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# An Empirical Investigation of the Dynamic Relations between Macroeconomic Factors and the Stock Markets of Malaysia and Thailand

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*ABSTRACT*

*This paper employs the Error-Correction Modeling technique to examine the relationship between macroeconomics variables and the stock returns of Malaysia and Thailand. The study extends Mukherje and Naka's (1995) analysis of the Japanese market. In addition, the article expands the results obtained by Maysami and Koh (2000) through the employment of Hendry's (1986) approach which allows making inferences to the short-run relationship between macroeconomic variables as well as the long-run adjustment to equilibrium. The macroeconomic variables analyzed are interest rate, inflation, money supply, exchange rate and real activity. A dummy variable is included to capture the impact of the 1997 Asian financial crisis. The results confirm the existence of such relationships, but type and magnitude of the associations seem to differ depending on the country's financial structure. The paper presents the economic interpretation for the dependence of the stock indices on these variables as well as discussing the mechanism of the relationship.*

*ABSTRAK*

*Kertas ini menggunakan teknik model pembetulan ralat atau error-correction modeling technique (ECM) untuk memeriksa hubungan di antara pembolehubah makroekonomi dan pulangan saham di Malaysia dan Thailand. Kajian ini melanjutkan analisa di pasaran Jepun oleh Mukherje dan Naka (1995). Selain itu, kertas ini mengembangkan keputusan yang diperolehi oleh Maysami dan Koh (2000) melalui pengguna pendekatan Hendry (1986) yang membenarkan takbiran dibuat terhadap hubungan jangka pendek di antara pembolehubah makroekonomi di samping pengubahsuaian jangka panjang menuju keseimbangan. Pembolehubah makroekonomi yang dianalisis ialah kadar faedah, inflasi, penawaran wang, kadar tukaran mata wang asing dan aktiviti sebenar. Pembolehubah patung juga dimasukkan bagi meninjau kesan krisis kewangan Asia pada tahun 1997. Keputusan yang diperolehi mengesahkan kewujudan hubungan tetapi jenis serta tahap hubungan tersebut berbeza-beza bergantung kepada struktur kewangan*

*negara yang dikaji. Kertas ini membentangkan interpretasi ekonomi terhadap penggantungan indeks saham kepada pembolehubah-pembolehubah berkenaan di samping membincangkan mekanisma hubungan tersebut.*

## INTRODUCTION

What determines stock prices? Stock valuation models typically employ the discounted future cash flows approach, P = E(c) / k where P is the stock price, c denotes the dividend stream, and k is the discount rate, to determine the intrinsic value of the security. Shiller (1981) and Leroy and Porter (1981) pointed to the fact that macroeconomic variables may influence the discount rate and the ability of firms to generate cash flows. Through this mechanism economic forces become risk factors in equity markets.

There are, however, no generally accepted asset pricing model that explicitly take macroeconomic variables into account. One of the more popular approaches, the Arbitrage Pricing Theory (APT) (Ross 1976), states that the returns of risky assets are related to a k-factor linear model, $R_{it} = E(R_{it}) + \beta_{i1}F_1 + \ldots + \beta_{ik}F_k + \varepsilon_i$, where $R_{it}$ is the random rate of return on the *i*th asset in period t and $E(R_{it})$ is the expected rate of return on the *i*th asset in that period. The $\beta_{ik}$ terms measure the sensitivity of the asset *i*'s return to the fluctuation in factor *k*. ε is a random error term. The expected return, $E(R_i)$ may then be expressed as $E(R_i) = \lambda_0 + \Sigma\, \lambda_k \beta_{ik}$ where $\lambda_0$ is a constant (e.g. the risk-free rate of return) and $\lambda_k$ is a vector of risk premia. APT seeks to measure the risk-premia attached to such risk-factors and attempts to assess which factors are significant and whether they have been 'priced' in the stock market returns.

Within the APT framework and using U.S. data, Chen, Roll and Ross (1986), asserted that industrial production, changes in a risk premium for bonds, and the term structure are significantly and systematically priced in the stock market. Measures of unanticipated inflation and changes in expected inflation were shown to have some influence as well, but only when they were highly volatile. APT, however, is limited in that it does not identify the relevant variables ex-ante—it neither predicts what factors influence returns nor does it indicate how many variables should appear in the model. Rather, the parameters are developed following a complex 'factor analysis' statistical procedure.

The development of cointegration analysis provides an alternative framework to study the relationship between macroeconomic variables and stock returns (Granger 1986). A set of time series are said to be cointegrated if they are integrated of the same order and a linear combination of them is stationary. Johansen and Juselius (1990) suggest that such linear combination would then point to the long-run relationship among the variables. An advantage of cointegration analysis is that through building an error-correction model (ECM), the dynamic co-movement among variables and the adjustment process towards long-term equilibrium may be examined.

Notwithstanding the methodology, the greater part of the evidence on the relationship between macroeconomic variables and stock market returns has been for developed countries. Asprem (1989), for example, compared the effects of economic factors on the stock markets of 10 European countries while Bulmash and Trivoli (1991) did similarly in the US market. Peiro (1996) compared such relationships in three European countries with the U.S., Cheng (1995) and Poon and Taylor (1991) examined the UK market, and Gjerde and Settem (1999) researched on Norwegian data. The number of similar studies using data from Asian markets is considerably limited, and with few exception, the research has concentrated on the world's second largest economy—Japan (Hamao 1988; Brown and Otsuki 1990; Kaneko and Lee 1995). The current study aims to narrow this gap.

One goal of this study is to extend the results of the inquiry by Mukherjee and Naka (1995) who explored the relationship between exchange rate, inflation, money supply, real economic activity, long-term government bond rate and call money rate with the Japanese market. They conclude that a cointegrating relation indeed existed and that stock prices contributed to this relation. The current study employs Engle and Granger's (1987) two-stage error-correction model technique to identify the dynamics of the stock return function in Malaysia and Thailand.

Additionally, the article aims to broaden the results obtained by Maysami and Koh (2000) who used Singapore data to conclude that inflation, exchange rate, short- and long-term interest rate changes, and money supply growth formed a cointegrating relation with changes in stock market levels. Although conclusions were made on the significance of interest and exchange rates in the cointegrating relation and the adjustment towards long-run equilibrium, no references were made to the short-run association between the variables and stock returns. Using Hendry's (1986) general to specific approach, the current study aims to remedy this situation—short-run relationships between macroeconomic variables and stock indexes of Malaysia and Thailand are assessed in addition to long-run cointegrating relationships.

## HYPOTHESIZED RELATIONSHIPS BETWEEN MACROECONOMICS VARIABLES AND STOCK RETURNS

Based on *simple and intuitive financial theory* (Maysami and Koh 2000; Mukherjee and Naka 1995), we hypothesize a relationship between several macroeconomic variables and the stock markets of two Southeast Asian economies, namely Malaysia and Thailand. Each country is studied separately since the assessment of cointegration between the Malaysian and Thai stock markets is not a goal of this study.

The macroeconomic variables considered include exchange- and interest rates, inflation, money supply, and industrial production. To acknowledge that that the Asian economic crisis would most likely have an effect on the extent of the relationships, a dummy variable to represent the crisis is included in the relevant models. Assessing the impact of the financial crisis on the stock market is beyond the intended goal of the study. Rather, it is the fact that the crisis has indeed influenced the relationship between macroeconomic variables and stock markets that the paper addresses.

Appreciation of domestic currency leads to a relative increase in price of a country's products in foreign markets, a decrease in demand for exports, and hence lower cash flows into the country. At the same time, stronger domestic currency lowers the cost of imported goods which constitute almost all of production inputs. The relationship between exchange rates and stock prices in the case of Malaysia and Thailand, thus becomes an issue for empirical studies. The long-standing position of the Bank of Thailand (BOT), at least prior to 1997, was to maintain the Baht measured against a basket of currencies, at a strong level.

Meanwhile, a strong currency may signal the relevant health of an economy, thus leading to inflow of capital. Pebbles and Wilson (1996) contend that currency appreciation is often accompanied by increases in reserves (and money supply) and hence decline in interest rates. As such, we hypothesize that stock prices are positively related to appreciating currency and increasing money supply, and negatively related to falling interest rates. We conjecture the same in Malaysia.

The intuition behind the relationship between interest rates and stock prices is straightforward. An increase in the rate of interest raises the opportunity cost of holding cash and is likely to lead to a substitution effect between stocks and other interest bearing securities. Additionally, changes in both short-term and long-term rates are expected to affect the discount rate in the same direction via their effect on the nominal risk-free rate (Mukherjee and Naka 1995). The effect of money supply on stock prices is again a matter of empirical proof. 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 rate of inflation and hence a rise in the discount rate. This may lead to 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).

Economic belief and common sense suggest a positive relationship between the unexpected inflation and stock returns as equities are 'hedges' against (unanticipated) inflation since they represent claims to real assets. Fisher (1931), citing market efficiency and noting that the nominal interest rate can be expressed as the sum of an expected real return and an expected inflation rate, concluded the same. In addition, he believed that the real and monetary sectors of the economy are largely independent and that the expected real return is determined by real factors such as the productivity of capital, investor time preferences and tastes for risk. Hence, the expected real return is determined solely by real factors and expected real returns are independent of inflationary expectations. On average, investors are compensated for changes in purchasing power.

On the other hand, since inflation does result in higher nominal discount rate while nominal cash flows may not increase on par with inflation, this might result in falling stock prices. Inflation in both countries, however, had been quite low for a number of years and this fact has, most likely, been reflected in business cash flows. Hence, cash flows may indeed rise equally, if not more, with accelerating inflation. Hence, the hypothesized relationship between stock prices and inflation in Malaysia and Thailand is positive in our opinion.

Finally, as fundamental valuation of stocks involves discounting cash flows or expected dividend streams over long periods in the future, the price of a firm's stock reflects investor's expectations of future earnings which are likely to be influenced by measures for real activity. Kwon et al. (1997) found the Korean stock market to be significantly related to real economic activities while Kaneko and Lee (1995) and Mukherjee and Naka (1995) found positive relationships between the Japanese industrial production and stock returns. This study expects similar positive relationship between the stock markets of Malaysia and Thailand and the expected real activities in the two countries.

## DATA AND METHODOLOGY

The data on macroeconomic variables are obtained from Datastream and International Financial Statistics, published by the International Monetary Fund on a quarterly basis as information on industrial production was available only quarterly. Definitions of variables are presented in Table 1 and summary statistics for the variables in levels and first differences are provided in Table 2.

The stock indices are not adjusted for dividend payments. Although stock returns consist of both price change and dividends, the study considers only the price variation component since dividends in absolute terms tend to be stable over time (Asprem 1989). Moreover, dividend yields have traditionally been small in the two countries, averaging 1.7 percent in Malaysia, for example. It is the movements in price which constitute the volatile component of the stock returns. Since the objective of this study is to explain the variability in stock returns, the omission of the dividend payments should not pose a problem.

TABLE 1. Definitions of variables and time series transformations

| Variables | Definition of variables |
|---|---|
| LIR | Natural logarithm of the quarter-end 3 month interbank offer rate. |
| LCPI | Natural logarithm of the quarter-end Consumer Price Index. |
| LMS | Natural logarithm of the quarter-end M1 money supply in each country. |
| LEX | Natural logarithm of the quarter-end exchange rate and is quoted as the amount of dollars in Malaysia and Thailand required to exchange for one US Dollar (USD). |
| LIP | Natural logarithm of the quarter-end industrial production index. The industrial production index is used as a proxy of the level of economic activity in the country. All industrial production figures are seasonally adjusted. |

| Transformation | Definition of Transformations |
|---|---|
| $\Delta TSE = TSE_t - TSE_{t-1}$ | Quarterly return on the TSE index. |
| $\Delta KSE = KSE_t - KSE_{t-1}$ | Quarterly return on the KSE index. |
| $\Delta IR = LIR_t - LIR_{t-1}$ | Quarterly change of the 3 month interbank rate. |
| $\Delta CPI = LCPI_t - LCPI_{t-1}$ | Quarterly realized inflation rate. |
| $\Delta MS = LMS_t - LMS_{t-1}$ | Quarterly growth rate of the M1 money supply |
| $\Delta EX = LEX_t - LEX_{t-1}$ | Quarterly change in exchange rate |
| $\Delta IP = LIP_t - LIP_{t-1}$ | Growth rate in industrial production |

As pointed out by Fama (1981), a shortcoming of regressing the changes in stock returns and the macroeconomic variables is the use of actual growth rates of the variables instead of anticipated growth rates. Asprem (1989), however, argued that most investors would form their expectations based on all current available information. Therefore, it would be reasonable to assume that the actual values of the variables are unbiased estimates of the ex-ante expectations.

## METHODOLOGY

Recent econometric theory and empirical studies have highlighted the problems in properties of time series data used in a regression analysis. Nelson and Posser (1982) and Perron (1988) reported that a large number of macroeconomic time series data for the U.S. are characterized by unit root non-stationary processes. Under these circumstances, it does not seem appropriate to use standard estimation techniques to approximate the

TABLE 2. Descriptive statistics of variables

| Variables in levels | | | | | |
|---|---|---|---|---|---|
| | | Mean | Std Dev | Minimum | Maximum |
| Malaysia | LKLSE | 6.378 | 0.508 | 5.253 | 7.151 |
| | LIR | 1.769 | 0.390 | 0.525 | 2.473 |
| | LCPI | 4.700 | 0.136 | 4.519 | 4.941 |
| | LMS | 10.427 | 0.595 | 9.519 | 11.316 |
| | LEX | 0.993 | 0.121 | 0.902 | 1.400 |
| | LIP | 4.781 | 0.384 | 4.107 | 5.365 |
| Thailand | LTSE | 6.431 | 0.650 | 4.866 | 7 428 |
| | LIR | 2.200 | 0.379 | 1.131 | 3.027 |
| | LCPI | 4.702 | 0.187 | 4.424 | 5.039 |
| | LMS | 5.434 | 0.486 | 4.498 | 6.058 |
| | LEX | 3.290 | 0.149 | 3.205 | 3.855 |
| | LIP | 4.349 | 0.283 | 3.771 | 4.730 |
| Variables in first differences | | | | | |
| Malaysia | ΔKLSE | 0.022 | 0.181 | -0.464 | 0.450 |
| | ΔIR | -0.007 | 0.236 | -1.040 | 0.351 |
| | ΔCPI | 0.008 | 0.012 | -0.032 | 0.074 |
| | ΔMS | 0.028 | 0.048 | -0.169 | 0.132 |
| | ΔEX | 0.008 | 0.046 | -0.065 | 0.226 |
| | ΔIP | 0.022 | 0.041 | -0.112 | 0.119 |
| Thailand | ΔTSE | 0.019 | 0.227 | -0.541 | 0.549 |
| | ΔIR | -0.021 | 0.303 | -0.913 | 0.848 |
| | ΔCPI | 0.012 | 0.007 | -0.007 | 0.028 |
| | ΔMS | 0.031 | 0.038 | -0.060 | 0.112 |
| | ΔEX | 0.006 | 0.070 | -0.196 | 0.348 |
| | ΔIP | 0.016 | 0.029 | -0.068 | 0.083 |

regression relationships among non-stationary times series variables as this may lead to spurious regression from which no appropriate inferences can be drawn. Banerjee et al. (1993), moreover, showed that neither t nor f tests have the standard distribution of stationary series, so there is a tendency to reject the null hypothesis when in fact it should not be rejected.

A possible way to avoid this problem is first-differencing all economic data before running a regression (Box and Jenkins 1970). Although this can help solve the question of spurious regressions, Enders (1995), suggested that valuable information concerning the long-run relationships among the levels of series postulated by economic theory may be removed following this methodology.

The solution may indeed be the use of cointegration and error-correction modeling approaches (Hendry 1986; Engle and Granger 1987). Augustine and Shwiff (1993) summarize the four desirable features of ECM: (1) it avoids the possibility of spurious correlation among strongly trended variables; (2) the long-run relationships that may be lost by expressing the data in differences to achieve stationarity are captured through inclusion of lagged levels of the variables on the right-hand side; (3) the specification attempts to distinguish between short-run (first-differences) and long-run (lagged-levels) effects; and (4) it provides a more general lag structure, and does not impose too specific a structure on the model.

Granger (1986) showed that a necessary condition to conclude that a long-term relationship exist is that the series must be cointegrated. A general exposition of this approach may be made by reference to a simple case of two time series, $x_t$ and $y_t$, both of which are individually non-stationary or I(1). If there exists a non-zero constant b such that $z_t = x_t - \beta' y_t$ is a stationary or I(0) process, then $x_t$ and $y_t$ are said to be cointegrated with a cointegrating parameter $\beta'$. This implies that the set of I(1) variables ($x_t$, $y_t$) does not diverge over time since $z_t$ has no trend in mean.

Coupled with error correction models, cointegration provides the tools to quantify both the long-run relationship and the short-run deviations from equilibrium. If cointegrating relationships exist among a set of I(1) variables, then Granger Representation Theorem suggests there is a dynamic error correction representation of the data (Engle and Granger 1987). This implies one can estimate an ECM that takes into account the short-run dynamics of all variables included in the cointegrating regression. In the simple case of two variables, $x_t$ and $y_t$, the ECM can be expressed as:

$$\Delta x_t = -\rho_1 z_{t-1} + \{\text{lagged}(\Delta x_t, \Delta y_t)\} + \varepsilon_{1t} \quad (1)$$
$$\Delta y_t = -\rho_2 z_{t-1} + \{\text{lagged}(\Delta x_t, \Delta y_t)\} + \varepsilon_{2t} \quad (2)$$

Where $z_t = x_t - \beta' y_t$ is I(0) and represents the error-correction term which displays the size of the preceding error derived from the long-run equation, $\rho_1$ and $\rho_2$ are white noises and either (1) or (2) or both is non-zero. In this setting, $x_t$ and $y_t$ are each a function of distributed lags of first differences of $x_t$ and $y_t$ as well as the one period lag of the error-correction term. The error-corrections in equations (1) and (2) may be interpreted as the disequilibrium mechanism that forces the economy to the equilibrium $x_t = \beta y_t$ in the long-run.

The error-correction stock return equation in this study consists of two parts. The first is a long-run equilibrium stock return that may be written as:

$$\ln P_t = \beta_0 + \beta_1 \ln IR_t + \beta_2 \ln CPI_t + \beta_3 \ln MS_t + \beta_4 \ln EX_t + \beta_5 \ln IP_t + e_t \quad (3)$$

where P is the desired stock prices, IR is interest rate, CPI is inflation, MS is money supply, EX is exchange rate and IP is industrial production.

Estimation of equation (3) using non-stationary data will lead to unreliable t-statistics, as the underlying time series would theoretically have infinite variances. We use the augmented Dickey-Fuller (ADF) test on the variables in levels and first-differences to check for stationarity or unit roots. A desirable feature of the ADF test is that it allows for heteroskedasticity as well as serial correlation in the error terms, thus compensating for the mis-specification of the dynamic structure of time series.

The ADF tests the null hypothesis $H_0$. $\gamma = 0$ in $\Delta Y_t = a_0 + \alpha_2 T + \gamma Y_{t-1} + \sum \beta_t \Delta Y_{t-(1+i)} + \varepsilon_t$, in order to examine if a unit root exists in the presence of a drift and deterministic trend. If there is a unit root in the autoregressive representation of $Y_t$, then the calculated t-statistic on the estimated coefficient in an absolute term must not be significantly greater than the critical values of DF and ADF.

The choice of lag-lengths used in the unit root tests must also be determined. Dickey and Pantula's (1987) principal is employed here to answer the question of the ideal order of differencing. Starting with the longest lag lengths of 8 and moving sequentially to lower lags, t and f statistics are used to find the lag that will accept the null hypothesis of k unit roots.

The next step is to test whether the time series concerned are cointegrated given that they are all I(1). In other words, even if each individual time series is level-non-stationary, it has to be determined if the linear combination of these series as suggested by equation (3) is level-stationary. This requires the application of the ordinary least squares (OLS) techniques to the estimation of the cointegration regression. The residual from such cointegrating regression (equation 3) is then examined using the ADF test to see whether it is I(0).

$$\Delta e_t = -\rho e_{t-1} + \sum \gamma_t \Delta e_{t-1} + e_t \qquad (4)$$

The rejection of the null hypothesis requires that the estimated residual series be stationary. No intercept or time trend is included in equation (4) since the $e_t$ must have a zero mean and we do not expect it to have a deterministic trend. If $e_t$ is I(0), then it can be concluded that the stock return equation is co-integrated and has a long-run cointegrating relationship.

Intuitively, actual stock prices do not always equal what investors wish to hold on the basis of long-run factors specified in equation (3). Therefore, the second part of our stock price model is a dynamic error-correction equation of the form

$$\Delta \ln P_t = \Psi_0 + \sum_{i=1}^{c4} \Psi_{1i} \Delta \ln P_{t-i} + \sum_{i=0}^{c4} \Psi_{2i} \Delta \ln IR_{t-i} + \sum_{i=0}^{c4} \Psi_{3i} \Delta \ln CPI_{t-i} + \sum_{i=1}^{c4} \Psi_{4i} \Delta \ln MS_{t-i} + \sum_{i=0}^{c4} \Psi_{5i} \Delta \ln EX_{t-i} + \sum_{i=0}^{c4} \Psi_{6i} \Delta \ln IP_{t-i} - \lambda e_{t-i} - CRISIS + \varepsilon_t \qquad (5)$$

where CRISIS is a dummy variable, $\varepsilon$ is the short-run random disturbance term, $\Delta$ refers to the first-difference operator, Ci represents the number of lags, and $e_{t-1}$ is the lagged value of the long-run random disturbance term.

Equation (5) yields the short-run determinants of stock returns, which include among others, current and past changes in the macroeconomic variables and the lagged value of the residual from long-run stock price function from equation (3). The parameter $\lambda$ which appears with $e_{t-1}$ in Equation (5) is the error-correction coefficient. The presence of $e_{t-1}$ reflects the presumption that actual stock price does not always equal what the investor expects on the basis of long-run macroeconomic factors. In the short-run, the stock price attempts to correct any short-run disequilibrium and adjusts to its long-run equilibrium. The parameter $\lambda$ measures the role such disequilibria play in explaining the short-run movements in stock price and it is expected to be negative.

The Engle-Granger procedure has been criticized on the grounds of the small-sample bias present in the ordinary least square (OLS) estimation of the cointegrating equation. This bias carries over into the prediction of the disequilibrium errors and hence into the second stage estimates of the short-run parameters. Therefore, Benerjee et al. (1986) suggest that it may be preferable to carry out the estimation of long- and short-run parameters in a single step. The current study will formulate the error-correction model using Hendry's (1986) general-to-specific approach which starts with a general framework and test down to a suitably final model. Both long- and short-run elasticities are estimated together.

Hendry's (1986) approach allows the restrictions implied by the cointegrating regression to be relaxed. That is the $e_{t-1}$ in equation (5) is replaced by the lagged levels of the variables in equation (3), so that the short- and long-run parameters are jointly estimated. Estimates of the level variables then reveal the long-run effects of the regressors. Substitution of equation (3) into equation (5) yields a combined ECM equation.

$$\begin{aligned}\Delta \ln P_t = {} & K_0 + \sum_{i=1}^{c4} \Psi_{1i} \Delta \ln P_{t-i} + \sum_{i=0}^{c4} \Psi_{2i} \Delta \ln IR_{t-i} + \\ & \sum_{i=0}^{c4} \Psi_{3i} \Delta \ln CPI_{t-i} + \sum_{i=0}^{c4} \Psi_{4i} \Delta \ln MS_{t-i} + \sum_{i=0}^{c4} \Psi_{5i} \Delta \ln EX_{t-i} + \\ & \sum_{i=0}^{c4} \Psi_{6i} \Delta \ln IP_{t-i} - CRISIS - \Phi_1 \ln P_{t-1} + \Phi_2 \ln IR_{t-1} + \\ & \Phi_3 \ln CPI_{t-1} + \Phi_4 \ln MS_{t-1} + \Phi_5 \ln EX_{t-1} + \Phi_6 \ln IP_{t-1} + e_t\end{aligned} \tag{6}$$

where $K_0 = \Psi_0 - \beta_0 \lambda$ and $\Phi_1 = \lambda$.

Equation (6) can be estimated using consistent estimation procedures, and all parameters of equation (3) and (5) may be recovered from those of equation (6). For example, the error correction coefficient $\lambda$ is $\Phi_1$, the long-term interest rate elasticity is $\Phi_2/\Phi_1$, the long term inflation elasticity is $\Phi_3/\Phi_1$, the long-term money supply elasticity is $\Phi_4/\Phi_1$, the long-term exchange rate elasticity is $\Phi_5/\Phi_1$, and the long-term industrial production elasticity is $\Phi_6/\Phi_1$.

Although $\ln P_{t-1}$, $\ln IR_{t-1}$, $\ln CPI_{t-1}$, $\ln MS_{t-1}$, $\ln EX_{t-1}$ and $\ln IP_{t-1}$ are I(1) variables, Thomas (1997) postulates ordinary least square estimates can still be applied since assuming cointegration, there is a linear combination of variables that is I(0). The existence of such a linear combination can be checked by testing the residuals from equation (6) for stationarity. There is evidence that small-sample properties of estimates obtained in this way are better than those of the two-stage Engle-Granger estimates.

The general-to-specific approach has the advantage that if the general model is rigorously tested for mis-specification, the possibility of any dynamic mis-specification is reduced in the final model (Thomas 1997). Certain tests of mis-specification should then be performed to assess the reliability of the final 'best' models. We remove variables or lags from equation (6) using linear restriction imposed and goodness-of-fit tests until a reliable 'best' model is achieved.

## RESULTS

Error-correction modeling and cointegration analysis involves four steps. First, the order of integration for each of the variables under consideration must be determined. Second, cointegrating regressions should be estimated with ordinary least squares (OLS) using variables with the same order of integration. Next is the test for stationarity of the residuals of the cointegrating regressions. The final step is to construct the error-correction models.

## UNIT ROOT TESTS

The results of the unit root tests applied to the 'levels' and 'first differences' of all series in the sample period are presented in Table 3. The evidence suggests that the levels of all time series concerned are characterized by unit root non-stationary processes—the null hypothesis of a unit root was not rejected for any variable at the 5 percent level. The ADF test for all variables after first-differencing is then performed. All variables failed to reject stationarity in the first differences of each time series. All series after first-differencing reject the null hypothesis of non-stationarity at the 1 or 5 percent levels. Hence, the evidence suggests stationary series in first-difference.

TABLE 3. Unit roots

| | Variable | Log-Level | First-Difference |
|---|---|---|---|
| Malaysia | KLSE | -1.7094 [0] | -6.8943 [0]** |
| | IR | -2.8350 [6] | -3.5997 [0]* |
| | CPI | -3.1409 [0] | -3.5997 [5]* |
| | EX | -2.2385 [1] | -4.4121 [0]** |
| | M1 | -1.2191 [2] | -3.5771 [1]* |
| | IP | -0.9398 [2] | -4.1739 [2]** |
| Thailand | TSE | -1.3340 [0] | -9.0237 [0]** |
| | IR | -2.5938 [0] | -6.0868 [0]** |
| | CPI | -2.3212 [0] | -5.6496 [0]** |
| | EX | -1.7319 [0] | -6.4865 [0]** |
| | M1 | -1.1680 [0] | -8.7939 [0]** |
| | IP | 0.2845 [0] | -6.2398 [0]** |

*Notes*:
1. The test for a unit root in the level form is based on the regression equation $\Delta Y_t = a_0 + \alpha_2 T + \gamma Y_{t-1} + \Sigma\ \beta_t \Delta Y_{t-(1+i)} + \varepsilon_t$. When the null hypothesis of unit root is not rejected, a regression of the form $\Delta^2 Y_t = a_0 + \alpha_2 T + \gamma \Delta Y_{t-1} + \varepsilon_t$ is run and then the null hypothesis, g=0, is tested.
2. Figures in square brackets represent the number of lagged dependent variables used in the autoregression. The choice of lags is determined by examining the t-values and f statistics of the lags.
3. The critical value at the 5% significance level for t is –3.50 for N=50. If the estimated absolute value of $\tau_t$ is smaller than 3.50, we do not reject the null hypothesis that $\gamma = 0$

*represents significance at the 5% level.
**represents significance at the 1% level.

In sum, the results show that all macroeconomic variables under study in Thailand and Malaysia are integrated of order one. These results are similar to those of Nelson and Posser (1982), Perron (1988), Mukherjee and Naka (1995), and Maysami and Koh (2000) who concluded that macroeconomic variables are non stationary stochastic processes—even in log form—and thus may be characterized as integrated of order one.

## ERROR CORRECTION MODELS

The basic idea of the general-to-specific model is to start within a framework that contains 'nested' within it a series of simpler models. These models represent all alternative economic hypotheses that require consideration. The error-correction models are presented in Table 4. A summary of the relationships between the economic variables and stock returns of the two countries are shown in Table 5.

A major decision is the choices of the lag lengths used in the model. We first estimated the model with four lagged terms for each variable and

TABLE 4. Error Correction Models

| | | ECM Model |
|---|---|---|
| Malaysia | $\Delta KLSE_t =$ | $\underset{(3.598)^{**}}{27.111} + \underset{(6.639)^{**}}{1.022\Delta KLSE_{t-2}} + \underset{(5.048)^{**}}{0.623\Delta KLSE_{t-3}} - \underset{(-2.872)^{**}}{0.391\Delta IR_t} -$<br>$\underset{(-3.033)^{**}}{0.208\Delta IR_{t-2}} + \underset{(4.839)^{**}}{11.519\Delta CPI_t} + \underset{(4.940)^{**}}{5.311\Delta CPI_{t-3}} + \underset{(3.824)^{**}}{1.838\Delta M1_t}$<br>$+ \underset{(3.039)^{**}}{1.432\Delta M1_{t-2}} - \underset{(-2.139)^{*}}{1.280\Delta EX_t} - \underset{(-3.530)^{**}}{1.659\Delta EX_{t-2}} - \underset{(-3.526)^{**}}{1.932\Delta EX_{t-3}}$<br>$+ \underset{(4.673)^{**}}{2.893\Delta IP_t} + \underset{(5.696)^{**}}{8.294\Delta IP_{t-1}} + \underset{(3.536)^{**}}{3.868\Delta IP_{t-2}} + \underset{(5.165)^{**}}{4.428\Delta IP_{t-3}}$<br>$+ \underset{(5.144)^{**}}{3.630\Delta IP_{t-4}} - \underset{(-4.229)^{**}}{0.396CRISIS} - \underset{(-4.813)^{**}}{0.776[LKLSE_{t-1}}$<br>$+ \underset{(-5.055)^{**}}{0.965LIR_{t-1}} - \underset{(2.591)^{**}}{7.988LCPI_{t-1}} - \underset{(5.290)^{**}}{3.863LMS_{t-1}} + \underset{(-2.860)^{**}}{1.348LEX_{t-1}}$<br>$- \underset{(4.758)^{**}}{8.396LIP_{t-1}}] + e_t$<br>$\Delta e_t = \underset{(-4.899)}{-1.856e_{t-1}} + \underset{(2.104)}{0.668\Delta e_{t-1}} + \underset{(2.408)}{0.660\Delta e_{t-2}} + \underset{(2.946)}{0.651De_{t-3}}$<br>$+ \underset{(2.046)}{0.321\Delta e_{t-4}}$<br>$^{+}$Adjusted $R^2 = 0.870$   $^{++}$ADF = -4.899<br>$^{+++}$LM = 1.179<br>$^{\#}$RESET = 0.101   $^{\#\#}$ARCH = 0.418   $^{\#\#\#}$JB = 1.151 |
| Thailand | $\Delta SET_t =$ | $\underset{(5.293)^{**}}{17.867} - \underset{(-5.319)^{**}}{0.347\Delta IR_t} + \underset{(2.087)^{*}}{8.363\Delta CPI_{t-1}} + \underset{(2.382)^{*}}{8.559CPI_{t-3}}$<br>$- \underset{(-2.672)^{*}}{0.927\Delta EX_t} - \underset{(-2.975)^{**}}{1.034\Delta EX_{t-2}} - \underset{(-6.341)^{**}}{0.755[LSET_{t-1}} + \underset{(-2.951)^{**}}{0.343LIR_{t-1}}$<br>$+ \underset{(-5.319)^{**}}{8.110CPI_{t-1}} - \underset{(2.589)^{*}}{1.686LMS_{t-1}} - \underset{(4.086)^{**}}{3.271LIP_{t-1}}]$<br>$- \underset{(-2.152)^{*}}{0.215CRISIS} + e_t$<br>$\Delta e_t = \underset{(-7.041)}{-1.073e_{t-1}}$<br>$^{+}$Adjusted $R^2 = 0.634$   $^{++}$ADF = -7.041<br>$^{+++}$LM = 0.491<br>$^{\#}$RESET = 0.041   $^{\#\#}$ARCH = 0.131   $^{\#\#\#}$JB = 2.304 |

*Notes*:
The numbers in parentheses are the t-statistics. $^{*}$ and $^{**}$ represent significance at the 5% and 1% levels respectively. $^{+}R^2$ is the coefficient of multiple determination; $^{++}$ADF is the augmented Dickey and Fuller statistic; $^{+++}$LM is the Breusch-Godfrey statistic for autocorrelation; $^{\#}$RESET is the Ramsey's test for specification error; $^{\#\#}$ARCH is Engle's statistic to test for presence of autoregressive process in the error term; $^{\#\#\#}$JB is the Jarque-Bera test of normality of the residuals.

TABLE 5. The Relationships between macroeconomic variables and stock returns

| | IR | CPI | MS | EX | IP | CRISIS |
|---|---|---|---|---|---|---|
| *Malaysia* | | | | | | |
| Short-run | Negative | Positive | Positive | Positive | Positive | Negative |
| Long-run | Negative | Positive | Positive | Positive | Positive | |
| *Thailand* | | | | | | |
| Short term | Negative | Positive | Insig | Positive | Insig | Negative |
| Long term | Negative | Negative | Positive | Insig | Positive | |

subsequently removed lags that were insignificant (Gilbert, 1986). It is crucial that the models which are eventually selected based on the general-to-specific approach observe certain criteria—the models must be "well-specified," in that the residuals should exhibit serial independence, homoskedasticity, and normality. We reject the hypothesis of serially uncorrelated errors using serial correlation LM test to examine if all coefficients of AR(4) for the residuals are equal to zero. In addition, The hypothesis of heteroskedasticity, examined by the Autoregressive Conditional Heteroskedasticity (ARCH) test, is not supported. And finally, the test statistic suggested by Jarque and Bera (1980) shows that all residuals in the stock return equations are normally distributed. This is necessary if the inferential aspects of classical regression are to be valid.

Another test for mis-specification which is not based directly on examination of residuals, is the regression error specification test (RESET) which investigates omitted variables, incorrect function form and whether the variables are correlated with the residuals used (Ramsey 1969). The results of this test, in addition to the above-mentioned diagnostic tests, suggest that the models do not suffer from any mis-specification.

Next the null hypothesis of non-cointegration is tested. This is required as Granger theorem demonstrates that cointegration is not only a necessary but also a sufficient condition for an error correction representation to exist. The calculated absolute value of the ADF statistic as presented in Table 4 rejects the null hypothesis that the residuals form a non-stationary series. We therefore conclude that residuals are I(0), indicating cointegrating relationships between the variables examined and the stock returns.

The error correction terms, which can be interpreted as a speed of adjustment towards the long-run equilibrium, are found to be significantly negative in the stock return equations for both Malaysia and Hong Kong. The larger the value of the error correction term, the faster the disequilibrium is removed in the short-run so that the long-run relationship holds. The speed of adjustment is faster in Malaysia, with an estimated value of error correction coefficient equal to 0.776, implying that about 77.6 percent of the previous discrepancies between the actual and desired stock price are corrected in each quarter. The short-run dynamic adjustment of the economic variables to the long-run equilibrium is slower but significant in Thailand with estimated speed of adjustments of 75.5 percent in each quarter.

## INTERPRETATION OF RESULTS

Based on the battery of diagnostic tests, the proposed stock return models are accepted as "well-specified" in the statistical sense. This implies that the estimated model parameters can be given their proper economic interpretation and that valid tests of economic hypothesis are possible within a standard statistical framework. A summary of the direction of relationships between interest rate, inflation, money supply, exchange rate and real activity with stock returns for the two countries are presented in Table 5.

*Interest rate* A negative relationship is confirmed between interest rate and the stock price in Malaysia. This follows theoretical financial valuation model where interest rate varies inversely with stock prices and is consistent with the findings by Asprem (1989), Fama (1990) and Bulmash and Trivoli (1991). Maysami and Koh (2000) concluded similarly in Singapore. When there is an increase in interest rate, the cost of borrowings to the firms is higher and business investment would be restrained. As investors expect lower profitability, there is a decrease in demand for the firm's stocks leading a higher required rate of return and lower valuation.

As at end 1998, the trading and manufacturing sector (both industrial and consumer products) made up about one-third and one-fifth of the KLSE respectively. The manufacturing firms borrow to finance the purchase of equipment and other operations. Trading firms, in turn, rely on short-term borrowings to finance their own activities. Should interest rate increase, costs of production/trading will increase and profits will decline, hence depressing stock prices. This process may happen with a lag. Alternatively, the effects of higher interest rates on stock prices may happen quickly through an increase in the discount rate and hence higher required rate of return.

The hypothesized inverse relation between interest rate and stock return is supported in Thailand as well. Banking, communication and energy sectors accounted for 45.7 percent of TSE's total market capitalization as at end 1998. The banking sector is especially important in the case of Thailand as they have historically provided approximately half of the market's profits. Interest rate movements would of course have a direct impact on cost of funds, hence affecting the profitability of banks. This is the likely reason for the strong negative association of interest rate and the stock market in Thailand. After the financial crisis hit the country, the government allowed interest rate to rocket up with the hope of attracting funds into the country. Such high interest rates, however, may have eroded investor confidence. Signaling the economy is in distress may have been detrimental to the stock market.

*Inflation* A significant positive relationship between inflation and stock prices exists in Malaysia. Marshall (1992) suggested that if inflation was caused by a money shock, the relationship between stock returns and inflation would be positive as higher liquidity would lower the rate of interest, causing investors to shift their cash holdings to stock and bond for potential capital gains. The increase in demand for equities drives up prices. Yet another explanation was put forward by Kaul (1987) who thought pro-cyclical monetary policy (as it may be during recession) is the cause of the positive relationship between inflation and stock prices. Finally, increases in expected inflation may also signal the market of potential increases in real activity and greater production as suggested by Fama and Gibbons (1982), and hence higher stock returns.

The reason behind the positive relation between Thailand's rate of inflation and stock return in the long-run, and the lack of significance in the short-term may be the conduct of monetary and exchange rate policies. The Bank of Thailand (BOT) has traditionally outlined its priorities as establishing an inflation-controlled monetary policy, a stable foreign exchange rate and a tight fiscal policy. Throughout the 1990s, however, BOT's foreign exchange policy (based on a basket of currencies comprising 70 percent U.S. dollar, and 30 percent Yen, Mark and other currencies) left the bank with little control over monetary policy, and led to excessive capital inflows and excess liquidity in the market.

There is nevertheless more flexibility in monetary policy as compared to strict-pegged policy of Hong Kong, and inflation is watched by investors. The result of the current study, indeed, shows an inverse relationship between inflation and the stock exchange of Thailand in the long-run. A possible reason is that persistent inflation would lead to a higher nominal interest rate. Another likely justification provided by Fama (1981) is that higher inflation affects stock returns through lowering real activity which itself has a direct impact on stock returns, i.e. higher inflation lowers stock return. In his opinion, the negative relationship between inflation and real activity outweighs the positive relationship between real activity and stock returns, yielding the overall inverse association between inflation and stock returns.

*Money Supply* A positive relationship is found between the money supply and the Malaysian security prices. This is consistent with studies by Maysami and Koh (2000), Kwon et al. (1997), and Mukherjee and Naka

(1995), in the cases of Singapore, Korea, and Japan. A suitable explanation is the liquidity effect (Asprem 1989): an increase in the money supply increases the liquidity in financial markets. The excess liquidity would not only lower interest rates directly, but would also be transferred into higher demand for financial assets such as stocks, hence inflating stock prices. Higher demand for bonds would put further downward pressure on interest rates, in turn leading to an increase in stock prices. Furthermore, as pointed by Lastrapes (1998), an increase in money supply could be seen as a future increase in real activity which improves the cash flows of the company, and hence an increase in demand for the firms' stocks.

Bulmash and Trivoli's (1991) results conclude that the long-run effects of changes in money supply may differ drastically from short-run effects. The results of the current study in the case of Thailand support such conclusion. A viable justification for the lack of short-run relationship between the money supply in Thailand and stock returns is the fact that as a result of the Baht's peg prior to July 1997, the Thai government did not engage in short-run active monetary policy. Hence, any temporary changes in money supply would not have a large impact on the stock market.

The Thai government however does have some control over the monetary policy as it has never followed a strictly-pegged Baht policy. Hence, in the long-run, there is a positive relationship between money supply and stock returns as investors would take the long-run direction of the monetary policy into account. Another possible reason suggested by Fama (1981) is that increases in real activity drives up stock returns and also stimulate the demand for money via the simple quantity theory model, thus creating the positive long-run relation between money supply and stock prices. This policy, of course, could lead to an overvalued exchange rate, such as the case was in Thailand prior to the onset of the economic crisis. Mukherjee and Naka (1995) suggest that injections of money supply have an expansionary effect that boost corporate earnings, hence resulting in stock price increases.

*Exchange Rate* Depreciation of the Malaysian Ringgit affects the stock prices negatively, as Maysami and Koh (2000) found in Singapore. This is in sharp contrast to larger economies of the US (Fang and Loo 1994) and Japan (Mukherjee and Naka 1995). Malaysia is highly dependent on imports for local consumption and production inputs for re-export purposes. Consequently, having a strong currency would mean cheaper imports and therefore lower cost of production. Also, with stronger domestic currency, foreigners may have greater confidence in the economic outlook leading to higher foreign investment in the country.

The Malaysian government imposed capital controls and pegged the Ringgit to the US Dollar at M$3.80 on 1 September 1998 following the dramatic depreciation of the Ringgit in the wake of the financial crisis. In a separate analysis, Q3 1998 to Q4 1998 were excluded from the model. Similar results were found. It may safely be concluded, then, that the positive relation is attributed to the pre Q3 1998 period and a strong Ringgit was beneficial to the stock market even before capital control were imposed. Additionally, portfolio inflows

There is no long-run relationship between the Baht-US dollar exchange rate and the Thai stock market as the Baht was pegged to a basket of currencies prior to the July 1997 devaluation. The peg between Baht and the US dollar was not perfect, however, leading to a positive relationship between the BHT/USD exchange rate and stock return in the short-run.

Moreover, as the currencies against which the Baht is pegged may fluctuate frequently, the peg may not be maintained strictly at all times. In the 1994-1995 period, for example, the Mexican Peso crisis led to large volatility in world currencies. Relative strength of the Baht against the USD during some such periods may have led to an inflow of funds while the opposite would have occurred in periods of relative weakness. When the Thai government announced a devaluation of the Baht in July 1997, the Thai economy collapsed.

*Real Economic Activities* Industrial production and the KLCI return are found to be positively related both in the short- and long-runs. The level of real activity through its effect on expected future cash flows in the future will likely affect stock market in the same direction. The observation is supported by Fama (1990), Chen, Roll and Ross (1986) and Mukherjee and Naka (1995). The level of industrial production in Malaysia would signal the future economic outlook. This is a feasible explanation for the direct connection between the two factors in the long-run.

The short-run positive association of the stock market with Malaysia's industrial production may be due to the fact that the consumer and industrial goods sector account for about 22 percent (as at end 1998) of the total market capitalization in the KLSE. Hence, the level of industrial production would reflect the performance of these manufacturing firms.

Industrial production displays a significant relationship with the Thai stock returns in the long-run The short run association, however, is statistically insignificant. Fama (1990) explains that stock prices affect expectations of future real activities while Schwert (1991) thinks the growth rate of industrial production is a major determination of long-horizon stock returns. An increase in real activity signals future increases in cash flows for the firm, and would probably increase the dividend paid to its shareholders. This will lead to an increase in expected stock prices. Kaneko and Lee (1995) and Mukherjee and Naka (1995) found similar results in Japan, while Kwon et al. (1997) concluded that the Korean stock market was also significantly related to real economic activities.

*The Financial Crisis* dummy variable (CRISIS) included in this study is highly significant both in Malaysia and Thailand. The reaction to macroeconomic variables might indeed have been magnified by the economic crisis, which itself may have been the result of the macroeconomic policy of each country prior to the onset of crisis. The persistent peg of the Baht to a basket of currencies, for example, does not seem consistent with a banking system in crisis and with an economy in distress. Devaluation was probably inevitable.

The problems in Asia may have begun, Krugman (1998a) argues, with financial intermediaries whose liabilities were perceived as having an implicit government guarantee, but were essentially unregulated and therefore were subject to serious moral hazard problems. The excessive risky lending of these institutions created an acute asset price inflation. This asset overpricing was sustained, in part, by a sort of circular process, in which the proliferation of risky lending drove up the prices of risky assets, making the financial condition of the intermediaries seem sounder than it was.

And then the bubble burst. Plunging asset prices made the insolvency of intermediaries visible, forcing them to discontinue operations, leading to further asset deflation. This circularity can explain both the remarkable severity of the crisis and the apparent vulnerability of the Asian economies to the self-fulfilling crisis, which in turn helps us understand the phenomenon of contagion between economies.

In Thailand, a crucial role was played by non-bank institutions that borrowed short-term money, often in dollars, and lent those funds to speculative investors, mainly in real estate. When the financial bubble burst, it left behind plummeting stock and real estate prices and a disordered banking system.

Widespread, high-profile bankruptcies highlighted the runaway debts of many corporate empires and the unsteadiness of the banks that owned those debts. International capital markets suddenly noticed that countries throughout the region had been running world-class trade deficits. A slump revealed deep problems that were masked by a boom. Japan is the classic case: it is now clear that growth in Japan's potential output began declining more than a decade earlier. That slowdown was concealed by the 'bubble economy' of the late 1980s, when runaway stock and land prices created an unsustainable boom. When the Japanese asset bubble exploded, the dreary reality was revealed.

Growth rates in the rest of Asia, by contrast, had stayed fairly high. By 1997, however, it had become clear that neither South Korea's not Thailand's torrid growth rates of the first half of the 1990s could continue. Wages were rising faster than productivity, and overheated domestic markets were spilling over into imports, creating enormous trade deficits.

The biggest lesson from Asia's troubles may be about governments, Krugman (1998b) asserts. When Asian economies delivered nothing but good news, it was possible to persuade oneself that the planners of those economies knew exactly what they were doing. The financial problems in many of the Asian markets may have indeed been visible to policymakers who, for a long time, failed to take necessary actions. The Thai officials, for example, declared they would never devalue at the onset of the crisis, but failed to make any convincing policy moves that would support the Baht, and finally did exactly what they had promised they would not do.

A government that chooses a pegged exchange rate in place of a free-floating regime, should stand ready to make a tradeoff between short-run macroeconomic flexibility and longer-term credibility. The logic of crisis then arises from the fact that defending a parity is more expensive (e.g. requires higher interest rates) if the market believes that the defense will ultimately fail. As a result, a speculative attack on a currency can develop either as a result of predicted future deterioration in fundamentals, or purely through a self-fulfilling prophecy.

Malaysia has not face a crash of similar magnitude, but such policies as attempts to banish its trade deficit by imposing import restrictions may require careful examination.

## CONCLUSIONS

The short- and long-run relationships between stock returns of Malaysia and Thailand and interest rate, inflation, money supply, exchange rate, real economic activities and a dummy variable to represent the financial crisis period were investigated in this study during the period Q1 1986 to Q4 1998. Using Hendry's (1986) general-to-specific approach to error correction modeling, the results suggested the existence of cointegrating relationships between macroeconomic variables and stock returns of the two countries, implying a stable long-run association. The type and extent of the relationships, however, differed depending on each country's macroeconomic setting. The study provided reasons for and economic interpretation of such variations.

When studying the relationship between interest rate and stock return, an area of concern is in deciding which proxy to use. Mukherjee and Naka (1995), for example, found the long-term government bond rates and stock return to be negatively related whereas call money rates and Tokyo Stock Exchange were positively related. Short-term interest rate represents the opportunity cost for investors in the stock market while the long-term rate is a better match to the length of the period when dividend payments are expected.

They concluded that in Japan, the long-term bond rate served as a better surrogate than the short-term rate for the nominal risk-free component of the discount rate in the valuation model. The proxies for interest rate used in other studies include the prime rate (Mok 1993) and 3-month Treasury bill rates (Bulmash and Trivoli 1991). More experiments in this area are thus warranted.

Moreover, it has been argued that the relationship between nominal interest rates and equity return is misleading since the nominal interest rate is affected by the rate of inflation. The observed interest rate-stock returns relationship may actually be due to the relationship between stock returns and inflation. As a matter of fact, Geske and Roll (1983) showed that the real interest rate effect was significant but often small in most of the countries their study covered. They also observed the greatest effects in countries that demonetized their budget deficits, such as Japan, West Germany, and Switzerland. The effects were weaker for countries like United States and United Kingdom, which increased their money supply to finance their budget deficit.

Granger (1986) thought that the existence of cointegration relationship and the fact that asset prices may be predicted would mean that the stock markets of such countries are not entirely efficient. Defining market efficiency as the absence of arbitrage opportunities, Dwyer and Wallace (1992), however, stressed that cointegration does not necessary violate the notion of information efficiency. This area, again, may be examined more closely in hope of conclusive results.

Limitations of the study include the fact that the ADF tests are quite sensitive to specification of the model. Thomas (1993) showed that the power of the ADF tests is low to differentiate between a unit root process and a near unit root process. Despite Enders' (1995) insight to the selection of the deterministic components, there are times where the tests may not be conclusive, hence requiring some personal discretion to interpret the results. The use of more sophisticated testing strategies suggested by Kwaitkowksi et al. (1992) may be warranted in future studies.

In addition, the error correction model is known to be sensitive to the choices of lags and the dimensions. For instance, Mukherjee and Naka (1995) used 20 years of data while employing seven variables. Due to a limited number of observations and to take into account the impact of the financial crisis, this study uses only six variables and one dummy factor. Future studies may consider experimenting with other time series data.

Finally, the importance of capital inflows into Malaysia and Thailand should be noted. Such capital inflows are likely to have had an effect on the stock indices of the two countries. For example, capital flows may have impacted the domestic money supply since the two countries have incomplete sterilization given their (relatively) infantile bond markets. In addition, portfolio fund inflows may have exerted influence on exchange rates, and hence on interest rates as a result of central banks' response to currency movements. Assessing and measuring the extent of these effects, however, are beyond the scope of the current study. As a matter of fact, this could be an excellent extension of this study.

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