



Contents lists available at ScienceDirect

## The Quarterly Review of Economics and Finance

journal homepage: [www.elsevier.com/locate/qref](http://www.elsevier.com/locate/qref)

# Dynamic transmissions between the U.S. and equity markets in the MENA countries: New evidence from pre- and post-global financial crisis

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## ARTICLE INFO

## Article history:

Received 23 November 2013  
 Received in revised form 4 July 2014  
 Accepted 19 August 2014  
 Available online 28 August 2014

## JEL classification:

G1  
 G15  
 F44

## Keywords:

Volatility spillovers  
 Dynamic correlations  
 MENA markets

## ABSTRACT

In this paper we investigate equity returns and volatility co-movement between the U.S. and a group of large Middle East and North African stock markets before and after the global financial crisis in 2008. Our empirical evidence suggests that the pre-crisis relation with the U.S. was weak and negligible, before it jumped to a high level after the crisis. The large diversification in the pre-crisis period was negatively influenced by higher transmissions after the crisis. However, it did not completely disappear during periods of stress. Moreover, there is some evidence that the association with the U.S. has started to revert to its initial low level and therefore, we may conclude that the Middle East and North African equities are important diversifiers for U.S. investors; particularly in the long run.

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## 1. Introduction

The transmission mechanism between the returns and volatilities of different stock markets, and the U.S. is important for three reasons. Firstly, it is well known that the U.S. markets have the largest equity capital traded and that these markets' interaction with other exchanges provides invaluable information for international investment and diversification. Therefore, studying transmission mechanisms with the U.S. may be useful in portfolio management, where knowledge of cross market association may help in asset allocation and market timing decisions. Secondly, there is substantial evidence of unidirectional information flows from the U.S. to global stock exchanges, and this has implications on other markets efficiency. In an efficient market it should not be possible to judge future returns and volatilities using another market's information. The finding that there are significant transmissions

may indicate market inefficiency and the possibility of generating profits in one market based on another market's information. Thirdly, knowledge of the nature of information transmission may help in building more accurate models of conditional volatility. For instance, if transmission from the U.S. is substantial, including the U.S. as a factor in a conditional volatility model may improve accuracy. This is important for some financial applications such as option pricing, portfolio optimization, and risk measurement and hedging.

This paper investigates returns dynamic conditional correlations and temporal volatility spillovers between a group of MENA<sup>1</sup> countries, and the U.S. before and after the collapse of Lehman

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<sup>1</sup> The MENA region consists of the following countries: Egypt, Turkey, Iran, Jordan, Libya, Tunis, Morocco, Algeria, Bahrain, Kuwait, Oman, Qatar, Saudi Arabia, and the United Arab Emirates. From the MENA region we chose only those countries that have old and well developed financial markets with large capitalization. The countries we have chosen are Turkey, Saudi Arabia, Jordan, Tunis and Egypt. The capitalization of these markets together consists of 58% of the total capital traded in the MENA region as of December 2012. For more details on the capitalization of individual markets see the World Bank, Financial Development Database in 2012 that is available at <http://data.worldbank.org/data-catalog/global-financial-development>.

Brothers; a period that marked the global financial meltdown in 2008.<sup>2</sup> The paper focuses on quantifying the consequences of varying market association on the diversification benefits of U.S. investors who are venturing into MENA equities. It also considers the influence on intra diversification among MENA countries. The results show that MENA equities are weakly associated with U.S. equities and that there is substantial diversification benefit in terms of return enhancement and risk reduction between the two regions. A 30% allocation into MENA equities would triple the Sharpe ratio of a portfolio that was fully invested in U.S. equities. The increased association spotted following the financial crisis has negatively impacted the benefits of diversifying into MENA equities. However it did not completely eliminate it, and the same combination that contains U.S. and MENA equities has continued to succeed and to have the highest Sharpe ratios even after the crisis. Furthermore, the correlations and spillovers have started to revert to their pre-crisis level toward the end of the sample period in 2011. Therefore, the diversification benefits between the two regions are expected to be restored as we head into the future and as the U.S. economy recovers.<sup>3</sup>

We found similar results for diversification within the MENA region. Stock markets were segmented in the pre-crisis period and therefore there were substantial benefits of diversification for all countries. However, these benefits were country specific in the post-crisis period as sharp declines swept over all MENA equities except for Tunisia and Turkey. Therefore for these two countries there are no diversification benefits of investing in other MENA equities.

These results highlight the importance of the MENA region in the strategic asset allocation of international investors. The equities of MENA are weakly associated with themselves and with the U.S.; and therefore they offer great diversification potential. Despite the increased association of these equities during stress there are still some diversification benefits to be reaped in terms of risk reduction. Over the longer term the chance of reversion in dynamic correlations after crisis is great; and hence the benefits of diversification may well be restored eventually.

The literature on MENA has focused on information transmissions and cross market dependence with little attempts to analyze or quantify the influence on the diversification of an international portfolio. In terms of cross market linkages, the evidence on segmentation from global markets has been provided by Cheng, Jahan-Parvar, and Rothman (2010), Darrat, Elkhail, and Hakim (2000), Grahama, Kiviahob, Nikkinenb, and Ofran (2013) and Neaime (2012). These empirical studies indicated that MENA stocks are good candidates for international diversification from the perspective of a global investor. There are also some results on the intra market segmentation of MENA exchanges that was provided by Lagoarde-Segot and Lucey (2007) and Neaime (2005). All these authors had stressed the low correlations and intra linkages among regional stock markets' returns and volatilities.

Our results on dynamic association during the pre-crisis period conform very well to these findings. However, we differ because we looked into the nature of dynamic association in stress and afterwards. We have also spotted higher than believed transmissions and correlations during the global financial crisis, and we noticed a mean reversion thereafter. Moreover, unlike previous studies, our paper has used the dynamically estimated correlations to quantify

the influence of changed association on international diversification. Surprisingly, and as mentioned previously, we found that the same combination that contains MENA and U.S. equities continue to perform well even after the global crisis in 2008.

From the international evidence on dynamic association, we are similar to Pesaran and Pesaran (2010) who found that changes in volatilities are become more correlated across markets during and after the global financial crisis in 2008. Similarly, we are in line with Diebold and Yilmaz (2009) who recorded spikes in returns and volatility transmissions across 18 stock exchanges around the globe. We also conform very well with the works of Samarakoon (2011) and Lahrech and Sylwester (2011) who indicated that association among Latin American stock exchanges has increased post-crisis; and with Aloui, Alissa, and Nguyen (2011) who found increased transmissions in the BRICS<sup>4</sup> block of countries; and finally with Kazi, Guesmi, and Kaabia (2013) who recorded higher interdependence among OECD stock markets.<sup>5</sup>

We differ to these studies as we found MENA markets are only driven by the U.S. stocks in stress, while its association is negligible in normal times.<sup>6</sup> Furthermore, higher transmissions and interdependence with U.S. stocks has not continued following the crisis. On the contrary, it had fallen by the end of the sample period as growth was restored in the U.S. economy. The mean-reversion tendency in the relationship indicates that MENA equities are long term diversifiers from the perspective of international investors.

To assess return association we used dynamic conditional correlations (DCC) as in Engle (2002).<sup>7</sup> The estimated correlations from the DCC model were then used to optimize portfolios and to measure the influence on the Sharpe ratios. The cross spillover of volatility was analyzed by decomposing forecast errors of a generalized vector autoregressive model of conditional volatility. These decompositions were then aggregated to compute spillover indices as in Diebold and Yilmaz (2012). Two virtues of these indices are that they are intuitive and they can be used to reveal the direction of the transmission besides its strength. Specifically, the net directional transmission to a market (or a group of markets) from another market (or even from a group of markets) can be easily computed. Thus these indices are used to measure the volatility information crossover to MENA stock markets from the U.S. and vice versa.

The previous studies inferred MENA stock market correlations using various methodologies. For instance, Darrat, Elkhail, and Hakim (2000) and Neaime (2005) used a traditional cointegration analysis. On the other hand, Lagoarde-Segot and Lucey (2007) optimized and constructed a re-sampled efficient frontier by the block bootstrap of returns to derive diversification potential among MENA markets. Cheng, Jahan-Parvar, and Rothman (2010) used an alternative method; they estimated variants of the CAPM model

<sup>2</sup> In fact, the crisis began to unfold on July 2007 with the credit crunch and the crisis rapidly developed and spread into a global financial shock with the collapse of Lehman Brothers in September 2008.

<sup>3</sup> This point has been raised to us thankfully by one of the referees.

<sup>4</sup> The BRICS group contains the following countries: Brazil, Russia, India, China and South Africa.

<sup>5</sup> The evidence on increased transmissions is not unanimous. For instance Dajcman, Festic, and Kavkler (2012) argued that the global financial crisis did not uniformly increase the degree of co-movement across the stock markets of the U.K., Germany, France, and Austria.

<sup>6</sup> Significant interdependence with U.S. equities was found by many: Janakiraman and Lamba (1998) and Hsiao, Hsiaob, and Yamashita (2003) in the Pacific Basin and Asia Pacific regions; Elyasiani, Perera, and Puri (1998) in emerging markets; Gilmore and McManus (2002) in Central Europe; Fernandez-Serrano and Sosvilla-Rivero (2003) in Latin America; Chuang, Lu, and Tswai (2007), Gallo and Otranto (2007), Dao and Wolters (2008), and Lee (2009) in East Asian markets; and Kanas (1998), Eger and Kočenda (2007), and Morana and Beltratti (2008) in Europe.

<sup>7</sup> The Engle (2002) DCC model has been widely used in the literature to investigate the common movements in international financial markets (e.g., Felipe & Diranzo, 2006; Chiang, Jeon, & Li, 2007; Celic, 2012; Dimitriou, Kenourgios, and Simos (2013); Baumöhl & Lyócsa, 2014).

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