Size and Volatility: new evidence from an application of wavelet approach to the emerging Islamic mutual funds' industry

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Abstract

As far as the author's knowledge, the paper is the first attempt dedicated to understanding the risk and volatility of constituents of the young and rapidly growing Islamic mutual funds' industry. The novelty of our approach lies in the usage of wavelet tools to high-frequency financial market data, which allows us to understand the relationship between returns of funds of different sizes in a completely different way. Major part of economic time series analysis is done in time or frequency domain separately. Wavelet analysis can combine these two fundamental approaches, so we can work in time-frequency domain. Using wavelet coherence, we have gained valuable insights into the volatility and continuous dynamics of cross-correlations between small, medium and large size Islamic mutual funds.

Key words: Islamic Mutual Funds, Volatility, Size, Assets Under Management, Wavelet Analysis, Wavelet Coherence, Diversification.

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1. Introduction and motivation

Significant amounts of wealth of individual and institutional investors, alike, are invested in mutual funds, in pursuit of capital growth and diversification benefits. Mutual funds are investment vehicles that pool financial resources of different investors and invest in tradable financial securities. Their popularity among individual investors is closely related to considerations of liquidity and portfolio diversification; not to mention investment expertise. As investors' goals differ in terms of return requirements, risk tolerance, liquidity needs, as well as religious and ethical compliance, a plethora of funds are offered in the market to match the various needs. In this regards, Islamic mutual funds were developed to meet the religious and investments' demands of Muslim investors. Prior to 1999,Shari'ahcompliant funds were small and few. Since then, they have witnessed tremendous growth, fostered by the increasing global recognition of Shari'ah screening methodologies, such as those brought forward by Dow Jones and FTSE. According to Ernst and Young's Islamic Funds and Investments Report 2011, the Islamic funds industry, comprising equities, commodities, Sukuk and alternatives asset classes, grew at a rate of 7.6% in the year 2010, to US$58 billion. Nonetheless, the report exclaimed that the industry's size and growth figures are shy in comparison to the target market with its funds in excess of US$500 billion, and estimated to be growing by at least 10-15% annually. GCC's Shari'ah conscious investors were, alone, projected to add more than US$70b to this pool by 2013.

Review of relevant literature reveals scarcity of analysis concerning Islamic mutual funds. Moreover, most of the studies are concerned with comparative performance of Islamic mutual funds relative to market indices or conventional peers; that is whether they present reward or punishment, if any, to faith-based (Shari'ah- compliant) investors. Despite that, the scarce existing literature indicates inconclusiveness of results with regards to the performance of the same. Furthermore, there is a need for a thorough analysis of the young industry that goes beyond the quest of comparative appearances towards an inward examination of Islamic funds and markets[3], their risk characteristics, correlations and investability. Such considerations are of utmost importance to Shari'ah-conscious investors; to whom the choice and investment frontier could never involve non-compliant investments but rather different Islamic alternatives. That is to say, Shari'ah-compliant investors are not likely to substitute their Shari'ah compliant investments with conventional ones, the alternative class in many of the recent studies, on the basis of risk-return analysis, but

[3] This is not to undermine the value of existing literature but to stress the importance of moving forward.

they are more likely to do so with another Shari'ah compliant investment. Findings are also important to investment managers and Islamic funds of funds, for instance, as it implicates on their portfolio investment strategies and choice of investment fund.

In this paper, we empirically investigate the risk characteristics of Shari'ah compliant mutual funds in Malaysia. In particular we attempt to shed some lights on the individual volatilities and correlations of Islamic mutual funds of different sizes, namely small, medium and large funds, over different horizons, in order to facilitate asset allocation decision-making by Shari'ah compliant funds' investors, given their risk tolerance, and derive some diversification implications for better portfolio management. Bearing in mind, all the while, that the issue of diversification[4] is closely related to correlations and comovements over time, and that the same is subject to different dynamics and market relationships at different scales. The different types of investors contribute to this variable dynamics. Starting with noise traders, whose investment horizon span from several minutes or hours to days, the spectrum of investors ranges through technicians with the horizon of several days to fundamentalists with the horizon of several weeks or months to institutional investors, the likes of pension funds and sovereign wealth funds, who usually invest for several years (Baruník et al., 2011*)*. Thus, apart from the time domain, there is a frequency domain, which represents various investment horizons that ought to be considered for an optimal decision on asset allocation. Wavelet analysis can combine these two domains, thus enabling us to gain valuable insights on the volatility and continuous dynamics of cross-correlations between small, medium and large size Islamic mutual funds.

The paper is structured as follows. In Section 2,wereview the literature on Islamic mutual funds. Section 3 outlines the data. We present very brief introduction to the methodology of the wavelet coherence in Section 4. After the methodology is set, we employ high-frequency (daily) data of daily returns of Islamic mutual funds and study their interdependence in both time and frequency domain. Empirical results are discussed in Section 5.Section 6concludes with an indication of areas for potential future research.

2. Literature review

As mentioned earlier,research on Islamic mutual funds is admittedly scarce and concentrated on comparative performance against market indices or conventional funds.

Elfakhani & Hassan (2005) studied the performance of Islamic mutual funds in relation to Islamic and conventional market benchmarks using a sample of 46 Islamic mutual funds for the period from January 1, 1997 to August 31, 2002. Utilizing measures of performance, such as Jensen

[4] This is as suggested by modern portfolio theory. Islamic asset allocation is not expected to diverge from the same in this regard.

alpha, Sharpe ratio, and Treynor ratio as well as ANOVA statistical test, the researchers found no statistical evidence of any performance differences between the investigated Islamic funds and the market benchmarks. Nonetheless, Islamic mutual funds were found to have some hedging benefits against market downturns.

A similar study by Fikriyah, Taufiq & Shamsher (2007) compared the performance of 14 Islamic unit trust funds in Malaysia to that of 51 conventional peers, for the period from 1992 to 2001. Their findings reinforced the hedging benefits of Islamic funds, which fared better than the conventional funds during market downturns. Both asset classes were found to have marginally underperformed the benchmark index. Treynor & Mazuy 1966 model provided little evidence in favor of Islamic and conventional funds' managers's selection and market timing skills. A finding that comes in contrast with that of a more recent study by Mansor and Bhatti (2011), which not only suggested the outperformance of Islamic mutual funds in Malaysia, but also the superiority of their stock selection skills relative to their conventional counterparts. The study, however, finds Islamic mutual funds' managers comparatively less able when it comes to market timing.

A more comprehensive study by Hoepner, Rammal, & Rezec (2009) examined the performance and investment styles of 262 Islamic equity funds from 20 countries and four regions relative to those of constructed portfolios. Applying a conditional three level Carhart model, they found mixed results, whereby the Islamic funds of eight countries (mostly from the Western world) significantly underperformed their relevant benchmarks while funds from only three countries outperformed their benchmarks. On the other hand, Islamic funds from the Gulf Cooperation Council (GCC) or Malaysia did not significantly underperform their respective benchmarks.

3. Data

Daily returns of 34 local Malaysian Islamic mutual funds are used in the study, spanning the period from October 2005 to February 2013[5]. The data was obtained from Thomson Reuters Eikon, which has an overall account of 592 Islamic mutual funds around the globe, 198 of which are domiciled in Malaysia alone. The analysis was focused on funds invested in the local Malaysian equity market only with FTSE Bursa Malaysia Emas Shariah Index recognized as a benchmark, in order to maintain comparability; overcome investment-strategy peculiarity and properly assess the size-controlled riskiness of relevant funds. A total of 49 funds were found to match the above criteria; however, 15 funds were disregarded from the study in consideration of insufficient data points. The remaining 34 funds were classified in accordance to their size as small, medium and

[5]A consideration was made to extend the sample, time-wise, however the number of funds would have been forfeited; as data availability is limited to that of 30 funds starting May 2004 and to only 25 funds as of December 2003.

large funds. Similar-sized funds were pooled together into 3 funds of funds and their weighted-average returns were calculated accordingly, as the research is more interested in aggregate performance of each class, rather than that of individual funds.

As tabulated in Table 1, there are a total of 17 funds with less than RM 50 million of assets under management; 10 funds with assets under management between RM 50-150 Million and 7 funds with more than RM 150 million worth of assets under management. The average assets under management for these funds vary considerably; as it ranges from RM18.7 million; RM76.3 million to RM1,317.5 million respectively. Therefore, each group of funds represents a healthy and unique slice of the overall population.

	No. of Funds	AUMs	Average AUM
Small Size Funds (<RM50M)	17	RM317,107,258	RM18,653,368
Mid Size Funds (RM50M-RM150M)	10	RM762,860,116	RM76,286,012
Large Size Funds (>RM150M)	7	RM9,222,300,119	RM1,317,471,446

Table 1. Funds' distribution

The funds descriptive statistics are presented in Table 2. Volatility seems to increase monotonically as the fund size increases but so is the mean of daily returns. Though it remains to be investigated, more volatility could be due to large funds needing to find more stock ideas than small funds, but it does not mean that they cannot. Indeed, large funds can hire more managers to follow more stocks. Implied volatility of large funds should be pursued by stakeholders; Shari'ah scholars; fund managers in order to come up with more options and investment opportunities.

	SML	MID	LRG
Mean	0.0063%	0.0076%	0.0130%
Median	0.0074%	0.0272%	0.0333%
Maximum	3.6507%	3.1200%	3.8773%
Minimum	-9%	-9%	-8%
Std. Dev.	0.006792	0.006875	0.007463
Skewness	-2.077247	-2.739466	-1.807776
Kurtosis	22.56526	32.94523	15.80698
Jarque-Bera	32604.82	75528.93	14432.92
Probability	0.000000	0.000000	0.000000
Sum	0.122442	0.149425	0.254803
Sum Sq. Dev.	0.090191	0.092402	0.108887
Observations	1956	1956	1956

Table 2. Descriptive statistics

4. Methodology

Financial time series are known to exhibit a multiscale tendency. That is the same time series have several structures at different time scales (Khalfaoui and Boutahar, 2011). However, majority of used models focus on one of the domains solely, thus neglecting considerable amount of information. As both frequency and time domains are important and necessary for a deeper understanding of the dynamics of the financial markets and instruments and crucial for a more informed decision making, we endeavor to combine both domains by applying wavelet analysis of high-frequency daily funds' returns.

4.1. The Continuous wavelet transform (CWT) and wavelet coherency (WTC)[6]

The continuous wavelet transform (CWT) performs time-frequency analysis of otherwise time signals, such that it estimates the spectral characteristics of signals as a function of time. With respect to the 'mother wavelet' Φ,CWTis a function $W_x(s,\tau)$ that provides wavelet coefficients, defined as

[6] The description of CWT and wavelet coherence are largely drawn from Barunik et al (2013) Tiwari et al (2013), Madaleno et al (2012) and.

$$W_x(s,\tau) = \int_{-\infty}^{+\infty} x(t)\frac{1}{\sqrt{s}}\phi^*\left(\frac{t-\tau}{s}\right)\mathrm{d}t$$

where * denotes the complex conjugate form. The mother wavelet $\Phi(.)$ as a prototype for generating other window functions. The term translation, τ, refers to the location of the window (indicating where it is centered). As the window shifts through the signal, the time information in the transform domain is obtained. The term scaling, *s*, controls the length of the wavelet by extracting frequency information from the time series; it is dilating the wavelet (if $|s| > 1$) or compressing it (if $|s| < 1$). In this way an entire set of wavelets can be venerated from a single mother wavelet function and this set can then be used to analyze the time series.

In comparison with discrete wavelet transform (DWT) and maximal overlap discrete wavelet transform (MODWT), CWT is a redundant transform that provides the following advantages:

- Larger freedom in selecting the wavelets in accordance to the length of examined data.
- Relatively easily-interpreted results (Aguiar-Conraria and Soares, 2011)
- Comparative ability in identifying patterns and hidden information of multi-scaled time series.

Wavelet transforms, thus, provide the phase spectrum needed for computation of coherence. Wavelet coherence is used to measure correlation of two time series in time-frequency domain. First, we briefly define the continuous wavelet transform, followed by the wavelet coherence. The continuous wavelet transform Wx (u, s) is obtained by projecting a wavelet (:) onto the examined time series

$\psi(.)$

denotes a normalization, u is a location parameter and s is a scale parameter

$$x(t) \in L^2(\mathbb{R}): W_x(u,s) = \int_{-\infty}^{\infty} x(t)\frac{1}{\sqrt{s}}\psi\left(\frac{t-u}{s}\right)dt, \text{ where } 1/\sqrt{s}$$

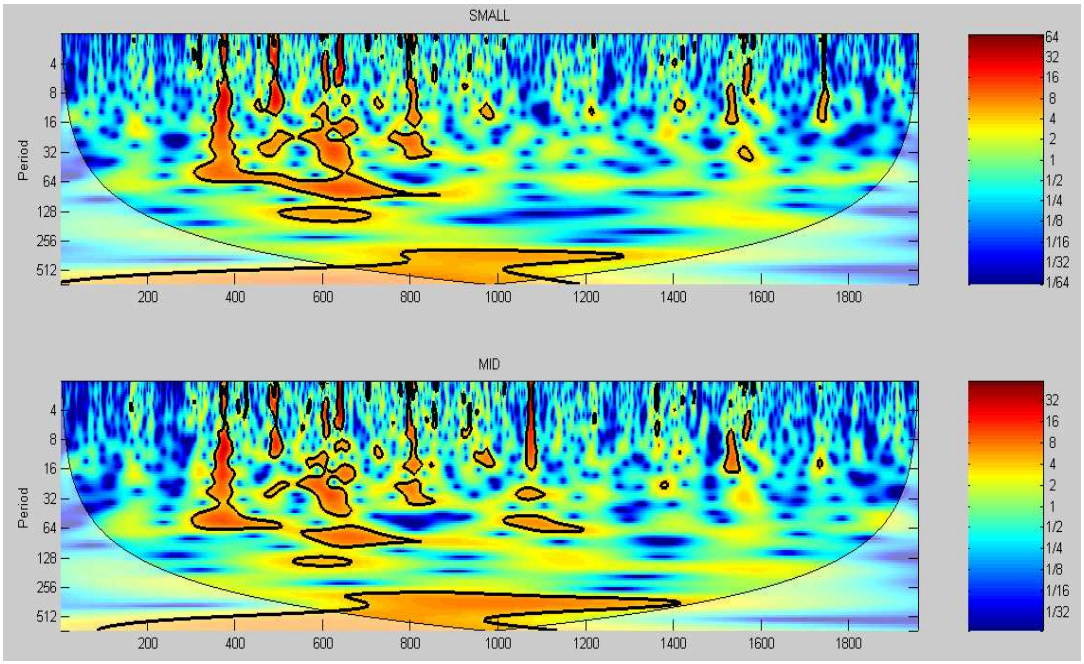
Wavelet coherence could be defined the as the squared absolute value of the smoothed cross wavelet spectra, Wxy(u, s), normalized by the product of the smoothed individual wavelet power spectra of each series i.e.,

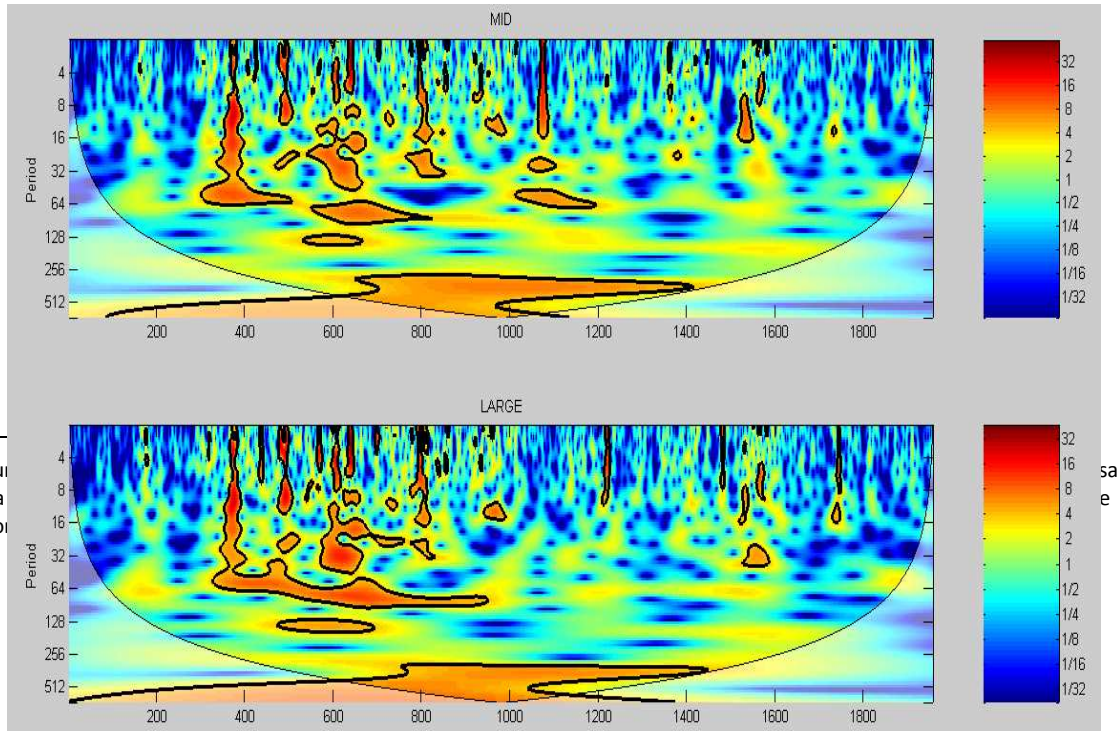
$$R^2(u,s) = \frac{|S(s^{-1}W_{xy}(u,s))|^2}{S(s^{-1}|W_x(u,s)|^2)S(s^{-1}|W_y(u,s)|^2)},$$

where S is a smoothing operator. The squared wavelet coherency coefficient is in the range 0 R2 (u; s) 1, values close to zero indicates weak correlation, while values close to one are evidence of strong correlation. Thus it provides useful tool for analysis of comovement across the Islamic mutual funds. The phase difference, indicated by arrows, gives us details about delays of oscillation of the two examined time series. Arrows pointing to the right (left) when the time series are in-phase (anti-phase) or are positively (negatively) correlated. Arrow pointing up means that the first time series leads the second one, arrow pointing down indicates that the second time series leads the first one.

5. Results

In our analysis, we utilize the wavelet transform to analyze the time-scale properties of funds' returns. Figure 1 shows the individual volatilities of the funds in the time–frequency domain. The horizontal axis refers to time while the vertical axis refers to frequency; the lower the frequency, the higher the scale. Upon examining the figure, it is clear that volatilities vary across the domain, in parallel with the overall volatility of FTSE Bursa Malaysia KLCI[7], as depicted in Figure 2. The pattern of volatility is almost the same across the small, medium and large funds.





[7] FTSE Bu sa
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Fig. 1. Individual volatilities of Small, Medium and Large funds.

The funds' returns were most volatile at the lower scales, higher frequencies, at the period corresponding to the global financial crisis of 2007/2008. It is worth noting, however, that this volatility was short-lived and has largely stabilized, at the same scales (up to 16 months), since then with the exception of September 2009 and more recently in 2011, probably as a consequence of renewed recovery concerns, especially with the ongoing sovereign debt issues in the US and Eurozone. The volatility during the years of the global financial crisis of 2007/2008 was more persistent over the 5-year investment horizon, which is interesting in light of the criterion of Lipper funds' award that recognizes best performers over the past 3, 5 and 10 years. Also, of interest is the pattern of volatility in the high scales, which was persistently moderate before subsiding considerably from 2011 onwards.

Having said that, an Islamic mutual funds' investor is not immune from volatility induced by the conventional credit-based system and must, therefore, be aware of developments and trends in the same; for a better wealth management.

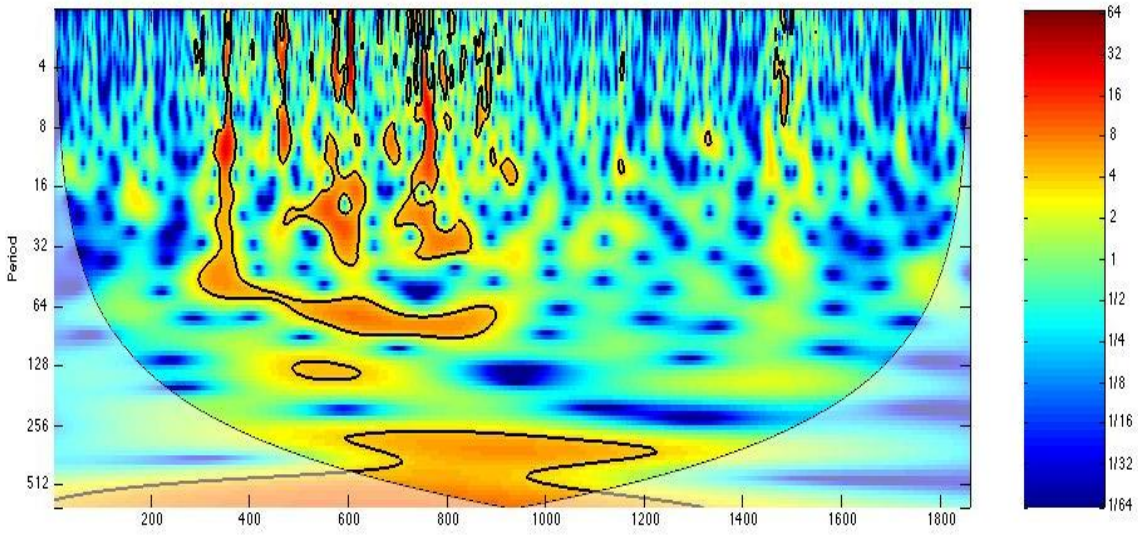

Fig. 2. Volatility of FTSE Bursa Malaysia KLCI.

Moreover, the main analysis of co-movement of the studied funds' returns is conducted with reference to the wavelet coherence; asit allows quantifying the relation between two time series in the time-frequency domain.

Figure 3 shows the estimated wavelet coherence for all pairs of small, medium and large funds. Wavelet coherence identifies the regions in time-frequency space where the two time series co-move. Warmer-colored regions inside the black lines represent regions where significant dependence has been found. The colder the color is the less dependent the series are. Periods and frequencies with no dependence in the funds are represented by blue regions. Therefore, it can be inferred that the small, medium and large Islamic mutual funds are more likely, than not, to be highly correlated over the different frequencies and time periods, which reduce diversification benefits for the average investor. Nonetheless, there have been frequency bands and time intervals of low correlations in the lower and middle scales, in particular. Thus, it could be hoped that an active investor or investment manager may be able to detect and reap advantage of such transient low correlation, by investing in the low-correlated funds simultaneously.

At any given point, continuous wavelet transform uses information of neighbor data points, thus areas at the beginning and at the end of the time interval should be interpreted with caution, especially those inside the cone of influence on lower frequencies.

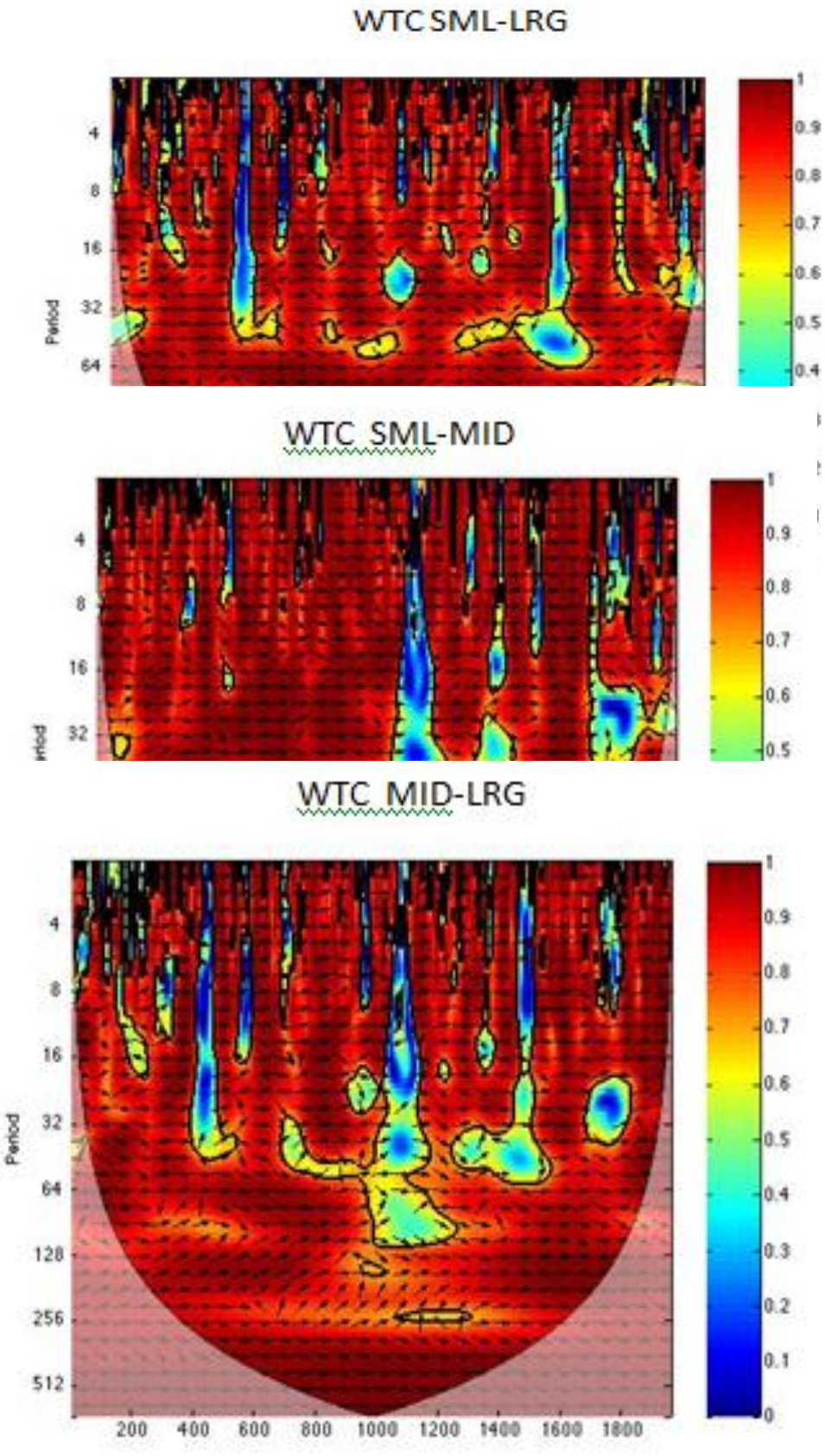

Figure 3. Wavelet coherence of funds' pairs on high-frequency daily returns. Horizontal axis shows time, while vertical axis shows scale in days.

6. **Conclusion**

We believe that our results have potentially important implications for Islamic mutual fund investors and managers of Islamic funds of funds. In particular, our analysis suggests that despite high correlations between the studied funds, on average, an investor or investment manager may be able to detect and reap advantage of some transient low correlation between mutual funds of different sizes by the virtue of active monitoring. Though no contrasting difference is detected in the wavelet presentation of individual volatilities, the larger standard deviation of daily returns of funds with larger assets under management, reported earlier, needs to be investigated. Future research, may wish to apply Mutlivariate Generalized

Autoregressive Conditional Heteroscedasticity (MGARCH) in a framework of Dynamic Conditional Correlation (DCC), in order to assess the interrelationships, own-volatility, cross-volatility spillovers, and own persistent volatility effects of Islamic mutual funds vis-à-vis other economic and financial variables of importance.

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