



Sanctuary in the Midst of Crisis? A Look into Shariah Indices using Multivariate GARCH DCC

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Abstract: Islamic Finance has evolved over the past few decades, and stands at over a trillion dollars today. At the foundations of Islamic finance lay the concept of risk sharing, and the purest forms of it in the modern day finance is equity investments. The evidence of Islamic investors pursuing equity investments in reality is thin. Multitude of reasons are attributed to this low participation, mainly revolving around lack of empirical proof of Islamic investments being a reliable and steady return alternative. This study is an attempt to study the volatilities and correlations with the conventional global equity indices utilizing Multivariate GARCH Dynamic Conditional Correlations (MGARCH DCC) method. The findings provide an interesting angle to our study, where there is a significant downwards trend in the correlations during the crisis era. This provides substance to the argument that Islamic investors would experience lesser downside in economic crisis. This study further dwells into the linkage of Islamic indices with global financial indices to study if financial sector exclusion from Islamic indices benefits the investors. The findings are positive, with lower correlations and that to reducing in the recent global crisis. Islamic finance's core philosophy is equity based investments and this study is a humble attempt to empirically substantiate its benefits.

Keywords: Islamic Equity Market, Global Crisis, Multivariate GARCH Dynamic Conditional Correlations, Equity Investments.

Introduction

Islamic finance in its nascent state has returned impressive growth numbers in the past decade. The threat of global recession and practically a credit freeze in US during the peak of crisis in 2008 began the search for an alternative-financing structure has brought Islamic finance under the spotlight. With the spotlight, comes critics who have highlighted the absence of in-depth literature and research in the areas of equity based Islamic financing.

Amongst the Islamic scholars, it is a generally accepted theory that Risk Sharing mechanism forms the crux of the theory of Islamic financial theory which is translated into the classical *shariah* compliant instruments of *mudarabah* and *musharakah*. (Mirakhor, 2007; Ayub, 2007; Krichener, Askari, Iqbal & Mirakhor, 2011). Unfortunately with all the depth of theory and historical evidence of equity instruments in Islamic financial history, the application of equity based financing lags by huge gap in the modern day, a three decade old Islamic financial system. In the banking system equity financing on the asset side is negligible.

The conventional financial system boasts of a well regulated and managed equity markets, contributing immensely towards the real sector growth. Majority of schools of laws in Islam are in agreement over the conventional equities framework to be compliant to Islamic norms and relate modern day corporation ownership structure to the principle of *mudarabah* and *musharakah*. For a company to be “fully” *shariah* compliant it should neither receive nor pay any kind of interest. In a financial system which is predominantly conventional interest based is rare to find. Owing to this dilemma majority Islamic jurists have developed a consensus over some tolerance and this has led to development of *shariah* stock screening criteria.¹

The exposure and penetration of *shariah* compliant investments in the equity markets has gained pace in the last few years, but compared to over a trillion dollars in Islamic financial instruments in the world, only a small fraction of it lies in Islamic equity funds and equity market investments. A cursory glance at the performance of Islamic fund managers and performance of Islamic indices gives a surprising contrast. Where thou the Islamic funds have failed to outperform their counterparts in conventional and regularly underperformed, the Islamic indices have had more or less a similar return pattern compared to their conventional counterpart. But with changing financial landscape since 2007 with the financial crisis, a cursory glance shows us that the downturn faced by the Islamic indices was lesser than the global conventional indices.

The plausible reasons that can be attributed to these observations could be a few. Firstly since the universe of *shariah* compliant stocks is less, this can lead to selection bias while creating indices. Secondly, global conventional indices cover a lot of developing markets which comprise mainly firms in growth stage which tend to be more leveraged, screening them for *shariah* compliant investments. This leads to the Islamic indices constituent list being positively skewed to the US market which has high returns and stability much throughout the second half of 20th century and early 21st century. Thirdly, in specific to crisis era starting in 2007, the *shariah* screening criteria excludes financial organizations. It was the financial sector from where the crisis started and it was only the spillover effect to the real sector which has led to the recessionary phase. This paper delves into the third possibility by trying to analyze the dynamic correlations between the US conventional indices and financial indices with key Islamic indices.

In this particular research we try to take an approach using Dynamic Conditional Correlation (DCC) between indices to examine the shifts in correlations during the crisis. An innovation in econometric techniques, Multivariate Generalized Autoregressive Conditional Heteroskedasticity (MGARCH) DCC allows us to see the shifts in conditional correlations on a dynamic basis incorporating the evolving nature of volatilities, which is a more correct picture of the reality. In our opinion this is of utmost importance to understand how Islamic indices move with global benchmark equity indices in comparison with their conventional counterparts to explain if Islamic indices’ benchmarking would have provided diversification or a dampened effect of the crisis. This we believe in our humble opinion would further provide empirical evidence to the actual workability of Risk sharing investments in Islamic finance and provide substance to the arguments in favor of Islamic equity investments as a less risky avenue in crisis eras.

The following section of the paper will comprise the research objectives while also covering the motivation for the study. Section 3 will make an attempt to provide an overview of the available literature available in the area of Correlations and Indices performance of Islamic and Conventional equity market. It will also highlight in brief the literature that has contributed towards developing MGARCH DCC methods. Section 4 will briefly discuss the data and methodology of the research with focus on the econometric method used. Following that is the

¹ Stock Screening Criteria normally differs from jurisdiction to jurisdiction, But the similarities are between prohibition on companies whose primary business is unlawful under Islamic Law. Other screening filters like debt ratios and all are implemented as well.

empirical results and their interpretation in the views of the author. Section 6 of this paper will shed light on some key takeaways of this study and possible avenues of further research in this specific area followed by the limitations of this study.

Research Objective

Referring back to the cursory glance at the dampened hit Islamic indices had taken in the crisis and the three plausible explanations. The reasoning based on smaller universe and selection bias is a phenomenon, which is out of the control, since it is based on *shariah* screening criteria which are paramount to the Islamic financial theory. This study focuses on the other two plausible reasons taking a holistic view by studying the global Islamic indices while benchmarking with US focused conventional indices.

In this paper, we attempt to empirically analyze the shift in correlations between global conventional and Islamic indices to have a better understanding on the conditional correlations between the two. The authors aspire to contribute positively towards the mounting interest of Islamic finance as an alternative to conventional banking. With various opinions on the viability of Islamic finance in times of crisis, there comes a need for more empirical work, such as this, to support the notion that Islamic finance provides a safer investment substitute for investors. This area of Islamic indices has been an area, which has been neglected, in mainstream literature. Possibly no studies have been done using multivariate GARCH model to estimate Dynamic Conditional Correlations and variances at equity indices level in Islamic finance. These reasons motivate this study to focus on selected global Dow Jones Conventional and Islamic indices by applying Multivariate GARCH to estimate DCC to address the following questions.

The question that this study addresses is twofold and interdependent

- a) Is the relationship between Islamic indices static or dynamic with respect to market condition?
- b) If evidence supports the dynamic argument, does the financial exclusion protect Islamic indices from impact of financial crisis?

Literature Review

Despite the surge in Islamic financial assets, and expanding reach of Islamic financial institutions and instruments geographically over the past two decades the literature on Islamic stock markets is scarce. There have been efforts to study the performance of capital market related investment products at firm level. In the knowledge of author no study on dynamic correlations of global Islamic and conventional indices is available in mainstream literature.

M. Kabir Hassan (2002) in “Risk, Return and Volatility of Faith-Based Investing: The Case of Dow Jones Islamic Index” while investigating the market efficiency and relationship with risk return framework of Dow Jones Islamic Market Index (DJIM), found DJIM outperforming their conventional counterparts from 1996 to 2000 and underperforming them from 2001 to 2005. His study further finds reward to risk and diversification benefits to be similar for both the Islamic and conventional indexes.

In a further study, Hakim and Rashidian (2004) found no traces of correlation between DJIM and Wilshire 5000 index and three month treasury bill rates. This provided a unique phenomenon of violating the interdependence theory of financial markets. The Hakim and Rashidian concluded that the *shariah* screening criteria leaves the index with unique risk return features independent of broad equity markets. KA Hussain (2004) finds amongst his sample of FTSE indices that Islamic and conventional indices have a similar performance but also shows that Islamic index achieves abnormal returns and underperforms in bullish and bearish markets respectively. In a recent country specific study Beik and Wardhana (2010) find that Indonesian

Islamic capital markets has no correlations with its regional counterparts Malaysia and global financial hub US during the crisis era of 2006 to 2008.

In this study the dynamic conditional correlation is employed to assess our research objectives. Although this method is considerably new but it has been utilized in diverse fields of study. Lebo and Box-Steffensmeier, (2008) utilizes it in political science, Lanza et.(2006) for modeling correlations in forward and future markets for oil and Pesaran and Pesaran, (2007) has used this technique in multiple futures market.

Naoui, Liouane and Brahim (2010) have utilized DCC for analyzing the contagion issue arising out of 2008 crisis. Considering US as one of the six sample economies they find an amplified dynamic conditional correlation during the crisis.

Sources of Data and Underlying Model

For our analysis, we have chosen to measure the volatility of four global conventional indices and Islamic indices. All the data required is derived solely from Dow Jones Indices family to allow for a level of homogeneousness in conventional indices, in both the underlying universe of stocks and calculation of index pricing. The rule of homogeneity applies for Islamic indices as well, providing us with a consistent *shariah* screening methodology.

Daily returns of stocks from, January 1, 2001 to December 30, 2011 amounting to 2870 daily observations. The indices that have been used are as follows:

Table 1: Details of Indices Used in the Study

Conventional Indices				Islamic Indices			
DJWFS	Dow Jones Services	World Financial		DJIMUK	Dow Jones Islamic UK		
DJUSFS	Dow Jones US Financial Services			DJIW	Dow Jones Islamic World		
DJUS	Dow Jones US			DJIUS	Dow Jones Islamic US		
DJWEM	Dow Jones Markets	World Emerging		DJIWEM	Dow Jones Islamic World Emerging Markets		

Dow Jones US index has been taken as the proxy for primary benchmark for conventional indices. The reason for this is, firstly US as the largest equity market and the largest constituent of Dow Jones universe. Secondly since our motivation is to analyze the change in correlations during crisis periods, US based index would be a better benchmark owing to the financial and economic crisis originating from US and impacting it the most. For our second research question, we have taken the Dow Jones US Financial Services, as well as the Dow Jones World Financial Services, to be able to understand the impact of exclusion of conventional financial services from Islamic indices.

We begin our analysis with a perfunctory glance at the unconditional correlation coefficients to establish the basis of answering our research question. Both Islamic and conventional indices will be tested on both normal and T distribution to determine which is a better fit to our data set.

However, a more detailed observation of the conditional correlations is required in answering our research questions. Utilizing MGARCH DCC model, we observe and pinpoint the shifts in conditional correlation, allowing for a more accurate study. There are two stages in estimating DCC for time varying correlations. Firstly, univariate volatility is estimated using GARCH model for each variable. In the second stage, residuals from the first stage are then used as inputs for estimation of the time varying correlations matrix. To avoid going into a complex discussion, the details of the mathematical calculations and equations can be found in Pesaran and Pesaran (2009).

We also test for mean reversion of the volatilities. This is done by estimating $(1 - \lambda_1 + \lambda_2)$ where λ_1 and λ_2 are asset specific volatility parameters. A value of zero for our estimation indicates Integrated GARCH model which tells us that shock to variance is permanent and conditional variance is non-stationary.

Results

Descriptive Statistics

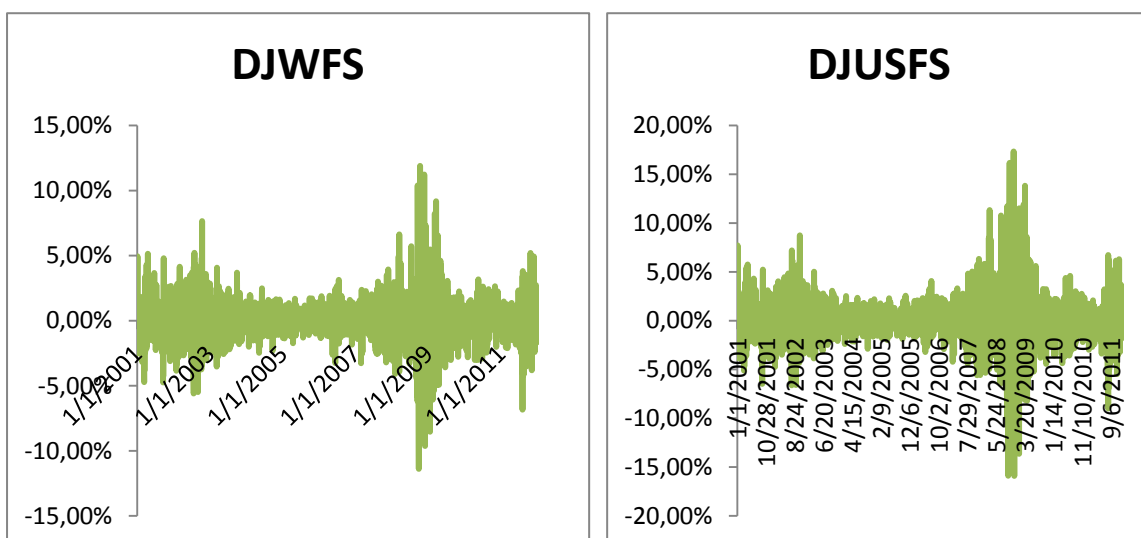
The descriptive statistics for the daily returns of the eight indices provides some interesting insights. The absolute time independent volatility of the returns, as represented by the standard deviations is relatively higher for the conventional indices as compared to Islamic ones. But the corresponding conventional and Islamic indices in the same category, World Emerging markets and US market are very closely similar although the Islamic indices show a lower mean return. At this point, the results seem similar to the aforementioned M. Kabir Hasan (2002) of Islamic indices underperforming.

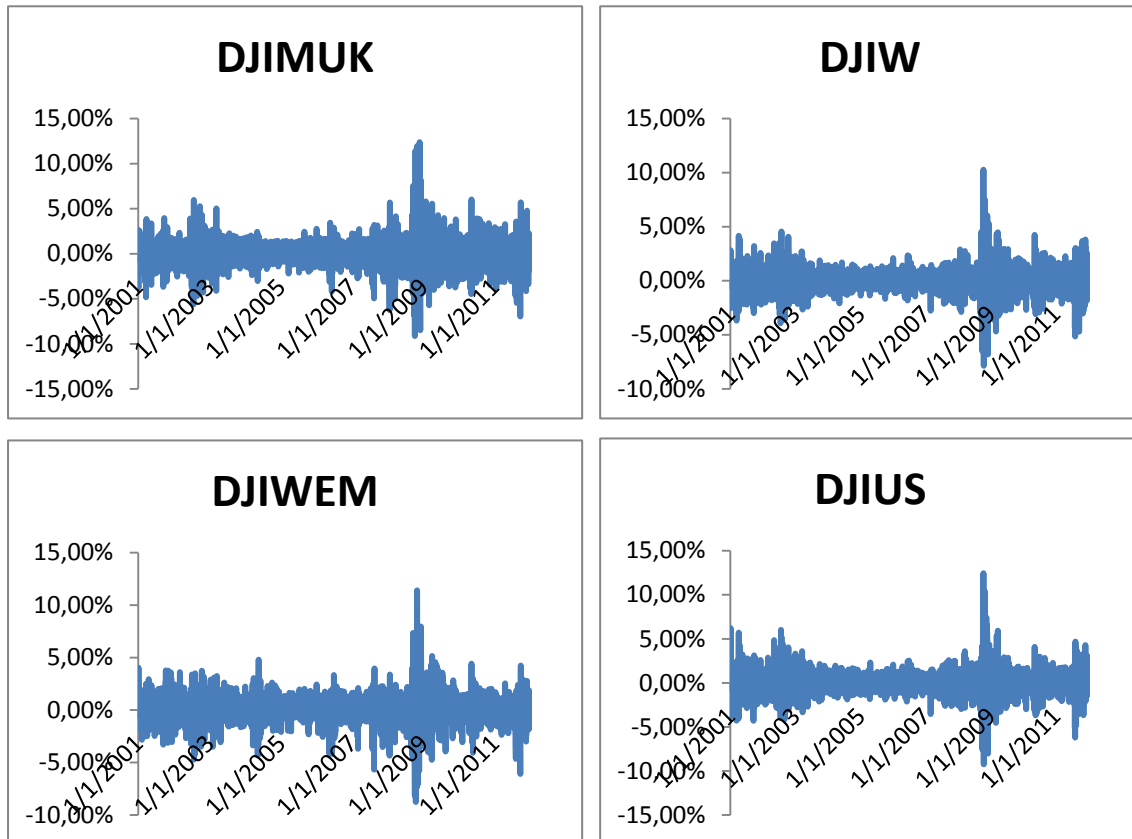
Table 2: Descriptive Statistics

	DJWFS	DJUSFS	DJWEM	DJUS	DJIUS	DJIWEM	DJIMUK	DJIW
Mean	0.0096%	-0.0043%	0.0435%	0.0119%	0.0109%	0.0285%	0.0128%	0.0089%
Std. Dev	0.015365	0.021690	0.013036	0.013637	0.013480	0.013519	0.015610	0.011411
Kurtosis	8.138618	9.938391	6.742846	7.489806	7.684444	5.756379	6.573120	7.293892
Skewness	0.154286	0.289763	(0.412002)	(0.035718)	0.158607	(0.236876)	0.086290	(0.142805)

Graphical representation of daily returns of the conventional and Islamic indices, provide a different perspective than the mere simple statistics table earlier. We notice that that all indices show a period of high volatility during the 2007 to 2009 period, which was the peak of the financial crisis and the returns tend to move towards normalization after that.

Chart 1: Graphs of Daily Returns of Conventional and Islamic Indices (2001-2011)





Graphical representation of daily returns of the conventional and Islamic indices, provide a different perspective than the mere simple statistics table earlier. We notice that that all indices show a period of high volatility during the 2007 to 2009 period, which was the peak of the financial crisis and the returns tend to move towards normalization after that. The interesting phenomenon which is observed at a cursory glance is in the corresponding conventional and Islamic indices for world emerging markets and the US market. With the analysis time period similar we observe that the volatility of returns spikes up at the same instance, but the width of the volatility period on the charts is smaller for the Islamic indices. This basically represents that the volatile periods amongst Islamic indices normalized quicker than their conventional counterparts.

Interestingly the volatile period of returns for Islamic UK markets is extended than any other indices in our sample. Also the index also shows variance in its returns in 2011, which is only observed in the conventional US and World Financial services indices. This may be attributed to the Euro zone crisis which has encompassed the financial sector in US and Europe mainly with Greece, and Italy and their counterpart heavily indebted to western banks. This second wave of financial crisis, seems to have relatively not affected the Islamic indices in the same magnitude, This observation provides weight to our second research question, that exclusion of institutions involved in interest based business, mainly banks, has provided Islamic equity indices has kept the them to some extent insulated from the recent crisis.

Unconditional Volatility and Unconditional Correlation

For our study we use a sample of 2870 observations from January 1, 2001 to December 30, 2011. In order to estimate dynamic conditional correlations we first take a look at the

summarized results of maximum likelihood estimates of λ_1 and λ_2 in Table 3 below. The table also summarizes the delta 1 and delta 2 estimates while comparing multivariate normal distribution with multivariate student t-distribution. An interesting aspect to note is the highly significance estimates of all the volatility decay parameters implying gradual volatility decay for all indices. Also if we analyze the sums of lambda 1 and lambda 2 values for different indices we observe that their summation is less than one, pointing that the indices are not following I-GARCH; which means that shocks to the volatility is not permanent.

From Table 3, it is observed that the maximized log-likelihood value for t-distribution 91,221.80 is larger than the maximized log likelihood under normal distribution 90,774.80. This suggests that the student t-distribution is a more appropriate representation of the fat tailed nature of indices. This observation is in agreement with findings of Pesaran & Pesaran (2009). To further substantiate this we observe the Degrees of freedom which is 8.9198, well below the critical level of 30. Henceforth our analysis of the study works with the t-distribution estimates.

Table 3: Estimates of λ_1 and λ_2 , Delta, for the Indices

Parameter	Normal Distribution		T - Distribution		
	Estimate	T Ratio	Estimate	T Ratio	
Lambda 1	DJUS	0.91895	221.1328	0.93115	212.9746
	DJUSFS	0.91699	190.5943	0.92526	178.3505
	DJWEM	0.91459	144.9272	0.92627	157.2073
	DJWFS	0.91989	200.3437	0.92719	191.6067
	DJIUS	0.91906	198.654	0.93139	196.0122
	DJIMUK	0.91871	129.73	0.93628	149.46
	DJIWEM	0.9177	140.9273	0.92962	151.175
	DJIW	0.92366	229.5436	0.93391	229.0568
Lambda 2	DJUS	0.0687	21.4431	0.05759	17.1407
	DJUSFS	0.071759	18.5391	0.063999	15.2732
	DJWEM	0.069156	15.1842	0.058474	13.5948
	DJWFS	0.069996	18.8657	0.062679	15.9816
	DJIUS	0.069837	19.1434	0.058162	15.7205
	DJIMUK	0.068682	12.7358	0.052521	11.1023
	DJIWEM	0.070256	13.873	0.058947	12.3888
	DJIW	0.066003	21.0586	0.055826	17.8442
Delta 1	0.94901	418.5707	0.95145	420.127	
Delta 2	0.037999	29.4287	0.034878	26.684	
Max. Log Likelihood	90,774.80		91,221.80		
Degrees of Freedom			8.9198	20.1271	

Table 4 below shows the unconditional correlation and volatility matrix for the eight indices within our study. The estimated unconditional volatilities are the diagonal elements highlight and in bold while off diagonal elements represent unconditional correlations.

Table 4: Estimated Unconditional Volatility & Correlation Matrix for the Indices

	DJUS	DJUSFS	DJWFS	DJWEM	DJIUS	DJIW	DJIWEM	DJIMUK
DJUS	0.013608	0.89002	0.88129	0.46368	0.9775	0.8979	0.38915	0.49292
DJUSFS	0.89002	0.021679	0.93266	0.34921	0.8132	0.71809	0.28296	0.37523
DJWFS	0.88129	0.93266	0.015364	0.57521	0.81793	0.8408	0.50454	0.56258
DJWEM	0.46368	0.34921	0.57521	0.013055	0.45216	0.68677	0.95371	0.63055
DJIUS	0.9775	0.8132	0.81793	0.45216	0.01341	0.91505	0.38074	0.49005
DJIW	0.8979	0.71809	0.8408	0.68677	0.91505	0.011407	0.62191	0.74738
DJIWEM	0.38915	0.28296	0.50454	0.95371	0.38074	0.62191	0.013518	0.58371
DJIMUK	0.49292	0.37523	0.56258	0.63055	0.49005	0.74738	0.58371	0.015612

In table 4 above a cursory glance at the diagonal element representing the unconditional volatilities show the highest volatility for the Dow Jones United States Financial Services Index, as expected as the ten years under the study have three of the years which were marred by the global meltdown starting in 2007. The worst hit sector was the financial sector in that era as the crisis initiated from there, and led to the infamous US credit crunch of 2008. Owing to the financial meltdown in US, which resulted in spillover effect to other sectors of economy in US very rapidly, the Dow Jones US Index is ranked third after Dow Jones World Financial Services with an unconditional volatility parameter of 0.013608 amongst conventional indices. Surprisingly enough the volatilities of Islamic indices is relatively high as well in the period from 2001 to 2011, with their volatilities ranging between 0.01 to 0.013.

An interesting observation from the unconditional volatility and unconditional correlation matrix is the very low volatility of the Dow Jones world Emerging Market Indices both in conventional and Islamic sets. The plausible reasons for this are the constituent countries of this index.² The World Emerging market index is constituent heavy on BRIC and ASEAN countries. A glance on the economic progress and their interdependence amongst the world economies, we observe that these countries have moved from heavily reliant on US economy for trade and financing activities to a more balanced global mix skewed towards China and India. This may explain the low volatility observed in the matrix for DJWEM, as these economies have had a stable last decade.

At this point our research questions stay unanswered, and require an intuitive interpretation of the unconditional correlations between conventional and Islamic indices. Reverting back to our first research question to analyze the correlation of Islamic indices we refer to table 5, which ranks them with respect to highest to lowest.

In the first panel of table 5, we observe that, Dow Jones Islamic US and Dow Jones Islamic World have very high correlations with Dow Jones US index (conventional) suggesting that any movement or crisis impacting DJUS would have a negative impact on the DJIUS and DJIW, only with a possibly slightly reduced impact. The high correlation between DJUS and DJIUS is owing to the underlying constituent base of similar pool of companies. In case of DJIW having a high correlation with DJUS market performance, this may be explained by the universe of underlying stocks in DJIW being skewed towards US market owing to its size and their absolute number.

² Constituent Countries Emerging markets under Dow Jones Classifications are Brazil, India, Poland, Chile, Indonesia, Russia, China Offshore, Malaysia, South Africa, Columbia, Mexico, South Korea, Czech Republic, Morocco, Taiwan, Egypt, Peru, Thailand, Hungary, Philippines and Turkey

Table 5: Unconditional Correlations Ranked by Value.

DJUS		DJUSFS		DJWFS		DJWEM	
DJIUS	0.9775	DJWFS	0.93266	DJUFUS	0.93266	DJIWEM	0.95371
DJIW	0.8979	DJUS	0.89002	DJUS	0.88129	DJIW	0.68677
DJUFUS	0.89002	DJIUS	0.8132	DJIW	0.8408	DJIMUK	0.63055
DJWFS	0.88129	DJIW	0.71809	DJIUS	0.81793	DJWFS	0.57521
DJIMUK	0.49292	DJIMUK	0.37523	DJWEM	0.57521	DJUS	0.46368
DJWEM	0.46368	DJWEM	0.34921	DJIMUK	0.56258	DJIUS	0.45216
DJIWEM	0.38915	DJIWEM	0.28296	DJIWEM	0.50454	DJUFUS	0.34921

While going further and analyzing the second and the third panel in Table 5, it is observed that Islamic indices are ranked lower than other conventional indices, on the unconditional correlations with the Dow Jones US Financial Services and Dow Jones World Financial Services indices. This provides partial substance to our second research question, that exclusion of conventional financial sector firms provides a low correlation for Islamic indices with the financial services indices. This suggests that investing in stocks mimicking Islamic indices, would partially protect the investors from a financial sector crisis, as the world experienced starting of 2007.

Considering that *shariah* screening criteria, completely removes the conventional financial sector from Islamic indices, the common fallacy is that there should be zero correlation between Islamic indices and DJUSFS and DJWFS. But our figures disprove this fallacy, the reason being two fold. The first being that *shariah* screening criteria removes the conventional financial institutions, not Islamic institutions, and with DJWFS comprising of Muslim economies from ASEAN and Middle East, Islamic banks and financial institutions are amongst the constituent lists of the index. Secondly and more importantly is the inter-linking of all sectors of economies, and heavy dependence of corporations on financial sector for financing. Any crisis in the financial sector spills over and impacts other sectors of economies in the form of high cost and unavailability of funds. This leads to vicious cycle of enhanced costs, low profitability's affecting the intrinsic value and the equity prices of the corporation. This spillover effect is the main reason of the existence of correlation amongst financial services sector indices and Islamic indices.

Dynamic Conditional Correlations

Till this point, our analysis and interpretations have focused on unconditional volatilities and unconditional correlations. In other words the analysis has been made on an underlying assumption that volatilities and correlations stay constant over the period of study. Intuitively this assumption seems flawed as changing dynamics of the capital markets, and socio – economic setup and political and natural events affect all of the economic variables. It is closer to reality and logical to comprehend that the volatility and correlation are dynamic in nature, and owing to this aspect, we utilize the Dynamic Correlation Coefficient (DCC) model in our study.

We initiate our study on DCC by charting the conditional volatilities of all the indices within our dataset. For comprehension and comparative purposes, the volatility charts are clubbed in sets of conventional indices and Islamic indices in Chart 2 and Chart 3 below.

The conditional volatilities of the conventional indices, corroborate our earlier findings from unconditional volatilities, of Dow Jones US Market having relatively higher volatility than, other conventional indices. The DJUS conditional volatility graph shows two high volatility eras, first, starting from mid-2001 to early 2003, and second volatility period between

mid-2007 to mid-2009; the financial crisis period. The other conventional indices, more or less show a steady conditional volatility up till 2007, where they have marked high conditional volatilities, during the financial crisis. Amongst them it is observable that the Dow Jones World Emerging market Index has the lowest volatility.

While the latter volatility period of DJUS and other indices is attributed to the financial turmoil, the earlier period of volatility has two major reasons. For a short period in September 2001, post 9/11 attacks, the US markets took a plunge and high volatility ensued in the US market. Secondly, before the markets had normalized from the terror attacks, the start of 2002, experienced, the dot.com bubble burst. The year of 2002 saw the internet companies, going bust, with Webvan, Exodus Communications, and Pets.com declaring bankruptcy, while amazon, yahoo and EBay share prices took a pounding. The near collapse of the technology sector, in the US market's impact on the equity market exponentially increased in mid-2002 with the outbreak of Accounting scandals, at Arthur Andersen, Adelphia, Enron and WorldCom.

Chart 2: Conditional Volatilities of Conventional Indices

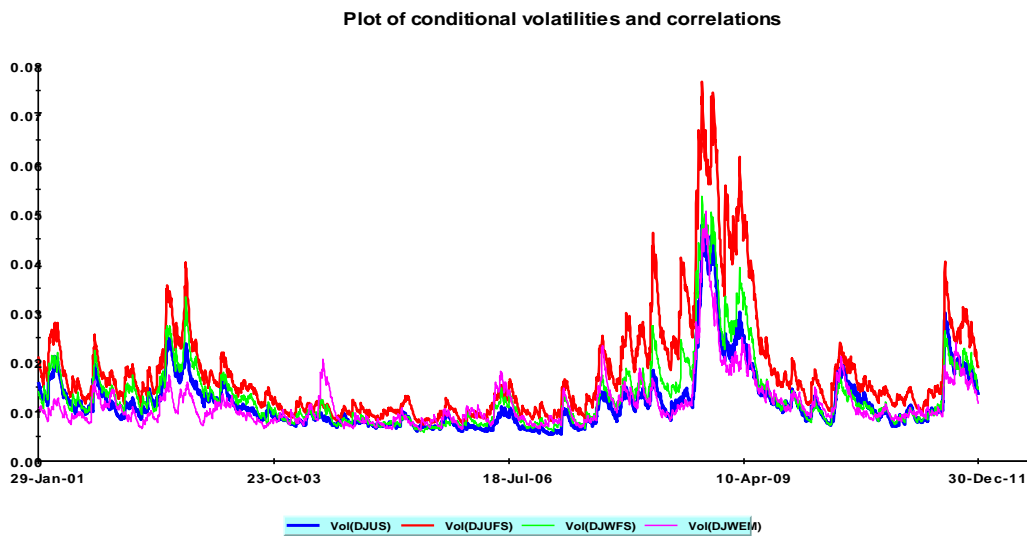
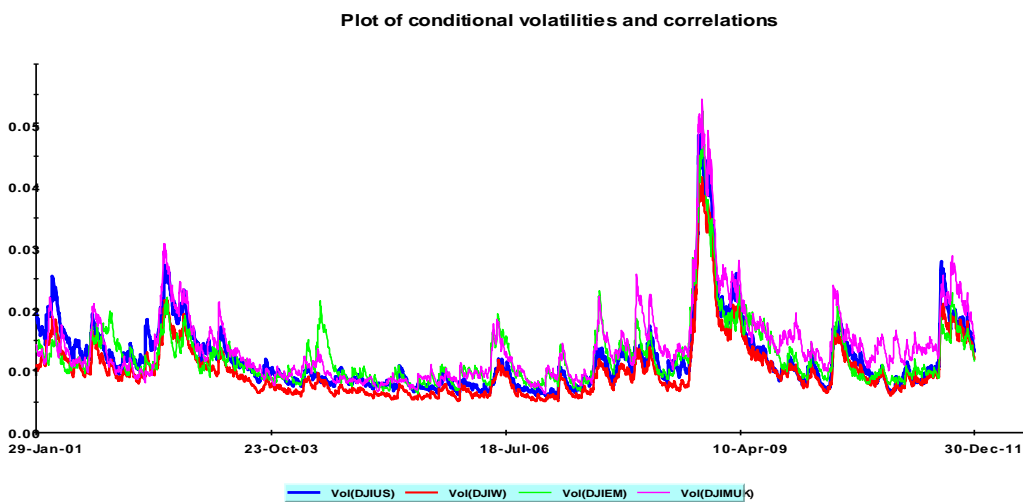


Chart 3: Conditional Volatilities of Islamic Indices



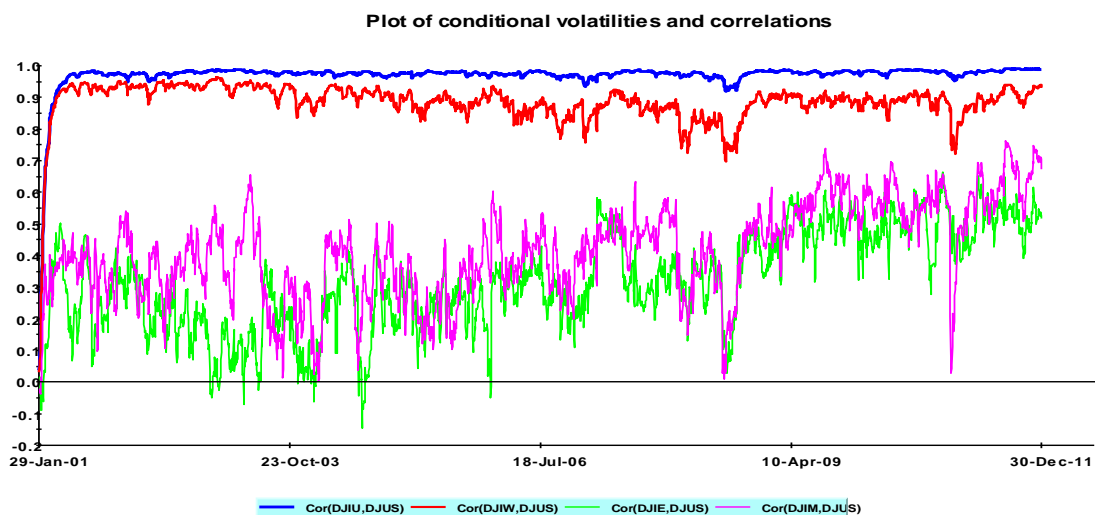
The Islamic indices, conditional volatility chart mimic that of conventional indices, with the observation that for all the Islamic indices their conditional volatilities are much closer to each other, with less absolute variation between different indices.

The conditional volatility charts and earlier analysis of unconditional correlations, partly answers our first research question, suggesting a strong correlation between the Islamic indices and their conventional counterparts. The conditional volatility suggests socio economic events and political and economic events have a similar impact on conventional and Islamic indices.

To further answer our first research question with more degree of certainty we use the dynamic conditional correlations between the Islamic indices and the Dow Jones US Index. Chart 4 plots the conditional correlations between the DJUS and all the Islamic indices in our study.

The interpretation of conditional correlation chart, for comprehension purposes is in two parts. Firstly upper part of the chart represents the conditional correlations of DJUS with Dow Jones Islamic US and Dow Jones Islamic World. The high level of correlation has been elaborated in Section 5.2. It is clearly observable, that although the dynamic correlation is high and steady over much part of the decade but the dynamic conditional correlations of DJIW with DJUS experiences a gradual decline from mid-2007 with negative fluctuations upto early 2009. Similarly DJIUS dynamic conditional correlation with DJUS reduces slightly during the crisis period.

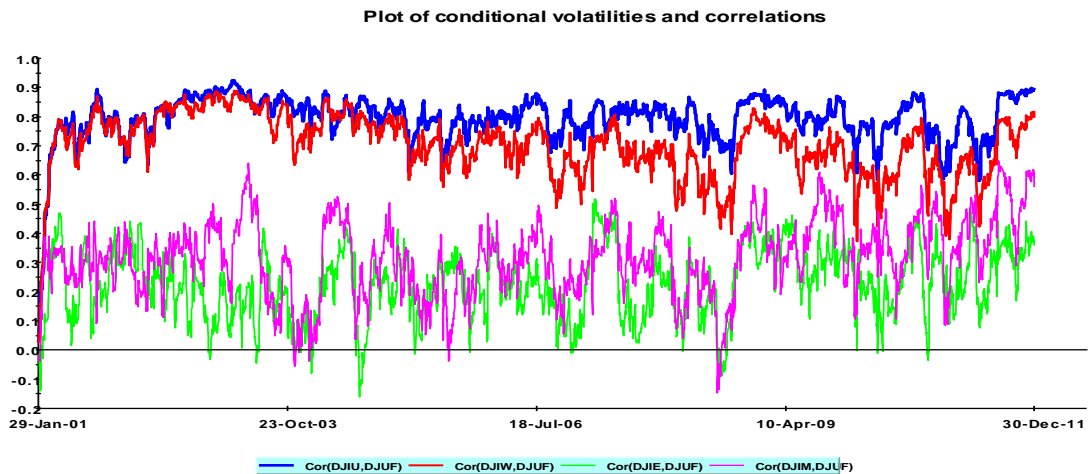
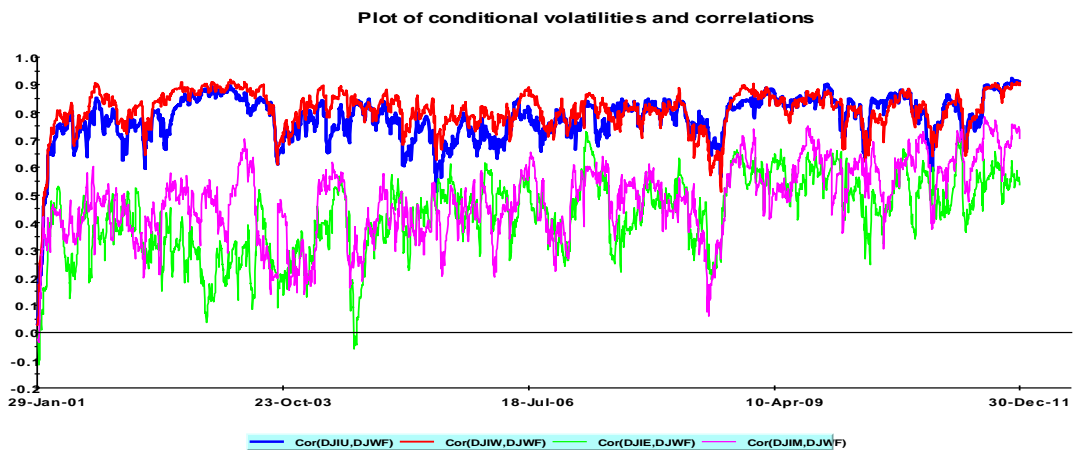
Chart 4: Dynamic Conditional Correlations of DJUS with Islamic Indices



Secondly the dynamic conditional correlation of DJIMUK and DJIWEM with DJUS represent a highly volatile relation. One thing which is common amongst the four plots is their significant downward trend during the crisis period of 2007-2009.

Within the context of our first research question our findings from unconditional correlation matrix and dynamic conditional correlations imply existence of a relation between the Islamic indices and conventional indices. The dynamic conditional correlation plot further substantiates our findings and indicates a dynamic link between Islamic and conventional indices. For our broader research motivation for this study, it suggests that the correlation between Islamic indices and conventional index shows a significant decline during the crisis era.

After establishing that the conditional correlation between Islamic and conventional indices declined during the recent financial crisis, we chart the dynamic conditional correlations between the Islamic indices and the financial indices represented by DJUSFS and DJWFS.

Chart 5: Dynamic Conditional Correlation between DJUSFS and Islamic Indices.**Chart 6: Dynamic Conditional Correlations between DJWFS and Islamic Indices**

Here we make this observation that conditional correlations between the financial services indices and Islamic indices follow a very volatile path. A surprising observation is the high volatility of conditional correlations of Dow Jones Islamic UK and Dow Jones Islamic world emerging markets with the DJUSFS index. The conditional correlations plot for them does not follow any trends. The plausible reasoning is twofold, firstly the partial decoupling of the UK and emerging markets from the US financial services sector. Secondly is related to our research question, that financial exclusion from Islamic indices, reduce any correlation between the financial sector and Islamic indices. The existence of even a relationship is out of the dependence of all other business on health and performance of financial sector.

In context of our second research questions from both the charts we observe a partial trend of decline in conditional correlation between financial indices and Islamic indices, with a near zero conditional correlation in second half of 2008, the peak of financial crisis. This implies that an investor, who had been mimicking the Islamic indices, would experience low correlations with the financial indices. This in the context of crisis or economic turmoil's with locus in financial sector would provide Islamic indices as a better haven. The conditional correlations plot indicates not complete immunity for Islamic indices from financial crisis but dampened negative effect.

Conclusions

To summarize our analysis, recall our two research questions set forth at the onset of this paper:

- a) Is the relationship between Islamic indices static or dynamic with respect to market condition?
- b) If evidence supports the dynamic argument, does the financial exclusion protect Islamic indices from impact of financial crisis?

Firstly our study does show empirical evidence of correlation between the Islamic and conventional indices via the unconditional correlation methodology. The evidence of a dynamic relationship is further strengthened by our analysis of the Dynamic Conditional correlation. The initial dynamic volatilities and conditional correlations suggest towards a changing relationship between Islamic and conventional indices, evident from similar yet varying intensity trends in volatilities and conditional correlations between conventional and Islamic indices.

With our first research question laid to rest towards dynamic relationship, our study on the relationship between Islamic indices and financial benchmark indices, suggest towards a dampening correlation between them. This helps us to reach a cautious conclusion that the exclusion of financial stocks due to *shariah* screening methodology has benefited the Islamic indices during the financial crisis periods. The implication of this is that an investor following the Islamic indices, would be better protected in times of economic crisis originating from financial sector.

The inherent philosophy of Islamic finance which promotes risk sharing instruments and prohibits interest bearing business (modern day conventional banks) has its benefits in the modern capital markets. Our analysis suggests Islamic equity investments though they follow a similar return pattern as conventional in times of economic growth, but in downturns, are a safer alternative.

Limitations

It is of utmost importance that we understand the limitations of our study. From the understanding of the authors, the following limitations exist in this study:

- a) The sample under consideration is of 10 years, and daily data, an extended time sample would make this study more intensive and comprehensive.
- b) The study takes into account 8 indices, 4 each from conventional and Islamic. Addition of further indices can make the study more robust.
- c) The analysis is based on global level indices; the findings of author may contradict findings for country specific indices using the same methodology.
- d) It should be noted that the purpose of this study was exploratory and to provide a holistic empirical evidence of Islamic indices as being a safer investment option during crisis period. By analyzing this study in isolation we cannot make judgments and decisions for the whole Islamic financial markets.

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