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Effects of Oil Price Shocks on the Economic Sectors in Malaysia

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ABSTRACT: This paper aims to examine the effects of oil price shocks on economic sectors in Malaysia. A unit root test was conducted, in which data were shown to be non-stationary in all levels, and stationary in the first difference for all variables. The co-integration model was applied, and the results indicated that one co-integrating equation exists, suggesting the long-term effects of oil prices on the agriculture, construction, manufacturing, and transportation sectors. Finally, Grange causality test was performed, and the results implied that in Malaysia, oil price shocks can affect agriculture, similar to Hanson et al. (2010). Oil price instability also influences the performance of the agriculture sector, contrary to the results of Alper and Torul (2009). In addition, the construction sector was found to be dependent on oil prices. Therefore, the current study has an important implication for the Malaysian government in formulating policies on oil prices. The Malaysian government needs to control the price to ensure that unstable price will not harm the agriculture, manufacturing, and construction sectors.

Keywords: oil price; agricultural, manufacturing and construction sectors.
JEL Classifications: E31; E52; E62

1. Introduction

In recent years, crude oil price has fluctuated all over the world. Several issues have emerged due to higher oil price. A common issue is people have to spend more than before for their daily use of oil. Moradkhani et al. (2010) stated that a rise in energy price, including that in crude oil, caused other prices to increase, as oil plays an important role in determining other prices. The cost of production also becomes higher due to higher petrol price, which results in a reduction in production. Therefore, a higher petrol price affects the productivity of a country, and a lower productivity can adversely impact economic growth. Several previous studies have proved that an increase in petrol price can harm GDP (Noordin, 2009; Saari, et al., 2007). Subsidy is typically provided to mitigate such problems and avoid an economic crisis. In several countries such as Malaysia, a policy on fuel subsidy is implemented to put people at ease. However, a large reduction in oil subsidy can trigger indignation from a number of parties.

Several economic sectors, such as agriculture, construction, manufacturing, and transportation, use oil to produce output. Hence, the oil price fluctuation can affect these sectors. Numerous studies from different countries have reported that a surge in crude oil prices significantly affects economic growth. The agriculture sector is one of the economic sectors that is harmed by higher oil price, as this sector inevitably consumes oil to run activities in agriculture. Several types of machines, such as tractors and croppers, use oil as power generator in the production, for instance, in cropping and carrying products such as rubber, coco, fruits, vegetables, and other agriculture products. Therefore, an increase in oil price can cause farmers more expense. Dhuyvetter and Kastens (2005) affirmed that, in the United States, higher oil prices can trigger higher machinery costs that agricultural producers have to bear.

Rising oil price also can influence the construction sector as it pushes up the costs of raw materials. Suppliers inevitably increase raw material prices for contractors to cover higher transportation costs. The higher prices also cause higher shipping costs. As mentioned by Shaver (2011), in the construction sector, oil price increase causes the contractors to incur the higher costs of raw materials. The manufacturing sector is also affected, as an increase in oil inevitably increases production costs. The number of production has to be reduced, which increases product prices, and, consequently, decreases consumer demand. High oil price has affected the cost and quantity of raw materials purchased mainly for manufacturers (Bolaji and Bolaji, 2010), as oil price affects the shipping costs of raw materials purchased for production. The fluctuation in oil price also threatens the transportation sector. This sector is tremendously dependent on oil as commodity for the execution of activities for transportation. Oil consumption on transportation escalates, such that fare, as in public transport, has to be increased. The affected transportations include buses, railways, and other shipping transport means. In this situation, Delsalle (2002) explained that as oil price increases, transportation costs are affected, thus reducing transport demand.

A number of previous studies, such as by Syed (2010), Ito (2008), and Mallik and Chowdhury (2011), seem to suggest that if economic growth is unaffected by oil price shocks on economic growth, policies on price are unnecessary. However, these studies did not consider any specific economic sector for policy formulation. Before any policy on oil price can be formulated, various economic sectors should first be considered. Studies that have taken economic sectors into consideration have done so only to investigate the effects on one or two sectors (Alper and Torul, 2009; Hanson et al., 2010). The agriculture, construction, manufacturing, and transportation sectors are the main economic sectors that substantially contribute to Malaysian GDP. Therefore, the current study attempts to examine the influence of oil price fluctuation on these four sectors in Malaysia.

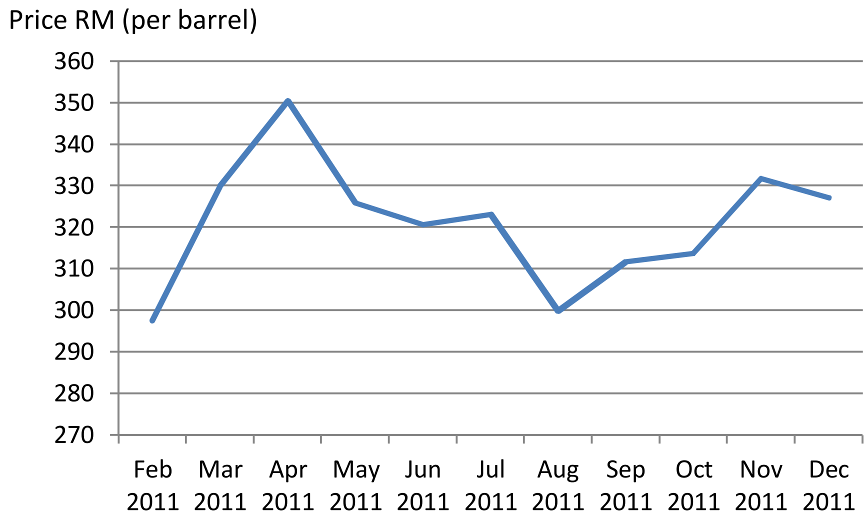
Malaysia is a developing country and a petroleum exporter. Malaysia relies on commodity to generate economic activities. The Malaysian government has been providing subsidy to people to reduce the effects of worldwide price fluctuation. Although Malaysia is an oil-producing country, an oil price hike in 2008 put the Malaysian economy under pressure. The largest increase, at 41%, was recorded in June 2008, which adversely affected the Malaysian economy. The issue of oil price remains a topic for debate. The opposition party has used the issue on oil to win votes from the people, in a time when the government subsidies for oil price maintenance were unfeasible. Fluctuations in global crude oil prices in 2010 caused domestic oil price to increase. The oil price issue continues to be debated among politicians and economists. Figure 1 shows the trend of oil price in Malaysia in 2011, in which a fluctuation in oil price is exhibited during the one year. The highest oil price was recorded at RM350.44 per barrel, in April 2011. The lowest price in that period was recorded in February 2009, at RM283.64 per barrel. From February to April, a surge in oil price by 23.55% was recorded in a period of one year.

2. Literature Review on Methodology

The issue of oil price fluctuation has attracted many researchers to investigate the detrimental effects of oil price fluctuation on the economy. Thus, there are various models that have been employed by previous researches to examine the effects of oil price. Vector Autoregressive Model is applied by several studies (Alper and Torul, 2009; Rodriguez and Sanchez, 2004; Petersen et al., 1994).

A study has been done by Alper and Torul (2009) to investigate the relationship between oil prices and manufacturing sub-sectors in Turkey. Vector autoregressive Model was employed and found that an oil price increase does not have any effect in manufacturing sectors in aggregate term. However, it influences the real production growth rate of several manufacturing sub sectors such as wood and wood products, furniture, chemical and chemical products, rubber and plastic products, electrical machinery and communication apparatus. Rodriguez and Sanchez (2004) employed the same method to examine the effects of oil price shocks on the real economic activity of some OECD countries. The results showed that a change in oil prices have different effects on OECD countries' real output as well as real activity. In the United Kingdom, a rise in oil prices negatively affects the economic growth. On the other hand, Norway, the economic growth is positively affected by oil prices.

Figure 1. Trends of the monthly crude oil price in Malaysia in 2011



Source: Index Mundi

Petersen et al. (1994) investigated the role of construction sector in the Texas economy during 1970s and 1980s. The study was also to find out the factors affecting the construction sector. The results were found that the factors such as oil prices, tax laws and interest rate significantly affect the construction sector. It showed that oil price fluctuations play an important role in influencing the construction sector as it affects the expectation of investors on the future growth of economy in Texas.

In Tunisia, a change in real crude oil prices negatively influences the real GDP. It suggested that a rising oil price can cause the economic growth to decrease since it affects the daily consumption pattern of households. An investigation on the causal relationship between oil prices and economic growth in Tunisia was done by using Johansen Co-integration Test, Vector Error Correction Model and Granger Causality (Bouzid, 2012). By using the same model, the negative effect of oil price was also found by Syed, (2010) in Pakistan. The objective of the study was to measure the impact of oil prices and GDP. The findings proved that there is a negative relationship between oil prices and GDP.

In Iran, agricultural and industrial sectors play important roles in the economy. As the issue of oil price came to the fore, a study was done to investigate the relationship between oil price shocks and the two sectors. Using Johansen Co-integration test and Vector Error Correction Model, the results showed that the oil price is negatively connected with agricultural sector and industrial sector.

Different models from Alper and Torul (2009), Rodriguez and Sanchez (2004), Petersen et al., (1994), the results remain the same that oil price changes trigger a negative impact on economy. Hanson et al. (2010) employed t input-output model to investigate the effects of oil price shocks on the United States agricultural sector. The results showed that agricultural sector is dependent on energy such as oil. A rise in oil prices cause prices of agricultural products such as grains and cotton to increase and thus reduce the income of the sector. Mallik and Chowdhury (2011) examine the relationship between inflation uncertainty and oil price inflation and growth in Australia. The results showed that inflation affects the economic growth. The oil price was found to be positively connected with inflation and inflation uncertainty. Therefore, stabilizing oil prices is important to reduce inflation uncertainty.

3. Methodology

This study applies empirical analysis and focuses on four variables, namely, oil price, agriculture, manufacturing, construction and transportation sector in Malaysia. The quarterly time series data from 2000 and 2011 are used for all variables in Malaysia.

Figures in parenthesis are the critical values

Where:

Ln OIL is the log of oil price in Malaysian Ringgit
Ln AGR is the log of agriculture sector's GDP
Ln CON is the log of construction sector's GDP
Ln MAN is the log of manufacturing sector's GDP
Ln TRAN is the log of transportation sector's GDP

All the data used where extracted from the statistic of Bank Negara Malaysia (2013) and Index Mundi (2013).

i. Stationary Test

The first step in constructing time series data is to determine the non-stationary property of each variable. We must test each of the series in the levels and in the first difference. All variables were tested in levels using the Augmented Dickey-Fuller (ADF) Test. Consider the equation below:

$$\Delta Y_t = \beta_1 + \beta_2 t + \delta Y_{t-1} + \alpha \sum_{i=1}^{p} \Delta Y_{t-1} + u_t \quad (1)$$

where Y is our variable of interest, Δ is t the time trend and the difference operator, t is the time trend, P is the number of lagged term and u is the white noise residual of zero mean and constant mean and constant variance. $(\alpha_1,\alpha_2,\beta_1,...\beta_m)$ is a set of parameters to be estimated. If the stationary test is significant, the variable series is stationary and have no unit root. Thus, the null hypothesis will be rejected, but the alternative hypothesis will be accepted. However, if the stationary test is not significant, the variable series is non stationary and has a unit root; thus, null hypothesis will be accepted. The hypothesis for this study is as follows:

$$H_0: \phi = 0 \text{ (unit root/ non stationary)} \quad (2)$$

$$H_1: \phi \neq 0 \text{ (no unit root/ stationary} \quad (3)$$

ii. Co-integration Test

Co-integration test is used in this study to examine the long-run relationship between all variables. Consider the following levels of VAR, with X_t defined as the log of oil price, agricultural, construction, manufacturing, and transportation sector.

$$X_t = c + \sum_{j=1}^{p} \Gamma_j \Delta X_{t-j} + \varepsilon_j \quad (4)$$

If the variables in X_t are I(1), the VAR in Eq. (4) is not stationary. If there is no co-integration, statistical inference is not possible by using the usual tests. Given this condition, the difference of the series should be determined and a first difference VAR of the form should be estimated

$$\Delta X_t = c + \sum_{j=1}^{p} \Gamma_j \Delta X_{t-j} + \varepsilon_j \quad (5)$$

Integration vectors give rise to the stationary variable. If this is the case, the VAR in Eq. (5) can be written as

$$X_t = c + \sum_{j=1}^{p} \Gamma_j \Delta X_{t-j} + \prod X_{t-1} + \varepsilon_t \quad (6)$$

In Eq. (6), II is a rank r matrix that can be divided as

$$\prod = \alpha\beta' \quad (7)$$

where α is a 3 × r loading matrix and β is a 3 × r matrix of co-integrating vectors, r being the number of co-integrating vectors. Following the Johansen procedure, the number of co-integrating vectors were tested by using the co-integrated VAR as in Eq. (6).

iii. Granger Causality Test

The Granger causality test is employed to examine the causal relationship between two variables. If the p values of the variable Y significantly contribute to forecast the value of another variable X, then Y has a Granger causal relationship with X and vice versa. The test is based on the equation below.

$$Y_t = \gamma_0 + \sum_{z=1}^{p} \gamma_z Y_{t-z} + \sum_{i=1}^{q} \lambda_i X_{t-1} + \mu_t \quad (8)$$

$$X_t = \varphi_0 + \sum_{z=1}^{p} \delta_z X_{t-z} + \sum_{i=1}^{q} \psi_i Y_{t-1} + \varepsilon_t \quad (9)$$

where Yt and Xt are the tested variables, μ_t and ε_t are the error terms, and t implies that the time period z and i's are the number of lags. The null hypothesis is $\lambda_i = \psi_i = 0$ for all i. In the alternative hypothesis that $\lambda_i \neq 0$ and $\psi_i \neq 0$ for at least some i's if the coefficient λ_i are significant but ψ_i are not significant, then X is Granger causal to Y. However, if both coefficients are significant, then causality runs both ways.

4. Findings

The results from the tests of the study are discussed. Quarterly data on oil price, agricultural, construction, transportation and manufacturing from 2000 to 2011 were used in this study. Unit root test based on Augmented dickey-fuller (ADF) was performed to measure the stationary property of the time series data. Subsequently, Johansen co-integration was done to examine the long run relationship between all variables. Finally, Granger causality was carried out to indentify the direction of the effects.

Table 1. Unit Root Test

	Intercept		Intercept + Trend	
	Level	**First Difference**	**Level**	**First Difference**
Oil Price	-0.6603 (0.8462)	-6.2907* (0.0000)	-2.6615 (0.2583)	-6.2297* (0.0000)
Agriculture	-0.7742 (0.8158)	-5.3428* (0.0001)	-0.0611 (0.9935)	-4.6215* (0.0041)
Construction	-0.9521 (0.7570)	-3.3411** (0.0220)	-0.5667 (0.9739)	-4.4818* (0.0097)
Manufacturing	-0.5441 (0.8726)	-9.2892* (0.0000)	-1.9912 (0.5898)	-9.1703* (0.0000)
Transportation	-0.3104 (0.9154)	-6.7890* (0.0000)	-2.8541 (0.1863)	-6.7255* (0.0000)

Note: *, ** and *** indicates the rejection of the null hypothesis of non-stationary at 1%, 5% and 10% significance level.

Table 1 shows that all variables (agricultural, construction, manufacturing, transportation sectors, and oil price) are non stationary in level with the constant trend. However, in the first difference test, the results for all variables show that they are significant, suggesting that all variables are stationary. The null hypothesis is rejected, and the alternative hypothesis is accepted. Thus, Johansen co-integration test can be done.

Table 2. Cointegration Test

Rank	Max-Eigen Statistic	Critical Value (Eigen) at 5%	Trace Statistic	Critical Value (Trace) at 5%
r = 0*	53.0800	33.8769	88.6173	69.8189
r ≤ 1	19.2198	27.5843	35.5373	47.8561
r ≤ 2	11.9138	21.1316	16.3176	29.7971
r ≤ 3	2.8892	14.2646	4.4037	15.4947
r ≤ 4	1.5146	3.8415	1.5146	3.8415

L.R test indicates one co-integrating equation at the 0.05 level

Table 2 shows the results of the Johansen co-integration test. The table shows that by using trace test and max-eigen value test, the results indicate that there is on co-integrating equation at 5% level. Therefore there are long-run effects of oil prices on the economic sectors (agricultural, construction, manufacturing, transportation sectors, and oil price). However, co-integration cannot determine which direction of the effects. Thus, Granger causality is performed to examine the direction of causality effects.

Table 3 presents the granger causality among the oil price volatility and agriculture sector's GDP, construction sector's GDP, manufacturing sector's GDP and transportation sector's GDP. Oil price does Granger cause construction with no feedback. Oil price does Granger cause manufacturing and vice versa. Oil price does Granger cause agricultural sector with feedback. Oil price does Granger cause all three sectors but it does not Granger cause transportation.

Table 3. Pairwise Granger Causality Test

Null Hypothesis	Obs.	F-Statistic	Prob.
Agriculture does not granger cause Construction Construction does not granger cause Agriculture	44	2.8508** 2.3965	0.0381 0.0689
Manufacturing does not granger cause Construction Construction does not granger cause Manufacturing	44	2.6046 2.9718**	0.0525 0.0326
Oil Price does not granger cause Construction Construction does not granger cause Oil Price	44	2.8569** 1.2488	0.0378 0.3085
Transportation does not granger cause Construction Construction does not granger cause Transportation	44	1.8195 2.3359	0.1471 0.0746
Manufacturing does not granger cause Agriculture Agriculture does not granger cause Manufacturing	44	2.4028 2.6947**	0.0683 0.0498
Oil Price does not granger cause Agriculture Agriculture does not granger cause Oil Price	44	5.6201* 2.6947**	0.0013 0.0467
Transportation does not granger cause Agriculture Agriculture does not granger cause Transportation	44	1.7447 4.1909*	0.1623 0.0071
Oil Price does not granger cause Manufacturing Manufacturing does not granger cause Oil Price	44	2.8252** 3.6385**	0.0394 0.0140
Transportation does not granger cause Manufacturing Manufacturing does not granger cause Transportation	44	0.3760 2.0393	0.8242 0.1102
Transportation does not granger cause Oil Price Oil Price does not granger cause Transportation	44	0.7827 1.1955	0.5441 0.3300

Note: *, and ** denote statistical significance at the 1%, and 5% level, respectively.

5. Conclusion

This paper aims to examine the effects of oil price shocks on economic sectors in Malaysia. A unit root test was conducted, in which data were shown to be non-stationary in all levels, and stationary in the first difference for all variables. The co-integration model was applied, and the results indicated that one co-integrating equation exists, suggesting the long-term effects of oil prices on the agriculture, construction, manufacturing, and transportation sectors. Finally, Grange causality test was performed, and the results implied that in Malaysia, oil price shocks can affect agriculture, similar to Hanson et al. (2010). Oil price instability also influences the performance of the agriculture sector, contrary to the results of Alper and Torul (2009). In addition, the construction sector was found to be dependent on oil prices. Therefore, the current study has an important implication for the Malaysian government in formulating policies on oil prices. The Malaysian government needs to control the price to ensure that unstable price will not harm the agriculture, manufacturing, and construction sectors.

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