# MACROECONOMIC VARIABLES AND STOCK RETURNS IN MALAYSIA: AN APPLICATION OF THE ARDL BOUND TESTING APPROACH

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**Abstract**

*The study seeks to explore the extent to which macroeconomic variables affect the stock market behavior in the emerging market of Malaysia in the post 1997 financial crisis period, using the latest time series econometrics technique to test for cointegration, namely, the Autoregressive Distributed Lag (ARDL) model. The estimation of results suggest that real effective exchange rate, money supply, industrial production index, and federal funds rate seem to be suitable targets for the government to focus on, in order to stabilize the stock market and to encourage more capital flows into the economy. Changes in U.S. monetary policy as measured by the changes in the federal funds rate seem to also have a significant direct impact on the Malaysian stock market behavior during the period of analysis. This implies that any changes in the U.S. monetary policy affect the Malaysian stock market.*

***Keywords:*** Macroeconomic variable; Stock market; Malaysia; ARDL

***JEL Classification***: C32, C53, G15

## 1. INTRODUCTION

The dynamic interactions between macroeconomic variables and stock market behavior have been well researched in the financial economics literature. According to simple discounted present value model (Liljeblom and Stenius, 1997; Ibrahim, 2002 and Ibrahim and Jusoh, 2001), stock prices are determined by the future cash flows to the firm and discounting rates. Changes in these factors which may be due to changes in macroeconomic variables may in turn affect the stock market. In an open economy such as

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the one in Malaysia, corporate cash flows are influenced by the changes in the macroeconomic variables such as IPI, M3, changes in interest rate as well as the exchange rate. However, in the past two decades growing efforts have been made by researchers to empirically calibrate these macroeconomic effects. More studies are focused on developed markets such as the ones in the U.S., UK and the Japan. Examples of these studies are Fama (1981) and Chen (1991) for the US market, Hamao (1988) on the Japanese market, and Poon and Taylor (1992) on the UK market.

This paper extends the existing literature to address the question whether local and foreign macroeconomic variables affect stock returns within the context of an emerging market. Emerging markets seem to have distinguished features from those of the developed markets. Given the different political and economic structures, the risk and return profiles in 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, 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.

Because the Kuala Lumpur Composite Index (KLCI) operates in different economic, financial and political structures than the United States, the movement of stock prices may be different. It is possible that, given that the KLCI is of a smaller market capitalization than the U.S., it is more susceptible to speculative activities and government interventions. From the investors' perception, the question whether KLCI responds differently to macroeconomic variables is of relevance.

The empirical question that we seek to explore is whether macroeconomic variables such as industrial production index (IPI), money supply M3, real effective exchange rate (REER), interest rate (TBR) and Federal fund rates (FFR) are significant explanatory factors of stock market returns. Accordingly, if these macroeconomic variables are significant and consistently priced in the stock market returns, they should 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; Ibrahim, 1999; and Maysami and Koh, 2000).

The 1997 financial turmoil 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 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 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 presents a literature review; section 3 highlights the model specification and the estimation technique; section 4 discusses the estimation results and finally, section 5 concludes the study.

## 2. LITERATURE REVIEW

The interactions between macroeconomic variables and stock prices have been extensively researched. For instance, Fama (1981) documents a significant relationship between stock returns and other macroeconomic variables, namely inflation, national output and industrial production. In their study, Nasseh and Strauss (2000) employ Johansen cointegration tests to investigate the long-run relationship between stock prices and both domestic and international economic activities in six European economies. They find that stock price levels are significantly related to industrial production, short- and long-term interest rates as well as foreign stock prices. Variance decomposition methods support the strong explanatory power of macroeconomic variables in contributing to the forecast variance of stock prices. Black and Fraser (2003) investigate deviations of U.S. stock prices from their value warranted by expected growth in output. The time-varying risk model produces fundamental prices that are closest to actual prices. The time-series characteristics of deviations from fundamental value suggest that deviations are similar over different time horizons and observational frequency, and appear to be driven by nonlinearities in the price–output relationship rather than irrational investor behaviour.

In addition, Theophano and Sunil (2006) examine the short run dynamic adjustments and the long run equilibrium relationships between selected macroeconomic variables, trading volume and stock returns in the emerging Greek stock market during the period 1990 to 1999. Empirical results show that short run and long run equilibrium relationship exists between inflation, money supply and trading volume and the stock prices in the Athens stock exchange. No short run or long run equilibrium relationship is found between the exchange rates and stock prices. The results of this research are consistent with the theoretical arguments and practical developments that occurred in the Greek stock markets during the sample period. The results also imply that the market is informationally inefficient because publicly available information on macroeconomic variables and trading volumes can be potentially used in predicting stock prices. Taking the Korean economy as a case study, Kwon and Shin (2001) investigate whether current economic activities in the country can explain stock market returns by using a cointegration test and a Granger causality test from a vector error correction model. They find that the Korean stock market reflects macroeconomic variables on stock price indices. The cointegration test and the vector error correction model illustrate that stock price indices are cointegrated with a set of macroeconomic variables–that is, the production index, exchange rate, trade balance, and money supply–which provides a direct long-run equilibrium relation with each stock price index. However, the stock price indices are not a leading indicator for economic variables; this is inconsistent with the previous findings that the stock market rationally signals changes in real activities.

For ASEAN economies, Wongbangpo and Sharma (2002) investigate the role of selected macroeconomic variables, i.e., GNP, the consumer price index, the money supply, the interest rate, and the exchange rate on the stock prices in five ASEAN countries (Indonesia, Malaysia, Philippines, Singapore, and Thailand). The study observes long- and short-term relationships between stock prices and these macroeconomic variables. Moreover, the macroeconomic variables in these markets have bidirectional causality with the stock prices in the Granger sense. Since the stock prices interact with the key macroeconomic variables in the short- and long-run, strategic government economic or financial policies can yield impressive gains in both the sectors.

The studies on the Malaysian economy on this topic have also been extensively investigated (e.g., Habibullah, and Baharumshah, 1996; Habibullah *et al.*, 1999; Ibrahim, 1999; and Ibrahim and Aziz, 2003). By employing the Granger non-causality test of Toda Yamamoto (1995), Habibullah *et al.* (1999) provide empirical evidence that KLSE stock prices has causal relationships with macroeconomic variables such as divisia money supply, national income, price level, interest rate and real effective exchange rate. Ibrahim (1999) investigates the dynamic interactions between seven macroeconomic variables and the stock prices for an emerging market, Malaysia, using cointegration and Granger causality tests. The results strongly suggest informational inefficiency in the Malaysian market. The bivariate analysis suggests cointegration between the stock prices and three macroeconomic variables: consumer prices, credit aggregates and official reserves. From bivariate error-correction models, we note the reactions of the stock prices to deviations from the long run equilibrium. These results are confirmed when we extend the analysis to multivariate settings. There is also evidence that the stock prices are Granger-caused by changes in the official reserves and exchange rates in the short run. Finally, Ibrahim and Aziz (2003) examine dynamic linkages between stock prices and several macroeconomic variables in the case of Malaysia using standard and well-accepted methods of cointegration and vector autoregression. The findings of Ibrahim and Aziz (2003) were in line with Ibrahim's (1999) earlier findings.

Looking at the above reviewed studies on the macroeconomic variables–stock returns causal nexus, the studies have investigated both advanced and emerging markets using different approaches. However, none of the studies reviewed above have investigated the dynamic interactions between macroeconomic variables and stock returns adopting the ARDL, the latest approach to cointegration during the post-1997 financial crisis period in the Malaysian economy. This motivates the present study to adopt the new estimation technique of ARDL approach to cointegration to examine the long run stability between the macroeconomic variables and stock market returns in Malaysia during the post-1997 Asian financial turmoil.

## 3. MODEL SPECIFICATION AND ESTIMATION TECHNIQUES

Based on the 'intuitive financial theory' (Maysami and Koh, 2000, Gjerde and Sættem, 1999), macroeconomic variables such as industrial production index (IPI), money supply M3, exchange rate and interest rate are hypothesized to affect stock market behavior. Uncovering this long run relationship may help gauge the predictability of the Malaysian equity market while providing valuable information to investors as well as policymakers. The money supply–stock market nexus has been widely tested and debated due to the belief that money supply changes have important and direct effects on stock prices through portfolio changes, and indirect effects through its impact on real consumption and investment activities.

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 U.S 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 KLCI. 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 short- and long-run relationship between the macroeconomic variables and stock market, by considering the following two models:

$$ln\text{KLCI}_t = a + b\ ln\text{M3}_t + c\ ln\text{IPI}_t + d\ ln\text{REER}_t + e\ ln\text{FFR}_t + \varepsilon_t \qquad (1)$$

$$ln\text{KLCI}_t = a + b\ \text{TBR}_t + c\ ln\text{IPI}_t + d\ ln\text{REER}_t + e\ ln\text{FFR}_t + \upsilon_t \qquad (2)$$

where KLCI is the Kuala Lumpur Composite 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 fund rates.

From the theoretical perspective, the effects of currency depreciation may be positively or negatively related to stock prices. However, based on the intuitive financial theory (Maysami and Sim 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.

According to the Monetary Portfolio Model (Rozeff, 1974), an increase in interest rates raises the opportunity cost of holding cash and is likely to lead to a substitution effect between stock and other interest bearing securities. Thus, a decrease in interest rate, which may also be a result of an expansionary monetary policy, will increase the price of the stocks and subsequently increase their returns. This study hypothesizes a negative relation between interest rates and stock prices. The intuition behind this relationship is straightforward. An increase in interest rates raises the opportunity cost of holding cash and is likely to lead to a substitution effect between stock and other interest bearing securities. We also hypothesize that the FFR and stock prices will move in the opposite direction as interest rates do.

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 industrial production index. 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 Autoregressive Distributed Lag (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-Granger (1987) and maximum likelihood-based Johansen (1988; 1991) and Johansen-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), thus 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:

$$\Delta \ln KLCI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln KLCI_{t-j} + \sum_{j=0}^{k2} c_j \Delta \ln M3t_{t-j} + \sum_{j=0}^{k3} d_j \Delta \ln IPI_{t-j} + \sum_{j=0}^{k4} e_j \Delta \ln REER_{t-j} + \sum_{j=0}^{k5} f_j \Delta AFFR_{t-j} + n_1 \ln KLCI_{t-i} + n_2 \ln M3_{t-i} + n_3 \ln IPI_{t-i} + n_4 \ln REER_{t-i} + n_5 FFR_{t-i} + \zeta_t \quad (3)$$

$$\Delta \ln KLCI_t = a_0 + \sum_{j=1}^{k1} b_j \Delta \ln KLCI_{t-j} + \sum_{j=0}^{k2} c_j \Delta TBR_{t-j} + \sum_{j=0}^{k3} d_j \Delta \ln IPI_{t-j} + \sum_{j=0}^{k4} e_j \Delta \ln REER_{t-j} + \sum_{j=0}^{k5} f_j \Delta AFFR_{t-j} + n_1 \ln KLCI_{t-i} + n_2 TBR_{t-i} + n_3 \ln IPI_{t-i} + n_4 \ln REER_{t-i} + n_5 FFR_{t-i} + \zeta_t \quad (4)$$

The terms with the summation signs in the above equations represent the error correction dynamics while the second part (terms with $n_S$) corresponds to the long-run relationship. Money supply (M3) and TBR is the only different independent variable included in Models 3 and 4 respectively, while the other independent variables are similar.

First of all, 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, 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 error correction models. 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).

## 4. ESTIMATION RESULTS

Equations (1) and (2) are estimated for Malaysia using monthly data over the period 1999:05 to 2006:02. 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 1. As evident in Table 1, the computed F-statistics for Model (with M3) are significant at 90% for lag orders 4, 5, 6 and 11. However, for Model 2 (with TBR), only the lag order of 9 is found to be significant. For Model 1 we employ the lag order of 6 due to its highest F-statistics value, while lag order of 9 is employed for Model 2.

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-squared, Akaike's Information Criteria (AIC) and Schwartz-Bayesian Criteria (SBC). Based on the results evident in Table 2, 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 stock market index in Malaysia over the period of analysis. Individually, only IPI and TBR are found insignificant for Model 1 and 2, respectively. Combining both models based on different lag-length cri-

**Table 1. F-Statistics for Testing the Existence of a Long-Run Relationship**

| Order of Lag | Model 1: | Model 2: |
|---|---|---|
| 1 | 2.9617 | 2.7064 |
| 2 | 2.3717 | 2.3239 |
| 3 | 2.1881 | 2.3938 |
| 4 | 3.5532*** | 2.9341 |
| 5 | 3.5160*** | 2.1281 |
| 6 | 3.5551*** | 2.3463 |
| 7 | 1.6383 | 1.6757 |
| 8 | 2.2285 | 3.1633 |
| 9 | 2.5524 | 3.2785*** |
| 10 | 0.95451 | 1.3458 |
| 11 | 3.2865*** | 1.7352 |
| 12 | 0.56551 | 1.7490 |

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

teria, we found that only TBR is not significant in the long run. However, as highlighted by 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 US and Japanese ones. The U.S 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 found to be 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 many 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).

For what concerns 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 exports 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 U.S market (Kim and Davidson, 1996; and Kim, 2003),[1] while Mookerjee and Yu (1997) report 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).

For FFR as in Models 1 and 2 (Table 2), it has a positive relation to stock market indexes. This finding echoes the study on Singapore stock market (Maysami and Koh, 2000) and other markets like Japan and US (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

[1] 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).

**Table 2. Long-Run Coefficient Estimates of Stock Market**

| Regressors | Model Selection Criterion | | | | | |
|---|---|---|---|---|---|---|
| | Model 1: | | | Model 2: | | |
| | Adjusted $R^2$ (0,2,5,0,4) | AIC (0,2,5,0,4) | SBC (0,0,0,0,0) | Adjusted $R^2$ (4,5,6,8,8) | AIC (4,6,6,8,8) | SBC (0,0,0,0,0) |
| lnM3 | 1.5540** (2.1597) | 1.5540** (2.1597) | .49436 (1.2812) | – | – | – |
| TBR | – | – | – | .014946 (.19485) | -.011684 (-.15181) | -.094150 (-.85433) |
| lnIPI | -1.3189 (-1.6690) | -1.3189 (-1.6690) | -.62547 (-1.2095) | .88523** (2.3314) | .86763** (2.4262) | .16497 (.48477) |
| lnREER | -1.3766*** (-1.7150) | -1.3766*** (-1.7150) | -1.4087** (-1.9515) | -.51960 (-.61486) | -.53179 (-.66835) | -.60610 (-.62419) |
| FFR | .053641* (3.0374) | .053641* (3.0374) | .012447 (1.0203) | .056971* (2.7901) | .057450* (2.9890) | 0064501 .(.44448) |
| Constant | -1.5909 (-.22832) | -1.5909 (-.22832) | 9.5293*** (1.8361) | 4.6729 (.84560) | 4.8769 (.93631) | 8.9015 (1.5933) |

Note: Figures inside the parenthesis are the value of t-ratios. *, ** and *** denotes significance levels at 1%, 5% and 10%, respectively.

is negatively related to long term interest rates. As explained by Mukherjee and Naka (1995), long term interest rates seem to be 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.

Based on Model 2 (Table 2), the IPI is found to have positive effect on the stock market at 5% significance level. This should be expected, given that stock prices should serve as a barometer of the health of the economy. Accordingly, changes in industrial production may affect the firm's expected future cash flows and, in turn, affect stock prices.

## Table 3. Error Correction Representation of ARDL Model (Dependent Variable is $\Delta lnKLCI_t$)

| Regressors | Model Selection Criterion | | | | | |
|---|---|---|---|---|---|---|
| | Model 1: | | | Model 2: | | |
| | Adjusted $R^2$ | AIC | SBC | Adjusted $R^2$ | AIC | SBC |
| $\Delta lnKLCI_{t-1}$ | – | – | – | .27607** (2.1824) | .25710*** (2.0044) | – |
| $\Delta lnKLCI_{t-2}$ | – | – | – | .079326 (.58313) | .10338 (.74601) | – |
| $\Delta lnKLCI_{t-3}$ | – | – | – | .33304** (2.6049) | .31579** (2.4417) | – |
| $\Delta lnKLCI_{t-4}$ | – | – | – | .21400*** (1.7965 | .26166*** (2.0215) | – |
| $\Delta lnM3_t$ | .76096 (.91873) | .76096 (.91873) | .14123 (1.3307) | – | – | – |
| $\Delta lnM3_{t-1}$ | 1.6557** (2.0079) | 1.6557** (2.0079) | – | – | – | – |
| $\Delta lnM3_{t-2}$ | 1.5671*** (1.8327) | 1.5671*** (1.8327) | – | – | – | – |
| $\Delta lnIPI_t$ | .015701 (.089730) | .015701 (.089730) | -.17869 (-1.3361) | .025906 (.13933) | .049171 (.26179) | .042611 (.47824) |
| $\Delta lnIPI_{t-1}$ | .51853** (1.9980) | .51853** (1.9980) | – | -.48521** (-2.1134) | -.50140** (-2.1746) | – |
| $\Delta lnIPI_{t-2}$ | .48646*** (1.9159) | .48646*** (1.9159) | – | -.51569** (-2.4051) | -.50234** (-2.3343) | – |
| $\Delta lnIPI_{t-3}$ | .86662* (3.6189) | .86662* (3.6189) | – | .19031 (.93699) | .19808 (.97294 | – |
| $\Delta lnIPI_{t-4}$ | .62410* (2.9305) | .62410* (2.9305 | – | .093855 (.44882) | .19553 (.83116) | – |
| $\Delta lnIPI_{t-5}$ | .35999** (2.2096) | .35999** (2.2096) | – | .42012** (2.2846) | .53465** (2.4281) | – |
| $\Delta lnIPI_{t-6}$ | – | – | – | – | .19535 (.94906) | – |

**Table 3. Continued**

| Regressors | Model Selection Criterion | | | | | |
|---|---|---|---|---|---|---|
| | Model 1: | | | Model 2: | | |
| | Adjusted $R^2$ | AIC | SBC | Adjusted $R^2$ | AIC | SBC |
| $\Delta TBR_t$ | – | – | – | -.069854*** (-1.9222) | -.07087*** (-1.9463) | -.024319 (-.84385) |
| $\Delta TBR_{t-1}$ | – | – | – | .0028913 .054421 | .0065848 (.12342) | – |
| $\Delta TBR_{t-2}$ | – | – | – | -.070390 (-1.3225 | -.054239 (-.96927) | – |
| $\Delta TBR_{t-3}$ | – | – | – | -.0068984 (-.13598) | -.010536 (-.20678) | – |
| $\Delta TBR_{t-4}$ | – | – | – | -.024255 (-.50585) | -.0076849 (-.15039) | – |
| $\Delta TBR_{t-5}$ | – | – | – | .061796 (1.4627) | .061330 (1.4493) | – |
| $\Delta TBR_{t-6}$ | – | – | – | .069839*** (1.9353) | .073530*** (2.0227) | – |
| $\Delta lnREER_t$ | -.38181*** (-1.6724) | -.38181*** (-1.6724) | -.40247*** (-1.8156) | .37831 (.57089) | .30956 (.46367) | -.15656 (-.59278) |
| $\Delta lnREER_{t-1}$ | – | – | – | -.76757 (-.87500) | .69905 (-.79298) | – |
| $\Delta lnREER_{t-2}$ | – | – | – | -.20849 (-.23947) | -.37448 (-.42106) | – |
| $\Delta lnREER_{t-3}$ | – | – | – | .31249 (.34729) | .47054 (.51344) | – |
| $\Delta lnREER_{t-4}$ | — | – | – | -.74547 (-.92324) | -.85333 (-1.0449) | – |
| $\Delta lnREER_{t-5}$ | – | – | – | -1.8003** (-2.1617) | -1.7741** (-2.1258) | – |
| $\Delta lnREER_{t-6}$ | – | – | – | -.55710 (-.75258) | -.68818 (-.91252) | – |
| $\Delta lnREER_{t-7}$ | – | – | – | -1.2779*** (-1.8401) | -1.2619*** (-1.8137) | – |

**Table 3. Continued**

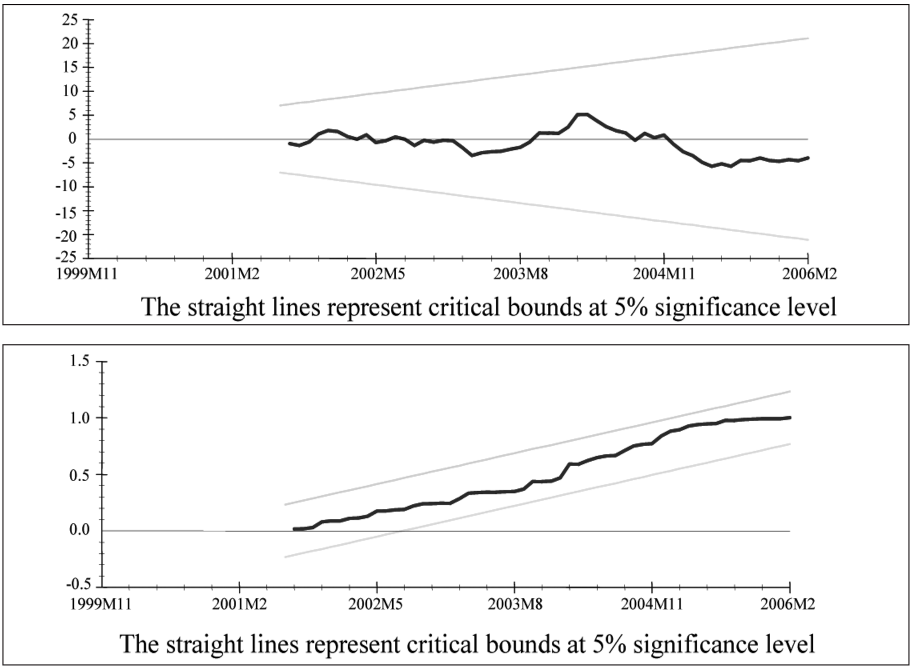
| Regressors | Model Selection Criterion | | | | | |
|---|---|---|---|---|---|---|
| | Model 1: | | | Model 2: | | |
| | Adjusted $R^2$ | AIC | SBC | Adjusted $R^2$ | AIC | SBC |
| $\Delta lnREER_{t-8}$ | – | – | – | .86253 (1.2448) | .87946 (1.2669) | – |
| $\Delta FFR_t$ | .12540* (3.0108) | .12540* (3.0108) | .14576* (3.8742) | .16308* (3.1198) | .16323* (3.1179) | .12324* (3.1114) |
| $\Delta FFR_{t-1}$ | .029216 (.63307) | .029216 (.63307 | – | .029216 (1.4112) | .089375 (1.5348) | – |
| $\Delta FFR_{t-2}$ | -.016602 (-.31898) | -.016602 (-.31898) | – | .091407 (1.4403) | .081974 (1.2742) | – |
| $\Delta FFR_{t-3}$ | -.051666 (-1.0221) | .051666 (-1.0221) | – | -.048498 (-.82208) | -.034448 (-.56554 | – |
| $\Delta FFR_{t-4}$ | -.12114** (-2.574) | -.12114** (-2.574) | – | -.047739 (-.93182) | -.065115 (-1.1952) | – |
| $\Delta FFR_{t-5}$ | – | – | – | -.0094567 (-.18393) | -.0090844 (-.17641) | – |
| $\Delta FFR_{t-6}$ | – | – | – | -.024644 (-.49313) | -.026178 (-.52273) | – |
| $\Delta FFR_{t-7}$ | – | – | – | -.10524** (-2.3010 | -.11983** (-2.4800) | – |
| $\Delta FFR_{t-8}$ | – | – | – | -.11986** (-2.4486) | -.12237** (-2.4924) | – |
| Constant | -.44124 (-.23408) | -.44124 (-.23408) | 2.7225*** (1.6578) | 2.8205 (.85207) | 3.1334 (.94049) | 2.2992 (1.3623) |
| $EC_{t-1}$ | -.27736* (-3.4363) | -.27736* (-3.4363) | -.28569* (-3.8066) | -.60359* (-4.8809) | -.64251* (-4.9247) | -.25830* (-3.3056) |
| Adjusted $R^2$ | .36713 | .36713 | .21711 | .51143 | .50991 | .15819 |
| F-Statistics | 3.9067 | 3.9067 | 5.3597 | 3.2047 | 3.1328 | 3.9060 |
| DW-Statistics | 1.9193 | 1.9193 | 1.8133 | 2.0426 | 1.9675 | 1.8257 |

Note: Figures inside the parenthesis are the value of t-ratios. *, ** and *** denotes significance levels at 1%, 5% and 10%, respectively.

We further estimate the error correction representations selected by Adjusted R-squared, AIC and SBC for both of our models. The results are presented in Table 3. The long run coefficients generated in Table 3 are used to generate the error correction terms for the two models. The adjusted R-squared are 0.37 (R-Squared), 0.37 (AIC) and 0.22 (SBC) respectively for Model 1. For Model 2, the adjusted R-squared are 0.51 (R-Squared), 0.51 (AIC) and 0.16 (SBC) respectively. As indicated in Table 3, 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 26 to 65 percent. This indicates that the last period disequilibrium is, on average, corrected by about 26 to 65 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

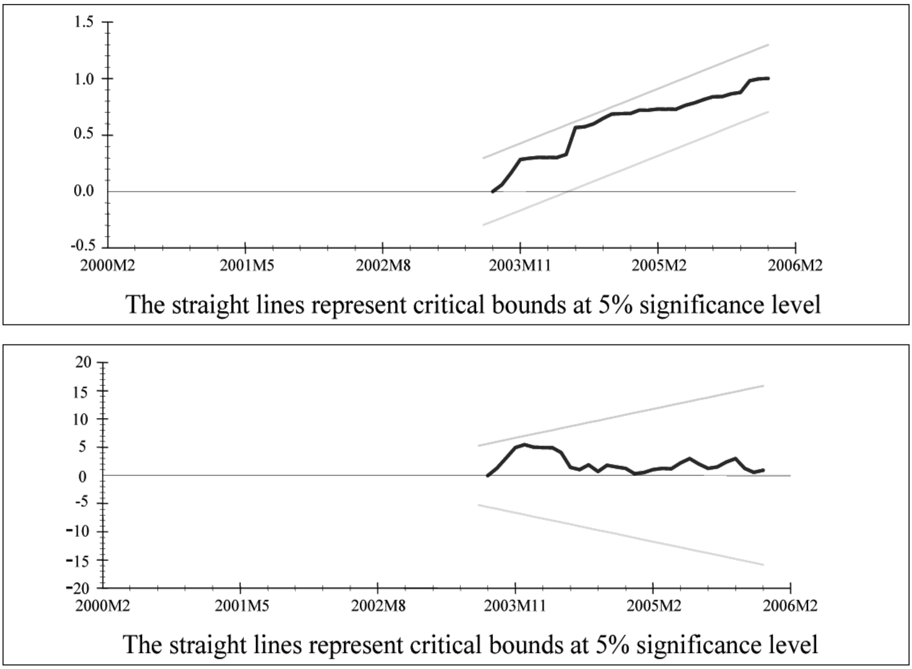
**Figure 1. Plots of CUSUM and CUSUMSQ Statistics for Coefficient Stability (Model 1)**



we apply CUSUM and CUSUMSQ (proposed by Brown *et al.*, 1975). The tests are applied to all the six models in Tables 2 and 3. The CUSUM test basically uses the cumulative sum of recursive residuals 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% significance level (represented by clear and straight lines drawn at 5%, the null hypothesis that all the coefficients and the error correction model are stable cannot be rejected. However, if the two lines are crossed, the null hypothesis of coefficient constancy can be rejected at 5%. 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 error correction model based on the Adjusted R-squared criterion. Neither the CUSUM nor CUSUMSQ indicate evidence of any structural instability for the models that we have tested. The Durbin-Watson (D-W) statistics also indicate that there is no problem of autocorrelation for all models tested.

**Figure 2. Plots of CUSUM and CUSUMSQ Statistics for Coefficient Stability (Model 2)**



## 5. CONCLUSION

The study examines 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.

Money supply M3, IPI, and REER seem to be suitable targets for the government to focus on, in order to stabilize the stock market and encourage more capital flows into the capital market. Changes in U.S. monetary policy, as measured by the changes in the FFR, seem also to have a significant direct impact on the Malaysian 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 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. Incorporating a longer sample period and other macroeconomic variables that may potentially affect stock market might enhance further analyses.

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**Résumé**

L'étude se concentre sur les effets des variables macroéconomiques sur la performance du marché des capitaux après la crise financière de 1997, en utilisant le modèle ARDL. Les résultats suggèrent que le taux d'échange effectif réel, l'offre de monnaie, l'index de production industrielle et le taux sur les fonds fédéraux semblent des cibles pour le gouvernement afin de promouvoir la stabilisation du marché des capitaux et d'encourager des flux ultérieurs de capital. De même, les changements de la politique monétaire des Etats-Unis ont aussi un impact direct sur les marché des capitaux de Malaisie.