OIL PRICES AND THE MALAYSIA ECONOMY

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This paper studies the impact of oil prices on GDP in Malaysia. In particular, three types of oil prices; world oil price (PW), world oil price in domestic currency (PWD), and domestic oil price (PD) are tested against the GDP within VAR framework. The results have documented positive relationship between GDP and oil prices, particularly the PWD and the PD oil prices. *In the asymmetric test, significant result is documented in PD analysis only*. *The finding signifies the presence of asymmetric relationship between oil price changes and the economy.*

Field of Research: Macroeconomics

1. INTRODUCTION

Since mid-2004, the price of crude oil has increased substantially in the world market. For example, the West Texas Intermediate (WTI, a reference price used in the United States and globally) increased from US$19 per barrel in 1993 to US$31 in 2003. In October 2004, it reached US$51 and in 2005 it went up to US$67 per barrel, and continues increasing exceeding US$70 in April 2006 and finally recorded its highest of US$102.08 a barrel in April, 2008.

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Factors like depletion in oil supply, increasing oil consumption, particularly from emerging industry in third world nations like China and India and political instability in oil producing countries are being blamed as the main causes for these increases. These events have triggered global panic that causes many countries to review and restructure their economic policies to offset the negative impacts.

In the case of Malaysia, oil price is set by the government. It is under government subsidy since 1970s. Despite the fact that Malaysia is exporting oil, the country also imports oil from other countries. The surplus of exporting value over the importing value makes Malaysia a net oil exporting country. Despite these facts, the repercussions from price increase in the world market could not be avoided from spill-over to the local market.

Being a government control item, the event of oil price surge has inflicted a soaring fuel subsidy[1] bill to the government. This situation pressured the Malaysian government to review its policy on oil prices and finally decides implement oil price increase in the local market.[2] The government's decision to slowly liberalize the local oil market has triggered mixed responses from the public, particularly households and business units. This is because, being a major energy resource to Malaysia's industries, the increase in oil prices is likely to push the overall price level, and adversely affect the economy. In particular, to the household, higher oil prices directly means taking a bigger percent of their income for gasoline expenses. Moreover, the inflation that results from higher oil prices will reduce the monetary value and adversely affect their expenditures and demand for goods and services. On the producers' side, a higher oil price is associated with higher input price. Production at higher cost will not only cause reduction in quantity of output produced but also push the price of output sold in the market to be higher.

The event of oil price increase and the publics' reaction to it has raised an important question of the impact of oil price on the economy. To answer the question, such a study deserves particular attention. In light of this, we are motivated to conduct a study in this area, specifically focusing on the impact of oil price shocks on Malaysia's GDP.

Issues of the study

In the literatures of oil price-GDP relationships, earlier studies, which include Pierce and Enzler (1974), Rasche and Tatom (1977), Mork and Hall (1980), Darby (1982), and Bruno and Sachs (1982, 1985) have all documented and explained the inverse relationship between oil price increases and aggregate economic activity. Later, studies by Gisser and Goodwin (1986) and Hickman et al. (1987), empirically proved and confirmed the inverse relationship between the variables for the United States.

Despite these findings, there are three issues at hand. Firstly, the evidenced of inverse relationships between oil prices and GDP in majority of the studies, however are subject to the usual linear framework. From empirical viewpoint, it is well known that asymmetries may exist in the links between the two variables. Rising oil prices generally retard aggregate economic activity by more than falling oil prices stimulate it or large decreases in oil prices are generally not followed by booms in economic activity. In order to apprehend this fact, this study employs the oil transmission method proposed by Jimenez-Rodriguez and Sanchez (2004) to capture for these asymmetric effects.

The second issue is related to the scope of the study. Majority of the existing studies concentrates on developed economies such as the United States and OECD countries, which represent established markets in world economy. Concisely, these studies, which aim to explore the oil price changes-GDP growth or the mechanisms, are only relevant for the US (United States) and/or to other developed economies. Little attention has been devoted to examine the effects of the fluctuations in oil prices on output (or other economic indicators and markets) for other types of economies, i.e. developing economies.[3] Further research on the effects of the oil price movements, especially pertaining to the developing country situation, is needed. Such a study would not only fill the gap that the oil macroeconomics literature lacks but would also serve to the needs of the policy makers.

The third issue is related to oil price variable used in the empirical analysis. In many studies, the study on oil price impact uses world oil price (PW), while a number of studies use world oil price converted in domestic currency (PWD) to represent the oil price variable in their model specification. The findings from these researches give mix results. Taking into account that oil price in Malaysia is set by the government, an important question raised here, how does the economy respond to changes in domestic oil price? Moreover, which oil price is most prominent in explaining the changes in the economy due to oil price shocks?

The issues highlighted provide us a motivation to conduct the study in this area. The general objective of this study is to investigate the impact of oil price on GDP. Specifically, the research aims to examine the dynamic interaction between oil prices and GDP, and to test the asymmetric effect of oil price changes on the GDP. Each analysis is tested against three types of oil price, PWD, PD and PW. The Vector Autoregressive (VAR) technique is employed to test the dynamic interactions between oil price(s) and GDP, while test on asymmetric relationship uses the Wald test method. The findings are expected to benefit us not only in providing empirical evidence on the impact of oil price to GDP but also to assist policy makers in recognizing in advance the extend of oil price effect on real market and guide them in policy designing. With the understanding and the application of the right policy tools, the detrimental effect of oil price increase in the economy could be avoided or lessened.

The organization of this paper starts with part 1 which covers the introduction part. The following two parts are the literature review and methodology. The last two parts are results reporting and conclusion.

2. REVIEW OF LITERATURE

Considerable number of researches relating to oil price impact on the economy has been conducted. Darby (1982) had one of the earliest econometric studies that attempted to estimate the economic effects of oil shocks.[4] His study aimsed to determine what had caused the 1973-1975 recessions in the US. He figured that, oil shock's effect on the economy was statistically significant and estimated the 1973 oil shock caused a total cumulative decrease in GNP of 2.5%. In the following year, Hamilton (1983) published what many would consider to be the seminal study on oil shocks.[5] He drew attention to the fact that all but one of the post-war recessions had been preceded by a sharp rise in the price of oil, and set out to demonstrate statistically that, contrary to conventional wisdom, it was oil price increase that caused the recessions.

Based on Hamilton's work, Burbidge and Harrison (1984) examined the impact of oil price shocks on several macroeconomic variables[6] in seven OECD countries. They converted their VAR estimation into vector moving average (VMA) representation to examine the impact of oil price shocks and used this to analyze the 1973-74 and 1979-80 oil price shocks. The results obtained showed that the 1973-1974 oil embargoes explain a substantial part of the behavior of industrial production (economic activity) in each of the countries examined. All findings appear to be consistent with the work of Hamilton (1983) except for the oil price shock in 1979-1980. In the analysis, they find little evidence that the changes in oil prices had an effect in industrial production. Gisser and Goodwin (1986) tried to capture the effects of monetary policy, fiscal policy, and oil price changes on economic growth, inflation, and unemployment. They figured that the effects of fiscal policy on GNP and unemployment are smaller than the effects of oil price changes, although larger than the effects on the price level.

Beyond establishing a relationship between oil price movements and aggregate economic activity, research on economic response to oil price shocks has gone in several directions. For example, Mork (1989) focuses on the asymmetric effects. Mork hypothesized that, unlike oil price increases, price declines had little effect on the economy. His regressions confirmed his hypothesis — when the distinction between price increases and decreases was made, the effect of price increases on GNP growth doubled, whereas price declines had a small and statistically insignificant effect.

Lee, Ni and Ratti (1995) look into oil price shocks and real U.S GNP growth from 1949 to 1992 in a framework similar to that of Hamilton (1983) and Mork (1989). Other than asymmetric relationships, they also investigate the impact of oil price volatility to the macroeconomy by means of Generalized Autoregressive Conditional Heteroskedasticity (GARCH) model. The results obtained showed that, oil price volatility significantly affect the GNP and they also find asymmetric effects between positive and negative normalized shocks.

Similar to Lee, Ni and Ratti (1995), Ferderer (1996) also believed that oil price volatility was the missing factor that could explain oil's macroeconomic effects and added a variable to capture volatility to his regressions that previous studies lacked. Using industrial production growth as a proxy for economic growth, he found that monthly oil price changes could statistically explain 5.7-18.5% of the fluctuations in industrial production, and oil price volatility could explain an additional 11.7-16.1% of the fluctuations.

Hamilton (1996) has posited that the reason why standard regressions do not find that oil has a strong effect on economic growth is due to mis-specification. Hamilton (2000) demonstrated that non-linear specifications suggest that oil has stronger effects than linear specifications.[7] Hamilton also noted that regression results may be hampered because the oil price can no longer be treated as exogenous, that is, it can now be driven by demand or supply. A recent paper by Rodriguez and Sanchez (2005) updates Mork's (1989), Hamilton's (1996), and Lee et al's (1995) respective work. Using standard vector autoregression methods, the analysis on oil price impact on real economic activities is carried out using both linear and non-linear models. From the findings they find evidence of non-linear impact of oil prices on real GDP. In particular, oil price increases are found to have an impact on GDP growth of a larger magnitude than that of oil price declines, with the latter being statistically insignificant in most cases.[8]

Other analyses as such are conducted by Bohi (1991), Smyth (1993), and Cunado and Perez de Garcia (2004) and all reported asymmetric effects in their studies.

The study on oil price impact is also extended to global economies, which compares the effect between developed and developing economies, and also oil price impact on importing and exporting countries. The few studies are, IMF (2000), Abeysinghe (2001), and finally Abeysinghe and Forbes (2001)

IMF (2000) in general, presents a study on the impact of oil price increase on global economy. In particular, the differential impact of an oil price increase of US$5 per barrel on developed and developing countries is assessed. The study figures that, the impact is found to be greater for developed countries than for developing countries as a group. In regional analyses, the results obtained vary widely, depending on the relative size of oil importing to exporting countries. Oil shocks are explained to lead to lower aggregate demand since the oil price increase redistributed income between the countries that are net oil importers and exporters. The study also figure that, the degree of influence of oil price changes on oil-importing countries is found to be different from those of oil-exporting and small open economies. The contributing factors for these differences are explained by different oil intensity levels in domestic production, exports and imports, and degree of openness of an economy. In addition, the study also provides evidence that oil price changes tend to be positively correlated with the economic growth of the oil-producing countries. The study also provides estimates of the first round impact of higher oil prices on GDP growth for some ASEAN countries, namely Indonesia (+0.5%), Malaysia (+0.2%), Philippines (-0.5%), and Thailand (-0.4%).

Abeysinghe and Forbes (2001) develop a structural VAR model to measure how a shock to one country can affect the GDP of other countries. It uses trade linkages to estimate the multiplier effects of a shock as it is transmitted through other countries' output fluctuations. This model is then used to examine the impact of shocks to eleven Asian countries, the U.S., and the OECD countries. The results obtained show that the ASEAN countries, with relatively smaller economies and are heavily dependent on oil, are much more vulnerable than the OECD economies when faced with world oil prices changes. They also discover that, the United States economy has more control over few variables, i.e. interest rates, which makes it practical to absorb the negative impact of oil price shocks.

Abeysinghe (2001) narrow down the study of IMF (2000) on the impact of oil price changes by focusing on only 12 economies, which includes Indonesia, Malaysia, Singapore, Philippines, and Thailand. By using data over the 1978-1998 periods, this study evaluates the direct and indirect effects of oil prices on GDP growth of these economies. Using a reduced form of bilateral export functions and structural VAR models to link up the GDP series through a trade matrix as proposed by Abeysinghe and Forbes (2001), the study demonstrates that high oil prices affect these economies both directly and indirectly (works through the network of an economy's trading partners). The findings also implied that, a shock to one country is found to have a statistically significant impact on other countries even if they are relatively minor bilateral trading partners. Consequently, net oil-exporters such as Indonesia and Malaysia are shown to be unable to avoid the negative impacts of high oil prices.

Cunado and Gracia (2003) have reported different results than the predicted. The study on oil price impact is conducted on 15 European countries gives mixed results. They conclude that, the use of either world oil price index or a national real price index is part of the explanation to the difference. Moreover, they could not find any cointegrating long-run relationship between oil prices and economic activity except for the United Kingdom and Ireland. Therefore, they suggest that the impact of oil shocks on economic activity is limited to the short run. Cunado and Perez de Gracia (2004) extend their analysis by conducting a comparative study on the influences of oil price changes for some small and open economies for six Asian countries, including Malaysia, Singapore, Philippines, Thailand, and also on OECD countries. The results obtained suggest that oil prices have a statistically significant effect on both economic growth and inflation although the impact is limited to the short-run. When compares the two studies, they figured that the effect on the Asian countries is found to be marginal relative to the effect on OECD countries.

3. METHODOLOGY

Data Descriptions

This study uses quarterly data for a time span of 1991.1 to 2005.4. The analysis of oil price impact on GDP uses three types of oil prices; world oil price (PW), world oil price converted into domestic currency value (PWD)[9], and domestic oil prices ((PD). The world oil price variable is derived from West Texas Intermediate (WTI)[10] crude oil prices, while PWD is the world oil price (WTI) in RM value.[11] The last oil price variable is the diesel oil price (in RM per liter)[12], representing domestic oil prices. The world oil price is deflated using world CPI, while the domestic oil prices use domestic producer's price index. We employ VAR modeling to capture the impact of oil price on GDP. All data used in the analyses are expressed in real terms[13], i.e. deflated by CPI-deflator. All data also are transformed by taking the natural logarithm of the real data.

The data are obtained from the Bloomberg, International Financial Statistic CD-Rom, various issues of Bank Negara Annual Report, the KLSE website and the EIA website.

Model Specification

The model specification for the current study is denoted as;

GDP_t = (OIL, INV, MS),

where GDP is the dependent variable, OIL, INV and MS represent oil price, investment and money supply variables. The analysis is conducted within VAR framework.
The VAR model is specified as follows;

$$y_t = A_0 + \sum_{k=1}^{p} A_k + y_{t-k} + e_t \qquad [1]$$

Where y_t is an *n x 1* vector of non-stationary *I(1)* variables, n is the number of variables in the system, in this study four in each case. A_0 is *n x 1* vector of constant terms, A_k is an *n x n* matrix of coefficients, e_t is an *n x 1* vector of error terms, which is independent and identically distributed, and *p* is the order of autoregression or number of lags. In this study we use quarterly frequency data for real market analysis and for stock market analysis, which employs monthly data.

The interpretation of model (1) is normally based on its moving average representations. By inverting or successive substitution, VAR model (1) has a moving average representation as follows;

$$y_t = B + \sum_{k=0}^{\infty} B_k e_{t-k} \qquad [2]$$

Thus, y_t is expressed as a linear combination of current and past innovations. Based on (2), impulse response functions are simulated for assessing dynamic effects of oil price shocks on output (GDP).

Unit Root and Cointegration Tests

The first step in our empirical implementation is to determine the unit root and cointegration properties of the variables under consideration. Briefly stated, a variable is said to be integrated of order d, written I(d) if it requires differencing d times to achieve stationary. Then, a set of variables is considered cointegrated if they are non-stationary integrated of the same order and yet their linear combination is stationary. The evidence of cointegration suggests that they cannot drift farther away form each other arbitrarily. Any deviations of a variable from the long run relationship will result in some variables adjusting to return back to the long run path; that is, the deviations (or disequilibrium) will be corrected. Accordingly, results from cointegration test not only provide information on the long run relationship among the variables but also are crucial for proper specification of their short run dynamics.

We apply the commonly used augmented Dickey-Fuller (ADF) and Phillips-Perron (PP) unit root tests[14] to determine the variables' stationarity properties or integration order. Before estimating the VAR model, we use the most recommended Akaike Information Criterion (AIC)[15] test to determine the lag length of the VAR system to make sure the model is well specified.[16]

The test estimation procedure takes the following forms;

[ADF-test]: $\Delta y_t = \alpha_0 + \alpha_1 t + \delta_1 y_{t-1} + \alpha_i \sum_{i=1}^{m} \Delta y_{t-1} + \varepsilon_t$ [3]

[PP-test] $y_t = \beta_0 + \beta_1 t + \delta_2 y_{t-1} + e_t$ [4]

where Δy_t denotes lag difference of the variable under consideration. m is the number of lags and ε_t is the error term. The stationarity of the variables can be tested using the hypothesis;

For ADF: *Ho:* $\delta_1 = 0$ (Null hypothesis), [where $\delta_1 = \rho - 1 = 0$]
Ha: $\delta_1 < 0$ (Alternative Hypothesis)

For PP:
Ho: $\delta_2 = 0$ (Null hypothesis)
Ha: $\delta_2 < 0$ (Alternative Hypothesis)

Based on the critical values of respective statistics, if null hypothesis cannot be rejected, then the time series are non-stationary at the level and need to go through first or higher order differencing process to achieve stationarity and to find the order of integration. The test is applied to each variable used in the model.

To test for cointegration, we employ a VAR-based approach of Johansen (1988) and Johansen and Juselius (JJ, 1990).[17] In particular, the Johansen and Juselius (JJ) test for cointegration is based on evaluating the rank of coefficient matrix of level variables in the regression of changes in a vector of variables on its own lags and lagged level variables. The rank of the matrix, which depends on the number of its characteristic roots (eigenvalue) that differ from zero, indicates the number of cointegrating vectors governing the relationships among variables. Johansen (1988) and JJ (1990) develop two test statistics to determine the number of cointegrating vectors – the Trace and the Maximal Eigenvalue (M.E) statistics;

$$\lambda_{Trace}(r) = -T \sum_{i=r+1}^{k} \ln(1 - \hat{\lambda}_i), \quad [5]$$

$$\lambda_{Max}(r, r+1) = -T \ln(1 - \hat{\lambda}_{r+1}) \quad [6]$$

Where T is the number of effective observations and λs are estimated eigenvalues. For real market analysis, with sample size of less than 100, we adjust[18] the trace and M.E statistics by a factor *(T-np)/T*, where T is the effective number of observations, n is the number of variables and p is the lag order. This is to correct bias towards finding evidence for cointegration in finite or small sample. The adjusted Trace statistic tests the null hypothesis that, the number of distinct cointegrating relationships is less than or equal to r against the alternative hypothesis of more than r cointegrating relationships. Meanwhile, the adjusted M.E test statistic tests the null hypothesis that the number of cointegrating relationships is less than or equal to r against the alternative of *r+1* cointegrating relationships.[19]

Causality and VECM Tests

A bivariate autoregressive standard Granger causality model is presented below:

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \alpha y_i \Delta Y_{t-i} + \sum_{i=1}^{p} \alpha x_i \Delta X_{t-i} + \varepsilon_t \qquad [7]$$

Where Δ is the first-difference operator and ΔX and ΔY are stationary time series. The null hypothesis that X does not Granger-cause Y is rejected if the coefficients, αxi, in equation [7] are jointly significant. Equation (7) is expanded to include other variables of the model to conduct multivariate Granger causality test.

In addition to the standard Granger causality test which captures the short-run causality, a new channel of causality can be emerged from the evidence of co-integration which captures the long-run causality. If there is a cointegrating (long-run) relationship between two variables then, as Granger (1988) points out, there is causality among these variables at least in one direction. The direction of causality is revealed by application of following vector error-correction model (VECM).

$$\Delta Y_t = \alpha + \sum_{i=1}^{p} \alpha y_i \Delta Y_{t-i} + \sum_{i=1}^{p} \alpha x_i \Delta X_{t-i} + \lambda E y_{t-1} + \varepsilon_t \qquad [8]$$

Where ΔY and ΔX are first difference stationary and co-integrated variables, and EYt-1 is the lagged value of the error correction term, defined by the following cointegration equation:

EYt = Yt – vXt [9]

From equation [8] the null hypothesis that *ΔX* does not Granger-cause *ΔY* is rejected if the coefficients αxi are jointly significant and the error-correction coefficient *λ* is significant. The inclusion of error-correction term *EYt-1*, in contrast to the standard Granger causality, introduces another channel of causality even if the coefficients αxi are not jointly significant. The bivariate vector error-correction models can also be modified to multivariate error-correction models by including more variables. If Granger-causality exists among variables then a forecast variance decomposition technique is utilized to assess the quantitative importance of these variables. Sims (1982) points out that the strength of Granger-cause relation can be measured by variance decomposition. For example, if a variable explains a small portion of the forecast error variance of another variable, this could be interpreted as a weak Granger-causal relation.

The Impulse Response and Variance Decomposition Functions [20]

Technically, we first generate the IRF function before the VDC function. The IRF is generated from an estimated VAR. In simulating impulse response function, the VAR innovations may be contemporaneously correlated. This means that a shock in one variable may work through the contemporaneous correlation with innovations in other variables. The responses of a variable to innovations in another variable of interest cannot be adequately represented since isolated shocks to individual variables cannot be identified due to contemporaneous correlation (Lutkepohl, 1991). Therefore, we use Cholesky factorization that orthogonalizes the innovations as suggested by Sims (1980) to solve this identification problem. The strategy requires a pre-specified causal ordering of the variables. The ordering of variables suggested by Sims (1980) is started with the most exogenous variables in the system and ended by the most endogenous variable.

It is important to highlight that, in this section, we specify a dynamic model using VAR framework and generate variance decompositions and impulse response functions to examine short-run dynamic interactions among the variables. Generally, there are two different ways of specifying a VAR when the time series under study are cointegrated – an unrestricted VAR in levels or a VECM.[21] Which specification is more appropriate remains debatable. While the VECM conveniently combines the long-run behavior of the variables and their short-run relations and thus can better reflect the relationship among the variables, there is no guarantee that imposing restriction of cointegration can be a reliable basis for making structural inferences (Faust and Leeper, 1997). Moreover, current finding is still unclear on whether the VECM outperforms the unrestricted VAR at all forecasting horizons. Naka and Tufte (1997) found that the two methods have comparable performance at short horizons. The support for the use of the unrestricted VAR can also be found in Clements and Hendry (1995), Engle and Yoo (1987) and Hoffman and Rasche (1996). Accordingly, with low computational burden required by the VAR in levels, we implement the VAR using the variables in levels. Compactly, the VAR model can be expressed as follows: $A(L)z_t = \mu_t$; where $A(L)$ is a matrix of polynomials in the lag operators and z is a vector consisting of the five variables considered. Orthogonalized innovations in each of the variables and the dynamic responses to such innovations are identified from the Cholesky decomposition of the variance-covariance matrix.

The Asymmetric Effects

The Wald (coefficient) tests is applied to determine the statistical significance of the different impacts of oil price increases and decreases to macroeconomic variables. The Wald test statistic compares how close the unrestricted estimates are to satisfying the restrictions under the null hypothesis. In this test, the type of oil price data transformation differentiates the oil price changes into two dummies; the positive rate of change in oil prices or oil price increase (DOPI) and negative rate of change or oil price decrease (DOPD). In particular the oil price transformation is defined as below;

DOPI=$DOIL_t$, if $DOIL_t$ >0, 0 if otherwise and DOPD=$DOIL_t$, if $DOIL_t$<0, 0 if otherwise.

Where $DOIL_t$ is the (quarterly) rate of changes in real oil price (LOIL) or $DOIL_t = LOP_t - LOP_{t-1}$

Under this approach, the estimated equation is;

$$y_t = \theta_0 + \sum_{i=1}^{m} \theta_{1i} y_{t-i} + \sum_{i=1}^{m} \theta_{2i} DOPI_{t-i} + \sum_{i=1}^{m} \theta_{3i} DOPD_{t-i} + \sum_{i=1}^{k} \alpha_i X_{it} + \varepsilon_t; \quad [10]$$

where m is the number of lags[22], the dependent variable y_t are the changes in GDP and as explanatory variables we include lagged values of the dependent variable plus the constructed proxies of oil price changes. With this specification, the conventional tests of the following null hypotheses will be carried out.

(i). $\theta_{2i} = \theta_{3i}$; The impact of oil price increase and decrease on GDP is the same

(ii). $\theta_{2i} = 0$; The impact of oil price increase on GDP is zero.

(iii). $\theta_{3i} = 0$; The impact of oil price decrease on GDP is zero.

4. RESULTS

The estimated results for the unit-root test are presented in Table 1 indicate that, both ADF and PP tests agree in classifying all variables; PWD, PD, PW, GDP, INV, and MS as *I(1)* variables at 5% level of significance , i.e. they are non-stationary in level but become stationary after first differencing. The overall findings lead us to conclude all series in (log of) levels are non-stationary, and are also stationary in the first differences at the 5 percent levels.

Table 1: Unit-root Tests

		PWD	PD	PW	GDP	INV	MS
LEVEL	ADF	-2.354[1]	2.519[0]	-1.830[1]	-2.041[5]	-2.456[0]	-1.944[1]
	PP	-2.129[1]	2.825[2]	-1.758[4]	-2.840[7]	-2.422[2]	-1.204[3]
1^{ST}. DIFF.	ADF	-6.515[0]***	-5.661[0]***	-6.128[0]***	-4.256[4]***	-9.001[0]***	-5.806[0]***
	PP	-6.528[1]***	-5.661[0]***	-6.154[3]***	-9.940[36]***	-8.984[1]***	-5.806[0]***

Note. 1) Unit-root computations are made using EViews 5. 2) with trend and intercept. 3) *** and ** denote significant at 1% and 5% significance level. 4) Values in square brackets are the optimum lag length for the ADF and optimum bandwidth for the PP tests. The optimum lag length and bandwidth for both tests, the (ADF) and the (PP), is automatically determined based on the SIC and Newey-West by Bartlett Kernel methods

Table 2 provides the Johansen-Juselius cointegration test results. In conducting the test, the lag order of first-differenced right-hand-side variables is set to 3 - which we find sufficient to render the error terms serially uncorrelated. In addition, following Reinsel and Ahn (1992), we adjust the Trace and Maximal Eigenvalue (ME) statistics by multiplying them with a factor; *(T-np)/T*, where *T* is the effective number of observations, n is the number of variables and p is the lag order. This is to correct bias towards finding evidence for cointegration in finite or small sample. Table 2 reports both the unadjusted and adjusted statistics.

Table 2: The Johansen-Juselius Cointegration Test

	Null Hypothesis	Statistics				Critical Values (5%)	
		Unadjusted		Adjusted			
		TRACE	ME	TRACE	ME	TRACE	ME
PWD	r = 0	69.193	44.069	54.386**	34.638**	47.21	27.07
	r ≤ 1	25.124	15.927	19.747	12.519	29.68	20.97
	r ≤ 2	9.197	8.531	7.229	6.705	15.41	14.07
	r ≤ 3	0.666	0.666	0.523	0.523	3.76	3.76
PD	r = 0	64.977	30.756	51.072**	24.174	47.21	27.07
	r ≤ 1	34.221	18.718	26.898	14.712	29.68	20.97
	r ≤ 2	15.503	11.970	12.185	9.408	15.41	14.07
	r ≤ 3	3.533	3.533	2.777	2.777	3.76	3.76
PW	r = 0**	56.567	33.719	44.462	26.503	47.21	27.07
	r ≤ 1	22.849	13.895	17.959	10.921	29.68	20.97
	r ≤ 2	8.954	7.825	7.038	6.150	15.41	14.07
	r ≤ 3	1.129	1.129	0.887	0.887	3.76	3.76

Notes: 1) The lag (p) order specified for all tests is set to 3, which we find sufficient to render the error term serially uncorrelated. 2) The 5% critical values are based on Osterwald-Lenum(1992). 3) Effective number of observations is 56.

The results from the adjusted Trace statistics indicate the presence of one cointegration equation in all analyses, except PW analysis. The presence of cointegration equations provide indication that the variables are tied together in the long run and any deviations from the long run equilibrium path will be corrected. The presence of cointegration also implies the presence of causality relationship between the variables, whereby there must be at least a unidirectional causality from one variable to the others. With these evidences; the study of oil price impact (particularly the PWD and PD oil prices) on GDP is further extended into Causality test and Impulse Response (IRF) and Variance Decomposition (VDC) tests.

The Long-run Cointegrating Equations

From VEC we derive the long run cointegrating equations to get an overview of the long-run associations between the variables. The summary of the long-run cointegrating equations for analyses PWD and PD are presented in Table 3.

Table 3: Long-run Cointegrating Equation (Normalized on GDP)

$$GDP = -1.272 + \underset{(0.060)}{0.456}\ PWD^{***} + \underset{(0.089)}{0.644}\ LINV^{***} + \underset{(0.072)}{0.118}\ MS$$

$$GDP = -1.322 + \underset{(0.199)}{0.549}\ PD^{***} - \underset{(2.680)}{0.119}\ INV^{**} + \underset{(0.054)}{0.877}\ MS^{***}$$

Note: 1)effective no. of observations= 58 2)Standard errors are in parentheses. *** denotes significant at 1% level.

Based on the results obtained, both analyses have documented a positive long-run association between GDP and oil price variables. The oil price coefficients appear to be highly significant. The positive relationship between oil price and GDP is consistent with our hypothesis which considers Malaysia as an oil exporting country; where increase in oil prices implies an increase in country's oil revenue and income.[23] This finding also appears to be consistent with Roger (2001) who claimed that, the event of oil price shocks had adversely affected the growth rates and trade balances of the Asian economies, except oil exporting countries; Indonesia, Malaysia, and Brunei.

Focusing on the GDP-INV and GDP-MS relationships, mixed results are obtained in terms of direction and degree of significance of the INV and MS coefficients in both analyses. In PWD analysis, GDP and INV are positively related while in PD analysis, both variables are negatively associated. The INV coefficient appears to be significant, at least at 5% level, in both analyses.[24] In the case of GDP-MS relationship, both analyses have documented positive associations between the two variables. However, the MS coefficient is significant in PD analysis only. The finding of positive relationship between output and INV and between output and MS is not only consistent with theoretical point of view[25] but also appears to be similar with our hypothesis. This is because; in Malaysia it is generally assumed that the flow of Foreign Direct Investment (FDI) into the country over the last twenty years has resulted in moderate to strong growth performance for the country. The belief of FDI generated the growth is approved by Tadaro and Smith (2003), WTO Trade Policy Reviews (1997), Asian Development Outlook (2004) and Fry (1996) and study by Guimaraes and Unteroberdoerster (2006).

Causality Test

The documented cointegration results in PWD and PD analyses only suggest the presence of long-run association between variables and imply causality relationship. However, it does not reveal the directions of causation among them. Thus, in order to differentiate the causal nexus among the concerned variables, Granger causality test is performed. With cointegration, the dynamic causal interactions among the variables are phrased in a vector error correction form/model (VECM). This approach enables us to assess both short-run and long-run causality relationships - based on the χ^2 and t - statistics results. For cases which had previously documented zero cointegration results, the causal relationship test is conducted within unrestricted VAR method. The summary of the short-run Granger-causality test results are presented in Table 4.

Table 4: Granger-causality Results

Analysis	Indep. Vars. / Dep. Vars.	χ^2-Statistics			t-statistics
		Δ P_{oil}	**Δ INV**	**Δ MS**	(ECT-term)
PWD	Δ GDP	3.106 0.376	12.721*** 0.005	18.516*** 0.000	0.148*** (0.034)
PD	Δ GDP	9.157** 0.027	9.106** 0.028	10.097** 0.018	-0.266*** (0.084)
PW	Δ GDP	2.424 0.489	9.165** 0.027	11.980*** 0.008	---

Notes: *** and ** denote significant at 1% and 5% level.

Based on the t-statistic results, only the PD analysis has documented significant and negative coefficient ECT term. This finding does not only provide reaffirmation on the presence of cointegration as documented in the previous test, but also provide evidence on the presence of long-run causality from PD oil price, INV, and MS to GDP. In other word, the GDP adjust to correct for any deviations from the long run equilibrium path. The see this adjustment in a more intuitive way, we write the GDP equation as;

$$\Delta GDP = f(\Delta Z) + 0.266\mu_{t-1} \quad [14]$$

$$\mu_{t-1} = GDP_{t-1} - (0.549\,PD_{t-1} - 0.119\,INV_{t-1} + 0.877\,MS_{t-1}) \quad [15]$$

where f(ΔZ) represents the first-differenced terms in the equation. From [14] we may note that the growth of GDP increases when $\mu_{t-1} > 0$ and vice versa. Given initially the long-run equilibrium (i.e. $\mu = 0$), an increase in PD and MS; and a decrease in INV, result in the error correction term μ to be less than zero. Consequently, GDP adjusts upward to restore equilibrium and vice versa.

The χ^2-statistics results derived from the standard Granger-causality test provide suggestion that all analyses, except PD analysis, have documented insignificant short-run causality relationship between change in oil price and change in GDP. In particular, change in PD oil price granger cause change in GDP. These findings provide evidence on the presence of short and long run causality relationships between change in oil price and GDP in PD analysis only.

Focusing on the GDP-INV and GDP-MS causality relationships, the results appear to show that changes in INV Granger-cause changes in GDP, in all analyses except analysis PD. Moreover, the reverse causality relationship indicates that, changes in GDP do not granger-cause changes in INV in all analyses, except PWD analysis.[26] The finding of bi-directional causality relationship, in PWD analysis, between INV and GDP variables appear to be consistent with Chowdhury and Mavrotas (2005).[27] In the case of GDP-MS causality relationship, the results indicate that change in MS granger-cause change in GDP in all analyses. This finding provides indication that, change in government's monetary policy give favorable impact to output. This finding contradicts the findings of Ferderer (1996), Bernanke, Gentler and Watson (1997), Hamilton and Hererra (2000) who assert a negative causality relationship between GDP and money supply.[28]

The overall findings lead us to conclude that, in PD analysis, GDP is causally related to all variables in the system, while in PWD and PD analyses, GDP is causally related to changes in INV and MS variables only. According to Sims (1982), if Granger-causality exists among the variables in the model, then a forecast variance decomposition technique is utilized to assess the quantitative importance of these variables. He points out that the strength of Granger-cause relation can be measured by Impulse Response (IRF) and Variance Decomposition Functions (VDC).

The Impulse Response Function (IRF) and Variance Decomposition(VDC)

From an estimated VAR, we compute impulse response and variance decomposition functions, which serve as tools for evaluating the dynamic interactions and strength of causal relations among variables in the system. However, before moving on to the IRF and VDC tests, Cholesky factorization is employed to solve the identification problem. The pre-specified causal orderings of the variables is determined through the correlation test and the results are presented in Table 6.

Table 6: Contemporaneous Correlations of VAR Error Terms

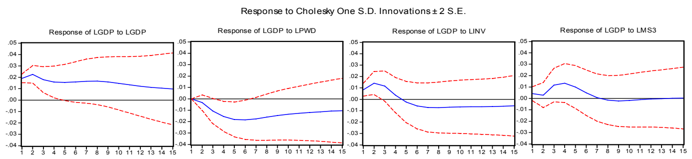
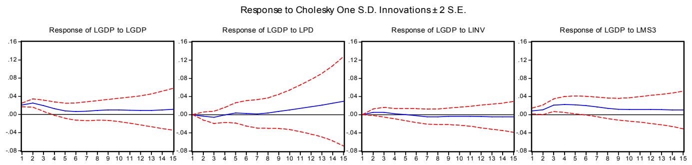
Analysis	Variables	GDP	OIL	INV	MS
	GDP	1.000	0.520	0.434	0.194
	PWD	0.520	1.000	0.050	-0.143
PWD	INV	0.434	0.050	1.000	0.269
	MS	0.194	-0.143	0.269	1.000
	Orderings	**3**	**4**	**2**	**1**
	GDP	1.000	-0.083	0.542	0.359
	PD	-0.083	1.000	0.066	-0.289
PD	INV	0.542	0.066	1.000	0.319
	MS	0.359	-0.289	0.319	1.000
	Orderings	**2**	**4**	**3**	**1**

The results in Table 6 indicate that, analysis PWD follows the order of MS, INV, GDP and PWD, while analysis PD follows the order of MS, GDP, INV and PD Both analyses treat MS variable as most exogenous while oil price variable as most endogenous.

The Impulse Response Test

Figure 1 presents the impulse response results of GDP to innovations in INV, MS and in PD oil price. In this analysis, the model is using variables in level. This is valid in the context of cointegrated series as argued by Ramaswamy and Slock (1988) that the IRF generated from the level VAR is more favorable as it allows the data to decide whether the effects of shocks are permanent or not.

Figure 1: Impulse Response Test

PWD	
PD	

From figure 1, only analysis PD is detected to have documented a slightly significant oil price-GDP impulse response results. In particular, GDP appears to response negatively to shocks in PD oil price in the first quarter horizon before gradually adjusts to positive response in the longer time horizons. In the case of GDP-INV impulse response, significant results are documented in both oil price analyses. In particular, in the first few quarters the GDP responds positively to innovations in oil price. In longer time horizons the degree of response subsides to zero. The significant results of the GDP impulse response to shock in oil price in PWD analysis appear to last longer, for almost 3 quarter horizons; compares to PD analysis, which lasts for about 2 quarter horizons only. For GDP-MS impulse response case, significant result is documented in PD analysis only. In this impulse response case, GDP appear to respond positively to shocks in MS. This response remains significant until six quarter horizons. After six quarter horizon, the GDP reaction remains positive but gradually decreases and subsides to the zero line in longer time horizon.

Variance Decomposition Functions

The next alternative method in examining the effects of shocks to the dependent variable is the variance decomposition function (VDC). It determines how much of the forecast error variance for any variable in a system is explained by innovations to each explanatory variable, over a series of time horizons. According to Sim (1982), this technique also is utilized to measure the strength of Granger-cause relation between variables, based on the results previously obtained in the Granger-causality test. Table 5.7 provides the summary of the VDC results for both PWD and PD analyses.

Table 7: Variance Decomposition Test

		% of Forecast Variance Explained by Innovations in				
Analysis	**Period**	**S.E.**	**GDP**	**P_{OIL}**	**INV**	**MS3**
PWD	1	0.021	80.557	0.000	15.678	3.765
	3	0.044	63.125	6.750	21.538	8.586
	5	0.057	51.872	21.372	13.138	13.618
	10	0.078	48.604	32.811	10.751	7.835
	15	0.087	47.556	34.939	11.201	6.304
PD	1	0.022	87.146	0.000	0.000	12.854
	3	0.046	66.756	2.205	2.520	28.519
	5	0.058	49.339	1.826	1.740	47.096
	10	0.071	39.314	4.757	2.611	53.318
	15	0.093	28.432	30.677	2.679	38.212

In both PWD and PD analyses, the results in the first quarter horizon suggest that shocks in GDP is mainly contributed from its own shock by the rate of 81% and 87% respectively, while shocks in INV in PWD analysis and shocks in MS in PD analysis, contribute by the rate of 16% and 13%. Shocks in other variables appear to be insignificant as the percent of forecast variance is smaller than 15%. Throughout the time horizon, percent contribution of its own shocks is declining. In particular, in PWD analysis, the percent changes from 81% in the first quarter to 52% in the 5th. quarter, and further decline to 48% in the last quarter. The same happens in the PD analysis where the percent contribution of its own shocks consistently decline from 87% in the first quarter horizon to 28% in the last quarter horizon. Focusing on the last quarter results, the fraction of forecast error variance attributable to variations in the GDP, PD, INV and MS for PWD analysis are 48%, 35%, 11% and 6% ; while for PD analysis, the results are; 28%, 31% 3% and 38%. These results provide indication that percent contribution of its own shock has experienced a significant decrease while percent contribution of shocks in oil price in both analyses, and shocks in MS in PD analysis have documented significant increase. These findings provide suggestion that shocks in oil price has substantiated shocks in its own shocks in PWD analysis, while in PD analysis shocks in both oil price and MS have substantiated shocks in its own shocks.

In relating the VDC results and the causality relationship; oil price variable, and MS variable in PD analysis, appear to have strong causality relationship with change in GDP as the value of the forecast error variance is more than 30% based on the results in the last quarter horizon. Other variables are having weak causality relationship with change in GDP as the percent of forecast error variance is less than 15%.

The Asymmetric Test Results

This section presents the asymmetric test results on the effect of oil price changes on the GDP. This test adopts the method proposed by Jimenez-Rodriguez and Sanchez (2004). The results are presented in Table 8.

Table 8: The Wald Test Results (normalized on GDP variable)

	PWD			PD			PW		
Null hypothesis	i. $\theta_2 = \theta_3$	ii. $\theta_2 = 0$	iii. $\theta_3 = 0$	i. $\theta_2 = \theta_3$	ii. $\theta_2 = 0$	iii. $\theta_3 = 0$	i. $\theta_2 = \theta_3$	ii. $\theta_2 = 0$	iii. $\theta_3 = 0$
Wald (χ^2) Stats.	0.765	0.443	0.661	16.241***	1.373	15.894***	3.065	2.017	2.395

Note: 1. standard errors in parentheses. 2. *** and ** denote significant at 1and 5% significance levels.

In testing null hypothesis i. $\theta_2 = \theta_3$, significant result is documented in PD analysis only. This finding signifies the presence of asymmetric relationship between oil price changes and changes in economic activity. Paying specific focus to the individual test results of θ_2 and θ_3 coefficients, significant result is observed in test (iii) of PD analysis only where GDP appear to be responsive during periods of oil price decrease. The rejection of null hypothesis (ii) provides suggestion that the event of oil price increase has no effect on GDP.

The finding on asymmetric relationship between oil price and real economy is similar to most of the studies highlighted in the economic literature. Among the few are; Mork (1989), Mork, Olsen, and Mysen (1992), Lee, Ni and Ratti (1995), Balke, Brown, and Yucel (2002) and Rodriguez and Sanchez (2005).

5. CONCLUSION

The objectives of this study are; to examine the dynamic interaction between oil prices and to investigates on presence of asymmetric effect. Following the standard VAR procedure, the GDP is tested against each type of oil prices; world oil price in domestic currency value (PWD), domestic oil price (PD), and world oil price (PW). The cointegration results have documented the presence of one cointegration equation in PWD and PD analyses. This finding provides indication of long-run relationship between the variables in the system. The long run equations are derived from the error correction model (ECM). The results in both analyses have documented a positive long-run association between GDP and oil price variables. The oil price coefficients appear to be highly significant and consistent with Roger (2001). The results from the VECM test indicate that, a negative and significant $ECT_{(t-1)}$ coefficient is observed in analysis PD only. This finding does not only provide reaffirmation on the presence of cointegration documented in the previous test but also provide evidence of long-run causality relationship from PD oil price, INV, and MS to GDP. The results from the standard Granger-causality test provide suggestion that all analyses have documented insignificant short-run causality relationship between change in oil price and change in GDP, except in PD analysis. In particular, change in PD oil price granger cause change in GDP. Based on this finding, evidence on the presence of short and long run causality relationships between change in oil price and GDP is documented in PD analysis only. The documented VDC results reported in the first and the last quarter horizon provide indication that shocks in oil price has substantiated the degree of shocks in its own shocks in PWD analysis, while in PD analysis shocks in both oil price and MS have substantiated the degree of shocks in its own shocks. In relating the VDC results and the causality relationship; oil price variable, and MS variable in PD analysis, appear to have relatively strong causality relationship with change in GDP as the value of the forecast error variance is more than 30% based on the results in the last quarter horizon. Other variables are having weak causality relationship with change in GDP as the percent of forecast error variance is less than 15%.

The asymmetric test result that tests null hypothesis (i) documented significant result in PD analysis only. This finding indicates the presence of asymmetric relationship between oil price changes (PD) and economic activity. The finding of asymmetric relationship between change in oil price and change in real economy is similar to most of the studies highlighted in the economic literature. Among the few are; Mork (1989), Mork, Olsen, and Mysen (1992), Lee, Ni and Ratti (1995), Balke, Brown, and Yucel (2002) and Rodriguez and Sanchez (2005).

The overall findings lead us to conclude that, change in oil prices affects the GDP. Out of all three oil prices considered in the analysis, PD appears to be most prominent, because significant results are documented both in long and short-run relationships. Based on the asymmetric test results, the effect of oil price (PD) increase or decrease on GDP is different, in which, the event of oil price decrease give more significant effect to the economy.

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APPENDIXXES

Appendix A

Total Petroleum Subsidies and Revenue Lost, 2001-2005 (RM Billion)

	2001	2002	2003	2004	2005
Subsidy	2.40	0.92	1.82	4.79	7.11
Revenue lost	5.08	3.31	4.76	7.15	7.85
Total	7.48	4.23	6.58	11.94	14.96

Source : EPU

Appendix B

PRICES OF PETROLEUM PRODUCTS IN MALAYSIA

Effective dates	Ron 97 (RM/Litre)			Ron 92 (RM/Litre)			Diesel (Sen/Litre)			LPG (RM/KG)		
	Pen*	Sbh**	Swk***	Sem	Sbh	Swk	Sem	Sbh	Swk	Sem	Sbh	Swk
1991.1	1.130	1.110	1.120	1.060	1.060	1.060	0.651	0.654	0.648	1.180	1.260	1.260
2000.10	1.200	1.180	1.190	1.160	1.160	1.160	0.701	0.704	0.698	1.280	1.360	1.360
2001.10	1.300	1.280	1.290	1.260	1.260	1.260	0.801	0.804	0.798	1.280	1.360	1.360
2001.11	1.300	1.280	1.290	1.260	1.260	1.260	0.701	0.704	0.698	1.280	1.360	1.360
2002.5	1.320	1.300	1.310	1.280	1.280	1.280	0.721	0.724	0.718	1.290	1.370	1.370
2002.11	1.330	1.310	1.320	1.290	1.290	1.290	0.741	0.744	0.738	1.310	1.390	1.390
2003.3	1.350	1.330	1.340	1.310	1.310	1.310	0.761	0.764	0.758	1.330	1.410	1.410
2004.5	1.370	1.350	1.360	1.330	1.330	1.330	0.781	0.784	0.778	1.350	1.430	1.430
2004.10	1.420	1.400	1.410	1.380	1.380	1.380	0.831	0.834	0.828	1.400	1.480	1.480
2005.5	1.520	1.500	1.510	1.480	1.480	1.480	1.081	1.084	1.078	1.400	1.480	1.480
2005.7	1.620	1.600	1.610	1.580	1.580	1.580	1.281	1.284	1.278	1.450	1.530	1.530

*Peninsular Malaysia
**Sabah
***Serawak

Endnotes

[1] Based on the official statistics (EPU), further subsidization will cause a 16-billion ringgit ($4.23 billion) reduction in the government's budget in year 2005, and this is an increase of 35% from year 2004.Also refer to Appendix A for overall statistics.

[2] Refer Appendix B

[3] This situation is also true in the case of oil price-stock market analysis. There are bulk of the empirical studies focus on the relation between economic activity and oil price changes, and only few studies have been conducted on the relationship between financial markets and oil price shocks. Moreover, these few studies concentrate mainly on few industrialized countries such as the United States, United Kingdom, Japan, and Canada.

[4] Michael Darby, "The Price of Oil and World Inflation and Recession," *American Economic Review*, v. 72, n. 4, September 1982, p. 738. The study covered 1957:Q1- 1976:Q4. The regression results had an R-squared of 0.9984 and the oil price variables were jointly significant at the 5% level.

[5] James Hamilton, "Oil and the Macroeconomy Since World War II," *Journal of Political Economy*, v. 91, n. 2, 1983, p. 228. The regression covered the period from 1948:Q2 to 1980:Q3 and the oil variables were jointly significant at the 1% level.

[6] i.e. oil prices, total industrial production in other OECD countries, domestic industrial production, short term interest rates, currency and demand deposits, average hourly earning in manufacturing and the consumer's price index.

[7] James Hamilton, "What is an Oil Shock?" National Bureau of Economic Research working paper *7755*, June 2000. His regressions cover the period 1949:Q2-1999:Q4. Oil's effects on growth were statistically insignificant after one and two quarters, significant at the 10% level after three quarters, and at the 1% level after four quarters.

[8] the authors find that a 10% increase in the oil price reduces GDP growth in the U.S. by a cumulative 0.39 percentage points after eight quarters. Using Mork's variation, they find that a 10% oil price increase reduces growth by 0.46 percentage points after eight quarters, but a 10% decrease increases growth by only 0.11 percentage points. Using Hamilton's net oil price measure increases the effect of a 10% price increase to 0.54 percentage points after eight quarters. Using Lee's method, which focuses on price volatility, yields the largest results: the 10% price increase now reduces growth by 0.61 percentage points after eight quarters.

[9] Most of the empirical literature which analyze the effect of oil price shocks in different economies use either the USD world price as a common indicator of the world market disturbances that affect all countries (i.e. Burbidge and Harrison, 1984) or the world oil price is converted into each respective country's currency by means of the market exchange rate (i.e. Mork et al., 1994) for OECD countries or Abeysinghe (2001) for Asian countries. A study by Nandha and Hammoudeh (2005) highlights the significance of using oil price expressed in domestic currency to capture the sensitivity of a country's stock market to changes in oil prices. The main difference between Pw and Pwd is that, the second oil variable takes into account the fluctuations in the exchange rates, which will assist us to differentiate whether each oil price shock reflects the world oil price evolution or could be due to other factors such as er fluctuations or national price index variations. In addition, study by Cunado and Garcia (2004) has observed more significant results are obtained when oil price shocks are defined in local currency.

[10] is the average crude oil spot prices - international price (USD) per barrel and is a reference price used in the US and global market, including Malaysia

[11] Converted by using market exchange rates. Calculations; $Pwd = \frac{Pw \times ER}{deflator}$

[12] Is the average real oil price of diesel

[13] base year 2000

[14] for ADF and PP tests, see Enders (1995), and Eun et. al. (1999)

[15] The estimated value of the parameter is not biased and efficient, as compared to the SC method.

[16] A correctly specified model residual should be random normal variables with zero mean and a constant variance-covariance matrix (Favero, 2001, P72)

[17] refer to Johansen and Juselius (1990) for specific details of the JJ procedure. See also Hall (1989) and Dickey et al. (1991)

[18] following Reinsel and Ahn (1992)

[19] for such cases where the trace statistics and the maximum eigenvalue statistic yield conflicting results, the results of trace statistics is preferred due to its better econometric properties

[20] The IRF measures the effect of a one-standard-deviation innovation o a variable on current and future values of the variables in a system of equations. IRF analysis is helpful to map out the shocks or innovations of macroeconomic time series. On the other hand, VDC allows one to examine the dynamic properties of the system and to gauge the relative strength of the Granger-causal chain among the variables outside the sample period in the VAR system.

[21] Ibrahim and Aziz (2003)

[22] chosen according to the AIC criteria

[23] Increase in world oil price implies increase in the price of local petroleum products sold/exported abroad. In domestic market, increase in world oil price is followed by increase in domestic (PD) oil price level too. The fact that inflation rate is under control due to effective policy implementation, the positive effect of oil price increase outweigh the negative effect of oil price increase. The final outcome of these economic interactions is positive relationship between output and oil price variable.

[24] The significant negative associations between GDP and INV in analysis PD, and insignificant MS coefficient in PWD analysis appear to be inconsistent with our hypothesis. This result appears somewhat puzzling and warrants further inspection.

[25] The standard Keynesian theory of economic growth theorized that output is a function of aggregate expenditures or C+ I + G + NX. The standard Keynesian theory also theorized, money is dichotomous; which means, change in money supply has real positive effect. The positive association between the two variables are also discussed in the neoclassical model, as first described by Solow (1956 and 1957), and new growth theory also know as endogenous growth theory) articulated by Romer (1986, 1987 and 1990), Lucas (1988) and Grossman and Helpman (1991).

[26] The results is available upon request.

[27] The study finds a bi-directional causality between GDP and FDI for Malaysia and Thailand over the period of 1969-2000, and a uni-directional causality relationship, that is GDP causes FDI, for Chile

[28] Theoretically, monetary policy is capable to shape the economy during oil price shock period. If the monetary authorities act to hold the growth of nominal GDP constant, the inflation rate will accelerate at the same rate at which real GDP growth slows. To the extent there is monetary illusion or other market imperfections, an accommodative (restrictive) monetary policy will partially offset (intensify) the losses in real GDP while it increases (reduces) inflationary pressure.