The Effect of Oil Price Fluctuations on the Malaysian and Indonesian Stock Markets

Abdul Razak Abdul Hadi*, Mohamed Hisham Yahya** and Abu Hassan Shaari***

Abstract

This study is pursued with the objective of examining the effect of changes in crude oil price on the share prices of public listed companies on Bursa Malaysia and the Jakarta Stock Exchange as proxied by the Kuala Lumpur Composite Index (KLCI) and Jakarta Composite Index (JCI), respectively. The study employs the Engle-Granger Cointegration test and Error Correction Modelling (ECM). Using time series data from January 1986 through December 2006, this study finds a significant long-term relationship between the movement of crude oil price and the performance of the two stock markets. The two observed variables in both stock markets are also found to be positively correlated. The test results from Impulse Response Function and Variance Decomposition show the presence of a dynamic interaction between the movement in crude oil prices and the two stock market indices.

Keywords: Engle-Granger Cointegration Test, Error Correction Model, Granger Causality Test, Impulse Response Functions, Jakarta Composite Index, Kuala Lumpur Composite Index, Variance Decomposition Technique

JEL Classification: F40

1. Introduction

Sadorsky (1999) and Hamilton (1983) indicate that commodity prices, particularly energy prices, have a significant impact on a country's economy. This is true in the case of crude oil price (OP). Oil is a major

* Corresponding author. Abdul Razak Abdul Hadi is a Senior Lecturer at the International School of Entrepreneurship, Universiti Kuala Lumpur, 1016 Jalan Sultan Ismail, 50250 Kuala Lumpur Malaysia, e-mail: abdrazak@ise.unikl.edu.my.

** Mohamed Hisham Yahya is a Senior Lecturer at the Universiti Putra Malaysia, e-mail: m_hisham@econ.upm.edu.

*** Abu Hassan Shaari is a Professor at the School of Economics Study, Universiti Kebangsaan Malaysia, 43600 Bangi, Malaysia, e-mail: ahassan@ukm.my.

commodity, which is used in almost every aspect of an economy. The upward movement of oil price would put a heavy burden on an economy as a whole. This was observed in the month of May 2008 when the crude oil price shot to almost USD140 per barrel. There have been numerous studies done on the interrelationship between oil price and the economy (Hamilton, 1983; Gisser & Goodwin, 1986; Ferderer, 1996). Most of the studies concentrate on the relationship between oil price changes and the reaction of the economic activity that ensues. For example, Sadorsky (1999) and Lee (1992) studied the interrelation between energy prices, economic activity and employment.

Public listed companies on Bursa Malaysia have been the core for economic growth in Malaysia. These companies have a major role in the country's '*entrepreneuralisation*' programme, which creates a base for small and medium size entrepreneurs to penetrate into new local and international markets. A slowdown in the public listed companies which themselves are entrepreneurs would mean a slowdown in economic activities of the smaller size entrepreneurs. Moreover, as listed companies are being viewed as pillars in the economy, they play a crucial role in strengthening and widening the national economic activities as a whole. This is carried out through increasing Malaysia's export value and reducing the nation's dependency on imported goods.

Due to the huge contribution of public listed companies to the nation's industrial development and economic growth, the government has taken action to design a strategic plan for both public listed companies and small and medium sized enterprises. Strong interrelation and synergy between public listed companies and small and medium sized enterprises are established. Nonetheless, these public listed companies are still vulnerable to macroeconomic factors as demonstrated by the Asian Financial Crisis in 1997/8.

This study attempts to investigate the impact of fluctuations in oil price on the stock market performance in Malaysia and Indonesia. These two countries are chosen because both of them are oil exporting countries and are also former members of the Organization of the Petroleum Exporting Countries (Humberto, 2008). Oil price hike is seen as an early signal of a potential increase in the industrial production capacity which may subsequently exert some positive impact on the performance of the Malaysian and Indonesian stock markets. 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. Burbridge and Harrison (1984) find that oil price shocks, during the 1973 – 1974 oil embargo, had an impact on the economies of the United States, Canada, the United Kingdom, Japan and Germany.

This study is regarded as preliminary with the objective of determining the effect of fluctuations in oil price on the performance of stock markets in Malaysia and Indonesia (proxied by the Kuala Lumpur Composite Index (KLCI) and Jakarta Composite Index (JCI)). Haung, Masulis and Stoll (1996) examine the relationship between daily oil future returns and stock returns in the United States. They find that oil futures do lead some oil company stock returns but do not have much impact on the spot market indices in general. Chen, Roll and Ross (1986) examine the impact of oil price changes on asset pricing. They argue that asset pricing should be influenced more by "systematic" risk or the market risk.[1] They find no overall effect of oil price movement on stock prices. Nonetheless, oil prices will continue to have an impact on the economy as suggested by an OECD study.[2] It suggests that the global dependence for oil will continue, especially in the transportation sector.

It is now evident that the findings on the causal-effect relationship between oil price fluctuation and stock market performances around the world are rather inconclusive. As such this study is carried out to look for new insight on the subject matter and specifically try to answer the research questions below:

1. Does the fluctuation in the oil price affect the performance of listed companies in the short-run, as well as in the long-run?
2. Is there a causality interrelationship between the two stock market indices and the movement in oil prices?
3. What is the lead-lag relationship between the two stock market indices and the movement in oil prices?

2. Data and Methodology

To investigate the effect of oil price changes on the performance of public listed companies, a methodology used by Sadorsky (1999) is adopted and improvised. The research instruments used in this study involve the normality test, unit root test, Engle-Granger Cointegration test, ARIMA, Error Correction Model (ECM) and Granger Causality test. All these statistical tools are deployed to investigate the relationship between the

[1] This is in line with the asset-pricing theories of Ross (1976) and Cox et al. (1985).
[2] Organization for Economic Co-operation and Development (OECD Economic Outlook no. 76).

two broad based market indices (KLCI & JCI) and spot crude oil prices (OP) for a study period from January 1986 through December 2006. The movements of these three variables against the time line are shown in Figure 2, Figure 3, and Figure 4, respectively. The KLCI and JCI are proxies for measuring the performance of the stock market in Malaysia and Indonesia, respectively. Specifically, the research framework is summarised in Figure 1.

Figure 1: Research Framework

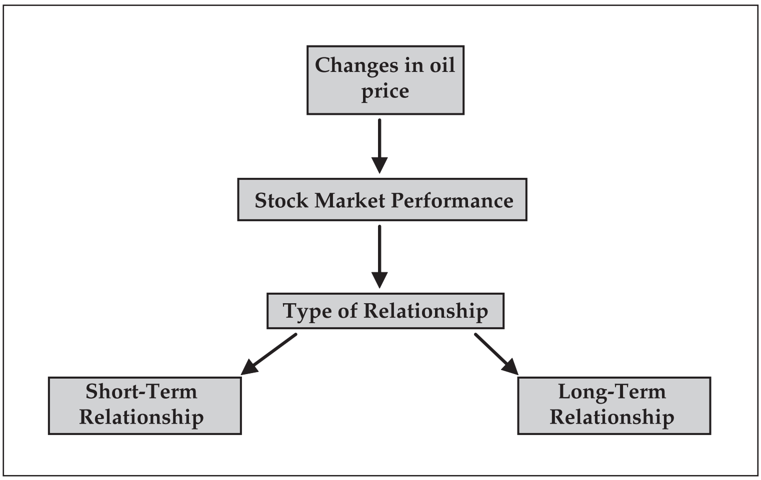


Figure 2: Movements of KLCI

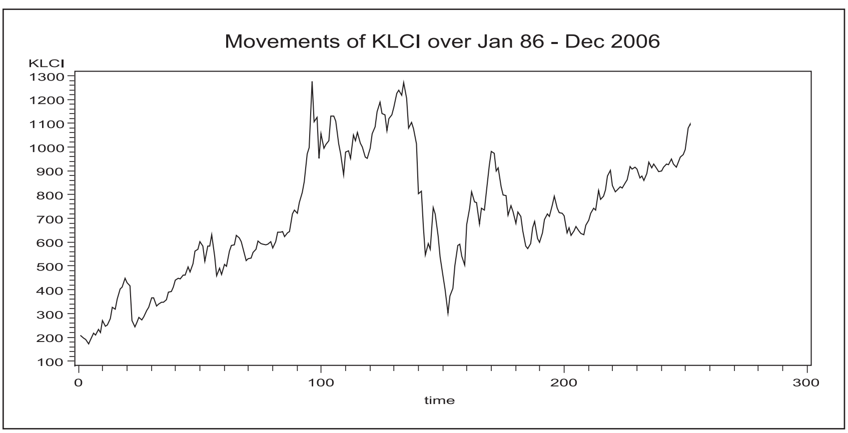


Figure 3: Movements of JCI

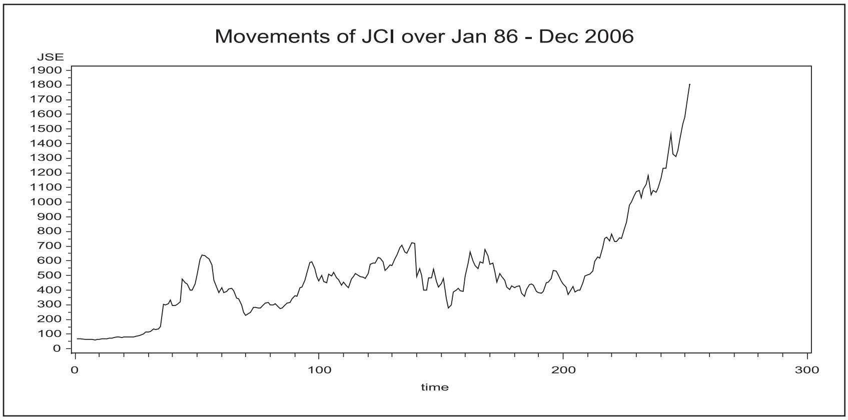
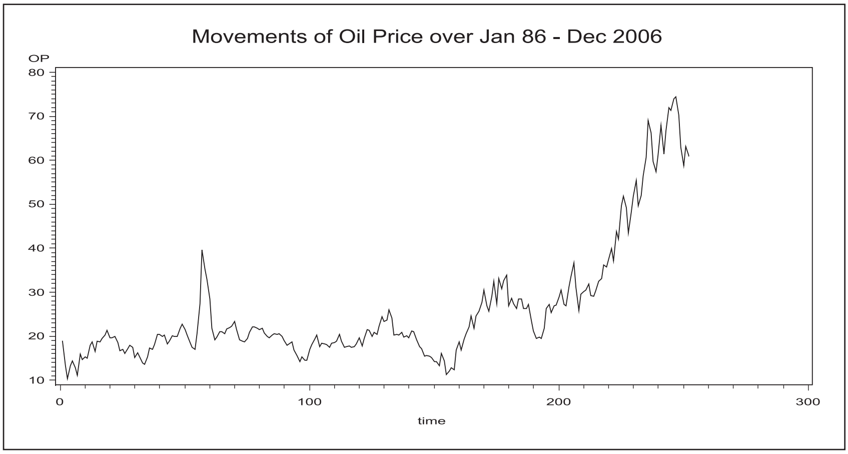


Figure 4: Movements of Oil Price (OP)



We performed unit root tests on the time series variables, followed by the Engle-Granger Cointegration test. Lastly, the Granger causality test (within Error Correction Modelling) is carried out to determine the presence of a short-term relationship between the tested variables.

We took monthly observations on changes to the level of oil price for 21 years. Its period spans from January 1986 to December 2006, involving 252 months. In evaluating the statistical relationship between the OP and the performance of KLCI, a procedure used by the Engle-Granger Cointegration test (1992) is deployed. This Cointegration test is a statistical concept introduced by Granger (1981), Granger (1986), Granger and Weiss (1983) and Engle and Granger (1987). Their new method of analysing time series data has received wide attention among researchers and is 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. Two variables are said to be cointegrated when a linear combination of the two is stationary, even though each variable is non-stationary on its own. 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 and 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.

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 a spurious regression relationship. This paper uses the Augmented Dickey Fuller test:

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

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: $\lambda_2 < 0$ (the 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 Error Correction Model (ECM) can be pursued.

The Vector Error Correction Model (VECM) is a restricted Vector Autoregressive method that involves Johansen-Juselius' multivariate cointegration. VECM restricts the long run behaviour of endogenous variables to converge to their cointegrating relationship while allowing for short run adjustments. The VECM model is shown below:

$$\Delta X_t = \mu_i + \sum_{i=1}^{n} A_i \Delta X_{t-i} + \sum_{i=1}^{n} \xi_i \Theta_{t-i} + v_t \quad (2)$$

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)

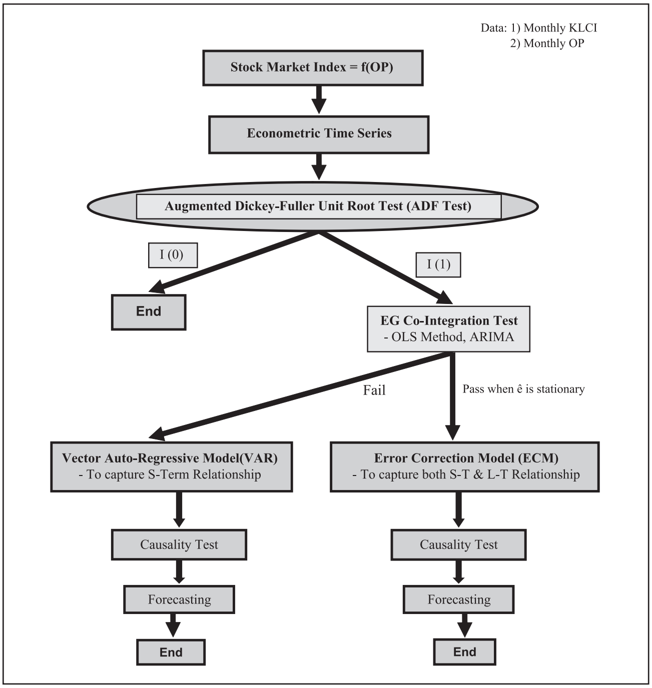
The VECM would allow us to separate short-term from long-term relationships.

The research flow is summarised in Figure 5 below. The study also applies the Ordinary Least Square Method (OLS), which is subjected to Classical Normal Linear Regression assumptions. These 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 the Augmented-Dickey Fuller unit root test, the Moments of Specification Test/White test, the Durbin-Watson test, the Anderson-Darling test and the Variance Inflation Technique are carried out. In investigating the relationship between stock market performance and movement in oil price, the study assumes one causal direction: changes in oil price affect stock market performance in Malaysia and Indonesia. Given the fact that an increase in the oil price will raise the opportunity cost of holding cash, this phenomenon will lead to a substitution effect between stocks and other financial securities. Specifically, the model of the study is developed as follows:

$$SMI_t = \beta 0 + \beta 1 OPt + \varepsilon_t \quad (3)$$

Where: *SMI = Stock market Index; OP = Oil Price Movements; β0 = Intercept β1 = Slope Coefficient;* ε_t *= Error Terms*

Figure 5: Research Flow on OP-Performance Effect



3. Empirical Findings

To show the effect of changes in crude oil price (OP) on the performance of the stock market, the procedures in time-series econometric modelling are deployed. Specifically, these procedures involve OLS, ARIMA, Cointegration test and ECM. To examine the data stationarity, a unit root test by Augmented Dickey-Fuller (ADF) is used and the results are shown in the Tables below.

Table 1 shows the results from the unit root tests performed on the KLCI and JCI. A hypothesis testing is carried out to determine the significance level of the stationarity test. *P*-values are reported, indicating the level of significance. The test statistics presented in Table 1 clearly show with all five different values of lags, it is noticeable that both the KLCI and JCI are non-stationary at all lags. Similarly, the test statistics presented in Table 2 also show that OP is non-stationary starting at all lags. On the other hand, Table 3 and Table 4 show that the first-differenced

Table 1: Stationarity Test for KLCI and JCI via ADF

Type	Lags	*p*-value (KLCI)	*p*-value (JCI)
ZERO	1	0.7644	0. 9977
MEAN	2	0.6877	0. 9980
	3	0.7529	0. 9979
	4	0.7729	0. 9975
	5	0.7736	0. 9980
SINGLE	1	0.3023	0. 9995
MEAN	2	0.1665	0. 9996
	3	0.2380	0. 9997
	4	0.2840	0. 9996
	5	0.3134	0. 9997
TREND	1	0.4725	0. 9989
	2	0.2358	0. 9992
	3	0.3925	0. 9993
	4	0.4660	0. 9993
	5	0.4938	0. 9996

Notes: H_0: Data series have a unit root (non-stationary)
H_1: Data series have no unit root (stationary)

Table 2: Stationarity Test for OP

Type	Lags	*p*-value	Tau
ZERO	1	0.8569	0.66
MEAN	2	0.9107	0.96
	3	0.9251	1.06
	4	0.9593	1.39
	5	0.9616	1.42
SINGLE	1	0.8450	-0.69
MEAN	2	0.9028	-0.42
	3	0.9347	-0.20
	4	0.9713	0.19
	5	0.9694	0.16
TREND	1	0.6880	-1.83
	2	0.8337	-1.48
	3	0.8721	-1.35
	4	0.9397	-1.01
	5	0.9463	-0.96

Notes: H_0: Data series have a unit root (non-stationary)
H_1: Data series have no unit root (stationary)

Table 3: Stationarity Test for First-Differenced KLCI and JCI via ADF

Type	Lags	*p*-value (KLCI)	*p*-value (JCI)
ZERO MEAN	1	<0.0001	<0.0001
	2	<0.0001	<0.0001
	3	<0.0001	<0.0001
	4	<0.0001	<0.0001
	5	<0.0001	<0.0001
SINGLE MEAN	1	<0.0001	<0.0001
	2	<0.0001	<0.0001
	3	<0.0001	<0.0001
	4	<0.0001	<0.0001
	5	<0.0001	<0.0001
TREND	1	<0.0001	<0.0001
	2	<0.0001	<0.0001
	3	<0.0001	<0.0001
	4	<0.0001	<0.0001
	5	<0.001	<0.001

Notes: H_0: Data series have a unit root (non-stationary)
H_1: Data series have no unit root (stationary)

Table 4: Stationarity Test for First-Differenced OP via ADF

Type	Lags	*p*-value	Tau
ZERO MEAN	1	<0.0001	-12.41
	2	<0.0001	-10.19
	3	<0.0001	-9.42
	4	<0.0001	-7.86
	5	<0.0001	-7.25
SINGLE MEAN	1	<0.0001	-12.49
	2	<0.0001	-10.29
	3	<0.0001	-9.55
	4	<0.0001	-8.03
	5	<0.0001	-7.47
TREND	1	<0.0001	-12.52
	2	<0.0001	-10.36
	3	<0.0001	-9.66
	4	<0.0001	-8.13
	5	<0.0001	-7.58

Notes: H_0: Data series have a unit root (non-stationary)
H_1: Data series have no unit root (stationary)

KLCI, JCI and OP series are stationary, respectively. This implies that the two stock market indices and OP are integrated at the first difference fulfilling the requirement set forth in the Enger-Granger Cointegration test.

The test results presented in Table 5 clearly show the acceptance of the alternative hypothesis for both stock markets. This statistical results suggest that there is a significant positive relationship between the individual stock market and the OP. However, in general, for OLS estimation to be statistically valid, Engle-Granger (1987) suggests that the error terms from a model must be time-invariant, that is, stationary. For this reason, the test for error terms stationarity is warranted. The results from the Dickey Fuller test and the Augmented Dickey Fuller test, presented in Table 6, show that the long-term residual (r) is stationary at all lags including lag 0. This finding indicates two important implications. First, having the long-term residuals stationary implies that there is a significant long-term relationship between the individual market and the OP. Second, having proven the long-term error terms are stationary, the individual stock market index and the OP are said to be cointegrated. Therefore, the Vector Error Correction Model can be mobilised for further analysis.

Table 5: Significance Test for Stock Market Index and OP Relationship

Variables in KLCI Model	Parameter Estimate	Standard Error	t-Value
Intercept	527.1777	32.9633	15.99*
OP	6.9149	1.1228	6.16*
Variables in JCI Model	Parameter Estimate	Standard Error	t-Value
Intercept	-2.0897	23.0959	-0.09
OP	19.3611	0.7867	24.61*

Notes: H_0: There is no long-term relationship between Stock Market Index and OP
H_1: There is a long-term relationship between Stock Market Index and OP

Table 6: Stationarity Test for Residuals (r) in KLCI Model

Type	Lags	*p*-value	Tau
ZERO	0	0.0211	-2.30
MEAN	1	0.0198	-2.32
	2	0.0093	-2.60
	3	0.0154	-2.42
	4	0.0213	-2.30

Notes: H_0: Residuals have a unit root (non-stationary)
H_1: Residuals have no unit root (stationary)

Table 7: Stationarity Test for Residuals (r) in JCI Model

Type	Lags	*p*-value	Tau
ZERO	0	0.0128	-2.49
MEAN	1	0.0015	-3.21
	2	0.0050	-2.82
	3	0.0084	-2.64
	4	0.0166	-2.39

Notes: H_0: Residuals have a unit root (non-stationary)
H_1: Residuals have no unit root (stationary)

3.1 *Error Correction Model (ECM)*

The Error Correction Model is deployed to investigate both long-term and short-term responses between the two tested variables. Based on the regression results, the optimum lag-length for the VECM lies at lag 2 (as indicated by its lower AIC). Specifically, the test results are shown in Table 8 below.

Table 8: Error Correction Model at Lag 2 or ECM(2)

Dependent Variable: dKLCI				
Variables	Parameter	Standard Error	t-Value	*P*-Value
Intercept	3.0702	3.4155	0.90	0.3696
ldop	-0.5565	1.3015	-0.43	0.6693
l2dop	-0.1407	1.2959	-0.11	0.9136
lr	-0.0364	0.0141	-2.58	0.0105*
ldklci	0.0373	0.0622	0.60	0.5493
l2dklci	0.2141	0.0626	3.42	0.0007

Table 9: Error Correction Model at Lag 2 or ECM(2)

Dependent Variable: dJCI				
Variables	Parameter	Standard Error	t-Value	*P*-Value
Intercept	6.5817	2.9710	2.22	0.0277
ldop	-1.9642	1.1226	-1.75	0.0814
l2dop	-1.9868	1.1297	-1.76	0.0799
lr	-0.0271	0.0188	-1.44	0.1514*
ldjci	0.1632	0.0650	2.51	0.0128
l2djci	0.0028	0.0665	0.04	0.9664

The *lr* is the error correction term at lag 1 and it measures the statistical long-term relationship between OP and the performance of the two stock markets. Its significance test is reported by the *p*-value. The *p*-value in Table 8 (0.0105/2 = 0.0052) indicates that there is a significant long-term relationship between OP and *dklci* at the 5 per cent level. Meanwhile, the *p*-value in Table 9 (0.1514/2 = 0.0757) shows the same inference but is only significant at the 10 per cent level. In these two instances, the individual *p*-value is divided by two as VECM lies on the premise of one-tail residuals distribution. Given the presence of a long-term relationship between the individual stock market and OP, there is a probable short-term relationship between them as well. To investigate if such a relationship exists, a Granger-Causality test is performed and its test statistic is reported in Table 10 below (via Simultaneous Wald F-test). The F-value reported in Table 10 indicates the acceptance of a null hypothesis in which the short-term relation between KLCI and OP is absent. On the other hand, the F-value reported in Table 11 shows the presence of a significant short-term relation between JCI and OP. This also implies that OP 'Granger-causes' JSI and therefore, OP is indeed a leading economic indicator.

Table 10: Short-term Relationship Between KLCI and OP

Source	DF	Mean Square	F-Value	Pr>F
Numerator	2	285.7119	0.10	0.9048
Denominator	243	2856.0137		

Note: significant at 5% level

Table 11: Short-term Relationship Between JCI and OP

Source	DF	Mean Square	F-Value	Pr>F
Numerator	2	6690.9686	3.19	0. 0427
Denominator	243	2094.4989		

Note: significant at 5% level

Although VECM is able to address the issues of exogeneity and endogeneity, as well as the direction of causality within the data collection period, evidently, this technique is still lacking in its ability to provide an understanding of the relative strength of the observed variables beyond the sample period. As such, the Impulse Response Functions (IRF) and the Variance Decomposition (VDC) techniques are deployed to tackle this problem. As shown in Appendix 1A and Appendix 1B, a one-standard deviation shock to OP results in some positive response in KLCI and JCI, respectively. This finding implies that the two stock market indices are sensitive towards changes in OP.

The Granger-causal chain implied by VDC in Table 12 suggests that in both stock markets, the OP usually leads the two stock market indices. For instance, in the OP model after a 5-month horizon, about 99.9 per cent of the forecast error variance of OP is explained by its own shock (compared to 99.6 per cent in the case of market indices). With regard to the out-of-sample causality test, it is therefore evident that the OP is the leading indicator as proven by both IRF and VDC.

Table 12: Proportions of Prediction Error Covariances by Variable

Variable	Lead	klci	op
klci	1	1.00000	0.00000
	2	0.99991	0.00009
	3	0.99994	0.00006
	4	0.99987	0.00013
	5	0.99663	0.00037
op	1	0.00003	0.99997
	2	0.00010	0.99990
	3	0.00006	0.99994
	4	0.00008	0.99992
	5	0.00019	0.99981
Variable	Lead	jci	op
jci	1	1.00000	0.00000
	2	0.99753	0.00247
	3	0.99812	0.00188
	4	0.99830	0.00170
	5	0.99675	0.00325
op	1	0.00120	0.99880
	2	0.00088	0.99912
	3	0.00064	0.99936
	4	0.00161	0.99839
	5	0.00453	0.99747

3.2 Moments of Specification Test or White Test

To ensure that the Ordinary Least Square (OLS) assumptions are intact, diagnostic tests are performed on the two vector error correction models. To see whether the error terms have constant variance, the moments of specification test or White test is performed. The test results are shown in Table 13. From the test statistic in Table 13, the study fails to reject H_0 at the 5 per cent significance level. This indicates that the residuals are homoscedastic or having constant variance for both models.

Table 13: Moment of Specification Test

Dependent Variable (y): dKLCI		
White Test	Chi-square	Pr > ChiSq
	29.44	0.0794
Dependent Variable (y): dJCI		
White Test	28.50	0.0981

Notes: H_0: Homoscedastic (Constant variance in εt)
H_1: Heteroscedastic (Inconstant variance in εt)

3.3 Test for Normality

Before any statistical inference can be made, the error terms distribution must be checked for normality. The test statistics for normality are based on the empirical distribution function, which involves Shapiro-Wilk, Kolmogorov-Smirnov, Cramer-von Mises, and Anderson-Darling statistics.

The results from all the normality tests, as shown in Table 14 (see *p*-value), indicate the rejection of the null hypothesis at the 5 per cent significance level. This means that the error terms from the ECM(2) are not normally distributed. However, given the large sample size, this result is not considered to be a major flaw in the financial modelling.

3.4 Autocorrelation Test

The Autocorrelation Test is performed to examine whether the residuals are independent of one another. The test results are presented in Table 15. The empirical findings from the Durbin-Watson tests show that the residuals are independent of one another in the two models.

Table 14: Test for Normality

Variable: r3 in KLCI Model			
Test		Statistic	P-Value
Shapiro-Wilk	W	0.955517	<0.0001
Kolmogorov-Smirnov	D	0.087128	<0.0100
Cramer-von Mises	W-Sq	0.407759	<0.0050
Anderson-Darling	A-Sq	2.455191	<0.0050
Variable: r3 in JCI Model			
Test		Statistic	P-Value
Shapiro-Wilk	W	0.940012	<0.0001
Kolmogorov-Smirnov	D	0.102006	<0.0100
Cramer-von Mises	W-Sq	0.889655	<0.0050
Anderson-Darling	A-Sq	4.554859	<0.0050

Notes: H_0: ECM residuals are normally distributed
H_1: ECM residuals are not normally distributed

Table 15: Autocorrelation Test

Dependent Variable: dKLCI	
Durbin-Watson D	1.935
Number of Observations	249
1st Order Autocorrelation	0.031
Dependent Variable: dJCI	
Durbin-Watson D	1.989
Number of Observations	249
1st Order Autocorrelation	-0.000

Note: Rule of thumb: 1.90 – 2.00
(no serial correlation or autocorrelation)

3.5 Variance Inflation Test (VI)

To examine whether the independent variables are not related to one another, the Variance Inflation test (VI) is carried out and the results are as shown in Table 16.

Table 16: Variance Inflation Test

Variables						
Dependent Variable: dKLCI Parameter Estimates						
Variable	DF	Parameter Estimates	Standard Error	t-Value	Pr> t	Variance Inflation
Intercept	1	3.0702	3.4155	0.90	0.3696	0
ldop	1	-0.5565	1.3015	-0.43	0.6693	1.00379
L2dop	1	-0.1407	1.2959	-0.11	0.9136	1.00434
lr	1	-0.0364	0.0141	-2.58	0.0105	1.01884
ldklci	1	0.0373	0.0622	0.60	0.5493	1.00939
l2dklci	1	0.2141	0.0626	3.42	0.0007	1.01039
Dependent Variable: dJCI Parameter Estimates						
Variable	DF	Parameter Estimates	Standard Error	t-Value	Pr> t	Variance Inflation
Intercept	1	6.5817	2.9710	2.22	0.0277	0
ldop	1	-1.9642	1.1226	-1.75	0.0814	1.0182
L2dop	1	-1.9868	1.1297	-1.76	0.0799	1.0407
lr	1	-0.0271	0.0188	-1.44	0.1514*	1.1642
ldjci	1	0.1632	0.0650	2.51	0.0128	1.0730
l2djci	1	0.0028	0.0665	0.04	0.9664	1.0861

Note: Rule of thumb: VI < 10 (no multicollinearity)

The test results from Table 16 show that none of the independent variables in the two models are subject to the multicollinearity problem as their variance inflation values lie below 10. As a whole, the overall diagnostic tests show that the two models possess credible econometric properties and are considered statistically valid. As shown in Figure 6 and Figure 7, the individual CUSUM analysis indicates the presence of parameter (short-run and long-run parameters) stability in the two VECM models over the sample period. These findings support the constancy of the coefficients in both models.

Figure 6: Plot of CUSUM in Estimated ECM(2) Involving KLCI

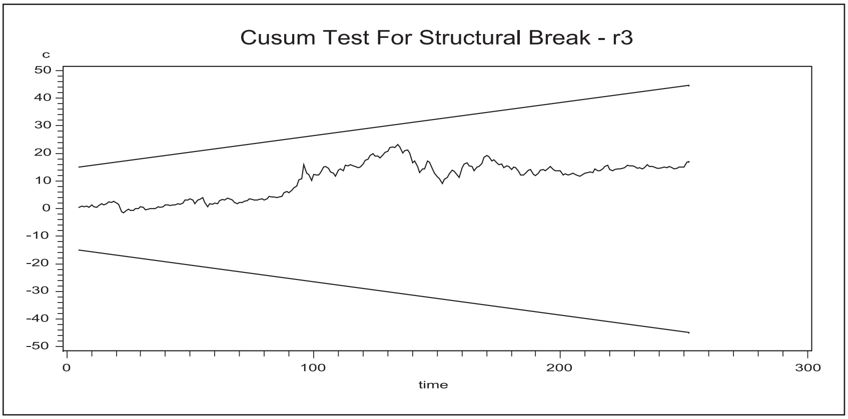
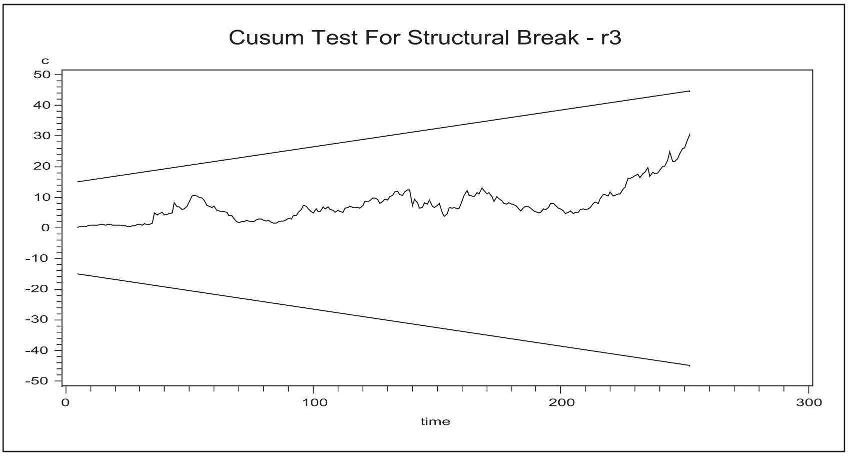


Figure 7: Plot of CUSUM in Estimated ECM(2) Involving JCI



4. Summary and Conclusion

This study is pursued with the objective of examining the effect of changes in oil price on the performance of emerging stock markets, namely, the Bursa Malaysia and Jakarta Stock Exchange. This is an important study because both countries are oil-producing countries and former members of OPEC. As such, they are expected to enjoy economic gains from rising oil prices. The oil and gas industries in both countries play a major role in generating economic growth and are likely to affect the viability of their financial markets.

Using time series data from January 1986 through December 2006, this study employs the Engle-Granger Cointegration test and the Vector Error Correction Model. From the empirical tests conducted, the study shows that there is a statistically significant long-term relationship between the performance of the two stock markets and the oil price movements. The empirical results from the Granger Causality test within sample show that a significant short-term relation exists between the JCI and OP (as shown by the test results in Simultaneous Wald F-test). Even though the study fails to support the presence of a dynamic relation between the OP and KLCI in the Malaysian stock market within the period of data collection, the test results from the out-of-sample Granger Causality test (via IRF and VDC) have confirmed the direction of causality. Thus, OP is relatively the 'leading' variable or the most exogenous of all in the cases of Bursa Malaysia and the Jakarta Stock Exchange.

The research findings have important implications for policy makers, stock traders and fund managers in both countries, particularly in regulating and executing their investment strategies in the emerging stock markets. For instance, in the case of the Jakarta Stock Exchange, a steady increase in oil price can be regarded as an early warning that the stock market is about to make a correction in its course. As crude oil price is considered a leading indicator in the case of the Malaysian and Indonesian stock markets, the fluctuation of the OP will definitely have some impact on the stock market performance in both the short-run and long-run. Although there are many other relevant factors that can influence stock market performance, oil price movement has been statistically proven to be one of the credible factors. There is no doubt that this finding is a violation of the efficient market theory which postulates that prices of securities in stock market are fairly priced and it is impossible to outperform the market. The use of Malaysian and Indonesian stock market samples has resulted in somewhat consistent findings and these will benefit stock traders and fund managers at most, particularly in formulating effective investment strategies in the emerging stock markets. Overall, this study has achieved its objectives in providing answers to the research questions.

It is hoped that future research will look into expanding the scope of the data analysis by using a broader set of emerging market data. As more data on emerging stock markets has become available, it is desirable to make this study more robust in the future. Having more comprehensive data sets will help improve the validity of the model and further enhance understanding of the relationship between oil price movements and stock market performance. Continuous improvement in the study is essential because new findings will provide an important insight and implications for policy makers and the investment community at large.

References

Burbridge, J., & Harrison, A. (1984). Testing for the effects of oil-price rises using vector autoregressions. *International Economic Review*, *25*(1), 459–484.

Chen, N., Roll, R., & Ross, S. A. (1986). Economic forces and the stock market. *Journal of Business*, *59*(3), 383–403.

Cox, J, Ingersoll, J., & Ross, S. (1985). An intertemporal general equilibrium model of asset prices. *Econometrica*, 53, 363-384.

Engle R.F., & Granger, C.W.J. (1987). Co-integration and error correction: Representation, estimation and testing. *Econometrica*, *55*, 251–276.

Faff, R.W., & Brailsford, T.J. (1999). Oil price risk and the Australian stock market. *Journal of Energy Finance and Development*, *4*, 69–87.

Ferderer, P.J. (1996). Oil price volatility and the macroeconomy. *Journal of Macroeconomics*, *18*(1), 1–26.

Gisser, M., & Goodwin, T. H. (1986). Crude oil and the macroeconomy: Test of some popular notions. *Journal of Money Credit Banking*, *18*(1), 95–103.

Granger, C.W.J. (1981). Some properties of time series data and their use in economic model specification. *Journal of Econometrics*, *16*(1), 121–130.

Granger, C.W.J. (1986). Development in the study of cointegrated variables. *Oxford Bulletin of Economics and Statistics*, *48*, 213–228.

Granger, C.W. J., & Weiss, A. (1983). *Time series of error correction models in Studies in Econometrics. Time series and multivariate statistics*. New York: Academic Press.

Hamilton, J.D. (1983). Oil and the macroeconomy since World War II. *Journal of Political Economics*, *92*(2), 228–248.

Haung, R.D., Masulis, R.W., & Stoll, H.R. (1996). Energy shocks and financial markets. *Journal of Futures Markets*, *16*(1), 1–27.

Humberto, M. (2008). Indonesia leaves OPEC, GM downsizes. Asia Times. Retrieved May 31, 2010, from http://www.atimes.com/atimes/Southeast_Asia/JF10Ae03.html.

Johansen, S., & Juselius, K. (1990). Maximum likelihood estimation and inference on cointegration with the application to the demand for money. *Oxford Bulletin of Economics and Statistics, 52*,169–210.

Lee, B. (1992). Causal relationships among stock returns, interest rates, real activity, and inflation. *Journal of Finance*, *38*(4), 1591–1603.

Ross, S.A. (1976). The arbitrage theory of capital asset pricing. *Journal of Economic Theory*, *13*, 341–360.

Sadorsky, P. (1999). Oil price shocks and stock market activity. *Energy Economics*, *21*, 449–469.

Appendix 1A

Impulse Response by Variable in Bursa Malaysia

Variable	Lag	klci	op
klci	1	1.01078	-0.28390
	2	0.98060	0.02679
	3	0.94927	0.38023
	4	0.91902	0.72403
	5	0.88994	1.05462
	6	0.86201	1.37223
	7	0.83517	1.67736
	8	0.80939	1.97049
	9	0.78463	2.25209
	10	0.76084	2.52262
	11	0.73798	2.78252
	12	0.71602	3.03219
	13	0.69492	3.27205
	14	0.67466	3.50248
	15	0.65519	3.72385
	16	0.63649	3.93651
	17	0.61852	4.14082
	18	0.60126	4.33709
	19	0.58467	4.52564
	20	0.56874	4.70678
op	1	-0.00036	1.04338
	2	0.00022	1.03895
	3	0.00086	1.03179
	4	0.00148	1.02471
	5	0.00208	1.01789
	6	0.00266	1.01135
	7	0.00321	1.00505
	8	0.00374	0.99901
	9	0.00425	0.99320
	10	0.00475	0.98762
	11	0.00522	0.98226
	12	0.00567	0.97712
	13	0.00610	0.97217
	14	0.00652	0.96742
	15	0.00692	0.96285
	16	0.00731	0.95847
	17	0.00768	0.95425
	18	0.00804	0.95021
	19	0.00838	0.94632
	20	0.00871	0.94258

Appendix 1B

Impulse Response by Variable in Jakarta Stock Exchange

Variable	Lag	jci	op
jci	1	1.13616	-1.33010
	2	1.12323	-0.56860
	3	1.07471	0.63858
	4	1.02225	1.83437
	5	0.97412	2.90642
	6	0.93193	3.83934
	7	0.89548	4.64337
	8	0.86414	5.33409
	9	0.83724	5.92683
	10	0.81417	6.43530
	11	0.79437	6.87142
	12	0.77739	7.24548
	13	0.76283	7.56631
	14	0.75035	7.84147
	15	0.73963	8.07747
	16	0.73045	8.27988
	17	0.72257	8.45348
	18	0.71581	8.60237
	19	0.71001	8.73007
	20	0.70504	8.83960
op	1	-0.00335	1.01249
	2	-0.00130	0.94894
	3	0.00190	0.87318
	4	0.00506	0.80205
	5	0.00789	0.73926
	6	0.01035	0.68489
	7	0.01247	0.63811
	8	0.01429	0.59794
	9	0.01586	0.56348
	10	0.01720	0.53392
	11	0.01835	0.50857
	12	0.01934	0.48682
	13	0.02018	0.46817
	14	0.02091	0.45218
	15	0.02153	0.43846
	16	0.02207	0.42669
	17	0.02252	0.41660
	18	0.02292	0.40794
	19	0.02325	0.40052
	20	0.02354	0.39415