MACROECONOMIC ACTIVITY AND THE MALAYSIAN STOCK MARKET: EMPIRICAL EVIDENCE OF DYNAMIC RELATIONS

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ABSTRACT

This study uses time-series analysis to investigate the long-run relationships and short-run dynamic interactions between the stock market and various macroeconomic variables in Malaysia over the period 1980:01 to 2006:12. The study applies the multivariate cointegration methodology to establish the possible causal relations between these variables. The cointegration test and the vector error correction model demonstrates the evidence of positive long-run relationships between real stock returns and measures of aggregate economic activity including industrial production, consumer price index, money supply and real exchange rate. The long-term elasticity coefficients of the macroeconomic variables on stock returns display relationships that are theoretically grounded. Further analysis using variance decompositions lends evidence of the dominant influence of certain macroeconomic variables namely; consumer price index, money supply and real exchange rate in forecasting stock price variance.

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KEYWORDS: Cointegration, VECM, Stock Market, Macroeconomic Variables, Variance Decomposition

INTRODUCTION

The purpose of the study is to investigate the response of the Malaysian equity market to macroeconomic fluctuations, that is, to determine whether the stock market returns can be explained by the current economic activities in Malaysia. The Malaysian stock market is known as Bursa Malaysia. "It is one of the largest bourses in Asia with just under 1,000 listed companies offering a wide range of investment choices to the world. Companies are either listed on Bursa Malaysia Securities Berhad Main Board for larger capitalized companies, the Second Board for medium sized companies or the MESDAQ Market for high growth and technology companies" (Bursa Malaysia, 2009).

This study analyzes the interactions between the stock returns and four main macroeconomic variables, namely industrial production, money supply, price levels and real exchange rates. There has been extensive literature written on this area, which is of interest and concern to many, both for theoretical and empirical reasons. The study of the lead-lag relationship between stock returns and the various macroeconomic variables has two important implications. Firstly, all these variables play an essential role in influencing a country's economic development and their relationship is commonly employed to forecast future trends by fundamental investors. Secondly, if the stock returns are affected by the lagged effects of macroeconomic variables, informational inefficiency of the stock market exist. Potential investors can therefore exploit past macroeconomic information to earn abnormal profits. On the other hand, if stock returns affect macroeconomic variables, then policymakers can study the stock market movements to pre-empt any policy changes and therefore, will be better equipped to formulate future macroeconomic policies.

This study extends the previous literature concerning the cointegration of macroeconomic variables and stock returns by studying a longer period of macroeconomic data (monthly data for 27 years) in an emerging market. Since studies of this nature are relatively new in the developing countries, this study will further broaden the existing literature.

The study is organized as follows. Firstly, the literature review is briefly discussed. The next section describes the data and methodology and this is followed by a discussion of the findings. The final section concludes.

LITERATURE REVIEW

Numerous studies have analyzed the interactions between the stock market returns and macroeconomic variables. Many of these studies focused on developed countries but in more recent times, there have been an encouraging number of studies focusing on the developing economies. The major studies that have been conducted on developed countries include studies done by Chen, Roll, and Ross (1986), Hashemzadeh and Taylor (1988), Dhakal *et al*. (1993), Thornton (1993), Mukherjee and Naka (1995), Nasseh and Strauss (2000), Nieh and Lee (2001), Morley (2002), Kia (2003), Chaudhuri and Smiles (2004), Huang and Yang (2004), Wong *et al*. (2006), Huynh *et al*. (2006) and Ratanapakorn and Sharma (2007). The macroeconomic variables researched in these studies include exchange rates, interest rates, inflation, industrial production, money supply, gross domestic product (GDP), private consumption and price of oil. Chaudhuri and Smiles (2004) used the multivariate cointegration methodology in their study and found evidence of a long-run relationship between real stock price and the measures of aggregate real activity including real GDP, real private consumption, real money and real oil price in the Australian market. Their study also found that the stock returns variation in the US and New Zealand markets significantly affected movements in the Australian stock returns. Using the Johansen Cointegration tests in their studies, Nasseh and Strauss (2000) documents evidence of a significant, long-run relationship between stock returns and both domestic and international economic activities in six European countries. The domestic variables include industrial production, business surveys of manufacturing orders, short and long-term interest rates, while the international variables include foreign stock returns, short-term interest rates and production. Their study also uses variance decompositions to "support the strong explanatory power of macroeconomic variables in contributing to the forecast variance of stock returns".

As for the developing countries, there have been several notable studies done on the impact of macroeconomic variables on stock returns. These include studies by Kwon *et al*. (1997) and Kwon and Shin (1999) on South Korea, Maysami and Koh (2000) on Singapore, Ibrahim (1999), Ibrahim and Aziz (2003) and Ibrahim (2003) on Malaysia and Erdem *et al*. (2005) on Israel. In their study on whether current economic activities in Korea could explain stock market returns, Kwon and Shin (1999) concluded that stock price indices were cointegrated with a set of four macroeconomic variables comprising the foreign exchange rate, trade balance, production level and money supply, hence providing a direct long-run equilibrium relation with each stock price index. Using the standard procedures of cointegration and vector autoregression methods, Ibrahim and Aziz (2003) demonstrates the existence of a long-run relationship between four macroeconomic variables (industrial production, exchange rate, money supply and price level) and the Malaysian equity price as well as substantial short-run dynamic interactions between them.

DATA AND METHODOLOGY

Data and Econometric Analysis

The monthly data from 1980:01 to 2006:12 of the macroeconomic variables of real output (IP), money supply (M1), real effective exchange rate (RER) and consumer price index (CPI) for Malaysia were obtained from International Financial Statistics (IFS), published by the International Monetary Fund. The data for the stock price index (KLCI) was obtained from DataStream.

A summary statistics of each series of the variables being studied is shown in Table 1.

Table 1: Summary Statistics of the Variables Being Studied

	KLCI	IP	CPI	M1	RER
Mean	624.4789	62.78673	81.67315	48774.29	126.0247
Median	597.2550	55.30000	79.95000	38816.00	123.3450
Std. Dev.	279.3791	36.32561	18.09915	35651.31	25.56050
Observations	324	324	324	324	324

This table shows the summary statistics of the mean, median, standard deviation and number of observations of the variables involved.

The industrial production data is used to represent the real output or real economic activity of the country. Money supply is based on the M1 definition (narrow money) to reflect the direct impact of the Central Bank (Bank Negara Malaysia) and the banking system. The use of M1 is further supported by the findings of Tan and Baharumshah (1999) on the superiority of M1 and the considerable impact it has on the economic fluctuations in Malaysia. The consumer price index is used as a proxy for inflation since it is believed that people are generally more responsive to consumer goods' prices when it comes to evaluating real stock returns, as supported by Abdullah and Hayworth (1993).

Model Specification

Several existing literature on economics and finance offers theoretical links between macroeconomic variables and stock returns. These include the stock valuation model, the monetary mechanism and the portfolio substitution model. The standard stock valuation model explains how any development in the economy impacts the macroeconomic variables which in turn affects the discounted value of expected cash flows and thus may influence the stock returns. Therefore, this model helps to explain how changes in real exchange rates can affect stock returns through its impact on firms' cash flows. This especially holds true for highly export-oriented countries like Malaysia.

The impact of changes in money supply on stock returns can be explained using the analysis of portfolio adjustments and inflationary expectations. According to the portfolio theory, investors will shift their portfolio choices to financial assets (including equity) rather than holding on to non interest bearing money as a result of an increase in money supply. Besides this, stock returns can also be affected through the effect on inflation uncertainty of any fluctuation in money supply. Inflation can also affect stock returns through its impact on future earnings and how investors discount these future earnings.

The arbitrage pricing theory (APT) developed by Ross (1976) (as cited by Ibrahim and Aziz, 2003) as well as the standard aggregate demand and aggregate supply (AD/AS) theoretical framework can also be applied to analyze the links between stock returns and macroeconomic variables. The various theoretical frameworks mentioned above provide the basis for this study.

The following model is proposed:

$$Z = (KLCI, IP, CPI, M1, RER) \quad (1)$$

Where KLCI represents the stock price index, IP is industrial production index, M1 is money supply, CPI is the consumer price index, RER is the real effective exchange rate and Z is a 5×1 vector of variables. All the variables used in this model are expressed in natural logarithms.

Methodology

The study applies the multivariate cointegration methodology of Johansen (1988) and Johansen-Juselius (1990) to establish the possible causal relations between macroeconomic variables and the stock returns. The cointegration test and the vector error correction model are used to find out whether there is evidence of long-run relationships between real stock price and measures of aggregate real activity including industrial production, consumer price index, money supply, and real exchange rate. The study further investigates the dynamic properties of the system through the generalized variance decomposition analysis based on the unrestricted VAR model, to establish whether or not the macroeconomic variables display explanatory power in forecasting stock price variance.

DISCUSSION OF FINDINGS

In this section the findings are discussed. First, the results of the Unit Root test are presented. This is followed by the discussions of the results of Johansen's Cointegration test. Thereafter, the results of the Vector Error Correction model are discussed and finally, the results of the Variance Decomposition analysis are presented.

Unit Root Test Results (Order of Integration)

The first thing that should be determined is the order of integration of the relevant variables. This is done to find out whether or not these variables are integrated since only integrated variables of the same order can be co-integrated. Prior to performing a cointegration test, one must test all variables for unit roots. The test for unit roots in the variables of the system is calculated through the Augmented Dickey-Fuller (ADF) test and further supported by the Phillips-Perron (PP) test. The results of the ADF and PP unit root tests are shown in Table 1 for both level and first-differenced series. The first-differenced series are also reported to ensure that all variables studied are $I(1)$.

The results from Table 2 consistently suggest that the time series considered contain unit roots at level using either the ADF or PP unit root tests. The null hypothesis of a unit root for all variables involved cannot be rejected (except for IP using the PP test with the time trend and CPI using the ADF test without the time trend). Therefore, the variables being studied are non-stationary and any standard regression analysis involving these variables at level may produce spurious results.

Table 2: Augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) Test Results

	ADF		PP	
Variables	***No Trend***	***Trend***	***No Trend***	***Trend***
Levels				
KLCI	-1.884862	-2.750925	-1.916735	-2.784549
IP	-1.069959	-2.440375	-1.026913	-4.155658***
M1	-0.383382	-2.793432	-0.451285	-1.807615
RER	-1.063363	-2.317003	-1.049312	-2.295999
CPI	-2.935274**	-2.526184	-2.326703	-2.574009
First-differenced				
KLCI	-10.45975***	-10.44502***	-15.59675***	-15.57141***
IP	-4.877927***	-4.911980***	-33.50049***	-33.56892***
M1	-2.928733**	-2.914571	-18.40037***	-18.36948***
RER	-14.64225***	-14.62026***	-14.68344***	-14.66152***
CPI	-14.65430***	-14.89101***	-15.05722***	-15.06276***

This table shows the ADF and PP unit root tests which confirm the stationarity of the variables when they are first-differenced .
*Note: *, ** and *** denote significance at 10 percent, 5 percent and 1 percent respectively*

These variables can be made stationary by differencing the data, after which both the ADF and PP unit root tests rejects the null hypothesis for a second unit root for all variables. Therefore, the results strongly support that all variables, when they are first-differenced, become stationary. In conclusion, Table 2 confirms the stationarity of the variables when they are first-differenced, that is; all the variables used in this time series are *I*(1).

Johansen's Test Results (Cointegration Test)

Since all the variables in this time series are *I*(1), there is a likelihood of an equilibrium relationship between them. The multivariate cointegration test of Johansen (1988) and Johansen-Juselius (1990) was applied to check on whether there exists a long-run equilibrium relationship among the variables in study. Table 3 estimates the number of long run relationships that exist between stock price and various macroeconomic variables for vector Z, where Z = [KLCI, IP, CPI, M1, RER]. The number of lags must be specified in the autoregressive specification when choosing the cointegration model specification. In specifying the lag length, it is necessary to ensure that the error terms of all equations in the system are serially uncorrelated. A model with twelve lags was chosen based on the Ljung-Box-Pierce Q statistics. The results in Table 3 show that both the trace statistics as well as the maximum-eigenvalue statistics indicates the presence of a unique cointegrating vector at 5% level.

Table 3: Results from Johansen's Cointegration Test Unrestricted Cointegration Rank Test (Trace and Maximum Eigenvalue)

Trace Statistics					
Null Hypothesis	Alternative Hypothesis	Eigenvalue	Trace Statistic	0.05 Critical Value	Prob.**
r = 0**	r ≥ 1	0.132120	102.3914	88.80380	0.0037
r ≤ 1	r ≥ 2	0.075677	58.32222	63.87610	0.1342
r ≤ 2	r ≥ 3	0.069654	33.84858	42.91525	0.2955
r ≤ 3	r ≥ 4	0.027793	11.39463	25.87211	0.8517
r ≤ 4	r ≥ 5	0.008416	2.628558	12.51798	0.9175
Maximum Eigenvalues					
Null Hypothesis	Alternative Hypothesis	Eigenvalue	Max-Eigen Statistic	0.05 Critical Value	Prob.**
r = 0**	r ≥ 1	0.132120	44.06914	38.33101	0.0098
r ≤ 1	r ≥ 2	0.075677	24.47364	32.11832	0.3182
r ≤ 2	r ≥ 3	0.069654	22.45395	25.82321	0.1310
r ≤ 3	r ≥ 4	0.027793	8.766073	19.38704	0.7483
r ≤ 4	r ≥ 5	0.008416	2.628558	12.51798	0.9175

*This table shows the results from Johansen's Cointegration Test for both Trace and Maximum Eigenvalue which shows the presence of cointegration for this system of variables. Note: *, ** and *** denote significance at 10 percent, 5 percent and 1 percent respectively*

Therefore, it can be concluded that both statistics shows the presence of cointegration for this system of variables. The empirical results suggest the presence of a long-run relationship between these variables and the stock returns.

Vector Error-Correction Model (VECM)

The vector error-correction model is used to capture the long-run equilibrium dynamics in the time series. Since there is evidence of cointegration, the dynamic relationships between the cointegrated variables can be studied using an error-correction model. The cointegrating vector (normalized on the stock price index) representing the long-run relationship is shown as follows:

$$KLCI = 1.1663IP + 1.3907CPI + 0.6248M1 + 1.3680RER - 15.8989 \quad (2)$$

The coefficients found in the normalized cointegrating vector in Equation 2 are long-term elasticity measures because the variables have undergone logarithmic transformation.

The normalized cointegrating vector indicates the presence of a positive equilibrium relation between the stock returns (KLCI) and the real economic activity (proxied by Industrial Production). This is consistent with the findings of Mukherjee and Naka (1995) for Japan, Kwon and Shin (1999) for South Korea, Mayasami and Koh (2000) for Singapore, Nasseh and Strauss (2000) for six European economies (France, Italy, Netherlands, Switzerland, U.K. and Germany), Hondroyiannis and Papapetrou (2001) for Greece, Ibrahim and Aziz (2003) for Malaysia, Kia (2003) for Canada and Ratanapakorn and Sharma (2007) for United States. Any innovations on industrial production will have a positive impact on the stock returns through its impact on the firms' changing expectations of future cash flows. An increase in industrial production may boost cash flows, thereby increasing profitability and eventually causing stock returns to go up.

The relationship between the stock returns and real inflation (CPI) is found to be positive, similar to results in studies done by Abdullah and Hayworth (1993) for United States, Mukherjee and Naka (1995) for Japan, Nasseh and Strauss (2000) for six European economies and Ratanapakorn and Sharma (2007) for United States. Although these findings contradict with others that have generally theorized the relationship as negative (Chen *et al*., 1986), an alternative argument is given. The positive impact of inflation on the stock returns may have resulted from an increase in output prices at a rate that is higher than the increase in input prices leading to an overall increase in cash flows. The rising inflation has a faster impact on output prices as opposed to input prices as businesses quickly seize the opportunity to increase output prices even before the inflation has an impact on input prices.

The vector in Equation 2 indicates a positive equilibrium relation exist between the stock returns and the money supply (M1) which is similar to findings by Abdullah and Hayworth (1993), Mukherjee and Naka (1995) for Japan and Ratanapakorn and Sharma (2007) for United States. This positive relationship can be explained via the portfolio substitution model that indicates how an increase in money supply will bring about portfolio re-balancing with other assets including securities. This is further reiterated by the liquidity effect or the transmission mechanism argument, whereby the expansionary effect of money supply on real economic activity suggests a positive relationship. An increase in money supply (a higher liquidity) will result in falling interest rates, thereby increasing aggregate demand and subsequently increasing the stock returns. Therefore, the results indicate that the stock market is not independent of the monetary policy.

Finally, the results also indicates that a positive relationship exist between stock returns and real exchange rates (RER) which concurs with the results of Mukherjee and Naka (1995) for Japan, Hondroyiannis and Papapetrou (2001) for Greece, Ibrahim and Aziz (2003) for Malaysia and Ratanapakorn and Sharma (2007) for United States. Since Malaysia is a country that is heavily involved in international trade, any changes in exchange rates will certainly affect its exports and imports. While it is a norm that any currency appreciation would bring about a decrease in exports, it is also true that that it would cause a decrease in the relative price of imported inputs, thus decreasing the cost of production for the domestic firms, thereby increasing their expected cash flows and hence the stock returns. Therefore, in this case, the positive association between stock returns and exchange rates is most likely due to the import-cost-effect of the currency appreciation.

It must be noted that the estimated coefficients of the cointegrating vector shown above only represents the long-term relationship that exists. It doesn't reflect the short-term dynamics that these variables could possibly share. In order to study the short-term dynamic relationships amongst the variables, the variance decompositions are generated based on the unrestricted VAR model.

Variance Decomposition

The study further investigates the dynamic properties of the system through the generalized variance decomposition analysis which is presented and discussed in this subsection. The variance decomposition displays the explanatory power or relative importance of each variable in accounting for fluctuations in other variables. The study illustrates the contribution of macroeconomic variables in forecasting the variance of stock returns and of each other. Table 4 represents the results of the generalized variance decomposition at different time periods: one month, six months, one year (short term), eighteen months and two years (medium to long term).

Table 4: Generalized Variance Decomposition

VDs	Horizons	Stock Price (KLCI)	Industrial Production (IP)	Consumer Price Index (CPI)	Money Supply (M1)	Real Exchange Rate (RER)
KLCI	1	100.0000	0.000000	0.000000	0.000000	0.000000
	6	94.75093	0.773752	0.434039	2.431021	1.610256
	12	79.22066	1.089673	6.277615	5.774059	7.637989
	18	68.39189	1.488068	10.96681	11.62182	7.531414
	24	60.86489	1.646680	15.45680	15.25696	6.774668
IP	1	0.082899	99.91710	0.000000	0.000000	0.000000
	6	1.426692	93.16937	0.920762	3.748847	0.734334
	12	2.568105	82.59880	4.933957	9.187926	0.711216
	18	3.599880	76.92488	11.03699	7.679806	0.758438
	24	3.642618	73.91093	12.43347	8.884865	1.128119
CPI	1	0.160567	1.459206	98.38023	0.000000	0.000000
	6	1.776034	3.044723	88.55497	5.532568	1.091703
	12	1.816862	3.980565	82.52625	5.612119	6.064206
	18	1.447768	7.479936	65.52900	14.29253	11.25076
	24	1.367993	7.602857	52.48812	23.38427	15.15677
M1	1	0.719769	0.429698	0.816845	98.03369	0.000000
	6	13.06516	0.968090	4.387121	79.73276	1.846865
	12	28.03562	3.055568	13.06976	46.09847	9.740578
	18	28.57587	2.186565	14.52054	46.27010	8.446933
	24	27.84097	2.574475	17.61475	45.01019	6.959608
RER	1	4.372159	0.468064	3.180084	4.246709	87.73298
	6	17.80006	2.884595	1.977656	2.687290	74.65040
	12	18.80067	4.082676	4.866107	1.603066	70.64748
	18	20.36704	6.698878	7.681591	1.474409	63.77808
	24	20.60263	14.15107	8.497719	1.397063	55.35152

Table 4 represents the results of the generalized variance decomposition at different time periods: one month, six months, one year (short term), eighteen months and two years (medium to long term).

It can be seen that the bulk of the variations in the real stock returns is attributed to its own variations. Even after 24 months, almost 61% of the variation in the real stock returns is explained by its own shock implying it is relatively exogenous to other variables. However, it is imperative to note the significant role played by the macroeconomic variables in forecasting the variance of stock returns. This is especially so in the case of consumer price index, money supply and the real exchange rate. The composite shocks associated with these three macroeconomic variables play an important role in explaining real stock price variations over the medium and long run period.

It can also be seen that over the medium to longer time horizon (2 years), CPI forecasts approximately 15.5% of the variance of stock returns followed by money supply and real exchange rate which explains approximately 15.3% and 6.8% of the stock price variance respectively. However, industrial production innovations do not seem to generate much fluctuation in stock returns. This result is not uncommon in the literature. Similar findings have been reported by Hondroyiannis and Papapetrou (2001) for Greece, Ibrahim (2003) for Malaysia and Ratanapakorn and Sharma (2007) for United States.

Table 4 also shows that the money supply is the most explained variable because almost 55% of its variance has been explained by innovations in the other variables. Almost 50% of variances in both the consumer price index and real exchange rates are explained by shocks in the other variables. However, industrial production is relatively exogenous in relation to the other variables as indicated in Table 3. Almost 74% of its variance is explained by its own shocks even after 24 months.

The results also point towards the dominant role of monetary shocks in generating fluctuations on inflation. On the other hand, shocks in the equity market significantly impacts the forecast error variances of money supply and real exchange rates in Malaysia.

CONCLUSION

The study was conducted to investigate whether macroeconomic variables have explanatory power over stock returns in Malaysia based on the stock returns response to macroeconomic fluctuations. The use of the vector error-correction model gives evidence that stock returns are cointegrated with a set of macroeconomic variables; namely, industrial production, consumer price index, money supply (M1) and real exchange rates. The empirical results suggest the presence of a long-run and equilibrium relations between these variables and the stock returns, i.e. the existence of macroinformation in the Malaysian stock market. The results lend evidence of the existence of a positive relationship between stock returns and industrial production, money supply, inflation and the real exchange rate. Therefore, the Malaysian stock market does signal changes in the country's real activities. This study has serious implications for policymakers and fund managers.

The study further analyzes the short-term dynamic relationships that exist amongst the variables by generating variance decompositions based on the unrestricted VAR model. The generalized variance decomposition analysis demonstrates the dominant influence of consumer price index, money supply and the real exchange rate on the Malaysian stock price variance. The results also show evidence of the dominant role of monetary shocks in generating fluctuations on inflation. On the other hand, shocks in the equity market significantly impacts the forecast error variances of money supply and real exchange rates in Malaysia. However, industrial production is relatively exogenous in relation to the other variables since a major portion of its forecast variance is explained by its own shocks even after 24 months.

Therefore, it can be concluded based on the empirical evidence of this study, that the domestic macroeconomic activity does influence the Malaysian stock market. The existence of cointegration suggests that the Malaysian stock market does not seem to be efficient in that the domestic macroeconomic variables can be used to forecast future fluctuations in the stock returns.

The study does have some limitations. Firstly, it only investigates the relationship between four macroeconomic variables and the Malaysian Stock market. Additional work can be done on different stock markets (like the stock markets of the other Asian countries) and include various other important macroeconomic variables that can contribute further to existing literature. The study could also consider the use of daily data. Besides that, the study could include structural breaks during periods of economic crisis and explore its resultant implications.

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