other data in the table are end of year figures for 2012, MC (market capitalisation of listed companies in Billion USD), MC/GDP (market capitalisation of listed companies as a percent of Gross Domestic Product). Listed stocks are the number of domestic listed companies. Turnover ratio corresponds to total value of shares traded during the period divided by the average market capitalisation for the period. Source: Reuters DataStream.

Table 1 presents some characteristics of the sample countries' exchanges. MENA stock markets are mixed, in terms of size and liquidity, from the largely capitalised stock markets of Saudi Arabia, Israel, Qatar, and Kuwait, to the less liquid markets of Bahrain, Lebanon, and Morocco. While Tunisia and Lebanon have market capitalisations of $8.88bn and $10.29bn, respectively, the value of the Saudi stock market alone reached $373.37bn in 2012. Total GCC market capitalisation has increased from $102bn in 2000 to $1.07tr in 2007, before shrinking to $701bn in 2012 following the global financial crisis. Conversely, the market value of the non-GCC stock markets of the MENA region remains largely unchanged.

3. The asymmetric MGARCH model

Multivariate GARCH models are suitable for examining the financial volatility transmission mechanism and correlation dynamics (Bauwens et al 2006). As such, they can model several return series simultaneously and allow the conditional variances and co-variances of series to influence each other, leading to more pertinent empirical models than working with individual univariate models (Bala and Premaratne 2004; Bauwens *et al* 2006). For multivariate GARCH models, however, the main concerns are not only the large numbers of estimated parameters, but also the positive-definiteness of the conditional covariance matrices.

With the development of several MGARCH models such as the diagonal VECH model of Bollerslev *et al* (1988), the constant correlation model of Bollerslev (1990), the VAR-GARCH model developed by Ling and McAleer (2003), and the copula-GARCH model of Patton (2000) and Serban *et al* (2007), we select the Baba-Engle-Kraft-Kroner (BEKK) model defined in Engle and Kroner (1995) and documented in various studies (e.g. Kroner and Ng 1998; Bekaert and Wu 2000; Lee 2009 among others) to capture the conditional variance and correlation of equity returns.

The VECH model is the most general MGARCH model, yet it is still highly parameterised for practical purposes. Besides, the diagonal VECH model is not guaranteed to be positive definite (Kring *et al* 2007). In the model of Bollerslev (1990), the assumption of constant correlation may seem too restrictive and unrealistic in empirical applications. The VAR-GARCH model defined in Ling and McAleer (2003) also produces unrealistic and naive constant conditional correlations. The copula-GARCH model can be viewed as an extension of the constant correlation model, typically estimated using a two-step maximum likelihood approach. Firstly, univariate GARCH models are fitted to each of the return series separately, assuming independence between them. Secondly, the point estimates of GARCH parameters are plugged in the copula function in order to estimate the copula parameters. Although this approach solves the dimensionality problem and is relatively straightforward to implement, its major drawback is that it does not take into account parameter uncertainty simultaneously (Rossi *et al* 2012), in contrast to an MGARCH-BEKK model.

On the other hand, the diagonal BEKK framework, which can model all data series at once (Bala and Premaratne 2004) by allowing the conditional variances and co-variances of the equity markets to influence each other, has a positive-definite variance-covariance matrix (guaranteed by construction due to its quadratic form) and a time-varying structure of all its components (particularly variance, covariance, and conditional correlation of return series). Furthermore, it also economises on parameters relative to other multivariate GARCH models. Apart from the aforementioned advantages, the asymmetric diagonal MARCH-BEKK model can examine cross-market asymmetric responses, which are both omitted in the model used in Hammoudeh *et al* (2009) and Serban *et al* (2007). This is important, given that stock volatility typically increases more after bad news than after good news (it tends to rise more in response to negative shocks than positive shocks). Therefore, we extend the BEKK model to allow for asymmetric responses of volatility in the variances and co-variances. Particularly, and unlike most of the MGARCH models which are usually estimated under multivariate normality, we capture the divergence of MENA return series from normality by estimating our model assuming multivariate GED. The assumption of normality does not fit MENA equity return time series, which are characterised by high values of kurtosis and non-zero skewness (see Table 1).

The dynamic process for the conditional variance-covariance matrix is given by:

$$H_t = C'C + A'(\varepsilon_{t-1}\varepsilon'_{t-1})A + G'H_{t-1}G + D'(\varepsilon_{t-1}\varepsilon'_{t-1}d_{t-1})D \qquad (1)$$

where H_t is 12×12 time-varying variance-covariance matrix of equity index returns; C is a lower triangular matrix of constants with 12×12 symmetric elements c_{ij}; A is a diagonal matrix with 12×12 symmetric elements a that measure lagged innovations (squared residuals) effects; *G* is a diagonal matrix with 12×12 symmetric elements *g* that measure the persistence of conditional volatility; d_{t-1} is a dummy variable equal to one if ε_{t-1} < zero and zero otherwise; *D* is a diagonal matrix with a 12×12 symmetric elements *d* that measure lagged asymmetric effects. The simple form of equation (1) is:

$$h_{11,t} = c_{1,1}^2 + a_{1,1}^2\varepsilon_{1,t-1}^2 + g_{1,1}^2 h_{1,1,t-1} + d_{1,1}^2\varepsilon_{1,t-1}^2 d_{1,t-1} \qquad (2)$$

The covariance equation for markets *i* and *j* is equal to:

$$h_{ij,t} = c_{i,j}\,c_{i,j} + a_{i,j}\,a_{j,j}\,\varepsilon_{i,t-1}\varepsilon_{j,t-1} + g_{i,i}\,g_{j,j}\,h_{i,j,t-1} + d_{i,i}\,d_{j,j}\,\varepsilon_{i,t-1}^2 d_{i,t-1} \qquad (3)$$

The time-varying correlations between conditional variances and past innovations are captured by the following formula, which measures the the conditional correlation between two markets:

$$\rho_{12,t} = \frac{h_{12,t}}{\left(\sqrt{h_{11,t}}\ \sqrt{h_{22,t}}\right)} \tag{4}$$

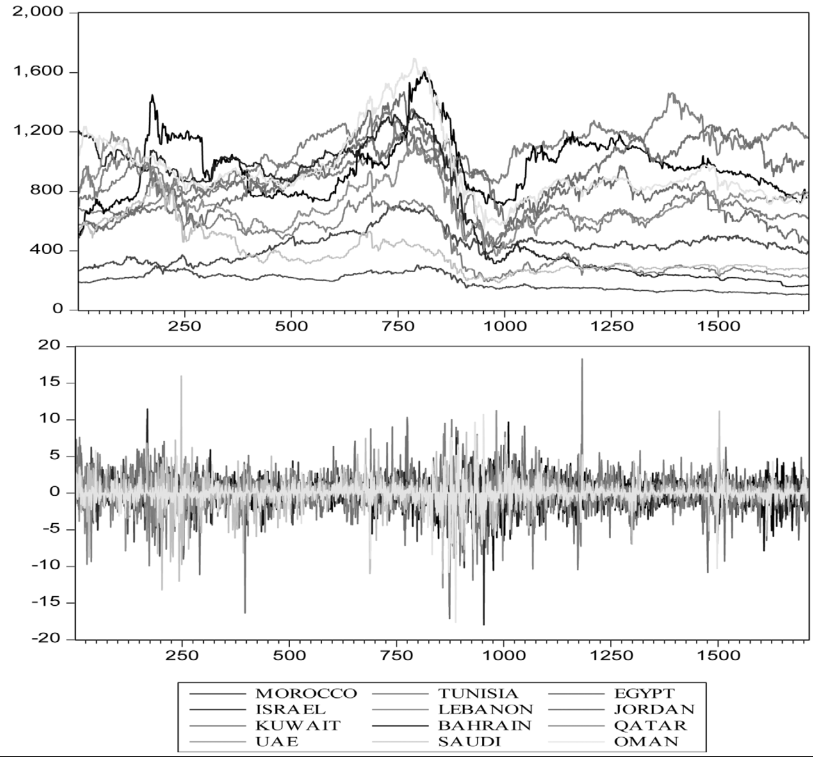
Given that MENA equity return series, represented by stock indices, are non-normally distributed (see Table 1), we assume multivariate GED of the residuals term ε_t and estimate the parameters of the models using the Berndt-Hall-Hall-Hausman (1974) algorithm. Accordingly, we will assess the robustness of our results using the LB-Q tests on the squared residuals.

4. Empirical results

4.1 Data and preliminary results

This paper covers 12 MENA countries (Morocco, Tunisia, Egypt, Israel, Lebanon, Jordan, Kuwait, Bahrain, Qatar, UAE, Saudi Arabia, and Oman) from June 1, 2005 to January 2, 2013, as several MENA indices are not available before this date. However, our data coverage is ideal because it enables us to cover the financial crisis of 2008 as well as the Israel-Hezbollah war of 2006. Using the database of Reuters DataStream, the data of the sample

Figure 1. Levels (upper panel) and first differences (lower panel) of MENA stock indices



MENA countries are collected from the daily closing prices of MSCI (Morgan Stanley Capital International) equity indices. For the Saudi equity market, we used the Standard and Poor's Saudi Arabia BMI (Broad Market Index), as the MSCI ceased to cover the Saudi stock market. Daily returns are defined as the first log difference of daily stock price indices. Figure 1 present levels and first differences of the series.

All stock indices, which are in USD, measure the price performance of equity markets without including dividends. On a daily basis, the price return of an index captures the sum of its constituents' free float-weighted market capitalisation returns. The data have been adjusted to reflect discrepancies in holidays across MENA stock markets. In other words, we collected data from *common trading days*.

For each market, a series of large changes tend to be followed by further large changes; and a series of small changes tend to be followed by further small changes. This phenomenon is known as volatility clustering and is commonly associated with financial time series. From the two figures, we can see that the stock prices and returns displayed substantial instability during July-August 2006, and July 2008 to February 2009, periods due respectively to the Israeli-Hezbollah war and the financial crisis.

Table 2. Descriptive statistics of the data

	Mean	*SD*	*Skewness*	*Kurtosis*	*Jarque-Bera*	*LB-Q (10)*	*ARCH-LM (10)*
MOROCCO	0.040	1.180	-0.339	6.106	785.597[a]	112.087[a]	139.095[a]
TUNISIA	0.029	1.022	0.117	9.150	2598.735[a]	52.053[a]	88.317[a]
EGYPT	-0.007	1.753	-1.135	11.135	5009.012[a]	40.957[a]	81.267[a]
ISRAEL	0.031	1.433	-0.489	7.757	1790.729[a]	34.712[a]	205.123[a]
LEBANON	0.023	1.540	-0.030	16.491	12918.799[a]	32.178[a]	99.318[a]
JORDAN	-0.050	1.284	-0.685	10.592	3981.902[a]	14.072[a]	239.903[a]
KUWAIT	-0.007	1.509	-0.981	11.979	6189.705[a]	30.130[a]	335.819[a]
BAHRAIN	-0.108	1.325	-1.996	30.959	59812.311[a]	21.167[a]	81.258[a]
QATAR	0.001	1.659	-0.757	12.649	7281.952[a]	23.917[a]	207.919[a]
UAE	-0.071	1.899	-0.593	15.081	9972.781[a]	40.117[a]	212.938[a]
SAUDI	-0.034	1.808	-1.008	15.795	12321.030[a]	17.792[b]	275.078[a]
OMAN	-0.018	1.375	-1.430	26.768	40572.029[a]	25.921[a]	117.813[a]

Note: SD (standard deviation); LB-Q (Ljung and Box Q-statistics) measures the serial autocorrelation in the returns up to 10 lags; ARCH-LM (Engle Lagrange multiplier) tests the null hypothesis that there is no presence of an ARCH process in the residuals up to 10 lags; Jarque-Bera tests the null hypothesis of normality of returns. For Jarque-Bera, Ljung-Box, and Engle LM tests, a, b, c indicate statistical significance at 1%, 5% and 10% levels respectively.

As summarised in Table 2, the distributional properties of the return series appear non-normal. Other than for Tunisia, MENA stock markets are negatively skewed and, since the kurtosis in all series exceeds by far three, a leptokurtic distribution is indicated. Such characteristics are common across stock returns (Claessens *et al* 1995; Harvey 1995). In addition, the autocorrelations in the returns as well as the heteroskedasticity in the residuals of the returns are omnipresent in all series. Such data characteristics justify the appropriateness of using a GARCH type model that has the capability of presenting time-varying conditional volatility and eliminating the autocorrelations and heteroskedasticity presence in the returns.

4.2 Stationarity of time series

Preceding the analysis of the temporal relations across return variables, testing the stationarity of returns is essential in order to prevent spurious conclusions. A time series is said to be stationary if its moments do not depend on time. If a non-stationary series Y_t, must be differenced d times before it becomes stationary, then it is said to be integrated of order d; We write $Y_t \sim I(d)$. We adopt the Augmented Dickey-Fuller (ADF) (Dickey and Fuller, 1979) and Phillips-Perron (PP) unit root tests (Phillips and Perron, 1988) and test the null hypothesis (H_0) that a time series $Y_t \sim I(1)$ i.e. has a unit root; against the alternative hypothesis (H_1) that the time series $Y_t \sim I(0)$ i.e. the time series is stationary. Table 3 reports the results of the unit root tests. The optimal lag length is chosen on the basis of the Akaike Information Criterion (AIC) for the ADF test and the Newey-West Bandwith using Barlett Kernel for the PP test, respectively.

Table 3. Unit roots tests

	Level		*1st difference*	
	ADF	*PP*	*ADF*	*PP*
MOROCCO	-2.121	-2.106	-33.911[a]	-33.845[a]
TUNISIA	-1.910	-1.850	-37.291[a]	-37.309[a]
EGYPT	-1.369	-1.389	-36.257[a]	-36.389[a]
ISRAEL	-1.723	-1.728	-38.908[a]	-38.817[a]
LEBANON	-2.519	-2.528	-29.083[a]	-29.751[a]
JORDAN	-0.778	-0.770	-43.988[a]	-43.328[a]
KUWAIT	-0.982	-0.985	-40.259[a]	-40.399[a]
BAHRAIN	-0.674	-0.680	-38.473[a]	-38.762[a]
QATAR	-1.528	-1.589	-38.372[a]	-38.317[a]
UAE	-1.023	-1.029	-36.552[a]	-36.502[a]
SAUDI	-1.330	-1.343	-38.838[a]	-38.791[a]
OMAN	-1.247	-1.251	-37.705[a]	-37.870[a]

Notes: ADF (Augmented Dickey-Fuller), PP (Philips and Perron). Both ADF and PP statistics are computed with a constant term. a, b, c indicate statistical significance at 1%, 5% and 10% levels respectively.

We reject the null hypothesis that the return has a unit root. The ADF and PP t-statistics for the first-differences are statistically significant at the one per cent significance level. This implies that all series are integrated of order one, i.e. they follow a covariance-stationary process.

4.3 Conditional variance process

Table 4 summarises the parameter estimates of the conditional variance process. The results indicate that strong GARCH and ARCH effects are present in all series. Similarly, the leverage effect is significant in most of the return series. This implies that the asymmetric volatility determines the conditional variance.

Table 4. Estimation of the MGARCH conditional variance process

	a		*g*		*d*		*LBQ²(10)*	*MLBQ²(10)*
MOROCCO	-0.213[a]	(0.035)	0.951[a]	(0.002)	0.187[a]	(0.052)	9.725	1209.172
TUNISIA	-0.237[a]	(0.037)	0.985[a]	(0.001)	0.173	(0.059)	11.918	
EGYPT	0.059	(0.035)	0.952[a]	(0.007)	0.520[a]	(0.050)	16.125	
ISRAEL	-0.257[a]	(0.075)	0.957[a]	(0.006)	0.817[a]	(0.081)	12.319	
LEBANON	0.172[a]	(0.025)	0.759[a]	(0.018)	-0.139	(0.125)	14.772	
JORDAN	0.089[a]	(0.035)	0.925[a]	(0.011)	0.579[a]	(0.059)	9.330	
KUWAIT	0.012[a]	(0.025)	0.980[a]	(0.002)	0.252[a]	(0.032)	9.572	
BAHRAIN	0.009[a]	(0.023)	0.981[a]	(0.001)	0.215[a]	(0.021)	11.259	
QATAR	0.035[a]	(0.035)	0.950[a]	(0.005)	0.328[a]	(0.070)	14.817	
UAE	0.057[a]	(0.025)	0.925[a]	(0.007)	0.409[a]	(0.050)	14.217	
SAUDI	-0.172[a]	(0.023)	0.958[a]	(0.002)	0.389[a]	(0.039)	17.329	
OMAN	0.095[a]	(0.038)	0.887[a]	(0.008)	0.408[a]	(0.059)	5.980	

Note: a, b, c indicate statistical significance at 1%, 5% and 10% levels respectively. Standard errors are reported in parentheses. LB-Q2 (Ljung and Box Q-statistics on the squared residuals). M LB-Q2 (Multivariate Ljung and Box Q-statistics on the squared residuals).

To verify the validity of the estimated model, we test whether or not the overall serial correlation in the squared residuals is significant. For each return series, the Ljung-Box (1979) statistic is found to be insignificant up to ten lags. Furthermore, the serial autocorrelation in the squared residuals of the multivariate model is absent.

4.4 Unconditional and conditional cross-market correlations of returns

Table 5 reports the values for unconditional and conditional cross-correlation of returns between all returns series.

Computing unconditional correlation is a simple approach to measure return linkages. Inter-stock market correlations are highest among the Arab Gulf markets (Kuwait, Bahrain, Qatar, UAE, Saudi Arabia, and Oman), especially between UAE and Qatar (0.50300). Such an outcome is not surprising, given strong cross-border trade and capital flows. The correlation coefficients are lowest between Israel and each of the remaining MENA countries. This result is expected, given weak trade and financial ties between Israel and the rest of the MENA economies.

On the other hand, the conditional correlations appear to be similar to the static unconditional correlations. An interesting pattern, however, appears in the downward trend in the degree of the conditional correlation across all the markets compared to the unconditional correlations results. The markets of Qatar and the UAE have the highest correlation, whereas Tunisia and Qatar are negatively correlated.

Table 5: Unconditional and conditional correlations across the MENA stock returns

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1)		**0.238**	**0.111**	**0.016**	**0.013**	**0.079**	**0.056**	**0.035**	**0.056**	**0.075**	**0.084**	**0.2316**
(2)	*0.231*		**0.048**	**0.003**	**0.017**	**0.045**	**0.054**	**0.015**	**-0.002**	**0.056**	**0.057**	**0.1799**
(3)	*0.179*	*0.084*		**0.023**	**0.041**	**0.160**	**0.097**	**0.075**	**0.245**	**0.295**	**0.193**	**0.0088**
(4)	*0.008*	*0.020*	*0.013*		**0.006**	**0.026**	**0.023**	**0.012**	**0.018**	**0.035**	**0.042**	**0.0663**
(5)	*0.066*	*0.061*	*0.151*	*0.010*		**0.059**	**0.050**	**0.026**	**0.038**	**0.050**	**0.007**	**0.1119**
(6)	*0.111*	*0.102*	*0.262*	*-0.012*	*0.161*		**0.104**	**0.098**	**0.165**	**0.191**	**0.135**	**0.0941**
(7)	*0.094*	*0.113*	*0.175*	*-0.015*	*0.112*	*0.232*		**0.162**	**0.167**	**0.215**	**0.142**	**0.0699**
(8)	*0.069*	*0.078*	*0.125*	*0.007*	*0.125*	*0.226*	*0.374*		**0.159**	**0.183**	**0.057**	**0.1233**
(9)	*0.123*	*0.090*	*0.288*	*0.010*	*0.101*	*0.314*	*0.311*	*0.275*		**0.391**	**0.175**	**0.1215**
(10)	*0.121*	*0.105*	*0.360*	*0.016*	*0.128*	*0.320*	*0.302*	*0.286*	*0.492*		**0.252**	**0.1278**
(11)	*0.127*	*0.084*	*0.284*	*-0.006*	*0.129*	*0.282*	*0.258*	*0.182*	*0.305*	*0.382*		**0.1086**
(12)	*0.108*	*0.127*	*0.266*	*0.027*	*0.147*	*0.288*	*0.250*	*0.283*	*0.453*	*0.457*	*0.311*	

Note: Unconditional correlations are reported in italic, whereas conditional correlations are reported in bold. Morocco (1), Tunisia (2), Egypt (3), Israel (4), Lebanon (5), Jordan (6), Kuwait (7), Bahrain (8), Qatar (9), UAE (10), Saudi Arabia (11), and Oman (12).

5. Further analysis

5.1 Sensitivity analysis

In this section, we test whether there is a distinct upward or downward shift in conditional correlations and variances. We thus regress both conditional variance (CV) and conditional correlation (CC) on both stress and post-stress period dummies as follows:

$$CV_{j,t} = m_0 + m_1\, war/crisis\ dummy_{k\,t} + m_2\, postwar/crisis\ dummy_{k\,t} + u_{j\,t} \quad (5)$$

$$CV_{j,t} = m_0 + m_1\, war/crisis\ dummy_{k\,t} + m_2\, postwar/crisis\ dummy_{k\,t} + v_{j\,t} \quad (6)$$

where the war dummy is a dichotomous variable, which equals one from July 12, 2006 to August, 14 2006 and zero otherwise; post-war is a dichotomous variable equal to one after August, 14 2006 and zero otherwise; the (financial) crisis dummy is a dichotomous variable equal to one from July 2008 to February 2009 and zero otherwise; post- crisis is a dichotomous variable equal to one after February 2009 and zero otherwise; u_t and v_t are error terms.

Equation (5) estimates are reported in Table 6. The results imply that only 33.33 per cent of the estimated war dummy coefficients (M_1) are statistically significant at the one per cent significance level. While the war of 2006 increased the conditional volatility in Morocco, Tunisia, and Lebanon, it decreased the conditional volatility in the UAE. In the post-war period, however, the conditional volatility decreased in Lebanon, Jordan, UAE, and Saudi Arabia, while it increased in Morocco, Tunisia, Israel, Kuwait, and Bahrain.

Table 6. Impact of global and regional events on the conditional variance

	War			*Financial crisis*		
	M_0	M_1	M_2	M_0	M_1	M_2
MOROCCO	8.896[a]	2.647[a]	1.395[a]	8.552[a]	5.283[a]	0.463[a]
	57.150	**4.702**	**8.130**	**111.152**	**28.963**	**4.146**
TUNISIA	5.062[a]	3.571[a]	3.158[a]	5.857[a]	5.438[a]	1.572[a]
	29.816	**5.815**	**16.916**	**63.107**	**24.714**	**11.657**
EGYPT	10.527[a]	0.547	0.256	8.359[a]	11.186[a]	1.021[a]
	24.651	**0.354**	**0.547**	**36.788**	**20.780**	**3.094**
ISRAEL	9.624[a]	-1.332	8.938[a]	10.568[a]	10.779[a]	9.088[a]
	10.581	**9.965**	**8.927**	**19.893**	**8.561**	**11.781**
LEBANON	16.997[a]	23.321[a]	-5.025[a]	15.017[a]	3.981[a]	-7.483[a]
	13.593	**5.108**	**-3.658**	**20.137**	**2.252**	**-6.903**
JORDAN	6.525[a]	-1.318[b]	-1.657[a]	4.702[a]	4.213[a]	-0.779[a]
	34.710	**-1.947**	**-7.859**	**45.806**	**17.317**	**-5.018**
KUWAIT	5.782[a]	-1.271	1.523[a]	4.732[a]	11.184[a]	1.390[a]
	19.297	**-1.170**	**4.573**	**34.359**	**34.252**	**6.972**
BAHRAIN	2.808[a]	-0.235	1.894[a]	2.468[a]	9.179[a]	1.430[a]
	11.711	**-0.273**	**7.189**	**22.581**	**35.419**	**9.030**
QATAR	8.699[a]	-1.865[b]	1.152[b]	6.098[a]	12.864[a]	-0.612[b]
	20.372	**-1.219**	**2.457**	**28.861**	**25.678**	**-1.971**
UAE	11.026[a]	-4.085[a]	-1.562[a]	7.772[a]	11.516[a]	0.057[a]
	25.753	**-2.646**	**-3.318**	**34.525**	**21.599**	**0.172**
SAUDI	14.162[a]	-0.597	-6.853[a]	9.185[a]	7.080[a]	-4.993[a]
	25.881	**-0.306**	**-11.375**	**30.117**	**9.797**	**-11.153**
OMAN	4.035[a]	-1.029	1.136[b]	3.279[a]	13.287[a]	-0.108
	0.081	**-0.665**	**2.395**	**15.268**	**26.193**	**-0.395**

Note: a, b, c indicate statistical significance at 1%, 5% and 10% levels respectively; Robust T-statistics are reported in bold.

Regarding the financial crisis, the conditional variance exhibited a positive time-trend in all cases. Nevertheless, the results of the slope coefficient estimates for the post-crisis dummy variable (M_2) are mixed. Most of the estimated coefficients are statistically significant at the one percent level. In contrast, conditional variances have increased significantly for Tunisia, Egypt, Israel, Kuwait, Bahrain, and UAE. On the other hand, conditional variances have decreased significantly for Lebanon, Jordan, and Saudi Arabia. Despite the major differences between the highly accessible Lebanese and Jordanian markets and the less accessible Saudi market, the financial crisis made the volatility behaviour in these markets respond differently to the financial crisis. It could be that rising volatility could be the result of a cognitive convergence of domestic investors during the financial crisis as suggested by Lagoarde-Segot and Lucey (2009).

Table 7. Analysis of conditional correlation

	War		*Financial crisis*	
	War (M_1)	*Post-war (M_2)*	*Crisis (M_1)*	*Post-crisis (M_2)*
Morocco / Tunisia	-0.005 [a]	-0.031 [a]	0.122 [a]	0.029 [a]
Morocco / Egypt	0.016 [b]	-0.021 [a]	0.027 [a]	0.005 [a]
Morocco / Israel	-0.039 [a]	0.018 [a]	0.025 [a]	0.031 [a]
Morocco / Lebanon	-0.035 [b]	0.002	-0.005 [a]	0.003
Morocco / Jordan	0.008 [c]	0.003 [b]	0.022 [a]	0.005 [a]
Morocco / Kuwait	0.016 [b]	-0.005 [b]	0.028 [a]	0.004 [a]
Morocco / Bahrain	0.012 [b]	0.001	0.052 [a]	0.014 [a]
Morocco / Qatar	-0.031 [b]	-0.001	-0.050 [a]	-0.012 [a]
Morocco / UAE	0.007	-0.012 [a]	0.031 [a]	0.004 [a]
Morocco / Saudi	0.102 [a]	-0.021 [a]	0.093 [a]	0.035 [a]
Morocco / Oman	-0.002 [a]	-0.001 [a]	-0.005 [a]	-0.007 [a]
Tunisia / Egypt	0.052 [a]	0.003 [b]	0.054 [a]	0.009 [a]
Tunisia / Israel	0.039 [a]	0.012 [a]	0.035 [a]	0.031 [a]
Tunisia / Lebanon	-0.035 [b]	0.009	-0.061 [a]	-0.005
Tunisia / Jordan	0.008 [c]	-0.018 [a]	0.018 [a]	-0.002 [a]
Tunisia / Kuwait	-0.014 [b]	-0.012 [a]	0.005 [b]	-0.014 [a]
Tunisia / Bahrain	0.011 [b]	-0.032 [a]	0.050 [a]	0.012 [a]
Tunisia / Qatar	0.007	-0.011 [a]	-0.025 [a]	-0.022 [a]
Tunisia / UAE	0.005	-0.012 [a]	0.035 [a]	-0.001
Tunisia / Saudi	0.180 [a]	0.025 [a]	0.098 [a]	0.032 [a]
Tunisia / Oman	-0.023 [a]	-0.025 [a]	-0.039 [a]	-0.016 [a]
Egypt / Israel	-0.035 [c]	0.052 [a]	0.121 [a]	0.035 [a]
Egypt / Lebanon	-0.031 [a]	0.012 [a]	-0.039 [a]	0.007 [a]
Egypt / Jordan	0.098 [a]	-0.071 [a]	0.205 [a]	0.003
Egypt / Kuwait	0.039 [b]	-0.023 [a]	0.192 [a]	0.021 [a]
Egypt / Bahrain	0.035 [a]	-0.005	0.215 [a]	0.032 [a]
Egypt / Qatar	0.117 [a]	0.021 [a]	0.125 [a]	0.025 [a]
Egypt / UAE	-0.017	-0.012	0.189 [a]	0.016 [a]
Egypt / Saudi	0.068 [b]	-0.023 [b]	0.165 [a]	0.021 [b]
Egypt / Oman	0.008	-0.054 [a]	0.108 [a]	0.018 [b]
Israel / Lebanon	0.075 [a]	0.001	-0.021 [a]	-0.005 [c]
Israel / Jordan	-0.061 [a]	-0.001 [b]	0.075 [a]	0.012 [a]
Israel / Kuwait	-0.039 [a]	-0.001	0.102 [a]	0.032 [a]
Israel / Bahrain	-0.035 [a]	0.001	0.125 [a]	0.039 [a]
Israel / Qatar	-0.025 [b]	-0.023 [a]	0.089 [a]	0.014 [a]
Israel / UAE	-0.059 [a]	-0.012 [a]	0.115 [a]	0.032 [a]
Israel / Saudi	-0.032 [c]	0.002 [c]	0.052 [a]	0.002
Israel / Oman	-0.052 [a]	-0.025 [a]	0.072 [a]	0.005
Lebanon / Jordan	0.018	0.017 [a]	0.014 [a]	0.009 [a]
Lebanon / Kuwait	0.005	0.018 [a]	-0.002 [a]	0.001 [a]

Lebanon/Bahrain	-0.025 [a]	-0.003	0.025 [a]	0.007
Lebanon/Qatar	0.129 [a]	0.072 [a]	0.071 [a]	0.023 [a]
Lebanon / UAE	0.012	0.025 [a]	0.018 [a]	0.014 [a]
Lebanon / Saudi	-0.025	0.017 [a]	-0.072 [a]	0.025 [a]
Lebanon / Oman	0.039 [c]	-0.032 [a]	0.093 [a]	0.014 [b]
Jordan / Kuwait	0.009	-0.035 [a]	0.212 [a]	-0.009
Jordan / Bahrain	0.012	-0.031 [a]	0.252 [a]	0.005
Jordan / Qatar	0.115 [a]	0.007	0.018 [a]	0.016 [a]
Jordan / UAE	-0.012	-0.052 [a]	0.239 [a]	0.002
Jordan / Saudi	0.071 [a]	0.002	0.162 [a]	-0.003 [a]
Jordan / Oman	-0.012	-0.059 [a]	0.129 [a]	-0.005
Kuwait / Bahrain	0.089 [a]	0.005	0.395 [a]	0.125 [a]
Kuwait / Qatar	0.081 [a]	-0.018 [b]	0.257 [a]	0.032 [a]
Kuwait / UAE	-0.023	-0.052 [a]	0.189 [a]	0.003
Kuwait / Saudi	0.012	-0.008	0.171 [a]	-0.021 [a]
Kuwait / Oman	-0.009	-0.054 [a]	0.198 [a]	-0.001
Bahrain / Qatar	0.095 [a]	0.032 [a]	0.259 [a]	0.039 [a]
Bahrain / UAE	0.018	-0.001	0.302 [a]	0.025 [a]
Bahrain / Saudi	0.061 [a]	0.025 [a]	0.331 [a]	0.002
Bahrain / Oman	0.032 [b]	-0.009 [c]	0.215 [a]	0.003
Qatar / UAE	0.002	0.031 [a]	0.183	0.007 [a]
Qatar / Saudi	0.039 [b]	0.012 [c]	0.072 [a]	-0.005
Qatar / Oman	0.009	-0.035 [a]	0.239 [a]	0.059 [a]
UAE / Saudi	-0.095 [a]	-0.023 [a]	0.135 [a]	0.021 [b]
UAE / Oman	-0.035	-0.018 [b]	0.210 [a]	0.025 [a]
Saudi / Oman	0.007	-0.017 [a]	0.052 [a]	0.018 [a]

Note: a, b, c indicate statistical significance at 1%, 5% and 10% levels respectively. The coefficients of constant terms (M0) are not reported here, but are all significant at 1% level.

Table 7 reports the coefficients of equation (6). During the war, conditional correlations increased significantly in 15 cases and decreased in 11. The highest increase is measured for Tunisia/Saudi, followed by Egypt/Qatar and Lebanon/Qatar, whereas the highest decrease is measured for UAE/Saudi, followed by Israel/UAE and Israel/Bahrain. In the post-war period, however, correlations increased in 14 cases and decreased in 26 cases. The highest increase is found for Lebanon/Qatar, followed by Egypt/Israel and Bahrain/Qatar, whereas the highest decrease is measured for Jordan/Oman, followed by Jordan/UAE and Israel/UAE.

During the financial crisis, on the other hand, conditional correlations surged in 55 cases and diminished in ten. The highest increase is measured for Kuwait/Bahrain, followed by Bahrain/Saudi and Bahrain/Qatar, while the highest decrease is measured for Tunisia/Lebanon, followed by Lebanon/Saudi and Morocco/Qatar. In the post-crisis period, however, correlations increased in 40 cases and decreased in seven. The highest increase is found for Kuwait/Bahrain, followed by Qatar/UAE and Qatar/Oman, whereas the highest decrease is measured for Tunisia/Qatar, followed by Jordan/Saudi and Kuwait/Saudi.

These above findings suggest that some countries experienced the effects of the war or financial crisis less than others, implying important diversification benefits during turbulent periods.

5.2 Drivers of stock market conditional correlation

Consistent with Kim *et al* (2005) we used variables such as 'logarithm of equity market turnover by volume' and 'ratio of stock market capitalisation to GDP' to explain the daily conditional correlations of stock returns of MENA markets.

We further examine the factors that determine conditional correlation series for each country by testing for the significance of domestic financial development (FD) as commonly measured by stock market capitalisation as a proportion of GDP, and liquidity as measured by the log of turnover by volume. We introduce other control variables which may affect stock markets returns and consequently correlations. These variables include Friday (*F*) and January (*J*) dummies, which measure the effects of both a day of the week and turn of the year, respectively. We use DataStream to construct country specific aggregate variables. The exogenous variables that are not dummies have been lagged by one day to minimise bias in our estimated coefficients. We also introduce the first lag of the endogenous variable (conditional correlation) in the regression. Based on Ljung and Box Q-statistics, we find that one lag is sufficient to eliminate most of the serial correlation.

Table 8. Determinants of conditional correlation

	b_0	b_1	b_2	b_3	b_4
MOROCCO	0.017[a]	0.001[a]	0.000	0.000	0.000
	3.918	3.297	1.391	1.088	0.839
TUNISIA	0.020[a]	0.002[a]	0.000	0.000	-0.000
	5.093	5.003	1.159	0.827	-1.079
EGYPT	0.009[a]	0.005[a]	0.000	0.000	0.000[a]
	3.577	3.308	1.125	0.786	3.729
ISRAEL	0.029[a]	0.007[a]	0.000[a]	0.000	0.000
	2.598	3.598	3.195	1.238	0.983
LEBANON	0. 010	0.005	0.000	0.000[a]	0.000
	1.723	0.932	1.542	0.198	0.592
JORDAN	0.032[a]	0.005[b]	0.000[a]	0. 000	0.000[a]
	5.702	2.189	3.591	0.953	3.259
KUWAIT	0.017[a]	0.002	0.000[a]	0.000	0.001[a]
	7. 215	1.191	3.983	0.845	3.917
BAHRAIN	0.022[a]	0.009[a]	0.000	0.000	0.000
	3. 789	5.718	0.987	1.250	0.957
QATAR	0.021[a]	0.008[b]	0.000[b]	0.000	0.001[a]
	3.039	2.285	2.982	1.389	3.911
UAE	0.032[a]	0.0028[a]	-0.000[a]	0.000	0.891
	5.023	3.921	1.085	1.357	0.928
SAUDI	0.030[a]	0.009[a]	0.000[a]	0.000	0.001
	5.987	2.598	7.819	1.008	1.058
OMAN	0.023[a]	0.005	0.000[b]	0.000	0.001[a]
	5.082	1.795	2.219	0.981	3.900

Note: a, b, c indicate statistical significance at 1%, 5% and 10% levels respectively; robust T-statistics are reported in bold.

Table 8 reports the estimation results of equation (7) which was specified as follows:

$$CC_{j,t} = b_{0j} + b_{1j}FD_{j\,t-1} + b_{2j}Liquidity_{j\,t-1} + b_{3j}F\ dummy_{j\,t}$$
$$+ b_{4j}J\ dummy_{j\,t} + b_{5j}CC_{j\,t-1} + z_{j\,t} \quad (7)$$

where $z_{j,t}$ is assumed an uncorrelated disturbance series.

Other than for Lebanon, the overall results indicate that at least one of the two financial variables, financial development and liquidity, are positive and significant for most countries in the MENA region. The Friday dummy is insignificant for all countries whereas the January effect is significant for Egypt, Jordan, Kuwait, Qatar and Oman.

6. Conclusions

Capturing accurate degrees of time-varying return volatility and correlation linkages among the stock markets of the MENA region is a challenge for policy makers and investors. To construct an optimal portfolio, a time-varying covariance matrix of all the assets in the portfolio is crucial. To this end, we propose a model which provides time-varying volatility and pair-wise correlation processes as key inputs for asset allocation, hedging, and risk measurement.

We have also examined the impact of a regional event (the Israeli-Hezbollah war of 2006) and a global event (the global financial crisis of 2008) on equity linkages across the stock markets of Morocco, Tunisia, Egypt, Israel, Lebanon, Jordan, Kuwait, Bahrain, Qatar, UAE, Saudi Arabia, and Oman. We have applied a multivariate GARCH model which can capture the asymmetric impact of information on returns volatility, allow for non-normal distribution, and derive the pair-wise conditional correlations of returns. The latter has varied significantly over stress periods, suggesting significant diversification opportunities.

The model outcomes indicate very strong own and cross-persistent volatility in all MENA countries' equity prices. The asymmetric framework model has uncovered the presence of asymmetric volatility, suggesting that the MENA markets overreact to bad news and underreact to good news. Furthermore, we find evidence of weak conditional correlations between Morocco, Tunisia, Israel, Lebanon, and the rest of the MENA countries. This result is supported by weak economic and financial ties between these groups of countries (Valadkhani and Chancharat 2008), thereby suggesting some diversification benefits.

On the other hand, conditional volatilities increased in all MENA markets during the global financial crisis of 2008, whereas during the Israeli-Hezbollah war of 2006 the conditional volatility increased in only three cases and dropped in one case. In particular, the conditional volatility in Lebanon spiked during the war but then waned, with the magnitude impact of the war volatility being seven times higher than that of the financial crisis. Conversely, in Israel, the conditional volatility responded slightly to the war effect but with a long-lived phenomenon. However, the magnitude of the effect of both the war and the financial crisis on the slope of the conditional volatility in the pre-stress periods was similar. During the war, however, the magnitude of the war on the conditional volatility in Lebanon was more than seven times the magnitude of the financial crisis.

Compared to the war period, the effect of the financial crisis on the positive time-trend of conditional correlation was more than three times higher. Conversely, the war and financial crisis periods had equal effect on the negative time-trend of conditional correlation, implying equal diversification benefits during turbulent periods when they are most needed. In the pre-war and pre-crisis periods, however, the volatility surged in five and seven markets, respectively. In the post-crisis period, the positive effect of the time-trend of conditional correlation was almost three times higher than the post-war period. Such findings contradict earlier studies that find correlations between stock market returns tend to intensify during stress markets (Longin and Solnik 2001; Ang and Chen 2002; Khallouli and Sandretto 2012). In contrast, the impact of the negative time-trend of conditional correlation was almost four times higher in the post-war period compared to the post-crisis period.

Our empirical results are important for asset allocation and risk management decisions. They also matter to financial regulators and monetary policy makers. Adverse stock market conditions reduce investor capital as well as the appetite for spending. Accordingly, this may weigh significantly on economic prospects and present a major obstacle to increasing the overall efficiency of the MENA financial sector.

We also provide evidence that the conditional correlation between MENA stock markets is dependent on stock market liquidity and level of financial development. This result may help MENA regulators and policy makers to manage cross borders shocks by influencing the significant channels which interlink national equity markets.

Stock market liquidity has a positive impact on conditional correlation. Therefore, improving stock market liquidity can be another tool for promoting stock market linkages. Besides, policy makers seeking to generate positive economic impacts from the growing activities in the stock markets, such as lower borrowing cost for corporate sector (Neaime 2012) among others, might develop the latter's size and liquidity, and thus enhance corporate disclosure and regulation. The level of financial development is important for stock market development in the region, and can also play a driving force in promoting economic growth. MENA policy makers should encourage public offer and the ‘culture of equity’ by appropriate policies.

Although our results do not take into account the direct effect of institutional quality on correlation, MENA countries need to enhance their institutional framework because effective institutions reduce political uncertainties which determine investment choice. Finally, further assessment of return linkages across equity sectors is suggested.

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Endnotes

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