VOLATILITY TRENDS OF SYARIAH INDEX RETURNS AND KUALA LUMPUR COMPOSITE INDEX

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ABSTRAK

Kajian ini bertujuan untuk menganalisis sifat-sifat yang mempengaruhi secara langsung kemeruapan pulangan KLSI dan KLCI menggunakan model-model keluarga ARCH. Tempoh kajian bermula dari Januari 1995 - Jun 2003 yang dibahagikan kepada tempoh 1 (2 Januari 1995 - 29 April 1999) sebelum wujud KLSI dan tempoh 2 (30 April 1999 – 13 Jun 2003) iaitu selepas wujud KLSI. Dapatan kajian menunjukkan pulangan KLSI lebih meruap jika dibandingkan dengan KLCI. Dapatan juga menunjukkan ketibaan maklumat Indeks Industri Dow Jones (DJII) merupakan faktor utama yang mempengaruhi sifat keberterusan kemeruapan pulangan KLCI. Sifat keberterusan kemeruapan pulangan KLSI pula lebih dipengaruhi oleh ketibaan maklumat volum dagangan diikuti oleh kadar antara bank Islam dan DJII. Selain itu, dapatan menunjukkan arah kejutan pulangan pula mempunyai hubungan tidak simetri dengan kemeruapan pulangan KLCI dan KLSI dan tiada pembolehubah luaran yang dapat dikenalpasti mempengaruhi sifat tidak simetri ini. Bagi hubungan min-varians, secara keseluruhannya wujud hubungan positif iaitu apabila risiko meningkat, pulangan akan turut meningkat dan sebaliknya tetapi arah hubungan ini adalah tidak signifikan. Tambahan pula, kadar faedah antara bank, DJII dan volum dagangan gagal menjelaskan kewujudan hubungan antara min pulangan dan varians.

Introduction

Stock returns volatility is normally defined as the distribution towards average stock returns, better known as variances. In relation to that, information and knowledge about the behaviour stock returns volatility are important to financial economists and analysts in solving various related economics problems. Changes in stock prices, whereby an increase in stock returns will result in investors selling their shares. It can be concluded that an increase in returns volatility will give a negative impact to stock prices and thus the level of volatility will enable investors to make an accurate decision on investments. Bollersleve et. al. (1992)[1] states that three factors influence stock returns volatility are: persistence of returns, mean-variances, assymetrical relationship.

Syariah-approved counter is a stock counter which is approved by the Syariah Advisory Council (SAC) of the Securities Commission (SC) based on a fixed criteria which is centred on the major activity of a company. A company which carries out activities that do not go against the Syariah principle is clarified as an approved counter and will only be dropped from its list if it is found to possess the following elements:

- An operation based on *Riba* (interest rate) as is conducted by financial institutions such as commercial and merchant banks and finance companies;
- An operation that involves gambling activities;
- An operation that manufactures and/or sells of *haram* (forbidden) such as alcoholic beverages, pork and meat that is not slaughtered according to Islamic regulations; and
- An operation that involves activities which has a element of *gharar* (uncertainty) such as conventional insurance business.

The importance of Syariah-approved stock counter is to aid Islamic investors and Islamic fund managers to identify the counter concerned, to increase the confidence of Islamic investors, to facilitate the expansion of Islamic capital market institutions, and to attract external investors. KLSI is an indicator of stock achievement approved

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1 T. Bollerslev, R.Y.Chou & K.F. Kroner (1992), "ARCH Modelling on Finance: A Reviews of the Theory and Empirical Evidence", *Journal of Econometrics*, Vol. 52, pp. 5 – 59.

by the Syariah. It was launched on 17 April 1999 by the Kuala Lumpur Stock Exchange (KLSE). It comprises all Syariah-approved counters listed on the KLSE Main Board. The KLSI component will be updated upon the announcement of each listing of companies approved by the Syariah and Securities Commission.

In Malaysia, the emergence of Syariah-approved counters have opened up a new dimension in economics activities and the Malaysian Islamic capital market. The government's wish that the nation's total Islamic equity could be increased and becoming the centre of regional Islamic capital market will be achieved if all Bumiputera (natives), specifically Muslims, can invest in Syariah-approved stocks. Since April 2003, Malaysia has achieved a total number 704 Syariah-approved counters. Table 1 shows the total number of Syariah-approved counters from September 1997 to April 1003.

Table 1:
Syariah - approved counters; September 1999 - April 2003

Year	Total No. of Counters *	Syariah-approved Counters*	Percentage of Approved Counters*
September 1999	746	545	73
April 2000	n.a	n.a	n.a
October 2000	791	606	77
April 2001	807	630	78
October 2001	807	638	79
April 2002			
October 2002	860	684	80
April 2003	874	704	81

Source : www.sc.com.my (adapted)

* Main Board, Second Board and MESDAQ

To show that Islamic finance system is a good alternative, the achievement of Syariah-approved stocks must be studied and compared to conventional stocks. In relation to that, an important aspect to evaluate is volatility. In an effort to have an in depth knowledge of the features of stock returns volatility and the importance of this knowledge, many researchers have carried out studies about the aforementioned features of the Kuala Lumpur Stock Exchange (KLSE) stock market. Nevertheless, research carried out had only focused on KLCI component. Therefore, the objective of this research is to analyse the features that directly influence the KLCI and KLSI returns volatility, namely: persistence of returns, mean-variance relationship and asymmetric relationship.

To achieve the objective of this research, the ARCH family models are used to sudy the Syariah-approved stock returns in KLSE because it is able to deal with the problem of stock returns with abnormal distribution and variance returns which is nonstationary against time.

This paper is organized as follows: Section I and II lay the introduction and literature review; Section III discusses the data and methodology used; in Section IV, reserach findings are presented; Finally, the concluding remarks is offered in Section V.

Literature Review

A precise estimation of the Syariah-approved stock returns volatility is important and can attract Islamic and non Islamic investors and also Islamic Trust Fund managers in observing dynamic investment strategies and hence further aid the increase of Islamic funding in Malaysia. Besides that, there has been little detailed research carried out previously about stock returns volatility in Malaysia. A research related to Syariah stock in Malaysia was carried out by Muhammad Najit (2002)[2] and Mohd. Yahya (2002)[3] and Sanep and Zamzuri (2002)[4] which had used the Granger Reasoning Test to see whether there is a relationship of stock movements between Syariah stock counters and conventional at the KLSE. Research findings have found a two-way Granger relationship and a one-way relationship between the two types of stock, that is either from the direction of Syariah stock to conventional stock or vice-versa. On the other hand, Mohd. Yahaya's (2002) research had compared the RHB Syariah Index volatility to KLSE Composite Index. This research based on the GARCH model, showed that the KLCI is more volatile compared to the RHB Syariah Index. This research also examined the influence of macroeconomic variables on both types of Index. It found that macroeconomic variables only managed to describe the volatility

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2 Muhammad Najit Sukemi (2002), "Ujian Penyebab Granger Terhadap Saham Islam dan Konvensional bagi Sektor Perladangan dan Kewangan" (Latihan Ilmiah Sarjana, Universiti Kebangsaan Malaysia).

3 Mohd Yahya Mohd Hussin (2002), "Kemeruapan Bersyarat Serta Kuasa Meramal Pembolehubah Makroekonomi ke atas Pasaran Saham Islam dan Konvensional di Malaysia" (Latihan Ilmiah Sarjana, Universiti Kebangsaan Malaysia).

4 Sanep Ahmad & Zamzuri (2003), "Perbandingan Kemeruapan Antara Saham Syariah dan Saham Konvensional", *Prosiding Seminar Kebangsaan 2003; Dasar Awam dalam Era Globalisasi: Penilaian Semula ke Arah Pemantapan Strategi*. Bangi: Fakulti Ekonomi, Universiti Kebangsaan Malaysia.

of KLCI and RHB Syariah Index of about 33% and 25% each. This research also found that almost 75% of Syariah stock volatility was caused by speculative activities. It is hoped that this research will be able to contribute towards the literature and the results of Syariah-approved stock returns volatility will benefit all groups concerned in the stock market.

Previous researchers such as Bollersleve *et.al* (1992) and Bera and Higgins (1993)[5] hardly identified the features in returns volatility. They are continous returns, assymetric relationship and means-variance relationship.

Persistence of Volatility

The feature of persistence of returns volatility means how far returns volatility exists at equilibrium. If the degree of persistence of returns is high, this shows that the level of volatility shifts to a new level, thus time taken to return to its original level is longer or vice-versa. The feature of persistence of volatility, also known as persistence of shocks on a variance is an important feature in stock return volatility. It also means that if a volatility shocks occurs it will result in the value of volatility will deviate from the value of long-term equilibrium.

Poterba and Summers (1986)[6] had linked the influence of persistence of returns on the relationship between volatility changes and stock price. They concluded that volatility gives a meaningful effect in explaining the fluctuations of the stock market and the degree of contiuous volatility must be high enough. Whereas, Chou (1988)[7] obtained a persistence of degree measured by the total coefficient in variance equitions for GARCH model (1,1)-M that is $\alpha + \beta$ id high. A shocks occurence of volatility can influence stock prices and has opposite leads if the value of $\alpha + \beta$ is close to one.

Ackert and Racine (1997)[8] studied the causes of the existence of persistence of volatile stock returns by linking the volatility group feature with persistence of volatility feature.

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5 Bera & Hinggins (1993), "ARCH Models: Properties, Estimation And Testing", *Journal of Economic Survey:* 7, pp. 305 – 362.

6 J.M. Poterba & L.H. Summers (1986), "The Persistence Of Volatility And Stock Market Fluctuations", *The American Economics* Review: 76, pp. 1142 – 1151.

7 R.Y. Chou (1988), "Volatility Persistence And Stock Valuations: Some Empirical Evidence", *Journal of Applied* Econometrics: 3, pp. 279 – 294.

8 L.F. Ackert & M.D. Racine (1997), "The Economics Of Conditional Heterosdasticity: Evidence From Canadian And U.S Stock And Futures Markets", *Atlantic Economic Journal*: 25, pp. 371 – 396.

This means if stock returns volatility experiences a high increase, it will be followed by a drastic change in the feature which can be positive or negative. Gallant et.al (1989)[9] and Diebold and Nerlove (1989)[10] and Engle et.al. (1990)[11] stated that persistence of volatility is the result of the arrival of information in clusters or is the result of how market participants act upon the information that reaches the market. If the information is not parrallel, the series of correction in the conditional variance can be observed even through participants act quickly to the news they receive. The use the futures contract index, and the American Stock Market Index was used to compare the effect on transaction cost and the chester information arrival factor on persistence of volatility. Through the GARCH (1,1) futures contract prices show a lower degree of continuity compared to persistence of degree for stock prices at the stock market.

Lamoureux and Lastrapes (1990)[12] stated that there is an positive correlation between the rate of information arrival and variance, by linking the rate of information arrival as the cause of a high degree of persistence of volatility. They used daily trading volume as proxy to the rate of daily information arrival which is included in the GARCH model (1,1). It was found that there is a decrease in the degree of persistence of volatility. Brailsford (1996)[13] used the GARCH model (1,1) and found that if trade volume is included as an independent variable, the level of persistence of volatility will decrease about 47%. The result of this research also shows that trade volume is capable of explaining the behaviour of persistence of volatility.

Engle and Gonzalez (1991)[14] and Schwert and Seguin (1990)[15] claimed that stocks which have a small firm size, the persistence of volatility is less compared to stock of

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9 A.R. Gallant, P.E. Rossi & G. Tauchen (1992), "Stock Prices and Volume", *Review of Financial Studies*: 5, pp. 199 – 242.

10 F.X. Diebold & M. Nerlove (1989), "The Dynamics Of Exchange Rate Volatility: A Multivariate Latent Faktor ARCH Models", *Journal Applied Econometris*: 4, pp. 1 – 21.

11 R.F. Engle, Ng V. & M. Rothschild (1990), "Asset Pricing with a FACTOR-ARCH Covariance Structure: Empirical Estimates for Treasury Bills", *Journal of Econometrics*: 45, pp. 213 – 237.

12 C.G. Lamoureux & W. Lastrapes (1990), "Heteroskedasticity in Stock Return Data: Volume Versus GARCH Effects", *The Journal of Finance* XLV, pp. 221 – 229.

13 T.J. Brailsford (1996), "The Empirical Relationship between Trading Volume, Returns and Volatility", *Journal of Accounting and Finance*, pp. 89 – 111.

14 R.F. Engle & G. Gonzalez-Rivera (1991), "Semiparametric ARCH Models", *Journal of Business & Economic Statistics*: 9, pp. 345 – 359.

15 G.W. Schwert & P.J. Seguin (1990), "Heteroskedasticity in Stock Returns", *Journal of Finance*, pp. 1129 – 1155.

firms of a larger size. The factor of firm size is taken into account by separating the stocks according to size. Through this separation, it may be able to give a more detailed information about the feature of persistence of volatility found.

Assymetric Relationship

Assymetric relationship means a negative shocks stock returns will give a greater effect on volatility returns compared to a positive shocks stock returns. This phenomena is known as the leverage effect. Negative shocks on returns can be defined as bad news and positive shock on returns as good news. When this ocurs, a company will have a large debt (debt ratio and high equity) and will face financial risk (Apergis and Eleptheriou, 2001)[16] when the value of equity decreaces.

According to Schwert (1989)[17] assuming a variance is fixed, then stock returns volatility is a function of leverage ratio. However, leverage only influences part of the volatility because the effect of stock price change which cause the volatility is too wide to explain by only relying on leverage (Black, 1976[18] and Christie, 1982[19] and French et al.,1987[20]).Besides the leverage effect, factors such as seasonal factor (Masulis and Ng, 1995[21]), trade volume (Gallant *et. al*.,1992)[22], firm size (Nelson,1991)[23] and macroeconomic factor (Schwert, 1989[24] and Christie, 1982)[25] are also identified as a determining factor on returns volatility.

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16 N. Apergis & S. Eleptheriou (2001), "Stock Returns and Volatility: Evidence from the Athens Stock Market Index", *Journal of Economics and Finance*, 25 (1), pp. 134 – 145.

17 G.W. Schwert (1989), "Why Does Stock Market Volatility Change over Time", *The Journal of Finance,* XLIV, pp. 1115 – 1153.

18 F. Black (1976), "Studies In Stock Prices Volatility Changes", *Pascasidang di Perjumpaan Persatuan Statistik Amerika Tahun* 1976, pp. 177 – 181.

19 A.A. Christie (1982), "The Stochastic Behavior of Common Stock Variances", *Journal of Financial Economics*, Vol. 10, pp. 407 – 432.

20 K.R. French, G.W. Schwert & R.F. Stambaugh (1987), "Expected Returns and Volatility", *Journal of Financial Economics*, Vol 19, pp. 3 – 30.

21 R. Masulis & V.K Ng (1995), "Overninght and Daytime Stock-Return Dynamics in the London Stock Exchange: The Impacts of "Big Bang" and the 1987 Stock-Market Crash".

22 A.R. Gallant, P.E. Rossi & G. Tauchen (1992), "Stock Prices and Volume", *Review of Financial Studies*: 5, pp. 199 – 242.

23 D.B. Nelson (1991), "Conditional Heteroskedasticity in Asset Returns: A New Approach", *Ecocometrica*: 45, pp. 7 – 38.

24 G.W. Schwert , *op.cit.*

25 A.A. Christie, *op.cit.*

According to Masulis and Ng (1995)[26], assymetric relationship between returns shocks and returns volatility is caused by marginal stock purchasing. When stock prices fall, investors who cannot afford to increase their margin, will sell the stocks involved in the market. Overselling of stocks will increase returns volatility in the market. Glosten (1993)[27] also provides another definition about assymetric relationship between returns and returns volatility. Based on the model Net Present Value, a change in cash flow variance is not proportional to changes in stock prices on the assumption that a change in stock prices is only caused by an anticipated change in cash flow. Thus, a change in price will be negative in proportion to volatility.

Mean-Variance Relationship

A popular model often discussed in financial theory about mean-variance relationship in the Capital Asset Pricing Model (CAPM) which was inspired by Sharpe (1963)[28] and Treynor (1961). According to the CAPM model, the rate of returns of an asset is equal to the total rate of risk free returns and premium risks. An assumption of this model is that the value of preium riks is time stagnation. Therefore the relationship between risks and returns is positive. In other words, if an asset has a high risk, its returns is also high and vice-versa (French *et. al*, 1987[29]). However, this relationship is still debatable when observed time series.

According to Harvey (1989) [30], the CAPM model cannot deal with dynamic stock returns volatility and time series. Stenius (1991) had studied the relationship between returns and time series risk of the Finland Stock Market. Using the ARCH-M model, they found that a significant positive relationship exists between returns and risks. This is because premium risks changes with time. In fact, the assumption in CAPM that premium risk is time stagnation in unacceptable. Baillie and Degennaro (1990)[31]

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26 R. Masulis & V.K Ng, *op.cit.*

27 L.R. Glosten, R. Jagannathan, & D.E. Runkle (1993), "On The Relation Between The Expected Value and The Volatility of The Nominal Excess Return on Stocks", *The Journal of Finance*: XLVIII, pp. 1779 – 1801.

28 W.F. A. Sharpe (1963), "Simplified Model for Portfolio Analysis", *Management Science*, pp. 277 – 293.

29 K.R. French, G.W. Schwert & R.F. Stambaugh, *op.cit.*

30 C.R. Harvey (1989), "Time Varying Conditional Covariances in Test of Asset Pricing Models", *Journal of Financial Economics*, Vol. 24, pp. 289 – 317.

31 R.T. Baillie & R. P. Degennaro (1990), "Stock Returns and Volatility", *Journal of Financial and Quantitative Analysis*, 25, pp. 203 – 214.

found a weak relationship between a positive lead in contact of time duration on which changes using the GARCH-M model.

Campbell and Hentschel (1992)[32] used the GARCH-M model, QGARCH-M by including the assymetrical factor and found the relationship that exists between returns and volatility can be positive or negative depending on the model and sub-duration used. Although using the standard GARCH-M, a positive relationship is still obtained which is sometimes insignificant. This may be done to the effect of debt ratio and equity which changes in line to the changes in market equity. Glosten et. al. (1993)[33] had modified the GARCH-M model by including the seasonal factor, nominal interest rate and assymetric relationship. The EGARCH-M model was used for the assymetric effect. They found that the modified GARCH-M model in order to observe the relationship between returns and volatility.

Beller and Nofsinger (1998)[34] had taken into account the seasonal factor to check volatility behaviour and found that the level of volatility varied according to the month and size of portfolio. They also found that premium risk is more significant for a small-sized portfolio and will slowly become insignifacant when the size of the portfolio increases.

Data and Methodology

Estimation Model: Returns and Volatility

Based on several previous research, it has been found that there are some factors affecting stock returns volatility. This research will taken into account the following factors: interest rates, total stock exchange or trade volume and Dow Jones Industry Index (DJII)

$$\text{RETURNS}_t = \beta_1 + \beta_2\,\text{Interest} + \beta_3\,\text{Volume} + \beta_4\,\text{Dowjones} + \varepsilon_t \qquad (1)$$

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32 J.Y Campbell & L. Hentchel (1992), "No News Is Good News: An Asymmetric Model of Changing Volatility in Stock Returns", *Journal of Financial* Economics: 31, pp. 281 – 318.

33 L.R. Glosten, R. Jagannathan, & D.E. Runkle, *op.cit.*

34 K. Beller & J.R. Nofsinger (1998), "On Stock Return Seasonality and Conditional Heteroskedasticity", *The Journal of Financial Research*, Vol. 21, pp. 229 – 246.

where;

RETURNS = stock returns for each counter and is calculated based on the following equation:

$$\frac{Price_t - Price_{t-1}}{Price_{t-1}}$$

Interest	=	Interbank interest rate 3 month-daily and Islamic interbank rate
Volume	=	Total stock exchange
Dowjones	=	Dow Jones Industry Index (DJII)

Equation (1) will be estimated to obtain the parameter of each variable and several statistics test will be carried out to determine the significant.

According to Schwert (1989)[35], interest rate is capable of explaining the trend of returns volatility. This is because the nominal interest rate may affect anticipated cash flow. Therefore it will indirectly further affect the trend of stock price. In this research, the interbank 3-month daily rate of interest is proxy to the market interest rate movement. This rate of interest is said to be frequently used as a standard measure to the current rate of interest. Meanwhile, trade volume is used as proxy to total of information that flows into the market, therefore in this research total stock that changes hands will be used to measure trade volume. Besides that, DJII is used as a flow of information from abroad.

ARCH and GARCH: Examining Volatility

To study stock returns volatility, the *Autoregressive Conditional Heteroskedasticity* (ARCH) and *Generalized* ARCH (GARCH) models will be used. These models were constructed by Engle in 198, and it is suitable in studying important features of returns volatility as it is capable in handling the problem of stock returns with an abnormal distribution and returns variance which is not stationary against time

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[35] G.W. Schwert , *op.cit.*

According to Robert Engle, a model with *Heteroskedasticity* problem can be overcome by using the ARCH method and this will increase the competency of that model. Based on the model in equation (1) above, we can observe the volatility level of a variable by looking at the variance feature for model equation (1), this is shown in equation (2),

$$\sigma^2_t = \alpha_0 + \alpha_1 \varepsilon^2_{t-1} \qquad (2)$$

In this equation, the variance for ε_t, is σ^2, has two components; constant and volatility in the past, whereby it is an error square in the past or known by term ARCH. In this model ε_t has the *Heteroskedasticity* feature, where it is conditional upon $\varepsilon_{t-1.}$ By taking *heterokedasticity* ε_t, information into account, we can estimete the β_1, β_2, β_3 and β_4 parameter more efficiently.

There exists a situation when variance ε_t is not conditional to the degree of previous volatility but also for a longer previous duration. Problem will arise when making an estimate of equations that experience a long time-lag. To overcome this problem the extended lag distribution model for σ^2_t can be used. By solving this problem, it will give a new model known as *Generalized* ARCH (GARCH), that is

$$\sigma^2_t = \alpha_0 + \alpha_1 \varepsilon^2_{t-1} + \lambda_1 \sigma^2_{t-1} \qquad (3)$$

From this equation, we will see that equation (1) variance model is noy only conditional to previous error squared, ε^2_{t-1} (term for ARCH) but is also conditonal on previous variance σ^2_{t-1} (term for GARCH). The Autoregressive Conditional Heteroskedasticity Model (ARCH) was constructed specifically to model and predict conditional variance. Conditional variable variance is modelled as a conditional and unconditional variable of previous value function, or exogenous variables.

The ARCH model was introduced by Engle (1982)[36] and is modified as GARCH (Generalized ARCH) by Bollerslev (1986)[37]. These models are widely used in various branches of econometrics, especially in financial time series analysis. (Refer Bollerslev,

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[36] R. Engle (1982), "Autoregressive Conditional Heteroskedasticity With Estimates Of The Variance of U.K Inflation", *Econometrica*, 50, pp. 987 – 1008.

[37] T. Bollerslev (1986), "Generalized Autoregressive Conditional Heteroskedasticity", *Journal of Econometrics*: 31, pp. 307 – 327.

Chou and Kroner (1992)[38] and Bollerslev (1994)[39], Engle and Nelson (1991)[40]for the latest research).

To achieve the objective of this research, several models of the ARCH family will be used in estimating Syariah-approved stock returns volatility. In general, this research will use GARCH(1,1) model to see the degree of market volatility. Besides that, to see the assymetrical relationship feature, the EGARCH (Exponential GARCH) will be used. Meanwhile, the continous volatility variable into the conditional variance model. To analyse the relationship between returns and risks or better known as mean-variance relationship, the conditional model will include risk returns as an explanatory variable.

Model GARCH(1,1)

In the standard GARCH (1,1) specification, it can be described as:

$$y_t = x_t'\gamma + \varepsilon_t \qquad (4)$$

$$\sigma_t^2 = \omega + \alpha + \beta \qquad (5)$$

The function of the given mean in equation (4) is written as a function of exogenous variable with error. Because it is a future one-duration prediction variance based on previous information, this variance is also known as conditional variance. The similarity of a conditional variance which is specified in equation (5) is a function that has three denominators that is mean (w), volatility information from previous duration, measured as lag error squared from mean equation, σ_t^2, as this item is often referred to as ARCH coefficient denominator, and last duration prediction variance, σ_t^2, this item is also known as GARCH coefficient denominator.

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38 T. Bollerslev, R.Y. Chou & K.F. Kroner (1992), "ARCH Modelling on Finance: A reviews of the Theory and Empirical Evidence", *Journal of Econometrics*, Vol. 52, pp. 5 – 59.

39 T. Bollerslev, R.F. Engle & D.B. Nelson (1994), *ARCH Models*. CRSP W.P. 382: Graduate School of Business, University of Chicago.

40 D.B. Nelson (1991), "Conditional Heteroskedasticity in Asset Returns: A New Approach", *Econometrica*: 45, pp. 7 – 38.

Expression (1,1) in GARCH(1,1) refers to the existence of the first lag GARCH (first denominator (first denominator in brackets) and first lag ARCH denominator (second denominator in brackets). A normal ARCH model is a special case of GARCH specification where there is no lagged prediction variance in the condition variance equation.

The ARCH model in this research will be estimated with maximum probability method assuming that errors are distributed in a normal conditon. As an example, for the GARCH model, a contribution to log probability from the observation of *t* is:

$$l_t = -\frac{1}{2}\log(2\pi) - \frac{1}{2}\log\sigma_t^2 - \frac{1}{2}(y_t - x_t'\gamma)^2 / \sigma_t^2 \qquad (6)$$

where

$$\sigma_t^2 = \omega + \alpha(y_t - x_t'\gamma)^2 + \beta\sigma_{t-1}^2 \qquad (7)$$

This specification is usually interpreted in finance, where an agent or trader estimates this variance for this duration by forming a weighted average of the long-run average variance, the variance predicted for this period, and the new information in this period that is captured by the most recent squared residual. If there is a large non-estimated assets returns, whether there is an increase or a decrease, traders will increase estimated variance for the following duration. This model is also consistent with volatility clusters which is always seen in financial returns data, where a great change in returns may be followed by a great change in the future.

There are two alternatives representing variance equation that may help in interpreting volatility model, firstly if we replace lagged variance in recurrence on the right-hand side of equation (2), we can state conditonal variance as a weighted average of all lagged error squared:

$$\sigma_t^2 = \frac{\omega}{1-\beta} + \alpha\sum_{j=1}^{\infty}\beta^{j-1}\varepsilon_{t-j}^2 \qquad (8)$$

We can see that GARCH(1,1) specification variance is always similar to sample variance. Error in returns squared is given as = - . By replacing the variance in the variance equation and rearranging the denominator, we can write our model in this error denominator:

$$\varepsilon_t^2 = \omega + (\alpha+\beta)\varepsilon_{t-1}^2 + \upsilon_t - \beta\upsilon_{t-1} \qquad (9)$$

Thus, error squared will follow the process of ARMA(1,1) Heteroskedasticity. The cause of autoregressive that controls shocks on volatility inflexibility is a product of the total of α and β.

Persistence of Volatility

Equation (2) can be added to take into account an external variable or exogenous, z, into the variance equation:

$$\sigma_t^2 = \omega + \alpha \varepsilon_t^2 + \beta \sigma_{t-1}^2 + \pi z_t \qquad (10)$$

Equation (10) shows that an estimated conditonal variance (a measurement of volatility) depends on the value of α and β. If the value (α+β) is less than one, then the effect of conditonal variance at *t* for the future duration will decrease againts time. On the other hand, if the value of (α+β) is equals to one, the value of conditional variance at *t* will equal to the value of future conditonal variance. If the value of (α+β) is greater than one, then the future of variance will keep an increasing with time. This situation will allow us to study the effect of the persistence of volatility when an external variable is included into the volatility equation as in equation (10). The closer the value of (α+β) to one, it can be said that the degree of the persistence of volatility will be higher. The external variables that will be included in this study are: interest rates, trade volume and DJII.

TGARCH and EGARCH: Assymetircal Relationship

TARCH or *Threshold* ARCH was introduced by Zakoian (1990)[41] dan Glosten, Jaganathan, and Runkle (1993)[42]. The specification for conditional variance is given as:

$$\sigma_t^2 = \omega + \alpha \varepsilon_{t-1}^2 + \gamma \varepsilon_{t-1}^2 d_{t-1} + \beta \sigma_{t-1}^2 \qquad (11)$$

where $d_t = 1$ if $\varepsilon_t > 0$ and 0 vice versa.

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[41] J.M. Zakoian (1990), "Threshold Heteroskedastic Model", *Momeo*. Paris: INSEE.

[42] L.R. Glosten, R. Jagannathan, & D.E. Runkle, *op.cit.*

In this model, the good news is ($\varepsilon_t > 0$), and the bad news is ($\varepsilon_t < 0$), has a distinct effect on conditional variance- the good news has a α effect, whereas the bad news has a ($\alpha+\gamma$) effect. If $\gamma > 0$ we can say that there is a leverage effect. If $\gamma \neq 0$, the news effect is assymetrical where the leverage effect is shown by the γ parameter.

Model EGARCH or *Exponential* GARCH was put forward by Nelson (1991).[43] The specification for conditional variance is:

$$\log \sigma_t^2 = \omega + \beta \log \sigma_{t-1}^2 + \alpha \left| \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \right| + \gamma \frac{\varepsilon_{t-1}}{\sigma_{t-1}} \qquad (12)$$

Observe that the left-hand side is the conditonal variance log. This shows that a leverage effect is exponent, not quadratic, and predictions on conditional variance is guaranted not negative. The existence of a leverage effect can be tested with the hypothesis that $\gamma > 0$. the effect os assymetric if $\gamma \neq 0$.

Model ARCH-M : To Observe Means-Variance

Variable x in equation (2) represents a variable that has been determined earlier or exogent which is included in the means equation. If we introduce conditional variance into means equation, we will get the model ARCH-in-mean (ARCH-M) (Engle, Lilien, Robin, 1987)[44]:

$$y_t = x_t{}'\gamma + \sigma_t^2 + \varepsilon_t \qquad (13)$$

Model ARCH-M in equation (13) is often used in financial application where returns are predicted as an asset with a predicted asset, where risk is represented by variance item, σ_t^2. The estimated coefficient at predicted risks is a measure of risk-returns exchange.

The specification of discriminating ARCH-M uses a standard deviation to replace conditional variance in equation (13).

A higher systematic Model GARCH, which is marked by GARCH(p,q), can be estimated by choosing wheter p or q is more than 1. The GARCH(p,q) variance is represented by:

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43 D.B. Nelson, *op.cit.*

44 R.F. Engle, D.M. Lilien & R.P. Robins (1987), "Estimating Time-Varying Risk Premia in The Term-Structure: The ARCH-M Model", *Econometrica,* 55, pp. 391 – 407.

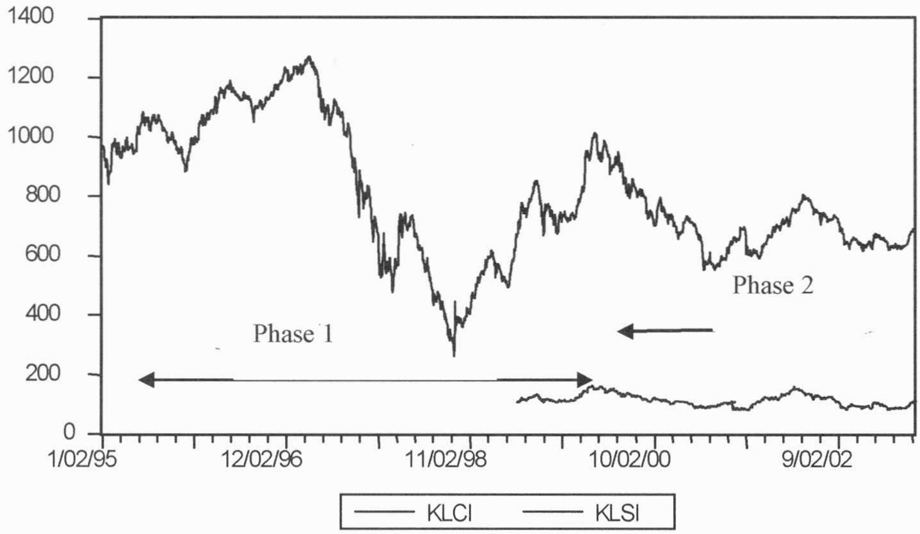
$$\sigma_t^2 = \omega + \sum_{j=1}^{p} \beta_j \, \sigma_{t-j}^2 + \sum_{i=1}^{q} \alpha_i \, \varepsilon_{t-i}^2 \qquad (14)$$

where p is GARCH denominator systematic and q is ARCH denominator systematic.

Data Sampling and Duration of Study

The duration of this study is from 2 January 1995 to 13 June 2003. The whole duration was divided into 2 phases, phase 1 that is before the launching of KLSI from 2 January 1995 to 29 April 1999. Phase 2 from 2 April 2003 to 13 Jun 2003 which was the phase after the launching of KLSI. Figure 1 shows the movement of KLSI and KLCI for Phase 1 and Phase 2.

Figure 1 :
Movement of KLSI and KLCI for Phase 1 and Phase 2



Note :
KLSI : Kuala Lumpur Syariah Index
KLCI : Kuala Lumpur Composite Index

External variable will be included in the variance equation to determine the significant on conditonal variance prediction and also tp test its effect on the persistence of volatility, assymetrical existence and mean-variance relationship.

For this research, the factors affecting the trend of KLSI returns volatiliting and Syariah-approved stock that will be taken into account is interest rate, trade volume and DJII. For KLCI returns volatility trend and stock security for Phase 1, interest rate and DJII will be taken into account.

Interest rate is taken as a variable which is more capable of describing the trend of returns volatility. According to Schwert (1989)[45] interest rate is said to be capable of describing the trend of returns volatility. This is because nominal interest rate can influence anticipated cash flow. Hence, indirecting it will influence stock price movement. Besides that, Campelbell (1987)[46], Breen *et al.* (1987)[47], Giovanni and Jorian (1989)[48] and Glosten *et al.* (1993)[49] had proven that interest rates have a high capability to predict second moment movement. Sill (1993)[51], in his study states that a high interest rate can be observed diving the economic recession and return volatility during that period is also high.

In this research, daily three-month Interbank Interest Rate (KLIBOR 3) is used as a proxy to the current market interest rate movement. The Malaysia Exchange of Securities Dealings and Automated Quatation Bhd (MESDAQ) states that 3-month InterBank interest rate is a financial market instrument with the highest volume and it is often used as an indicator/standard measure of the current interest rate. KLIBOR 3 in this month is also traded as a future finance contract at MESDAQ. Daily 3-month Interbank Interest Rate is used for Phase 1 that is before the launching of KLSI. Whereas daily 3-month Islamic Interbank Rates is used for Phase 2 that is after the launching of KLSI.

This study uses trade volume as a modifier variable because Lamoureoux and Lastrapes (1990)[51] calimed that trade volume can be a proxy to total information that flows into

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45 G.W. Schwert , *op.cit.*

46 J.Y Campbell & L. Hentchel, *op.cit.*

47 W. Breen, L.R Glosten & R. Jagannathan (1989), "Economic Significance Of Preditable Variations In Stock Index Returns", *Journal of Finance*, pp. 1177 – 1189.

48 A. Giovannini & P. Jorion (1989), "The Time Variation Of Risk And Return In The Foreign Exchange And Stock Markets", *Journal of Finance*, pp. 307 – 323.

49 L.R. Glosten, R. Jagannathan, & D.E. Runkle, *op.cit.*

50 D.K. Sill (1993). "Predicting Stock Market Volatility", *Business Review*, pp. 15 – 29.

51 C.G. Lamoureux & W. Lastrapes (1990), "Heteroskedasticity In Stock Return Data: Volume Versus GARCH Effects", *The Journal of Finance* XLV, pp. 221 – 229.

the market. This is proven by a study carried out by Admati and Pfleiderer (1988)[52], if trade volume increases therefore information on a stock price will also increase. So is the case of a study carried out by Brailsford (1996)[53] and Tang and Ganon (1998)[54] which stated that trade volume can be a proxy to information flow into the market. Hence, in this study, trade volume which is measured as total stock that changes hands will be used.

This study also uses the DJII as proxy to expected information which will reach the market. New York Stock Exchange returns is used as a proxy based on a study carried out by Othman (1993)[55], which stated that if we compare the Tokyo Stock Exchange and New York Exchange, the achievement of New York Stock Exchange has a greater influence on the Kuala Lumpur Stock Exchange (KLSE), compared to the Tokyo Stock Exchange. This is supported by a study carried out by Hooy and Tan (2002)[56] which studied about volatility flow by comparing 7 stock markets in major countries in the Asia-Pacific namely: U.S.A, Japan, Hong Kong, Taiwan, Korea, Singapore and Malaysia, using the MEGARCH. They concluded that developing countries like Taiwan, South Korea and Malaysia are affected by a one-way volatility excess from 4 markets namely: U.S.A., Japan, Hong Kong and Singapore. U.S.A. is identified as an information provider in the Asia-Pasific region.

Returns of daily closing price for KLSI and KLCI, DJII and KLIBOR/Islamic Bank Interest Rates is calculated by:

$$R_t = (P_t - P_{t-1}) / P_{t-1}$$

R_t = return at period t

P_t = price at period t

P_{t-1} = price at period t-1

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52 A. Admati & P. Pfleiderer (1988), "A Theory Of Intraday Patterns: Volume and Price Variability", *Review of Financial Studies* 1, pp. 3 – 40.

53 T.J. Brailsford (1996), "The Empirical Relationship Between Trading Volume, Returns And Volatility", *Journal of Accounting and Finance*, pp. 89 – 111.

54 K.M. Tang & G.L. Gannon (1998), "Modelling Volatility in the Malaysian Stock Market", *Asia Pacific Journal of Finance*, 1 (2), pp. 155 – 190.

55 Othman Yong (1993), "Inter-Relationship Between Malaysia And Selected Stock Market In The Far East And New York: Parametric Versus Non Parametric Approach Revisited", *Jurnal Pengurusan,* 12, pp. 65 – 84.

56 C.W. Hooy & H.B. Tan (2002), "Volatility Spillover Effects Among Major Asia Pacific Equity Markets", *Proceedings of Asia Pacific Economics and Business Conference 2002*, pp. 911 – 918.

Research Finding

The Persistence of Volatility

Returns analysis of the features that directly influence KLSI and KLCI volatility will begin with a discussion of the features of the persistence of volatility of KLSI and KLCI. Besides that, the influence of interest rates, trade volume and DJII on the degree of volatility is studied in each phase with reference to Table 2.

Table 2 also discussion 6 models where each model shows the factors that influence the degree of the persistence of returns volatility. The result of an estimation using GARCH (1,1) model for Model 1 shows that the degree of KLCI volatility for Phase 1 is high that is 1.01096. This result means that the level of the persistence of volatility increases with time, and stocks which are traded are very volatile. However, when estimation is divided between KLCI (1999 – 2003) and KLSI (1999-2003) it was found that the level of volatility shown is less than one(1). To see this in detail, the results obtained show that the degree of KLSI returns volatility (1999-2003) is higher then KLCI (1999-2003) that is at a value of 0.91364 to 50.88892.

When interbank interest rates is included in the variance equation (model 2) the degree of the persistence of volatility is still higher at the value of one (1) that is 1.0083. Nevertheless, that value is lower than the degree of volatility without bringing in rates of interest. The degree of volatility is significant at a level of 1%, but the rate of interest is insignificant. This shows that the rate of interest is not a cause or is not capable to describe the feature of the degree of the persistence ofreturns volatility for KLCI in Phase 1.

For Phase 2, when interest rate is included in the variance equation, the value of volatility for KLCI decreases to 0.77639 and it is significant at a level of 1%. This indicates that interest rate is a factor that contribute to the persistence of volatility but the direction of relationship between returns and interest rate is positive. This indicates that this degree of the persistence of volatility during the recession is lower compared to after the recession. This may be that a low interest rate which had been fixed by the government for Phase 2 had encouraged customers to borrow in order to finance investments in the KLSE. When this occurs, the degree of the persistence of volatility will increase parallel to an increase in stock trading.

This result in a way, supports early research about the persistence of volatility, Poterba and Summers (1986)[57], Chou (1988)[58], Engle, Lilien and Robins (1987)[59] who claimed that if volatility is expected to continue, it will give a greater effect to the discount factor which was used to calculate the current value of anticipated cash flow and this will give a significant effect in describing stock market fluctuations. Meanwhile, for Phase 2, when Islamic interbank rate is brought in, the degree of the persistence of volatility of KLCI and KLSI will decrease to 0.7763 and 0.9027 respectively. This indicates that there exists a the persistence of volatility phenomena for both index at the significant level of 1%. If the value of the degree of the persistence of returns volatility is observed carefully, we find that KLSI is more volatile compared to KLCI. The direction of the relationship between returns and Islamic interbank rate is positive.

When the DJII is included into the variance equation for Phase 1, the value of volatility drops to 0.744421 and the variable DJII is significant at the level of 1%. This indicates that the DJII is the major factor contributing to the KLCI the persistence of volatility as shown in model 4.

Meanwhile for Phase , the DJII is still significant but the degree of volatility is constant. This proves that, the DJII does not contribute to the KLCI the persistence of returns volatility. Furthermore indicator lead between returns and DJII is negative for both indexes. This may be due to the fact that investors do not feel that the DJII is a proxy factor to expected information arrival in the market especially after the September 11 2001 incident.

For KLSI, the DJII is a contributing factor to the persistence of volatility. This is because the value of volatility falls to 0.883679 from 0.913644 when the IIDJ variable was included in that varians equation.

For model 5 Phase 1, by including the external rate of interest variable and DJII, the value of volatility falls from 0.75014 and both variables are significant at a level of 5%. Meanwhile for Phase 2, inclusion of external rate of interest variable and DJII contribute

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57 J.M. Poterba & L.H. Summers (1986), "The Persistence of Volatility And Stock Market Fluctuations", *The American Economics Review,* 76, pp. 1142 – 1151.

58 R.Y. Chou (1988), "Volatility Persistence and Stock Valuations: Some Empirical Evidence", *Journal of Applied Econometrics,* 3, pp. 279 – 294.

59 R.F. Engle, D.M. Lilien & R.P. Robins Engle, *op.cit.*

to the persistence of volatility. This situation occurs when the value of volatility falls to 0.783569 and both variables are significant at a level of 1%.

Distinct from KLCI, the degree of KLSI the persistence of volatility is not influenced by Islamic interbank rate and DJII. This is because the value of volatility (0.909248) does not show a great change although both variables are significant at least at the level of 5%. But if another external variable, trade volume, is included the existence of the persistence of volatility can be proven when the value of volatility falls to 0.750000 as shown by model 6 in table 4.2. This result is the same as the result which was obtained by Zaibi Isa (2000)[60], Lamaureux and Lastrapes (1990)[61] who stated that a feature of high the persistence of volatility shows that stock prices depends on information arrival such as trade volume.

On the whole, it can be concluded that for Phase 1, the external variable that has the greaters influence on the KLCI feature of the persistence of volatility is DJII. For Phase , interest rate variable is the major factor that has a great influence on the feature of the persistence of volatility of KLCI returns. For KLSI, Islamic interbank rate variable and trade volume are the major factors influencing the feature of the persistence of volatility.

Assymetric Feature

Assymetric relationship is one of the features that influence returns volatility that can be interpreted as returns shocks lead that can affect stock returns volatility. By using the EGARCH (1,1) model, it was found that estimated parameter is inclined towards a negative value compared to a positive value. With reference to Table 3, the indicator on the KLSE Main Board has a assymetrical relationship between shocks on stock returns lead against stock returns volatility. For Phase 1, and Phase 2, the relationship between stock returns and returns volatility is negative and significant at a level of 1%. Assymetric relationship in KLSI is similar to KLCI that is, there is a negative relationship between shocks on stock returns against volatility and it is significant at a level of 1%. Therefore, it can be concluded that a significant assymetrical relationship that exists between returns shocks and returns volatility in KLCI and KLSI has a negative shocks level.

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60 Zaibi Isa (2000), "Gelagat Kemeruapan Pulangan Saham Di Bursa Saham Kuala Lumpur" (Tesis Ijazah Doktor Falsafah, Universiti Kebangsaan Malaysia).

61 C.G. Lamoureux & W. Lastrapes, *op.cit.*

This means that a negative shocks will have a greater effect on returns volatility compared to a positive shocks, and this is agreed upon by Bollerslev (1992)[62] and Bera and Higgins (1993)[63]. However this result is not parallel with Tang and Gannon (1998)[64]. They used the models GARCH (1,1) and GJR-GARCH and found that there is no feature of assymetric that exists in stock returns volatility in the KLSE. The study by Zaibi (2000)[65] also shows that there does not exist the feature of assymetry in the KLSE Main Board.

External variable that is trade volume is included in the variance equation model EGARCH (1,1) for Phase and its role is tested against a significant assymetrical relationship and estimated parameter lead. Based on the analysis carried out, it is found that trade volume does not have a assymetrical relationship between returns shocks and returns volatility and is not significant. This results contradicts Gallant et. al. (1992)[66] who found that trade volume influence assymetrical relationship. He used the semi-parameter model and found that the assymetrical relationship that existed initially was lost when previous trade volume and previous returns are included in the model used.

Mean-variances Relationship

Table 4 shows that the result of a significant mean-variance relationship through time in Phase 2. Overall, the relationship between mean-variance shows a positive relationship lead. The effect of external variables such as interest rate/Islamic interbank rate, trade volume, DJII against the mean-variance relationship do not bring any specific variation and are not significant. Therefore, we can concluded that without taking into account the significant relationship of mean-variance, no role can be played by external variables such as interest rate/Islamic interbank rate, trade volume and DJII is determining the mean-variance relationship lead either in market returns for KLSI and KLCI for Phase 1 and Phase 2

From this analysis, it can be concluded again that the significant of mean-variance relationship and mean-variance lead in actual fact are not influenced by the factors

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[62] T. Bollerslev, R.Y.Chou & K.F. Kroner, *op.cit.*

[63] Bera & Hinggins (1993), *op.cit.*

[64] K.M. Tang & G.L. Gannon, *op.cit.*

[65] Zaibi Isa, *op.cit.*

[66] A.R. Gallant, P.E. Rossi & G. Tauchen, *op.cit.*

like duration of study and the inclusion of an external variable. As in the study carried out by Glosten et.al (1993)[67], it also proves that it is not necessary for mean-variances relationship through time to exist significantly because there is a probability that invertors take into account other risk factors besides returns variance in valuating their invesment risks. This study is also supported by Cochran and Mansur (1993)[68] and French et. al. (1987)[69] where in their research, most of the studies of the effect of variance on stock returns are not significant although several factors of macroeconomy had been taken into account in the variance equation.

Relate to mean-variance lead, although on the whole mean-variance relationship is seen as through time is positive, that is the higher the risk the higher the returns but this relationship is not significant. The positive relationship between risks and returns for a period of time fulfills the assumption in Capital Asset Pricing Model (CAPM). This means a higher estimated returns is expected for a high risk stock. This is proven in a study by French et.al. (1987)[70] who used the standard Composite Index Data and Poor from January 1928 until 1984 and found that the relationship between returns and risks that is seen through time is positive. They stated that if the volatility is high, then expected estimated returns of assets is also high (positive relationship).

A positive and insignificant mean-variance relationship in this study is equal to a study by Baillie and Degennaro (1990)[71] who observed the relationship between returns and risks in the context of changing duration periods.They used GARCH-M model and found that the relationship between returns and risks (variance) is weak although there is a positive lead. Although they have included external variable that is the factor of trade clearing period but they stil fail to prove the existence of a relationship between means returns and variances. They state that investors at that time, probably considered that other risks are more important compared to variance returns. Some goes for investors in Malaysia from 1995 to 003, they probably considered other factors as a risk measure in making transaction on the KLSI and KLCI.

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67 L.R. Glosten, R. Jagannathan, & D.E. Runkle, *op.cit.*

68 S.J. Cochran & M. Iqbal (1993), "Expected Returns and Economic Factors: A GARCH Approach", *Applied Finacial* Economics: 3, 243 – 254.

69 K.R. French, G.W. Schwert & R.F. Stambaugh, *op.cit.*

70 *Ibid.*

71 R.T. Baillie & R.P. Degennaro (1990), *op.cit.*

Conclusion

In order to have a better understanding of returns volatility in KLCI and KLSI, features of volatility must be studied in detail. Using GARCH (1,1) model before the launching of the Syariah-approved counters, the information of DJII was found to be the major factor that influences the feature of the persistence of volatility in KLCI returns. But after the launching of Syariah-approved counters, it was found that interest rate variable has greater influence on the feature of the persistence of volatility in KLCI returns. This is probably because at that time, the low interest rate attracted investors to borrow for investments. The feature of KLSI the persistence of returns volatility on the other hand was most influenced by information arrival of trade volume followed by Islamic interebank rates, and DJII. Investors have to be cautious when making investments in Syariah-approved counters. This is becauce it was found that KLSI had a high degree of the persistence of volatility compared to KLCI.

Meanwhile, by using the EGARCH (1,1) model, returns shocks lead had a assymetrical relationship against KLCI and KLSI returns volatility. Unfortunately, no external variable can be determined that influenced this feature of assymetry. There is strong evidence the assymetrical relationship between shocks on volatility lead and returns is negative and exists in the KLSE. This means that a decrease in stock price will result in an increase in stock transactions. Many investors will make buying and selling transactions in a large quatity. Hence, those stocks will face a high degree of volatility.

For mean-variance relationship, the EGARCH (1,1) model is used and is found on the whole as a positive relationship which is precise to the Capital Assets Pricing Model (CAPM), that is, when risk increases, returns will also increase and vice-versa. But the positive relationship between risks and returns is not significant. This probably because investors take into account other risks which are more important compared to variance returns. Furthermore external variable like interbank interest rate, DJII and trade volume fail to explain the existence of a relationship between mean returns and variance returns.

Table 2:

Feature of the persistence of Returns Volatility of KLCI and KLSI

Duration Period		Model 1	Model 2	Model 3 91	Model 4	Model 5	Model 6
KLCI (2/1/1995-29/4/1999)	α	0.115779* (11.02754)	0.121570* (11.07251)	-	0.150045* (8.396340)	0.150101* (8.537124)	-
	β	0.895182* (143.9761)	0.886820* (138.7642)	-	0.594376* (11.64774)	0.600039* (12.03652)	-
	(α+β)	***1.010961***	***1.00839***	-	***0.744421***	***0.75014***	-
	R	-	0.000000120 (0.311752)	-		- 0.0000107** (-2.488830)	-
	V	-	-	-	-	-	-
	DJ	-	-	-	0.007822* (31.48523)	0.006794* (17.73036)	-
KLCI (30/4/1999-13/6/2003)	α	0.189736* (8.178404)	0.160022* (7.476995)	-	0.177287* (8.022611)	0.165848* (7.456208)	-
	β	0.699481* (22.64839)	0.616373* (14.48609)	-	0.712385* (23.31361)	0.617721* (15.12674)	-
	(α+β)	***0.889217***	***0.776395***	-	***0.889672***	***0.783569***	-
	R	-	0.0000614* (2.735851)	-		0.0000785* (4.368088)	-
	V	-	-	-			-
	DJ	-	-	-	-0.000700* (-4.777877)	-0.000508* (-3.104383)	-

Table 2:

Feature of the persistence of Returns Volatility of KLCI and KLSI

Duration Period		Model 1	Model 2	Model 3	Model 4	Model 5	Model 6
KLSI (30/4/1999-13/6/2003)	α	0.197331* (8.494813)	0.168881* (8.749954)	0.150000* (13.59439)	0.210750* (7.778065)	0.171126* (8.872759)	0.150000* (6.122116)
	β	0.716313* (27.17180)	0.733903* (34.77824)	0.600000* (33.52884)	0.672929* (20.25335)	0.738122* (40.25384)	0.600000* (11.68883)
	$(\alpha+\beta)$	***0.913644***	***0.902784***	***0.750000***	***0.883679***	***0.909248***	***0.750000***
	R	-	0.0000362* (9.204714)	-	-	0.0000435* (11.65692)	-0.0000257*** (-1.691785)
	V	-	-	0.0000001217* (10.81931)	-	-	0.0000000709* (5.985997)
	DJ	-	-	-	-0.000394* (-3.042732)	-0.000185** (-2.153685)	-0.0000101 (-0.047956)

Note : value in ( ) is statistic z value
* significant at level 1%
** significant at level 5%
*** significant at level 10%
R = Interbank interest rate/Islamic interbank rate
V = Trade volume
DJ = Dow Jones

Model 1 = GARCH(1,1)
Model 2 = GARCH(1,1)+ R
Model 3 = GARCH(1,1)+ V
Model 4 = GARCH 1,1)+ DJ
Model 5 = GARCH(1,1)+ RC+DJ
Model 6 = GARCH(1,1)+ R+V+DJ

Table 3:

Feature of Assymetrical Returns Relationship of KLSI and KLCI Using the EGARCH

Duration Period	Assymetrical Relationship
KLCI (1995-1999)	-0.068805* (-7.917002)
KLCI (1999-2003)	-0.070658* (-5.194984)
KLSI (1999-2003)	-0.054620* (-5.124566)
KLSI (1999-2003) Trade volume variable is included	-0.024939 (-1.2103646)

Note : value in ( ) is statistic z value

- significant at level 1 %

Table 4:
Feature of Mean-Variance Returns Relationship of KLSI and KLCI Using GARCH-M ;
(Risk Returns) $y_t = c + \alpha_1 X_1 + \alpha_2 X_2 + \alpha_3 X_3 + \tau \sigma_t^2 + \varepsilon_t$

Duration Period	Model	Constant	Interest Rate	Trade Volume	Dow Jones	Risk
KLCI (1995-1999)	Model 1					
	Model 2	-0.003484** (-2.058174)	0.000497** (2.137277)		0.061560*** (1.600653)	0.897912 (0.590091)
	Model 3	-0.003541** (-2.070976)	0.000515** (2.190230)			0.841661 (0.551846)
	Model 4	-0.00000247 (-0.007320)			0.063483*** (1.656290)	1.180050 (0.794907)
KLCI (1999-2003)	Model 1					
	Model 2	0.013486 (1.268201)	-0.004341 (-1.291251)		-0.057714* (-3.30696)	4.628720 (0.922854)
	Model 3	0.010052 (0.916035)	-0.003246 (-0.936265)			4.628631 (0.869558)
	Model 4	-0.00468 (-0.700690)			-0.062482* (-3.506544)	6.686807 (1.313885)
KLSI (1999-2003)	Model 1	0.001258 (0.225100)	-0.001503 (-0.784859)	0.0000138* (11.12829)	- 0.025886*** (-1.685948)	2.945514 (0.664843)
	Model 2	-0.004187 (-0.732438)	0.001143 (0.589864)		- 0.031292*** (-1.914411)	5.050685 (1.010638)
	Model 3	-0.000306 (-0.052747)	-0.0000151 (0.007649)			5.394628 (1.106263)
	Model 4	0.005151 (0.925105)	-0.002690 (-1.409414)	0.000128* (10.40589)		3.283664 (0.758206)

Notes : value in ( ) is statistic z value
* significant at level 1%
** significant at level 5%
*** significant at level 10%