Further evidence on Middle East and North Africa financial markets integration

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Abstract: This paper provides further evidence on financial integration among MENA and developed the US stock markets between 2000 and 2015. This paper employs Zivot and Andrews (1992) and Bai and Perron (2003) methods to test for single and multiple structural breaks in MENA markets, respectively, along with the autoregressive distributed lag (ARDL) and Granger causality techniques to examine the dynamic interaction among the aforementioned stock markets in both long and short-run. Results find that, in general, the Global Financial Crisis (GFC) to be the most significant event leading to structural change in almost all the MENA markets. Furthermore, MENA countries are cointegrated among each other, and with US stock market. Financial markets in the MENA region are not isolated from global events and global shocks such as the GFC and the European debt crisis are found to have at least the same impact as local and regional events on the financial systems in MENA countries.

Keywords: structure breaks; financial integration; MENA stock markets; Global Financial Crisis; GFC; causal relationships; Middle East and North Africa.


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1 Introduction

The degree of international financial integration has significantly increased over the last two decades due to policies implemented by developed and developing countries aimed at enhancing financial liberalisation and openness (Lane and Milesi-Ferreti, 2003). During the past 20 years, the Middle East and North Africa (MENA) region have gone through a period of reforms and undertaken important steps to improve the financial system and to move toward further concordance and amalgamation with the international financial markets. Moreover, the evolution of new financial hubs in MENA region, such as Dubai, Abu Dhabi and Doha, has increased the importance of the region as a potential conduit for international portfolio diversification. Despite the fact that MENA region has been known for its weak integration with developed financial markets, the Global Financial Crisis (GFC) had significant effects on the stock markets in MENA countries which have witnessed an uneven financial stress. On average, stock market indices in the Arab countries crashed by more than 50 per cent between their peak in mid-2008 and their low in early 2009, thereby causing around US$ 200 billion to US$ 600 billion in losses (Brach and Loewe, 2010). Along with the GFC, the financial markets in MENA countries have also witnessed various regional shocks that led to a remarkable variation in stock markets’ performance in the last fifteen years.

The aim of this paper is to investigate the impact of both international and regional shocks to stock markets for a group of MENA countries, and to measure the degree of financial integration among MENA stock markets, and between MENA and developed stock markets. This paper employs Zivot and Andrews (1992) and Bai and Perron (2003) tests for single and multiple structural changes, respectively. In addition, the ARDL cointegration approach is used to capture the long-run dynamic co-movements among these markets.

The contribution of this paper to existing literature is twofold; first, it investigates whether the internal and external shocks in the past fifteen years, especially the GFC, had a drastic impact on stock markets in MENA countries. Second, it revisits the concept of financial integration among MENA markets, on both regional and global levels, by measuring the long-run co-movement of stock markets in MENA region, and whether these markets are integrated with developed markets represented by the US market.

This paper is structured as follows: Section 2 presents an overview of MENA stock markets. Section 3 describes the impact of the GFC on MENA stock markets and the subsequent policy responses. Section 4 presents literature review. Section 5 discusses the data. Section 6 describes empirical model and results. Finally, Section 7 presents the conclusion and policy implications.
2 Overview of MENA stock markets

Stock markets in the MENA region started developing in the late 19th century, with Egypt being the first country in the region to have a stock market. Other countries in the region began developing their stock markets in the late 20th century, with these stock markets representing a significant share of the frontier markets. These markets have been marked by challenges of poor institutional quality, lack of effective regulatory framework and poor liquidity. These issues were noted by policy makers, who reassessed the role of their stock markets in the past two decades; undertaking legal and financial reforms, reviving some markets such as in Egypt, Kuwait, Morocco and Jordan, and establishing new markets such as in the UAE, Dubai and Abu Dhabi, and Qatar.

Financial development in MENA markets increased over time with most markets diversifying the financial instruments they offer and the introduction of derivatives and swaps in some markets. The degree of financial development in the region increased significantly, with these markets surpassing other developing markets in Latin America and Eastern Europe, becoming the second-most developed after Asia (Legarde-Segot and Lucey, 2008).

3 Impact of GFC on MENA stock markets

The GFC has reverberated beyond its main epicentres. Therefore, the stock markets in MENA countries have not been isolated from the repercussions of the crisis. The main channels through which the crisis has affected the MENA region are, mainly, the decline in oil prices, the dry up of foreign direct investment inflows, the deterioration in remittances and tourism revenues and the tightening liquidity conditions. In fact, these channels had different influences on MENA countries based on their economic structures. In this regard, it would be somewhat important to differentiate between two groups of MENA countries; oil exporting countries represented by the gulf cooperation council (GCC) and non-GCC MENA countries.

By the end of 2008, GCC stock indices declined by 49.40% as compared to 2007. The Dubai financial market declined by 72.42%, followed by Saudi Arabia stock market (57.02%), Abu Dhabi stock market (47.49%), Muscat securities market (39.78%), Kuwait stock exchange (39.03%) and Doha securities market (28.12%) (Doha Securities Market, 2009). These declines have been mainly attributed to a decline in oil prices which represents the main economic growth engines for these countries, to the sharp decline in foreign investments, and foreign banks’ lending to GCC countries became more constrained (World Bank, 2009).

Stock market indices in non-GCC MENA countries have also declined in the wake of the GFC, yet not as severe as the GCC markets. The main factors behind the decline are the contagion from GCC markets and the dry up of capital flows (remittances) from oil exporting countries. By the end of 2008, the Egyptian stock market registered the largest decline of 56.43%, followed by Beirut stock exchange (20.74%), Amman Stock Exchange (16.23%) and Casablanca Stock Exchange (13.84%) (Doha Securities Market, 2009).
In response to the GFC, MENA governments have undertaken financial, monetary and fiscal reforms. The reaction of the GCC authorities was threefold; on the financial front, central banks across the GCC region infused liquidity into the financial system through repos and placement of long-term deposits. On the monetary front, central banks across the GCC region have used monetary policy tools to ease credit and ensure that liquidity does not dry up. Lastly, fiscal authorities in the GCC countries responded to the crisis by increasing government spending.

With regard to non-GCC countries, the pace and magnitude of responses undertaken by authorities were less as compared to their counterparts in the GCC region. The Tunisian authority introduced fiscal measures totalled 1.4% of GDP to support export sector and accelerate investment projects (IMF, 2009). In Egypt and Morocco, governments stepped up expenditure on infrastructure and public investments, respectively. In terms of monetary measures, economic stimulation was induced in these countries by cutting interest rates and lowering the minimum reserve requirement (Habibi, 2009). In Egypt, Morocco and Jordan, governments have announced their total guarantee of banking sector deposits.

4 Review of literature


More recently, Diamandis (2009) tests the financial integration among stock markets in Latin America and the US in post financial openness era. The results suggest that there is evidence that Latin American stock markets have become more integrated with the US market. Abo Majid and Kassim (2009) examine the cointegration among Asian stock markets of Malaysia, Indonesia and Japan and two major markets UK and US during the GFC. They utilise the Johansen-Jusilius cointegration test to analyse the daily observations between February 2006 and December 2008, they conclude that financial integration among these indices has strengthened during the crisis. Assidenou (2011) measures the linkage among markets within three separate groups of stock indices; the Organisation for Economic Co-operation and Development (OECD) group, Pacific group, and East Asia group between August 2008 and July 2009. They confirm the cointegration among indices included in each group separately. Nikkinen et al. (2011) explore the impact of current GFC on the financial integration among developed European and Baltic (Estonia, Latvia and Lithuania) indices. Their study finds clear evidence of increased correlation among Baltic indices during the GFC. Padhan and Sujit (2013) examine the impact of the GFC on the financial integration among world leading indices (Nasdaq, Nikkei225, SENSEX, SSE50 and FTSE100). They did not find significant change in the degree of financial integration in post as compared to pre crises period.

In a more recent work, MBA (2015) tests the financial integration of the Indian stock market and other major stock markets including the US, UK, Japan, Singapore, Hong Kong, Malaysia, South Korea, Taiwan and China over the period from 2001 to 2008. He
employs Johansen-Juselius cointegration test along with vector error correction model (VECM). He finds that the Indian stock market exhibits a long-run cointegration relationship with its counterpart in US; however, the relationship with other markets is not confirmed. Deltuvaite (2015) measures the global financial integration of the Baltic stock markets. The study employs cross correlation analysis and Granger causality to test for long and short-run integration, respectively. He finds that, compared to the Latvian market, the Lithuania and Estonia stock markets are more integrated with the world markets. Finally, Seth and Sharma (2015) measure the stock market integration among group of Asian and US markets between 2000 and 2010. The study utilises the Johansen-Juselius and Granger causality tests. They find that, in general, stock markets in Asia are integrated with US market in the long-run.

Recently, part of the literature has focused on the financial integration among stock markets in MENA region as these markets are experiencing ongoing economic and financial reforms. Further, these markets play an important role in the world economy being the world’s main oil and gas providers.

Butler and Malaikah (1992) study the financial integration between Saudi Arabia and Kuwait stock markets over the period from 1985 to 1989 and the results find no evidence of financial integration among these two markets. Darrat et al. (2000) investigates the financial integration between three MENA stock markets (Jordan, Egypt and Morocco). Using Johansen-Juselius cointegration technique, they confirm the financial integration among these three markets. Mohd and Hassan (2003) investigate the long-term relationships among stock prices in some GCC countries (Kuwait, Oman and Bahrain). They employ Johansen-Juselius and Granger Causality tests and find that both Kuwait and Bahrain are co-integrated with one co-integration vector in the long-run, whereas, Oman stock market is not integrated with Kuwait or Bahrain. Assaf (2003) and Simpson and Evans (2004) employ Johansen and Juselius (1990) methodology to explore the long-run association among GCC countries using weekly observations from 1997 to 2000 and 1994 to 2001 respectively, and affirm the interdependence and feedback effect among GCC markets. AL-Khazali (2006) examines the integration among four GCC countries of Saudi Arabia, Kuwait, Bahrain and Oman. Using Johansen and Juselius (1990) methodology, the study finds one cointegration vector among the four markets. Bley and Chen (2006) examine the impact of financial markets liberalisation on the dynamic relationship among the GCC markets over the period from 2000 to 2004. They find that liberalisation process has enhanced financial integration among the GCC markets. Marashdeh and Shrestha (2010), measure the stock market integration among all GCC countries, and other developed countries (US and European stock markets). They find that the GCC countries are integrated among themselves. However, their findings do not confirm the financial integration between the GCC markets and other developed markets. Genc et al. (2010) apply the Granger causality test to discover the causal direction among USA, Saudi Arabia and UAE. They find that there is a univariate causal relationships running from USA to Saudi Arabia and UAE. Chaudhry and Boldin (2012) utilise Johansen and Juselius (1990) cointegration method and Granger Causality to test the linkage among GCC indices and find cointegration among these indices.

Marashdeh (2006) measures the financial integration among stock markets in Egypt, Turkey, Jordan and Morocco, and among MENA and developed markets of Germany, US and UK. His paper utilises the ARDL cointegration technique and Granger causality test. The findings suggest that there is a cointegration relationship among MENA markets
in both short-run and the long-run. However, the long-run equilibrium between MENA and the developed markets is rejected. Legoarde-Segato and Lucey (2008) use different cointegration methods to investigate the cointegration among Morocco, Tunisia, Egypt, Lebanon, Jordan, Turkey and Israel. They confirm financial integration among MENA countries; however, their findings reject long-run equilibrium relationship between MENA and US markets. Paskelian et al. (2013) examine financial integration among MENA and US stock markets. They find that MENA stock markets are not yet fully integrated with US stock market, and benefits of portfolio diversification for international investors still exist.

In the aftermath of the GFC, MENA countries have experienced significant economic and financial slowdowns. However, the literature which explores the exact dynamic changes in the linkages among MENA stock indices due to the GFC, is scarce. A study by Neaime (2012) assesses how the GFC affected the global and regional correlation among MENA and developed markets. Using daily observations of national stock indices between 2007 and 2010, he finds that the stock markets in nonoil-exporting MENA countries have become more integrated with the world financial markets.

5 Data and descriptive statistics

The research in this paper employs monthly stock price indices to account for stock markets in nine MENA countries (Bahrain, Egypt, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, Tunisia and the UAE) and one developed country (the US), for a period ranging between January 2000 and May 2015. Monthly financial data is utilised since this type of data frequency is less volatile than higher frequency data, and it avoids common biases arising from non-trading and non-synchronous trading. Furthermore, the emerging markets, such as MENA markets, might be expected to react slowly to world events; hence, the use of lower frequency data provides a clearer picture of the movement and reactions of the indices in response to global events.

6 Empirical model and results

Research in this paper employs Zivot and Andrews (1992) and Bai and Perron (2003) tests for single and multiple structural breaks, respectively. The Zivot and Andrews (1992) model tests the unit root hypothesis with the presence of single structural break in MENA stock markets. This test also determines the most significant structural change in stock markets under consideration for the selected time span. Bai and Perron (2003) test, on the other hand, demonstrate and locates the multiple (if any) structural breaks in aforementioned variables. Moreover, this paper applies the ARDL approach to investigate the long-run association (cointegration) relationships among MENA markets, and between MENA and US stock markets. We also estimate the long- and short-run causalities among these markets within the VECM and vector autoregressive (VAR) frameworks.
6.1 Structural breaks in MENA financial markets

Nelson and Plosser (1982) argue that infrequent events, such as sudden shocks, have a permanent effect on macroeconomic time series variables and may lead to structural changes. These sudden shocks can be the result of unique economic events. Perron (1989) states that the failure to allow for the existence of structural breaks in unit root testing leads to misleading inferences. The conventional Augmented Dickey Fuller (ADF) and Phillip-Perron (PP) unit root tests lose power and channel researchers towards unreliable conclusions because they are biased towards the non-rejection of the null hypothesis of the unit root. Thus, new methodologies have been introduced to account for the presence of the structural break while testing for the stationarity of time series.

6.1.1 Zivot and Andrews (1992) unit root test with one structural break

Zivot and Andrews (1992) introduce a unit root methodology that allows for depicting a single structural break. Their method is based on the treatment of a structural break as an endogenous rather than an exogenous phenomenon. They claim that the bias in the usual unit root tests can be reduced by endogenously determining the time of break. According to their method, a regression is run for every possible break date consecutively within the time span, which starts with the observation after starting date until the one before last observation.

The null hypothesis of Zivot and Andrews (1992) test is that the dependant variable (such as $y_t$) contains a unit root with drift and no structural break. The null hypothesis is presented as follows:

$$H_0: \quad y_t = \mu + y_{t-1} + \epsilon_t$$

(1)

The alternative hypothesis states that the variable is a trend stationary process with a one-time structural break occurring at an unknown point in time. The alternative hypothesis presented in Zivot and Andrews (1992) methodology is more general and allows for a change in the level and/or the growth rate of series. The alternative hypothesis is presented below:

$$H_1:$$

Model $(A)$$y_t = \hat{\mu} + \hat{\theta}^A DU_t(\tilde{T}_b) + \hat{\beta} A t + \hat{\alpha} A y_{t-1} + \sum_{j=1}^{k} c^A_j \Delta y_{t-j} + \hat{\epsilon}_t$

(2)

Model $(B)$$y_t = \hat{\mu} + \hat{\gamma} B DT_t(\tilde{T}_b) + \hat{\beta} B t + \hat{\alpha} B y_{t-1} + \sum_{j=1}^{k} c^B_j \Delta y_{t-j} + \hat{\epsilon}_t$

(3)

Model $(C)$$y_t = \hat{\mu} + \hat{\theta} C DU_t(\tilde{T}_b) + \hat{\beta} C T_t + \hat{\alpha} C y_{t-1} + \sum_{j=1}^{k} c^C_j \Delta y_{t-j} + \hat{\epsilon}_t$

(4)

Model $(A)$ permits one time change (break) in the intercept. Model $(B)$ tests for stationarity of a time series around a broken trend. Model $(C)$ allows for change in the intercept as well as a broken trend. In this method, the time break $(T_b)$ is chosen to minimise one-sided t-statistic of $\alpha = 1$, wherein the structural break point is selected as the least favourable to the null hypothesis. $DU_t$ is the dummy variable which captures the shift in intercept, and $DT_t$ is dummy variable which captures shift in trend.
Table 1 illustrates results of the Zivot and Andrews (1992) unit root test in the presence of a single structural change. Our empirical investigation is based on the Zivot and Andrews (1992) model C estimation because it is more comprehensive than A and B as it allows for a break in both intercept and trend.

Table 1: Zivot and Andrews test results: break in both intercept and trend (Model C)

<table>
<thead>
<tr>
<th>Variable</th>
<th>K</th>
<th>t-statistic (t_α)</th>
<th>T_b</th>
<th>Possible cause of break</th>
<th>Unit root results</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>3</td>
<td>–6.617***</td>
<td>09/2008</td>
<td>GFC(^{(1)})</td>
<td>Stationary</td>
</tr>
<tr>
<td>Egypt</td>
<td>2</td>
<td>–3.860</td>
<td>09/2008</td>
<td>GFC</td>
<td>Unit root</td>
</tr>
<tr>
<td>Kuwait</td>
<td>2</td>
<td>–5.361**</td>
<td>08/2008</td>
<td>GFC</td>
<td>Stationary</td>
</tr>
<tr>
<td>Morocco</td>
<td>3</td>
<td>–4.210</td>
<td>02/2007</td>
<td>Financial liberalisation(^{(3)})</td>
<td>Unit root</td>
</tr>
<tr>
<td>Qatar</td>
<td>1</td>
<td>–3.568</td>
<td>12/2012</td>
<td>Euro debt crisis(^{(4)})</td>
<td>Unit root</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>2</td>
<td>–3.915</td>
<td>10/2008</td>
<td>GFC</td>
<td>Unit root</td>
</tr>
<tr>
<td>Tunisia</td>
<td>1</td>
<td>–4.079</td>
<td>05/2009</td>
<td>GFC</td>
<td>Unit root</td>
</tr>
<tr>
<td>UAE</td>
<td>3</td>
<td>–4.800</td>
<td>09/2008</td>
<td>GFC</td>
<td>Unit root</td>
</tr>
<tr>
<td>US</td>
<td>1</td>
<td>–4.087</td>
<td>10/2008</td>
<td>GFC</td>
<td>Unit root</td>
</tr>
</tbody>
</table>

Notes: Column (1) presents the stock markets of countries under investigation. Column (2) presents lag length K determined by SBIC. In column (3), t_α is the test statistic under the null hypothesis of unit root with no structural break. The critical values for t_α is –5.57, –5.08, and –4.82 at 1, 5 and 10% level, respectively, (Zivot and Andrews, 1992). Column (4) presents T_b, the break date from the iteration where the SBIC estimate is minimised. Column (5) illustrates possible causes of structural breaks in variables. Column (6) presents unit root results. ***, **, * denote rejection of null hypothesis at 1%, 5%, 10% level, respectively.\(^{(1)}\)Represents Global Financial Crisis.\(^{(2)}\)Represents Iraq war in 2003, and amendments of accounting and auditing law in 2003.\(^{(3)}\)Indicates for liberalisation of transport, energy and communication sectors.\(^{(4)}\)Indicates for impact of the Euro debt crisis on the financial sector in Qatar.

The results in Table 1 reveal that we are unable to reject the null hypothesis of the unit root for Egypt, Morocco, Qatar, Saudi Arabia, Tunisia, the UAE and the US markets; hence, they exhibit a unit root in levels. The null hypothesis is rejected for the stock markets of Bahrain (at 1%), Kuwait (at 5%) and Jordan (10%), and this indicates that the markets are stationary in levels. Results also indicate that all variables under examination have experienced an endogenous structural change. We find that the GFC was the most traumatic event to cause structural changes in the stock markets of the MENA region. Apart from stock markets in Jordan, Morocco and Qatar, the rest of MENA markets experienced a structural break during 2008 – the crisis year – or, in the case of Tunisia, in the following year. The Jordanian stock market experienced a structural change at end of 2004, which might result from two events. First, financial market regulations were developed, such as the amendment of the accounting and auditing practices in 2003 in order to improve competencies and efficiency (Haddad et al., 2009). Second, the Iraq war in 2003 led to political tensions in the region, especially in neighbouring countries such as Jordan. In the case of Moroccan stock market, the structural break occurred in
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February 2002. This coincides with opening up trade regimes and liberalisation of energy, transports and communication sectors, which led to a surge of foreign investments in Morocco (IMF, 2007). The results also show that stock market in Qatar had experienced a structural change by the end of 2012, which might be a result of the impact of the European debt crisis on the financial sector in Qatar, where it experienced a 19% drop in lending from European banks over the period 2011 and 2012 (IMF, 2012).

6.1.2 Bai and Perron (2003) test for multiple structural breaks

The Bai and Perron (2003) multiple structural breaks approach has been recognised as being preferable to other structural breaks tests as it enables us to determine both the number and location of structural changes with their autoregressive coefficients. Furthermore, it allows for the simultaneous forecast of breaks and reforecast of break points (Enders and Sandler, 2005). Additionally, the Bai and Perron (2003) test allows for testing the alternative hypothesis of fewer structural changes against a large number of breaks, wherein prior to the introduction of this test, the Sup-Wald statistics has been utilised by other testing procedures in order to investigate the existence of break only against null hypothesis. Moreover, this method allows for heteroscedasticity and autocorrelation in error, and it enables us to investigate whether additional breaks lead to reducing the sum of forecasting residual squares (Antoshin et al., 2008).

Bai and Perron (2003) initially introduce three test statistics; The Test of structural stability versus a fixed number of breaks, Double Maximum test (the test for structural stability against unknown number of breaks) and Sequential test. However, following Bai and Perron (2003), we base our empirical examination on the double maximum and sequential tests. We apply the sequential test (\( \ell + 1 \mid \ell \)) for variables exhibiting significant test statistics of \( UD_{\text{max}} \) since this technique leads to the best results and is recommended for empirical application (Bai and Perron, 2003). The optimal lag length is determined based on Schwartz Bayesian information criterion (SBIC) and the maximum number of breaks allowed is five, as this method requires the least number of observations between breaks. The Bai and Perron (2003), allows for heterogeneity in the standard correction parameter error; hence, the value of trimming \( h = 0.15 \) is considered to be enough for heterogeneity in the errors or the data (Bai and Perron, 2003).

According to Bai and Perron (2003), the main objective of the double maximum test statistic is to allow for investigation of break points with no pre-determination of a particular number of breaks. It encompasses two tests of null hypothesis of no structural breaks against the alternative hypothesis of an unknown number of breaks given some upper bound \( M \). The first test, denoted as \( UD \), is an equally weighted version defined as:

\[
UD_{\text{max}} F_T(M, q) = \max_{1 \leq m \leq M} F_T \left( \hat{\lambda}_1, \ldots, \hat{\lambda}_m; q \right)
\]

where \( \hat{\lambda} = \hat{T} / T \) are estimates of break points obtained using the global maximisation of the sum of squared residuals assuming segments of minimal length \( h = \varepsilon \). The second test, denoted as \( WD \), applies weights to individual test such that the marginal p-values are equal across values of \( m \). It is defined as:

\[
WD_{\text{max}} F_T(M, q) = \max_{1 \leq m \leq M} \left( \frac{\sum_{j=1}^{m} \alpha_j}{\sum_{j=1}^{m} \alpha_j} \right) F_T \left( \hat{\lambda}_1, \ldots, \hat{\lambda}_m; q \right)
\]

\[
\Rightarrow \max_{1 \leq m \leq M} \left( \frac{\sum_{j=1}^{m} \alpha_j}{\sum_{j=1}^{m} \alpha_j} \right) \sup_{(\hat{\lambda}_1, \ldots, \hat{\lambda}_m) \in \Lambda_\alpha} F_T \left( \hat{\lambda}_1, \ldots, \hat{\lambda}_m; q \right)
\]
<table>
<thead>
<tr>
<th>Variable</th>
<th>UD$_{max}$</th>
<th>WD$_{max}$</th>
<th>$F_t(2 \mid 1)$</th>
<th>$F_t(3 \mid 2)$</th>
<th>$F_t(4 \mid 3)$</th>
<th>$F_t(5 \mid 4)$</th>
<th>Optimal number of breaks</th>
<th>Break dates</th>
</tr>
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<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
</tr>
<tr>
<td>Stock markets</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bahrain</td>
<td>13.65***</td>
<td>18.43***</td>
<td>2.37</td>
<td>1.74</td>
<td>1.74</td>
<td>-</td>
<td>1</td>
<td>01/2009</td>
</tr>
<tr>
<td>Egypt</td>
<td>40.87***</td>
<td>71.17***</td>
<td>1.60</td>
<td>0.21</td>
<td>0.27</td>
<td>-</td>
<td>1</td>
<td>05/2005</td>
</tr>
<tr>
<td>Jordan</td>
<td>33.81***</td>
<td>47.59***</td>
<td>12.57***</td>
<td>2.72</td>
<td>0.51</td>
<td>-</td>
<td>2</td>
<td>12/2008; 03/2011</td>
</tr>
<tr>
<td>Kuwait</td>
<td>18.76***</td>
<td>57.36***</td>
<td>4.86</td>
<td>3.79</td>
<td>2.45</td>
<td>0.02</td>
<td>1</td>
<td>11/2008</td>
</tr>
<tr>
<td>Morocco</td>
<td>16.10***</td>
<td>21.38***</td>
<td>14.33***</td>
<td>2.72</td>
<td>2.26</td>
<td>0.10</td>
<td>2</td>
<td>05/2006; 05/2012</td>
</tr>
<tr>
<td>Qatar</td>
<td>10.21**</td>
<td>10.21**</td>
<td>1.69</td>
<td>0.15</td>
<td>0.03</td>
<td>-</td>
<td>1</td>
<td>09/2013</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>23.47***</td>
<td>58.76***</td>
<td>11.88**</td>
<td>4.13</td>
<td>6.80</td>
<td>0.40</td>
<td>2</td>
<td>12/2006; 12/2013</td>
</tr>
<tr>
<td>Tunisie$^{(1)}$</td>
<td>6.3</td>
<td>15.94***</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>0</td>
<td>-</td>
</tr>
<tr>
<td>UAE</td>
<td>22.23***</td>
<td>35.95***</td>
<td>25.76***</td>
<td>0.33</td>
<td>0.01</td>
<td>-</td>
<td>2</td>
<td>03/2005; 11/2008</td>
</tr>
<tr>
<td>US</td>
<td>11.47**</td>
<td>11.71**</td>
<td>1.74</td>
<td>1.87</td>
<td>0.24</td>
<td>0.75</td>
<td>1</td>
<td>03/2013</td>
</tr>
</tbody>
</table>

Notes: Column (1) presents the stock markets of countries under investigation. Column (2) presents UD$_{max}$ test statistics of the null hypothesis of no breaks (zero number of breaks) against the alternative hypothesis of unknown number of breaks, critical values of UD$_{max}$ equal 12.37, 8.88 and 7.46 at 1, 5 and 10% significance levels, respectively. Column (3) presents WD$_{max}$ test statistics of the null hypothesis of no breaks against the alternative hypothesis of unknown number of breaks, critical values of WD$_{max}$ equal 13.83, 9.91 and 8.20 at 1, 5 and 10% significance levels, respectively. Columns (4), (5), (6) and (7) present the sequential test of the null hypothesis of $\ell$ breaks against the alternative hypothesis of $\ell + 1$ breaks, i.e. For $F_t(2 \mid 1)$, $\ell = 1, \ldots, F_t(5 \mid 4)$, $\ell = 4$; 1, 5 and 10% critical values are 13.98, 10.31 and 8.51 for $F_t(2 \mid 1)$, 14.80, 11.14 and 9.41 for $F_t(3 \mid 2)$, 15.28, 11.38 and 10.04 for $F_t(4 \mid 3)$, and 15.76, 12.25 and 10.58 for $F_t(5 \mid 4)$, respectively. Column (8) illustrates number of estimated breaks. Column (9) presents the break dates. ***, **, * denote rejection of null hypothesis at 1%, 5%, 10% level, respectively. (1), (2) and (3) show that the test statistics of UD$_{max}$ is lower than critical values, hence, the sequential test is not applied as suggested by Bai and Perron (2003).
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Bai and Perron (2003) provide critical values from $M = 5$ and $\epsilon = 0.05$. The main difference between $UD_{\text{max}}$ and $WD_{\text{max}}$ is that the former gives an equal weight, whereas the latter gives weights to the individual test in such a way that the marginal $p$ values are equal across the values of $M$ bounds.

Table 2 illustrates the Bai and Perron (2003) test results of multiple structural breaks for variables under examination. We find that the results of $UD_{\text{max}}$ tests are significant for all variables, and this indicates that at least one structural change is present. Thus, we apply the sequential test $(\ell + 1 \mid \ell)$ for MENA stock markets in order to explore the number of structural changes. The only exception is the Tunisian stock market, as indicated by $UD_{\text{max}}$ test statistics, where the null hypothesis of no structural break cannot be rejected in favour of the alternative hypothesis of an unknown number of breaks. Consequently, in the case of the Tunisian stock market, the sequential test is not applied as suggested by Bai and Perron (2003).

Results in Table 2 demonstrate that the stock markets in Bahrain, Egypt, Kuwait, Qatar and the US are subject to one structural break. The estimated break points for the stock markets in Bahrain and Kuwait in January 2009 and November 2008, respectively, can be attributed to the GFC and this is in accordance with the Zivot and Andrews (1992) test results for both markets. In the case of the stock market in Egypt, the structural break occurs in May 2005 and that corresponds to the appreciation of the local currency, following the change in the foreign exchange policy. The estimated break point for Qatar is September 2013, and this can be attributed to the announcement of MSCI’s results of the 2013 annual market classification review in June 2013, when the Doha Stock Exchange was first classified as part of MSCI Emerging Market Index. One structural break is realised for the US stock index in March 2013.

The stock markets of Jordan, Morocco, Saudi Arabia and the UAE are subject to two significant break points. For Jordan, these breaks essentially happened between 2008 and 2011, which corresponds to the global crisis and political instability in Syria, respectively. For Morocco, the changes occur in May 2005 and May 2012. The first break point in May 2005 may be due to the financial liberalisation process. The second break point in May 2012 can be attributed to political instability in neighbouring countries, such as Tunisia and Egypt, and to the intensification of the debt crisis in the European area, the main trade partner of Morocco. In regard to the first realised structural changes in stock markets of Saudi Arabia and the UAE, we believe that the tremendous declines are due to the GCC stock markets crash in 2006. The second breaks for Saudi Arabia and the UAE are realised in December 2013 and in November 2008, respectively. These can be attributed to increased political tension in the MENA region in 2013 and 2014, and to the GFC, respectively.

6.2 The ARDL cointegration approach

This section employs the ARDL cointegration approach to examine the financial integration of stock markets in the MENA region. The ARDL approach is developed by Pesaran and Shin (1995; 1998a), Pesaran et al. (1996), Pesaran (1997) and Pesaran et al. (2001). This approach is considered to be a robust technique to test the cointegration among financial time series variables. It might be preferred over other approaches such as Engle and Granger (1987) and Gregory and Hansen (1996).
There are three reasons for using the ARDL approach in our study. First, it can be applied regardless of whether the underlying variables are stationary in levels $I(0)$ or in first difference $I(1)$, or mutually integrated. However, the conventional cointegration methodologies require the underlying regressors to be integrated in the same order. The results of the Zivot and Andrews (1992) unit root test in Table 1 indicate that the financial time series variables under examination are integrated of different orders. The choice of the ARDL cointegration approach enables us to test the long-run relationships among these variables. Second, the ARDL approach is considered to be a statistically significant approach and more valid than other cointegration techniques for a small sample size. This study uses monthly observations from 2000 to 2015, and the number of data points for different variables ranges between 125 and 175: which is considered a small sample (Narayan et al., 2004). Third, by using this approach, we can estimate the long- and short-run components of the model simultaneously. The dynamic error correction model (ECM), which combines short-run dynamics with long-run equilibrium, can be estimated from the ARDL via simple linear transformation (Marashdeh, 2006).

According to Pesaran and Pesaran (1997, 2009), and Pesaran et al. (2001) the augmented ARDL $(p, q_1, q_2, \ldots, q_k)$ is given in the following equation:

$$
\alpha(L, p)y_t = a_0 + \sum_{i=1}^{k} \beta_i(L, q_i)x_{it} + \lambda_t w_t + \epsilon_t \quad \forall t = 1, \ldots, n
$$

(7)

where $\alpha(L, p) = 1 - \alpha_1 L - \alpha_2 L^2 - \cdots - \alpha_p L^p$,

$$
\beta_i(L, q_i) = \beta_{0i} + \beta_{1i} L + \beta_{2i} L^2 + \cdots + \beta_{qi} L^{q_i} \quad \forall i = 1, 2, \ldots, k,
$$

(8)

$y_t$ is dependent variable, $L$ is lag operator such that $L y_t = y_{t-1}$, $a_0$ is a constant term and $w_t$ is a vector of deterministic variables, such as intercept term, time trend, dummy variables and other exogenous variables with fixed lags. The $x_{it}$ represents independent variables where $i = 1, 2, \ldots, k$. The long-run coefficients for a response of dependent variable $y_t$ to a unit change in independent variable $x_{it}$ is estimated by:

$$
\phi_i = \frac{\hat{\beta}_i(1, \hat{q}_i)}{\alpha(1, \hat{p})} = \frac{\hat{\beta}_{0i} + \hat{\beta}_{1i} + \cdots + \hat{\beta}_{qi}}{1 - \hat{\alpha}_1 - \hat{\alpha}_2 - \cdots - \hat{\alpha}_{p}} \quad \forall i = 1, 2, \ldots, k
$$

(9)

where $\hat{\beta}_i$ and $\hat{q}_i$, $i = 1, 2, \ldots, k$, are estimated values of $\hat{p}$ and $\hat{q}_i$, $i = 1, 2, \ldots, k$.

The long-run coefficients associated with exogenous variables with fixed lags (i.e., the intercept term, time trend and dummy variables) are estimated by:

$$
\pi = \frac{\hat{\lambda}(\hat{p}, \hat{q}_1, \hat{q}_2, \ldots, \hat{q}_k)}{1 - \hat{\alpha}_1 - \hat{\alpha}_2 - \cdots - \hat{\alpha}_p}
$$

(10)

where $\hat{\lambda}(\hat{p}, \hat{q}_1, \hat{q}_2, \ldots, \hat{q}_k)$ indicates the OLS estimates of $\lambda$ in equation (7) for the selected ARDL model. The error correction mechanism representation of the ARDL $(\hat{p}, \hat{q}_1, \hat{q}_2, \ldots, \hat{q}_k)$ model is obtained by rewriting equation (7) in terms of lagged values and first differences of $y_t$, $x_{1t}$, $x_{2t}$, $\ldots$, $x_{kt}$ and $w_t$.
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\[ \Delta y_i = \Delta a_0 - \alpha (1, \hat{p}) EC_{t-1} + \sum_{i=1}^{k} \beta_{i0} \Delta x_{i} + \lambda' w_i - \sum_{j=1}^{p-1} \alpha^* j \Delta y_{t-j} \]

\( \Delta \) is the first difference operator, \( \alpha^* \), \( \beta_i \) and \( \lambda' \) are coefficients that are associated with short-run dynamics of the model convergence to equilibrium, and \((1, \hat{p})\) measures the speed of adjustment.

The ARDL cointegration approach requires a two-step procedure to investigate the long-run relationship among variables of interest. The first step is to investigate the existence of cointegration relationship among variables. This can be done using the bound test approach to cointegration. The second step considers the estimation of long- and short-run coefficients using ECM to determine the short-run adjustment to long-run equilibrium.

**Table 3** F-statistics of testing for the existence of long-run relationships

<table>
<thead>
<tr>
<th>Stock markets</th>
<th>Equation</th>
<th>Calculated F-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>Bahrain</td>
<td>F(Bs/Es, Js, KS, Ms, Qs, Ts, Us, USs)</td>
<td>2.5032</td>
</tr>
<tr>
<td>Egypt</td>
<td>F(Es/Bs, Js, KS, Ms, Qs, Ts, Us, USs)</td>
<td>2.1580</td>
</tr>
<tr>
<td>Jordan</td>
<td>F(Js/Bs, Es, KS, Ms, Qs, Ts, Us, USs)</td>
<td>3.9445**</td>
</tr>
<tr>
<td>Kuwait</td>
<td>F(Ks/Bs, Es, Js, Ms, Qs, Ts, Us, USs)</td>
<td>1.9072</td>
</tr>
<tr>
<td>Morocco</td>
<td>F(Ms/Bs, Es, Js, KS, Ms, Qs, Ts, Us, USs)</td>
<td>3.0654</td>
</tr>
<tr>
<td>Qatar</td>
<td>F(Qs/Bs, Es, Js, KS, Ms, Qs, Ts, Us, USs)</td>
<td>5.0098***</td>
</tr>
<tr>
<td>Saudi Arabia</td>
<td>F(Ss/Bs, Es, Js, KS, Ms, Qs, Ts, Us, USs)</td>
<td>3.7469**</td>
</tr>
<tr>
<td>Tunisia</td>
<td>F(Ts/Bs, Es, Js, KS, Ms, Qs, Ms, Us, USs)</td>
<td>2.6653</td>
</tr>
<tr>
<td>UAE</td>
<td>F(Us/Bs, Es, Js, Ms, Qs, Ts, Us, USs)</td>
<td>2.0960</td>
</tr>
<tr>
<td>US</td>
<td>F(USs/Bs, Es, Js, Ms, Qs, Ts, Us, USs)</td>
<td>1.7964</td>
</tr>
</tbody>
</table>

Notes: Bs, Es, Js, KS, Ms, Qs, Ts, Us, USs represent the stock market indices of Bahrain, Egypt, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, Tunisia, the UAE and the US, respectively. The relevant critical value bounds are obtained from Pesaran et al. (2001), Table CI (V) (with unrestricted intercept and unrestricted trend). The critical values in the case of nine regressors are 2.16–3.24 at a 10% significance level, 2.43–3.56 at a 5% significance level and 2.97–4.24 at a 1% significance level. ***, **, * denote rejection of null hypothesis at 1%, 5%, 10% level, respectively.

Table 3 demonstrates the results of the F-statistics that indicate for cointegration among MENA markets, the order of the distributed lag on both dependent and regressors in the above equations is selected using the SBIC since it is considered to be preferable to other lag selection criteria (Pesaran and Shin, 1998b). The results of computed F-statistics are significant for the stock markets of Jordan and Saudi Arabia, at 5% level and for Qatar, at 1% level. This indicates that the null hypothesis of no cointegration is rejected in the case of Jordan Qatar and Saudi Arabia. In the case of
Bahrain, Morocco and Tunisia, we have inconclusive results as the computed F-statistics are less than the upper bounds critical values but greater than the lower bounds critical values. This implies that the null hypothesis of no cointegration cannot be rejected when these markets are dependent variables. Results also show that F-statistics for stock markets indices of Egypt, Kuwait, the UAE and the US are insignificant as the F-statistics are below the lower bounds critical values; hence, there is no long-run relationship when Egypt, Kuwait, the UAE and the US are dependent variables.

6.2.1 Long-run coefficients and ECM

The long-run equilibrium between the stock price indices of the MENA region is measured when the stock markets of Jordan, Qatar and Saudi Arabia are dependent variables, respectively. The error correction version of ARDL model for the price index of Jordan is illustrated in panel A of Table 4. The SBIC lag specification is ARDL (1, 0, 0, 1, 0, 0, 0, 0, 0, 0). The results indicate that two regressors have significant long-run impact on Jordan’s stock market; namely, the stock markets in the UAE and the US at 5% and 10% significant level, respectively. An increase in the stock price index of the UAE by 1% has a positive long-run impact on the Jordan stock market index by 0.03%, while an increase in the stock price index of the US by 1% has a negative long-run impact on the Jordan stock market index by −0.04%. The first dummy variable is significant at the 10% level, and this implies that the structural change that took place in December 2008, attributable to the GFC, has a long-run negative effect on stock market of Jordan. Panel B in Table 4 illustrates the estimation of long-run cointegration among stock price indices in Qatar and other stock price indices in MENA and the US. The lag specification of ARDL is (1, 0, 0, 0, 0, 0, 0, 0, 1, 0), and results indicate that the stock markets in Kuwait and the UAE have a long-run impact on the stock price index in Qatar. A 1% change in Kuwaiti stock market index leads to a decrease in Qatar stock market index by 1.29%, whereas a 1% change in the UAE stock market index leads to 0.86% change in the Qatar stock market index. Panel C in Table 4 illustrates the estimation of long-run cointegration in the stock price index in Saudi Arabia and other stock price indices in MENA and the US. The lag specification of ARDL is presented as (1, 1, 0, 1, 1, 0, 0, 0, 0, 0). The results show that the stock markets in Bahrain, Tunisia and the UAE exhibit a long-run influence on the stock index in Saudi Arabia. The impact of change in the Bahrain stock index on the Saudi Arabia stock market index is negative and greater than the impact of changes in stock markets in Tunisia and the UAE. A 1% change in the Bahrain stock market index causes change in Saudi Arabia by -3.79% in the long-run. A 1% change in the stock markets of Tunisia and the UAE lead to 1.84% and 0.21% changes in Saudi Arabia stock market, respectively. The results also show that the structural break in Saudi Arabia stock market, which occurred in December 2006, has a negative influence on Saudi Arabian stock market movements. This implies that the GCC stock market crash has a negative long-run impact on the stock market in Saudi Arabia.
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Table 4: Long-run coefficients of MENA stock markets

Panel A: ARDL (1, 0, 0, 1, 0, 0, 0, 0, 0, 0) model selected based on SBIC.

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficients</th>
<th>T-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>3.4269</td>
<td>7.0585***</td>
</tr>
<tr>
<td>Bs</td>
<td>–0.0658</td>
<td>–0.1979</td>
</tr>
<tr>
<td>Es</td>
<td>0.0015</td>
<td>0.0554</td>
</tr>
<tr>
<td>Ks</td>
<td>0.0289</td>
<td>1.1519</td>
</tr>
<tr>
<td>Ms</td>
<td>–0.0423</td>
<td>–0.5621</td>
</tr>
<tr>
<td>Qs</td>
<td>0.0242</td>
<td>1.5420</td>
</tr>
<tr>
<td>Ss</td>
<td>–0.3644</td>
<td>–0.9816</td>
</tr>
<tr>
<td>Ts</td>
<td>0.2987</td>
<td>1.1258</td>
</tr>
<tr>
<td>Us</td>
<td>0.0332</td>
<td>2.1654**</td>
</tr>
<tr>
<td>USs</td>
<td>–0.0411</td>
<td>–1.7345*</td>
</tr>
<tr>
<td>T</td>
<td>–1.0193</td>
<td>–3.1812**</td>
</tr>
<tr>
<td>D12/08</td>
<td>–4.9282</td>
<td>–1.8649*</td>
</tr>
<tr>
<td>D09/13</td>
<td>7.3130</td>
<td>0.2792</td>
</tr>
</tbody>
</table>

Panel B: ARDL (1, 0, 0, 0, 0, 0, 0, 1, 0, 0) model selected based on SBIC.

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficients</th>
<th>T-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>–7.3787</td>
<td>–0.0091</td>
</tr>
<tr>
<td>Bs</td>
<td>–3.1473</td>
<td>–0.6904</td>
</tr>
<tr>
<td>Es</td>
<td>–0.1546</td>
<td>–0.3496</td>
</tr>
<tr>
<td>Js</td>
<td>0.9170</td>
<td>0.3107</td>
</tr>
<tr>
<td>Ks</td>
<td>–1.2937</td>
<td>–3.1280***</td>
</tr>
<tr>
<td>Ms</td>
<td>1.4237</td>
<td>1.3513</td>
</tr>
<tr>
<td>Ss</td>
<td>–0.0282</td>
<td>–0.0568</td>
</tr>
<tr>
<td>Ts</td>
<td>1.2610</td>
<td>0.3118</td>
</tr>
<tr>
<td>Us</td>
<td>0.8654</td>
<td>4.3448***</td>
</tr>
<tr>
<td>USs</td>
<td>0.4987</td>
<td>1.2553</td>
</tr>
<tr>
<td>T</td>
<td>4.0584</td>
<td>0.7854</td>
</tr>
<tr>
<td>D09/13</td>
<td>3.6249</td>
<td>–0.8008</td>
</tr>
</tbody>
</table>

Notes: Refer to note in Table 3 for Bs, Es, Js, Ks, Ms, Qs, Ss, Ts, Us and USs.

- D12/08 is dummy variable takes value of 1 on 12/2008 and 0 otherwise.
- D03/11 is dummy variable takes value of 1 on 03/2011 and 0 otherwise.
- D12/06 is dummy variable takes value of 1 on 09/2013 and 0 otherwise.
- D12/13 is dummy variable takes value of 1 on 12/2006 and 0 otherwise.
- D12/13 is dummy variable takes value of 1 on 12/2013 and 0 otherwise.
- T is time trend.

*, **, *** denote rejection of null hypothesis at 1%, 5%, 10% level, respectively.
Table 4  Long-run coefficients of MENA stock markets (continued)

Panel C: ARDL (1,1,0,1,1,0,0,0,0) model selected based on SBIC.

Dependent variable: Saudi Arabia (Ss)

<table>
<thead>
<tr>
<th>Regressors</th>
<th>Coefficients</th>
<th>T-ratio</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>4.5674</td>
<td>1.3993</td>
</tr>
<tr>
<td>Bs</td>
<td>–3.7950</td>
<td>–4.2125***</td>
</tr>
<tr>
<td>Es</td>
<td>–0.0079</td>
<td>–0.0870</td>
</tr>
<tr>
<td>Js</td>
<td>0.6100</td>
<td>0.9193</td>
</tr>
<tr>
<td>Ks</td>
<td>0.1331</td>
<td>1.3745</td>
</tr>
<tr>
<td>Ms</td>
<td>–0.3407</td>
<td>–1.4959</td>
</tr>
<tr>
<td>Qs</td>
<td>0.0552</td>
<td>1.0387</td>
</tr>
<tr>
<td>Ts</td>
<td>1.8436</td>
<td>2.1152**</td>
</tr>
<tr>
<td>Us</td>
<td>0.2111</td>
<td>4.6788***</td>
</tr>
<tr>
<td>USs</td>
<td>0.0196</td>
<td>0.2434</td>
</tr>
<tr>
<td>T</td>
<td>0.4678</td>
<td>0.4078</td>
</tr>
<tr>
<td>D_{12/06}</td>
<td>–1.6472</td>
<td>–2.2506**</td>
</tr>
<tr>
<td>D_{12/13}</td>
<td>3.6700</td>
<td>0.4440</td>
</tr>
</tbody>
</table>

Notes: Refer to note in Table 3 for Bs, Es, Js, Ks, Ms, Qs, Ss, Ts, Us and USs. 
D_{12/08} is dummy variable takes value of 1 on 12/2008 and 0 otherwise.
D_{03/11} is dummy variable takes value of 1 on 03/2011 and 0 otherwise.
D_{09/13} is dummy variable takes value of 1 on 09/2013 and 0 otherwise.
D_{12/06} is dummy variable takes value of 1 on 12/2006 and 0 otherwise.
D_{12/13} is dummy variable takes value of 1 on 12/2013 and 0 otherwise.
T is time trend.
*, **, *** denote rejection of null hypothesis at 1%, 5%, 10% level, respectively.

Table 5 illustrates long- and short-run causal relationships among the stock markets in the region. The error correction terms (ECT) are estimated for the stock market indices of Jordan, Qatar and Saudi Arabia which exhibit significant F-statistics. The short-run causalities of stock markets in Bahrain, Egypt, Kuwait, Morocco, Tunisia, the UAE and the US are computed based on VAR models, as these market indices do not pass the bound testing procedure successfully. The coefficient of ECT of ΔJs is negative and highly significant, and this confirms the existence of cointegration among MENA stock market indices when the stock market in Jordan is dependent variable. Moreover, the coefficient of ECT is –0.369, and this implies that the deviation from the long-run equilibrium following a short-run shock is corrected by about 37% after one month. In regard to ΔQs, the table illustrates that the coefficient is negative and significant and this affirms the existence of a long-run relationship among MENA stock market indices when the stock market of Qatar is is the dependent variable. The ECT suggests that, following a shock, about 23% of the adjustment to long-run equilibrium is completed after one month. In the case of stock market in Saudi Arabia, the ECT coefficient is negative and significant, but, more interestingly, we find that more than half (58%) of the deviation from the cointegration relation is corrected after one month. This confirms the existence of a long-run relationship among stock markets in Saudi Arabia (dependent variable) and in Bahrain, Tunisia and the UAE.
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<table>
<thead>
<tr>
<th>Variables</th>
<th>ΔBs</th>
<th>ΔEs</th>
<th>ΔJs</th>
<th>ΔKs</th>
<th>ΔMs</th>
<th>ΔQs</th>
<th>ΔSs</th>
<th>ΔTs</th>
<th>ΔUs</th>
<th>ΔUSs</th>
<th>ECT</th>
<th>Coefficients</th>
<th>t-statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td>(1)</td>
<td>(2)</td>
<td>(3)</td>
<td>(4)</td>
<td>(5)</td>
<td>(6)</td>
<td>(7)</td>
<td>(8)</td>
<td>(9)</td>
<td>(10)</td>
<td>(11)</td>
<td>(12)</td>
<td>(13)</td>
<td></td>
</tr>
<tr>
<td>ΔBs</td>
<td>-</td>
<td>3.475***</td>
<td>-1.972*</td>
<td>1.552</td>
<td>1.973*</td>
<td>-3.515***</td>
<td>-2.160**</td>
<td>-2.061**</td>
<td>4.953***</td>
<td>0.821</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ΔEs</td>
<td>-2.423**</td>
<td>-</td>
<td>-2.977***</td>
<td>1.828*</td>
<td>0.121</td>
<td>-1.335</td>
<td>-1.684*</td>
<td>-1.870*</td>
<td>2.457**</td>
<td>-1.554</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ΔJs</td>
<td>-0.199</td>
<td>0.055</td>
<td>-</td>
<td>3.290***</td>
<td>-0.556</td>
<td>1.454</td>
<td>-1.087</td>
<td>1.137</td>
<td>2.465**</td>
<td>-1.575</td>
<td>-0.369</td>
<td>-5.428***</td>
<td>-</td>
</tr>
<tr>
<td>ΔKs</td>
<td>-4.047***</td>
<td>1.880*</td>
<td>-0.084</td>
<td>-</td>
<td>0.880</td>
<td>-2.888***</td>
<td>-3.222**</td>
<td>-0.623</td>
<td>4.692***</td>
<td>1.192</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ΔMs</td>
<td>0.133</td>
<td>3.331***</td>
<td>-2.133</td>
<td>0.379</td>
<td>-</td>
<td>-2.395***</td>
<td>0.408</td>
<td>-0.532</td>
<td>0.793</td>
<td>-2.022**</td>
<td>-</td>
<td>-</td>
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</tr>
<tr>
<td>ΔQs</td>
<td>0.665</td>
<td>-0.357</td>
<td>0.04</td>
<td>-2.633***</td>
<td>1.319</td>
<td>-</td>
<td>0.056</td>
<td>0.318</td>
<td>9.179***</td>
<td>1.332</td>
<td>-0.233</td>
<td>-4.230***</td>
<td>-</td>
</tr>
<tr>
<td>ΔSs</td>
<td>1.648</td>
<td>-0.087</td>
<td>-2.344**</td>
<td>-4.173***</td>
<td>2.211**</td>
<td>1.031</td>
<td>-</td>
<td>2.166**</td>
<td>5.146***</td>
<td>0.243</td>
<td>-0.575</td>
<td>-3.944***</td>
<td>-</td>
</tr>
<tr>
<td>ΔTs</td>
<td>-1.344</td>
<td>2.778***</td>
<td>-1.653</td>
<td>-0.506</td>
<td>1.165</td>
<td>-1.485</td>
<td>0.710</td>
<td>-</td>
<td>1.065</td>
<td>-1.955*</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ΔUs</td>
<td>-2.669***</td>
<td>1.618</td>
<td>-0.961</td>
<td>0.876</td>
<td>0.667</td>
<td>-1.672*</td>
<td>-2.149**</td>
<td>-1.468</td>
<td>-</td>
<td>0.798</td>
<td>-</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>ΔUSs</td>
<td>-2.234**</td>
<td>1.991**</td>
<td>-3.476***</td>
<td>2.066**</td>
<td>-0.486</td>
<td>-0.307</td>
<td>-0.733</td>
<td>-1.249</td>
<td>1.832**</td>
<td>-</td>
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</tr>
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</table>

Notes: Column (1) presents dependent variables Bs, Es, Js, Ks, Ms, Qs, Ss, Ts, Us and USs, see note in Table 3. Columns (2)-(11) presents independent variables. Columns (12) and (13) illustrates coefficients and t-statistics of ECT representing error correction model of selected ARDL procedure for stock market indices in Jordan, Qatar and Saudi Arabia. ***, **, * denote rejection of null hypothesis at 1%, 5%, 10% level, respectively.
Table 5 also illustrates the direction of short-run causal relationships among the MENA stock market indices. The results show a number of bidirectional causalities between stock markets in Bahrain and Egypt, Bahrain and the UAE, Egypt and Kuwait, Egypt and Tunisia, Kuwait and Qatar, Kuwait and Saudi, Qatar and the UAE, and Saudi and the UAE. The stock market in the UAE is the most influential on other markets in the short-term as it causes seven MENA markets. The stock market in Bahrain seems to be most endogenous among other MENA markets as seven causal relationships run from MENA stock market indices to the stock market in Bahrain. The results also indicate that in the short-run, there are causal relationships running from the stock markets in Bahrain, Egypt, Jordan, Kuwait and the UAE to the US stock market. The US market causes Morocco and Tunisia.

7 Conclusions and policy implications

Research in this paper aims at measuring the financial integration among stock markets in a group of MENA countries that are namely; Bahrain, Egypt, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, Tunisia and the UAE, in addition to the US, and among MENA and US markets for the period between 2000 and 2015. The paper also investigates the existence of single and multiple structural breaks in the aforementioned stock market indices.

The paper applies the Zivot and Andrews (1992) test for single endogenous structural breaks in the time series. The results find the GFC to be the most significant event leading to structural change in almost all the MENA markets. More specifically, the structural break in the stock market indices of Bahrain, Egypt, Kuwait, Saudi Arabia, Tunisia and the UAE coincide with the crisis. The paper also employs the Bai and Perron (2003) test for multiple structural changes, as the Zivot and Andrews (1992) test shed light on only the most significant break in a time series. Results of Bai and Perron (2003) test indicate that the stock market indices in Jordan, Morocco, Saudi Arabia and the UAE were subject to two structural changes. Again, most of these breaks can be attributed to the crisis, in addition to financial liberalisation and political instabilities in the region.

Research in this paper employs the ARDL cointegration approach for the aim of testing financial integration among MENA markets. The results of the bound test F-statistics show that stock market indices in the MENA region are cointegrated among each other when Jordan, Qatar or Saudi Arabia are dependent variables, whereas cointegration is not confirmed for other stock markets. The financial integration between MENA developed markets is confirmed since the long-run coefficients of the ARDL model indicate that the financial markets in the region are bound by developed markets in long-run equilibrium relationships when the stock markets in Jordan, Morocco and Saudi Arabia are dependent variables. The results of short-run causal relationships show that the stock market in the UAE is most influential in the region as it causes six MENA markets, whereas the stock market in Bahrain seem to be most endogenous one.

Overall, the results in this paper find that the financial markets in the MENA region are not isolated from global events. Moreover, global shocks such as the GFC and the European debt crisis are found to have at least the same impact as local and regional events on the financial systems in MENA countries. This might be an indication for a noticeable increase in financial amalgamation between MENA regional markets and
developed markets. Furthermore, financial markets in the MENA region are cointegrated at an international level, yet not fully bound to developed markets. However, we believe that the opportunity of international portfolio diversification seems to be reduced since the MENA markets react swiftly and respond significantly to global shocks.

References


Economic and Social Commission for Western Asia (ESCWA) (2009) *The Impacts of the Financial Crisis on ESCWA Member Countries: Challenges and Opportunities*, 14 March, ESCWA, Beirut.


Further evidence on Middle East and North Africa financial markets


Notes

1 MENA region comprises of 21 countries: GCC countries: Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, United Arab Emirates; non-GCC countries: Algeria, Djibouti, Egypt, Iran, Iraq, Israel, Jordan, Lebanon, Libya, Malta, Morocco, Syria, Tunisia, West Bank and Gaza, Yemen. Due to data limitation, our paper includes nine MENA markets (Bahrain, Egypt, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, Tunisia and the UAE).

2 MENA markets represent the largest component of the MSCI frontier market index by 60%.

3 For instance, authorities in Bahrain, Kuwait, Oman, Qatar, Saudi Arabia and UAE have injected US$ 150 million, US$ 150 million, US$ 400 million, US$ 700 million, US$ 2.67 and US$ 18.7 billion, respectively, in their banking systems (ESCWA, 2009).

4 This was mainly centred around reducing both reserve requirements and overnight repurchase rates.

5 For instance, authorities in Kuwait and Saudi Arabia have increased government spending by US$ 104 million and US$ 400 million, respectively (ESCWA, 2009).

6 Interest rate decreased in Jordan, Egypt, Tunisia and Morocco by 325, 250, 75 and 75 basis points, respectively.

7 Descriptive statistics available from authors.

8 The MSCI indices data is used for Egypt, Jordan, Kuwait, Morocco, Qatar, Saudi Arabia, the UAE and the US, while the S&P indices data is used for Bahrain and Tunisia.

9 Due to unavailability of data, the monthly observations of stock market indices are from June 2003 for Qatar and the UAE, and from June 2006 for Saudi Arabia.

10 Additional critical values for $\epsilon = 0.10$ (M = 5), 0.15 (M = 5), 0.20 (M = 5) and 0.25 (M = 5) are simulated (again with $q$ ranging from one to ten) (Bai and Perron, 2003).

11 The numbers represent lags for variables which are listed in the same order.