The current issue and full text archive of this journal is available at
www.emeraldinsight.com/0828-8666.htm

Long-run relationship between Islamic stock returns and macroeconomic variables

An application of the autoregressive distributed lag model

M. Shabri Abd. Majid and Rosylin Mohd. Yusof
Department of Economics, Kulliyyah of Economics and Management Sciences, International Islamic University Malaysia (IIUM), Kuala Lumpur, Malaysia

Abstract

Purpose – The purpose of this paper is to explore the extent to which macroeconomic variables affect the Islamic stock market behavior in Malaysia in the post 1997 financial crisis period.
Design/methodology/approach – The paper employs the latest estimation technique of autoregressive distributed lag (ARDL) model approach to cointegration.
Findings – The results suggest that real effective exchange rate, money supply M3, treasury bill rate (TBR) and federal fund rate (FFR) seem to be suitable targets for the government to focus on, in order to stabilize the Islamic stock market and to encourage more capital flows into the market. As for the interest rates and stock returns relationship, the paper finds that when interest rates rise either domestically (TBR) or internationally (FFR), the Muslim investors will buy more *Shari'ah* compliant stocks; thereby escalating the Islamic stock prices.
Research limitations/implications – The results of this study are limited to the post 1997 financial crisis period until the beginning of the year 2006 for a small open economy, Malaysia.
Practical implications – The paper reveals that both changes in the local monetary policy variables and in the US monetary policy as measured by the changes in the FFR have a significant direct impact on the Islamic stock market behavior in Malaysia.
Originality/value – The paper adopts the latest time series econometrics technique to test for cointegration, ARDL. And it is among the earliest attempts to investigate the long-run effects of the macroeconomic variables changes either domestically or internationally on the Islamic stock market.

Keywords Islam, Stock markets, Macroeconomics, Malaysia, Autoregressive processes
Paper type Research paper

Introduction

The claim that macroeconomic variables affect stock market behavior is a well-established theory in the financial economics literature. However, it is in the past two decades that there is a growing efforts made by researchers to empirically calibrate these macroeconomic effects. More studies are focused on the conventional developed markets such as the USA, UK and Japan. Examples of these studies are Fama (1981) and Chen (1991) for the US market, Hamao (1988) on Japanese market and Poon and Taylor (1992) on the UK market.

This study extends the existing literature to address the question whether local and foreign macroeconomic variables affect Islamic stock returns within the context of an emerging market. Emerging Islamic markets seem to have distinguished features from those of the conventional emerging and developed markets. Given the different political and economic structures, the risk and return profiles in all these markets seem to also differ. For instance, risks and returns in the emerging stock markets are found to be higher relative to the developed stock markets (Errunza, 1983; Claessens *et al.*, 1993; Harvey, 1995). In fact, in the recent years, more empirical evidences have been found,

Humanomics
Vol. 25 No. 2, 2009
pp. 127-141

0828-8666
DOI 10.1108/08288660910964193

suggesting that emerging markets are segmented from the developed markets (Goetzmann and Jorion, 1999; Bilson *et al.*, 2001). These studies support the view that emerging markets now represent a feasible investment alternative for international investors witnessing massive capital inflows into these markets.

Studies on Malaysian stock market behavior have also been conducted in the recent years. Tang and Garnon (1998) assess the adequacy of the exponentially weighted moving average and various GARCH – class models in predicting behavior in both the Malaysian stock market and individual stocks and at the same time identify which of these models is most preferred. Ibrahim and Jusoh (2001) investigate the causes of stock market volatility by employing the generalized least squares estimation together with the Hendry's general-to-specific based on the Davidian and Caroll (1987). The finding suggests that among the most important determinants of the KLCI conditional volatility is the lagged market volatility and lagged money supply volatility, the volatilities of the industrial index and the inflation rate. Ibrahim (2002) compares two approaches, namely the moving average standard deviation and ARCH models, to examine relationship between stock market volatility and economic volatility. He finds that the presence of unidirectional causality is running from exchange rate volatility and reserve volatility to stock market volatility. From the above studies, we can conclude that inconsistent results are obtained with regards to which variables significantly affects the Malaysian stock market behavior.

Unlike the studies on conventional stock market, less attention is being given to its Islamic counterpart. For instance, Hakim and Rashidian (2005) explore the risk and return of the Dow Jones Islamic Market Index (DIJMI) and its parallel conventional counterpart, Wilshire 5000 Index (W5000). Their findings suggest that the DIJMI presents unique risk-returns characteristics compared to the risk profile of W5000. In the Malaysian context, Muhammad (2002) investigates the performances of the Kuala Lumpur Stock Exchange (KLSE) composite index, KLSE *Syari'ah* index (KLSI) and the Rashid Hussain Berhad Islamic (RHBI) index during the period of 1992-2000. The study finds that the movements of both the conventional and Islamic indices are somewhat parallel. There has been no study conducted on the effect of macroeconomic variables on Islamic stock market using an autoregressive distributed lag (ARDL) approach, in a small open economy like Malaysia. This study attempts to fill this gap by exploring the effect of the macroeconomic variable changes towards the Islamic stock market in Malaysia.

The KLSI operates in different economic, financial and political structures than the other developed markets such as the USA, UK and Japan, as such, the movement of stock prices may be different. It is possible that given that the KLSI is of a smaller market capitalization than the USA, it is more susceptible to speculative activities and government interventions. From the investors' perception, the question whether KLSI responds differently to macroeconomic variables is of relevance.

The empirical question that we seek to examine is whether macroeconomic variables such as industrial production index (IPI), money supply M3, real effective exchange rate (REER), interest rate (treasury bill rate (TBR)) and federal fund rates (FFR) are significant explanatory factors of Islamic stock market returns. Accordingly, if these macroeconomic variables are significant and consistently priced in the Islamic stock market returns, they should therefore be cointegrated. Various methodologies are employed to test the relationship between macroeconomic variables and the stock market returns and more recent ones employ the time series analysis within the VAR framework to test the presence of cointegration among the variables tested (Chen *et al.*, 1986; Kwon and Shin, 1999; Maysami and Koh, 2000).

The 1997 financial crisis has directly affected the Malaysian stock market. Many studies are conducted to examine the macroeconomic causes of stock market behavior during the crisis. This also prompts researchers as well as policy makers to re-examine the macroeconomic causes of Islamic stock market behavior during the post-crisis period and to re-examine the transmission mechanism by which the financial crisis may reinforce itself. In this paper, we employ a new estimation technique of ARDL approach to cointegration to examine the long-run stability between the macroeconomic variables and Islamic stock market returns in Malaysia for the 1997 post-crisis period. A monthly data starting from May 1999 to February 2006 is used in the analysis.

The outline of this paper is as follows: section 2 provides an overview of the Malaysian stock market; section 3 highlights the model specification and the estimation technique; section 4 discusses the estimation results; and finally section 5 concludes the study.

The Malaysian stock market

The Malaysian stock market is one of the most prominent emerging markets in the region[1]. The Malaysian Stock Exchange was initially set up in March 1960, and public trading of stocks and shares commenced in May 1960 in the clearing house of Bank Negara Malaysia. The Capital Issues Committee was established in 1968, to supervise the issue of shares and other securities by companies applying for listing or already listed on the Exchange. Following the termination of the interchangeability with Singapore and the floating of the Malaysian dollar, the Malaysian Stock Exchange was separated into KLSE and Stock Exchange of Singapore in 1973.

In 1992, the Islamic Capital Market (ICM)[2] (2000) was introduced in the Malaysian economy. Its existence is reflected by the presence of Islamic stock-broking operations which include Islamic indices, Islamic unit trusts and a list of permissible counters in the KLSE as issued by the Securities Commission. The main feature of ICM is its activities are guided by *Shari'ah* injunctions. Precisely, ICM represents an assertion of religious law in the capital market transactions where the market should be free from the elements such as usury (*riba*), gambling (*maisir)* and uncertainties (*gharar*).

There are two major components of the Islamic corporate securities market, namely Islamic debt securities market and the Islamic equity market. Currently, there are two Islamic Indices; the Rashid Hussain Berhad Islamic (RHBI) index introduced in 1992 and the KLSI launched in 1999. When first time it was introduced, the RHBI was based on 179 KLSE Main Board counters which approved by the *Shari'ah* council of Bank Islam Malaysia Berhad and the *Shari'ah* Panel of RHB. In addition, the KLSI was launched to meet the demands from investors who seek to invest in securities which are consistent with *Shari'ah* principles. It acts as a benchmark for tracking the performance of *Shari'ah*-approved securities. The KLSI is a weighted-average index with its components made up of Main Board companies.

On June 23, 2005, the Dow Jones-RHB Islamic Malaysia Index was launched. This new index was jointly developed by Dow Jones Indexes and RHB Research Institute Sdn Bhd and replaces the RHB Islamic Index that has been in use since May 1996. The Index is part of the DIJMI series and follows the methodology of the *Shari'ah* compliant index family. The index has been developed specifically to meet the growing demand for *Shari'ah* compliant in the Malaysian stock market. The index is based on internationally acknowledged Islamic finance standards. A committee consisting of international *Shari'ah* scholars, the Dow Jones *Shari'ah* Supervisory Board, is formed to observe the execution of those standards used by Dow Jones Indexes.

Model specification and estimation techniques

Basically, the basis of our hypothesized model is the interrelationship among the four markets, i.e. the goods market, the money market, the labor market and the security market. Following the literature in the analysis of the security market, this study excludes the labor market from the analysis since Walras's law allows us to drop any one of these markets (Wongbangpo and Sharma, 2002). However, since Malaysia is an open economy, to examine the international influence on the market we have included the US monetary policy variable as proxied by FFR. Following earlier studies (Chen *et al.*, 1986; Mukherjee and Naka, 1995; Wongbangpo and Sharma, 2002, among others), the good market variable considered is IPI. The money market variables considered are M3, TBR and FFR. The security market is represented by KLSI. Finally, as an external competitiveness measure, the REER is included in the model. We believe that for the trade-oriented developing economies the exchange rate plays a significant role in the stock market movement. In short, these selected variables cover a wide range of macroeconomic aspects. Thus, we explore the long- and short-run relationship between the stock market and macroeconomic variables, by considering the following two models:

$$\ln \mathrm{KLSI}_t = a + b \ln \mathrm{M3}_t + c \ln \mathrm{IPI}_t + d \ln \mathrm{REER}_t + e \ln \mathrm{FFR}_t + \varepsilon_t \quad (1)$$

$$\ln \mathrm{KLSI}_t = a + b\ \mathrm{TBR}_t + c\ \ln \mathrm{IPI}_t + d\ \ln \mathrm{REER}_t + e\ \ln \mathrm{FFR}_t + \upsilon_t \quad (2)$$

where KLSI is the Kuala Lumpur *Syari'ah* Index; M3 is broad money supply, TBR is treasury bill rates, IPI is industrial production index, REER is real effective exchange rate and FFR is federal reserve rates.

Based on the intuitive financial theory (Maysami and Koh, 2001; Gjerde and Saettem, 1999), we hypothesize a positive relation between exchange rate and stock prices. Mukherjee and Naka (1995) and Wongbangpo and Sharma (2002) among others, indicate that both exchange rate levels and changes affect the performance of a stock market. For an export dominated country, Mukherjee and Naka (1995) suggest that currency depreciation will have a favorable impact on a domestic stock market. As the Malaysian Ringgit depreciates against foreign currencies, products exported from Malaysia become cheaper in the world market. As a result, if the demand for these good is elastic, the volume of exports from the country increases, which in turn causes higher cash flows, profits and the stock prices of the domestic companies. The opposite should happen when the currency of the country appreciates against foreign currencies.

As for the relationship between stock prices and interest rates, we hypothesize an independent relation between them. Islamic investment is not interest rate-driven. In the case where Muslims decide to invest their money only in interest-free bearing securities without considering the level of interest rates, then the stock prices and interest rate relation is independent. This is in line with the tenet of Islamic principles which postulates that the interest rate is not a significant variable in explaining stock returns. Similar to the interest rate, we also hypothesize that there will be a non-negative relation between FFR and stock prices.

The stock valuation model is generally concerned with the factors which affect the average stock price of all firms. From this valuation model, an increase in money supply leads to an increase in the expected dividends and in turn, increases the stock prices, assuming the interest rate remains unchanged. The effect of money supply on stock prices, however, can be positive or negative. Since the rate of inflation is positively related to money growth rate (Fama, 1981), an increase in the money supply

may lead to an increase in the discount rate and lower stock prices. However, this negative effect may be countered by the economic stimulus provided by money growth, which would likely increase cash flows and stock prices (Mukherjee and Naka, 1995).

Finally, following Geske and Roll (1983), Chen *et al.* (1986), Wongbangpo and Sharma (2002), we hypothesize a positive relation between stock prices and IPI. The levels of real economic activity (proxied by IPI) will likely influence stock prices in the same direction, through its impact on corporate profitability: an increase in output may increase expected future cash and, hence, raise stock prices, while the opposite effect would be valid in a recession.

The ARDL approach adopted in this study was introduced by Pesaran *et al.* (1996). The ARDL has numerous advantages. Unlike the most widely used method for testing cointegration – the residual-based Engle and Granger (1987) and maximum likelihood-based Johansen (1988, 1991) and Johansen and Juselius (1990) tests, the ARDL approach can be applied regardless of the stationary properties of the variables in the samples and allows for inferences on long-run estimates, which is not possible under the alternative cointegration procedure. In other words, this procedure can be applied irrespective of whether the series are $I(0)$, $I(1)$ or fractionally integrated (Pesaran and Pesaran, 1997 and Bahmani-Oskooee and Ng, 2002), this avoids problems resulting from non-stationary time series data (Laurenceson and Chai, 2003).

Another advantage of this approach is that the model takes sufficient numbers of lags to capture the data generating process in a general-to-specific modeling framework (Laurenceson and Chai, 2003). The ARDL method estimates $(p+1)^k$ number of regressions in order to obtain optimal lag-length for each variable, where p is the maximum lag to be used, and k is the number of variables in the equation. The model can be selected using the model selected criteria like Adjusted R^2, Akaike information criteria (AIC) and Schwartz-Bayesian Criteria (SBC). SBC is known as the parsimonious model (selecting the smallest lag-length), whereas AIC and adjusted R^2 are known for selecting the maximum relevant lag-length. This study reports the models based on these three criteria. Finally, the ARDL approach provides robust results for a smaller sample size of cointegration analysis. Since the sample of our study is small, this provides additional motivation for the study to adopt this approach.

Moreover, a dynamic error correction model (ECM) can be derived from ARDL through a simple linear transformation (Banerjee *et al.*, 1993). The ECM integrates the short-run dynamics with the long-run equilibrium, without losing long-run information. The error correction representation of the ARDL models for Equations (1) and (2) can be written as follows:

$$\begin{aligned}\Delta \ln \text{KLSI}_t = {} & a_0 + \sum_{j=1}^{k1} b_j \Delta \ln \text{KLCI}_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln \text{M3}_{t-j} \\ & + \sum_{j=0}^{k3} d_j \Delta \ln \text{IPI}_{t-j} + \sum_{j=0}^{k4} e_j \Delta \ln \text{REER}_{t-j} + \sum_{j=0}^{k5} f_j \Delta \text{FFR}_{t-j} \\ & + n_1 \ln \text{KLSI}_{t-1} + n_2 \ln \text{M3}_{t-1} + n_3 \ln \text{IPI}_{t-1} \\ & + n_4 \ln \text{REER}_{t-1} + n_5 \text{FFR}_{t-1} + \xi_t\end{aligned} \tag{3}$$

$$\begin{aligned}\Delta \ \ln \ \mathrm{KLSI}_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ \ln \ \mathrm{KLCI}_{t-j} + \sum_{j=0}^{k2} c_j \Delta \mathrm{TBR}_{t-j} \\ + \sum_{j=0}^{k3} d_j \Delta \ \ln \ \mathrm{IPI}_{t-j} + \sum_{j=0}^{k4} e_j \Delta \ \ln \ \mathrm{REER}_{t-j} + \sum_{j=0}^{k5} f_j \Delta \mathrm{FFR}_{t-j} \\ + n_1 \ \ln \ \mathrm{KLSI}_{t-1} + n_2 \mathrm{TBR}_{t-1} + n_3 \ln \ \mathrm{IPI}_{t-1} \\ + n_4 \ \ln \ \mathrm{REER}_{t-1} + n_5 \mathrm{FFR}_{t-1} + \zeta_t\end{aligned} \quad (4)$$

The terms with the summation signs in the above equations represents the error correction dynamics while the second part (terms with n_s) corresponds to the long-run relationship.

To begin with, the null hypothesis (H_0: $n_1 = n_2 = n_3 = n_4 = n_5 = 0$) which indicates the non-existence of the long-run relationship, is tested against the existence of a long-run relationship. The calculated *F*-statistics of the null hypothesis of no cointegration is compared with the critical value tabulated by Narayan (2004). If the computed *F*-statistic falls above the upper bound critical value, the null hypothesis of no cointegration is rejected. Likewise, if the test statistic falls below a lower bound, then the null hypothesis cannot be rejected. Finally, if it falls inside the critical value band, the result would be inconclusive. Once cointegration is confirmed, the long-run relationship between stock market and macroeconomic variables using the selected ARDL models are estimated. The last step of ARDL is to estimate the associated ARDL ECMs. Finally, to ascertain the goodness of fit of the selected ARDL model, the diagnostic and the stability tests are conducted. The structural stability test is conducted by employing the cumulative sum of recursive residuals (CUSUM) and the cumulative sum of squares of recursive residuals (CUSUMSQ).

Estimation results

Equations (1) and (2) are estimated using monthly data over the period 1999:05-2006:2. In the process of testing for cointegration, it is important that we determine the order of lags on the first differenced variables. Bahmani-Oskooee and Bohl (2000) suggest that the results of this first step are usually sensitive to the order of VAR. We therefore impose lag orders of 1-12 on the first difference of each variable and compute the *F*-statistics for the joint significance of lagged levels of variables. The computed *F*-statistics for each order of lags together with critical values proposed by Narayan (2004) are reported in Table I. As evident in Table I, the computed *F*-statistics for Model 1 (with M3) are significant at 95 percent for lag orders 4, 6 and 11, while lag order 5 is significant at 90 percent. However, for Model 2 (with TBR), the lag orders of 4 and 9 are found to be significant at 95 percent. For Models 1 and 2, we employ the lag order of 6 and 9, respectively, due to their highest *F*-statistics values.

In the second part of the analysis, we use the determined lag orders to estimate Equations (3) and (4) according to the appropriate lag-length criteria such as adjusted R^2, AIC and SBC. Based on the results evident in Table II, the cointegration test indicates that a set of macroeconomic variables namely, M3, IPI, REER and FFR (Model 1) and TBR, IPI, REER and FFR (Model 2) are cointegrated with the Islamic stock market index in Malaysia over the period of analysis. Individually, only IPI is found insignificant for both Models 1 and 2, respectively. However, as highlighted by

Order of lag	Model 1	Model 2
1	2.6477	2.5721
2	2.4129	2.4874
3	2.3906	2.7597
4	3.7592*	3.7891*
5	3.6998**	2.8099
6	3.8960*	2.7459
7	1.6763	1.7109
8	2.4096	3.3235
9	2.7697	3.8956*
10	1.3008	1.5670
11	3.4897**	1.5890
12	0.61431	2.2859

Notes: The relevant critical value bounds are given in Appendices A1-A3 (Case II: with a restricted intercept and no trend; number of regressor = 4, Narayan, 2004). They are 3.608-4.860 at the 99 percent significance level, 2.725-3.718 at the 95 percent significance level and 2.320-3.232 at the 90 percent significance level. * and ** denotes that *F*-statistics falls above the 95 percent and 90 percent upper bound, respectively

Table I.
F-statistics for testing the existence of a long-run stock market equation

	Model selection criterion					
	Model 1			Model 2		
Regressors	Adjusted R^2 (0,2,5,0,4)	AIC (1,0,3,0,0)	SBC (0,0,0,0,0)	Adjusted R^2 (4,5,4,8,8)	AIC (4,8,7,8,8)	SBC (0,0,0,0,0)
ln M3	1.2794**	0.34467	0.13702	–	–	–
	(2.3367)	(1.61557)	(1.34591)			
TBR	–	–	–	0.13152*	0.020259	−0.047104
				(1.7705)	(0.22759)	(−0.41769)
ln IPI	−1.4076	−0.68173	−0.55870	0.44243	0.48962	−0.24440
	(−1.5826)	(−0.91727)	(−1.0318)	(1.1998)	(1.3977)	(−0.69541)
ln REER	−2.0328**	−1.6168**	−1.8085**	−1.3902*	−1.2917	−1.3641
	(−2.3545)	(−2.2044)	(−2.4179)	(−1.6950)	(−1.6060)	(−1.3874)
FFR	0.048021***	0.015218	0.0086037	0.045212**	0.053142*	0.0052007
	(2.6997)	(1.2443)	(0.68288)	(2.2114)	(2.8467)	(0.34103)
Constant	3.6119	10.8202*	13.8855***	8.5944	8.1748	12.3019**
	(0.50618)	(1.9238)	(2.6023)	(1.6089)	(1.5559)	(2.1649)

Notes: Figures inside the parentheses are the value of *t*-ratios; *, ** and *** denotes significance levels at 10 percent, 5 percent and 1 percent, respectively

Table II.
Long-run coefficient estimates of stock market

Kwon and Shin (1999), a cointegration relation between stock price index and any single macroeconomic variable is not expected as the stock returns are in fact, a linear function of some macroeconomic variables.

This finding seems to be consistent (at least for three variables) with the study of Kwon and Shin (1999) on the Korean stock market. For the period January 1980 to December 1992, Kwon and Shin (1999) find that stock market indexes are cointegrated with a set of macroeconomic variables; namely, the foreign exchange rate, the trade balance, money supply and production index. Meanwhile, somewhat similar findings are reported for the Singapore stock market. Mookerjee and Yu (1997) find that stock

prices are cointegrated with money supply (both M1 and M2) and foreign exchange reserves. An important implication derived is that these markets (Malaysian, Korean and Singapore) are sensitive to a different set of macroeconomic variables compared to more mature markets such as the USA and the Japanese one. The USA and Japanese stock markets are found to be more sensitive to inflationary variables such as a change in unexpected inflation, expected inflation, risk premium and term structure (Burmeister and Wall, 1986; Chen *et al.*, 1986; Hamao, 1988; Chen, 1991). This further implies that the investment perception in the Malaysian market is different from that of more mature markets and that different strategies may be required in managing the portfolio of Malaysian stocks.

As hypothesized, money supply M3 is positively related to the changes in stock prices. An increase in the growth of money supply increases a firm's cash flow thereby increases the stock price (Mukherjee and Naka, 1995). Among the macroeconomic variables, the money–stock market nexus has been widely researched, because money supply changes have direct effects through portfolio changes as well as through their indirect effects on real economic activity (Habibullah *et al.*, 1999). Most of these studies provide evidence that money supply and the stock market are indeed related. Examples of these studies include Lin (1993), Habibullah and Baharumshah (1996).

As for the stock price and exchange rate, the present study finds a negative relationship between the variables. This supports the view that when a currency depreciates, our imports are cheaper and this in turn causes an increase in the firm's profitability and therefore the value of the stock, while domestic exporters have incentive to raise the Ringgit prices as their products become cheaper in foreign currencies. This indicates that the effect of fluctuating Ringgit value on corporate profits in Malaysia could be transmitted either through the domestic currency price or the foreign currency price. Existing studies on the effects of exchange rate and stock prices seem to indicate mixed results. For Malaysia, Ibrahim and Wan Yusof (2001) reports a negative net effect of the exchange rate on the stock prices. Similar results are also documented for Korean stock prices (Kwon and Shin, 1999) and the US market (Kim and Davidson, 1996; and Kim, 2003),[3] while Mookerjee and Yu (1997) report a consistent finding with our study where the net effect of the exchange rate on stock prices is positive (for both the expected and the unanticipated exchange rates).

As evident from Table II, for TBR in Model 2 and FFR in Models 1 and 2, they seem to have positive relation with the stock market indexes. An increase in interest rates will motivate Muslim investors to buy more *Shari'ah*-compliant stocks rather than depositing the money in banks or invest in other interest bearing securities. This finding indicates that when interest rates rise either domestically (TBR) or internationally (FFR), the Muslim investors will buy more *Shari'ah* compliant stocks; thereby escalating the Islamic stock prices. This is perhaps due to the perception to some Muslim investors that excessive rate of interest is not permissible. On contrary, with lower interest rate, some Muslim investors may perceive that it is compatible to *Shari'ah* compliant rate of returns and therefore is being misconstrued as permissible. In Malaysia, the rates of return for Islamic financial products including *Shari'ah* compliant stocks are always being benchmarked against the conventional interest rate. However, as clearly stated in the Holy Qur'an (2: 278), every amount irrespective of its magnitude over and above principal is considered as *riba* and thus not permissible.

Our positive stock price-FFR relation finding echoes the study on Singapore stock market (Maysami and Koh, 2000) and other markets like Japan and USA (Bulmash and Trivoli, 1991 and Mukherjee and Naka, 1995).The Singapore stock market is found to

have a positive relationship with short term interest rates and is negatively related to long-term interest rates. As explained by Mukherjee and Naka (1995), long-term interest rates seem to a better proxy for the nominal risk-free component of the discount rate in stock valuation models. Conversely Bulmash and Trivoli (1991) suggest that the long-term interest rate is a proxy for expected inflation that is incorporated in the discount rate. For Hong Kong, however, Mok (1993) finds that interest rates and stock returns are independent, while Habibullah *et al.* (1999) report a significant relationship between interest rates and stock returns for Malaysian stock market for the period before 1997 financial crisis.

We further estimate the error correction representations selected by Adjusted R^2, AIC and SBC for both of our models. The results are presented in Table III. The long-run coefficients generated in Table III are used to generate the error correction terms for the two models. The adjusted R^2 are 0.31 (R^2), 0.25 (AIC) and 0.20 (SBC) for Model 1. Meanwhile for Model 2, the adjusted R^2 are 0.44 (R^2), 0.42 (AIC) and 0.13 (SBC). As indicated in Table III, the error correction representations carry negative signs and are highly significant for both models based on all the lag-length criteria. This therefore substantiates our earlier findings that M3, IPI, REER, TBR and FFR are cointegrated with stock returns as provided by the *F*-test. Furthermore, the speed of adjustment for all the models is rather fast, ranging from 25 to 71 percent. This indicates that the last period disequilibrium is, on average, corrected by about 25-71 percent in the following month.

Finally, we examine the stability of the long-run coefficients together with the short-run dynamics based on Pesaran and Pesaran (1997) and therefore we apply CUSUM and CUSUMSQ (proposed by Brown *et al.*, 1975). The tests are applied to all the six models in Tables II and III. The CUSUM test basically uses the CUSUM-based the first set of n observations and is updated recursively and then plotted against the break points. If the plot of CUSUM remains within the critical bounds at 5 percent significance level (represented by clear and straight lines drawn at 5 percent, the null hypothesis that all the coefficients and the ECM are stable cannot be rejected. However, if the two lines are crossed, the null hypothesis of coefficient constancy can be rejected at 5 percent. The same analysis applies for CUSUMSQ test which is based on the squared recursive residuals.

Figures 1 and 2 show the graphical representations of CUSUM and CUSUMSQ plot applied ECM based on the adjusted R^2 criterion. Neither the CUSUM nor CUSUMSQ indicate evidence of any structural instability for the models that we have tested. The Durbin–Watson statistics also indicate that there is no problem of autocorrelation for all models tested.

Conclusion

The study empirically assesses both the short- and long-run dynamics between the macroeconomic variables and stock market behavior in Malaysia during the post 1997 financial crisis. Based on the analysis, the inclusion of money supply M3, IPI, TBR, REER and FFR enhance the predictability measure of the Malaysian stock market.

Except the IPI, all the macroeconomic variables analyzed in the paper seem to be suitable targets for the government to focus on, in order to stabilize the stock market and encourage more capital flows in to the capital market. As for the interest rates and stock returns relation, the study finds that when interest rates rise either domestically (TBR) or internationally (FFR), the Muslim investors will buy more *Shari'ah* compliant stocks; thereby escalating the Islamic stock prices. In investing their money into the stock markets, the Malaysian Muslims investors are guided by interest rates in their

Regressors	Model selection criterion					
	Adjusted R^2	Model 1 AIC	SBC	Adjusted R^2	Model 2 AIC	SBC
$\Delta \ln KLSI_{t-1}$	–	0.18450 (1.5304)	–	0.29323* (2.2752)	0.30930* (2.1123)	–
$\Delta \ln KLSI_{t-2}$	–	–	–	0.064050 (0.49288)	0.092548 (0.64078)	–
$\Delta \ln KLSI_{t-3}$	–	–	–	0.37000** (2.9578)	0.32753 (2.3994)	–
$\Delta \ln KLSI_{t-4}$	–	–	–	0.13466 (1.1310)	0.21008 (1.5201)	–
$\Delta \ln M3_t$	0.15934 (0.19001)	0.099818 (0.64231)	0.037410 (0.35388)	–	–	–
$\Delta \ln M3_{t-1}$	1.3954*** (1.6707)	–	–	–	–	–
$\Delta \ln M3_{t-2}$	1.4153 (1.6333)	–	–	–	–	–
$\Delta \ln IPI_t$	0.050110 (0.28107)	−0.065754 (−0.40093)	−0.15254 (−1.1478)	−0.047703 (−0.25319)	0.11612 (0.55323)	−0.060416 (−0.69568)
$\Delta \ln IPI_{t-1}$	0.51089*** (1.9452)	0.029382 (− 0.40093)	–	−0.37355*** (−1.7667)	−0.26925 (−1.1429)	–
$\Delta \ln IPI_{t-2}$	0.42736 (1.6632)	−0.12172 (−0.58814)	–	−0.37958*** (−1.7808)	−0.30139 (−1.2581)	–
$\Delta \ln IPI_{t-3}$	0.78225** (3.2280)	0.22586 (1.3996)	–	0.23627 (1.1101)	0.32969 (1.4661)	–
$\Delta \ln IPI_{t-4}$	0.58244** (2.7071)	–	–	0.18851 (0.86128)	0.42311 (1.5641)	–
$\Delta \ln IPI_{t-5}$	0.34887* (2.1229)	–	–	0.49165* (2.5676)	0.77748** (2.8736)	–
$\Delta \ln IPI_{t-6}$	–	–	–	–	0.51308*** (1.7387)	
$\Delta \ln IPI_{t-7}$	–	–	–	–	0.34832 (1.3866)	
$\Delta \ln IPI_{t-8}$	–	–	–	–	0.23549 (1.2236)	
ΔTBR_t	–	–	–	−0.053220 (−1.4305)	−0.056614 (−1.4070)	−0.011644 (−0.41559)
ΔTBR_{t-1}	–	–	–	−0.074685 (−1.6102)	−0.019871 (−0.28920)	
ΔTBR_{t-2}	–	–	–	−0.14340** (−2.9708)	−0.091834 (−1.2931)	
ΔTBR_{t-3}	–	–	–	−0.062488 (−1.4742)	−0.050438 (−0.74508)	
ΔTBR_{t-4}	–	–	–	−0.086117* (−2.4299)	−0.037438 (−0.57721)	
ΔTBR_{t-5}	–	–	–	–	0.022219 (0.38452)	
ΔTBR_{t-6}	–	–	–	–	0.036879 (0.68993)	

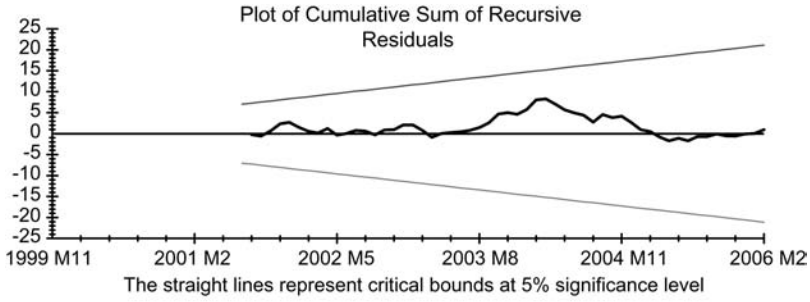
Table III.
Error correction representation of ARDL model (Dependent variable is $\Delta \ln KLSI_t$)

(*Continued*)

Regressors	Model selection criterion					
	Adjusted R^2	Model 1 SBC	Adjusted R^2	AIC	Model 2 Adjusted R^2	SBC
ΔTBR_{t-7}	–	–	–	–	−0.038590 (−0.91262)	
$\Delta \ln REER_t$	−0.54756* (_2.2904)	−0.46824* (−2.0994)	−0.49378* (_2.1961)	0.41610 (0.59439)	0.003879 (0.005106)	−0.33721 (−1.2188)
$\Delta \ln REER_{t-1}$	–	–	–	−0.11932 (0.88121)	−0.22446 (−0.23757)	–
$\Delta \ln REER_{t-2}$	–	–	–	0.73203 (0.88121)	0.13932 (0.14700)	–
$\Delta \ln REER_{t-3}$	–	–	–	0.40937 (0.43988)	0.75843 (0.76605)	–
$\Delta \ln REER_{t-4}$	–	–	–	−0.37307 (−0.44843)	−0.64281 (−0.73395)	–
$\Delta \ln REER_{t-5}$	–	–	–	−1.5786*** (−1.8724)	−1.6760*** (−1.8994)	–
$\Delta \ln REER_{t-6}$	–	–	–	0.032073 (0.043557)	−0.33480 (−0.41843)	–
$\Delta \ln REER_{t-7}$	–	–	–	−1.0638 (−1.4992)	−0.99491 (−1.3208)	–
$\Delta \ln REER_{t-8}$	–	–	–	1.0242 (1.4330)	0.81316 (1.0829)	–
Δ FFR_t	0.11934** (2.7914)	0.12409** (3.3661)	0.12982** (3.5371)	0.15486** (2.9216)	0.14985* (2.6482)	0.10925** (2.8304)
Δ FFR_{t-1}	−0.0010088 (−0.021631)	–	–	0.057624 (0.97816)	0.070721 (1.1641)	–
Δ FFR_{t-2}	0.013598 (0.26257)	–	–	0.096724 (1.5129)	0.070231 (1.0388)	–
Δ FFR_{t-3}	−0.072867 (−1.42680	–	–	−0.041417 (−0.69627)	−0.049376 (−0.75275)	–
Δ FFR_{t-4}	−0.099991* (−2.0815)	–	–	−0.003338 (−0.065577)	−0.035692 (−0.58671)	–
Δ FFR_{t-5}	–	–	–	−0.002323 (−0.045466)	−0.003972 (−.070342)	–
Δ FFR_{t-6}	–	–	–	−0.025929 (−0.51041)	−0.048667 (−0.89506)	–
Δ FFR_{t-7}	–	–	–	−0.10937* (−2.3700)	−0.11295* (−2.2458)	–
Δ FFR_{t-8}	–	–	–	−0.10879* (−2.1990)	−0.15089* (−2.6483)	–
Constant	0.97287 (0.47551)	3.1336*** (1.6984)	3.7912* (2.1857)	5.2815 (1.5775)	5.7812 (1.5845)	3.0410*** (1.7378)
EC_{t-1}	−0.26935** (−3.3228)	−0.28960** (−3.6626)	−0.27303** (−3.6087)	−0.61453** (−5.4203)	−0.70720** (−4.9148)	−0.24720** (−3.0995)
Adjusted R^2	0.30863	0.25403	0.19732	0.43636	0.42012	0.13292
F-statistics	3.2800	4.0600	4.8874	2.7571	2.4041	3.4075
DW-statistics	1.9338	2.0547	1.8257	1.9751	1.9290	1.8096

Notes: Figures inside the parentheses are the value of *t*-ratios; *, ** and *** denotes significance levels at 5 percent, 1 percent and 10 percent, respectively

Table III.



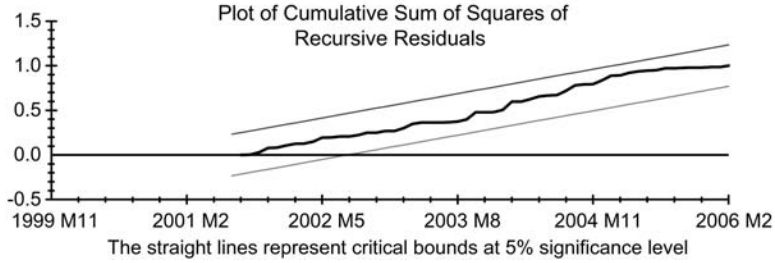
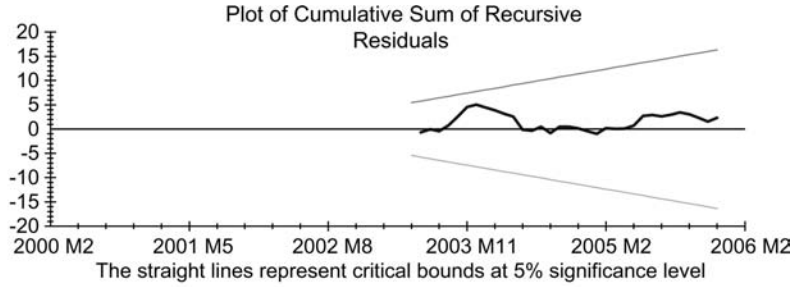


Figure 1.
Plots of CUSUM and CUSUMSQ Statistics for coefficient stability (Model 1)



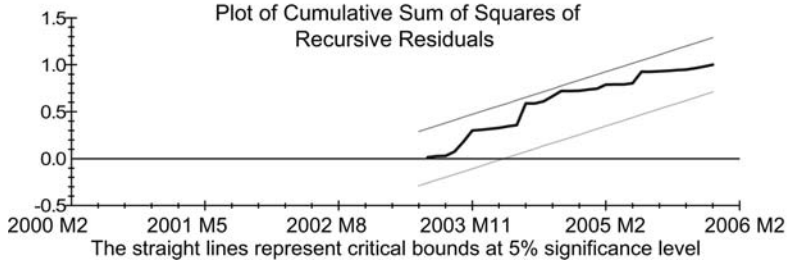


Figure 2.
Plots of CUSUM and CUSUMSQ statistics for coefficient stability (Model 2)

investment decisions in the case where the interest rates are high. In a case of lower interest rates, some Muslim investors may not end up buying more *Shari'ah* compliant stocks. This is due to the misconception that non-excessive interest rate is considered as permissible. As highlighted earlier, every amount of interest rates irrespective of its magnitude is not permissible.

In addition, changes in US monetary policy as measured by the changes in the FFR seems to also have a significant direct impact on the Islamic stock market behavior

during the period of analysis. This implies that any changes in the US monetary policy may affect the Malaysian stock market. As a small open economy, Malaysia remains susceptible to external influence like the changes in the US economy. This may be perceived as a channel through which the stock market shocks of more developed markets are being transmitted to an emerging market like Malaysia.

The findings and implications of this study are limited to the post 1997 financial crisis period until the beginning of the year 2006 for a small open economy, Malaysia. Incorporating longer sample period, covering more Islamic stock markets worldwide and including other macroeconomic variables that may potentially affect Islamic stock market might enhance further analysis and implications of the study in this issue.

Notes

1. In comparison with other markets, Malaysia was ranked 23rd in the world in 2004, being the largest market in ASEAN and is currently ranked 8th in Asia. If 1996 was used as yardstick, the KLSE would be one of the largest markets in the world (Bank Negara Malaysia, 2005, pp. 307-10).
2. See http://islamic-world.net/Islamic-state/malay_islamcap market.htm.
3. For a more comprehensive and excellent discussion on the total effects of exchange rate on stock prices, please refer to Kim (2003; pp. 4-5).

References

Bahmani-Oskooee, M. and Bohl, M.T. (2000), "German monetary unification and the stability of the German M3 money demand function", *Economics Letters*, Vol. 66, pp. 203-8.

Bahmani-Oskooee, M. and Ng, R.C.W. (2002), "Long-run demand for money in Hong Kong: an application of the ARDL model", *International Journal of Business and Economics*, Vol. 1 No. 2, pp. 147-55.

Banerjee, A., Dolado, J.J., Galbraith, J.W. and Hendry, D.F. (1993), *Co-integration, Error-Correction and the Econometric Analysis of Non-Stationary Data*, Oxford University Press, New York, NY.

Bank Negara Malaysia (2005), *Annual Reports* (various issues), pp. 307-10.

Bilson, C.M., Brailsford, T.J. and Hooper, V.J. (2001), "Selecting macroeconomic variables as explanatory factors of emerging stock market returns", *Pacific-Basin Finance Journal*, Vol. 9, pp. 401-26.

Brown, R.L., Durbin, J. and Evans, J.M. (1975), "Techniques for testing the constancy of regression relations over time", *Journal of the Royal Statistical Society*, Vol. 37, pp. 149-92.

Bulmash, S. and Trivoli, G. (1991), "Time-lagged interactions between stock prices and selected variables", *The Journal of Portfolio Management*, Vol. 17 No. 4, pp. 61-7.

Burmeister, E. and Wall, K.D. (1986), "The arbitrage pricing theory and macroeconomic factor measures", *Finance Review*, Vol. 21, pp. 1-20.

Chen, N.F. (1991), "Financial investment opportunities and the macroeconomy", *Journal of Finance*, Vol. 46, pp. 529-54.

Chen, N.F., Roll, R. and Ross, S. (1986), "Economics forces and the stock market", *Journal of Business*, Vol. 59 No. 3, pp. 383-403.

Claessens, S., Dasgupta, S. and Glen, J. (1993), "Return behaviour in emerging stock markets", *World Bank Economic Review*, Vol. 9, pp. 131-52.

Engle, R.F. and Granger, C.W.J. (1987), "Cointegration and error correction: representation, estimation and testing", *Econometrica*, Vol. 55 No. 2, pp. 251-76.

Errunza, V. (1983), "Emerging markets: a new opportunity for improving global portfolio performance", *Financial Analysis Journal*, Vol. 39, pp. 51-8.

Fama, E.F. (1981), "Stock returns, real activity, inflation, and money", *The American Economic Review*, Vol. 71 No. 4, pp. 545-65.

Geske, R. and Roll, R. (1983), "The fiscal and monetary linkage between stock returns and inflation", *Journal of Finance*, Vol. 38, pp. 7-33.

Gjerde, Ø. and Sættem, F. (1999), "Causal relations among stock returns and macroeconomic variables in a small, open economy", *Journal of International Financial Markets, Institutions and Money*, Vol. 9, pp. 61-74.

Goetzmann, W.N. and Jorion, P. (1999), "Re-emerging markets", *Journal of Financial and Quantitative Analysis*, Vol. 34, pp. 1-32.

Habibullah, M. and Baharumshah, A.Z. (1996), "Money, output and stock prices in malaysia: an application of the cointegration tests", *International Economic Journal*, Vol. 10 No. 2, pp. 121-30.

Habibullah, M., Baharumshah, A.Z., Mohamed, A. and Wan Ngah, W.A.S. (1999), "Stock market and economic activity: a causal analysis", paper presented at the Annual FEP Seminar on The Malaysian Economy and Management: Into the Next Millennium, Department of Economics, Universiti Putra Malaysia, Serdang.

Hakim, S. and Rashidian, M. (2005), "Risk and returns of Islamic stock market indexes", available at: www.mafhoum.com/press4/136E15.pdf (accessed 21 June 2006).

Hamao, Y. (1988), "An empirical examination of the arbitrage pricing theory: using Japanese data", *Japan World Economy*, Vol. 1, pp. 45-61.

Harvey, C.R. (1995), "Predictable risk and return in emerging markets", *Review of Financial Studies*, Vol. 8, pp. 773-816.

Ibrahim, I. and Jusoh, M.A. (2001), "The causes of stock market volatility in Malaysia", paper presented at the Malaysian Finance Association 3rd Annual Symposium, Kuala Lumpur.

Ibrahim, M. (2002), "Volatility interactions between stock returns and macroeconomic variables Malaysian evidence", *Savings and Development*, Vol. 26 No. 2, pp. 194-483.

Ibrahim, M. and Wan Yusof, W.S. (2001), "Macroeconomics variables, exchange rate and stock price: a Malaysian perspective", *IIUM Journal of Economics and Management*, Vol. 9 No. 2, pp. 141-63.

Islamic Capital Market (2000), available at http://islamic-world.net/Islamic-state/malay_ islamcapmarket. Htm (accessed 12 April).

Johansen, S. (1988), "Statistical analysis of cointegration vectors", *Journal of Economic Dynamics and Control*, Vol. 12, pp. 231-54.

Johansen, S. (1991), "Estimation and hypothesis testing of cointegrating vectors in gaussian vector autoregressive models", *Econometrica*, Vol. 55, pp. 251-76.

Johansen, S. and Juselius, K. (1990), "Maximum likelihood estimation and inference on cointegration – with application to the demand for money", *Oxford Bulletin of Economics and Statistics*, Vol. 52 No. 2, pp. 169-210.

Kim, K. (2003), "Dollar exchange rate and stock price: evidence from multivariate cointegration and error correction model", *Review of Financial Economics*, Vol. 83, pp. 1-13.

Kim, K. and Davidson, C. (1996), "Fluctuation in currency value and aggregate profit of the US manufacturing sector", *International Journal of Business*, Vol. 1, pp. 45-58.

Kwon, C.S. and Shin, T.S. (1999), "Cointegration and causality between macroeconomic variables and stock market returns", *Global Finance Journal*, Vol. 10 No. 1, pp. 71-81.

Laurenceson, J. and Chai, J.C.H. (2003), *Financial Reform and Economic Development in China*, Edward Elgar, Cheltenham.

Liljeblom, E. and Stenius, M. (1997), "Macroeconomic volatility and stock market volatility: empirical evidence on Finnish data", *Applied Financial Economics*, Vol. 7, pp. 419-26.

Lin, S.M. (1993), "Stock returns and money supply: a comparison among three Asian newly industrialized countries", paper presented at the Annual FEP Seminar on the Malaysian Economy and Management into the Next Millennium, Universiti Putra Malaysia, Serdang.

Maysami, R.C. and Koh, T.S. (2000), "A vector error correction model of the Singapore stock market", *International Review of Economics and Finance*, Vol. 9, pp. 79-96.

Mok, H.M.K. (1993), "Causality of interest rate, exchange rate and stock prices at stock market open and close in Hong Kong", *Asia Pacific Journal of Management*, Vol. 10, pp. 123-43.

Mookerjee, R. and Yu, Q. (1997), "Macroeconomic variables and stock prices in a small open economy: the case of Singapore", *Pacific – Basin Finance Journal*, Vol. 5 No. 3, pp. 377-88.

Muhammad, J. (2002), "Isu Praktikal Mengenai Pelaburan Dalam Indeks Islam", *Seminar Pelaburan Beretika Menurut Islam: Satu Cabaran*, IKIM.

Mukherjee, T.K. and Naka, A. (1995), "Dynamic relations between macroeconomic variables and the Japanese stock market: an application of a vector error-correction model", *The Journal of Financial Research*, Vol. 18 No. 2, pp. 223-37.

Narayan, P.K. (2004), "Reformulating critical values for the bounds f-statistics approach to cointegration: an application to the tourism demand model for Fiji", Discussion Paper No. 02/04, Department of Economics, Monash University, Melbourne.

Pesaran, M.H. and Pesaran, B. (1997), *Working with Microfit 4.0: Interactive Econometrics Analysis*, Oxford University Press, Oxford.

Pesaran, M.H., Shin, Y., Smith, R.J. (1996), "Testing for the existence of a long-run relationship", DAE Working Paper No. 9622, Department of Applied Economics, University of Cambridge, Cambridge.

Poon, S.H. and Taylor, S.J. (1992), "Stock returns and volatility: an empirical study of the UK stock market", *Journal of Banking and Finance*, Vol. 16, pp. 37-59.

Tang, K.M. and Garnon, G. (1998), "Modeling volatility in the Malaysian stock market", *Asia Pacific Journal in Finance*, Vol. 1, pp. 155-90.

Wongbangpo, P. and Sharma, S.C. (2002), "Stock market and macroeconomic fundamental dynamic interactions: asean-5 countries", *Journal of Asian Economics*, Vol. 13, No. 1, pp. 27-51.

Further reading

Rozeff, M.S. (1974), "Money and stock prices: market efficiency and the lag in effect of monetary policy", *Journal of Financial Economics*, Vol. 1, pp. 245-302.

Corresponding author

M. Shabri Abd. Majid can be contacted at: mshabri@iiu.edu.my