The Performance of Islamic Equity Indexes Global Capital Markets

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Abstract

In the wake of the global financial crisis of September 2008, Islamic financial products were thrust into the spotlight as alternatives to the shaken conventional equity markets. To examine the resilience of Islamic equities indexes, we compare the performance of the Dow Jones Islamic Market Index (DJIMI) against the Wilshire 5000 (W5000), FTSE All Share Index (ASX), and Shanghi Stock Exchange Composite Index (SSECI) between 2008 and 2011. We found the DJIMI had lower levels of volatility relative to the W5000, ASX and the SSE. The DJIMI annual returns were less than the W5000 but comparable to those of the ASX and SSE. Although these equity indexes are highly correlated, our cointegration analysis revealded no the long-term relationships between the DJIMI and its international counterparts. Although the DJIMI is comprised of equity shares from over 50 countries, our Granger causality results suggest that the DJIMI is the least susceptible the global contagion effects.

Introduction

In the wake of the tremendous fallout following the collapse of 158 year-old Lehman Brothers and the subsequent global financial crisis in September 2008 (NBER, 2012), investors in both developing and developed nations searched with increased vigor for alternative investments opportunities in place of conventional products. Islamic banking and Islamic financial products, which were believed to have shown significantly more resilience in the face of the crisis (IMF, 2010) were thrust into the spotlight as viable alternatives to the severely shaken conventional equity markets.

Although the development of a distinctly Islamic perspective into finance was born nearly 1450 years ago with the inception of the Islamic faith, Islamic finance has recently developed a coherent regulatory framework. Fueled by a massive influx of

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petro capital in the Middle East in the 1970s, Islamic *Shari'ah* councils, most notably in Sudan, Iran, Qatar, UAE, Saudi Arabia, and Bahrain established the framework for *Shari'ah* compliant markets and products as alternatives to conventional investments for investors in these nations (Bakar, 2008 (b)). In the 1980s and 1990s, under the auspices of globalization, principles and frameworks were further consolidated and developed.

Under these Islamic guidelines, equity markets and the trading of shares are considered permissible. It should be noted that there are no salient structural differences between the composition of what could be deemed Islamic equity and conventional equity but rather the difference lies in activities the firm undertakes in its operation (Bakar, 2008 (a)). That is to say, a conventional firm such as Apple is not involved in usury or other activities deemed *haram*, would be considered *Shari'ah* compliant and a permissible investment as per Islamic jurisprudence.

Today, a significant range of Islamic investment products are available to investors and the area of Islamic indices is no exception. Several major groups including the FTSE and S&P Dow Jones offer their own variations of Islamic indices ranging from broad market products such as the Islamic sustainability index, Global Finance and *Takaful* Index, Islamic Market Global ex-U.S. Index, Islamic Market Titans 100 Index to very particular areas such as the *Sukuk* Index, and even Islamic Market Greater China index.

Islamic finance has distinguished itself through the financial crisis and has appealed to clients from markets in East Asia to North America. Although Islamic finance implicitly has religious foundations, the benefit of its products can be universally realized by investors globally. If Islamic financial equity indices return comparable returns at reduced levels of volatility, the performance of Islamic equity indices should be of prime interest to all investors, both individual and institutional as an alternative product in times of volatility. If Islamic financial products are performing at levels equal to or above conventional products, all factors being considered, they can prove to be an immense sector driver, providing a means of stable and sustainable long-term growth for markets if implemented globally.

Having looked into the background and contemporary circumstances, this study is meant to update and develop on certain aspects of the earlier study made by Hakim and Rashidian (2004) in their paper "Risk and Return of Islamic Stock Market

Indexes." To that respect, the Dow Jones Islamic Market Index (DJIMI) will be used to represent Islamic equity indices while the Wilshire 5000 will represent the conventional equity index in the U.S. To further expand and develop on the paper by Hakim and Rashidian, we compare the performance of the DIJMI with the U.K.'s FTSE All Share index (ASX) and China's Shanghai Stock CompositeIndex (SSECI).

Using these different indices and the earlier study as a backbone for the performance analysis, year-on-year data will be analyzed to determine if the conclusions of Hakim and Rashidian's study, conducted for the 1999-2002 period are valid for the years 2008-2011. To determine the degree to which volititlity has changed since, the Sharpe ratios for the DJIMI, W5000, ASX, and SSE over the 2008-2011 period will be compared with the Sharpe ratios Hakim and Rashidian (2004) estimated for the DJIMI and W5000 over the1999-2002 period.

Data

The Dow Jones Islamic Market World Index started in March of 1999. Today it is composed of 2,515 stocks traded globally which meet Islamic *Shari'ah* compliance. Table 1 displays the *Dow Jones Islamic Market World Index Factsheet*, showing the geographic composition of the stocks with the top three regions comprising 55.26% from the U.S., followed by 6.66% from the U.K., and 4.75% from Japan (S&P Dow Jones, 2012). Table 2 shows that the DJIMI's sector composition is just as diversified, with 21.15% of the index being represented by technology firms, 16.98% in healthcare and 16.69% in oil & gas (S&P Dow Jones, 2012).

Table 1 : Dow Jones Islamic Market World Index, Country and Sector Allocations

	DJIMI Country Share		DJIMI Country Share
U.S.	55.26%	Thailand	0.19%
U.K.	6.66%	Spain	0.18%
Canada	4.53%	Poland	0.17%
Switzerland	3.42%	Turkey	0.15%
Australia	2.93%	Kuwait	0.13%
France	2.61%	Qatar	0.12%
Germany	2.36%	Philppines	0.10%
South Korea	2.03%	Belgium	0.08%
China	1.99%	Ireland	0.07%
Taiwan	1.89%	New Zealand	0.07%
Russia	1.39%	Austria	0.05%
India	1.22%	Egypt	0.03%
Sweden	1.11%	Morocco	0.03%
South Africa	0.99%	UAE	0.02%
Hong Kong	0.68%	Portugal	0.02%
Netherlands	0.61%	Hungary	0.02%
Denmark	0.61%	Czech Republic	0.02%
Brazil	0.60%	Oman	0.02%
Singapore	0.52%	Slovenia	0.01%
Norway	0.50%	Jordan	0.01%
Malaysia	0.43%	Bahrain	0.01%
Indonesia	0.37%	Romania	0.00%
Finland	0.34%	Sri Lanka	0.00%
Chile	0.34%	Greece	0.00%
Italy	0.21%	Lithuania	0.00%
Mexico	0.21%	Bulgaria	0.00%
Thailand	0.19%	Estonia	0.00%

Source: S&P Dow Jones, 2012; *Dow Jones Islamic Marke World Index, Fact Sheet*

Notes: Data calculated in USD as of July 31, 2012

Table 2 : Dow Jones Market World Index, Sector Allocation

Technology	21.15%
Health Care	16.98%
Oil & Gas	16.69%
Indusrials	13.15%
Basic Materials	11.85%
Consumer Goods	8.66%
Consumer Services	7.17%
Telecommunications	2.15%
Financials	1.26%
Utilities	0.92%

Source: S&P Dow Jones, 2012; *Dow Jones Islamic Marke World Index, Fact Sheet*
Notes: Sectors are based on the ten industries defined by the proprietary;
classification system as described at www.cjindexes.com
Data calculated in USD as of July 31, 2012

Meeting *Shari'ah* compliance for this index involves the stock meeting explicit fundamental requirements as deemed by Islamic jurisprudence. Dow Jones screens for:

1) Industry type – industries deemed *haram* or not in compliance such as alcohol, tobacco, firearms, entertainment, conventional finance involved in the use of *riba*, and pork related products (S&P Dow Jones, 2012 (b)).

2) Financial ratios –

Terms for exclusion are:

a) The total debt divided by trailing 24 month average market capitalization must be above 33% (S&P Dow Jones, 2012 (b))).

b) Cash plus interest bearing securities divided by trailing 24 month average market capitalization must be above 33% (S&P Dow Jones, 2012 (b)).

c) Accounts receivable divided by trailing 24 month average market capitalization must also be above 33% (S&P Dow Jones, 2012 (b)).

These ratios are implemented in part to insure the companies are low in debt, mitigate income from interest bearing sources and not have significant amount of capital locked into accounts receivable. The stocks included in the index are monitored quarterly (S&P Dow Jones, 2012 (b)) for compliance with the *Shari'ah* standard and if found to breach terms of compliance, are removed from the index.

The Wilshire 5000 (W5000) was selected in order to synchronize parameters of our study with that of Hakim and Rashidian (2004). The W5000 is an unfiltered equity series for any *Shari'ah* compliancy and therefore, representative of a measure of a conventional equity index in the U.S. First listed in 1974 and composed of over 5,000 capitalization weighted security returns on the NYSE and NASDAQ, the Wilshire 5000 is often considered the best comprehensive representative of the U.S. equity capital markets (Wilshire Indexes, 2010).

In order to diversify the range of the study from its predecessors and provide a suitable global context for comparison, the FTSE All Share Index was selected as an analogous UK index to the Wilshire 5000. First listed in April 1962, the FTSE All Share Index (ASX) is composed of the FTSE 100 Index, FTSE 250 Index and FTSE SmallCap Index. The FTSE All Share Index is composed of nearly 630 constituents representing nearly 98% of the UK market capitalization. The largest three constituents are HSBC Holdings with a 6% index weight, followed by British Petroleum with a 4.71% weight and Vodafone Group with 4.62% weight (FTSE Group, 2011). Lastly, the Shanghai Stock Exchange's Composite Index (SSECI) was selected as the 4th constituent in the analysis. The SSECI index was chosen due to the increasing capitalizationand depth of equity capital markets from mainland China along with its increasing importance to international investors despite being closed to foreign investors. The SSE Composite Index is composed of 872 constituents and all A and B shares that are traded on the SSECI, with a base year of 1991(Shanghai Stock Exchange, 2012).

Methodology

Year-on-year data including adjusted daily closing price, percentage daily change and volume was compiled on each index from the period 01 January, 2008 until 31 December, 2011. The values were analyzed in their respective annual intervals as well as in a four year aggregate in order to maximize the scope of information. The daily and annual volatility, σ, compounded annual growth rate (CAGR) and the Sharp ratios were calculated in order to clearly gain a degree of understanding to the behavior of the difference of the indices and if significant divergence can be observed in these descriptive statistics.

- Daily and annual volatility, σ (calculated on 1-year and 4-year data)

- $$\sigma = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(m - x_i)^2} \quad (1)$$

The value of the volatility is inherent in assessing risk performance metrics. The importance of the behavior of volatility is particularly emphasized after 2008 in order to develop best practice risk management methods. As the historical volatility tends to increase, so does the degree of risk tolerance. Volatility may also provide fundamental information about the indices being assessed.
Compounded annual growth rate (CAGR) aggregate of the four-year data aggregated performance metric

- $$CAGR = \left(\frac{EndingValue}{BeginningValue}\right)^{\left(\frac{1}{NumberofYears}\right)} - 1 \quad (2)$$

- Annualized Sharpe ratios with the corresponding historical volatility and 1-year T-bill interest rate used as the risk free rate

In addition to the Sharpe ratio being an inclusive metric in the study by Hakim & Rashidian, Hendrik Scholtz and Marco Wilkensin (2006) explanation of why and how the Sharpe ratio is an important analytical tool is also insightful. In “Interpreting Sharpe Ratios: The Market Climate Bias,” the authors note that the

“*Sharpe ratio of a fund is defined as its excess return above the risk-free rate per unit of overall risk. It is widely admitted that if two funds have identical excess returns, the fund with the lower standard deviation is the one with the better performance, and thus with the higher Sharpe ratio.*”
-Scholtz and Wilkensin

Sharp ratio = (actual return - risk-free return) / standard deviation (3)

Through the process of developing the methodologies, several divergences from original Hakim and Rashidian’s procedure should be noted. Firstly, it appears that they produced singular values to represent the three-year data they analyzed. This may have been because they aggregated their data in the three year period. In the period they analyzed (October 12th 1999 – September 4th 2002), the growth rates were negative year-on-year, so they may have felt that the singular value was still a fair representation of their analysis. However, in the period from 2008-2011, there was significant volatility in closing prices in most of the indices analyzed which in no way would lead to inaccurate singular value for the time period. This led to the development of an annular interval convention.

Secondly, it appears that Hakim and Rashidian repeated this trend in their calculation for annualized standard deviation. We avoided this because, again, there was a significant amount of change in the annualized standard deviation which would have presented a skewed value if the four-year period data was used to produce a single value for historical volatility. This is also in keeping with best practices, as a historical volatility calculated on data over too wide of an interval may produce inaccurate results.

Lastly, in contrast with using a three-month U.S. Treasury Bill (T-bill) as the risk free rate, we opted for the one-year T-bill which we felt better corresponded with real returns when analyzing the index over a one-year period.

Results

Data was processed using the Exel and VBA macros and functions. The associated excel files are electronically available upon request. Table 3 displays the aggregated descriptive statistics compiled and color coded in conjunction with respective performance.

It is clear to see that the SSE Composite Index (SSECI) is one of the worst-performers in the period analyzed. The SSECI's volatility was the highest in each of the four years analyzed until 2011. However, the maximum and minimum daily change values are not representative of the annual volatility and trailed only the ASX's maximum value by 0.24 percent and performed the best in minimum value change. In this case, it can be concluded that singular or binary outlier values in no way can be indicative of trends until a large enough sample of data is used to establish normative distribution curves.

Table 3 : Descriptive Statistics

	DJIM	W5000	ASX	SSECI
Annualized Volatility| 2008	32.328077%	40.394988%	35.812170%	43.991227%
2009	21.885148%	27.754546%	21.540171%	29.659839%
2010	16.113662%	18.558958%	17.194090%	22.153073%
2011	21.197946%	24.421457%	20.844985%	18.019011%
Volatility (4yr aggregate)	23.656892%	28.913926%	25.063310%	30.442317%
Max Daily Change	9.933236%	11.401108%	9.210547%	9.454912%
Min Daily Change	-7.861302%	-9.145331%	-8.341378%	-7.728694%
Annual Return| 2008	-38.484206%	-37.816906%	-32.417361%	-65.394104%
2009	30.344528%	23.462633%	21.336246%	74.249224%
2010	10.965550%	13.638339%	11.117049%	-13.431327%
2011	-7.837887%	-2.435862%	-8.371914%	-22.899059%
Com. Annual Growth Rate	-4.839874%	-3.948149%	-4.410816%	-20.350079%
Sharpe Ratio| 2008	-1.240847264	-0.976529704	-0.950720408	-1.523578873
2009	1.365973337	0.829148236	0.969641596	2.488186937
2010	0.661894882	0.718700865	0.62911436	-0.619838456
2011	-0.377767138	-0.10670378	-0.409782687	-1.280262231

Best Performer

Worst Performer

Faring poorly in comparison to the other indices in its volatility, the SSE Composite index entirely repeats the trend in annual returns; returning the least amount in three of the four years analyzed, with the exception being in 2009 when it was the best performer. Without surprise, SSECI also provided the lowest CAGR. Lastly, Sharpe ratio trends were identical to the other four year interval trends in that SSECI was the worst-performer in three of the four years.

Although the SSECI is insular in that it is a 'domestic-only' market with limited involvement by international firms, it nonetheless suffered from the contagion effects of the U.S. recessionary period, December 2007 until June 2009 (NBER, 2012). However, it was not just the SSE Composite Index's prices which suffered in this time period; all indices analyzed for this study showed significant susceptibility to the U.S. recession. Our causality analysis, highlighted in the subsequent section, suggests that the recessionary contagion was channeled to DJIMI, ASX, and SSECI via the W5000.

In returning to the comparison between the Dow Jones Islamic World Index and the Wilshire 5000, several trends can be seen repeating from the Hakim and Rashidian study but with several interesting variances. The aforementioned found that the DJIMI showed an annual aggregate mean over the 1999-2002 period of -19% against -12% for the Wilshire 5000. In the updated interval, the W5000 outperformed the DJIMI in returns in all but one year, 2009, in which the DJIMI outperformed the W5000 by nearly seven percent. This performance was reflective in CAGR, which may be most analogous to the Hakim & Rashidian study. The DJIMI returned a CAGR of -4.8% over the 4-year period versus -3.94% (best-performer) of the W5000.

In terms of volatility, the DJIMI exhibited lowest volatility among the indices in 2008 and 2010 and the best overall aggregate performance. The W5000 on the other hand had the most volatility with the exception of China. Volatility against the other indices seems to have worsened in 2011, when its volatility was higher than the SSE Composite Index. It was the second highest overall volatility analyzed.

Reversing their positions from the earlier study, the one-day minimum and maximum of the W5000 was the most of the indices studied. This is in contrast to the earlier study when the DJIMI showed higher daily min/max values.

Lastly, in looking at Sharpe ratios, the pattern seems to mimic performance as it had in returns. The DJIMI trailed the W5000 slightly in all but one year, 2009. The spread between ratios had decreased significantly.

In the broader assessment, the DJIMI also managed to outperform the FTSE All Share and the SSE Composite Index in terms of volatility, leaving the DJIMI as the best-performer of all indices analyzed. The FTSE's All Share index's higher performance in volatility versus the W5000 may be a result of the W5000's strong correlation to the broader U.S. equity markets (Hakim &Rashidian, 2004) and the significant contraction that occurred to the U.S. economy during the recessionary period from 2007-2009. We also believe that the FTSE All Share's performance displayed uniformity in the face of the Euro crisis due to a degree of insulation afforded to the U.K. in having a non-integrated Euro currency and monetary policy.

The W5000 managed to outperform the DJIMI in terms of annual returns in all but

one year (2011), again, maintaining trends shown in the earlier study. However, we believe one significant divergence from the earlier study was found in that the differences between the returns were much smaller than in the previous results; what may be indicative of increased performance of DJIM and/or inherent qualities of robustness through the financial crisis attributable to having filters established to exclude firms in particular industries and failing to meet several capital requirements, managing to result in higher returns (S&P Dow Jones, 2012 (b)). The return value in the original study over the three year interval was -19% for the DJIMI versus -12% for the W5000, the DJIMI faring over 58% worse. However, in 2008, the DJIMI was 24.96% lower, 26.82% lower in 2009, 15.25% in 2010 and 22% higher in 2011. The CAGR aggregated values showed the DJIMI returning a rate 24% lower than the W5000. But the difference in absolute CAGR values was a return of -4.8 for DJIMI and -3.9 for the W5000, a spread of just 0.9%. When taken into consideration of the FTSE All Share's CAGR of -4.4%, it is explicitly clear that the DJIMI manages to return comparable rates to conventional counterparts with the added benefit of reduced volatility. It is also clear that the annual returns have improved from their 1999-2002 interval performance while maintaining an almost equivalent volatility.

Lastly, in looking at the Sharpe ratios, we found the DJIMI being outperformed by the W5000's higher ratios in all but 2009. Similarly, the DJIMI outperformed the FTSE Index in 2009, 2010 and 2011. The 2008-2011comparison of the DJIMI and the W5000 was in contrast to what the Hakim and Rashidian study found in the earlier period. Although slightly behind the W5000 in terms of performance, the DJIMI still returned higher Sharpe ratios then the FTSE's index.

Cointegration Analysis

This section employs the cointegration methodology to investigate the long-run relationship between the DJIMI and the other series. Cointegration between any two indices implies the existence of some kinds of error-adjusting process that keeps the two series from drifting apart from each other over time. Granger and Engle (1987) have shown that if two time series are cointegrated there exist an error correction mechanism responsible for the adjustments process between the short-run disequilibrium and the long-run steady-state position.

Cointegration is a statistical property defined by the concept of stationarity and the order of the integration of two or more series. If a series is stationary its mean and variance are constant over time (Hendry and Julius 1999). Classical econometric theory rests on the assumption that the observed data are stationary. Nonstationarity invalidates ordinary least squares results and undermines statistical inference in regression analysis (Granger and Newbold, 1974).

In many instances, a nonstarionary series can be transformed into a stationary series through differencing. The order of integration is the number of times the series must be differenced in order to achieve a stationary series. A series that is stationary without having been differenced is denoted as $I(0)$. A stationary series resulting from first-differencing is integrated of order 1 and denoted as $I(1)$. For example, if first-differencing makes times series x_t stationarity we write

$$x_t = x_{t-1} + \varepsilon_t \qquad \text{where } \varepsilon_t \sim IN[0,\sigma^2] \qquad (4)$$

Subtracting x_{t-1} from both sides of equation (4) yields $\Delta x_t \sim IN[0,\sigma^2]$, which is stationary.

Cointegration analysis is valid when the individual series are nonstationary and integrated of the same order. An $I(1)$ series is said to possess an unit root. A unit root or nonstationary condition applies to a univariate time series, say x_t or y_t. The Augmented Dickey-Fuller (ADF) test is commonly used to test for the presence of a unit root (nonstationarity) in the univariate time series analysis. The ADF test can be used to verify the order of integration condition. Cointegration vectors are of considerable significance when they exist since they determine $I(0)$ relations that hold between variables that are individually stationary. Cointegration is said to exist between two or more nonstationary time series variables if they possess the same order of integration and a linear combination of these series is stationary. For example if x_t and y_t are nonstationary of the same order (i.e. possess a unit root) and the residual series, μ_t arising from ($\mu_t = y_t - bx_t$) is stationary (e.g. $\mu_t \sim IN\ [0, \sigma^2]$), then x_t and y_t are said to be cointegrated series.

Applied to the present context, cointegration between (and/or among) the equity indexes implies the presence of a stable relationship between (and/or among) these series. The finding of cointegration between markets has been explained as a result of improved technology and communications as well as the reduction of barriers restricting the capital flow movements across international borders. Shim and Eun (1989) found that stock market prices movements in the U.S. markets were the most influential in the world. While their analysis used 1979-1985 data, the global equity markets seem to have responded similarly to the U.S. financial crisis in 2008 as well as the U.S. recession (2007 – 2009) and recovery (2009 –).

The present analysis builds on this earlier scholarship by applying cointegration analysis to the 2008 – 2011 period.[i] We believe this time frame which contains recessionary and expansionary positions on the business cycle offers an unique opportunity to further examine the linkages between the DJIMI and U.S. equity markets through cointegraion analysis. We also examine potential conintegration linkages between the DJIMI and the ASX and SSE (Shanghi Stock Exchange Composite Index). Finally, we use the descriptive statistics and data analysis of the previous sections to explain the global composition of Islamic index. Granger (1986) noted that cointegration is a sufficient (but not necessary condition) for the presence of causality in at least one direction. Accordingly, we apply the Granger causality analysis to examine the contagion effects among the equities indexes.

Graphical evidence presented in Figures 1 and Figure 2 supports the cointegration prescription that the series do not wander "too far" away from each other over time. Indeed, the figures clearly show the existence of strong and stable relationships among the DJIMI, ASX, SSE and W5000. These series are clearly meet the nonstationary criterion as the means and variances are not constant over all time periods. Indeed, the unit root tests detailed below confirm the DJIMI, ASX, SSE, W5000 are nonstationary and integrated at order 1, $I(1)$.

Cointegration between the DJIMI and W5000 seems most plausible since the DJIMI and the W5000 have many stocks in common. Indeed Figure 1 reveals that the DJIMI and W5000 series moving together over time. Graphical similarities between the DJIMI the ASX plots are particularly striking given that the ASX stocks constitute only 6.6% of the DJIMI.

Figure 1 : DJIMI, W5000 and ASX Daily Close, 2008 – 2011

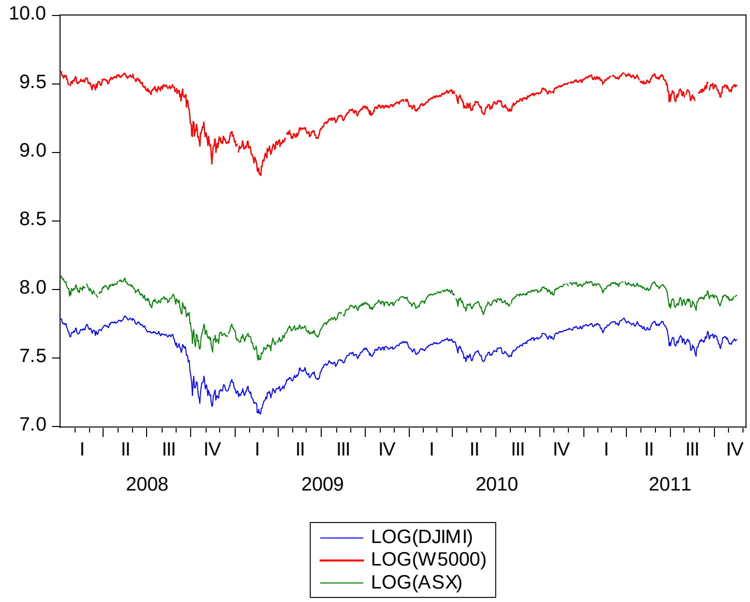

Figure 2 : DJIMI, SSE and ASX Daily Close, 2008 - 2011

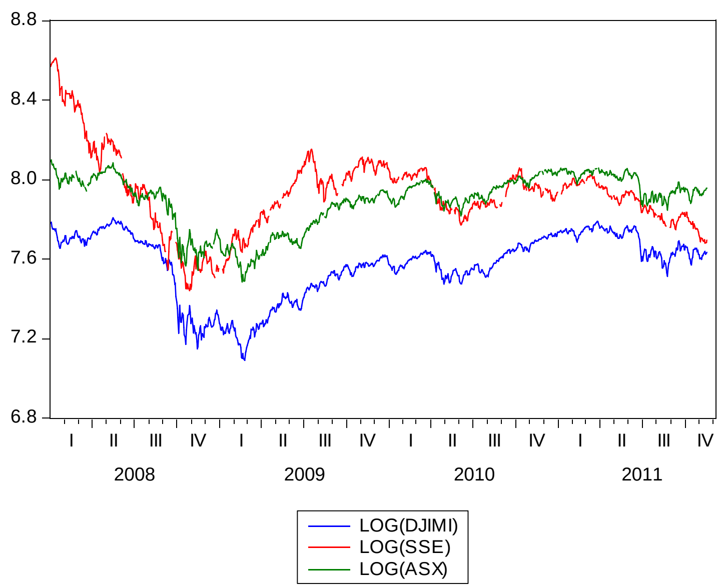

Table 4 : summarizes the coefficient of correlation between pairs of the series. The correlation between DJIMI and the W5000 is nearly perfect, 0.99. Moreover, The DJIMI and W5000 have the same correlation (0.35) against the U.S. Treasury Bill (TBILL). The DJIMI and W5000 also share the same correlation with the ASX, 0.97 even though the ASX traded stocks comprise only 6.6% of the DJIMI. Only 1.99% of DJIMI shares are from China, yet the DJIMI is more correlated with the SSE (0.53) than with the U.S. Treasury Bill (0.35).

Table 4 : Coefficient of Correlation Matrix

	DJIMI	W5000	ASX	SSE	TBILL
DJIMI	1.00	---	---	---	---
W5000	0.99	1.00	---	---	---
ASX	0.97	0.97	1.00	---	---
SSE	0.53	0.48	0.53	1.00	---
TBILL	0.35	0.35	0.26	0.57	1.00

The Test for Nonstationarity: Augmented Dickey-Fuller Test

The order of intergration for each series must be established before performing the cointegration analysis. For two (or more) series to be cointegrated, each individual series must be integrated of the same order. We apply the Augmented Dickey-Fuller (ADF) unit root test to the levels and the first-difference of each series.[ii] The ADF level test will determine if series is nonstarionary and the order of integration.

Table 5 presents the ADF test results (*t-statistics)* for the level and first-difference for each of the series. The level *t-statistics* do not exceed the critical values for the 5% and 10% level of significance respectively for any of the variables. Accordingly, the null hypothesis of nonstationarity cannot be rejected for the levels for any of the series. However, nonstationarity hypothesis can be rejected for first-differenced the series. In other words, the first-differencing yields stationary series. Thus, the series are $I(1)$. And since the series are of the same order, we can proceed to test for cointegration.

Table 5 : Augmented Dickey-Fuller (ADF) Test for Unit Roots (Periods 01/02/2008 – 12/30/2011, N=1025)

	Level*	First-Difference*	5% Critical Value	10% Critical Value
DJIMI	-1.73	-22.48	-2.86	-2.56
ASX	-1.26	-21.87	-2.86	-2.56
SSE	-1.01	-31.45	-2.86	-2.56
W5000	-1.29	-24.90	-2.86	-2.56
T-Bill	-2.75	-4.79	-2.86	-2.56

**MacKinnon critical values for rejection of hypothesis of a unit root.*

*Lag length determined Akaike Information Criterion[iii]

Table 6: Engle-Granger Cointegration Results

Ho: the series are not cointegrated*	Engle-Granger tau-statistic	Engle-Granger tau z-statistic
Series: {DJIMI, W5000}	-2.45 (0.28)	-13.04 (0.21)
Series: {DJIMI, ASX}	-2.32 (0.36)	-10.97 (0.31)
Series: {DJIMI, SSE)	-1.53 (0.75)	-5.02 (0.73)
Series: {DJIMI, TBILL}	-1.35 (0.87)	-4.48 (0.86)
Series: {DJIMI, W5000, ASX, SSE, TBILL}	-9.95 (0.15)	-19.31 (0.51)

MacKinnon *p-values* in parenthesis

*Lag length determined Akaike Information Criterion

Table 6: displays the Engle-Granger Cointegration tests results. We found that none of the equity series to be cointegrated. In other words, there is no long-run relationship between any of the series. While this result essentially replicates Hakim and Rashidian finding, it is particularly suprising given that over 55% percent of the DJIMI stocks are the W5000 stocks. One possible explanation for these non conintegration results is the differences in the series' volatility. Volatility is one indirect way to account for how the indexes might wander from each other. Intuitively, we might expect cointegrated series to have similar volatilities in the long-run, with differing short-run volatilities explaining the error correction mechanism responsible for the adjustments process between the short-run disequilibrium and the long-run steady-state position. However, Table 3 shows the index volatilities differing substantially annually (short-run) and over the four year period (long-run).

The volatility is a function of the diversity comprised in each index. The DJIMI is truly a global index comprised of equities from 54 countries while the W5000, SSE and ASX represent domestic markets exclusively. Including shares from different countries spreads systemic risks globally. Global diversification apparently damped the DJIMI exposure to the volitility in the U.S equity markets in 2008 and 2009. Again, in terms of volatility, Table 3 shows all four indexes to be significantly different, with the DJIMI recording the best aggregate performance in terms of volatility. The SSE, which is the most insular index, recorded the worst aggregate performance in volatility.

Secondly, the DJIMI's *Shari'ah* compliance filtering criterion appears to have not adversely impacted the DJIMI's volatility performance. The DJIMI inherently provides less diversification than the W5000 on the premise that the DJIMI has *Shari'ah* compliance criterion set forth which limits the constituents to those companies deemed compliant. The DJIMI *Shari'ah* compliance establishes a *de facto* restriction of capital flow movements which would tend to negate arbitrage opportunities. In contrast, the W5000 is an open index including a broad range of constituents. Yet the filters which reduced diversity of DJIMI constituents apparently did not off-set the stabilizing effects of global diversification. Indeed, the DJIMI maintained a lower volatility in the original study (1999-2002) and again, during the period presently analyzed, 2008-2011.

These results are consistent with Hakim and Rashidian's findings that the Islamic index presents a unique risk/return profile based on the results of the historical volatility. Since no long-run relationship exists among these markets, benefits could be reaped by conventional investors who wish to diversify into the DJIMI.

Granger Causality Results

Although there appears to be no long-run relationship between the indices, the indices appear to have reacted similarly to the periods of crisis and recovery. Understanding the 'contagion effect' is particularly notworthy in the context of the 2008 global equity crisis and subsequent recovery. Granger causality analysis offers an approach to understanding the interdependece of global equity markets. Granger causality tests whether one time series is useful in forecasting another (Granger, 1969). The Granger causality does not test for causality per se but precedence. Applied to present study, Granger causality measures the contagion effect of the U.S. stock market crash in 2008 on different equity markets. Table 7 displays the paired Granger cauality results.

In order to obtain stationary series, the Granger tests were conducted using first-differences, designated by the letter "D".

Table 7: Pairwise Granger Cauality Test Results, 6 lags*

Null Hypothesis:	Obs	F-Statistic	Prob.
D(W5000) does not Granger Cause D(DJIMI)	887	8.04583	2.E-08
D(DJIM) does not Granger Cause D(W5000)		2.13182	0.0476
D(ASX) does not Granger Cause D(DJIMI)	874	1.38504	0.2176
D(DJIMI) does not Granger Cause D(ASX)		9.94972	1.E-10
D(SSE) does not Granger Cause D(DJIMI)	782	0.76829	0.5950
D(DJIMI) does not Granger Cause D(SSE)		5.44001	2.E-05
D(TBILL3) does not Granger Cause D(DJIM)	869	1.21334	0.2969
D(DJIM) does not Granger Cause D(TBILL3)		1.54304	0.1611
D(ASX) does not Granger Cause D(W5000)	788	2.35183	0.0294
D(W5000) does not Granger Cause D(ASX)		21.7396	1.E-23
D(SSE) does not Granger Cause D(W5000)	757	1.05850	0.3861
D(W5000) does not Granger Cause D(SSE)		4.80387	8.E-05
D(TBILL3) does not Granger Cause D(W5000)	808	2.94648	0.0075
D(W5000) does not Granger Cause D(TBILL3)		1.66597	0.1264
D(SSECI) does not Granger Cause D(ASX)	706	1.96089	0.0690
D(ASX) does not Granger Cause D(SSECI)		5.57679	1.E-05
D(TBILL3) does not Granger Cause D(ASX)	761	2.81945	0.0102
D(ASX) does not Granger Cause D(TBILL3)		3.83057	0.0009
D(TBILL3) does not Granger Cause D(SSE)	703	2.35022	0.0296
D(SSE) does not Granger Cause D(TBILL3)		3.17677	0.0044

*Lag length determined Akaike Information Criterion (AIC)

The Granger causality results indicate that the DJIMI has a bi-directional feedback loop with the W5000 and 'Granger causing' the ASX and the SSE indexes. These results stand in contrast to the 1999-2002 findings of Hakim and Rashindian who found that "the Islamic index is influenced by factors independent from the broad market." We found no Granger cauality between the DJIMI and TBILL. This later result is consistent with the Hashim and Rashidian findings and the DJIMI's *Shari'ah* compliance in regards to interest rates retrictions. These results are particularly noteworthy in the context of the Federal Reserve Bank's 'quantitative easing' monetary policies (June 2008 and August, 2010) which sought to stimulate the U.S.

economy by increasing the money supply (through the purchase of Treasury notes and other financial assets) *without* regards to the interest rates. The TBILL series 'Granger caused' the W5000 had feedback loops with the ASX and SSE series.

Although the DJIMI shares a feedback loop with the W5000 it is not susceptable to contagion influences from the SSE and ASX. The ASX shares feedback loops with the W5000 and TBILL and is 'Granger caused' by the DJIMI. The W5000 'Granger causes' the SSE and ASX (feedback) and is 'Granger caused' by the TBILL. As expected, the TBILL 'Granger causes' the W5000 but is 'Granger caused' by the DJIMI and shares feedback loops with the SSE and ASX. The ASX, which is 'Granger caused by' the DJIMI and Granger causes the SSE, shares feedback loops with the TBill and the W5000.

Conclusion

With the continued growth and popularity in Islamic finance as an alternative investment opportunity, indices such as the Dow Jones Islamic Market World Index continue to gain popularity. The DJIMI stands as a unique counterpart to the Wilshire 5000 index, introducing the idea of *Shari'ah* compliancy to screen for stocks not meeting certain capital requirements and involved in sectors such as alcohol, firearms, entertainment and tobacco.

We began the present study by looking at earlier scholarship done by Hakim and Rashidian (2004) in comparing the DJIMI and W5000's performance using metrics such as annual return, median, Sharpe ratio and annual standard deviation from the period of 1999 until 2002. We built upon several of the performance metrics that were used in the study comparing the DJIMI and W5000 and updated it with data from 01 January 2008 through 31 December 2011. We also introduced the FTSE All Share Index and the SSE Composite index to provide better context to the performance of indices outside of the United States. We also choose to use year-on-year intervals for the development of Sharpe ratio and annualized standard deviation metrics versus the aggregate data used by Hakim &Rashidian. What we found helped further validate several conclusions made in the original study and help identify what could be salient features of the DJIMI.

As shown in the original study, we also found the DJIMI to display significantly lower levels of volatility versus not just the W5000 but both the FTSE All Share and the SSE Composite Index. We also found that, similar to the original study, annual returns of the DJIMI were less than the W5000 but at spread values which were smaller than they had been a decade previously and when taken into context of the FTSE and SSE's indices, showed comparable return rates with significantly reduced levels of volatility and promising Sharpe ratios.

Our cointegration results indicate that the DJIMI is not cointegrated with W5000, ASX or SSE. While the *Shari'ah* compliancy screening does limit the DJIMI's constituent diversity this aspect does not appear to have significantly offset the advantages of the DJIMI's global diversity or significantly compromise the DJIMI returns. The non cointegration results suggest that the DJIMI offers international investors profitable opportunities and as well as the benefits diversification not duplicated in domestic equity markets. Accordingly, DJIMI could provide international investors with portfolio diversity and comparable returns. Our Granger causality results suggest that the DJIMI is the least susceptible the global contagion effects as it is only Granger caused by the W5000.

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End Notes

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[i] Accordingly, we would not expect these equities to drift far apart over time. However, Hashim and Rashidian's cointegration analysis (2004) found no long-run relationship between the DJIMI and the W5000 or between the DJIMI and the returns on three month U.S. Treasury bonds between 1999 and 2002. Hakim and Rashidian concluded that "the Islamic index is influenced by factors independent from the broad market or interest rates."

[ii] See Engle and Granger (1991) for a discussion and basis of Augmented Dickey Fuller Test for unit roots

[iii] Using the AIC we choose different lag lengths for all pairs; however the results are qualitatively the same