Causality between domestic fuel price and economic sectors: evidence from Malaysia

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Abstract

This paper makes an attempt to test the possible directions of causality between domestic fuel price and economic sectors in particular manufacturing and construction sectors. Malaysia is taken as a case study. As oil plays an important role in determining other prices, a higher fuel price affects the productivity of a country, and a lower productivity can adversely impact economic growth. Standard time-series techniques are applied using the error correction and variance decompositions techniques including the 'long-run structural modelling (LRSM). The findings, based on the variance decompositions analysis, tend to suggest that in Malaysia, domestic fuel price is driven by manufacturing sector and followed by the construction sector. In other words, the construction sector is affected by the fuel price. The result of this study has an important implication for the Malaysian government in formulating policies on oil prices specifically domestic fuel prices as the Malaysian government needs to control the price in ensuring that unstable price will not jeopardize the construction sector. Proactive initiatives in replacing the fuel as an alternative will help the developing country like Malaysia overcome the global oil price shocks.

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1. Introduction

Crude oil price has rapidly fluctuated all over the world in recent years of which a rise in crude oil price caused other prices to increase, as oil plays an important role in determining other prices. Therefore, a higher fuel price affects the productivity of a country, and a lower productivity can adversely impact economic growth. In Malaysia, oil has been largely used as the intermediate inputs in the industrial production activity around 40 percent in 2005 and petroleum products are highly demanded that constitute more than 60 percent of total energy consumption in 2005 (Economic Planning Unit of Malaysia, 2006). This creates an environment of uncertainty as the high dependency on petroleum products kept Malaysia at risk if the global crude oil price remains high.

Although Malaysia is considered as one of the lowest amongst the Southeast Asian countries after Brunei in implementing a policy on fuel subsidy to put people at ease, the rise of global crude oil price is likely burdening the government (Mansor, 2010). On the other hand, a large reduction in oil subsidy can trigger bigger implications. Several economic sectors such as manufacturing, construction and transportation use oil to produce output. Hence, the oil price fluctuation can affect these sectors.

Several previous studies (Noordin, 2009; Saari, et al., 2007, quoted by Shaari, et al., 2013) have proved that an increase in petrol price can harm Gross Domestic Product (GDP). Shaari, et al. (2013) further emphasized that rising oil price also can influence the construction sector as it pushes up the costs of raw materials. The manufacturing sector is also affected, as an increase in oil inevitably increases production costs. In contrast, Shaari, et al. (2013) quoted that a number of previous studies, such as by Syed (2010), Ito (2008), and Mallik and Chowdhury (2011), seem to suggest that economic growth is unaffected by oil price shocks and as such policies on price are unnecessary. The issue on the critical question of the existence and direction of causality still remains unresolved.

Section 2 identifies the objective of the study followed by the literature review and theoretical framework in Section 3. It is followed the methodology used in Section 4. Data, empirical results and discussions are dealt in Section 5. Finally, this article ends with the major conclusions and the policy implications of the study in Section 6.

2. The Objective of the Study

With the motivation in place, this study empirically examined the relation between the domestic fuel price and the disaggregated economic sectors in Malaysia. According to Department of Statistics, Malaysia (DOSM) the agriculture, construction, manufacturing, and transportation sectors are the main economic sectors that substantially contribute to Malaysian GDP. The advantage of using disaggregated data is to see whether fluctuation of the prices will leave any consequences on any particular economic sectors in Malaysia. This study humbly attempts to examine the influence of oil price fluctuation specifically on manufacturing and construction sectors in Malaysia, simply due to both economic sectors are proportionately allocated in each state across the country (DOSM) as compared to agriculture and transportation sectors.

3. Literature Review and Theoretical Framework

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. Shaari, et al. (2013) in their paper quoted several studies instigating the relationship between oil prices and economic sectors such as Bouzid (2012); Syed, (2010); and Rodriguez and Sanchez (2004).

Bouzid, (2012) investigated the causal relationship between oil prices and economic growth in Tunisia using Johansen Co-integration Test, Vector Error Correction Model and Granger Causality that showed negative effect of oil price which 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. Rodriguez and Sanchez (2004) found that the results of oil price changes trigger a negative impact on economy.

Shaari (2013) also revealed studies done by Alper and Torul, 2009 and Petersen et al., 1994 that specifically relationship between oil prices with manufacturing and construction sectors respectively. Alper and Torul (2009) employed vector autoregressive and found that an oil price increase does not have any effect in manufacturing sectors in aggregate term. 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.

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. Fluctuations in global crude oil prices in 2008 caused domestic fuel price to increase where in early June 2008 the government increased the domestic petrol fuel price to RM2.70 (RON97 petrol) due to the significant increase of the world crude oil (Mansor, 2010).

Based on the above, the proxy for variable of domestic fuel price is RON97 petrol being the product that highly consumed than RON95 petrol (as this category had just replaced RON92 beginning May 2009) and diesel (Mansor, 2010). Since the literature captured the economic sectors and growth in relation to GDP being the standard national expenditure, thus the manufacturing and construction sectors are represented by the portion of national expenditure of GDP in current prices respectively.

Thus, it is vital to (i) test the theoretical relationship; and (ii) confirm which variable is exogenous and endogenous. Standard time series technique addresses these two questions by among others, testing cointegration and ranking the impact of one variable shock to other variables and itself (Variance Decompositions). This will be explained further in the methodology section below. Overall, due to theories being inconclusive, we would like to test them by using real data.

4. The Methodology Used

This study employs the standard time series techniques, in particular, cointegration, error correction modelling and variance decompositions, in order to find empirical evidence of relations between domestic fuel price and economic sectors particularly manufacturing and construction sectors in Malaysia. This method is favoured over the traditional regression method for the main reason that most economic and finance variables are non-stationary that performing ordinary regression on the variables will render the results misleading, as statistical tests like t-ratios and F statistics are not statistically valid when applied to non-stationary variables. When variables are regressed in their differenced form, the long term (theoretical) trend is effectively removed. Thus, the regression only captures short term, cyclical or seasonal effects. In other words, the regression is not really testing long term (theoretical) relationships. In addition, cointegration techniques embrace the longterm dynamic interaction between variables whereas traditional regression methods, by definition, exclude or discriminate against interaction between variables.

Basically, there are eight (8) required steps to perform standard time series technique as detailed in Masih (2013). First four steps are testing theory while the last four steps are testing causality. The first step is to test the stationarity of the data. It is worth to note that most of the economic and finance variables are non-stationary. Non-stationary series has an infinite variance (it grows over time), shocks are permanent (on the series) and its autocorrelations tend to be unity (Masih, 2013). The second step is to determine the optimum order (or lags) of the vector autoregressive model. The order given will be used in the third step subject to certain conditions. The third step is testing cointegration. Cointegration implies that the relationship among the variables is not spurious i.e. there is a theoretical relationship among the variables and that they are in equilibrium in the long run (Masih, 2013). However, cointegration is not able to test causality. The fourth step is Long Run Structural Modeling (LRSM). This test confirms whether a variable is statistically significant and tests the long run coefficients of the variables against theoretically expected values.

Vector Error Correction Model (VECM) is the fifth step, and it is used to test Granger causality. The VECM shows the leading and lagging variables but it is unable to show relative exogeneity and endogeneity. The sixth step (Variance Decompositions or VDCs) ranked the variables by determining the proportion of the variance explained by its own past shocks whereby the variable that is explained mostly by its own shocks (and not by others) is deemed to be the most exogenous of all (Masih, 2013). Step seven, the Impulse Response Function (IRF) and step eight, Persistence Profiles (PP) is in graph form. According to Masih (2013), IRF exposes relative exogeneity and endogeneity (similar to VDC) while PP estimates the speed with which the variables get back to equilibrium when there is a system-wide shock (unlike the IRF which traces out the effects of a variable-specific shock on the long-run relationship).

5. Data, Empirical Results and Discussions

As stated above, domestic fuel price (OIL), manufacturing sector to GDP (MFG) and construction sector to GDP (CON) are the variables used in this paper. All the data are converted into logarithms form (LOIL, LMFG and LCON) to achieve stationarity in variance. All the 'level' forms of the variables were transformed into the logarithm scale. Quarterly data for eight years starting from 2006 (quarter 1) are collected from Department of Statistics Malaysia and Economic Planning Unit of Malaysia. In total, there are 30 observations in this paper.

5.1 Step 1: Testing the non-stationarity / stationarity of each variable

The objective of this first step is to check whether the variables chosen were stationary or not. The checking can be done by using the Augmented Dickey-Fuller Unit Root Tests (ADF) and also the Phillips-Perron Test (PP).

Augmented Dickey-Fuller (ADF) test were conducted on each variable (in both level and differenced form). The test statistic figures are obtained based on the highest value of Akaike Information Criterion (AIC) and Schwarz Bayesian Criterion (SBC) which sometimes give an equivalent test statistic results. Ignoring the minus sign, the test statistics for all variables are smaller than their 95% critical value which means that the null hypothesis cannot be rejected. In other words, all the variables are non-stationary in its 'level' form.

For 'differenced' form variables, the upper table (include an intercept but not a trend) should be used instead. Again, the test statistic figures are obtained based on the highest value of AIC and SBC. Here, the test statistics for all variables are higher than their 95 percent critical value which means that the null hypothesis can be rejected (i.e. variables are stationary). Since the variables are non-stationary in 'level' form but stationary in 'differenced' form, these variables are known as I(1) from this ADF test.

Table 1 summarises the results of variables that were tested at the level form while Table 2 summarises the results of variables that were tested at differenced form.

Table 1: ADF Results for Variables in Level Form

Variable	Test Statistics		Critical Value	Result
	AIC	SBC		
LOIL	-2.3999	-2.3999	-3.6027	Non-stationary
LMFG	-3.0096	-3.0096	-3.6027	Non-stationary
LCON	-1.8707	-1.6312	-3.6027	Non-stationary

Table 2: ADF Results for Variables in Differenced Form

Variable	Test Statistics		Critical Value	Result
	AIC	SBC		
DOIL	-5.2309	-5.2309	-2.9907	Stationary
DMFG	-4.6260	-4.6260	-2.9907	Stationary
DCON	-8.9152	-8.9152	-2.9907	Stationary

Subsequently, PP test were conducted to further confirm the stationarity of variables. As in ADF test, the variables were tested in the 'level' and 'differenced' form and results for both can be referred to Table 3 and Table 4 respectively. The results are concluded based on the p-value that it informs the error we are making when rejecting the null (i.e. variable is non-stationary). If the p-value is high (the value is above 0.05), the null hypothesis cannot be rejected. On the other hand, if the p-value is low (the value is below 0.05), the null hypothesis can be rejected. In contrast to ADF test above, the PP test for 'level' form variables shown that MFG is I(0) instead. As expected, the PP test confirmed that the 'differenced' form variables are stationary as in ADF test. Although PP test found that MFG are I(0), we have retained these variables because it was I(1) in the ADF test. The summary of the PP test results are shown below.

Table 3: PP Results for Variables in Level Form (Differenced Once)

Variable	P-value	Result
DOIL	0.088	Non-stationary
DMFG	0.015	Stationary
DCON	0.815	Non-stationary

Table 4: PP Results for Variables in Differenced Form (Differenced Twice)

Variable	P-value	Result
D2DOIL	0.000	Stationary
D2DMFG	0.000	Stationary
D2DCON	0.000	Stationary

Based on the above two (2) results from ADF and PP tests, it is confirmed that all the variables used for this analysis are I(1), thus we may proceed with testing of cointegration.

5.2 Step 2: Determination of the order (or lags) of the Vector Autoregressive (VAR) model

Before proceeding to the cointegration test, it is compulsory to determine the optimum order (or lags) of the vector autoregressive model. Referring to Table 5 (Appendix 2 for detail), it is found that there is a contradicting optimum order given by the highest value of AIC and SBC. As expected, SBC gives lower order as compared to AIC. This difference is due to the AIC tries to solve for autocorrelation while SBC tries to avoid over-parameterization. In other words, the different lag values may be attributable to the different nature or concern of the test.

Table 5: AIC and SBC results for order (or lags) of the VAR model

	AIC	**SBC**
Optimal order	3	0

By selecting high order of VAR, it may result in over-parameterization issue because we have only 30 observations. On the other hand, if we adopted a lower order, we may encounter the effects of serial correlation. Thus, the order of lag used is 2 on the basis of the average optimum lag value given by AIC and SBC.

5.3 Step 3: Testing cointegration

Once the variables are established as I(1) and determined the optimal VAR order as 2, next step is testing cointegration. As depicted in the Table 6, the maximal Eigenvalue and Trace value indicate that there are one and two cointegrating vectors respectively at 95% significance level whereas according to AIC, SBC and HQC indicated there are three cointegrating vectors

Table 6. Johansen ML results for multiple cointegrating vectors – domestic fuel price, manufacturing sector to GDP and construction sector to GDP (Q1/2006-Q2/2013)

H_0	**H_1**	**Statistic**	**Critical value**		**Result**
Maximal Eigenvalue			**95%**	**90%**	
r = 0	r = 1	26.9206	25.4200	23.1000	Cointegration
r<= 1	r<= 2	17.6091	19.2200	17.1800	
Trace value			**95%**	**90%**	
r = 0	r = 1	54.6302	42.3400	39.3400	Cointegration
r<= 1	r<= 2	27.7096	25.7700	23.0800	

Notes: The statistics refer to Johansen's log-likelihood maximal eigen value and trace test statitistics based on cointegration with unrestricted intercepts and restricted trends in the VAR. From the above results, we select one cointegrating vector based on the maximal eigenvalue at 95% level. The underlying VAR model is of order 2 and is computed using 30 quarterly observations.

Although the cointegration test revealed that there are conflicting number of cointegrating vector in Maximal eigenvalue, trace value and AIC, SBC & HQC, intuitively it is believed that there is one cointegrating vector. One cointegrating vector is based on the strong theoretical relationship among the variables that they co-move together in the long run between domestic fuel price and economic sectors (in this case manufacturing and construction). As such, based on the above statistical result as well as our insight, for the purpose of this study, we shall assume that there is one cointegrating vector, or relationship.

5.4 Step 4: Long Run Structural Modeling (LRSM)

Long Run Structural Modelling (LRSM) attempts to quantify this apparent theoretical relationship among the variables in comparing the statistical findings with theoretical (or intuitive) expectations. Relying on the Long Run Structural Modelling (LRSM) and normalizing our variable of interest, the Manufacturing sector to GDP, we initially obtained the results in Panel A of Table 7 Next, we imposed restriction on one of the variable at the 'overidentifying' stage (Panel B of Table 7). The above results tend to indicate that the null restriction of zero on domestic fuel price stands. However, based on the evidence of a significant cointegrating relationship as well as strong theoretical reasons, we proceed with Panel A for the remainder of the analysis.

Table 7: Exact and over identifying restrictions on the cointegrating vector

	Panel A		Panel B	
LOIL	-0.24774	(0.17742)	0.00	*(None)*
LMFG	1.0000	*(None)*	1.0000	*(None)*
LCON	-1.8673*	(0.77648)	-2.5325	(1.2271)
Trend	0.051495	(0.024810)	0.069220	(0.039714)
Log-likelihood	141.2843		140.6486	
Chi-square	None		1.2714	[0.260]

Notes: The output above shows the maximum likelihood estimates subject to exactly identifying (Panel A) and over-identifying (Panel B) restrictions. The 'Panel A' estimates show that one variable (LCON) is significant (SE are in parenthesis). All the coefficients have the correct signs. The above results tend to indicate that the null restriction of zero on domestic fuel price stands. However, based on the evidence of a significant cointegrating relationship as well as strong theoretical reasons, we proceed with Panel A for the remainder of the analysis. *Indicates significance at the 1% level.

5.5 Step 5: Vector Error Correction Model (VECM)

The previous four steps tested theories and confirm that there is cointegration between the variables but it did not show any causality among variables. Step 5 onwards allows us to answer this shortcoming. The statistical results generated from these steps will be welcomed by policy makers. Policy makers want to know which variable is the leader to focus their policies on those variables to make the biggest impact. Thus, we have performed VECM and the results are summarised in Table 8

Table 8: Error correction models – domestic fuel price, manufacturing sector to GDP and construction sector to GDP

Dependent variables	dLOIL		dLMFG		dLCON	
dLOIL1	-0.39465	(0.19796)	0.094760	(0.12996)	0.020280	(0.10128)
dLMFG1	0.83772	(0.38322)	0.18713	(0.25159)	-0.33515	(0.19607)
dLCON1	-0.19201	(0.42585)	-0.037061	(0.27957)	0.56167	(0.21788)
ecm1(-1)	0.40210	(0.19461)	0.032936	(0.12776)	0.38461*	(0.099569)
Chi-sq SC(4)	8.6713	[0.070]	6.5859	[0.159]	8.3933	[0.078]
Chi-sq FF(1)	2.7472	[0.097]	2.7803	[0.095]	0.52661	[0.468]
Chi-sq N(2)	13.6289	[0.001]	4.3953	[0.111]	0.89655	[0.639]
Chi-sq Het(1)	1.6316	[0.201]	0.63547	[0.425]	0.78915	[0.374]

Notes: SEs are given in parenthesis. The diagnostics are chi-squared statistics for: serial correlation (SC), functional form (FF), normality (N) and heteroskedasticity (Het). *Indicates significance at the 1% level.

Looking at the significance or otherwise of the error correction coefficients, it is found that domestic fuel price variable is exogenous. Interestingly, only one of the economic sector variables (construction sector) is endogenous but the manufacturing sector variable is exogenous. That tends to indicate that the construction sector variable responds to the manufacturing and also domestic fuel price variables. The error correction model also helps us distinguish between the short-term and long-term Granger causality. The error correction term stands for the long-term relations among the variables. However, this VECM step does not provide any relative degree of exogeneity between domestic fuel price and manufacturing sector.

5.6 Step 6: Variance Decompositions (VDCs)

In this step, Variance Decompositions (VDCs) provide the results on the relative degree of endogeneity or exogeneity of the variables. Variance Decompositions (VDCs) are made up of orthogonalized VDC and generalized VDC. Orthogonalized VDC result are shown in Table 9. Table 9 shows the variance of forecast error once we shocked one variable. Basically, we are interested on the variance of forecast error of the shocked variable on itself. This impact can be used to explain exogeneity and endogeneity of a variable. However, we will not discuss orthogonalized VDC result because it has ordering bias. In orthogonalized VDC, the variable that is ordered first will usually become exogenous. Consequently, our exogeneity ranking will be incorrect.

Table 9: Percentage of forecast variance explained by innovations in: Orthogonalized variance decompositions

Quarter	ΔLOIL	ΔLMFG	ΔLCON
Relative variance in ΔLOIL			
4	68.30%	13.61%	18.09%
12	67.56%	16.43%	16.02%
20	67.30%	17.01%	15.70%
Relative variance in ΔLMFG			
4	16.65%	81.52%	1.83%
12	17.42%	80.84%	1.73%
20	17.58%	80.67%	1.74%
Relative variance in ΔLCON			
4	2.60%	64.93%	32.47%

12	3.37%	83.18%	13.45%
20	3.54%	87.94%	8.52%

When performing generalized VDC, it is important to realize that the variance of forecast error given in each horizon will not be equal to 1. In other words, the results generated have to be recalculated to obtain Table 10. The relative exogeneity or endogeneity of a variable can be determined by the proportion of the variance explained by its own past. The variable that is explained mostly by its own shocks (and not by others) is deemed to be the most exogenous of all. In Table 10, at the end of the forecast horizon number four, the contributions of own shocks towards explaining the forecast error variance of each variable are as follows: domestic fuel price variable (65%), manufacturing sector to GDP variable (70%) and construction sector to GDP variable (49%).

Table 10: Percentage of forecast variance explained by innovations in: Generalized variance decompositions

Quarter	ΔLOIL	ΔLMFG	ΔLCON
Relative variance in ΔLOIL			
4	**64.89%**	33.91%	1.20%
12	61.88%	37.65%	0.47%
20	61.26%	38.44%	0.30%
Relative variance in ΔLMFG			
4	11.95%	**69.68%**	18.37%
12	12.51%	69.70%	17.79%
20	12.64%	69.75%	17.61%
Relative variance in ΔLCON			
4	2.06%	49.35%	**48.59%**
12	2.44%	60.41%	37.15%
20	2.53%	63.41%	34.06%

The variable that is explained mostly by its own shocks and depends relatively less on other variables is the leading variable. These results tend to indicate that the manufacturing sector variable is the most exogenous of all followed by domestic fuel price as the second leader. Both variables contribute to the construction sector as the most endogenous (follower). These out-of-sample variance forecast results given by the generalized variance decompositions further strengthen our earlier within-sample results given by the error correction model that the domestic fuel price leads (rather than lags) only one economic sector that is construction sector and not the manufacturing sector. In addition, manufacturing has become the factor for the construction sector within the overall economic sectors of GDP.

5.7 Step 7: Impulse Response Functions (IRFs)

In step 7, generalized IRFs were performed for the each variable as per Figure 1-3 respectively. Consistent to our earlier results, it can be seen that the construction variable is more responsive to the shock by domestic fuel price and manufacturing sector. We have also performed orthogonalized IRFs.

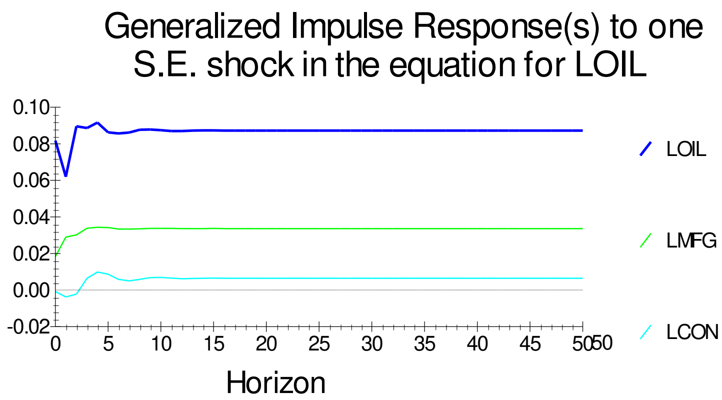

Figure 1: Generalized impulse responses to one SE shock in the equation for LOIL

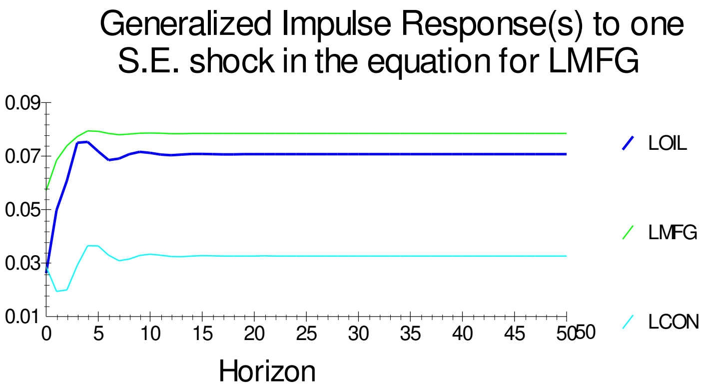

Figure 2: Generalized impulse responses to one SE shock in the equation for LMFG

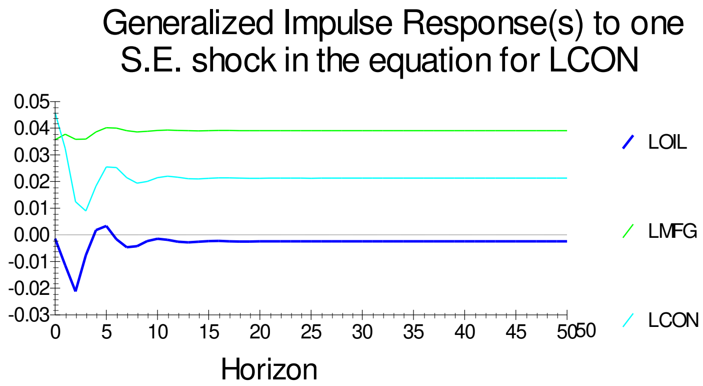

Figure 3: Generalized impulse responses to one SE shock in the equation for LCON

5.8 Step 8: Persistence Profiles (PF)

Finally, persistence profile indicated that where there is a system-wide shock to the cointegrating relationship, it will take about 7 quarters to regain equilibrium (Figure 4).

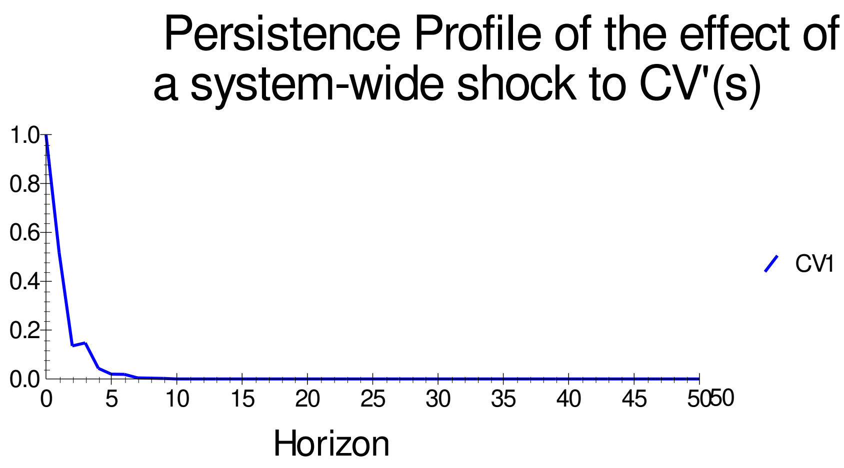

Figure 4: Persistence profile of the effect of a system-wide shock

Notes: The above graph shows the persistence profile from a system wide shock. We see substantial impact during the first half year (two quarters) then the system comes back to equilibrium after just 7 quarters.

As expected, domestic fuel price does affect construction sector in coherence to the results found by Mansor (2010) and Petersen et al. (1994) as quoted by Shaari (2013). However, it is surprising to see that domestic fuel price does not affect manufacturing sector which in contrary to the results found in Shaari, et al. (2013). Based on the distribution of activities in the manufacturing sector by DOSM, most of activities are fairly contributed by oil-based products such as fuel or diesel. Another findings showed that manufacturing does affect construction sector within the entire economic sectors in Malaysia concur to the rule of thumb that all of raw materials for construction come from manufacturing sector (DOSM) and the raw materials alone constitute about 50%-60%[1] of construction sector.

[1] Standard / norm established by Construction Industry Development Board Malaysia (CIDB) and author's experience in estimating construction project costs.

6. Conclusions and Policy Implications

This paper aims to examine the effects of oil price shocks on economic sectors in Malaysia. The paper, which is exclusively empirical in nature, leads us to several important conclusions. A unit root test was conducted, in which data were shown to be non-stationary in level forms, 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 theoretical relationship of domestic fuel prices with the construction and manufacturing sectors. Finally, causality test was performed using VECM and VDC, and the results implied that in Malaysia, domestic fuel price can affect construction but not towards the manufacturing section. In addition, manufacturing does affect construction sector as in the practical real ground foundation. Therefore, the current study has an important implication for the Malaysian government in formulating policies on oil prices specifically domestic fuel prices as the Malaysian government needs to control the price in ensuring that unstable price will not jeopardize the construction sectors and manufacturing sectors in the long run as well as other economic sectors which are yet to be empirically tested.

This rather entails that it is important to consider not just whether oil prices increase (internationally or domestically) or decline (and by how much) but also the environment in which the movement takes place. With the fluctuation of international oil prices, the future foreseeable challenge for Malaysia in attaining sustainable economic growth is crucial and critical.

As such, proactive and innovative programme should be formulated to ensure efficient coordination in the future scenario of the oil prices. This includes the innovation in energy efficient technologies and upgrading existing equipment in order to reduce dependency on crude oil. As noted by Mansor (2010) that renewable energy such as biofuel from the blend of

5 percent processed palm oil and 95 percent diesel would be an alternative especially for the industrial sectors. The revenue from palm oil industry would be another option for government to reduce the subsidy burden and a stable foreign exchange rate regime. Besides, the applications of biofuel, the utilization of the hydropower, solar power and wave power would be alterative sources to fuel. This would be beneficial for Malaysia especially in view of decreasing fossil fuel production and increasing energy demand coupled with the increasing awareness of environmental issues, concern for increasing green house gas emissions and uncertain oil prices.

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