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The Effect of Changes in Oil Price and Monetary Stance on Stock Market Performance – Evidence From Bursa Malaysia

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ABSTRACT

The study is pursued with the objective to examine the effect of changes in crude oil price and three macroeconomic variables, namely exhange rate (RM/USD), overnight lending rate (OLR), and money supply (M1) on the performance of public listed companies in Bursa Malaysia as proxied by Kuala Lumpur Compsite Index (KLCI). The study employs Engle-Granger Cointegration test and Johansen-Juselius Multivariate Cointegration on the investigated variables. Using time series data from January 1983 through December 2006, the empirical findings show there exists a significant long-term relationship between KLCI performance and the four variables. The test results from Impulse Response Function and Variance Decomposition, however, fail to support the presence of a dynamic interaction between KLCI and the investigated variables. Interestingly, the test results form Granger Causality test indicate a significant role of money supply in influencing the performance of KLCI. The empirical findings from this study do have direct policy implications for regulators, international traders and investors.

Keywords: Kuala Lumpur Composite Index, Engle-Granger Cointegration Test, Johansen-Juselius Cointegration Test, Error Correction Model and Cusum Test For Structural Break.

1. INTRODUCTION

The public listed companies (PLC) in Bursa Malaysia Securities Berhad have been the 'engine rooms' for economic growth in Malaysia. These companies play a major role in the country's industrialization program as a base to penetrate into new markets overseas. The global market strategy is adopted after they have gained competitive advantages and enough experiences together with the capability to perform aggressive promotion in the international markets. Besides being viewed as economic forces, these listed companies also have a strategic role to strengthen and widen the national

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economic activities. This is carried out through concerted effort to increase Malaysia's export value and to reduce the level of dependency on imported products.

Due to the significant contributions of public listed companies (PLC henceforth) in Malaysia industrial development and economic growth, the government has formulated a strategic plan for both PLC and small-medium industries (SMI henceforth). The main objectives of the plan are to establish strong connections and synergy drive between PLC and SMI, which in turn allowing them to penetrate the export markets in the most efficient manner. However, it is important to note that even a strong company is still fragile and vulnerable to changes in external forces; for instance the effect of Asian Debt Crisis 1997 on South East Asia financial markets. The Asian financial crisis which started in July 1997 exerted tremendous impact on stock market performances in the region. The crisis has caused local interest rate to increase sharply and forced many companies to shut down their operations due to their inability to repay short-term debts and loans. The sudden change in the monetary policy (as shown by sharp increase in the short-term interest rates) detrimentally affect all market players in the economy.

This study is pursued with the motivation to find out the impact of changes in crude oil price and monetary policy on the stock market performance in Malaysia. A sudden increase in crude oil prices coupled with drastic changes in monetary policy like the one during Asian Financial Crisis in July 1997 would not only exerted tremendous impact on the financial well-being of small-size industries but also on large-size companies such as Tenaga Nasional Berhad (TNB) and Telekom Malaysia (TM). Sadorsky (1999) and Hamilton (1983) indicate that commodity prices, particularly enery prices, pose a significant impact on a country's economy. Calverley, Hewin, and Grice (2000) conduct a post-crisis study on the effect of financial crisis on the stock market performances in the emerging economies. They discover that the sharp recovery in most emerging stock markets is attributed to the continuing interest of investors in emerging stocks as an asset class. For this reason, it is imperative to investigate the theoretical linkage between these four variables (crude oil prices, exchange rates, interest rates and money supply) and the performance of Malaysian stock market. The study is narrowed towards a number of pertinent issues within the energy crisis, monetary policy and stock price behavior theoretical frameworks. Subsequently, the following research questions are studied and analyzed:

a) Is there a long-run equilibrium relationship between Kuala Lumpur Composite Index (KLCI henceforth) and the four variables?
b) What is the causality relationship between KLCI and the four variables?
c) Which is the lead-lag relationship between KLCI and the four variables?

Faff and Brailsford (1999) reveal a positive and significant impact of oil prices on the oil and gas companies listed on the Australian stock market. Haung et al. (1996) examine the relationship between daily oil futures returns and stock returns in the United States. They find oil futures do lead some oil company stock returns but there is not much impact on the spot market indices in general. Burbridge and Harrison (1984) find that oil price shocks, during the 1973-1974 oil embargo, had an impact on the economies of the United Stated, Canada, the United Kingdom, Japan and Germany.

Jensen and Mercer (1998) assert that fundamental and technical analyses on stock valuation rely heavily on monetary policy indicator such as Federal Funds Rate and Overnight Lending Rates. An increase in the Federal Funds Rates signals a period of restrictive monetary policy, while a decrease in the Federal Funds Rates implies an expansive monetary policy. Federal Funds Rate is the interest rate on overnight loan of deposit at the Federal Reserve Bank (U.S Central Bank). It is actually a borrowing rate of one commercial from other commercial banks as the borrowing bank fails to meet the Statutory Reserve Requirement set by the Federal Reserve Bank at the end of business day.

Hasyemzadeh and Taylor (1988) examine the causality between stock prices, money supply and interest rates. By using Granger-Sims test, it is found that rise interest rates reduce the present value of future cash flows to be received by the investors. In addition, the causality seems to be mostly running from the interest rates to stock prices, but not the other way around. They also find that there is a strong empirical linkage between money supply and stock prices and between stock prices and market interest rates. Flannery and James (1984) reveal a significant negative association between interest rate changes and common stock return in their research on interest rate sensitivity in United States. In a study by Oldfield and Rogalski (1981), the Treasury bill weekly return was found to provide a source for identifying statistical factors that influence common stock returns.
Gail (1968) concludes that monetary policy affects all rates, with greatest effect on short-term rates. Fama and Schwert (1977) found a statistically significant positive relationship between stock returns and future interest rate changes. Based on the high correlation, they suggest the inclusion of the stock price movement in the inflation forecasting models. Ghazali (1992) indicates that there is no significant relationship between the money market rates

movement and the common stock returns in Malaysia. However, the directions of response between two variables are inversely related. This evidence explains the theoretical linkage between the money market rates and stock market performance.

2. DATA, MODEL & METHODOLOGY

The Vector Autoregressive method (VAR) is the key research instrument used in this study and it encompasses the Johansen-Juselius Multivariate cointegration, Vector Error Correction Model (VECM), Impulse Response Function (IRF) and Variance Decomposition (VDC). Similar approach was used by Islam (2003) in his study on stock price behavior in the Malaysian stock market. To investigate the theoretical relationship between KLCI and the four key variables, the following model is developed:

$$KLCI_t = \beta_0 + \beta_1 OP_t + \beta_2 ER_t + \beta_3 OLR_t + \beta_4 MS_t + \mu_t \quad \text{.............................1)}$$

where: KLCI = Kuala Lumpur Composite Index
OP = Crude Oil Price
ER = Exchange Rate (RM/USD)
OLR = Overnight Lending Rate
MS = Money Supply (M1)
μ_t = Error Terms

The selection of the four key variables are based on the theoretical framework of past literature and the research framework of this study is demonstrated in Figure 1 below.

This study takes 24 years monthly observation spanning from January 1983 till December 2006 involving 288 months. In evaluating the statistical relationship between KLCI and the four variables, cointegration procedures used by Engle-Granger (1987) and Johansen-Juselius (1990) are deployed. Cointegration test is a statistical concept introduced by Granger (1981), Granger and Weiss (1983) and Engle and Granger (1987) which has received wide attention and is beginning to be applied to test the validity of various theories and models. Cointegration is an econometric technique for testing the correlation between non-stationary time series variables. In this concept, two variables are cointegrated when a linear combination of the two is stationary, even though each variable is non-stationary on its own or at level. Usually when X and Y variables are non-stationary, it is expected that a linear combination of two variables would also be non-stationary. However, this notion has been proven wrong by Engle and Granger (1987). According to Granger (1981) and Engle-Granger (1987), components in vector X_t is cointegrated at *d,b* degree if:

i) All components of X_t is *I(d)*
ii) There is a nonzero vector $\beta = (\beta_1, \beta_2, \ldots, \beta_n)$ so that the linear combination of $\beta X_t = \beta_1 X_{1t} + \beta_2 X_{2t} + \ldots + \beta n X_{nt}$ will be cointegrated at *d,b* degree where $b > 0$. The vector β is the cointegration vector. Note that *d* is the number of differencing, while *b* represents the number of cointegrating vector.

In order to avoid the problem of non-stationarity, it is necessary to make use of first (or higher) differentiated data. Such differencing, however, may result in a loss of precious data points on long-run characteristics of the time-series data. However, Engle and Granger (1987) show that, if there is an equilibrium relationship between such variables, then the disequilibrium error should fluctuate about zero i.e. error terms should be stationary. The unit root test is important in determining the stationarity of time series data. Whether the variables tested has the tendency to return to its long term trend after a shock (*i.e.* it is stationary) or exhibits a random walk pattern (*i.e.* it has a unit root) is an important question to be answered prior to any further data analysis as the latter would suggest spurious regression relationship. This paper uses the Augmented Dickey Fuller test (ADF):

$$\Delta X_t = \lambda_0 + \lambda_1 T + \lambda_2 X_{t-1} + \Sigma \lambda_i \Delta X_{t-i} + \varepsilon_t \quad \ldots\ldots 2)$$

where i = 1, 2, 3…k

The hypotheses being tested are:

H_0: $\lambda_2 = 0$ (the data is not stationary, it contains unit root)
H_1: $\lambda_2 < 0$ (data is stationary, it does not contain unit root)

Once this requirement is met, X and Y variables are said to be cointegrated and a method of Vector Error Correction Model (VECM) can be pursued. VECM is a restricted Vector Autoregressive method (VAR) which involves Johansen-Juselius multivariate cointegration. VECM restricts the long run behaviour of endogeneous variables to converge to their cointegrating relationship while allowing for short run adjustments. The VECM would allow us to separate short-term from long-term relationships. The VECM model is expressed below:

$$\Delta X_t = \mu_i + \sum_{i=1}^{n} A_i \Delta X_{t-i} + \sum_{i=1}^{n} \xi_i \Theta_{t-i} + v_t \quad \ldots\ldots 3)$$

where:

X_t is in the form of nx1 vector
A_i and ξ_i are the estimated parameters
Δ is the difference operator

v_t is the reactional vector which explains unanticipated movements in Y_t and Θ (error correction term)

The study also applies Ordinary Least Square Method (OLS), which is subjected to Classical Normal Linear Regression assumptions. Those critical assumptions are: a) time-series data must be stationary, b) residual or error term must be homoscedastic, c) residuals are independent of one another or there is no autocorrelation between residuals, d) residual distribution is normal, and e) independent variables are not related to one another or there is an absence of multicollinearity. In order to ensure all statistical findings are valid, the assumptions must be observed. For this reason, diagnostic tests consisting of Augmented-Dickey Fuller unit root test, Moments of Specification Test/White test, Durbin-Watson test, Anderson-Darling test and Variance Inflation Technique are carried out. In investigating the relationship between KLCI and the four tested variables, the study expects unidirectional causality from the four variables to KLCI.

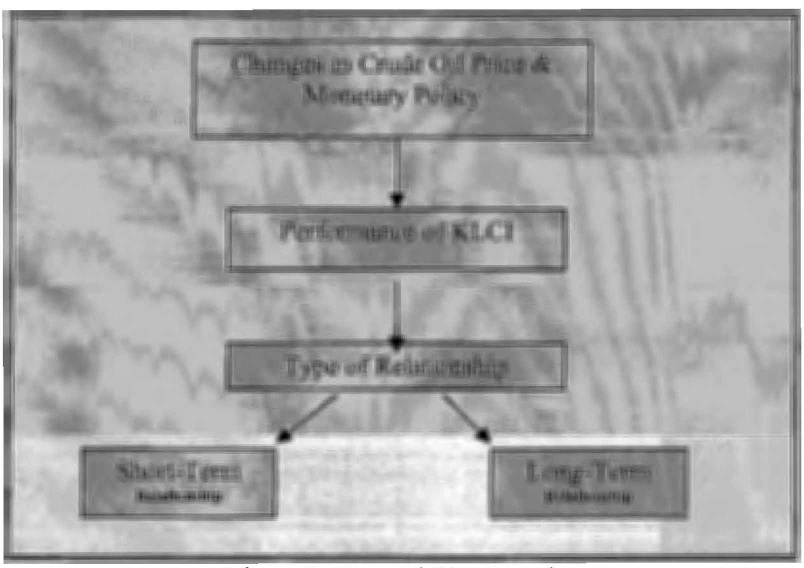

Figure 1: Research Framework

To begin with, the study will perform unit root tests on all time series variables, followed by Johansen-Juselius cointegration test and Granger causality test within Vector Error Correction Modeling. To examine the dynamic interaction between the variables, the study employs IRF and VDC.

3. EMPIRICAL FINDINGS

This study employs Augmented Dickey-Fuller stationary test on the five time series data. The p-value is used to determine the significance level of the hypothesis testing. The time series under consideration should be integrated in the same order before the study can proceed to Johansen-Juselius Cointegration test. Table 1 presents the test results from the ADF test on each variable at level and first difference. The test results show the acceptance of null hypothesis indicating that all time series variables are non stationary at level. On the other hand, all null hypotheses on the first differenced data series are rejected indicating all data series under consideration are stationary at first difference. From the test results above, it is now obvious that all investigated variables are stationary at the same order or I(1).

Table 1:
Dickey-Fuller Unit Root Tests at Level

Variable	Type	Rho	Pr < Rho	Tau	Pr < Tau
klci	Zero Mean	0.27	0.7468	0.21	0.7470
	Single Mean	-4.95	0.4373	-1.48	0.5437
	Trend	-10.02	0.4286	-2.20	0.4858
cop	Zero Mean	0.43	0.7884	0.27	0.7626
	Single Mean	-3.14	0.6388	-0.83	0.8074
	Trend	-7.78	0.5970	-1.79	0.7076
er	Zero Mean	0.17	0.7214	0.26	0.7606
	Single Mean	-4.70	0.4625	-1.61	0.4777
	Trend	-10.48	0.3979	-2.21	0.4813
olr	Zero Mean	-3.10	0.2260	-1.32	0.1725
	Single Mean	-16.33	0.0270	-2.82	0.0566
	Trend	-22.65	0.0369	-3.36	0.0597
ms	Zero Mean	2.17	0.9922	3.84	0.9999
	Single Mean	1.77	0.9967	1.74	0.9997
	Trend	-4.55	0.8507	-1.21	0.9050

Augmented Dickey-Fuller Unit Root Tests at First Difference

Variable	Type	Lag	Tau	Pr < Tau
klci	Zero Mean	1	-9.49	0.0001
		2	-9.75	0.0001
		3	-8.87	0.0001
		4	-7.90	0.0001
		5	-7.72	0.0001
cop	Zero Mean	1	-12.60	0.0001
		2	-10.68	0.0001

		3	-10.00	0.0001
		4	-8.30	0.0001
		5	-7.56	0.0001
er	Zero Mean	1	-11.21	0.0001
		2	-8.83	0.0001
		3	-6.95	0.0001
		4	-7.20	0.0001
		5	-6.27	0.0001
olr	Zero Mean	1	-15.22	0.0001
		2	-12.48	0.0001
		3	-10.39	0.0001
		4	-7.48	0.0001
		5	-6.44	0.0001
ms	Zero Mean	1	-11.23	0.0001
		2	-9.06	0.0001
		3	-7.45	0.0001
		4	-6.34	0.0001
		5	-5.44	0.0001

Johansen-Juselius Cointegration Test (1990) is used to determine the number of cointegrating vectors. Johansen (1988) suggests two statistic tests to determine the cointegration rank, namely lamda trace and lamda max. The results of this cointegration analysis are reported in Table 2 and Table 3. Lamda trace and lamda max statistics indicate the existence of cointegration between variables. Null hypothesis of no cointegrating vector (r=0) is rejected at 5% significance level on all lag tested (1,2 and 3). Since lamda trace and lamda max are greater than their respective critical values, we conclude that there is at least one cointegrating vector exists for the time series variables in the system. This cointegrating vector or r is the variable that pulls all the five variables in the equation to be cointegrated in the long-run. In other words, r indicates the number of cointegrating relationships (Masih et al., 1996).

Table 2 - Johansen-Juselius Cointegration Test Using Maximum Eigenvalue

Lag Length = 1 lag

H0: Rank = r	H1 Rank = r+1	Eigenvalue	Maximum	5% Critical Value
0	1	0.1299	39.9501	33.46
1	2	0:0807	24.1494	27.07
2	3	0.0261	7.5905	20.97
3	4	0.0195	5.6378	14.07
4	5	0.0041	1.1907	3.76

Lag Length = 2 lag

H0: Rank = r	H1 Rank = r+1	Eigenvalue	Maximum	5% Critical Value
0	1	0.1321	40.5330	33.46
1	2	0.0674	19.9608	27.07
2	3	0.0313	9.1077	20.97
3	4	0.0209	6.0435	14.07
4	5	0.0043	1.2231	3.76

Lag Length = 3 lag

H0: Rank = r	H1 Rank = r+1	Eigenvalue	Maximum	5% Critical Value
0	1	0.1342	41.0784	33.46
1	2	0.0658	19.4119	27.07
2	3	0.0.330	9.5669	20.97
3	4	0.0246	7.0848	14.07
4	5	0.0049	1.3940	3.76

Table 3- Johansen-Juselius Cointegration Test Using Trace

Lag Length = 1 lag

H0: Rank = r	H1: Rank > r	Eigenvalue	Trace	5% Critical Value
0	0	0.1299	78.5186	68.68
1	1	0.0807	38.5685	47.21
2	2	0.0261	14.4191	29.38
3	3	0.0195	6.8286	15.34
4	4	0.0041	1.1907	3.84

Lag Length = 2 lag

H0: Rank = r	H1: Rank > r	Eigenvalue	Trace	5% Critical Value
0	0	0.1321	76.8681	68.68
1	1	0.0674	36.3351	47.21
2	2	0.0313	16.3743	29.38
3	3	0.0209	7.2667	15.34
4	4	0.0043	1.2231	3.84

Lag Length = 3 lag

H0: Rank = r	H1: Rank > r	Eigenvalue	Trace	5% Critical Value
0	0	0.1342	78.5360	68.68
1	1	0.0658	37.4576	47.21
2	2	0.0.330	18.0457	29.38
3	3	0.0246	8.4788	15.34
4	4	0.0049	1.3940	3.84

To determine optimum lag-length, the study uses AIC and SBC statistics. The test results in Table 4 show that the best model is obtained with the utilisation of lag 2. To test the significance of the ect (or error correction terms) in each individual model above, the p-value is reported to indicate the level of significance. Table 4 below shows that the ect in VECM (2) and VECM (3) are significant at 5% and 10% level respectively. Recall that ect has to be negative in value or its value must lie within the range of 0.00 and -1.00 (0.00>ect>-1.00). Having the value of ect from VECM (2) equals -0.0261, we can conclude that there is a significant long-run relationship between KLCI and the other four variables, namely COP, ER, OLR and MS. Furthermore, there is about 2.6% speed of adjustment towards equilibrium made by KLCI in the system. However, this is considered a slow adjustment process and could be attributed to the nature of Malaysian financial markets. Higher speed of adjustment is prefered because a statistically reliable endogenous variable should have higher speed of adjustment. This finding is in line with our expectation that KLCI is the endogeneous variable in relation to COP, ER, OLR, and MS. Interestingly, the test results from Granger Causality within sample in both VECM (2) and VECM (3) indicate a presence of dynamic relation between KLCI and money supply. This finding implies that money supply 'Granger-causes' KLCI and, therefore, money supply is indeed a leading economic indicator in the system.

Table 4
Granger Causality Test in VECM (Simultaneous Wald F-test)

Dependent Variable AIC = 20.8093	***Δklci***	***Δcop***	***Δer***	***Δolr***	***Δms***	***ect***	***Ect***
Lag Length=1 or VECM (1)						*(estimate)*	
Δklci		0.8215	0.3561	0.3475	0.0061*	-0.01553	0.1660
Δcop	0.9190		0.0973**	0.7913	0.7963	0.00004	0.4990
Δer	0.7507	0.5086	0.0146*	0.1554	-0.00015*	0.0001	
Δolr	0.0236*	0.3612	0.4140		0.9927	0.00081	0.0096
Δms	0.4647	0.8940	0.8627	0.8027		1.97191	0.0001
Dependent Variable *AIC* = *20.8581*	**Δklci**	**Δcop**	**Δer**	**Δolr**	**Δms**	**ect**	**ect**
Lag Length=2 or VECM (2)						(estimate)	
Δklci		0.9777	0.7344	0.3326	0.0219*	-0.02618*	0.0420
Δcop	0.8617		0.2434	0.6552	0.9846	0.00020	0.3972
Δer	0.0578**	0.6450		0.0429*	0.3776	-0.00009*	0.0127
Δolr	0.0663**	0.2082	0.7444		0.9485	0.00089	0.0067
Δms	0.4648	0.0851**	0.9148	0.6005		2.43943	0.0001
Dependent Variable *AIC* = *20.8091*	***Δklci***	***Δcop***	***Δer***	***Δolr***	***Δms***	***ect***	***Ect***
Lag Length=3 or VECM (3)						(estimate)	
Δklci		0.9790	0.5879	0.3087	0.0543**	-0.02131**	0.0652
Δcop	0.9595		0.3968	0.8133	0.9998	0.00025	0.7088
Δer	0.0865**	0.7332		0.0695**	0.1113	-0.00004	0.1610
Δolr	0.0676**	0.0111*	0.7159		0.9036	0.00108	0.0001
Δms	0.3753	0.1237	0.7173	0.5274		2.28807	0.0001

All values above are p-values
* significant at 5% level
** significant at 10% level

Dynamic simulations are used to calculate IRF and to visualize VDC in order substantiate the results obtained from VECM. From one standard deviation shock in COP, the response of KLCI is seen significant even though it moves in opposite direction (negative sign). The impact lasts until the 6^{th} month after which it tends to stabilize. Similar finding is observed in investigating the impact of ER on KLCI. As such, the impact of COP and ER on KLCI performance appear to be significant and consistent over short-haul.

The effect of both OLR and MS on KLCI as shown in the IRF test is found to be insignificant. This implies that KLCI does not response to changes in OLR and MS significantly over short-run horizon. This finding is in tandem with the work of Mansor (2003) in which he postulates that the effect of MS on KLCI only exists over the long-run.

Table 5 - Simple Impulse Response by Variable

(To confirm the results in VECM and to get out-of-sample dynamic or short-term relationship)

Variable	Lag	klci	cop	er	olr	Ms
klci	1	1.00143	-0.4717	-20.64725	0.81294	0.00446
	2	1.19964	-0.52692	-12.5206	5.73415	0.00564
	3	1.18018	-1.19503	-18.18585	5.2255	0.00619
	4	1.20614	-1.65037	-15.26517	6.59754	0.00626
	5	1.19036	-1.79806	-16.4418	6.88468	0.00639
	6	1.18412	-1.93653	-16.21288	7.41286	0.00642
	7	1.17161	-2.06835	-16.70243	7.70695	0.00644
	8	1.16178	-2.18663	-16.84651	8.04482	0.00645
	9	1.15151	-2.28854	-17.12496	8.32196	0.00646
	10	1.14239	-2.38248	-17.32894	8.58624	0.00646
	11	1.13381	-2.46853	-17.54073	8.82255	0.00647
	12	1.12599	-2.54743	-17.725	9.04163	0.00647
	13	1.11877	-2.61965	-17.89879	9.24159	0.00647
	14	1.11217	-2.68595	-18.05654	9.4254	0.00648
	15	1.1061	-2.74677	-18.20207	9.59387	0.00648
	16	1.10053	-2.80257	-18.33529	9.74852	0.00648
	17	1.09542	-2.85377	-18.45767	9.89039	0.00649
	18	1.09073	-2.90075	-18.5699	10.02057	0.00649
	19	1.08643	-2.94386	-18.67291	10.14002	0.00649
	20	1.08248	-2.98341	-18.76742	10.24962	0.00649
cop	1	-0.00053	1.08901	-1.97915	-0.08547	0.00001
	2	0.00145	0.99234	-1.68873	-0.18758	0.00002
	3	0.00279	0.98548	-1.68128	-0.16986	0.00002
	4	0.00315	0.99993	-1.67659	-0.15645	0.00003
	5	0.00356	1.00313	-1.67768	-0.16921	0.00003
	6	0.00386	1.00339	-1.66967	-0.1784	0.00003
	7	0.00414	1.00584	-1.66055	-0.18374	0.00003
	8	0.00437	1.00843	-1.65589	-0.19006	0.00003
	9	0.00459	1.01049	-1.65075	-0.19593	0.00003
	10	0.00478	1.01237	-1.64615	-0.20131	0.00003

	11	0.00496	1.01415	-1.64181	-0.20618	0.00003
	12	0.00512	1.01578	-1.63796	-0.2107	0.00003
	13	0.00527	1.01727	-1.63438	-0.21483	0.00003
	14	0.0054	1.01864	-1.6311	-0.21863	0.00003
	15	0.00553	1.0199	-1.6281	-0.22211	0.00003
	16	0.00565	1.02106	-1.62534	-0.22531	0.00003
	17	0.00575	1.02211	-1.62281	-0.22825	0.00003
	18	0.00585	1.02309	-1.62049	-0.23094	0.00003
	19	0.00594	1.02398	-1.61836	-0.23341	0.00003
	20	0.00602	1.02479	-1.61641	-0.23567	0.00003
er	1	-0.00007	0.00066	0.89873	-0.01303	-0.00000
	2	-0.0005	-0.00275	0.95027	-0.00296	-0.00000
	3	-0.00059	-0.00312	0.94739	-0.00037	-0.00001
	4	-0.00079	-0.00444	0.94284	0.00179	-0.00001
	5	-0.00089	-0.00553	0.94191	0.00555	-0.00001
	6	-0.00101	-0.00654	0.93826	0.00809	-0.00001
	7	-0.0011	-0.0075	0.93645	0.0109	-0.00001
	8	-0.0012	-0.00839	0.93403	0.01329	-0.00001
	9	-0.00128	-0.0092	0.93219	0.01558	-0.00001
	10	-0.00135	-0.00995	0.93034	0.01764	-0.00001
	11	-0.00142	-0.01064	0.92872	0.01956	-0.00001
	12	-0.00148	-0.01127	0.9272	0.0213	-0.00001
	13	-0.00154	-0.01185	0.92582	0.02291	-0.00001
	14	-0.0016	-0.01238	0.92454	0.02439	-0.00001
	15	-0.00164	-0.01287	0.92338	0.02574	-0.00001
	16	-0.00169	-0.01332	0.92231	0.02698	-0.00001
	17	-0.00173	-0.01373	0.92133	0.02812	-0.00001
	18	-0.00177	-0.01411	0.92043	0.02916	-0.00001
	19	-0.0018	-0.01445	0.9196	0.03012	-0.00001
	20	-0.00183	-0.01477	0.91884	0.031	-0.00001
olr	1	-0.00186	-0.00842	0.45886	0.64629	-0.00001
	2	-0.00076	-0.02995	0.52745	0.61277	-0.00004
	3	-0.00064	-0.01168	0.54711	0.62045	-0.00004
	4	-0.00001	0.00151	0.56419	0.59632	-0.00004
	5	0.00049	0.0059	0.56803	0.57368	-0.00004
	6	0.00107	0.01107	0.58685	0.55948	-0.00004
	7	0.00157	0.0167	0.59775	0.54481	-0.00004
	8	0.00205	0.02155	0.60933	0.53158	-0.00004
	9	0.00248	0.0259	0.61947	0.51931	-0.00004
	10	0.00288	0.02991	0.62925	0.50821	-0.00004
	11	0.00325	0.03361	0.638	0.49797	-0.00004
	12	0.00359	0.037	0.6461	0.4886	-0.00004
	13	0.0039	0.0401	0.65351	0.47998	-0.00004
	14	0.00418	0.04295	0.66033	0.47209	-0.00004
	15	0.00444	0.04557	0.66657	0.46484	-0.00004
	16	0.00468	0.04797	0.67231	0.45819	-0.00004
	17	0.0049	0.05017	0.67757	0.45209	-0.00004
	18	0.00511	0.05219	0.68239	0.44649	-0.00004
	19	0.00529	0.05404	0.68682	0.44136	-0.00004
	20	0.00546	0.05574	0.69089	0.43665	-0.00004
ms	1	4.43409	27.16456	560.35257	-156.89435	0.9849
	2	5.00449	-43.10433	309.95823	-149.67825	0.89615
	3	7.58967	-20.34854	701.17197	-237.65618	0.88399
	4	9.83209	23.28556	721.54815	-329.2257	0.88413
	5	12.14164	50.85879	769.48679	-393.65968	0.88182

6	14.33349	72.32202	819.41473	-459.43965	0.8798
7	16.38569	92.64974	871.24815	-517.07326	0.87845
8	18.27137	111.93956	916.11096	-569.45243	0.87747
9	20.00595	129.46051	957.47698	-617.83734	0.87656
10	21.60043	145.42173	995.60472	-662.22434	0.87572
11	23.0642	160.08824	1030.6932	-702.87532	0.87497
12	24.4075	173.5586	1062.8535	-740.17658	0.87428
13	25.64015	185.9127	1092.3599	-774.40915	0.87365
14	26.77128	197.24622	1119.4424	-805.81761	0.87308
15	27.80917	207.64614	1144.2931	-834.63573	0.87255
16	28.76151	217.18889	1167.0947	-861.07819	0.87206
17	29.63534	225.94483	1188.0165	-885.34096	0.87162
18	30.43714	233.97893	1207.2139	-907.60353	0.87121
19	31.17285	241.35074	1224.8287	-928.03084	0.87083
20	31.8479	248.11485	1240.9914	-946.7742	0.87049

The results of VDCs are presented in Table 6 below. The twenty-period horizon is used to demonstrate a sense of the dynamics in the system. The Granger-causal chain implied by the VDC analysis tends to suggest that COP is relatively the leading variable, being the most exogenous of all, followed by KLCI and OLR. Decomposition of variance in MS, besides being explained by its own, can also be explained by KLCI (28%) and OLR (12%). Interestingly, the same can be said for ER, in which 27% of its variation is explained by KLCI, while another 6% is explained by COP

Table 6 - Proportions of Prediction Error Covariances by Variable (VDC) (Out of Sample test for relative endogenity and exogenity)

Variable	Lag	klci	cop	er	olr	Ms
klci	1	1.00000	0.00000	0.00000	0.00000	0.00000
	2	0.98608	0.00014	0.00022	0.00000	0.01355
	3	0.97733	0.00018	0.00014	0.00227	0.02009
	4	0.97189	0.00063	0.0001	0.00279	0.02459
	5	0.96794	0.00129	0.00008	0.00376	0.02693
	6	0.96483	0.00183	0.00007	0.00451	0.02876
	7	0.96228	0.00232	0.00006	0.00527	0.03008
	8	0.96007	0.00278	0.00005	0.00596	0.03115
	9	0.95809	0.00322	0.00004	0.00663	0.03202
	10	0.95628	0.00364	0.00004	0.00727	0.03277
	11	0.9546	0.00405	0.00004	0.00789	0.03343
	12	0.95302	0.00445	0.00003	0.00849	0.03401
	13	0.95153	0.00484	0.00003	0.00907	0.03453
	14	0.95011	0.00521	0.00003	0.00964	0.03501
	15	0.94876	0.00558	0.00003	0.01019	0.03544
	16	0.94747	0.00593	0.00002	0.01073	0.03585
	17	0.94623	0.00628	0.00002	0.01125	0.03622
	18	0.94504	0.00662	0.00002	0.01175	0.03657
	19	0.9439	0.00694	0.00002	0.01224	0.0369

	20	0.9428	0.00726	0.00002	0.01271	0.03721
cop	1	0.00002	0.99998	0.00000	0.00000	0.00000
	2	0.00003	0.99527	0.00413	0.00053	0.00003
	3	0.00031	0.99264	0.00487	0.00211	0.00008
	4	0.00103	0.99089	0.00522	0.00272	0.00013
	5	0.00166	0.98981	0.00538	0.00296	0.0002
	6	0.00225	0.98881	0.00548	0.00322	0.00024
	7	0.00279	0.98791	0.00555	0.00347	0.00028
	8	0.00331	0.98711	0.00558	0.0037	0.0003
	9	0.00379	0.98638	0.0056	0.00391	0.00032
	10	0.00424	0.9857	0.00561	0.00412	0.00033
	11	0.00467	0.98506	0.00562	0.00431	0.00034
	12	0.00509	0.98446	0.00562	0.00449	0.00035
	13	0.00548	0.98389	0.00561	0.00467	0.00036
	14	0.00585	0.98335	0.0056	0.00484	0.00036
	15	0.00621	0.98283	0.00559	0.005	0.00037
	16	0.00655	0.98234	0.00558	0.00515	0.00037
	17	0.00688	0.98187	0.00557	0.0053	0.00038
	18	0.0072	0.98142	0.00556	0.00544	0.00038
	19	0.0075	0.981	0.00555	0.00557	0.00038
	20	0.00779	0.98059	0.00554	0.0057	0.00038
er	1	0.0064	0.00987	0.98373	0.00000	0.00000
	2	0.0104	0.00893	0.9732	0.00516	0.00231
	3	0.03624	0.01401	0.94312	0.00345	0.00319
	4	0.05389	0.01694	0.92258	0.00255	0.00404
	5	0.07558	0.02025	0.89755	0.0021	0.00452
	6	0.09442	0.02361	0.87494	0.00218	0.00485
	7	0.11295	0.02692	0.85253	0.00258	0.00502
	8	0.1301	0.03021	0.83128	0.0033	0.00511
	9	0.14633	0.03342	0.81087	0.00424	0.00514
	10	0.16152	0.03653	0.79147	0.00536	0.00513
	11	0.17578	0.03951	0.77303	0.00659	0.0051
	12	0.18914	0.04235	0.75556	0.0079	0.00505
	13	0.20165	0.04505	0.73905	0.00926	0.00499
	14	0.21335	0.04761	0.72347	0.01065	0.00492
	15	0.22430	0.05003	0.70878	0.01204	0.00485
	16	0.23454	0.05231	0.69495	0.01341	0.00478
	17	0.24413	0.05446	0.68194	0.01477	0.00471
	18	0.25309	0.05648	0.66969	0.01609	0.00464
	19	0.26149	0.05839	0.65817	0.01738	0.00457
	20	0.26935	0.06018	0.64734	0.01863	0.00451
olr	1	0.00102	0.0007	0.00004	0.99824	0.00000
	2	0.00532	0.00056	0.00228	0.99133	0.00052
	3	0.00474	0.00292	0.00358	0.98559	0.00318
	4	0.00419	0.00258	0.00457	0.98394	0.00471
	5	0.0036	0.00227	0.00539	0.98281	0.00592
	6	0.00346	0.00217	0.00606	0.98129	0.00702
	7	0.0041	0.00233	0.00669	0.97892	0.00797
	8	0.00558	0.00278	0.00727	0.9756	0.00878
	9	0.00794	0.0035	0.00781	0.97125	0.0095
	10	0.01114	0.00445	0.00832	0.96594	0.01015
	11	0.0151	0.0056	0.0088	0.95976	0.01074
	12	0.01974	0.00694	0.00925	0.95281	0.01127
	13	0.02496	0.00842	0.00968	0.94519	0.01175
	14	0.03067	0.01003	0.01009	0.93703	0.01218

	15	0.03677	0.01174	0.01047	0.92844	0.01259
	16	0.04319	0.01352	0.01083	0.9195	0.01295
	17	0.04986	0.01537	0.01117	0.91032	0.01329
	18	0.05669	0.01725	0.01149	0.90098	0.0136
	19	0.06364	0.01915	0.01179	0.89154	0.01388
	20	0.07065	0.02106	0.01207	0.88207	0.01414
ms	1	0.01399	0.00005	0.02877	0.01046	0.94673
	2	0.0317	0.00069	0.03409	0.0211	0.9124
	3	0.04056	0.00147	0.03393	0.02446	0.89958
	4	0.05339	0.00132	0.0357	0.03036	0.87923
	5	0.06806	0.00121	0.03642	0.03816	0.85614
	6	0.08451	0.00167	0.03667	0.04596	0.83119
	7	0.10193	0.00255	0.03663	0.05387	0.80502
	8	0.11975	0.0038	0.0364	0.06151	0.77854
	9	0.13742	0.00535	0.03605	0.06876	0.75242
	10	0.1546	0.0071	0.03562	0.07558	0.72709
	11	0.17109	0.00898	0.03513	0.08195	0.70285
	12	0.18676	0.01092	0.03463	0.08786	0.67984
	13	0.20153	0.01288	0.03411	0.09332	0.65816
	14	0.2154	0.01483	0.03359	0.09836	0.63783
	15	0.22837	0.01675	0.03308	0.103	0.61881
	16	0.24047	0.01861	0.03258	0.10727	0.60107
	17	0.25174	0.02041	0.03211	0.1112	0.58454
	18	0.26223	0.02214	0.03165	0.11483	0.56915
	19	0.272	0.02379	0.03121	0.11817	0.55483
	20	0.28108	0.02537	0.0308	0.12125	0.5415

Table 7 - The VARMAX Procedure
(Vector Auto Regression Moving Average with Xs)

Type of Model	VECM(2)
Estimation Method	Maximum Likelihood Estimation
Cointegrated Rank	1

Long-Run Parameter Beta
Estimates When RANK=1

Variable	1
klci	1.00000
cop	*13.21702*
er	*113.14798*
olr	-64.25168
ms	-0.01043

These are the normalized long-run (variables at level) coefficients from the long-run regression by the system (via Johansen-Juselius Cointegration using lamda max etc). The respective COP and ER coefficients of 13.2170 and 113.1479 are actually indicating negative signs. This suggests that there is a negative relationship between KLCI and the two variables in the long-run. Any changes in the COP or ER, will leave a negative long-run effect on the KLCI. It is interesting to note that this finding is in line with investment theory that depreciating local currency and increasing crude oil price will lead to a plummeting stock market performance.

4. CONCLUSIONS AND POLICY IMPLICATIONS

The results from out-of-sample Granger causal chain via IRF and VDC are used to substantiate the findings in VECM (2). In other words, this procedure is actually a reconfirm exercise. Referring to the statistical properties in VECM(2), it is evident that the speed of adjustment of KLCI towards equilibrium point is rather weak, around 3%. As a result, the findings from out-of-sample Granger causal chain seem fail to support the hypothesized model. However, the results from Causality Test within sample clearly show that money supply (MS) does play an important role in influencing the performance of KLCI over short-horizon.

The research findings have important implications for policy makers, stock traders and fund managers, particulary in regulating and executing their investment strategies. In the case of money supply, it is now evident that any marginal or drastic changes in money supply can be regarded as an early signal that KLCI is about to make a movement in its course. As a leading economic indicator, any changes in money supply will definitely exert some impact on the performance of KLCI in both short-run and long-run. Although there are many other relevant factors that can influence the Malaysian stock market performance, money supply has been statistically proven to be one of the credible factors. Overall, this study has achieved its objectives in providing answers to the research questions. It is hoped that future research will into expanding the scope of the data analysis by using a broader set of market data. Having more comprehensive data sets will help improve the validity of this model and further enhance understanding of the relationship between the four investigated variables and the performance of KLCI.

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