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Pass-through Effect of Oil Price into Consumer Price: An Empirical Study

POH PAIK XUAN AND LEE CHIN*

Faculty of Economics and Management, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor

ABSTRACT

The fuel price in Malaysia is subsidizes by the government with the aim to improve the standard living of the poor by making fuels affordable and obtainable. However, the government has begun phasing out the subsidy by stages due to the adverse effect to the country's development in the long run. Nevertheless, the most demanded type of fuel in Malaysia is diesel and it is still subsidized by the government. Hence, the primary objective of this paper is to study the pass-through effect of actual diesel price and subsidized retail diesel price into Malaysia's consumer price. Essentially, this paper highlights on whether there will be difference in the transmission effect of diesel price into consumer price at both aggregated as well as the disaggregated level. The well-established Autoregressive Distributed Lags (ARDL) method is adopted by incorporating the quarterly data spanning from 2005 until 2013. The results indicated that the transmission effect of actual diesel price is more prominent whereby no subsidy is given comparatively to the retail diesel price whereby the price is subsidizes by the government.

Keywords: ARDL, augmented Philips Curve, diesel price, disaggregated consumer price index

* Corresponding Author: E-mail: leechin@upm.edu.my

Any remaining errors or omissions rest solely with the author(s) of this paper.

INTRODUCTION

During the 1970s, the shocking increase in the oil prices has been associated with the successive economic deterioration. Nonetheless, up till today it has been stereotyped that any economic uncertainty or downturn is more or less associated with the oil prices. Furthermore, there are also growing interest on the relationship between oil price and inflation. This is due to the rising food prices as well as fluctuations in oil price triggered by uncertainty in the global oil and gas outlook.

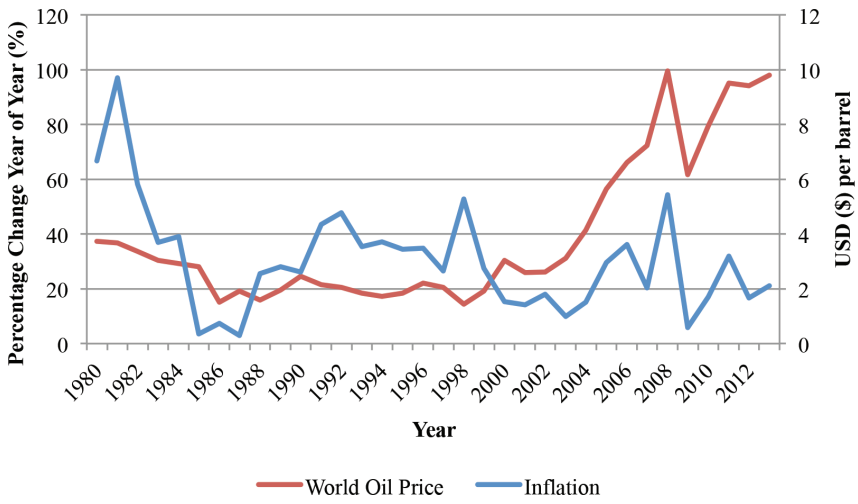
In September 2013 to overcome the problem of the blistering budget deficit; the subsidies for petrol and diesel were reduced. The retail price or price with subsidy for petrol as of 3 March 2013 is at RM 2.10 per liter for RON 95 whereas the diesel is priced at RM 2.00 per liter. The estimated savings from the fuel subsidy rationalization is approximately RM 1.1 billion[1]. On the other hand, government scraped the subsidy for the premium grade petrol, RON 97 which is currently on a managed float system in which the retail price will reflect the price movements of the international oil price. Currently, the RON 97 is priced at RM 2.90 per liter[2]. Since, the diesel price is among the cheapest in the region; government has implemented numerous ways to avoid the exploitation of the fuel subsidies.

The main purpose of this paper is to investigate the pass-through effect of oil price into the consumer price. Figure 1, shows Malaysia's inflation against the movement of the world oil price. The oil price has essentially gone through periods of high and lows throughout the three decades. It is clearly observed that the oil price is between $15 and $40 per barrel with its ups and downs during 1980s until 1990s. However, since the year 2000, the oil price has been climbing steadily and peaked at 2008 with approximately $99 per barrel. This phenomenon is fundamentally motivated by the strong demand for oil as well as stagnating of world oil production. Besides that, it is observe that the recent trend movement for inflation and world oil price seems to exhibit similar trend movement since 2005 onwards. Does these events validate the perception that oil price hike presage inflation in general? Hence, this ultimately drives our interest to investigate the relationship between oil price and inflation for the case of Malaysia spanning from 2005 until 2013 on quarterly basis. Essentially, this can be undertaken by analyzing whether the CPI will be affected by the movement of the oil price.

Moreover, there are arising concerns regarding the transition of Malaysia's role from a net oil exporter to net oil importer in the near future. This has definitely set-off alarms on the future prospects of Malaysia's energy industry. The uncertainty

[1] Facts obtained from Economic Report 2013/2014.

[2] The retail price is as of the price for 7 March 2014 onwards at the petrol station.



Source: World Development Indicators and Oxford Economics

Figure 1 Malaysia's inflation versus world oil price

of the world oil price has been exerting pressure on the government spending since the oil price is subsidized by the government. However, the government has begun implementing the subsidy rationalizing. Therefore, it is crucial to compare the effect of oil price with and without the subsidy on the consumer price. Acknowledging this fact, this paper utilized the diesel price as the proxy for oil price because it is the highest demanded fuel type in Malaysia besides it is still heavily subsidized by the government. Thus, the data for diesel price will be investigated both at the actual price as well as the retail price. The notion of retail price refers to the price with subsidy whereas the actual price indicates the price without subsidy. The oil price quoted in the actual and retail price will have different effect on the consumer price. The actual price refers to the diesel price before the government subsidy whereas the retail price indicates the diesel price after the government subsidy. Hence, by taking into account of the retail price; the effect of subsidies will be incorporated. The transmission effect of the retail price will indicate the actual effect bore by the consumer after considering the subsidy effect into the consumer price index.

Currently, the study on the pass-through effect of oil price into consumer price for the case of Malaysia has also been undertaken by Ibrahim and Said (2012). Nevertheless, the fundamental difference between this paper and Ibrahim and Said (2012) are: First, Ibrahim and Said (2012) employed the data for CPI from 1971 to

2009 on annual basis whereas this paper utilized the quarterly data from the year 2005 onwards. The sub-index for CPI has been redefined in which there were nine sub-indexes before 2005 and has been elaborated to twelve sub-indexes from 2005 onwards. Second, this paper utilized all the twelve sub-indexes whereas Ibrahim and Said (2012) only utilized four sub-indexes namely the food price index (FPI); rent, fuel and power price index (RFPI); transportation and communication price index (TCPI) and medical care and health price index (MHPI). Third, the oil price proxy adopted by Ibrahim and Said (2012) is the West Texas Intermediate (WTI) crude oil price data. However, Malaysia's oil price is subsidizes by the government or in other words; part of the transmission effect of the oil price into consumer price is absorbed by the government. Hence, the usage of world oil price as proxy might not be able to capture the actual effect undergone by the consumer in general. Therefore, with that in mind this paper introduces the usage of diesel price both in the actual price as well as the retail price.

Nevertheless, there is a lack of empirical evidence on the pass-through effect of oil prices into inflation at a disaggregated level. This paper will examine the transmission effect of oil price on the consumer price index at the aggregated level as well as at the disaggregated level which incorporates all the twelve sub-indexes by investigating the long run relationship between inflation and oil price. Fundamentally, the knowledge of the pass-through effect at the disaggregated level through the findings from this paper will be able to shed some lights on how much each good category is affected by the energy price. Therefore, this paper will indicate how many percent of the variation in the inflation for each good category is explained by the oil price shock as well if there is a long run significance of the oil price to each sub-price index. In a nutshell, by being able to comprehend the transmission of the oil price into the consumer price index; these findings will be able to assist policymakers in outlining effective policies particularly the future subsidies policies. Since, the government has planned to phase out subsidy in near future; the effect of inflation and transmission into the price levels has to be monitored carefully in order to avoid further burdening the consumer's cost of living which has been soaring in the recent years.

REVIEW OF LITERATURE

The pass-through effect of oil price into consumer price at the aggregated price level has been highlighted in numerous studies. Among others who captured the pass-through of oil price into inflation has decreased or can even be ignored include Hooker (2002). Hooker (2002), explored the impacts of the oil price changes on the United States' inflation. The findings on the structural break obtained shows that

the effect observed for the two period of time were contrasting. It is observed that the effect of oil pass-through was more obvious before the year 1981. However, the situation took a turn after the year 1981 in which the pass-through was so small and can be assumed to be negligible. Besides that, Chen (2009), acknowledged that decline in the oil price pass-through can be explained by the appreciation of the domestic currency, a more effective monetary policy in response to inflation as well as a higher degree of trade openness for the 19 industrial countries[3] investigated. Moreover, De Gregorio et al. (2007), also suggests a decreasing transmission trend for a total of 33 both developed and developing countries[4] studied.

In addition, mixtures of results were documented essentially involving the developing nation. LeBlanc and Chinn (2004), assesses the relationship between changes in oil prices on inflation for United States, United Kingdom, France, Germany and Japan utilizing the augmented Philips curve approach. The empirical results show that the rises in oil price only have modest impact on the inflation for the case of United States, Japan and Europe[5]. Moreover, Alvarez (2011), analyzes the effect of oil price change on consumer price inflation for Spain and euro area which consists of France, Germany as well as Italy. The oil price changes on Spain's inflation appear to be slightly higher comparatively to other euro area.

Besides that, taking into consideration of the Asian countries Cunado and de Gracia (2005), investigates the effect oil price shocks on both inflation and economic growth by engaging a different oil-output and oil-CPI specifications for six Asian countries which incorporated Japan, Singapore, South Korea, Malaysia, Thailand and the Philippines. The findings conclude that for the oil-CPI relationship the impact is restricted to the short run and is more significant when the oil price shocks are measured in the local currencies. Particularly for the case of Malaysia, the evidence of asymmetries is recorded for the oil prices changes and inflation relationship whereas the oil price and macro-economy relationship appears to be less significant comparatively to other countries since Malaysia is a net oil exporting country. Furthermore, Chou and Tseng (2011), investigates the short run and long run impact of oil prices on inflation for the case of Taiwan. The empirical finding suggests that the international oil price has a significant and long run pass-through impact on inflation. However, the short run pass-through impact was not significant.

[3] Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Ireland, Italy, Japan, the Netherlands, Norway, Portugal, Spain, Sweden, Switzerland, the U.K. and the U.S.

[4] The countries included are Argentina, Australia, Austria, Barbados, Belgium, Canada, Chile, Côte d'Ivoire, Denmark, Finland, France, Germany, Greece, India, Ireland, Israel, Italy, Japan, Jordan, Korea, Malaysia, Mexico, Netherlands, Nigeria, Norway, Portugal, Senegal, South Africa, Spain, Sweden, Switzerland, United Kingdom and United States.

[5] Europe refers to United Kingdom, France and Germany.

Mandal et al. (2012), evaluates the relationship between India's oil price pass-through into inflation and industrial output. Since 2002, it is observed that there is a higher pass-through effect of international prices on domestic inflation. This is due to the repercussion effect of the frequent adjustments of the prices of some petroleum prices in order to be consistent with international crude prices.

On the other hand, at the disaggregated level; the pass-through effect of oil price into the commodity prices is captured. Baffes (2007), studied the pass-through effect of the crude oil prices changes on the prices of the 35 fundamental commodities that were internationally traded for the case of United States. The findings indicates that at the aggregated level the effect of the crude oil price changes to the overall non-energy index is at 0.16 whereas at the disaggregated level it is observed that the most apical pass-through effect is the fertilizer index with 0.33, agriculture tailing behind at 0.17 and followed by metals with 0.11. Moreover, Alghalith (2010), examined the effect of oil price uncertainty on food prices for two small oil-based countries which incorporates Trinidad and Tobago. The findings show that higher oil price leads to higher food price. This is indicated by an increase of a dollar in the oil prices causes an increase of 5.6 points in the food price index. Chen et al. (2010), examined the relationship between the crude oil price and the global grain prices namely corn, soybean and wheat. The findings indicate that the change in each grain price is significantly affected by the changes in the crude oil price as well as the other grain prices.

Moreover, studies with emphasize on the short run and long run at the disaggregated level include Nazlioglu and Soytas (2011), who studied the relationship between the short run and long run interdependence between oil prices, exchange rate and agricultural commodities prices namely wheat, cotton, soybeans and sunflower for the case of Turkey. The results show that the findings for the short run and long run are in unison whereby the agricultural commodity is neutral to the changes in oil price. Ibrahim and Kanokwan (2014) investigated the inflationary effects of oil prices at both aggregated and disaggregated level for the case of Thailand. The conclusion drawn from the co-integration test indicated that there exists long run relationship between oil price and the subsequent price indices: aggregate consumer price index, non-food and beverage price index, housing and furnishing price index, energy price index, non-raw food and energy price index as well as transportation and communication price index. In addition, the short run relationship between for the impacts of oil prices on inflation is found to be significant in all goods sectors. Moreover, the largest effects of oil price changes are observed on the energy price inflation tailed by the transportation and communication price inflation and the non-raw food and energy price inflation.

Furthermore, Ibrahim and Said (2012), examines the long run and short run relationship of the oil price pass-through into consumer price index for the case of Malaysia. The study include both the aggregate consumer price index (CPI) as well as the disaggregated sub price-indexes mainly the food price index (FPI), rent, fuel and power price index (RFPI), transportation and communication price index (TCPI) as well as the medical care and health price index (MHPI). The conclusion drawn is that the long run relationship is only observed for CPI and FPI with the oil price. However, in the short run oil price changes appears to have meaningful impact on the CPI, FPI, RFPI, and TCPI.

RESEARCH METHODOLOGY

Model

The oil price pass-through relationship into the consumer price index utilized the augmented Phillips curve following Chen (2009) which investigated the degree of oil price pass-through into inflation as per suggested by the following model:-

$$\pi_t = \gamma + \sum_{i=1}^{k} \sigma_i \pi_{t-i} + \delta(y_{t-1} - \overline{y}_{t-1}) + \sum_{i=0}^{k} \theta_i \Delta o_{t-i} + \varepsilon_{t-1} \qquad (1)$$

where Δ denotes the first difference operator, k indicates the optimal lag order, represents $\pi_t = p_t - p_{t-1}$ change in the natural log of consumer price index (CPI), y_t shows the natural log of real output whereas $\overline{y}_t$ is the potential output and the augmented term, o_t is the natural log of oil price.

Method

The pioneering work on the ARDL bound test was introduced by Pesaran and Shin (1999) and were later further elaborated by Pesaran et al. (2001). The core foundation of this approach was built on the Ordinary Least Square (OLS) estimation of a conditional unrestricted error correction model (UECM) for co-integration. It is utilized to test for the presence of the long run relationship on the oil price pass-through into inflation. The beauty of this method has been outlined by Narayan and Narayan (2005), Ghatak and Siddiki (2001), Tang (2003) as well as Duasa (2007) which suggest that the ARDL approach allows for the usage of small sample size but yet, yield valid results. According to Pesaran et al. (2001), a unit root test is deemed unnecessary if a conclusion can be drawn from the bound test for co-integration. Besides that, Hoque and Yusop (2010), stated that the ARDL

method allows for the condition in which the regressors are I(1) and I(0) or mutually co-integrated whereas Johansen's method necessitates the variables to be integrated at the same lag order for the co-integration test to be conducted.

Based on Pesaran et al. (2001), the model can be expressed in the unrestricted error correction model (UECM) form of the ARDL model. In order to achieve a parsimonious model; the general to specific modelling suggested by Hendry (1995) is adopted by excluding the insignificant lagged variables subsequent from estimating the general model through the OLS method. Consider the following equation asserted in the UECM form:-

$$\begin{aligned}\Delta \ln(CPI)_t = {} & c + \beta_1 LCPI_{t-1} + \beta_2 LAP_{t-1} + \beta_3 LRGDP_{t-1} \\ & + \sum_{i=1}^{P} \alpha_{1i} \Delta LCPI_{t-i} + \sum_{i=0}^{P} \alpha_{2i} \Delta LAP_{t-i} \\ & + \sum_{i=0}^{P} \alpha_{2i} \Delta LRGDP_{t-i} + \varepsilon_t \end{aligned} \tag{2}$$

where Δ indicates the first difference operator and ε_t represents the white noise. The CPI in equation (2) is replaced accordingly when examining for the disaggregated data as well as the actual price of diesel (AP) is substituted accordingly with retail price of diesel (RP) based on the model that is investigated.

Next, to examine the presence of co-integration, Wald coefficient test is employed by computing the F-statistic which will be compared to the critical values indicated in Narayan (2005). Besides that, to examine the long run and short run relationship, the Schwarz Bayesian Criterion (SBC) model selection criterion is utilized which have been suggested by Lutkepohl (1991) to be more consistent comparatively to the Akaike Information Criterion (AIC) in order to select the appropriate lag for the models.

The expected signs for the relationship between the oil price proxy by actual diesel price (LAP) and retail diesel price (LRP) with consumer price are predicted to be positive. This is because an increase the LAP or LRP in general will lead to increase in cost of production which will be reflected in increase of the price index. Besides that, the relationship between real gdp and price level is also expected to be positively related. Based on the theory of Phillips curve which suggests negative relationship between inflation and unemployment; hence, when there is an increase in real GDP this will lead to lower unemployment which is translated to higher inflation. In other words, increase in real GDP will lead to an increase in the inflation. The expected signs are also supported by the findings from Ibrahim and Said (2012).

Data

The oil price transmission into the consumer price levels utilized the quarterly data from 2005:Q1 until 2013:Q4[6]. The data for both the aggregated and twelve disaggregated consumer price index as well as the real gdp are obtained from Bank Negara Malaysia. The twelve disaggregated consumer price index include the food and non-alcoholic beverages price index (FNAPI); alcoholic beverages and tobacco price index (ATPI); clothing and footwear price index (CFPI); housing, water, electricity, gas and other fuels price index (HWEPI); furnishing, household equipment and routine price index (FHRPI); health price index (HPI); transport price index (TPI); communication price index (CMPI); recreation services and culture price index (RSCPI); education price index (EPI); restaurant and hotels price index (RHPI) as well as miscellaneous goods and services price index (MGSPI). Furthermore, the oil price is proxy by actual and retail diesel price which were employed from the Department of Statistics Malaysia.

RESULTS

Firstly, in order to determine the stationarity of the variables whether it is I(0) or I(1); a series of unit root tests are conducted which include DF or ADF, PP and KPSS unit root tests[7]. The findings from all three unit root tests were in unison by concluding that all the variables are I(1) process excluding LAP and LRP which appear to be I(0) process. Nevertheless, ARDL framework allows for regressors to be I(1) and I(0) or mutually co-integrated (Pesaran et al., 2001).

Subsequent from determining the stationarity of the variables through the unit root test; the ARDL bound testing is conducted to confirm the existence of the long run relationship between the variables in the model. Therefore, the Hendry's General to Specific method is utilized to determine the optimal lag length based on the top down approach. Table 1 presents the result of ARDL bound test for both actual diesel price (LAP) and retail diesel price (LRP). Model 1A (LCPI) is the model that used aggregate consumer price, whereas Model 2A – 13A are models that employed twelve different disaggregate price level. According to Table 1, it is indicated that the F-statistic for Model 1A (LCPI), Model 6A (LFHRPI) and Model 8A (LTPI) is more than the upper bound for 1% critical value. Besides that, Model 2A (LFNAPI) is also higher than the upper bound for 5% critical value. This

[6] The data is collected from 2005 onwards because the sub-index for CPI has been redefined in which there were nine sub-indexes before 2005 and has been elaborated to twelve sub-indexes from 2005 onwards.

[7] The result of unit root test is available from authors upon request.

concludes the existence of long run relationship for Model 1A at the aggregated level as well as Model 2A, 6A and 8A at the disaggregated level in which the null hypothesis of no co-integration is rejected. On the other hand, Model 1B (LCPI) is the model that used aggregate consumer price, whereas Model 2B – 13B are the disaggregate price level models. Based on Table 1, it is clearly indicated that the F-statistic for Model 1B (LCPI), Model 6B (LFHRPI) and Model 9B (LCMPI) is more than the upper bound of 1% significant level critical value. Hence, the null hypothesis of no co-integration in the long run is rejected. Table 2 indicates the summary of diagnostic test for ARDL bound test on actual diesel price (LAP) and retail diesel price (LRP). As shown in Table 2, the models passed the diagnostic tests; the long run co-integration test is then undertaken.

Table 1 ARDL bound test for Actual Diesel Price (LAP) and Retail Diesel Price (LRP)

	Variable	F-statistic	
		Model A (Actual Diesel Price)	**Model B (Retail Diesel Price)**
	Aggregated		
Model 1:	Consumer price index (LCPI)	8.9622***	10.3841***
	Disaggregated		
Model 2:	Food and non-alcoholic beverages price index (LFNAPI)	5.7483**	4.1982
Model 3:	Alcoholic beverages and tobacco price index (LATPI)	4.3015	1.4771
Model 4:	Clothing and footwear price index (LCFPI)	1.4282	2.7103
Model 5:	Housing, water, electricity, gas and other fuels price index (LHWEPI)	4.3850	4.3916
Model 6:	Furnishing, household equipment and routine household maintenance price index (LFHRPI)	11.6068***	8.5916***
Model 7:	Health price index (LHPI)	2.4784	2.3019
Model 8:	Transport price index (LTPI)	9.8916***	4.3068

Model 9:	Communication price index (LCMPI)	4.6942	9.2227***
Model 10:	Recreation services and culture price index (LRSCPI)	0.8838	1.4746
Model 11:	Education price index (LEPI)	2.6656	2.1452
Model 12:	Restaurants and hotels price index (LRHPI)	2.7202	3.0500
Model 13:	Miscellaneous goods and services price index (LMGSPI)	1.3160	1.5228

Narayan (2005)[a] k=2; n=36		
Critical Value	**Lower Bound**	**Upper Bound**
1%	6.140	7.607
5%	4.183	5.333

Note: *** and ** denotes significance at the 1% and 5% level respectively. [a]Critical values are cited from Narayan (2005) [Table Case III: Unrestricted intercept and No Trend, p. 1988]. The variables indicated in the table are the dependent variable and the independent variables include the actual diesel price and real gdp.

Table 3, shows the ARDL co-efficient for long run co-integration. Based on Table 3, the long run relationship appears to be positive sign for all models except for Model 9B which is the communication price index (LCMPI). These findings are concurrent with the expected signs excluding LCMPI. The comprehensive discussion of the results will begin with the findings from actual diesel price (LAP). The results captured for the aggregated model shows that Model 1A (LCPI) in which both the LAP and LRGDP is significant at 5% level. Hence, a 1% increase in the actual price of the diesel (LAP) is associated with a 0.21% increase in the consumer price (LCPI). Besides that, 1% increase in the real gdp (LRGDP) leads to 0.29% increase in the consumer price (LCPI). These results are consistent with Ibrahim and Said (2012), which also finds a positive a significant relationship between CPI and both the real output and oil prices. This is in accordance with the theory because oil is an important input to production. As input price increase, cost of production increase; this increase in cost of production will be reflected in the increase of the consumer price. Next, we will look at how the actual price affect consumer price in disaggregate level. Model 2A (LFNAPI) indicated a 1% increase in the LAP correlates with an increase in the LFNAPI by 0.39%. Furthermore, a 1% increase in the LRGDP leads to an increase in LFNAPI by 0.54%. Since, the pass-through effect of actual diesel price is investigated in which the subsidy is not taken into

Table 2 Summary of diagnostic test for ARDL bound test on Actual Diesel Price (LAP) and Retail Diesel Price (LRP)

Determinants	LAP				LRP		
	Model 1A (LCPI)	**Model 2A (LFNAPI)**	**Model 6A (LFHRPI)**	**Model 8A (LTPI)**	**Model 1B (LCPI)**	**Model 6B (LFHRPI)**	**Model 9B (LCMPI)**
	Consumer price index	***Food and non-alcoholic beverages price index***	***Furnishing, household equipment and routine household maintenance price index***	***Transport price index***	***Consumer price index***	***Furnishing, household equipment and routine household maintenance price index***	***Communication price index***
Lag Structure	(1, 0, 1)	(1, 0, 0)	(2, 0, 0)	(1, 0, 0)	(1, 0, 0)	(1, 0, 1)	(2, 1, 0)
F-statistics	8.9622***	5.7483***	11.6068***	9.8916***	10.3841***	8.5196***	9.2227***
Diagnostic Tests							
LM Test (2)	2.4419	0.0857	0.6209	1.6018	1.2833	0.8998	1.2056
LM Test (4)	4.8224	3.6670	4.4784	5.8563	2.0089	3.0056	1.8850
ARCH Test (1)	0.0087	0.0400	0.2952	0.0148	0.0792	0.3733	0.6682
CUSUM Test	Stable	Stable	Stable	Stable	Stable	Stable	Stable
CUSUMQ Test	Stable	Stable	Stable	Stable	Stable	Stable	Stable

Note: ** denotes 5% significance level and *** indicates 1% significance level. The figure in parenthesis (…) is the lag selected based on Hendry's General to Specific method.

Table 3 ARDL co-efficient for long run co-integration

Determinants	LAP				LRP		
	Model 1A (LCPI)	**Model 2A (LFNAPI)**	**Model 6A (LFHRPI)**	**Model 8A (LTPI)**	**Model 1B (LCPI)**	**Model 6B (LFHRPI)**	**Model 9B (LCMPI)**
	Consumer price index	***Food and non-alcoholic beverages price index***	***Furnishing, household equipment and routine household maintenance price index***	***Transport price index***	***Consumer price index***	***Furnishing, household equipment and routine household maintenance price index***	***Communication price index***
Lag Structure	(2,1,0)	(1,0,1)	(1,1,2)	(2,1,0)	(1,0,0)	(1,1,2)	(1,2,0)
LAP	0.2104**	0.3914*	0.3337	0.2913**	–	–	–
LRP	–	–	–	–	0.1552***	0.1660**	–0.024***
LRGDP	0.2938**	0.5417**	0.5149	0.0266	0.4510***	0.3613***	–0.1045***

Note: * shows 10% significance level, ** indicates 5% significance level and *** denotes 1% significance level. The figure in parenthesis (…) is the lag selected based on SBC.

account; a higher pass-through effect at 0.39 is observed comparatively to Gilbert (1989) at 0.25, Baffes (2007) at 0.18 and Ibrahim and Said (2012) at 0.06 which examined the transmission effect of world oil price into food price. Model 8A (LTPI) reported an increase of 1% in the LAP is associated with a 0.29% increase in the LTPI whereas no significant relationship is captured between LTPI and LRGDP. The transmission of the LAP into the LTPI is predicted as the transportation industry is one of the highest diesel consuming industries. Therefore, if the LAP increases it is expected the LTPI will increase. As for Model 6A (LFHRPI), there is no significant long run relationship captured in LAP and LRGDP with LFHRPI.

When the proxy for oil price has been changed from actual price (LAP) to retail price (LRP), it is observed that the transmission effect of oil price into consumer price is more noticeable for LAP comparatively to LRP. The estimated coefficients for Model 1A and 6A are greater than the estimated coefficients for Model 1B and 6B, respectively. This scenario is well justified with the understanding that the LAP is not subsidizes by the government or in other words the subsidy effect does not stand in the way of the actual transmission effect to the consumer. The findings shows that when LAP is utilized, the long run transmission effect is captured in four price indexes which include the LCPI at the aggregated level as well as LFNAPI, LFHPRI and LTPI at the disaggregated level. On the other hand, as for LRP the long run transmission effect is seen in three price indexes which incorporate LCPI at the aggregated level as well as LFHRPI and LCMPI at disaggregated level. According to Table 3 for Model 1B, a 1% increase in the LRP is associated with 0.16% increase in the LCPI. Also, it also observed that 1% increase in the LRGDP leads to 0.45% increase in LCPI. Furthermore in Model 6B, 1% increase in the LRP relates to 0.17% increase in the LFHRPI. Moreover, 1% increase in the LRGDP is associated with a 0.36% increase in the LFHRPI. These results are accordant to the theory and expected signs. However a significant and negative relationship is captured between communication price index (LCMPI) in Model 9B with both LRP and LRGDP which is inconsistent with the expected sign. The LCMPI incorporates the telephone and telefax equipment as well as services. This phenomenon can be justified that this industry is a very unique industry where the fixed cost is huge in this industry. The fixed costs include the equipment, infrastructure and tower that is utilized in the communication industry whereas oil price falls under the variable costs. Hence, an increase in the oil price or in our case the diesel retail price will have only negligible effects on the LCMPI. The negative relationship between LCMPI and LRP is probably due to the changes in other variable costs that lead a decrease in the LCMPI. Besides that, the negative relationship between LCMPI and LRGDP can be explained by the fact that as the economy progress into higher income economy; this leads to a higher purchasing power of the public in general

and therefore higher affordability to subscribe for the communication service. Applying the understanding in the economics of scale, with higher demand leads to lower per unit cost for production and ultimately a lower price in the communication service which is reflected in LCMPI.

On the other hand, the error correction model refers to the speed of adjustment of the dependent variables accustoms to the changes in the independent variables before converging to the equilibrium level. Ultimately, this model is essentially utilized to estimate the presence of the short run co-integration. Table 4 provides an insight of the finding for the error correction model for the both LAP and LRP. Bannerjee et al. (1998), suggest that the presence of a stable long-run relationship is further confirmed if the error correction term (ECT) appears to be highly significant. Based on the actual price (LAP), Table 4 indicates that the $ECM_t(-1)$ is -0.2211 which denotes that the convergence to equilibrium of the Malaysia's consumer price in one year is corrected approximately 22.11% in the following year and is significant level at 1%. Besides that, the negative and significant scenario also observed in Model 2A and 8A. However, only negative but not significant relationship captured in Model 6A through the error correction model. Furthermore, it is shown that LTPI has the fastest speed of adjustment and is highly significant. As for the retail price (LRP), Table 4 shows that the convergence to equilibrium of the Malaysia's consumer price index is approximately 19.01%. Besides that, the speed of adjustment for furnishing, household equipment and routine household maintenance and communication prices are 8.23% and 43.02%, respectively. Both the model is robust which is indicated in the diagnostic tests

In a nutshell, the findings indicated that the pass-through effect for LAP is more prominent comparatively to LRP. Although, both shows significance for the pass-through effect at the aggregated level but at the disaggregated level LAP indicates that the transmission effect into price index is significant for three sub-indexes which incorporates LFNAPI, LFHRPI and LTPI. However, LRP only recorded significance for two sub-indexes namely LFHRPI and LCMPI at the disaggregated level. Nevertheless, both LAP and LRP captured significance for LFHRPI at the disaggregated level.

CONCLUSIONS AND POLICY IMPLICATIONS

The main objective of this paper is to investigate the pass-through effect of the actual diesel price and subsidized retail diesel price into consumer price at both the aggregated as well as disaggregated level. If the government were to rationalize and eventually phase out the subsidy most probably in the near future; the effect on the consumer price can be observed through the actual diesel price. On the other

TABLE 4 Error Correction Model

Determinants	Actual Diesel Price (LAP)				Retail Diesel Price (LAP)		
	Model 1A (LCPI)	**Model 2A (LFNAPI)**	**Model 6A (LFHRPI)**	**Model 8A (LTPI)**	**Model 1B (LCPI)**	**Model 6B (LFHRPI)**	**Model 9B (LCMPI)**
	Consumer price index	***Food and non-alcoholic beverages price index***	***Furnishing, household equipment and routine household maintenance price index***	***Transport price index***	***Consumer price index***	***Furnishing, household equipment and routine household maintenance price index***	***Communication price index***
Δ LAP_t	0.0143	0.0363***	0.0049	0.0241	0.0823***	0.0293***	–0.0012
Δ $LRGDP_t$	0.0650	–0.2047**	–0.0393	0.0174	0.0857***	–0.0850**	–0.0445***
ECM_t (-1)	–0.2211***	–0.0928**	–0.0604	–0.6532***	–0.1901***	–0.0823***	–0.4302***
			Diagnostic Tests				
LM Test (2)	1.4955	1.5680	3.3188	1.7195	0.1366	1.4773	2.2476
LM Test (4)	8.2255	5.6008	3.8010	6.5704	0.3202	3.4832	2.6490
ARCH Test (1)	0.0504	0.0775	0.2007	1.8986	0.0085	1.1108	1.3158
CUSUM Test	Stable	Stable	Stable	Stable	Stable	Stable	Stable
CUSUMQ Test	Stable	Stable	Stable	Stable	Stable	Stable	Stable

Note: * shows 10% significance level, ** indicates % significance level and *** denotes 1% significance level.

hand, the current situation where the oil price is subsidized by the government; the pass-through effect into consumer price can be observed through the retail diesel price. These denote that precise and effective policy outline should be undertaken in order to curb any adverse impact transmitted into the consumer price due to the oil price fluctuation whether it is with or without subsidy. The major key findings of this paper are as per follow: (1) The pass-through effect of oil price into consumer price proxy by the actual diesel price is observed for CPI at the aggregated level as well as FNAPI, FHRPI and TPI at disaggregated level, (2) As for the oil price utilizing the retail diesel price which also takes into the account of the subsidy effect; the pass-through effect is detected for CPI at the aggregated level whereas FHRPI and CMPI at the disaggregated level.

Since, the findings indicated that the pass-through effect of actual diesel price is larger than the subsidized retail diesel price; we will focus our policy implication on the actual diesel price which is also the price that will be faced by the consumer when government phase out the subsidy in the future. Based on the findings, it is shown that the transmission effect of actual diesel price into consumer price at the disaggregated level in the long run is captured for food and non-alcoholic beverages price index (FNAPI); furnishing, household equipment and routine household maintenance price index (FHRPI) as well as transport price index (TPI). Hence, careful attention needed to be given to these price indexes if the government decides to phase out subsidy. Nevertheless, the policy implication is straight forward.

Fundamentally, the FNAPI make up almost one third[8] of the consumer price index (CPI) or in other words it will have severe effect on the consumer. The oil price increase will exert pressure on FNAPI because the modern agriculture utilized oil products to fuel farm machinery as well as to transport inputs to farm and transport farm output to the potential consumers. Therefore, policy implication can be outline to boost the domestic production of the important food components with better land management as well as increase in productivity. Besides that, focus should also be given into efficient distribution and marketing chains of food products which will lead to a reduction of cost in production through efficient utilization of fuel. The pass-through effect is also observed in the transportation price index (TPI) which is also expected. This is because the transportation sector is highly engage in the usage of fuel in most of the mode of transport. Thus, policy implication blueprint should emphasize on effort to develop the public transportation, encourage carpooling as well improve the freight transport management. This will essentially reduce reliance of consumers on the fuel. On the other hand, the transmission effect of oil price into the furnishing, household equipment and routine household maintenance

[8] The weights for FNAPI out of the total CPI is 30.3 as per the Department of Statics, Malaysia (b=2010).

price index (FHRPI) is the knock-on effect due to the increase in the global energy and food prices which lead to an increase in the cost of operations for business. Hence, many businesses transfer the higher costs of production to consumers by increasing the retail prices. In that case, the government should monitor closely the market through the effective role of the Ministry of Domestic Trade so that irresponsible businessmen do not take the advantage of the situation by simply raising the retail price.

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