Contagion between World and Emerging Islamic Equity Markets: An Application of Clayton Copula Technique

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Abstract

The aim of this study is to examine the contagion between the world Islamic equity market and selected emerging Islamic equity markets including Bahrain, Bangladesh, Egypt, Indonesia, Malaysia, Pakistan, Qatar, Saudi Arabia, Turkey and UAE. We applied Clayton Copula technique using daily MSCI Islamic indices data from 1st September 2010 to 30th September 2017. The results confirm the existence of contagion between MSCI's world Islamic equity market and the selected ten Emerging Islamic Equity Markets during the period of study. Past academic discourse is mainly focused on examining the connectivity between conventional and Islamic or developed and underdeveloped markets, whereas, this study focuses on investigating transmission of spillovers from the world Islamic equity market to ten emerging Islamic equity markets. Clayton Copula has been used in this context for the first time.

*Keywords***:** Contagion, Volatility Spillover, Archimedean Copula, Islamic Equity Market

JEL Classification Codes: E44, G15 & G32.

Introduction

Different studies have been carried out to study the phenomena of mean and volatility spillover between money, commodity and equity markets. There are also a plenty of studies (Jawadi, Jawadi & Louhichi, 2014; Khan & Khan, 2018; Nagayev, Disli, Inghelbrecht & Ng, 2016; Shahzad et al., 2017; Shahzad, Ferrer, Bellester & Umar, 2017; Rajeb & Arfoui, 2019) on the connectivity of conventional and Islamic equity markets but there are only a few studies such as Majdoub and Mansour (2014) on the integration between world Islamic equity market to emerging Islamic equity markets though with a narrow focus and regional coverage.

Moreover, the econometric techniques based on normality of data cannot be relied upon when the underlying assumption of normal Gaussian distribution are not met as it become difficult to make inferences then. Copula models provide a possibility to cope with the issue of asymmetry and fat tails hence are gaining popularity. It is therefore imperative to fully explore the integration between world Islamic equity stock markets and the emerging equity stock markets in an exhaustive manner using modern econometric methodologies that enable researchers overcome the limitations associated with the old methodologies and to paint a greater picture of Islamic equity markets in a single study including often ignored Islamic equity markets.

The aim of this study is therefore to examine the contagion between the world Islamic equity market and a wider canvas of emerging Islamic equity markets based on Clayton Copula technique. This would have twofold purposes i.e., enable to make valid inferences in case the data is not normal and also to generalize the findings keeping in mind major emerging equity markets have been examined.

According to Bala and Takimoto (2017), scholars attribute the inability of the old econometric models to examine asymmetry and fat tails as the main cause of global financial crisis of 2007. Post global financial crisis, researchers introduced different models, such as construction of spillover index by Diebold and Yilmaz (2009) which was later enhanced by Greenwood-Nimmo (2016), on which we can study different types of risks typical to connected markets.

The perception of safer financial securities is gradually taking root (Alqahtani & Mayes, 2018; Cerovi´c, Nikolaj, and Maradin, 2017) as the global financial crisis has exposed the flaws in having synthetic securities ignoring the principle of asset-backing hence there has been growing concern to study Islamic equity markets in comparison to conventional stock markets to examine if the added safety features are sufficient to mitigate risks and ensure steady returns.

The phenomenon of globalization has played its due part in the correlation of risk between countries, global markets and stock market performance. A strong trend in one market is reflected in another market, which is called financial contagion.

According to Fleming, Kirby and Ostdiek (1998), not only information flows from one market to another but also the cross-market hedging would result in information spillovers. This not only changes the expectations of the investors but also strengthens the linkages amongst the markets especially during crisis (Akca & Ozturk, 2016).

Following the financial crisis of 2008 and the financial contagion as a result, investors have renewed their interest in emerging markets (Kocaarslan, Sari, & Soytas, 2017).

The market integration leads to spillovers and reduces possibilities of mitigating risks through diversification. According to Hedtrom, Zalander, Junttila and Uddin (2019) spillovers from emerging markets to the developed markets is lower but it is high at regional level opening a window for

diversification. Moreover, the impact of a financial shock which starts from the mature markets of developed countries loses its relative intensity till it reaches the emerging markets.

This market integration and market contagion play an important role in shaping the economies around the world whether developed or emerging. Lately, the researchers have focused on investigating the impact of volatility spillover effects during stable and turbulent times and how long a spillover effect remains once initial impulse causes volatility from one market to another. The impact of volatility can be harmful for the markets as the phenomenon of market contagion implies (Kenourgios, Samitas, & Paltalidis, 2011).

If shocks in markets are transferred from one market to another then it implies that there would be instances where investments are made with the perspective of diversification and hedging against risk but, due to integration the benefits of risk minimization are not fully realized (Majdoub & Mansour, 2014; Majdoub & Sassi, 2017). Hence this study is intended to be helpful for investors in taking advantage of diversification giving due consideration to the possibility of integration.

In this study market contagion between the World Islamic equity market and selected Emerging Islamic equity markets will be examined by application of an Archimedean copula technique called Clayton copula. In order to do so, Morgan Stanley Capital International's (MSCI) Islamic equity index for world and emerging markets i.e., from the entire emerging Islamic equity market spectrum a sample of selected countries including Islamic stock market indices representing Bahrain, Bangladesh, Egypt, Indonesia, Malaysia, Pakistan, Qatar, Saudia Arabia, Turkey and UAE are explored to carry-out the empirical study in a comprehensive manner.

The Islamic equity index of MSCI is used for analysis as this index is devised following stringent Shariah-based (Islamic law) criteria. Inclusion or exclusion of a company in the index is dependent on the nature of business and its capital structure (MSCI, 2017). For instance, companies directly realizing revenues from products or services that are prohibited as per Islamic law are not included in the index. These products or services include utilization of alcohol, tobacco, pork, weapons, gambling and adult entertainment etc. Furthermore, businesses deriving significant amount of revenues while relying on excessive leverage are also not included in the index.

Conceptually, it can be assumed that since the Shariah compliant markets avoid leverage and strictly adhere to the asset-backing rule, so probability of having market contagion from a market which depends heavily on leverage are remote, but this needs to be validated with the help of strong empirical evidence.

The rest of the paper is organized as follows: Section 2 summarizes a review of relevant previous literature. Research Methodology is described in Section 3 followed by Results and Discussion, Conclusion, Recommendations and Future Research Directions are presented in Sections 4 to 7 respectively.

Literature Review

World Bank introduced the term emerging markets for the first time (Agtmael, 1980), but this term gained popularity in mid 1990s. It refers to markets or economies in the process of rapid growth and industrialization with respect to social and business activities.

Due to fast growth rate and improving performance; emerging markets are a good investment option for diversification purposes. On the other hand this fast growth rate indicates a high level of riskiness associated with the investments in these markets as they carry additional risk linked to politics, economy and currency (Guégan, Bertrand, & Zhao, 2014).

Substantial diversification advantage of emerging market assists the investors to gain more while their links to global markets tends to be specific to countries depending upon the heterogeneity amongst the markets with respect to their market size and investment. This integration between global and emerging markets can be beneficial or contagion.

The field of Islamic Finance has opened a relatively new and innovative form of investment in the form of Islamic hedge funds and notably Sukuks (Majdoub & Sassi, 2016). Islamic finance is governed by restricted rules and Shariah (Islamic) law. This mode is free of interest and investment cannot be done in businesses which are prohibited in Islam.

What is allowed and what is prohibited in Islamic finance do affect the behavior and investment decisions of the investors which in turn influence the whole market. Previous studies have shown that there is considerable difference in conventional and Islamic equity markets with respect to their products and rules (El Alaoui, Dewandaru, Rosly, & Masih, 2015; Hammoudeh, Mensi, Reboredo & Nguyen, 2014; Mansour, Khoutem & Majdoub, 2015).

The conventional and Islamic equity markets may be different in terms of products, but still global Islamic equity market index is influenced by conventional equity market indices. Global Islamic equity index measured through Dow Jones Islamic Market Index exhibit great dependence on three major global conventional equity market indices i.e. Asia, Europe and United States moreover they are also influenced by the oil prices and stock markets (Hammoudeh, Mensi, Robredo & Nguyen, 2014). This clearly indicates the fact that current manifestation of Islamic Shariah principles is not sufficient to make the Islamic equity index different from conventional indices.

Islamic markets also received the setback from financial crisis 2008, but the impact was less significant as compared to conventional indices in Europe, US and the rest of the world (Jawadi, Jawadi, & Louhichi, 2014). In another study (Majdoub & Mansour, 2014) identified low integration among the selected Islamic market and the US conventional market. Moreover, the Islamic market within US is less exposed to shocks originated in the region (Rizvi, Arshad, & Alam, 2015).

Significant spillover effect was identified in another study between developed and selected emerging countries in Asia, Middle East, and North Africa region, showing the dominance of US shocks across all emerging markets (Balli, Balli, Louis, & Vo, 2015).

According to Bala and Takimoto (2017), scholars attribute the inability of the old econometric models to examine asymmetry and fat tails as the main cause of global financial crisis of 2007 as mostly the Gaussian models were used back then and when the underlying assumptions of normality are not present in the distribution it is not possible to draw inferences. Copula models provide a possibility to cope with these issues of asymmetry and fat tails, and hence are gaining popularity.

Copulas are functions that combine one-dimensional distribution functions together to form multivariate distribution functions (Sklar, 1959). Copulas provide a solution to deal with the problems of non-linear and non-elliptical data. Copulas enable researchers to explore multivariate dimensions providing a way to apply holistic approach towards considering all the risks in a go. Interestingly, in the field of financial economics we find only a few applications of Copulas before 1990s when statisticians started to pay attention to them. Before this, we only had applications of copulas in the field of mathematics (Xiao & Dhesi, 2009).

There are many studies that indicate that Archimedean copulas including Clayton and Gumbi Copulas perform better than elliptical copulas in terms of model to data fit (Melchiori et al., 2003; Chen et al., 2007, Koziol-Kunisch, 2005) hence Clayton Copula has been used in this study.

Embrechts, McNeil and Straumann (1999) and Embrechts, Lindskog and McNeil (2001) pioneered dependence modelling with copulas in the context of risk management mainly to counter a situation when the underlying assumptions of normality are not met. Jondeau and Rockinger (2006) showed how dynamism can be incorporated to analysis with the help of Copula-GARCH models. These studies can be attributed to bridging the gap between Copulas solutions and financial risk management and analysis.

Yang and Hamori (2013) used GARCH-Copula analysis to investigate the dependence structures among stock markets of developed and emerging economies and found that the emerging markets were sensitive to outside negative news and also discovered contagion between developed and emerging markets during crisis period.

Guo and Wang (2016) adopted the time-varying and static copulas to examine the dependence structures in volatility between Shanghai and Shenzhen stock markets in China based on high frequency data and identified asymmetrical dependence structure in stock market volatility. Further they noted that Gumbel copula best fitted the data distribution.

Working on the same lines, Usman, Jibran, Amir-ud-Din and Akhter (2018) also investigated the decoupling hypothesis of Islamic stocks applying Copula CoVaR approach and shown evidence consistent with decoupling hypothesis of Islamic stocks. The results also suggested that asymmetry of

downside and upside risks are not equal hence concluding that it is possible to decrease risk by adding Islamic stocks to the investment portfolio.

Using GAS-based dynamic Gaussian Copula, Yang, Ma and Hamori (2018) examined the dependence between government securities markets in Central and Eastern European countries across different maturities and found high dependence of government securities markets on long maturities and low dependence on short maturities.

While applying Vector Autoregressive (VAR)-Structural Vector Autoregressive (SVAR) Granger Causality and Student's-t Copula methodologies, Huynh (2019) studied spillover effects among cryptocurrency markets and found that Ethereum was likely to be an independent coin whereas Bitcoin was recipient of spillover effect.

Research Methodology

A market index depicts the overall sentiment of the market. Daily MCSI Share World and Emerging Markets index prices from 1st September 2010 to 21st September 2017 were used covering all the emerging equity markets separately, the emerging markets composite index and the overall world equity market index. The countries are selected keeping in view reforms implemented to implement and promote Islamic financial systems.

The period 2010 to 2017 has been selected as during this period reforms were introduced for not only recovering from the global financial crisis 2007 but also to make financial markets comply with more prudent and stringent policy regimes to avoid the occurrence of same like situation in future and most importantly focus on Islamic financial systems further increased.

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Descriptive statistics are used to examine the characteristics of time series data for the World, Emerging market composite and each of the Emerging Islamic equity indices.

For time-series analysis, it was ensured that data series have matching dates for valid comparison. Daily returns were calculated using the following formula:

Index Daily Return = $Ln(P_t/P_{t-1})$

Based on Sklar (1959) theorem, a copula is a function that combines a multivariate distribution function to univariate marginal distribution function. Interestingly, only by late 1990s those copulas were applied to finance to highlight market, capital and operational risks. It becomes difficult to draw inferences when the underlying assumptions of normal distribution are not satisfied. In that case copula provides a solution to researchers to confidently interpret results.

Assuming continuous distributions where F is the joint cumulative distribution function of the random vector $X = (X,Y)$ and F_x and F_Y are the marginal cumulative distribution functions of *X* and *Y*. In mathematical terms, the same can be represented as under:

$$C(u,v) = F\{F^{-1}_x(x), F^{-1}_Y(y)\} \qquad (1)$$

It is important to note that *X* and *Y* need not necessarily to have the same distribution, and the joint distribution may differ again i.e., a normally distributed variable can be linked to an exponentially distributed variable can be linked through a bivariate gamma function.

There are different classes of copulas used in the field of finance particularly Gaussian and Archemedian copulas are popular due to their ease of use. Three Archemedian copulas commonly used are Clayton, Frank and Gumbel. In this study Clayton copula has been used which is constructed using the following function:
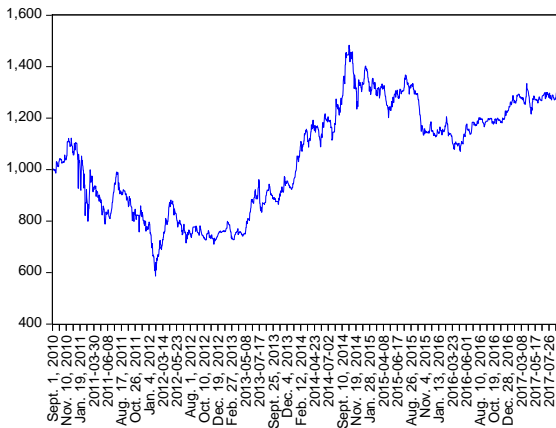
$$C_\alpha(u,v) = max([u^{-\alpha} + v^{-\alpha} - 1]^{-1/\alpha}, 0) \qquad (2)$$
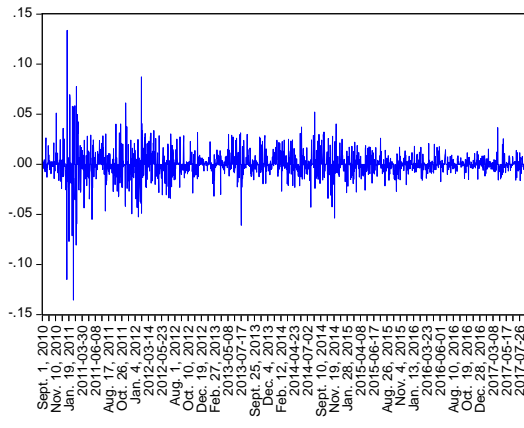
Results & Discussion

Before carrying on with tests and analysis, it is imperative to study the characteristics of data. Therefore, Islamic equity market indices and their corresponding return series are given below:
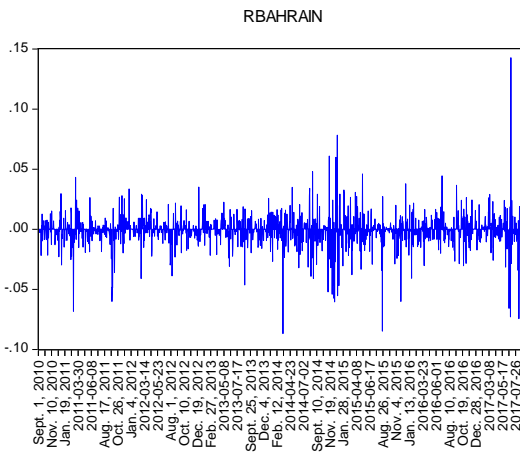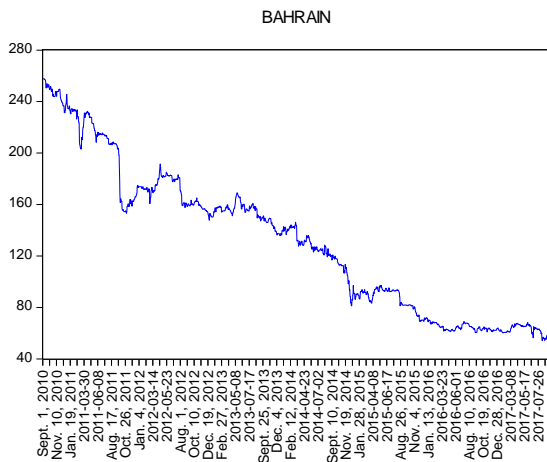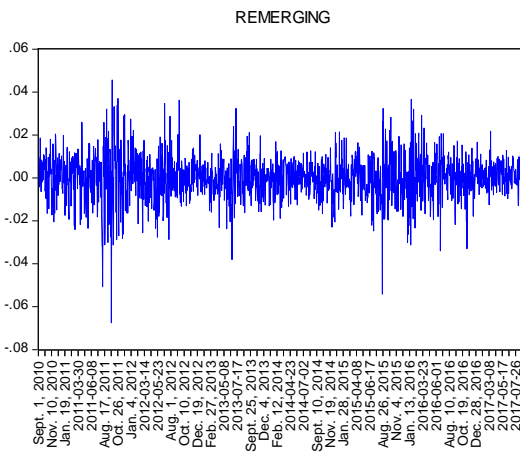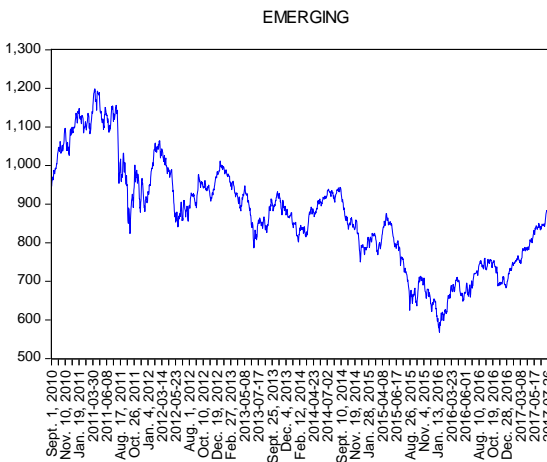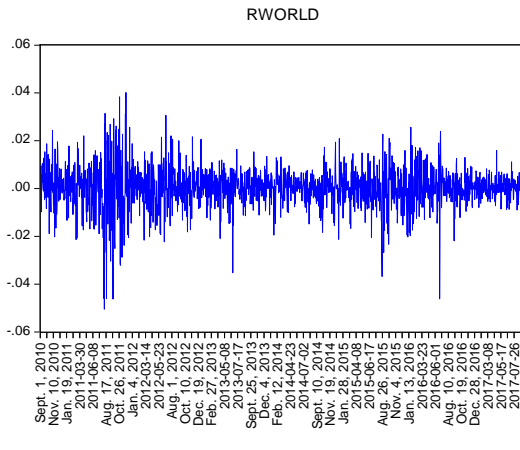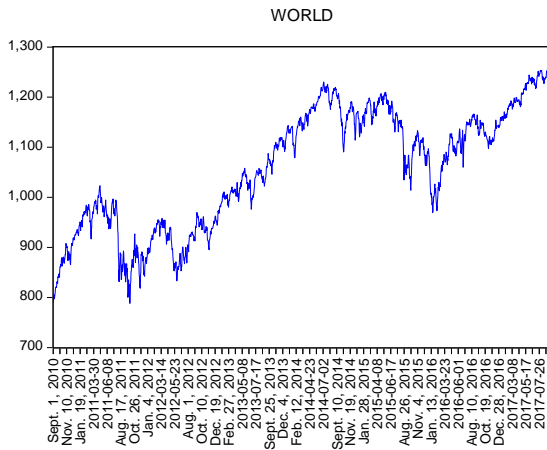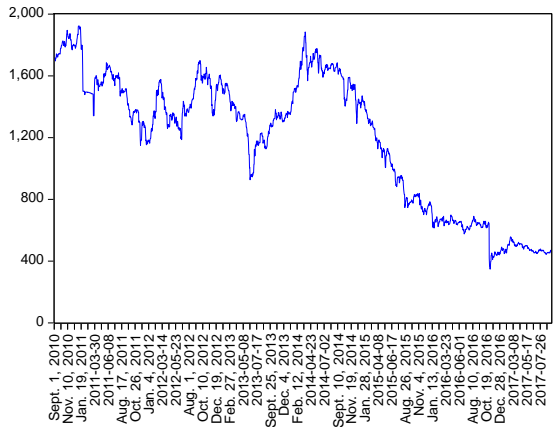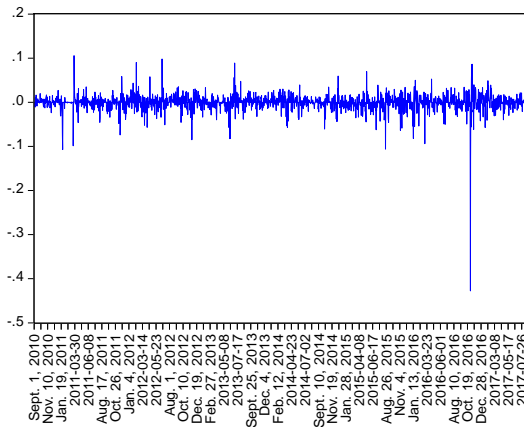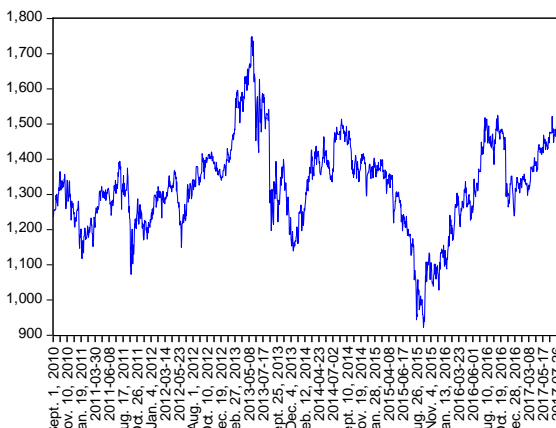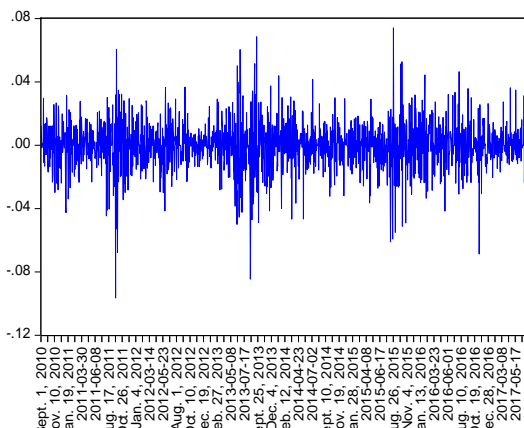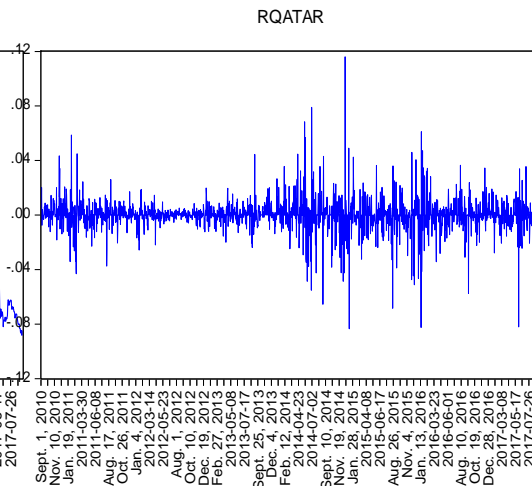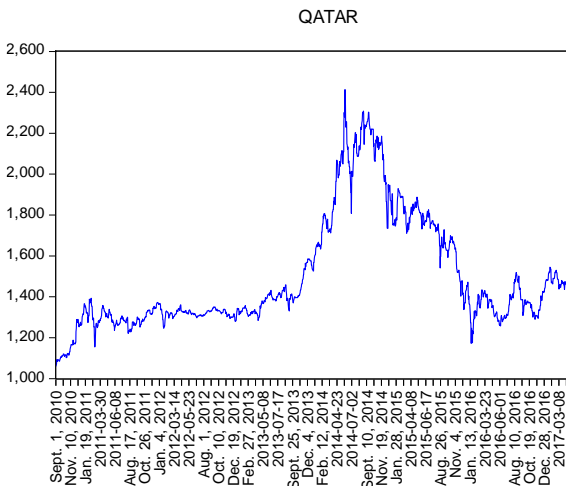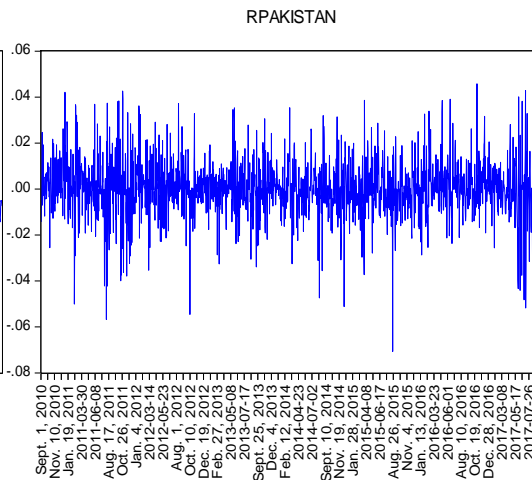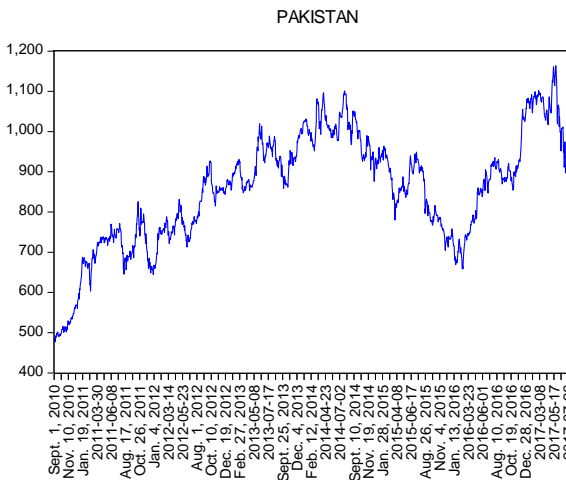
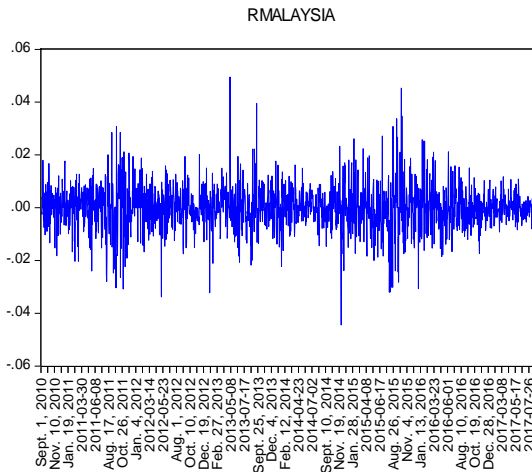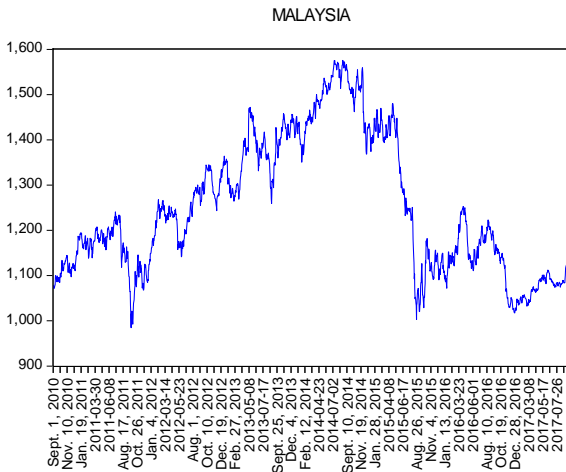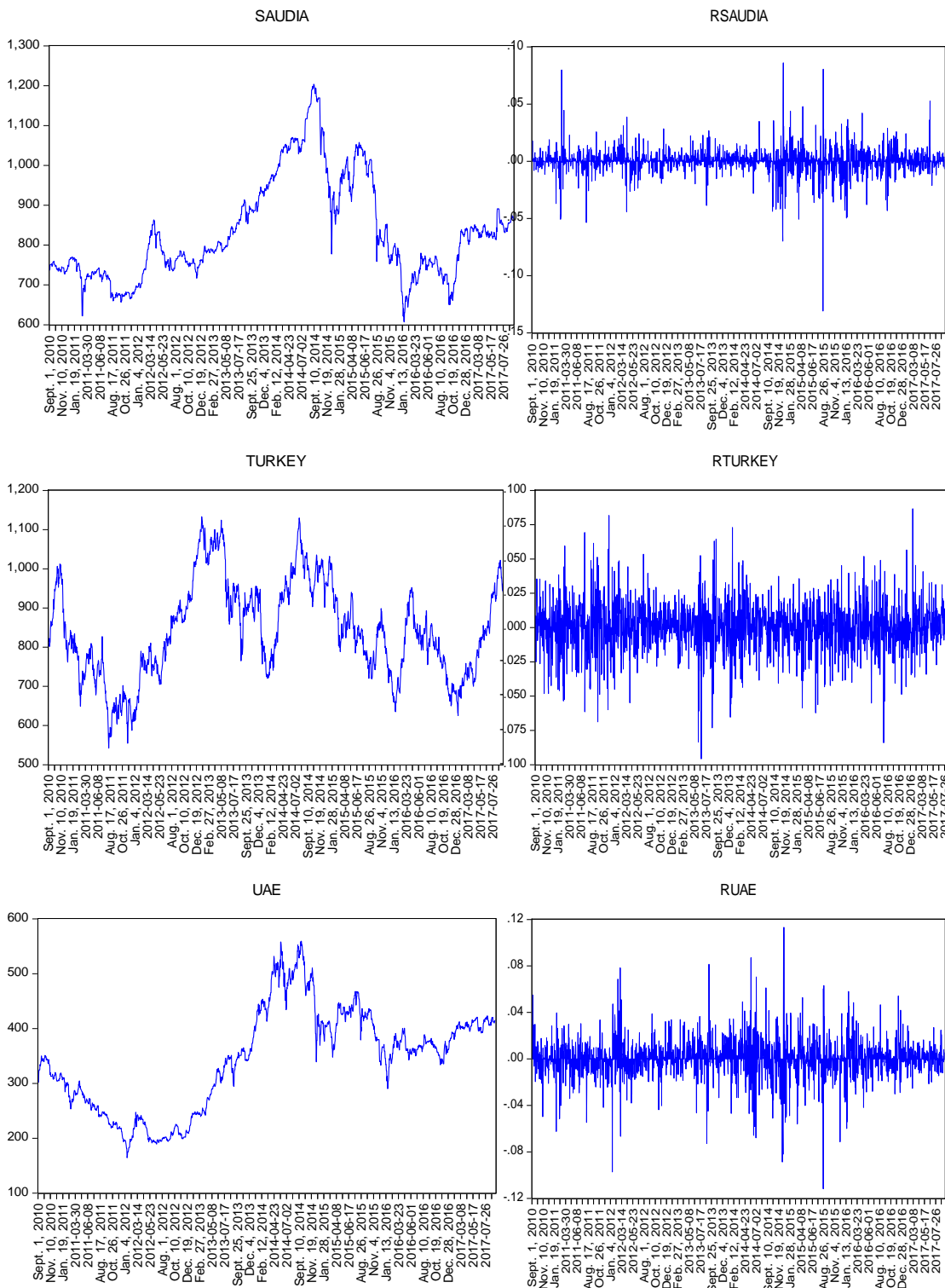**Figure-1: Plot of Islamic Equity Indices & Corresponding Return Series**

We can see that all the indices depict a trend and the return chart shows that in all the cases small shocks are followed by small shocks and bigger shocks are followed by bigger shocks. There are abnormal returns but no outliers in the return series.

For all the indices, statistics depicting their daily mean return, standard deviation of returns from their mean, maximum and minimum daily returns, kurtosis and skewness of the return distributions are given below:

**Table-1: Descriptive Statistics – 2010 to 2017**

Description	Mean	St. Dev	Kurtosis	Skewness	Min	Max	CoVar
World	0.000265	0.008313	7.481463	-0.515019	-0.050465	0.040220	0.0318
Emerging	-4.89E-06	0.009838	6.160623	-0.338878	-0.067478	0.045670	-0.0005
Bahrain	-0.000833	0.011985	23.73983	-0.068017	-0.086853	0.142781	-0.0695
Bangladesh	0.000165	0.013734	20.67253	-0.186333	-0.135503	0.133825	0.0120
Egypt	-0.000710	0.019848	123.4617	-5.875652	-0.427743	0.105743	-0.0357
Indonesia	0.000103	0.014773	6.853458	-0.405949	-0.096472	0.074087	0.0069
Malaysia	1.71E-05	0.008449	6.086948	0.039463	-0.044394	0.049517	0.0020
Pakistan	0.000281	0.012343	5.797997	-0.238825	-0.070683	0.045802	0.0022
Qatar	7.76E-05	0.012083	16.65797	0.006547	-0.083467	0.116056	0.0006
Saudi	8.46E-05	0.011011	23.57703	-0.893447	-0.131000	0.085967	0.0076
Turkey	7.75E-0.5	0.018102	5.470625	-0.204836	-0.095758	0.086670	0.0042
UAE	0.000173	0.016300	10.98159	-0.096976	-0.111817	0.113208	0.0106

The above table shows that the mean returns of Emerging and Egyptian equity markets are negative whereas for the rest of indices the mean returns are positive. Egypt has the highest standard deviation of 0.019848, which indicates that Egyptian stock market is comparatively volatile. Least volatile are the Islamic World and Malaysian stock markets. Except for the Malaysian and Qatari market return distributions, rest of the distributions are negatively skewed indicating large negative returns. The values of kurtosis in all cases are greater than 3 indicating that the distributions of returns are leptokurtic in orientation. The value of Covariance in each case is less than 0.100 which shows the data is varying. This justifies the use of Copula Modelling to cope with the problem of variation in data.
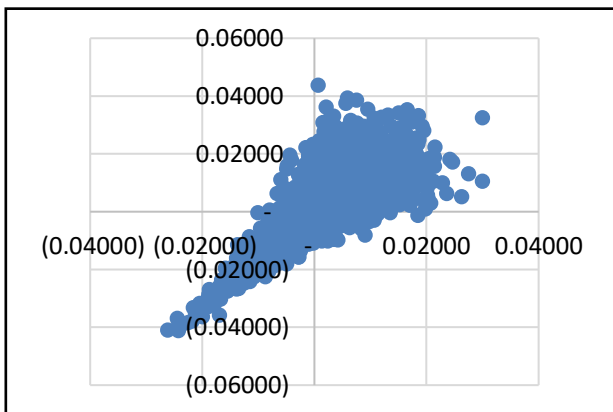
Using the Clayton copula models the relationship between world and the emerging Islamic stock markets is depicted below in Figure-2:
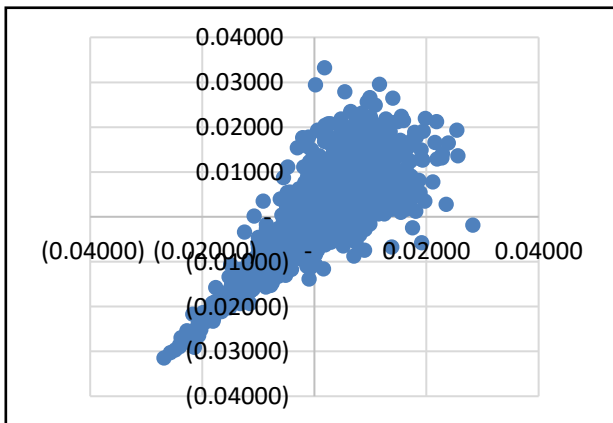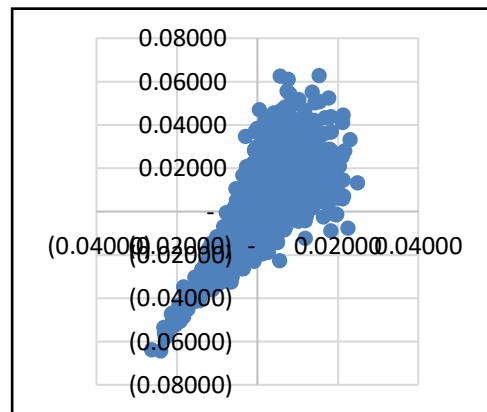
Contagion from World to Emerging
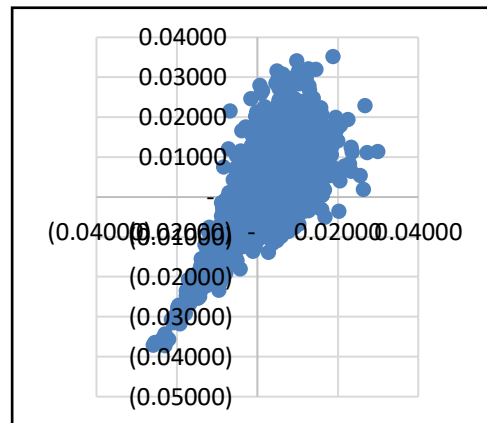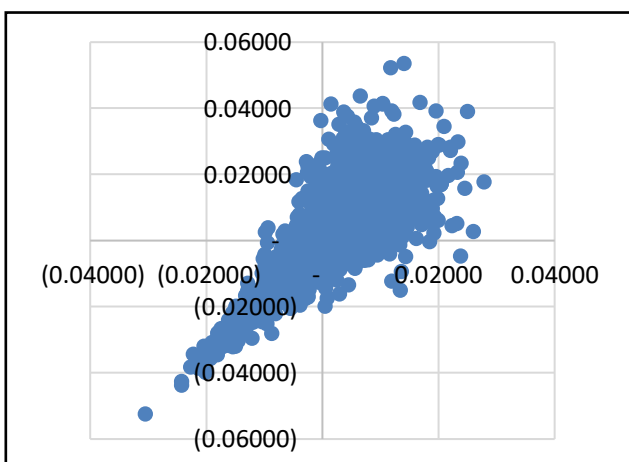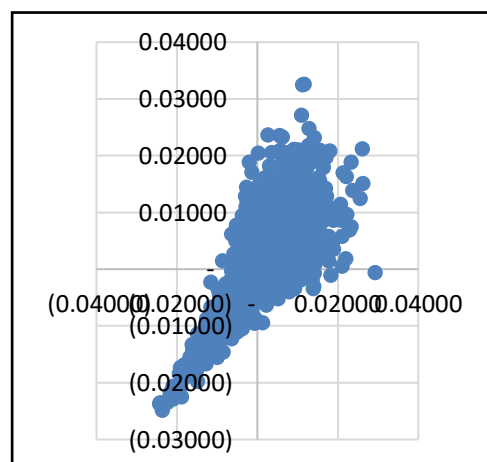

Contagion from World to Bahrain

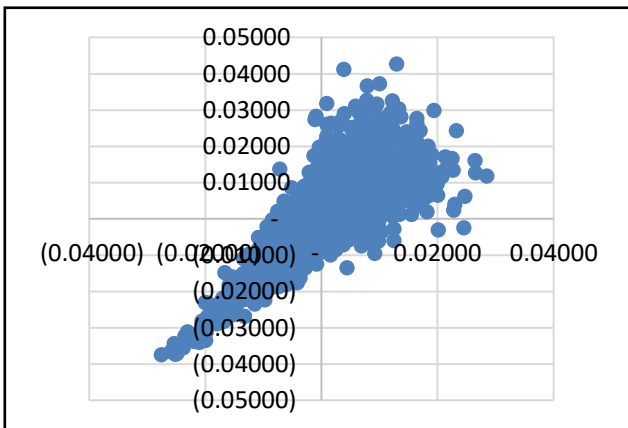Contagion from World to Bangladesh

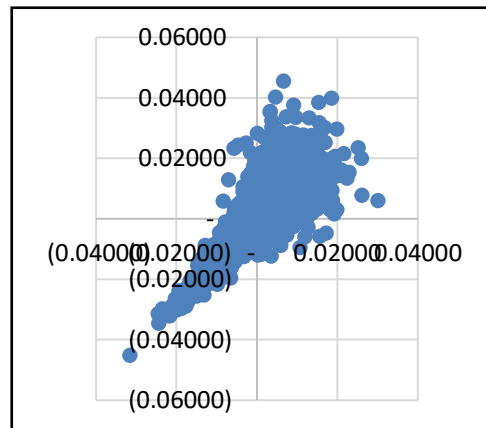Contagion from World to Egypt

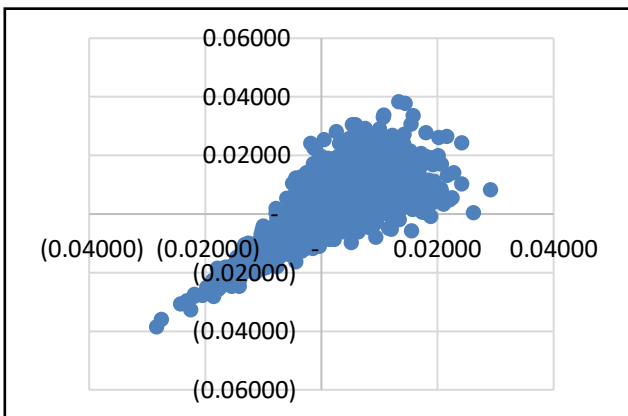

Contagion from World to Indonesia
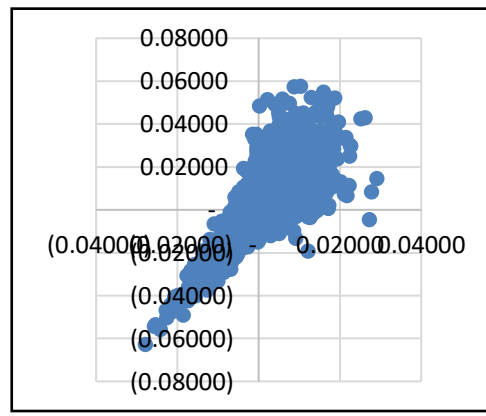

Contagion from World to Malaysia
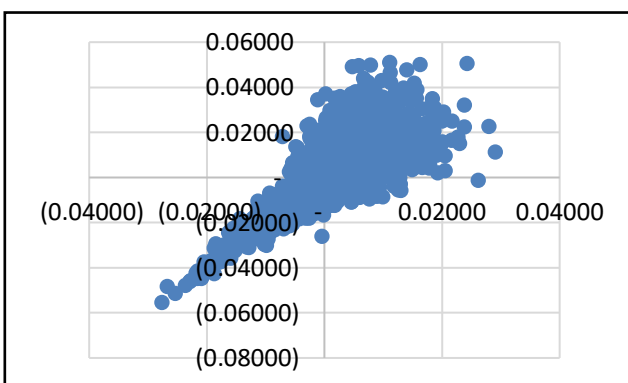
Contagion from World to Pakistan

Contagion from World to Qatar

Contagion from World to Saudi Arabia

Contagion from World to Turkey

Contagion from World to Turkey

Figure-2: Copula Diagrams

Copula technique has enabled us to examine the contagion from world Islamic equity market to emerging Islamic equity market using the MSCI. The emerging Islamic countries selected for the study are Bahrain, Bangladesh, Egypt, Indonesia, Malaysia, Pakistan, Qatar, Saudia, Turkey and UAE.

The results clearly exhibit that there is a contagion between world and emerging Islamic equity markets. In all the above cases for each emerging country, there is a state of lower tail dependency. This indicates that there are strong chances of transmission of shocks from world to emerging Islamic equity markets. Previous studies have also shown that increased tail dependency is an important factor for contagion between two markets (Rajwani & Kumar, 2019).

It is also evident that there is lower tail dependency in all the cases; hence it would be dicey to test dependence of one series under the auspices of normal distribution. The results clearly show that copula framework is more insightful to examine dependence in the context of volatility spillover. The distributions are compact with data points tightly dispersed which confirms contagion between the world and emerging Islamic equity markets.

The results are in line with the findings of studies that are carried out to examine volatility spillover from conventional to Islamic equity indices such as Shahzad, Ferrer, Bellester and Umar (2017), Hammoudeh, Mensi, Robredo and Nguyen (2014) and Dewandaru, Bach, Masih and Masih (2015) etc.

Conclusion and Recommendations

The aim of this study was to investigate contagion between World Islamic equity market and emerging Islamic equity markets. The results reveal that there is integration between World Islamic equity market and the Emerging Islamic equity markets. This indicates for the need to revisit the basis for Shariah screening and improve the criteria on which these indices are constructed.

As evident from the results of this study there is a contagion between world Islamic equity market and emerging Islamic equity markets and also different other studies the Islamic equity markets are still prone to risks and there are also questions regarding stability of Islamic indices during the times of crisis. Hence it is imperative to revise the criteria on which these indices are constructed. It would not be possible to consider Islamic indices safer for investment if they exhibit the same characteristics that of conventional indices both during stable and volatile periods. The Shariah screening mechanisms need to be tighten across the globe and there should be more transparency and uniformity in this regard.

It is important to realize that Islamic indices are going through infancy stage and it would take time for them to take a mature shape. Another factor is the intent of the management as mostly stocks included in Islamic indices belong to companies where there is no deliberate attempt to follow Islamic principles in operations. Only the companies which declare their resolve to follow Islamic principles in day to day affairs need to be included in the Islamic indices. Moreover, Islamic governments and

their regulatory bodies may apply a holistic international approach towards developing national regulations and standards to make Islamic equity markets depict the true spirit of Islamic finance.

Future Research Directions

There are different regulatory frameworks for implementation of Islamic finance and banking in different countries. Notably, the systems and practices in Malaysia, Indonesia, Qatar and Egypt are comparatively at advanced stage. Interpretations of Islamic Shariah and financial systems differ in many countries hence there is a need for collecting primary data through structured and unstructured questions. In this regard, a pragmatic research paradigm would reveal more insights particularly if findings from secondary data are substantiated and supported by using primary data. There is a need to develop a scale for measurement. Apart from copula the spillover effects can also be examined through wavelets and other modern econometric tools.

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