Impact of Arab uprising on Portfolio diversification benefits at different investment horizons for the Turkish investors in relation to the regional stock markets: Multivariate GARCH-DCC and Wavelet coherence approaches

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24 June 2015

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Abstract

The current political changes in the Arab countries have raised concerns about the behaviour of stock markets in the region. It brings an expectation of distortions in the behaviour of the regional financial markets. This study aims at analysing the dynamic relationship between Middle Eastern and North African equity markets exposed to the Arab Spring, namely Turkey, Egypt, Oman, and Lebanon, using Multivariate GARCH-DCC and Wavelet Coherence techniques on weekly data spanning from 2005 to 2015. We employ Multivariate GARCH-DCC to find out the time-varying volatilities and correlations between the markets, and Wavelet Coherence based on Continuous Wavelet Transform followed by the multiscale variance, covariance, and correlations based on Maximal Overlap Discrete Wavelet Transform are used for multi-resolution analysis to see the pattern of interactions between the stock markets across the time-scales: low, medium, and high. The findings tend to suggest that the correlations between the stock markets are quite low all over the period: on average, about 4% until the Global Financial Crisis and 10% afterwards. In general, the volatilities are relatively stable, except for the global financial turmoil period. In particular, equity markets of Lebanon and Egypt display a slightly higher volatility during the Arab Spring. It means that the Turkish investors who have allocated their investments in major trading partners like Egypt may not experience great diversification benefits for almost all investment horizons related to higher trade intensity but moderate benefits arise for Lebanon up to the investment horizons of 32-64 days and longer. However, portfolio diversification benefits are greater if Turkish investors invest in the Oman stock index except during long investment horizons. As for the long run, stock holding periods exceeding 32-64 days have minimal benefits for portfolio diversification. As an implication, Turkish investors should carry out the reassessment of their stock exposures and investment horizons more frequently

Keywords: Arab uprisings, portfolio diversification, MGARCH-DCC, Wavelet Coherence

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Introduction: motivation and objective of the study

Stock indices highly thrive in information and the information revolution has transformed these markets world over. Investors are now able to keep track on a real time basis and can react to the flow of information around the world. The insulation of national economies towards global events no longer pertain or in other words, the repercussions of international events can actually influence the movement of shares and other investments (Menon et. al 2009).

Under this purview, the fast information transmission to stock markets of the world is facilitated by economic globalisation making investors to be driven more to invest outside their countries as geographic diversification generates superior risk adjusted returns while capturing the higher rates of returns by these overseas markets (Khan 2011).

Over the last decade, the empirical finance literature has been concerned with the financial integration of the world major stock markets (see for example, Kim and Wadhani 1990, Joen and Von Furstenberg 1990, Arshanapalli and Doukas (1993), Eun and Shim (1989), and Kasa (1992)). Recently, there has been a shift in attention to the emerging markets of developing countries (Bekaert and Harvey 1997, DeSantis and Imrohoroglu 1997). The new focus stems from the fact that these markets present portfolio and fund managers a new possibility to enhance and optimize their portfolios. For example, Bekaert (1993), and Bekaert and Harvey (1997) found that stock market returns in emerging markets were high and predictable but lacked strong correlation with major markets.

However, MENA (Middle East and North Africa) member countries do not treat international or even intra-regional capital investments uniformly. Over the last two decades, the MENA region has experienced a wave of financial sector liberalization which has included updating stock market legislation and activities. The whole MENA region can be classified as a bank-based economy. Nevertheless the importance of capital markets for economic development

has been recognized. As such the reform agenda has included revitalizing existing stock markets in some countries and establishing stock markets in others. Many of the MENA countries have passed new capital market laws aimed at encouraging private investment and increasing investor protection. The core provisions of these laws include establishing a new legal framework to govern specialized capital market companies, strengthening financial disclosure, giving foreign investors full access to the market, and increasing investors' rights through provisions prohibiting unfair market practices (Ben Naceur, Ghouzoani, &Omran, 2007).

Despite of many new rules and laws in the region, financial integration still remains a distant goal, and has been overtaken by smaller more functional arrangements, such as the Gulf Cooperation Council (GCC). This regional integration is important because the MENA stock markets as a group may be able to offer investment opportunities not possible by one individual MENA market. Specifically, GCC countries have traditionally discriminated against non-GCC investors, but the rest of the regional markets, particularly those of Amman, Cairo, Casablanca, and Turkey are largely open to MENA investors. These markets offer capital-rich GCC equity investors unique diversification benefits associated with optimum portfolios with a balanced mix of domestic and international securities.

There have been a lot of happenings over the past two decades that has affected the global financial sector, which also had a substantial effect towards portfolio investment activity. One of the major events happening in the financial world was the market crash of October 1987 was a significant event not just because of the market decline that was severe, but also because it exposed the weaknesses of the trading systems themselves and how they could be strained and come close to breaking in extreme conditions (Carlson 2007). Later on in 1997 the Asian Financial Crisis came which was triggered by the distorted policies plus the market overreaction and herding that led to the plunge of exchange rates, asset prices and economic activity in the countries of the Asian region (Roubini et. al 1998). The most recent crisis which was the global financial crisis in 2008 actually indicated that the global financial system was far more interconnected than was previously recognized and the excessive risk taking that threatened the collapse of the financial system was far more pervasive than almost anyone realized coming from the subprime mortgage crisis along with the existence of Ponzi borrowers (Mishkin 2011).

Looking at the MENA (Middle East and North Africa) region, specifically the big and influential nation of Turkey, and it is the 18th largest economy in the world (The World Bank). In less than a decade, per capita income in the country has nearly tripled and now exceeds $10,000. Although economic growth was slowed by the onset of the global economic crisis in 2008, it has nonetheless remained resilient – making Turkey an example from which other countries in the region can learn (The World Bank). Furthermore, fundamental reforms carried out after 2001 have allowed Turkey's financial sector to remain relatively strong in spite of the global economic crisis. Turkey was the only country in the Organization for Economic Cooperation and Development (OECD) which did not provide public sector support to the banking sector in the wake of the crisis (The World Bank). Notably, Turkey has been strongly trading with other MENA countries such as UAE, Iraq, Libya, Egypt, Syria, Morocco, Saudi Arabia, Iran and Israel as of year 2010 (European Commission) which was before the political turmoil (Arab Spring) in the region.

With regards to Arab Spring, a revolutionary wave was triggered firstly in Tunisia and spread to other Arab countries especially in North Africa such as Morocco, Libya and Egypt. Such protests had the objective to demand reforms and have led to varying degrees of political changes with the rulers being forced out of power in some countries along with changes in domestic and foreign policies of the government. Major political events like this have a huge probability to affect the interdependency among stock markets owing to their social and economic implications (Cau et. al 2014). Since year 2011 onwards, Arab spring has been significantly affecting the trading relationship between Turkey and MENA countries. Meaning to say, some of the trading partnerships weakened. For example, Syria and Egypt almost lost trading connections with Turkey, and we can assume according to the reports by the ministry of Economy of Turkey that it paved a way for Algeria to strengthen trading relationships with the country. Although a number of empirical studies (Bekaert& Harvey, 2002; Bessler& Yang, 2003; Kim & Rogers, 1995; Phylaktis&Ravazzolo, 2002b; Tai, 2000; Yang, Kolari, & Min, 2003) have examined long-run relationships and short-run dynamic causal linkages among the emerging Asian financial markets and major developed markets, relatively few studies have adopted an exclusively MENA regional perspective. Furthermore, no study to date has examined the correlations of returns between stock index of Turkey and its trading partners in the region with regards to Arab Spring within different intervals. In our opinion, researchers hypothetically have seen no cointegration or insignificant co-movement among them, because of the Arab Turmoil impact which does not reflect recent econometric

methodology. Therefore this paper will do humble attempt to partially fill the gap in the literature and to provide recent empirical evidence on correlation and volatility of returns of stock market among Turkey and its major MENA region trading partners namely Egypt, Lebanon, Oman, and the impact of regional crisis on regional stock market behaviourtogether with observing it at different time intervals by applying the recent research methodologies such as the Multivariate-GARCH DCC.The findings help Turkish investors in order to decide which major trading partner theyshould invest in and together with Continuous wavelet transform and maximal overlapping Discrete Wavelet Transform that aims to fulfil the objective to unravel the international portfolio diversification benefits given different stock holding periods (eg. 2-4 days, 4-8 days, 8-16 days, 16-32 days, etc..). Through this study of volatilities and correlations between the index returns of Turkey stock index with the indices of its major trading partners plus observing correlations at different time intervals, it would be useful for policy makers in Turkey in a sense that if stock indexes of Turkey are found to be strongly correlated to its major trading partners then there is a danger that shocks (especially political crisis) in one market may spill over to other markets and thus, calls for stronger cooperation among the authorities of these countries. In short, the study intends to fulfil the needs of Turkish investors who want to diversify their portfolios with respect to Turkey's major trading partners which were directly exposed to political turmoil in the region during 2010-2013.

The rest of the paper is organized as follows. Section 2 discusses about theoretical framework. Section 3 briefly reviews the relevant and empirical literature. The humble contributions of the study will be introduced in Section 4. Section5 describes a comprehensive description of the data set, and the methodologies used in this study will be explained in Section 6. In Section 7, we provide summary statistics and estimation results discussion of various multivariate time series techniques including Multivariate GARCH Dynamic Conditional Correlations (MGARCH-DCC), Continuous Wavelet Transform (CWT), and Maximal Overlapping Discrete Wavelet Transform (MODWT) analysis along with economic analysis. Section 8 gives summary and conclusion. Lastly, section 9 discusses the policy implications based on the results reported while section 10 ends up with the limitations of the study and suggestions for further researches.

Theoretical Framework

The main underlying theory of this study is the Markowitz's Modern Portfolio Theory which theory suggests a hypothesis that expected return on a portfolio for a given amount of portfolio risk is attempted to be maximized or alternately the risk on a given level of expected return is attempted to be minimized by choosing the quantities of various securities cautiously taking mainly into consideration the way in which the price of each security changes in comparison to that of every other security in the portfolio, rather than selecting securities individually.

According to the theory, each security has its own particular risk and that a portfolio of diverse securities shall be of lower risk than a single security portfolio, emphasising the importance of portfolio diversification to reduce risk.

The main outcome of the Portfolio Theory is that the risk weight of a portfolio shall be less than the average risk weights of the securities it contains resulting optimum diversification .The Theory uses standard deviation as a substitute to risk and the variance of expected returns is expressed as follows:

$\sigma p2= \Sigma Wa2\sigma a2 + \Sigma\Sigma WaWbCovab$

Wa is the size of the portfolio in security a, σa is the standard deviation of the expected return of the security a, and Covab is the covariance of the expected returns of the securities a and b. With the assumption that the covariance is less than 1 (which is not a practical assumption), it is derived that the weighted average of the standard deviation of the expected returns of the securities shall be more. As such the theory proves that diversification of securities in a portfolio reduces risk (Portfolio Theory n.d.).

Another theory instilled in this paper is the efficient market hypothesis which states that the ideal market is the one that provides accurate signals for resource allocation whereby firms can investors can make investment decisions under the assumption that security prices at any time fully reflect all available in information. An efficient market is a market whereby the price always reflects the available information (Fama 1970)

The next theory that can be linked to this study is the Black Swan theory. The Black Swan theory argues that the human beings' tendency to dwell and reflect towards the past events in order to come up with a prediction of the future can limit one's understanding of the world and increases the vulnerability to extreme and unexpected events. In short, black swan events

are unpredicted events that lie within the outliers of a bell curve which is beyond the realm of regular expectations (Taleb 2007).

The methodology of the M-GARCH DCC adopted in this paper has the ability to adopt a t-distribution of variances which reflects the reality more in capturing the fat tailed nature of the non-normal distributions of the index returns which overcomes the criticism in Markowitz's portfolio theory of being overly simplistic and assumes that portfolio variances are normally disttributed (JP Morgan n.d.). According to In and Kim (2013), such assumptions were not made in the application of wavelet transform methodologies which can produce more realistic results.

Literature review

The connection between stock market comovement with globalization frequently is studied both theoretically and empirically. A substantial interest also exists among academics and policy-makers on the effects of the global and regional crises on the behaviour of stock markets regionally and internationally. The concept of studying the linkage among stock markets is incremented by the globalization of capital markets (Forbes and Rigobon, 2002), and, thereafter, the advancement of information technology. A crisis that used to affect only the local economy starts to affect other related economies. Capital movements, common economic ties, and regional policy coordination across countries are among the factors that can interlink stock prices (Valadkhani and Chancharat, 2008). Globalization could be in favour of portfolio diversification. Often, this is in the interest of investors, but only to the extent that it does not increase the correlation among national stock markets.

Looking at the Middle East and North Africa region, the literatures have focused on information trans-missions and cross market dependence with little attempts to analyse 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, Elkhal,and Hakim (2000), Grahama, Kiviahob, Nikkinenb, and Omran(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.

From the international evidence on dynamic association, Pesaran and Pesaran (2010) found that changes in volatilities are become more correlated across markets during and after the global financial crisis in 2008. Similarly, Diebold and Yilmaz (2009) 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 block of countries; and finally with Kazi, Guesmi, and Kaabia (2013) who recorded higher interdependence among OECD stock markets.

Moreover, the previous studies inferred MENA stock market correlations using various methodologies. For instance, Darrat, Elkhal, 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 theblock bootstrap of returns to derive diversification potential amongMENA markets. Cheng, Jahan-Parvar, and Rothman (2010) used analternative method; they estimated variants of the CAPM model that allow for time-varying degree of integration with international equity. Grahama, Kiviahob, Nikkinenb, and Omran (2013) used another alternative; they applied wavelet squared coherency with simulated confidence bounds to infer association. Finally, Neaime(2012) used a fitted GARCH type model of conditional volatility to estimate simple correlations. On the other hand, and due to recent crises over the last decades – starting with the terrorist attack of September 11 and then the supreme debt crises following the European sovereign debt crisis (Aroni and Deck 2010) – local investors have concentrated on their own local markets (Bouri 2014). The local markets of the MENA region are a case in point.

By going over this literature review its clear there are insufficient empirical evidences showing a clear result of volatility in the MENA region in stock indexes and there are no such studies up to 2015 data set especially focusing on both global financial and regional political crisis. So the literature here is not conclusive. My study is a humble attempt to add up to the literature and answer some important question usually an international investor like to have by using the most suitable technique Multivariate GARCH-DCC for volatility and CWT for correlation, and MODWT in order to check if the results are robust. By using daily

data for academicians, it would provide better insights of what time can investor take decisions to be reflected in making better asset allocation of the portfolio.

The Contributions of the Paper

The study will depart from earlier works and also advance the field in the following ways:

As far as our knowledge goes this study will be the first humble attempt to investigate the issue of correlation and volatility of stock markets among Turkey and its main trading partners in the MENA region which includes both global financial crisis in 2008 and regional political crisis within 2010-2013.

In addition to the first point, this paper specifically investigates the co-movement of stock prices among Turkey and the countries which have been exposed to Arab Turmoil in order to check if the Arab crisis has an impact on stock market behavior in the region by looking at different investment horizons.

The findings of the study, therefore, will have distinct policy implications for Turkey government and policy makers.

Data Set

This paper examines the correlation and volatility behaviour of stock markets among Turkey and its trading partners in the region including both global financial and regional political crises by focusing on the countries which were exposed to Arab Spring. The original intention was to include all trading partners of Turkey in MENA countries in our analysis. The analyses, however, are limited to the four biggest and most active stock exchanges in the region (Turkey, Egypt, Lebanon, and Oman) because some of countries in the region have only recently established their stock markets or have none (e.g., Iraq, Libya, Sudan, Syria, and Yemen), and we had to drop some stock markets (Tunisia and Israel) because of the technical issues in deriving results from given data.

The stock market returns data for the MENA region used in this paper are drawn from Morgan Stanley Capital International indexes (MSCI). These broad-based market return indexes are value weighted and are calculated with dividend reinvestment. The MSCI international indexes are composed of stocks that broadly represent stock composition in the different countries and regions. In this study, five MSCI country daily indexes (for Turkey,

Egypt, Lebanon, and Oman) covering the period between June 2005 and April 2015 are utilized. The reason for this is to focus solely on the effects of the 2008 global financial crisis and 2011 political crisis.Daily data was employed in order to get better insights of what time can investor take decisions to be reflected in making better asset allocation of the portfolio. Furthermore, the transmission of shocks may take place within a few days and thus, monthly data is not employed in this study as it cannot fully capture the transmission of the shocks (Karim et. al 2010). We have tabulated the selected indexes and their symbols used in this paper together with their definitions in Table 1.

Table 1: Selected Indexes for Research

Country	**Symbol used in this study**	**Definition**
Turkey	TURK	MSCI TURKEY INDEX
Egypt	EGYP	MSCI EGYPT INDEX
Lebanon	LEBN	MSCI LEBANON INDEX
Oman	OMAN	MSCI OMAN INDEX

Methodology

1. Multivariate GARCH Dynamic Conditional Correlations

This study employs dynamic conditional correlation (DCC) method in order to estimate time dependent correlation and volatility of returns of MENA region stock indices which is different from typical diversification studies that employ constant correlation. Moreover, forecasting correlation of the returns over a specific period is another focus of this study.

With the DCC model, a member of the GARCH family, one can pinpoint precisely the timing and nature of plausible changes in the time series co-movement(Lee & Crowley 2004). For each time point, the DCC method gives a value that serves as the forecasted correlation between series for the next period(Lebo & Box-Steffensmeier 2008). The estimation of DCC consists two stages, which makes the estimation of a time varying correlation matrix simplified (Engle & Sheppard 2001).

In the first stage, GARCH models are applied to estimate univariate volatility parameters for each of the variables(Engle & Sheppard 2001).So if there are two variables, then 2 GARCH equations are estimated (Glosten et. al 1993). For example:

$$h_t = c_0 + a_1\varepsilon_{t-1}^2 + b_1 h_{t-1} + b_2 h_{t-2} + m_1\varepsilon_{t-1}^2 I_{\varepsilon>0}$$

(GJR, 1993 Asymmetric GARCH equation).

I is an indicator function in which it will equal to 1 when the standardized residuals of the series (ε_t) are positive and equals to 0 otherwise. If 'm' has a negative value, it can be implied that periods with negative residuals would immediately be followed by periods of higher variance compared to periods of positive residuals .

In the second stage, the inputs come from the standardized residuals from the first stage to estimate a time varying correlation matrix (Engle & Sheppard 2001). Following Engle (2002), Ht is a conditional covariance matrix and is:

Ht=DtRtDt

Here:

Ht= Conditional variance matrix

Dt= Diagonal matrix of conditional time varying standardized residuals that are obtained from the univariate GARCH models (on-diagonal elements or variance or volatility component)

Rt= Time varying correlation matrix(off diagonal elements)

The log-likelihood of the above estimator can be written as:

$$L = -0.5 \sum_{t=1}^{T} (k \log(2\pi) + 2\log(|D_t|) + \log(|R_t| + \varepsilon_t' R_t^{-1} \varepsilon_t)$$

In the first step, maximisation only happens to the volatility component of Dtin which the log likelihood is reduced to the sum of the log likelihood of the univariate GARCH equations.

In the second step, the correlation component Rtis maximised with elements of (ε_t) from step 1 which gives the DCC parameters α and β(Engle 2002),

$$R_t = (1 - \alpha - \beta)\,\bar{R} + \alpha\varepsilon_{t-1}\varepsilon_{t-1}' + \beta R_{t-1} \qquad \text{(DCC equation)}$$

Over here, if $\alpha = \beta = o^1$, thenRtis simply $\overline{R}$ and CCC model is sufficient enough. The GARCH type dynamics are contained within these models for both conditional correlation and conditional variances. Time varying conditional variances can be defined as the measure of uncertainty and thus give us insight into what causes the movement in the variance(Engle & Sheppard 2001).

The two-step estimation of the likelihood function is consistent, albeit inefficient (Engle and Sheppard, 2001). Asymmetries are allowed by the DCC, meaning that there are different weights for positive and negative shocks to a series. The asymmetries are in the variances (not in the correlations) (Cappiello, Engle and Shephard, 2003).

Conditional correlation is a forecast of the correlation that would be appropriate next period conditional on this period's data. Therefore the parameter uncertainty only causes the uncertainty in this forecast (assuming correctly specified model).

Lanza et al. (2006) also applied this technique in order to observe the dynamic conditional correlations in the daily returns on West Texas Intermediate oil forward and future prices and discovered that from 1985 to 2004, the DCC can vary dramatically in contrast to the common view that the volatility of futures price returns at different maturities are perfectly correlated. In general, the dynamic volatilities in the returns in the WTI oil forward and future prices could be either independent or interdependent over time.

The DCC estimates of the conditional correlations between the volatilities of forward and futures returns were always statistically significant which indicate that the assumption of constant conditional correlations (CCC) (between returns at different maturities) was not supported empirically since the DCC between the forward and futures returns varied dramatically. The range of variation (between the max and min) was relatively narrowin the case of the dynamic volatilities of the 3-months futures returns and 6-months future returns , namely (0.832, 0.996).On a general basis, the dynamic volatilities in the returns in the WTI forward and futures prices could be either independent or interdependent over time.

In the case of DCC between forward 1-month and futures 1-month, the max is 0.998 implying that forward one month and futures one month returns would have the same risk. However, the min is -0.291 implying that shocks to either of them are not perfect substitute in terms of risk

It was assumed by Bollerslev (1990) that the conditional variance for each return, hit (i=1,..,m) follows a univariate GARCH process, that is, CCC specification:

$$h_{it} = \omega_i + \sum_{j=1}^{r} a_{ij}\, \varepsilon_{i,t-j}^2 + \sum_{j=1}^{s} \beta_{ij}\, h_{i,t-j} \quad \textbf{(CCC model)}$$

The ARCH effects or short-run persistence of shocks to return j is represented by aij and βijrepresents the GARCH effects, or contribution of shocks to return ito long-run persistence.

Independence of the conditional variances across returns is assumed by the CCC specification above and asymmetric behaviour is not accommodated.Asymmetric GARCH or GJR specification for the conditional variance, which for r=s=1 was then proposed by Glosten et al. (1993) to accommodate the asymmetric impacts of positive and negative shocks which is given below:

$$h_{it} = \omega_i + \alpha_i \varepsilon_{i,t-1}^2 + \gamma_i I_{i,t-1} \varepsilon_{i,t-1}^2 + \beta_i h_{i,t-1}$$

(Asymmetric Conditional Variance Model)

Iit is an indicator function to distinguish between positive and negative shocks on conditional volatility.

The following DCC model was proposed by Engle (2002) and Tse and Tsui (2002) in order to capture the dynamics of time-varying conditional correlation Γt:

$$\Gamma_t = (1 - \theta_1 - \theta_2)\Gamma + \theta_1 \eta_{t-1} \eta_{t-1}' + \theta_2 \Gamma_{t-1}$$

Effects of previous shocks and previous dynamic conditional correlations on current DCC are captured using the scalar parameters θ1and θ2.

The reasonable flexibility in modelling individual volatilities and can be applied to portfolios with a large number of assets has made the DCC model a popular estimation procedure(Pesaran and Pesaran, 2007).

DCC model used with a multivariate t-distribution is more appropriate since it can capture fat-tailed nature of the distribution of index returns especially for risk analysis where the tail properties of return distributions are of most concern. The log-likelihood function of the DCC model can be maximized by using a two-step procedures as suggested by Engle (2002).However, such procedures will no longer be applicable to such a t-DCC specification

and a simultaneous approach to the estimation of the parameters of the model which includes the degrees of freedom parameter of the multivariate t distribution would be needed (Pesaran and Pesaran, 2007).

The standardized returns used by Engle (2002) are as follows:

$$z_{it} = \frac{r_{it}}{\sigma_{i,t-1}(\lambda_i)}$$

A two-step procedure is also proposed by Engle (2002) in estimating the cross asset correlations which includes; the Individual GARCH (1, 1) models are fitted to the 'm' asset returns separately, and then, the coefficient of the conditional correlations, θ, is estimated by Maximum Likelihood Estimator (MLE) (assuming that asset returns are conditionally Gaussian). But such procedure poses drawbacks of the assumption of Gaussianity is not applicable for daily returns and the portfolio risk can be estimated by its use and there would be inefficiency in the two stage approach under the Gaussianity assumption even if it is consistent.

An alternative formulation of conditional correlations $(\rho_{ij,t-1})(\emptyset)$ is therefore proposed by Pesaran which makes use of the realised volatilities. The estimates of the correlations of Pesaran is based on the devolatized returns that are nearly Gaussian (Pesaran&Pesaran 2007).

$$\tilde{r}_{it} = \frac{r_{it}}{\sigma_{it}^{realized}} = \frac{r_{it}}{\sigma_{it}(p)}$$

For daily returns a value of p=20 tends to render $\tilde{r}_{it}$ nearly Gaussian.

Under the study done by Pesaran and Pesaran (2007) by applying the t-DCC estimation procedure towards a portfolio composed of six currency futures, four ten year government bonds and five equity index futures over the period of 2 January 1995 to 31 December 2006 and discovered that the normal-DCC model is rejected but the t-DCC specification is favoured.

2. Continuous Wavelet Transform and Maximal Overlap Discrete Wavelet Transform

Some of the researchers that have applied continuous wavelet transform in their studies include Alaoui and Hkiri(2014), Reboredo (2012). Under the CWT, the original time series is

mapped and represents a function of just one variable time separate into the function of two different variables such as time and frequency. The number of wavelets time scales is not required to be defined in CWT. Since it generates itself based on the data length. The series correlations in a two dimensional figure is mapped by the CWT which enables easy identification and interpretation of patterns. For this study, the least asymmetric wavelet filter by Daubechies (1992) of length L=8 which is denoted by LA(8) based on eight non-zero coefficients. The length filter of L=8 is shown as a moderate length by previous studies which is adequate to deal with the characteristics of time series data (Gencay et. al 2001, In& Kim 2013). It has also been argued that a more smooth wavelet coefficient compared to other filters such as Haar wavelet filter is generated by the LA(8) (In & Kim 2013).

With referring to Rua and Nunes (2009) and Vacha and Barunik (2012), the continuous wavelet transform is given by

$$W_x(u,s) = \int_{-\infty}^{\infty} x(t) \frac{1}{\sqrt{s}} \overline{\psi\left(\frac{t-u}{s}\right)} dt.$$

urepresents the position of the wavelet in the time domain while s is the position in the frequency domain . From here, information on time and frequency can be simultaneously obtained by mapping the original time series into a function of u and s in the wavelet transform. Next, a bivariate framework called the wavelet coherence is needed to be adopted to investigate the interaction between two time series on how closely X and Y are related by a linear transformation (Madaleno&Pinho 2012).The wavelet coherence is defined as the scared absolute value of the smoothed cross wavelet spectra normalised by the product of the smoothed individual wavelet power spectra of each selected time series according to Torrence and Webster (1999). The squared wavelet coefficient is given as

$$R^2(u,s) = \frac{\left|S\left(s^{-1}W_{xy}(u,s)\right)\right|^2}{S(s^{-1}|W_x(u,s)|^2)S\left(s^{-1}\left|W_y(u,s)\right|^2\right)}.$$

The smoothing parameter is denoted by s and in the case where there is no smoothing, the wavelet coherence will be equal to one. The squared wavelet coherence coefficient is in the range $0 \le R^2(u,s) \le 1$ and values that are close to zero signify correlations that are low while values close to one indicates the presence of strong correlations. Based on the discussion

above, the wavelet coherence is deemed to be a suitable tool to study stock market co-movements over time (Alaoui&Hkiri 2014).

Besides CWT, MODWT is also applied in this study which decomposes a signal to Jlevels which requires the application of J pairs of filters under theory. The filtering operation at the jth level consists of application a rescaled father wavelet to yield a set of fluctuation coefficients and a rescaled mother wavelet to yield a set of scaling coefficients which can overcome some of the difficulties associated with discrete wavelet transforms. Specifically, the variance estimator based on coefficients of the MODWT is asymptotically more efficient compared to the one based on the discrete wavelet transform coefficients. From here it is the wavelet variance and covariance can be efficiently calculated in different time scales. A set of time-dependent wavelet and scaling coefficients with basis vectors associated with a location t and scale $\tau_j = [2^{j-1}, 2^j]$ for each decomposition level j = 1…..J is also produced in MODWT. Hence, the decomposed signals for multi resolution analysis in MODWT is defined as follow:

$$S_j(t) = \sum_k s_{J,k}\phi_{J,k}(t)$$

$$D_j(t) = \sum_k d_{J,k}\psi_{J,k}(t) \quad j = 1, 2..., J.$$

$S_j(t)$ and $D_j(t)$ correspond to the fluctuation and scaling coefficients at the jth level wavelet. Such coefficients measure the contribution of the corresponding wavelet function to the total signal is measured by such coefficients. Thej level on the other hand is the multi resolution level which reconstructs the signal in terms of a specific frequency (trending and fluctuation components). Thus a time series y(t) can be expressed in terms of those signals as:

$$y(t) = S_j(t) + D_j(t) + D_{j-1}(t) + \ldots + D_1(t).$$

With regards to multi scale analysis correlation the multi-resolution analysis can be applied to represent the variability and dependence structure of a stochastic process on a scale-by-scale basis. $X_t = (y_t, x_t)$ let to be the bivariate stochastic process while $W_{j,t} = (w_{yj,t}, w_{xj,t})$ is let to be the scale vj wavelet coefficient computed from Xt. Each wavelet coefficient process

is obtained from applying the MODWT to each process in Xt. If it exists and if it is finite, the time-dependent wavelet variance for scale νj of signal Xt is given by:

$$\sigma_X^2(\nu_j) = Var\left(\hat{W}_{x,j,t}\right) \wedge Var\left(\hat{W}_{y,j,t}\right)$$

Similarly, the wavelet covariance for scale νj is given by:

$$\gamma_{x,y}(\nu_j) = Cov\left\{\hat{W}_{x,j,t}, \hat{W}_{y,j,t}\right\}.$$

We thus obtain the correlation coefficient as:

$$\rho_{x,y}(\nu_j) = \frac{cov\left\{\hat{W}_{x,j,t}, \hat{W}_{y,j,t}\right\}}{\left(var\left\{\hat{W}_{x,j,t}\right\} var\left\{\hat{W}_{y,j,t}\right\}\right)^{1/2}} = \frac{\gamma_{x,y}(\nu_j)}{\sigma_x(\nu_j)\sigma_y(\nu_j)}$$

Considering a lag τ in one of the time series in equation before this, we obtain the wavelet cross-correlation as (Reboredo& Rivera-Castro 2014)

$$\rho_{x,y,\tau}(\nu_j) = \frac{\gamma_{x,y,\tau}(\nu_j)}{\sigma_x(\nu_j)\sigma_y(\nu_j)}.$$

Results and Discussions

1. Data analysis

As for descriptive Statistics in Table 2 below show that the volatility of returns represented by the standard deviation is the highest for the MSCI Turkey index and lowest for the MSCI Oman index. This standard deviation shows absolute time independent volatility of the returns.

Table 2: Descriptive statistics of the data

	EGYP	**LEBN**	**OMAN**	**TURK**
Mean	0.0000981	0.0000544	-0.0000601	0.000055
Median	0.0000	0.0000	0.0000	0.00039
Maximum	0.04542	0.04485	0.04719	0.07018

Minimum	-0.07444	-0.07104	-0.07527	-0.0638
Std. Dev.	0.007545	0.006084	0.005565	0.010264
Skewness	-0.912884	0.041732	-1.308578	-0.287459
Kurtosis	11.49511	20.72376	32.63092	7.305317
Jarque-Bera	8028.201 (0.0000)	33403.4 (0.0000)	94088.1 (0.0000)	2006.115 (0.0000)
Observations	2552	2552	2552	2552

The asymmetric property of any distribution is indicated by the skewness where the findings show that all returns are negatively skewed except for the returns of the MSCI Lebanon index returns, indicating that the returns for this index are not symmetric, leading to higher variability and risk.

The fatness of the distribution can be measured by the kurtosis which describe how concentrated the data are around the mean of the distribution. From the table above, kurtosis values are all more than 3 indicating that the returns in the stock indices are not normally distributed and therefore has higher risks. For the Jarque-Bera test results, all returns are significant meaning that the non-normality,variability and higher risk of the returns of the stock indices are further strengthened(Kabir et. al 2013).

2. Estimation using M-GARCH DCC model

Under this section, comparison of Gaussian DCC Model and the t-DCC model is done together with plotting the estimated conditional volatilities and correlations. The comparison between the Gaussian DCC Model and the t-DCC model serves as a preliminary step to determine which model is relatively more significant.

Since we are primarily interested in volatility modelling and correlations between these indices, we set $\mu_{t-1} = 0$, and estimate the DCC models on the stock indices daily returns over the period of 19 October 2005 to 11 March 2015. Any case of non-convergence was not encountered and furthermore the Maximum Likelihood estimates of the Gaussian DCC and t-DCC models on stock indices daily returns was obtained under this section.

Table 3: Maximum Likelihood estimates of the Gaussian DCC model on stock indices daily returns:

Parameter	Estimate	Standard Error	T-Ratio	Probability
lambda1_LEBN	0.64949	0.085696	7.579	[.000]
lambda1_TURK	0.84488	0.056869	14.8567	[.000]
lambda1_EGYP	0.79312	0.050211	15.7956	[.000]
lambda1_OMAN	0.81182	0.03843	21.1247	[.000]
lambda2_LEBN	0.25868	0.057652	4.4869	[.000]
lambda2_TURK	0.10706	0.032659	3.2782	[.001]
lambda2_EGYP	0.10785	0.025261	4.2695	[.000]
lambda2_OMAN	0.16066	0.031252	5.1406	[.000]
delta1	0.9927	0.0038975	254.6995	[.000]
delta2	0.0035913	0.0024543	1.4632	[.144]
Maximized Log-Likelihood	5586.8			

The upper panel (Table 3) of the above results of the Gaussian DCC model presents the maximum likelihood estimates for the returns on the four stock index returns and λ_{1i} and .λ_{2i} The volatility parameters observed under this model are highly significant together with estimates ofλ_{1i}, i= 1,2,3,4 are very close to unity implying a gradual volatility decay. The estimated unconditional volatilities and correlations are reported within the lower panel of the results in Table 4.

Table 4: Unconditional Correlation and volatilities

	LEBN	TURK	EGYP	OMAN
LEBN	0.012659			
TURK	0.12106	0.023434		
EGYP	0.11203	0.18204	0.016952	
OMAN	0.1897	0.086299	0.20602	0.011595

After this, the ML estimates of the t-DCC model were obtained to serve as a preliminary step to determine which model is more significant for this study which can be referred to Table 5 on the next page.

Table 5: Maximum Likelihood estimates of t-DCC model on stock indices daily returns

Parameter	Estimate	Standard Error	T-Ratio	Probability
lambda1_LEBN	0.59116	0.11608	5.0927	[.000]
lambda1_TURK	0.89357	0.058432	15.2925	[.000]
lambda1_EGYP	0.73916	0.11263	6.563	[.000]
lambda1_OMAN	0.78654	0.04692	16.7634	[.000]
lambda2_LEBN	0.33211	0.087341	3.8025	[.000]
lambda2_TURK	0.052568	0.023254	2.2606	[.024]
lambda2_EGYP	0.11894	0.048688	2.4429	[.015]
lambda2_OMAN	0.18396	0.038915	4.7272	[.000]
delta1	0.99528	0.0026528	375.178	[.000]
delta2	0.0040959	0.0021744	1.8837	[.060]
df	4.0339	0.26283	15.3478	[.000]
Maximized Log-Likelihood	5769.4			

From the ML estimates of the t-DCC model (Table 5) on the stock indices daily returns, it could be seen that all return volatility estimates are statistically significant and near to unity implying a gradual decay in volatility under the t-DCC model. The maximized Log-Likelihood value of 5769.4 is larger than the one obtained under the Gaussian model which was 5586.8. On top of that, the estimated degrees of freedom for the t-normal distribution is below 30 and therefore all of these results suggest that the t-distribution is a more appropriate model for capturing the fat- tailed nature of the distribution of the stock returns.

Since now we have chosen the t-DCC model, we now refer to Table 5 for our following discussion. From the Table 5, it is observed that the volatility parameters are highly significant that indicates gradual volatility decay in which for example the riskiness involved in the returns gradually cancels out after following a shock in the market. Even after adding lambda1_TURKand lambda2_TURK (0.89357+ 0.052568= 0.946138) and also the other three remaining indices, the result of the summation is still less than 1 or unity which tells us that the volatility of Turkey stock return together with the other returns are not following the Integrated Generalized Auto Regressive Conditional Heteroskedascticity(IGARCH) or in other words, the shock to the volatilities are not permanent. If shocks to volatilities are

permanent, investors and portfolio managers would have a high chance of losing their investment even if they make high profit in the short run. On the other hand, speculators would be welcoming such conditions with temporary shocks that are favorable to their interests. From here, it can also be concluded that it is safer to invest in MENA region equities regardless whether political turmoil will last longer or not.

Table 6: Unconditional Correlation and volatilities

	LEBN	**TURK**	**EGYP**	**OMAN**
LEBN	0.012659			
TURK	0.12106	0.023434		
EGYP	0.11203	0.18204	0.016952	
OMAN	0.1897	0.086299	0.20602	0.011595

The on-diagonals in Table 6 explain the unconditional volatilities of the indices. If the unconditional volatility is near to zero, it can be implied that the particular index has the least volatility whereas if the unconditional volatility is near to 1, it indicates higher volatility levels.

Table 7: Ranks of the unconditional volatilities of the four stock indices returns

No.	**Indices**	**Unconditional Volatility**
1	MSCI Oman Index	0.011595
2	MSCI Lebanon Index	0.012659
3	MSCI Egypt Index	0.016952
4	MSCI Turkey Index	0.023434

In this study, we have ranked the four indices return in Table 7 and we found out that all of them had very low unconditional volatilities ranging from 0.0116 to 0.0234 that in turn signifies on overall that these four returns on the four stock indices have are less volatile. Moreover, it could be observed that the MSCI Oman Index is relatively less volatile compared to the other three indices. As far as the previous research of theauthor shows, Oman could imply some sense of stability during the 2011political turmoil in the MENA regionwhich could give a potential positive diversification effect on investment portfolio.

With regards to the off-diagonal elements showing the unconditional correlations as presented in Table 6, it is observed that MSCI TurkeyIndex returns have the highest correlation with MSCI Egypt Index returns among the other returns of the three indexes which is +0.18204. This is not much of a surprise since Egypt is the largest trading partner of Turkey,and definitely changes in Egypt index will have significant impact on Turkey stock index in the long run. This positive correlation of 18% is considered to be low and not even moderate. The lowest correlation was found to be between the returns of the MSCI Oman stock index with the MSCI Turkey stock index which is +0.0863. From here, we can say that there is more chances of diversification benefits if Turkish investors were to include MSCI Oman stock index in their portfolio as compared to the other stock indices.

We now then proceed to examine the dynamic conditional correlations which capture the time-varying properties in the volatilities and the correlations. Figure 1 and 2 illustrate the results on the next page.

Figure 1: Conditional volatilities – TURK, EGYP, LEBN, OMAN

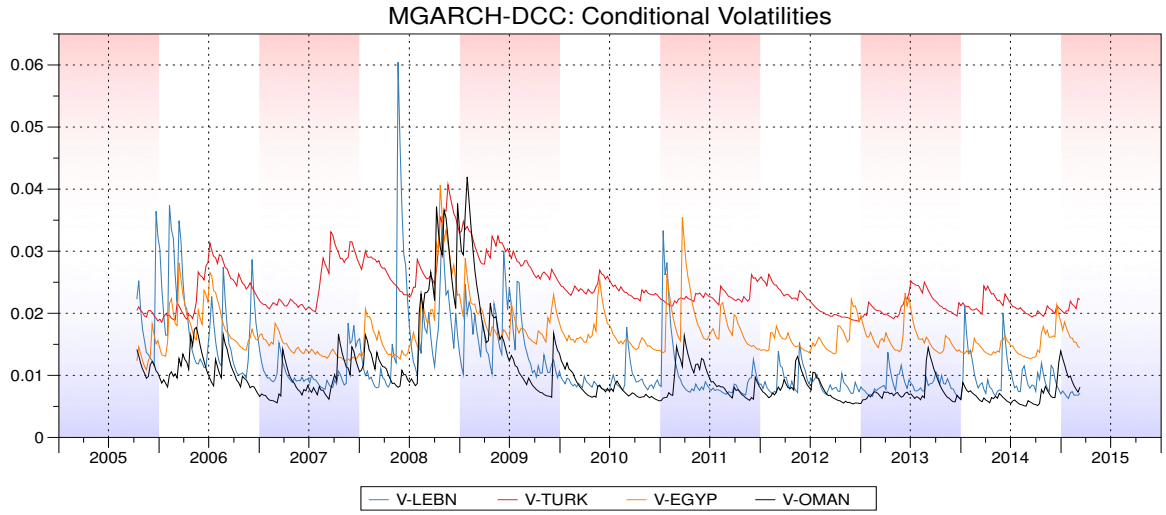
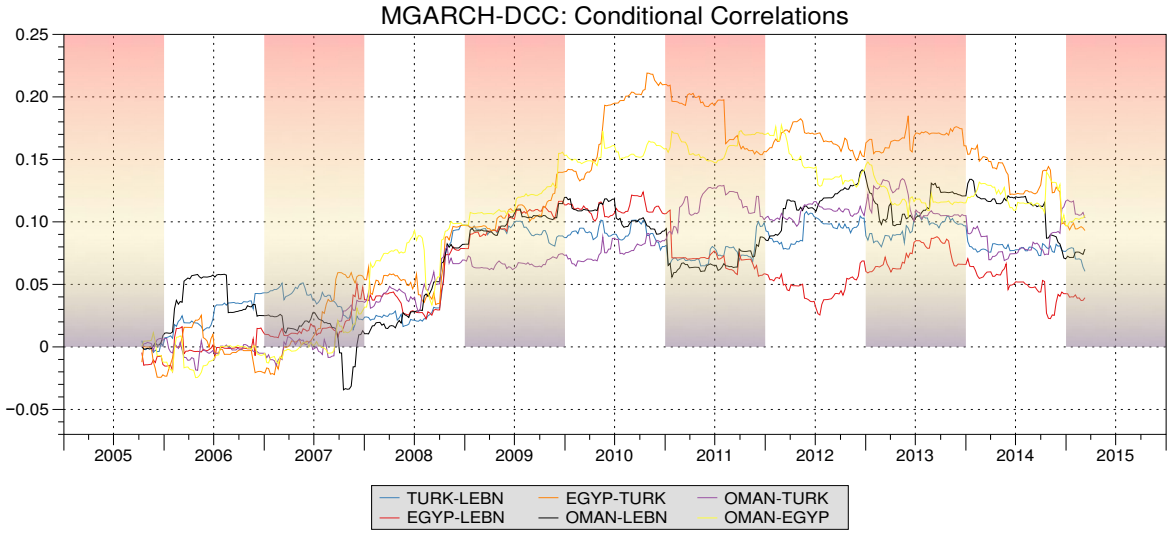


Figure 1that illustrates the conditional volatilities of all stock index returns tend to move more or less simultaneously except during the 2008 global financial crisis. During the period of the 2008 global financial crisis(Assidenou 2011), there seems to be a high convergence of volatility amongstock index returns of Egypt and Oman which reflects a higher financial integration between these markets but this is not the case with the Turkey and Lebanon stock index returns. Usually higher financial integration between stock returns is unfavorable for investors and portfolio managers since it would lead to less opportunities to obtain benefits

from portfolio diversification(Kabir et. al 2013). These results confirm the ones shown in Table 6. The conditional volatilities of the Turkey stock index returns were also observed to be high just a few months before the global financial crisis occurred.On the side note, there seems to be an unusual peak between 2010-2011 for the Egypt and Lebanon stock markets that is higher than other stock indexes that can be attributed to the beginning of the Arab Spring in the mid-2010, and its emergence on 2011 in the region. Lebanon was one of the initial countries that witnessed the beginning, and followed by a huge uprising in Egypt in 2011.

Figure 2: Conditional Correlations – TURK, EGYP, LEBN, OMAN



Next, we plot the conditional correlations in Figure 2 and again it consistently confirms with the results of the unconditional correlations in Table 6 showing that the Turkey stock index returns has the least correlation with the Oman stock index returns. Plus, the figure supports the previous results that Turkey stock index returns is highly correlated with the Egypt stock index returns. More importantly, the figure actually indicates that the correlations of the returns of the Turkey stock index with stock returns of Egypt, Lebanon, and Oman or in other words the MENA region trading partners, seem to be moving quite closely together especially during the 2008 global financial crisis period and at the very beginning of the Arab Spring in 2010. It can be suggested from here that Turkish investors are better off investing in Oman stock markets to gain more portfolio diversification compared to other stock markets of the major trading partners.

3. Estimation using the Continuous Wavelet Transform Analysis

In this section, continuous wavelet transform analysis is done to analyze the impacts on portfolio diversification benefits given the different investment horizons. To perform continuous wavelet transform analysis, we will focus on the wavelet coherency methodology. The continuous wavelet transform and phase difference of Turkey stock index returns with stock index returns of Egypt, Lebanon, and Oman are presented in Figures 3 to 5 respectively from scale 1 (one day) up to scale 9 (512 days). The horizontal axis represents the time in terms of number of trading days whereas the vertical axis refers to the investment horizon. The values for the 5% significance level represented by the curved line was obtained from the Monte Carlo simulations. The color code for power or strength of correlation ranges from blue (low coherency, near zero) to red(high coherency, near one). The vectors pointing to the right mean that the indexes are in phase but if they point to the left it means that the indices are out of phase. If they are directed to the right and up means that the first series is lagging, but to the right and down means that the second series is lagging. To the left and up indicates that the second series leading whereas second series becomes lagging when the arrows are pointing towards the left and down (Madaleno&Pinho 2010). In our study, the Malaysian shari'ah stock index is made as the first series in all the wavelet coherency diagrams.

For very short stock holding periods consisting of 2-4 days and 4-8 days, we generally find that correlations seem to be weak for all the index returns of Turkey's trading partners with the Turkey returns during the whole period studied. But if we were to do a relative comparison, the returns of the Egypt stock index have a stronger correlation relative to stock index returns of Lebanon and Oman. This is also the case when we were to narrow down our scope to the period of the Global Financial Crisis(indicated by observation points 675 to 936) by referring to the period of the global financial crisis used by Assidenou (2011), where Egypt stock index returns are correlated at a higher level with the Turkey returns when compared to the other stock indices. The same position holds in the case of Arab Spring period (indicated observation points 1198 to 1718) by referring to the period of the political crisis used by previous researchers. Therefore, if Turkishinvestors were to invest in these time periods, investing in stock indices other than Egypt is a more viable option.

Now observing the short holding periods of 8-16, 16-32, and 32-64 days, we found strong correlations of the Turkey index returns with the stock index returns of Egypt but for other trading partners, correlations were low during the period covered in this study but there is an exception. The exception is during the 2010-2011Political Crisis period where all the returns of the stock markets of Turkey's major trading partners showed relatively strong correlations

with the Turkey returns.In other words, there was a change in the co-movement between the Turkey stock index returns with the indices of its major trading partners to relatively higher frequency overlaps during the inception of the Arab Spring. Such increases in the coherence of the indices at high frequencies corroborate the contagion hypothesis during crisis periods which could result in structural breaks in the asset price series when external shocks are experienced (Aloui&Hkiri 2014). Other than that, if we focus solely on time scales of 32-64 days,then we can see that most of the correlations between the Turkey stock index with the indexes of its major trading partners are relatively high compared to time scales of 8-16 and 16-32 days which make up the short investment horizon.

Moving on to medium investment horizons of 64-128 and 128-256 days, high level of correlations are observed during and post global financial crisis between Egypt, Lebanon, and Oman stock index returns with Turkey index returns. Have to take into account that there is a strong correlation among stock market index returns appeared during political turmoil in 2010. The high correlation extended till 2011 between Turkey and its trading partners in the MENA region which have been exposed to Arab Spring. But Lebanon stock returns only showed high correlation with Turkey stock returns in 2010. It might be because of the fact that Lebanon have hosted the political crisis only at the beginning level which falls within first half of 2010. Lebanon was in stable position till 2013.As for this stock index, returns of this stock market had considerable correlations became more intense during 2013 that was similar for investment horizons for 16-32 days. The reason could be the Al-Hassan assassination and the Battle of Sidon which are out of scope of this study. As an addition to this, there were also high correlations from observation points 1198 to 1458(resembling year 2010) for investment horizons 128-256 days which is indeed because of the peak point of Arab Spring. From here medium term investors may want to avoid investing in the stock indices of Turkey's trading partners as it would be difficult to experience benefits from portfolio diversification especially during the rise of political uncertainties.

Relating to investment horizons of 256-512 days, very strong correlations are observed between all the stock index returns of Turkey's major trading partners with the Turkey index returns from observation points 1198 to 1458 which is year 2010 that in turn reduce or eliminate the benefits for potential portfolio diversification. Speaking of the arrows that indicate the phases of the variables, the direction of most arrows in the higher time scales or longer investment periods indicates that the relationship between the market returns of the

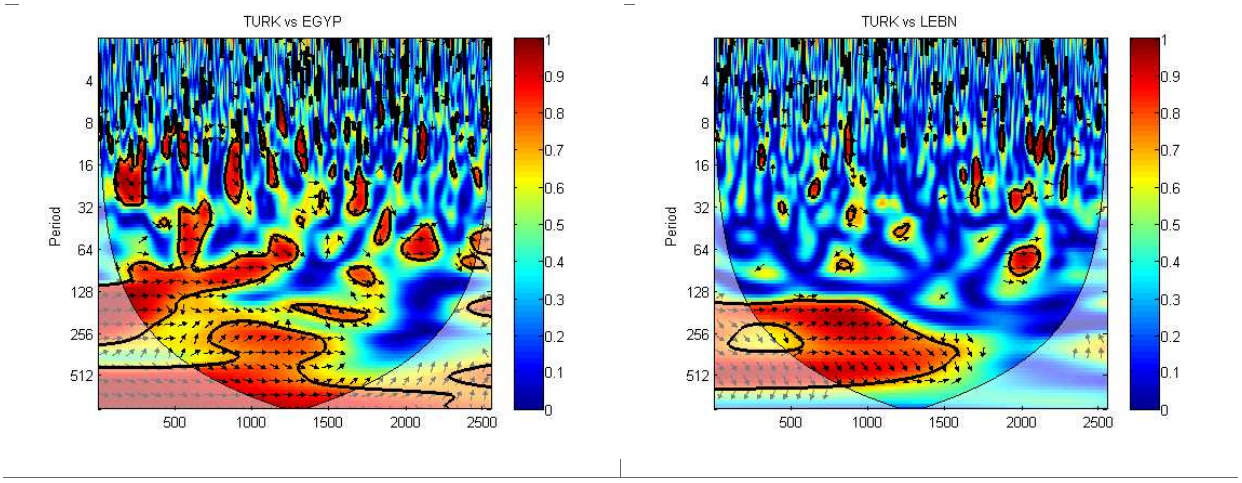
Turkey trading partners with the Turkey returns are in phase most of the time. Needless to say it is because of the peak point of Arab Turmoil in 2010 in the region.

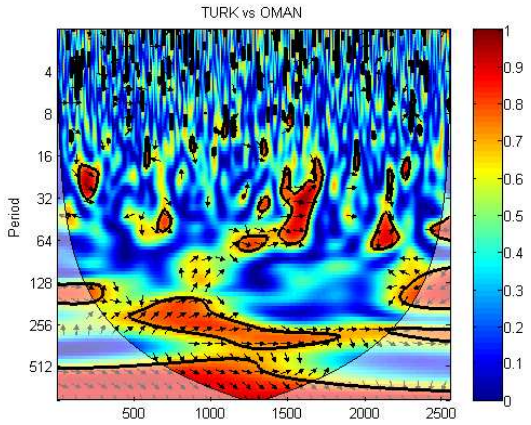
Such results obtained from this wavelet analysis is aligned with the findings in Alaoui and Hkiri (2014) which found that the occurrence of the financial and political crisis has considerably increased the degree of co-movements between all the stock markets especially at high frequency levels or short investment horizons which could be viewed as higher degree of persistence of shock transmission during turbulent periods. By the same token, Aloui and Hkiri (2014) found that the time scale of 128 to 256 days detected a strong co-movement between the stock markets which was also evident in our study between Turkey stock market and its major trading partners.Overall, the wavelet transformations have contributed by helping us understand the potential benefits of international portfolio diversification for investors with different investment horizons.

Figure 3: Continuous Wavelet Transform – TURK vs EGYP

Figure 4: Continuous Wavelet Transform – TURK vs LEBN

Figure 5: Continuous Wavelet Transform – TURK vs OMAN





*Global Financial Crisis occurring from observation point 675-936 and political turmoil from points 1198 to 1458, 1458 to 1718 and 1980-2240.

4. Robustness test through estimation using the application of MODWT

As test for robustness to ensure the results obtained from the CWT analysis, a Maximal Overlap Discrete Wavelet Transform (MODWT) was applied to our original data set consisting of returns series for all four stock indexes. In MODWT, the researcher is required to specify the time scales for the returns whereby we had seven scales (1-2 days, 2-4 days, 4-8 days, 8-16 days, 16-32 days,32-64 days and 64-128 days). The correlations between the Turkey stock market returns with the index returns of its major trading partners are examined using the generated MODWT returns series using R structural programming and the results are shown in the table below.

Table 8: Wavelet correlations of Turkey stock market returns with returns of major trading partners of Turkey – MODWT Transformation.

MODWT SCALING	**EGYP**	**LEBN**	**OMAN**
(1-2 days)	0.075982	0.034173	-0.022
(2-4 days)	0.17636	0.101468	0.10194
(4-8 days)	0.303301	0.108155	0.215718
(8-16 days)	0.384708	0.116165	0.308437
(16-32 days)	0.379039	0.090053	0.183875
(32-64 days)	0.652247	-0.1309	0.239968

(64-128 days)	0.600516	0.642371	0.506578

Note: Correlations more than 0.6 is arbitrarily considered to be strong (Najeeb&Masih) and are indicated by the values highlighted in bold. The values not highlighted in bold and are between 0.37 and 0.6 indicate moderate correlation. The rest indicate low correlation.

Interestingly, the results happen to be consistent with the one obtained from the earlier CWT analysis. The stock index of Egypt seems to be providing opportunities of portfolio diversification that is not favorable to the Turkish investors inmedium investment horizonwhere the correlations are seen to be strong. But at the same time, we can also observe from above that Oman definitely offers a better opportunity for portfolio diversification for Turkish investors compared to Egypt and Lebanon from holding periods of 1-2, 2-4,32-64, and 64-128 days based on the values of the coefficient of correlations.Oman can been seen as a safe haven for Turkish investors since there is no strong correlation between returns of these two stock indexes.As a whole, all the stock index returns of Turkey's major trading partners show very strong correlations with Turkey returns at higher investment horizons of 32-64 days and 64-128 days except for Oman. But even in the case of Oman, the correlation coefficient with Turkey returns was almost close to 0.6 at 64-128 days .Therefore, the findings from the MODWT analysis are in line with ones obtained under the CWT analysis.

Summary of the results obtained

The empirical results regarding the level of the portfolio diversification benefits for Turkish investors with their major trading partners.The research objectives of this paper has been highlighted under this table and the corresponding results are communicated in a way that distinguishes the level of portfolio diversification benefits into high, moderate or low based on the M-GARCH DCC approach together with the wavelet analysis approach.

Table 9: Portfolio Diversification Benefits for Turkey Index Investors

Level of portfolio diversification opportunities(High/Moderate/Low)			
	Egypt	Lebanon	Oman
M-GARCH DCC	Low	Moderate	High
Wavelet Transform			

1-2 days	High	High	High
2-4 days	High	High	High
4-8 days	High	High	High
8-16 days	Moderate	High	High
16-32 days	Moderate	High	High
32-64 days	Low	High	High
64-128 days	Low	Low	Moderate
128-256 days	Low	Low	Low
256-512 days	Low	Low	Low

Interpretation of results

From the results obtained from the three different methodologies, it can be seen that stock index of Egypt is definitely not suitable for Turkish investors to include it in their portfolio which can be attributed to some underlying factors. The main underlying factor why Turkey stock market returns is so highly correlated with stock index of Egypt is obviously due to the high intensity of trading activity between these two countries compared to other trading partners as Egypt is the largest trading partner of Turkey, reported by Republic of Turkey Ministry of Economy (2013). According to the Ministry, Egypt remains to be Turkey's top trading partner in the region with bilateral trade between both countries hitting USD 5.18 billion in the first quarter of the year 2012.

Economic relations between Egypt and Turkey have also evolved and expanded beyond the area of trade such going into the services sector, particularly the financial sector, tourism and education. Egypt is a significant market for Turkish contractors as well. Turkish firms held and are holding 26 projects in Egypt with a total value of USD 1 billion up until now. Moreover, investments of Turkey have been increased especially in the textile and apparel sector in the Egypt, reported by Republic of Turkey Ministry of Economy (2013).

It is important to mention that the military coup that took place on 3 July 2013 and led to the ousting of the first democratically elected President Mohammed Morsi has adversely affected the relationship between Turkey and Egypt. So Turkey's decision to downgrade the level of its diplomatic relations with Egypt was taken on 23 November 2013 in accordance with the principle of reciprocity, reported by Republic of Turkey Ministry of Foreign Affairs (2013). This should be a very clear message to the investors.

By now, it is already clear that Turkish investors should avoid investing in stock index of Egypt which happens to be Turkey's largest trading partner since it would give them minimal benefits of portfolio diversification based on the factors outline above.

Looking now at the relationship between Turkey and Lebanon through the moderate correlations between their stock markets during short invest horizons of 32-64 days, 64-128 days in the 2013Political Crisis period when Al-Hassan assassination and Battle of Sidon have taken place. One of events that took place which led to the moderate correlations between Lebanon and Turkey Includes Turkey's proactive stance adopted during the July 2006 war in Lebanon, Turkey's efforts towards the solution of the political crisis in Lebanon, concluded with the signing of the Doha Agreement in November 2008, subsequent election of the President and the establishment of the government, have contributed to the positive image of Turkey vis-à-vis the Lebanese politicians and public opinion. The initiatives undertaken by our Prime Minister and Minister in order to overcome the government crisis in Lebanon in the 2010-2011 periods were received with appreciation.

Important bilateral agreements were signed during the period of intense relations and high-level visits in 2010, among which are: Agreement on Abolishment of Visa Requirement for Turkish and Lebanese Citizens, (11 January 2010); Training, Technical and Scientific Cooperation in the Military Field (Framework) Agreement (11 January 2010); Memorandum of Understanding on Cooperation in the Field of Agriculture, (11 January 2010); Memorandum of Understanding on Cooperation in the Field of Forestry, (11 January 2010); Memorandum of Understanding on Mutual Recognition of Certificates Pursuant to Regulation 1/10 of theInternational Convention on Standards of Training, Certification and Watchkeeping for Seafarers (11 January 2010); Agreement on Cooperation in the Field of Health (11 January 2010); Association Agreement between the Republic of Turkey and the Republic of Lebanon (Free Trade Agreement) (24 November 2010); Joint Political Declaration on the Establishment of High-Level Strategic Cooperation and Coordination Council (24 November 2010). On the other hand, in the margin of the Turkish-Arab Forum held on 9-10 June 2010 in Istanbul, Ministers of Foreign Affairs of Turkey, Jordan, Syria and Lebanon, advanced the cooperation in the region by announcing the Joint Declaration on the establishment of Quadripartite High-Level Strategic Cooperation. During the visit to Lebanon of H.E. RecepTayyipErdoğan, ex-Prime Minister of the Republic of Turkey, on 24-25 November 2010, the Joint Political Declaration on the establishment of the High Level

Strategic Cooperation and Coordination Council was signed, reported by Republic of Turkey Ministry of Foreign Affairs (2013).

Relating to increasing correlations which are still moderate during political tensions at short investment horizons as shown under wavelet coherency analysis, some studies found that Lebanon stock market reacts to some of its political activities. During Lebanon's political unrests, such eventshave sent Lebanon's main stock index down. Probably when Lebanon was facing such issues, the government was seeking some help from neighboring countries like Turkey in terms of seeking advice on how to overcome and handle such problems that may lead to increased correlations between Lebanon stock markets and Turkey stock markets. Seeing the political issue from another angle, investors who have investments in Lebanon may feel worried about their investments being affected by the political uncertainty which will make them shift their investments to a safer haven such as Turkey which entails some level of interdependency between the Lebanon stock market and the Turkey stock market. But at the end of a day, they may not get as much diversification benefits since Turkey is correlated with Lebanon. As a lesson, short term investors should be very critical in investing in Lebanon during political tensions or in any country for that case.

Synthesizing the discussions made under the correlations between returns of the Lebanon and Egypt stock indices with the Turkey stock index returns, such relations or integrations were evident in studies of few researcherswhich focused on examining the dynamic linkages or integration that existed between the MENA region countries that included Egypt, Israel, Jordan, Morocco, and Turkey. To further strengthen the results obtained under this study especially under the wavelet coherency analysis, Lucey and Zhang (2010)found that countries with smaller cultural distance exhibit relatively higher stock market co-movement. Following these, we hypothesize that while the MENA region stock markets may be globally segmented, regional markets exhibit high levels of linkages for economic and cultural reasons, at least in the long run,which could be linked to our study when the correlations were high at long investment horizons for the returns of stock indices of Egypt and Lebanon with the Turkey stock index returns.Therefore, Turkish investors shall avoid from putting too much investments in stock indices of its major MENA region trading partners which are Egypt strictly and Lebanon but relatively, Lebanon may pose less danger since the strength of correlations were more moderate compared to Egypt.

Lastly, we look at the weak correlations between the Oman stock indexes returns with the Turkey stock index returns shown by the results under the M-GARCH DCC analysis. Also under the wavelet coherency analysis and MODWT analysis, weak correlations were also found between Oman and Turkey during the short investment horizons. One of the underlying reasons why this could happen is the geographical locations between these two nations that are on different sides of the Middle East continent. We can deduce in an opposite way that further geographical locations may lead to lower correlations by referring to the earlier explanation about the close geographical proximity of Turkey and Lebanon which had caused higher correlations between them.

As for the longer investment horizons, correlations or returns were strong between the Oman and Turkey for the whole period studied under the wavelet coherence analysis. In fact for all the returns of the stock markets returns of Turkey's trading partner, correlations between them and Turkey were found to be high which is in conformity with Gallegati (2005) who found that markets of Turkey, Egypt, Morocco,Jordan, Lebanon and Oman were moving towards more integration especially following the political crisis. The correlation is relatively strong for Turkey, Lebanon, and Egypt. Therefore, if the Turkish investors were to invest in the Oman, diversification benefits can arise when they invest during investment horizons which are longer than 16-32 days.

As a wrap up for all the above mentioned explanations, the results which are presented in the summarized version of the findings are in conformity with the previous literature consisting of theoretical and empirical work. In short, Turkish investors who have allocated their investments across stock markets of Turkey's major trading partners such as Egypt may not be able to derive portfolio diversification benefits for all the investment horizons except for the very short investment horizons of 2-4, and 4-8 days. But for investments in Lebanon would give some better portfolio diversification effect, depending on the investment horizons especially at 4-8, 8-16 days and 16-32 days, portfolio diversification benefits may be at a moderate level but for Oman stock index, portfolio diversification benefits can be gained at a great level from very short investment horizons up until below investment horizons of 32-64 days. At the end of the day, at stock holding periods that are more than 32 or 64 days will usually result in higher correlations in all stock markets in this study that yields minimal portfolio diversification benefits.

Conclusion

This study examines the correlations between the Turkey stock index returns and the returns of the stock indices of its major trading partnersnamely, Egypt, Lebanon, and Oman which can imply the extent of the potential diversification benefits among these stock indices for the Turkish investors, of course with regards to global financial crisis and regional political crisis. Daily data spanning from June 2005 to April 2015 was used together with employing the M-GARCH DCC techniques and also wavelet approaches consisting of CWT and MODWT analysis which produced results that are coherent with one another. The study found that Turkish investors who have allocated their investments in major trading partners like Egypt may not experience comparatively great diversification benefits for almost all investment horizons. At the same time, investing in stock indices of major trading partners like Lebanon pose moderate diversification benefits up to before investment horizons of 32-64 days and longer. Instead, portfolio diversification benefits are greater if Turkish investors invest in the Oman stock index except during long investment horizons. Speaking about the long run implication for all stock indices, stock holding periods exceeding 32 days would lead to very strong correlations, producing minimal benefits of portfolio diversification. Taking into account on the above explanations, consistent reassessment of stock exposures and investment horizons of more than 32 days should be done more frequently, for example in every month or two for the Turkish investors. Thus, 2008 financial crisis, especially Arab Turmoil seems to have impacted the correlation between these stock markets and made them very volatile, especially for Turkey with Egypt. Overall the results of this study supports the previous empirical literatures that stock markets have strong integration after the both financial and political crises period resulting in lesser diversification benefits from participating in the market and trade does matter for stock market interdependence as what was found by Karim and Majid (2010). The findings of this paper are expected to have significant implications for Turkish investors and portfolio managers because the understanding of return correlations among the stock indices is important for diversifying portfolios into other markets for higher risk-adjusted returns(Paramati et. al 2012). Such results are also essential for even government authorities regarding the allocations and stock index policies at different investment horizons which will be discussed in the next section.

Policy Implications

For the purpose of policy making, any shocks in the major trading partners should be taken into consideration by the Turkish authorities in order to formulate macro stabilisation policies that pertain to its stock market as ignorance to do so may result in a contagion effect. The

extent of effectiveness of the Turkey macroeconomic policies in dealing with its stock market imbalances will rely heavily on the extent of financial integration of each of its major trading partners. Since the Turkey stock index is interconnected with the markets of its major trading partners, but not really with the Oman, then Turkey cannot be isolated or insulated from foreign shocks and thus, the scope for independent monetary policy will be reduced. Furthermore, the advantage of effective diversification among these markets of the major trading partners excluding the Oman can no longer be achieved and the Turkey stock index together with its major trading partners are perceived as one market set by investors intending to invest in the long run period. In other words, Turkey cannot serve as a potential market for international portfolio diversification for those who have a short investment horizon with regards to its major trading partners except for the Oman.

Now it is evident that the correlation of the Turkey stock index returns with its major trading partners reflects the limitation attributed to the pursuit of interdependent policy especially the financial policy. This limitation then brings about the need for policy coordination in Turkey to mitigate the impact of financial fluctuations. If Turkey intends to exploit the advantages of greater economic interdependence, trade and investment barriers would need to be lifted in addition to better policy coordination. Given this index returns correlation of Turkey with its major trading partners, policy makers may want to use this issue as a solid reason to establish a monetary union among its trading partners especially the ones from MENA region which we think will not happen in the near future as it is highly debated.

By the same token, the degree of diversification benefits between the Turkey stock market with its major trading partners will definitely have important bearings on the formulation of policies of multinational corporations. The reason being is that an idea of the exchange rate risks between these countries can be known through the identification of the long run relationship or co-movement among these stock markets at different time intervals. Acquiring such knowledge would enable the managers of these multinational companies to mitigate international risks and manage the economic, transaction and translation exposure of the corporation (Karim and Majid 2010).

Limitations and recommendations for future research

This study can be further enriched in the future by looking at other groups of trading partners, for instance, Asian, European and, North and South American trading partners instead of just taking the countries from the top of the list of the trading partners.

Since this study focused only at conventional stock indices, then future studies may attempt to investigate a more comprehensive perspective by doing a comparison of portfolio diversification benefits that arises between the Shari'ah stock indices and the conventional stock indices.

Other than that, further studies can also be carried on this matter by considering an analysis based the comparison on sectors for example, construction, finance and agriculture in Turkey with its major trading partners. This enables us to see in more detail about the co-movements of the sectors which then allows the investors to minimize their risks in a way that is more efficient (Najeeb & Masih 2014).

References

Abou-Zaid, A. S. (2011). Volatility Spillover Effects in Emerging MENA Stock Markets. RAE, 7(1-2).

Ali, S., Butt, B. Z., & Rehman, K. (2011). Comovement between emerging and developed stock markets: an investigation through cointegration analysis. World Applied Sciences Journal, 12(4), 395-403.

Ali, S., Butt, B. Z., & Rehman, K. (2011). Comovement between emerging and developed stock markets: an investigation through cointegration analysis. World Applied Sciences Journal, 12(4), 395-403.

Aloui, C., & Hkiri, B. (2014). Co-movements of GCC emerging stock markets: New evidence from wavelet coherence analysis. Economic Modelling, 36, 421-431.

Aloui, C., & Hkiri, B. (2014). Co-movements of GCC emerging stock markets: New evidence from wavelet coherence analysis. Economic Modelling, 36, 421-431.

Assidenou, K. E. (2011). Cointegration of major stock market indices during the 2008 global financial distress. International Journal of Economics and Finance, 3(2), 212.

Bollerslev, T. (1990). Modelling the coherence in short-run nominal exchange rates: a multivariate generalized ARCH model. The Review of Economics and Statistics, 498-505.

Celık, S. (2012). The more contagion effect on emerging markets: The evidence of DCC-GARCH model. Economic Modelling, 29(5), 1946-1959.

Celık, S. (2012). The more contagion effect on emerging markets: The evidence of DCC-GARCH model. Economic Modelling, 29(5), 1946-1959.

Chau, F., Deesomsak, R., & Wang, J. (2014). Political uncertainty and stock market volatility in the Middle East and North African (MENA) countries. Journal of International Financial Markets, Institutions and Money, 28, 1-19.

Dewandaru, G., Masih, R., & Masih, A. M. M. (2015). Why is no financial crisis a dress rehearsal for the next? Exploring contagious heterogeneities across major Asian stock markets. Physica A: Statistical Mechanics and its Applications, 419, 241-259.

Dewandaru, G., Rizvi, S. A. R., Masih, R., Masih, M., & Alhabshi, S. O. (2014). Stock market co-movements: Islamic versus conventional equity indices with multi-timescales analysis. Economic Systems, 38(4), 553-571.

Gençay, R., Selçuk, F., & Whitcher, B. (2001). Differentiating intraday seasonalities through wavelet multi-scaling. Physica A: Statistical Mechanics and its Applications, 289(3), 543-556.

Kabir,SH, Masih, AMM, & Bacha,O.I, , 'Are Islamic equities Immune to Global Financial Turmoil ?An Investigation of the Time Varying Correlation and Volatility of Islamic Equity Returns', Australian Journal of Basic and Applied Sciences, Vol. 7, No. 7, 686-701.

Karim,BA & Majid,MS 2010, 'Does trade matter for stock market integration' ,Studies in Economics and Finance, Vol. 27 No.1 2010, 47-66.

Khan, T. A. (2011). Cointegration of international stock markets: An investigation of diversification opportunities. Undergraduate Economic Review, 8(1), 7.

Lanza, A., Manera, M., & McAleer, M. (2006). Modeling dynamic conditional correlations in WTI oil forward and futures returns. Finance Research Letters, 3(2), 114-132.

Lebo, M. J., & Box-Steffensmeier, J. M. (2008). Dynamic conditional correlations in political science. American Journal of Political Science, 52(3), 688-704.

Madaleno, M., & Pinho, C. (2010). Relationship of the multiscale variability on world indices. Revista De EconomiaFinanciera, 20, 69-92.

Najeeb, S. F., Bacha, O., & Masih, M. (2015). Does Heterogeneity in Investment Horizons Affect Portfolio Diversification? Some Insights Using M-GARCH-DCC and Wavelet Correlation Analysis. Emerging Markets Finance and Trade, (ahead-of-print), 1-21.

Pesaran, M. H., & Timmermann, A. (1995). Predictability of stock returns: Robustness and economic significance. The Journal of Finance, 50(4), 1201-1228.

Saiti, B., Bacha, O. I., & Masih, M. (2014). The diversification benefits from Islamic investment during the financial turmoil: The case for the US-based equity investors. Borsa Istanbul Review, 14(4), 196-211.

Tse, Y. K., & Tsui, A. K. C. (2002). A multivariate generalized autoregressive conditional heteroscedasticity model with time-varying correlations. Journal of Business & Economic Statistics, 20(3), 351-362.

You, L., & Daigler, R. T. (2010). Is international diversification really beneficial?. Journal of Banking & Finance, 34(1), 163-173.