The Effects of Fuel Price Fluctuation on Household Income in Malaysia

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ABSTRACT

The removal of fuel subsidy has affected many Malaysians due to the increase in the cost of living and hence causing insufficient income to cover monthly expenditures. This study investigates the total, direct and indirect effects of fuel price fluctuations on household income in Malaysia due to subsidy removal. The data from the Household Expenditure Survey (HES) conducted by the Department of Statistics Malaysia was used in this study. The households were differentiated into three income groups, namely Top 20% (T20), Middle 40% (M40), and Bottom 40% (B40) which incuded the years 2009/ 2010, 2014, and 2016. Then, the partial equilibrium approach was used to investigate all effects. The effects were investigated for different incomes and ethnic groups. This study found that group B40 experienced the greatest indirect and total effect of fuel price fluctuations due to the subsidy removal. For the direct effect, there was not much difference seen among all income groups after the subsidy removal. Furthermore, the effects were found to be lower after the fuel subsidy removal for all ethnic groups. Thus, the findings could help the government in examining the policy of subsidy removal in order to successfully help the poor. Hence, this could improve the quality of life, especially for the income groups B40 and M40.

Keywords: Fuel price fluctuation, income group, partial equilibrium, subsidy removal.

1.   Introduction

The world crude oil price has experienced an increasing trend from 2005 to 2013. The world crude oil prices had a significant increase in 2008 of about 36.70% that resulted in 94.4 USD per barrel, in Saari et al. (2016). In Malaysia, the crude oil price has doubled from 0.70% in 2001 to 1.40% in 2007 (see Saari et al. (2016)). Due to that phenomenon, the Malaysian government took a big step by removing the fuel subsidy in 2007. Since then, the fuel subsidy has been a controversial issue for many years in Malaysia.

The rise in crude oil price has caused the increase of fuel price and hence, contributed to the increase in the price of necessities, cost of living, and the rise in bankruptcies. Moreover, the effect has greatly affected many economic sectors. The most significant sector that has been affected by the increase in fuel price is transportation as it is highly dependent on fuel consumption. Several studies have found that the transportation sector has received the most significant impact due to increase in fuel price (see Aimer (2016), Delsalle (2002), Setyawan (2014)). Other economic sectors that are affected by the increasing fuel price were manufacturing, agricultural, and construction. The economic growth of many countries has also been significantly affected by the increase in fuel price.

Initially, the fuel subsidy in Malaysia was introduced to lighten the burden of households especially the lower income and to improve the welfare of the society. However, it turns out that only the rich groups have mostly benefited from this initiative. Thus, the objective of this initiative has not been achieved. In Malaysia, the government has taken a big step by removing the fuel subsidy. In consequence, most individuals have experienced income loss due to the removal of the fuel subsidy. The greatest income loss has been experienced by Malays as compared to Chinese and Indians. The income loss has occurred due to the consumption of products that require a lot of energy that share most of the household income, see Saari et al. (2016). Hakim et al. (2016) also found that the middle-income groups were significantly affected by the increase in fuel price. Thus, the concerns of this study will revolve around the issue of income loss among households. The government of Malaysia currently distinguishes households into three different groups primarily Top 20% (T20), Middle 40% (M40) and Bottom 40% (B40). This is done with the aim to help the Bottom (B40) group. Many programs have been developed to assist the B40 group

such as health protection scheme, low cost housing, cost of living aids, and others. These programs have been established to provide a better life for this group. Thus, this study investigated the direct, indirect and total effects of fuel price fluctuations on household income groups in Malaysia. The interest was to see the impacts on the three different income groups and examine whether the government initiatives in helping the B40 group has been successful. Additionally, the effects of fuel price fluctuations on household incomes for major ethnic groups in Malaysia were also investigated.

2. Literature review

The fuel subsidy was initially introduced with the aim to help the poor households. However, several empirical studies found that the subsidy was mostly benefited by the richest households. Thus, the objective of the fuel subsidy has failed. Coady et al. (2010) found that the gasoline subsidies were mostly enjoyed by the richest 40% of households. This group also received over 65% subsidy of diesel and 70% subsidy of petroleum. Another study by El-Said and Leigh (2006) also found that about one third of the total subsidy was received by the richest 10% group in Gabon. Moreover, Jiang et al. (2015) discovered the negative effects of the subsidy removal on the poor groups as they share the largest portion of their income on fuel. Since the fuel subsidy failed to achieve the main objective, this paper focused on the effects of fuel subsidy removal and the removal of fuel subsidy that has caused fuel price fluctuations. Hence, this paper reviews the effects on the economic sectors and income loss among households.

2.1 Effects of fuel price fluctuation on economic sectors

The fuel price fluctuation significantly affects many economic sectors. The most affected sector is the transportation sector. This is due to the greater consumption of fuel in the transportation sector (see Setyawan (2014)). Delsalle (2002) also found that transportation had been significantly affected by the increase in fuel prices. Consequently, the demand for transportation decreased. The effect can also be seen in other economic sectors namely manufacturing, construction, production, and agricultural. Riaz et al. (2016) conducted a study in Pakistan to investigate the impact of the fluctuation of fuel price on the manufacturing sector. The study used the Exponential Generalized Autoregressive Conditional Heteroskedasticity (EGARCH) model. It shows that the manufacturing sector is non-linearly related to fuel price fluctuation, but this is subsequent to a threshold-level manufacturing production that started

declining with the increased uncertainly in oil price. Aimer (2016) investigated the sensitivity of different economic sectors to the volatility of the price in the long run. The results showed that agriculture, construction, manufacturing and transportation sectors have a long run relationship. The results show that the increase in fuel price is not significant in the manufacturing sector. The same result was also found in a study conducted by Mahboub and Ahmed (2017).

In the United States, Hanson et al. (1996) used the input-output model to examine the fuel price shocks in the agricultural sector. This study found that an increase in fuel price did have an impact on agricultural production and hence reduced the income of the sector. Taghizadeh Hesary et al. (2015) conducted a study in Japan to investigate the impact of fluctuations in fuel price on economic sectors. This study used a Vector Autoregressive (VAR) model and found that the most affected sectors were industrial and transportation. Alper and Torul (2010) applied the VAR model to study the relationship between the increasing fuel price and manufacturing sector in Turkey. This study found that the increase in fuel price influenced the real production growth rate of several manufacturing sectors such as wood products, furniture, chemical products, rubber, plastic products, electrical machinery, and communication devices.

The fuel price fluctuations negatively affected the economic growth in many countries around the world. Jiménez-Rodríguez and Sánchez (2004) investigated the impacts of the increasing fuel price of real economic activities of Organisation for Economic Co-operation and Development (OECD) countries. The results showed that an increase in fuel price negatively affected the economic growth in the United Kingdom but there was a positive relationship in Norway. Mallik and Chowdhury (2011) examined the relationship of fuel price with inflation and growth in Australia. The results showed a positive relationship between fuel price and inflation.

2.2 Effects of fuel price fluctuation on income

Apart from affecting the economic sectors, the increasing fuel price also affects almost everyone. It can be seen that Malaysians nowadays have started taking alternative method on how they commute from one place to another. A study byRohani and Pahazri (2018) found that there was a reduction in the frequency of personal vehicle usage. The reduction was about 2% - 7%, which was based on the trips that were frequently observed. This study also showed that the number of respondents using public transportation has increased when the fuel price increased. Another study by Ahmat et al. (2012) showed that individuals had changed their travel patterns because of income insufficiency, which was due to the increase in fuel price.

Moreover, another consequence on the increment in fuel price is the income loss among Malaysians. Saari et al. (2016) conducted a study on the impact of fuel price fluctuation across various ethnicities in Malaysia. This study found that Malays faced the biggest impact compared to Chinese and Indians. At the same time, another study by Hakim et al. (2014) also investigated the impact of increasing fuel price on three different income groups in Malaysia. This study found that the middle-income group was significantly affected by the increase in fuel price. In Indonesia, Oktaviani et al. (2007) studied the impact of fuel subsidy elimination on macroeconomy, sectoral, and poverty. This study also found that the removal of fuel subsidy has resulted in the reduction of household income in Indonesia. Moreover, a study by Coady et al. (2006) stated that when the fuel prices increased by 50% on average, the average real income decreased by 4.60%. This is in line with the study by Godek and Murray (2011) that showed the overall expenditure was reduced which was a result of the decrease in income due to the increase in the fuel price. Furthermore,Moshiri (2015) also showed a heterogeneous response to energy prices and income changes in different income groups. Since the fluctuation in fuel price significantly affected household income, there is an urgent need to measure the impact. This could help all households to maintain a good lifestyle.

3. Methodology

To measure the real income effects of fluctuations in fuel prices, this study used secondary data from the Households Income Survey (HIS) and Household Expenditure Survey (HES) for three different periods specifically 2009/10, 2014 and 2016. The survey was conducted by the Malaysian Department of Statistics.

Next, the partial equilibrium approach developed by Coady and Newhouse (2005) was used in this study. The direct and indirect effects were calculated to examine the effect of fuel price fluctuations on the real household income. The direct and indirect effects were calculated for two different periods that were before subsidy removal and after subsidy removal. The direct effect measures the real income loss due to the fluctuation in fuel prices (transportation) using the following formula:

$$D = \sum_i \frac{\alpha_i}{\delta_i} \times \Delta P \tag{1}$$

where

$$D = Direct\ effect$$
$$\alpha_i = household\ fuel\ expenditure\ of\ ethnic\ (income)\ group\ i$$
$$\delta_i = gross\ income\ of\ ethnic\ (income)\ group\ i$$
$$\Delta P = percentage\ change\ in\ fuel\ price.$$

The indirect effect measures the real income loss of households due to the price increase in goods and services that include fuel as the input to the production process. The indirect effect formula is as follows:

$$ID = \sum_i \frac{\beta_i}{\delta_i} \times \Delta P \qquad (2)$$

where

$$ID = Indirect\ effect$$
$$\beta_i = household\ fuel\ expenditure\ on\ non\text{-}fuel\ item\ of\ ethnic\ (income)\ group\ i$$
$$\delta_i = gross\ income\ of\ ethnic\ (income)\ group\ i$$
$$\Delta P = percentage\ change\ in\ fuel\ price.$$

Then, the total effect measures the real income loss of households due to the price increase in goods and services that include fuel as the input to the production process and fuel consumption in transportation. The total effect formula is as follows:

$$TE = \sum_i \frac{\gamma_i}{\delta_i} \times \Delta P \qquad (3)$$

where

$$TE = Total\ effect$$
$$\gamma_i = household\ fuel\ expenditure\ on\ fuel\ and\ non\text{-}fuel\ item\ of\ ethnic\ (income)$$
$$group\ i$$
$$\delta_i = gross\ income\ of\ ethnic\ (income)\ group\ i$$
$$\Delta P = percentage\ change\ in\ fuel\ price.$$

4.   Results and discussions

This section discusses the effect of fuel price fluctuation for several income groups in Malaysia. The income was categorized into three different groups

namely Top 20% (T20), Middle 40% (M40) and Bottom 40% (B40). These groups were categorized based on their monthly income. For group B40, the income range was below RM3,000 per month. While the income for M40 and T20 was between RM3,001 - RM6,275 and more than RM6,275 per month respectively. Then, this section also discusses the effect of fuel price fluctuation of the income of major ethnic groups in Malaysia. The major ethnic groups included in this study were Bumiputera, Chinese, Indians and Other ethnic groups. The effects were examined directly, indirectly, and total effect on the income. This analysis was carried out for three selected periods that were 2009/2010, 2014, and 2016. The selected year was considered in order to investigate the effects on income before and after the removal of fuel subsidies.

4.1 Effects on income groups

This study investigated the effects of fuel price fluctuation for different income groups in Malaysia. Table 1 presents the average monthly gross income and the budget shares of fuel expenditure for three different income groups, namely Top 20% (T20), Middle 40% (M40) and Bottom 40% (B40). The gross income showed an increasing trend from 2009/2010 to 2016 for all income groups. The result indicates that Malaysia's economy is in a good state and still developing.

For direct budget shares of fuel expenditure, the analysis shows a decreasing trend from 2009/2010 to 2016 for all income groups. The significant decrease was recorded from 2009/2010 to 2014 for all income groups. This scenario could be due to the removal of the fuel subsidy and thus, the fuel price kept increasing. Therefore, Malaysians are reducing their budget on the fuel expenditure. Before the removal of the fuel subsidy in 2009/2010, the direct budget shares of fuel expenditure were high for all income groups. It was found that group T20 experienced the highest direct budget shares of 30.54% compared to the other income groups. This result is in line with the study by Hakim et al. (2016). This result indicates that the richest have benefited the most from the fuel subsidy provided. Then, group B40 experienced slightly lower direct budget shares of 29.93% compared to the T20 group. The group M40 showed the lowest direct budget shares in 2009/2010. In 2014, the direct budget shares were stable between these different income groups. However, the budget share showed a significant decrease in 2014 compared to 2009/2010. The direct budget shares for T20, M40, and B40 were 11.46%, 11.23%, and 10.61% respectively. In 2016, the direct shares of fuel expenditure significantly decreased to 5.57%, 6.28%, and 5.40% for T20, M40, and B40 respectively.

For indirect budget shares of fuel expenditure, the results showed a similar trend. Before the removal of the fuel subsidy in 2009/2010, Malaysians on average spent more on fuel compared to the period after the removal of fuel subsidies. This was observed in 2009/2010 where the budget share for fuel expenditure was more than the income earned among the B40 group. However, the indirect budget shares for the B40 group significantly decreased to only 50.61% in 2014 and hence decreased again to 33.55% in 2016. For the M40 group, the highest indirect budget shares of 37.95% was recorded in 2009/2010 and decreased to 22.07% after the removal of the fuel subsidy in 2016. For the T20 group, the indirect budget shares of fuel expenditures were 17.83%, 24.33% and 14.49% for 2009/2010, 2014, and 2016 respectively. As for the total budget shares of fuel expenditure, the B40 group showed the highest percentage among the three different income groups.

Table 1: Monthly average gross income and budget shares of fuel expenditure by income groups.

Income groups		2016	2014	2009/2010
Top 20% (T20)	Gross income (RM)	16,088	14,305	9,987
	Budget shares of fuel expenditure (%):			
	Direct budget shares	5.57	11.46	30.54
	Indirect budget shares	14.49	24.33	17.83
	Total budget shares	37.72	65.34	79.26
Middle 40% (M40)	Gross income (RM)	6,502	5,662	3,631
	Budget shares of fuel expenditure (%):			
	Direct budget shares	6.28	11.23	21.67
	Indirect budget shares	22.07	32.18	37.95
	Total budget shares	48.74	78.86	106.66
Bottom 40% (B40)	Gross income (RM)	2,848	2,537	1440
	Budget shares of fuel expenditure (%):			
	Direct budget shares	5.40	10.61	29.93
	Indirect budget shares	33.55	50.61	152.57
	Total budget shares	60.03	96.73	275.83

Table 2 shows the effects of fuel price fluctuation on three different income groups in Malaysia. The effects were categorized into direct, indirect, and total effects of fuel price fluctuation on income groups. In 2014, the direct effects were most significant as compared to 2009/2010 and 2016 for all income groups. The indirect and total effects also showed the same pattern for all income groups. These findings indicated that the transition period gave the most significant impact on the household income for all groups.

In 2009/2010, the direct effects of fuel price fluctuation for T20, M40, and B40 groups were 1.98%, 1.41%, and 1.94% respectively. The effect is not much different for all income groups. In 2014, there was an increase in direct effects for all income groups with the highest direct effect recorded for T20 group. The direct effects for each group were 2.43% (T20), 2.38% (M40), and 2.25% (B40). In 2016, all income groups experienced the lowest direct effects compared to previous years. The direct effects for T20, M40, and B40 were 0.91%, 1.02%, and 0.88%. The lowest effects were recorded in 2016 as a result of the lowest budget shares of fuel price recorded for that year.

As for the indirect effect, the B40 group was the most affected by the fluctuation of fuel price. The highest indirect effect of 10.71% happened in 2014. The indirect effect for 2009/2010 and 2016 were 9.89% and 5.46% respectively. For group M40, the indirect effects were 2.46% (2009/2010), 6.81% (2014) and 3.59% (2016). However, group T20 experienced less indirect effect of fuel fluctuation in income. The indirect effect group was 1.16% (2009/2010), 5.15% (2014), and 2.36% (2016). The worst indirect effect experienced by group B40 could be due to the increase in the price of food products that became their priority.

For the total effects of fuel price fluctuation in income, group B40 was found to be the most affected in general. The total effects for B40 were 17.88% in 2009/2010, 20.47% in 2014 and 9.76% in 2016. The highest effect happened in 2014 where the fuel subsidy was removed, and the price fluctuated over time. The other two groups also experienced the same trend. For the M40 group, the total effects were 6.91% (2009/2010), 16.69% (2014) and 7.93% (2016). The total effects for T20 group were 5.14% (2009/2010), 13.82% (2014) and 6.13% (2016) that were the lowest effect compared to the other two groups.

Table 2: Effects of fuel price fluctuation on income groups

Income groups	Effects (%)	2016	2014	2009/2010
Top 20% (T20)	Direct	0.91	2.43	1.98
	Indirect	2.36	5.15	1.16
	Total	6.13	13.82	5.14
Middle 40% (M40)	Direct	1.02	2.38	1.41
	Indirect	3.59	6.81	2.46
	Total	7.93	16.69	6.91
Bottom 40% (B40)	Direct	0.88	2.25	1.94
	Indirect	5.46	10.71	9.89
	Total	9.76	20.47	17.88

4.2 Effects on ethnic groups

This study continued by investigating the effects of fuel price fluctuations on the income of major ethnic groups in Malaysia. Table 3 shows the average gross income and budget shares of fuel expenditure for four major ethnic groups in Malaysia. Generally, the monthly gross income showed an increasing trend from 2009/2010 to 2016 for all ethnic groups. The direct budget shares for the Bumiputera group showed a decreasing trend from 2009/2010 to 2016. This indicates that the Bumiputera spend less on fuel when the fuel subsidy was removed starting in 2014. Chinese showed stable budget shares of fuel expenditure from 2009/2010 to 2016. This finding indicates that the allocation for fuel did not affect the fuel subsidy removal for the Chinese. The budget shares of fuel expenditure for Indians and other ethnic groups showed an unclear trend. There was an increase and decrease in budget shares of fuel expenditure during the selected period for both groups. As in the total effects, the budget shares of fuel expenditure were almost the same for all ethnic groups. The results also showed a small increase in budget shares of fuel expenditures from 2009/2010 to 2016.

Table 4 presents the effects of fuel price fluctuation on the household income for major ethnic groups in Malaysia. The effects were examined in three different approaches which were direct effect, indirect effect, and the total effect. The direct effect considered only the budget shares of fuel expenditure on transportation. While the indirect effect included several categories of goods and services that could be affected by the fluctuation in fuel price. In 2009/2010, the direct effect was almost the same for all ethnic groups. The direct effects for Bumiputera, Chinese, Indians, and Others were 0.50%, 0.40%, 0.38% and 0.37% respectively. There is only a small difference between these major ethnic groups. The significant increase in the direct effect was recorded in year 2014 as compared to 2009/2010 for all ethnic groups. This is not surprising since the direct budget shares of fuel expenditure also showed the highest percentage in 2014. This phenomenon could be a result of the removal of the fuel subsidy by the government. Thus, Malaysians need to spend more of their budget for fuel consumption.

Table 3: Average monthly gross income by ethnic groups

Ethnics		2016	2014	2009/2010
Bumiputera	Gross income	7,572	6,729	4,516
	Budget shares of fuel expenditure (%):			
	Direct budget shares	7.03	7.40	7.66
	Indirect budget shares	20.52	20.73	19.26
	Total budget shares	49.02	48.67	46.32
Chinese	Gross income	10,714	9,386	6,203
	Budget shares of fuel expenditure (%):			
	Direct budget shares	6.22	6.82	6.13
	Indirect budget shares	19.76	20.37	18.35
	Total budget shares	47.66	48.64	44.75
Indian	Gross income	8,654	7,641	4,963
	Budget shares of fuel expenditure (%):			
	Direct budget shares	7.04	7.47	5.92
	Indirect budget shares	20.42	20.86	19.18
	Total budget shares	49.36	49.14	44.04
Others	Gross income	6,054	7,492	4,728
	Budget shares of fuel expenditure (%):			
	Direct budget shares	6.27	6.57	5.73
	Indirect budget shares	23.03	23.14	17.79
	Total budget shares	46.77	50.56	41.24

Table 4: Effects of fuel price fluctuation on income by ethnic groups.

Ethnics	Effects (%)	2016	2014	2009/2010
Bumiputera	Direct	1.14	1.57	0.50
	Indirect	3.34	0.32	1.25
	Total	7.97	10.30	3.00
Chinese	Direct	1.01	1.44	0.40
	Indirect	3.21	0.29	1.19
	Total	7.75	10.29	2.90
Indian	Direct	1.15	1.58	0.38
	Indirect	3.32	0.33	1.24
	Total	8.03	10.40	2.86
Others	Direct	1.02	1.39	0.37
	Indirect	3.75	0.32	1.15
	Total	7.61	10.70	2.67

In 2016, the direct effect decreased for all ethnic groups compared to 2014. But, the percentage was still higher compared to 2009/2010 where the subsidy was still available from the government. For Bumiputera, the direct effect decreased from 1.57% in 2014 to 1.14% in 2016. The direct effect of Indians in 2016 was 1.15%, which showed a decrease from 1.58% in 2014. The other ethnic groups also showed a similar trend where the direct effect in 2014 was 1.39% and which then decreased to 1.02% in 2016. Chinese showed the lowest direct effect among the major ethnic groups in Malaysia. The direct effect in 2016 was only 1.01% compared to 1.44% in 2014. The findings implied that Malaysians have started to reduce their budget shares of fuel expenditure after the removal of fuel subsidies. Several studies have shown that Malaysians have started taking other alternatives instead of using their personal vehicles to commute from one place to another. For example, Rohani and Pahazri (2018) found that there was a reduction of 2% to 7% in the use of personal vehicles. This study also found that the use of public transport has increased. Moreover, Ahmat et al. (2012) also found that individuals had changed their travel patterns due to small budget shares of fuel expenditure as a result of the increase in fuel price.

The indirect effect for all major ethnic groups in Malaysia was further investigated. The indirect effect showed fluctuated trends from 2009/2010 to 2016 for all ethnic groups. A significant increase can be seen in 2016. The possible reason for these results could be due to the increase in goods and services as the fuel price increased after the removal of fuel subsidies. As in the total effect, the highest effect can be seen in 2014. Furthermore, the effect was still higher in 2016 compared to 2009/2010 where the subsidy was still available. Generally, the effects were almost the same for all ethnic groups in Malaysia.

5. Conclusions

This study was carried out to investigate the effects of fuel price fluctuation due to the subsidy removal in Malaysia for the years 2009/2010, 2014, and 2016. The direct, indirect and total effects were examined in different major ethnic groups and as well as different income groups in Malaysia. The partial equilibrium approach was used to measure the direct, indirect, and total effect of fuel price fluctuations on income. Before the subsidy was removed, this study found that group T20 had the highest direct effect as they spent more on fuel expenditure. While group B40 had the highest indirect, and total effects of fuel price fluctuation in terms of income. In 2016 where the subsidy had been removed, all the effects were not much different for all income groups. However, this study found that group B40 had the highest indirect and total effects in 2016. The lowest direct effects were found in 2009/2010 where the subsidy was still available for all ethnic groups in this study. This study revealed that the highest effects were recorded in 2014 for all ethnic groups. However, the slightly lower effects were experienced by all ethnic groups in 2016. In conclusion, this study could help the government to improve their plan in helping the poor especially with regards to the fuel subsidy policy. Thus, this could help to improve the living standards of all Malaysians.

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