Impact of global financial crisis on Islamic and conventional stocks in emerging market: an application of ARCH and GARCH method

DR.Raditya Sukmana
(Lecturer in Dept of Islamic Economic, Airlangga University, Surabaya,Indonesia)
Email: momyadit@gmail.com
&
Muhamad Kholid, MBA, CIFP
(Islamic Finance Practitioner & Student in INCIEF, Kuala Lumpur, Malaysia)
Email: kholidti@gmail.com

Abstracts

In the wake of recent global crisis, the stock market shocks spread and transmitted from its epicenter in the developed stock market to emerging stock markets. The financial contagion affects performance of emerging stock markets like those of in Indonesia, Malaysia and in most Southeast Asia countries. In supporting development of emerging stock markets, this study aims to see the resilient of the Islamic stock index compare to conventional stock index in facing the global financial crisis. Another purpose of this study is to provide a new guide for the investors in emerging stock market before making investment decisions. This study examines the risk performance of Islamic stock index (Jakarta Islamic Index/JAKISL) and its conventional counterpart (Jakarta Composite Index/JCI) in Indonesia. Daily data from early January 2001 to December 2009 will be adopted. In order to measure the involved risk, we employ the ARCH and GARCH methodologies. The result shows that investing in Islamic stock index is less risky than that of the conventional

1. Introduction

Stock market crash around the world during the crisis period demonstrated the financial contagion of recent global financial crisis. Notwithstanding the financial crisis firstly hit stock markets in the United States and other developed market, it soon spread around the world to hit stock markets in emerging country like Indonesia and other Southeast Asia countries. This is well explained as one of the salient features of globalisations and the rapid transmission of information across market is the spread of financial crisis from one country to another, even when underlying economic fundamentals are different (Ahlgren & Antell, 2009). Hence, high economic linked between emerging market and developed market just becomes the conductor of the contagion. With such markets environment, investors need a guide to make effective investment portfolio, an investment that can stand market shocks and least risky. Risk is important in investment since risk is a factor that shapes individuals' decision to make investment (Lipe, 1998; Yang and Qiu, 2005). Knowing the investment risk, it will guides investor in developing effective investment portfolio especially during the crisis period.

In view of rapid development of Islamic finance, and thus Islamic investment, this paper tries to measure and compare the resilience of Islamic stock index and conventional stock index during the financial crisis. This study will further be used as new guide for investors in emerging stock markets to create effective investment portfolio. The study examines the risk performance of stock markets in Indonesia. The stock market has two indices namely, Jakarta Islamic Index (JAKISL) and its

conventional counterpart, Jakarta Composite Index (JCI). JAKISL is a subset of JCI where all stocks of JAKISL are part of JCI.

JAKISL consists of sharia compliant stocks that have gone through sharia screening process. The screening process measures sharia compliant of stock using three approach/method of valuation namely, production or activity method, income method and capital structure method (Rosly, 2005). The components of the JAKISL are 30 listed companies, approved by the Sharia Supervisory Board of Danareksa Investment Management to be in line with Sharia rules. The index is calculated with a base value of 100, with January 1, 1995 as the base year. The trading of the index was started on July 3, 2000 (Rahim, Ahmad N & Ahmad I, 2009).

Risk performance of JAKISL and JCI is measured using ARCH and GARCH methodologies. These methodologies are useful to measure volatility of individual stocks or index. The volatility of index is measured throughout the period prior, during and after 2008's financial crisis. This is to find out whether financial crisis affects to the volatility of stocks and severity of the effect towards Islamic and non-Islamic/conventional index. Finding of this research is useful to guide investor in their investment decision.

This paper subdivides into five sections to cover the above discussion; first section is introduction to the research that includes background and objectives of the study. The next section discusses Islamic stock index and sharia screening process to provide understanding and give appreciation about Islamic stock and the process to determine Islamic stocks. Observation data and methods are discussed in section 3 while the empirical result and analysis will be described and discussed in section 4. Following it, the discussion ends with conclusion.

2. Islamic Stock Index and Sharia Screening Process

It is important to know about Islamic stock index and the process to determine sharia compliance stocks that form the index. The relevance to know these is lied on the purpose of this paper which is to measure the resilience of the Islamic stock index compare to its conventional counterpart. This paper is expected to provide a guide for investor in their investment decision especially during financial crisis. Hence, a clear understanding about Islamic stock index and sharia screening process is required.

The fundamental different between Islamic index and conventional index is that the former requires stocks to be sharia compliant while the latter has no such requirement. A sharia compliant stock, in simple term, can be described as stock of company whose activities are free from riba (interest), gharar (uncertainty), maysir (gambling) elements and prohibited activities like producing products or delivering services which against Islamic teaching like pornography, producing/selling alcohol, casino etc.

Sharia stock index consist of stocks that are available in stock markets and have been selected under stock screening process to determine whether a stock is sharia compliant stock (permissible/halal stock) or otherwise. According to Rosly (2005), there are three approaches in stock screening process. Those approaches are activity or production method, income method, and capital structure method. For the production method or activity method, a stock is declared permissible (halal) when the issuing company produces output or products that are free from the prohibitive elements of riba, gambling, intoxicants, pork and pornography. Under income method, income derived from reserves and investments securities must be free from interest/ Riba. The Dow Jones Islamic Index is the most conservative in this regards.

Companies that hold cash and interest-bearing securities exceeding 33 percent of total assets are excluded from the index. The third method is capital structure method where debt to equity ratio of the issuing company becomes the key to measures stock compliance. The bigger the ratio, the more dependent is the bank on debt financing with payments and receipts of interest fully implicated. Nevertheless, full compliance is not possible today. On the leverage factor, a debt to equity ratio of less than 45% will claim Islamic legitimacy while Dow Jones Islamic Index at less than 33%.

To the best of the author knowledge, study on the comparison of the risk between Islamic and conventional stock is only done by Zoubi and Maghyereh (2007). It uses the sophisticated method of Value at Risk (VaR) metholologies such as RiskMetrics, Student-t APARCH and skewed Student-t APARCH covering from year 1996 to 2005. In conclusion, the result suggests that the value of VaR is greater for DJIM than for DJIS Islamic. This means that Islamic index has a risk which is significantly less than the board market basket of stocks. This present study aims to extend the study done by Zoubi and Maghyereh (2007) using the emerging market case of Indonesia where Islamic and conventional stocks exists.

3. Data and Methodology

3.1. Data

The data used in this study consists of daily series (last price) on Jakarta Composite Index (JCI) and Jakarta Islamic Index (JAKISL) from January 3, 2001 to 30 December 2009 (2185 observations). Briefly, JCI reflects an index of an Indonesian stock market and JAKISL refer to the selected Indonesian stocks which have been filtered with the shariah values/parameters. All the data are retrieved from Bloomberg. Since the focus of this study is to examine the impact of crisis, hence dummy variable will be adopted. The decision to create dummy variable which represents the crisis period will be subjective and it depends on the author's argument. This paper set the crisis starts at March 2008. The reason for this is that Bear Stern was provided loan by Federal Reserve to avert collapse of the company. When such big company requested a help from US government, it was a sign that the crisis start as this influenced the market confidences and triggered market panic that in shortly spread around the globe. Furthermore, with regard to the last day of crisis, this study argue that crisis ended at July 31,2009. This date was selected based on the fact that Bank Indonesia rate, as an important instrument in conducting the Indonesian monetary policy, has been stable. Hence it is subjectively argued that particular date was a signal that crisis ends.

3.2. Volatility Measures

The volatility approach used is based on an Autoregressive Conditional Heteroscedasticity model (ARCH) which is introduced by Engle (1982). Furthermore, other method of Generalized Autoregressive Conditional Heteroscedasticity (GARCH) by Bollerslev (1986) will also be examined. These models are adopted since it allows for heteroscedasticity in the residual series. Furthermore, these models take into account the volatility shock to persist over time (Ibrahim, 2002). GARCH(p,q) model is as follows:

$$x_t = \mu + \sum_{i=1}^{r} \beta_i x_{t-1} + e_t \quad \text{.....(1)}$$

$$e_t \mid I_{t-1} \sim N(0, h_t)$$

$$h_t = \alpha_0 + \sum_{i=1}^{p} \alpha_i e_{t-1}^2 + \sum_{i=1}^{q} \phi_i h_{t-1} \quad \text{.....(2)}$$

Model 1 above represent the conditional mean equation which is modelled as an autoregressive process. The r is selected such that the residuals (e_t) are not serially correlated. Model 3 refers to the conditional variance equation. The h_t, conditional variance depends on lagged squared errors and lagged conditional variances. In order to be well defined GARCH model, it necessitates that coefficient of the lagged squared errors and lagged conditional variances are non-negative and their sum is less than unity (Ibrahim, 2002).

To start with, we will depict the descriptive statistics of all the variables such as mean, median kurtosis etc. following it, we will ensure that the non homoscedastic or heteroscedasticity in the residual present in the model by testing it with the ARCH LM Test. Having known that the result is as expected, we proceed to test the main objective of this paper that is whether crisis as represented by dummy variables extend its influence to the JCI and JAKISL.

4. Empirical Result and Analysis

Descriptive statistics of the variables are given in table 1. From the table, some observations may be made. First, total number of observation used in this paper during the period of study is 2185. Second, for the mean, median, maximum and minimum, JAKISL is relatively low as compare to that of JCI. For instance, JAKISL' mean of 203.8 is much smaller comparing to JCI's mean of 1211.4. Median also provides similar result that the value for JAKISL, which is 178.53, is much lower compare to the median for JCI which is 1085.7.

One of the reason behind this fact is that, shariah filtered stocks in the Islamic index is a subset of the all stocks traded in the Indonesian stock market. In other word, there is no single stock in the JAKISL which is not part of JCI. Given the relatively small number of stocks in the JAKISL then it is expected that the observations of Mean, Median, Maximum, Minimum and including the standard deviation is very low compared to those computed for JCI. A detail description can be seen in table 1 below.

Tabel 1
Descriptive Statistics

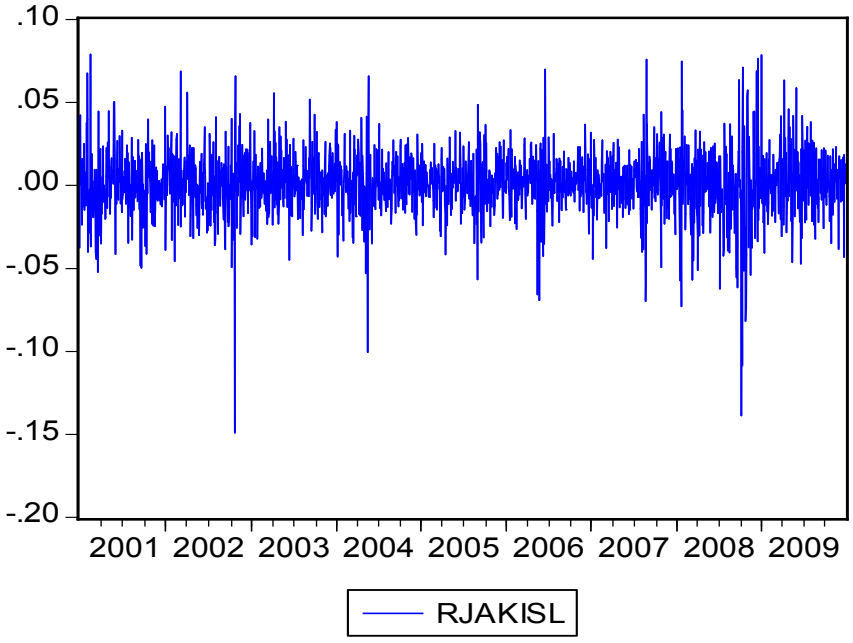
	JAKISL	JCI
Mean	203.8156	1211.449
Median	178.5340	1085.744
Maximum	517.8140	2830.263
Minimum	48.99100	337.4750
Std. Dev.	129.7691	735.0121
Skewness	0.616586	0.546737
Kurtosis	2.206686	1.993350
Jarque-Bera	195.7453	201.1139

Probability	0.000000	0.000000
Sum	445337.0	2647016.
Sum Sq. Dev.	36778589	1.18E+09
Observations	2185	2185

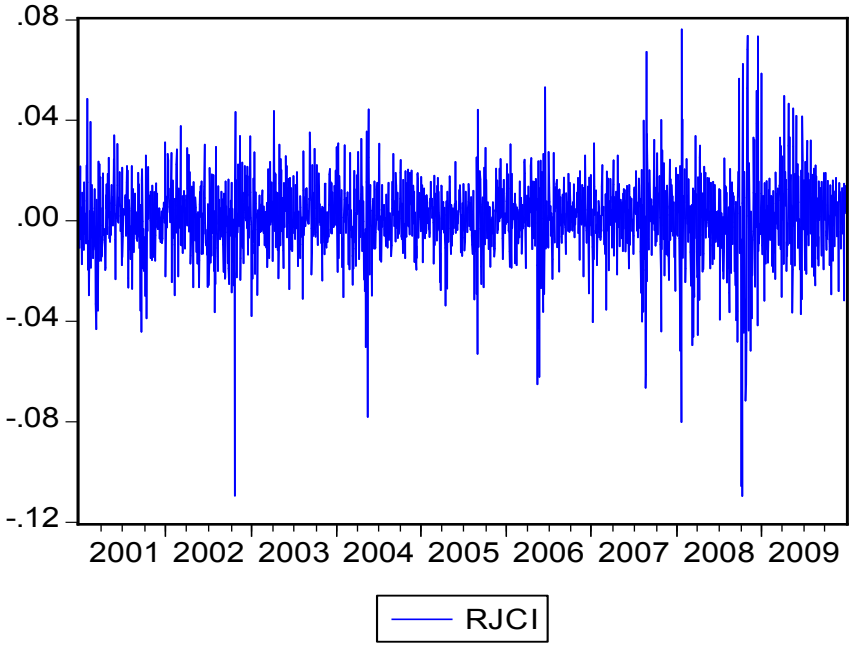
Third, on the skewness of the variables, JAKISL and KCI exhibit the value of 0.61 and 0.54 respectively. This positive skewness indicates that the distribution has a long right tail. With regard to the peakedness or flatness of the distribution of the series as represented by the kurtosis, both variables reveal that all distribution is platykurtic (flat) since those two value of the kurtosis are less than 3.

Having known on the descriptive statistics of those 2 variables, we proceed to clarify whether heteroscedasticity is presented in the residual. However, before clarifying the possibility of the existence of the heteroscedasticity, it is worth to look into the graphical distribution on the return of JCI as well as JAKISL as shown in the graph 1 and graph 2.

Graph 1
Graphical Distribution of the Return of Jakarta Islamic Index (JAKISL)



Graph 2
Graphical Distribution of the Return of Jakarta Composite Index (JII)



From both figures above, it shows that there exists periods with larger and smaller volatility in both samples. For example, during mid 2008 to mid 2009, it is seen that volatility is relatively high compared to other periods (such as during 2003 or during mid 2004 to mid 2005). This suggests that the crisis, which is occurred in that period (mid 2008 to mid 2009) may affect the performance of both stock indices. Furthermore, still in the same period, volatility return on the Islamic index seems to be slightly lower than that of the JCI. However, in order to decide whether heteroscedasticity is truly exist, we need to adopt the statistical measurements of Breusch-Pagan ARCH test or ARCH LM test. Results of the tests for both of variables are shown in the Table 2 and 3.

Table 2
A Simple AR(1) Model and Testing for ARCH(1) effects for JAKISL

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	0.223711	0.181026	1.235793	0.2167
JAKISL(-1)	0.999712	0.00075	1333.654	0.0000
R-squared	0.998775			
Durbin-Watson stat	1.847425			

ARCH Test:			
F-statistic	216.5407	Prob. F(1,2181)	0.0000
Obs*R-squared	197.1638	Prob. Chi-Square(1)	0.0000

Dependent Variable: RESID^2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	341.4874	42.00866	8.128978	0.0000
RESID^2(-1)	0.371283	0.019882	18.67435	0.0000
R-squared	0.137853			
Durbin-Watson stat	2.190877			

On table 2 and 3, the important part to confirm the existence of heteroscedasticity is on the ARCH test. The Obs*R-Squared statistics are 197.1 and

300.9 for JAKISL and JCI respectively. This clearly suggests that null hypothesis of non heteroscedasticity/homoscedasticity is rejected even in 1%. On other words, ARCH (1) effect are present. To check the robustness of the result, this study also employs high order ARCH effects (order 6 will be used). Results are shown in table 4 and 5 below.

Table 3
A Simple AR(1) Model and Testing for ARCH(1) effects for JCI

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	1.012176	0.96176	1.05242	0.2927
JCI(-1)	0.999967	0.000679	1472.45	0.0000
R-squared	0.998995			
Durbin-Watson stat	1.794275			

ARCH Test:			
F-statistic	348.7314	Prob. F(1,2181)	0.0000
Obs*R-squared	300.9334	Prob. Chi-Square(1)	0.0000

Dependent Variable: RESID^2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	341.4874	42.00866	8.12898	0.0000
RESID^2(-1)	0.371283	0.019882	18.6744	0.0000
R-squared	0.137853			
Durbin-Watson stat	2.190877			

Table 4
Testing for ARCH(6) effects for JAKISL

ARCH Test:

F-statistic	73.42189	Prob. F(6,2171)	0.0000
Obs*R-squared	367.4003	Prob. Chi-Square(6)	0.0000

Dependent Variable: RESID^2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	8.400199	1.542775	5.444865	0.0000
RESID^2(-1)	0.189717	0.021455	8.842558	0.0000
RESID^2(-2)	0.194303	0.021792	8.916409	0.0000
RESID^2(-3)	0.045181	0.022019	2.051883	0.0403
RESID^2(-4)	0.125731	0.022027	5.708155	0.0000
RESID^2(-5)	0.067303	0.02179	3.088747	0.0020
RESID^2(-6)	-0.028641	0.021559	-1.328475	0.1842
R-squared	0.168687			
Durbin-Watson stat	1.99488			

Table 5
Testing for ARCH(6) effects for JCI

ARCH Test:

F-statistic	99.60768	Prob. F(6,2171)	0.0000
Obs*R-squared	470.1479	Prob. Chi-Square(6)	0.0000

Dependent Variable: RESID^2

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	213.9425	41.95549	5.099274	0.0000
RESID^2(-1)	0.26062	0.021411	12.17223	0.0000
RESID^2(-2)	0.225896	0.022036	10.25143	0.0000
RESID^2(-3)	-0.021341	0.022424	-0.951723	0.3413
RESID^2(-4)	0.116294	0.022429	5.184939	0.0000
RESID^2(-5)	0.095139	0.022037	4.317278	0.0000
RESID^2(-6)	-0.069767	0.021461	-3.250866	0.0012
R-squared	0.215862			
Durbin-Watson stat	1.989956			

Result of Table 4 and 5 strengthen our previous argument that ARCH effect exist. The Obs *R-Squared statistics are 367.4 and 470.1 for both JAKISL and JCI. These results are even higher than that with the lag of 1. It suggests a massive rejection of the null hypothesis. Moreover, almost all of the lagged squared residuals are all highly statistically significant with the exception of lag 6 in JAKISL and lag 3 in JCI. It is then clear for this equation specification that an ARCH model will provide

better results. Next is to check whether volatility on both indices is affected by the crisis.

Table 6
An ARCH-GARCH (1,1) model for the JAKISL

Dependent Variable: JAKISL
Method: ML - ARCH
Convergence achieved after 25 iterations

Mean Equation				
	Coefficient	Std. Error	z-Statistic	Prob.
C	0.017473	0.077558	0.225295	0.8217
JAKISL(-1)	1.001244	0.000571	1752.852	0.0000
DUMMY	-0.186264	0.404954	-0.459963	0.6455

Variance Equation				
C	0.036192	0.007632	4.742372	0.0000
RESID(-1)^2	0.093338	0.007969	11.71222	0.0000
GARCH(-1)	0.908639	0.007331	123.9506	0.0000
DUMMY	0.409453	0.213859	1.914595	0.0555
R-squared	0.998774			
Durbin-Watson stat	1.849226			

Table 7
An ARCH-GARCH (1,1) model for the JCI

Dependent Variable: JCI
Method: ML - ARCH
Convergence achieved after 33 iterations

Mean Equation				
	Coefficient	Std. Error	z-Statistic	Prob.
C	-0.142968	0.393459	-0.363362	0.7163
JCI(-1)	1.0016	0.000487	2054.948	0.0000
DUMMY	-2.392962	2.095297	-1.142063	0.2534

Variance Equation				
C	1.128338	0.215982	5.224228	0.0000
RESID(-1)^2	0.122462	0.009262	13.22244	0.0000
GARCH(-1)	0.881413	0.008224	107.1821	0.0000
DUMMY	16.95182	6.699258	2.530403	0.0114
R-squared	0.998995			
Durbin-Watson stat	1.79708			

Table 6 and 7 reveal some important results that will be used in identifying whether crisis affects both stock indices. This study examines our estimation of the

generalized mode to the case where both p and q[1] are set to 1 since several studies indicate the adequacy of this specification in fitting time series (Ibrahim, 2002).

From the variance equation in both tables, it suggests that crisis affects the variance of both indices. The probability of the dummy in the JAKISL which is 0.055 is significant in the 10%. Meanwhile, crisis has shown to have more significant (in 5%) in the context of JCI with the probability of 0.0114. In terms of the magnitude as represented by the coefficient, it shows that the coefficient of the crisis to the volatility of JAKISL is 0.40 whilst that for JCI is 16.95.

With respect to the mean equation, it reveals that the existence of crisis is not significant in influencing both indices. This is shown by the probability of 0.645 and 0.25 for JAKISL and JCI.

Comparing the result of variance equation (in terms of the significances and the magnitude) in both models, it suggests that the crisis which starts to occur in mid 2008, affects the volatility in both indices namely JAKISL and JCI. Volatility also measures the risk. Therefore, the existence of the crisis will provide more risk to the JCI as this index is more volatile. In contrary, although crisis also creates volatility for JAKISL, but the degree is much less than that of the JCI. In other word, crisis provides less risk for the JAKISL.

With this result, it suggests that investing in the stocks in the JAKISL will be facing less risk as compare to that of the stocks in JCI. Hence, JAKISL is another better alternative for the investor especially during crisis time.

Table 6 & 7 have provided us the guidelines for the investors especially during crisis. There are two types of investors based on the risk appetite namely risk seeker and risk avoider. The former refer to the investors who like to opt for high risk which is normally followed by high return. The latter refers to the investors who try to avoid such a high risk. Certainly, for the investors who are risk seeker, JCI may be suited for them as JCI prove to have high risk. Conversely, investors who are risk avoider may opt for collections of stock in JAKISL due to its less volatility.

There are at least two policy recommendations derived from this study: firstly, the result facilitates investor with the risk profile on each index. This certainly brings a more accurate analysis as to kinds of investment venture that suit with investors' risk appetites. Secondly, the result suggests that the shariah screening process is important not only it eliminates the non shariah stocks but also it provides less risk kind of investment which is inline with the nature of Islamic value of small uncertainty (gharar shaghir).

The further study that needs to be done is to look into the case of other countries which allow Islamic and conventional stock coexists in their capital market. This is important to see the consistency of the result with this study and the previous study Zoubi and Maghyereh (2007). If the same results are obtained than we can conclude that majority of the Islamic stock are having lesser risks. This will give some important information to the investors since they can have a portfolio of islamic stocks, which have proven to have lesser risk, in several countries.

5. Conclusion

Financial crisis could affect the volatility of both Islamic stock index and conventional stock index. An empirical study on two stock indices of Jakarta Islamic Stock Index (JAKISL) and Jakarta Composite Index (JCI) is conducted to measure the

[1] See equation 2 above

magnitude of effect of the financial crisis towards the indices volatility. Even though volatility of both indices is affected by financial crisis, the study reveals that the magnitude of volatility of the indices is different where volatility of JCI is greater than that of JAKISL. This finding shows that Islamic stock index is more resilience towards crisis compare to conventional stock index. As volatility measure risk, hence JAKISL is less risky than JCI especially during crisis time. This finding can guide investors in their investment decision by providing information on the risk exposure on those two indices. For the risk seeker investor, stock collection in JCI is suited to them. Meanwhile for the risk avoider investors which always seek a lower risk, they will opt for JAKISL which prove to have a lesser risk. For the muslim investor who are valued with the Islamic norm of the allowing small uncertainty (gharar shagir), they will definitely select stocks from JAKISL.

References

Bollerslev, T. (1986),” Generalised Autoregressive Conditional Heteroscedasticity”, Journal of Economic Surveys,7,pp. 305-62

Engle, R.F. (1982),” Autoregressive Conditional Heteroscedasticity with estimates of the Variance of U.K. Inflation”, Econometrica, 50,pp 987-1008

Ibrahim, M (2002),” Volatility Interactions Between Stock Returns and Macroeconomic Variables: Malaysian Evidence,” Savings and Development no 2-2002-XXVI

Lipe, M. G. (1998), “Individual investors' risk judgments and investment decisions: the impact of accounting and market data,” Accounting, Organizations and Society 23, 625-640

Yang, J. and Qiu, W. (2005), “A measure of risk and a decision-making model based on expected utility and entropy,” European Journal of Operational Research 164, 792-799

Rosly, S.A. (2005), “Critical Issues on Islamic Banking and Financial Markets”, Dinamas Publishing, Kuala Lumpur

Ahlgren, N & Antell, J. (2009),”Stock Market Linkages and Financial Contagion: A Cobreaking Analysis,” The Quarterly Review of Economics and Finance 50 (2010) 157 – 166

Rahim, F.A., Ahmad, N., Ahmad, I, (2009),”Information Transmission between Islamic Stocks Indices in South East Asia,” International Journal of Islamic and Middle Eastern Finance and Management, Vol. 2 No. 1, 2009 pp. 7-19

Zoubi, H.A., & Maghyereh, A.I. (2007),” The relative Risk Performance of Islamic Finance: A new Guide to Less Risky Investments.” International Journal of Theorethical and Applied Finance. Vol.10, No.2 pg 235-249.