

INVESTIGATING THE DETERMINANTS OF ENERGY EXPENDITURE IN MALAYSIA MAJOR CITIES BY MIDDLE- INCOME HOUSEHOLDS

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Abstract. This paper attempts to investigate the factors that affecting energy expenditure in Malaysia capital city by middle-income households. The aim of this study was to find out the determinants of household spending on electricity and petrol in three major cities (George Town, Kuala Lumpur and Johor Bahru). A survey was conducted in these three major cities and a total of 473 observations are used for estimations by using the censored Tobit model. The results showed that household income is statistically significant and do affect electricity spending. Meanwhile, petrol spending is not significant as households consider petrol as an undesirable purchase in Malaysian domestic market. Also, there is a strong evidence of relationship between the number of electrical appliances and the number of rooms with electricity expenditure, as well as the number of private cars with petrol spending due to the complementarity. The results also proved that race does not play a crucial role in affecting electricity and petrol expenditure in Malaysia. But from a different perspective, electricity spending pattern by households in Johor Bahru, George Town and Kuala Lumpur is completely different, whereas Johor Bahru has different spending patterns in petrol.

Keywords: *electricity, energy, expenditure, middle-income, petro, Tobit*

Introduction

The electricity demands per capita in Malaysia was 4,194 kWh/person in 2014 compared to 626 kWh/person in 1980 (Malaysia Energy Commission, 2015). The growth in electricity consumption in Malaysia has been faster than other fuels. In 2015, the electricity consumption reached 127,077.6 million kWh compared to 111,643.6 kWh in 2012. With 100 per cent electricity coverage and access in urban areas and 98.3 per cent in rural areas (Ministry of Finance, 2016), electricity becomes a necessity. In conjunction with that, some electricity appliances in the households consume high cost and have a high average or watt that contributed to the higher consumption in electricity. For example, according to Saidur et al. (2007), the average power or watt of kettle is 2,125 compared to other electrical appliances such as water heater (2,000 watt), air conditioning (1,385 watt), iron (1,200 watt), vacuum cleaner (1,200 watt), microwave oven (1,125 watt), hair dryer (1,125 watt) and washing machine (1,005 watt).

There is a significant growth in the number, size and features of electrical appliances that affect the energy consumption. In other words, the ownership and use of electrical appliances is an important factor that influences growth in household energy consumption. By the way, there is a declining trends in energy consumption for cooking

or lighting as income increase, but to live more comfortable and higher living standard, the energy consumption for water heating, refrigeration, any electrical appliances and air conditioning grows continuously. In 2014, the mean monthly household expenditure on electricity was RM104.79 (US\$24.44) a month, where US\$1 = RM 4.2885 at middle rate at 13th July 2017. The ownerships and use of cooking appliances, air conditioning and refrigerators have to pay more than RM3 (US\$ 0.69) a month to enjoyed the services. However, living in the major cities such as Kuala Lumpur, where the households have to pay RM119.08 (US\$27.77) for electricity a month and more than RM7 (US\$1.63) a month for the ownerships and use of cooking appliances, air conditioning and refrigerators (*Table 1*). Air conditioning is still a luxury goods confined to a small percentage of households (Dzioubinski and Chipman, 1999).

More on, there is a different scenario with petrol in terms of retail prices and household expenditure. The Research Octane Number 97 or RON97 retail price in 2014 was RM2.55/litter (US\$0.59/litter), an increase of 125.7 per cent within 24 years. RON95 entered the Malaysian market in 2009 to replace RON92 with price introduction of RM1.75/litter (US\$0.41/litter), and increase to RM2.30 (US\$0.54) in 2014. Similarly, the diesel price of RM1.18/litter (US\$0.28/litter) remains considerable since 1991 and increased to RM1.90/litter (US\$0.44/litter) in 2014 (Malaysia Energy Commission, 2015). The issue of petrol price attracted public attention when the Malaysian government scrapped subsidies for RON95 and diesel and implemented a managed float system. Under this float system, the petrol price for the month was determined by using the average price difference in refined petroleum products of the last 10 days of the previous month. Currently, Malaysia applied and move to a new system, which is ceiling prices will be announced every week using the average crude oil price of the previous week.

Table 1. Mean Monthly Household Consumption Expenditure, 2014.

Item	Malaysia	State		
		Johor	Penang	Kuala Lumpur
Electricity	104.79	99.35	103.64	119.08
(a) Cooking appliances	3.28	3.53	3.63	7.78
(b) Air-conditioning	3.45	3.10	2.12	7.51
(c) Washing machine	2.61	2.77	1.56	5.64
(d) Refrigerators and freezers	3.54	3.38	2.46	7.55
(e) Small electrical appliances	2.41	3.20	1.70	5.37
Fuel and lubricants for personal transport	319.97	396.74	279.90	401.23

Source: Department of Statistics (2015)

Furthermore, the mean monthly household expenditure on petrol for private cars in Malaysia is RM319.97 (US\$74.61) a month, compared to Kuala Lumpur (RM401.23 or US\$93.56), Johor (RM396.74 or US\$92.51) and Penang (RM279.90 or US\$65.27) (*Table 1*). A total of 14.62 per cent of household expenditure has been allocated to transport and 8.94 per cent of these spending itself on petrol, 7.22 per cent in Kuala Lumpur, 7.99 per cent in Penang and 10.42 per cent in Johor (Department of Statistics, 2015), making transport the third most consumed item. Clearly, for those who live in the major cities have a tendency to pay more on electricity and petrol than other households. Any increases in petrol prices or electricity tariff will directly give a greater

impact on middle income households because a big proportion of their expenditure has been allocated on these two items.

Nowadays, the expenditures in electricity and petrol continue to escalate reflects the government's accessibility in providing electricity and petrol services at competitive prices and sustainable particularly in the capital city. This is because both of these types of expenditure are non-renewable resources and will be extinct in the future. Thus, the expenditure pattern of households particularly middle-income in the major cities is very important in order to know their behaviour towards energy consumption in the future by providing a good policy.

The urbanization process is one of major important determinant that leads to higher level of household energy consumption, particularly in developing countries (Dzioubinski and Chipman, 1999). The determinants of electricity and petrol demand in the household include prices of petrol and electrical appliances, household's disposable income, preferences and the availability of fuels and electrical appliances. Thus, this paper examines the determinants of expenditure pattern on electricity and petrol in Malaysia. This study analyses the patterns of middle-income household expenditure in the three major cities in Malaysia. It examines the influence of household socio-economic characteristics on demand for electricity and petrol. The following section 2 will explain the literature review, followed by the methodology in section 3. The empirical results and discussion are presented in sections 4. Lastly, the conclusion of this study is laid out in section 5.

Review of Literature

Study on the consumption pattern, either in urban or rural areas has interesting implications to policy makers. Most of the studies in developing countries show the important of electricity and petrol on household's expenditure. Studies conducted by Regmi et al. (2015), Bamiro and Ogunjobi (2015), Eakins (2014), Mekonnen and Köhlin (2009), Bamiro et al. (2004) and others found that the significant results on the electricity and petrol expenditure. Some of the socio-demographic characteristics such as age of household head and family size were the most important indicators in order to influence the spending pattern of the households particularly in the urban areas (Regmi et al., 2015). Bamrio and Ogunjobi (2015) also found a negative relationship of family size and statistically significant by regressing with the choice of household's main fuel.

However, the age of household heads does not influence the decision on household's main fuel. Sekhampu and Niyimbanira (2013) as well as Kulub Abd. Rashid et al. (2010) also found that gender and age of the household head have positive relationships with household expenditure but the relationships are not statistically significant. Other studies found a significant and positive relationship between family size and household expenditure (Benus et al., 1976; Battese and Bonyhady, 1979; Kulub Abd. Rashid et al., 2010; Sekhampu and Niyimbanira, 2013). In contrast, Bamiro et al. (2004) findings show that the household or family size on household energy use were insignificant. But the age of household heads results is consistent with Regmi et al. (2015), in which the age of household heads statistically significant influence the household expenditure on electricity and petrol.

Households that live in the urban areas and big cities tend to increase the number of electricity that they use as their incomes rise (Mekonnen and Köhlin, 2009; Bamiro et al., 2015). According to Bamiro et al. (2015), an improvement in income also would

cause the demand for petrol increase. This statement is consistent with Eakins (2014) findings that the households in possession of higher number of cars, number of family members working and higher income level or willingness to pay will spend more on petrol and diesel. As indicate in the household expenditure theory, income is one of the important indicator that directly influence households spending pattern, and normally statistically significant (Bamiro et al., 2004; Bamiro and Ogunjobi, 2015; Eakins, 2014). In addition, Kulub Abd. Rashid et al. (2010) indicated that the income level among the society seems to be the main factor that determines individual consumption spending. The total household income and the mean income are directly proportional to and have positive relationships with total expenditure, where an increase in income will increase the total expenditure as well.

Renwick (1998), Allegretto (2006), Fisher and French (2014) indicate that the budget share for transportation, communication and electricity are also important items in the household expenditure. According to Flanagan and Flanagan (2011), electricity is the second priority of household expenditure in their study and the percentage of income spent on energy is higher in low income households and as a consequence any significant increase in electricity prices will be regressive in its impact and a relatively severe burden for all low income households. More on, Ismail (1971), Haworth and Rasmussen (1973), Benus et al. (1976) and Kulub Abd. Rashid et al. (2010) found a positive and statistically significant relationship between transportation expenditure and household expenditure. The finding by Deaton et al. (1980) contrasts with other research where transportation expenditure has a significant but negative relationship with household expenditure based on age. It seems that the older one is above 14 years old, the lesser one spends on transportation expenditure.

The urbanization process, advanced technology, number of electrical appliances in the market and number of private cars that owned by the households has affected the consumption pattern on electricity and petrol (Dzioubinski and Chipman, 1999; Bamiro et al., 2004; Eakins, 2014). This reflects the increasing desire for comfort and discretionary energy consumption of household's middle income earners. There is a greater proportion of household's expenditure on electricity and petrol especially in the urban areas.

Materials and Methods

This study employed the censored Tobit model since the dependent variable for consumption analysis is constrained and beware of clustering (if any) in order to avoid the inconsistency and biased results. The OLS analysis is biased and inconsistent if the dependent variable for consumption analysis is constrained and clustering. Some of the respondent may not make spending on petrol during the survey period because do not have car and thus have zero expenditures. Thus, we employ the Tobit Model developed by James Tobin to analyze censored dependent variables. According to McDonald and Mofitt (1980) and Wooldridge (2002), the augmented Tobit model can be represented by:

$$y_i^* = x_i\beta + \varepsilon_i \quad \text{with } \varepsilon_i \sim N(0, \sigma^2) \quad (1)$$

$$y_i = \begin{cases} y_i^* & \text{if } y_i^* > 0 \\ 0 & \text{if } y_i^* \leq 0 \end{cases} \quad (2)$$

where:

y_i = actual observed household level of expenditure

y_i^* = households level of expenditure (latent variable)

x_i = individual characteristics

β = parameters to be estimated

ε_i = normally distributed error term

By using maximum likelihood methods, the log likelihood function for this estimation is as follows;

$$LL = \sum_0 \ln \left[1 - \Phi \left(\frac{x_i \beta}{\sigma_i} \right) \right] + \sum_+ \ln \left[\frac{1}{\sigma_i} \phi \left(\frac{y_i - x_i \beta}{\sigma_i} \right) \right] \quad (3)$$

where:

0 = summation over the zero observations in the sample ($y_i = 0$)

+ = summation over positive observations ($y_i > 0$)

Φ = cumulative distribution function (cdf)

ϕ = probability density functions (pdf)

To calculate the probability of a positive value;

$$P[y_i > 0|x] = \Phi \left(\frac{x_i \beta}{\sigma_i} \right) \quad (4)$$

And the level of expenditure conditional on $y_i > 0$ can be written as;

$$E[y_i | y_i > 0, x] = x_i \beta + \sigma_i * IMR \quad (5)$$

where;

$$IMR = \text{inverse mills ratio} = \left(\frac{\phi \left(\frac{x_i \beta}{\sigma_i} \right)}{\Phi \left(\frac{x_i \beta}{\sigma_i} \right)} \right)$$

Thus, the marginal effect for the probability of a positive value is as follows;

$$\frac{\partial P[y_i > 0|x]}{\partial x_j} = \frac{\beta_j}{x_i} \phi \left(\frac{x_i \beta}{\sigma_i} \right) \quad (6)$$

The marginal effect for level of expenditure on $y_i > 0$ is as follows;

$$\frac{\partial E[y_i | y_i > 0, x]}{\partial x_j} = \beta_j \left(1 - IMR * \left[\frac{x_i \beta}{\sigma_i} + IMR \right] \right) \quad (7)$$

Lastly, the marginal effect of the unconditional expectation;

$$\frac{\partial E[y_i|x]}{\partial x_j} = \beta_j \Phi\left(\frac{x_i\beta}{\sigma_i}\right) \quad (8)$$

This study used middle-income household expenditure in three major cities on electricity and petrol as dependent variable. The explanatory variables are total household income (M), family size (FS), gender of household head (GH), age of household head (AH), electrical appliances usage costs (EAC) and number of private cars (Table 2). The electrical appliances usage costs or EAC refer to the electrical appliances used and owned by a household and will be multiplied with the mean monthly consumption of electrical appliances according to the city. Most people are not aware of the fact that modern electrical and electronic appliances such as televisions, computers and printers consume power for standby functions with a typical loss of electricity per appliance ranging from less than 1 watt to 25 watts. Therefore, in this analysis we included the number of kettles, water heaters, air conditioners, irons, vacuum cleaners, microwave ovens or ovens, hair dryers and washing machines in the household that have more than 1,005 average power or watts.

Table 2. Summary of explanatory variables.

Explanatory Variable	Description
Total Household Income (M)	Total monthly income household income (in RM)
Family Size (FS)	Number of family members in the household
Gender of Household Head (GH)	1 if male; 0 otherwise
Age of Household Head (AH)	Age of household head (in years)
Electrical Appliances Usage Costs (EAC)	Electrical appliances x mean monthly consumption (RM)
Number of Rooms (NR)	Number of bedroom (units)
Number of Private Cars (NPC)	Number of personal car for working or personal used (units)
Malay (D _M)	Omitted / Benchmark variable
Chinese (D _C)	1 if Chinese; 0 otherwise
Indians (D _I)	1 if Indians; 0 otherwise
Other races (D _O)	1 if Other races; 0 otherwise
Kuala Lumpur (KL)	Omitted / Benchmark variable
Johor Bahru (JB)	1 if Johor Bahru; 0 otherwise
George Town (GT)	1 if George Town; 0 otherwise

Other than that, the binary variables also included to measure the effect of races (Malay (D_M), Chinese (D_C), Indian (D_I) and others (D_O)) and major cities (Kuala Lumpur (KL), George Town (GT), Johor Bahru (JB)). Three major cities namely, Kuala Lumpur, George Town and Johor Bahru are chosen based on analysis of variance and multiple comparison tests results. These three state major cities have demonstrated a high cost of living, with a higher frequency of being significantly different and a high variance. To avoid perfect collinearity problem in the model, the dummy variable for Malay (D_M) and Kuala Lumpur (KL) capital city was omitted and treated as a reference group. The survey was conducted randomly and clustered by geographical location. A total of 473 samples is eligible as sample for this study.

Results

Table 3 indicates the descriptive statistics for the data set employed in this study. It is observed that the measures of central tendency for variables are positive and total household income has the largest dispersion or spread. The skewness denotes the existence of both positive and negative skewed in the variables. According to the kurtosis indicate that the distribution is peaked (leptokurtic) relative to the normal for all variables.

Table 3. Descriptive statistics of the variables.

	Electricity	Petrol	M	FS	GH	AH	EAC	NR	NPC
Mean	146.34	274.06	8120.53	3	1	37	23.93	3	2
Median	100	250	7620	4	1	35	18.29	3	2
Maximum	1500	1200	17923.36	9	1	72	117.28	8	4
Minimum	0	0	2222.4	1	0	1	0	0	0
Std. Dev.	149.29	155.33	3459.30	1.76	0.39	9.29	17.16	0.89	0.72
Skewness	3.4434	1.6557	0.6129	0.2801	-1.5957	0.5092	1.5367	0.5125	0.4512
Kurtosis	23.738	8.5587	2.7099	2.4588	3.5464	3.1309	5.8967	6.7911	3.6096

Electricity expenditure

As can be seen in Table 4, the estimated coefficients (β) are presented in the second column. The third column shows the marginal effect of explanatory variables on the expected value of the dependent variable. The fourth column is representing the marginal effect on the expected value of the dependent variable for observations exceeding the threshold value. The fifth column depicts the marginal effect on changes in the probability for those who did not spend on electricity but might, which refer to observations at the limit. Firstly, the model is concluded as having a good fit with the probability value of the Wald statistic almost zero or significant at 1 per cent level. The results also showed that the estimated coefficients of total household income (M), electrical appliances usage costs (EAC) and number of rooms (NR) are statistically significant in and carry the expected positive sign.

Table 4. The Tobit estimated coefficient and marginal effect of electricity expenditure.

Variables	Coefficient	z-statistics	$\frac{\partial E[y_i x]}{\partial x_j}$	$\frac{\partial E[y_i y_i > 0]}{\partial x_j}$	$\frac{\partial P[y_i > 0 x]}{\partial x_j}$
C	-210.1***	-6.3537	-182.97	-140.39	-1.6702
M	0.0086***	3.6500	0.01	0.01	0.0001
FS	-0.8838	-0.2018	-0.77	-0.59	-0.0070
GH	0.0724	0.0045	0.06	0.05	0.0006
AH	0.8216	1.0252	0.72	0.55	0.0065
EAC	5.0533***	9.2029	4.40	3.38	0.0402
NR	18.277**	2.4259	15.92	12.21	0.1453
D _c	-18.295	-1.1124	-15.93	-12.22	-0.1454
D ₁	11.061	0.4880	9.63	7.39	0.0879
D ₀	-2.5346	-0.0480	-2.21	-1.69	-0.0201
JB	93.578***	4.8334	81.49	62.53	0.7439
GT	138.21***	6.4694	120.37	92.35	1.0987
Log-likelihood	-2820.9		$x\beta$		142.22

Wald statistic	21.778***	SF ₁	0.6682
Uncensored Obs	447	SF ₂	0.8709

Note: ***, ** and * indicate significance at 1%, 5% and 10%, respectively.
SF₁ Scale factor or adjustment factor in equation (7)
SF₂ Scale factor or adjustment factor in equation (8)

These findings means that an increase in monthly household income by RM100 (US\$23.32), the expected value of the latent variable is found to increase by RM0.86 (US\$0.20) a month. By considering the total sample, an increase in monthly household income by RM100 (US\$23.32) leads to a rise of RM1 (US\$0.23) a month in household expenditures in electricity. By holding other things constant, household expenditures among those who spent on electricity during the survey period will rise by RM1 (US\$0.23) give each additional of RM100 (US\$23.32) in monthly household income. For those who have not spent on electricity, there is 0.01 per cent probability of spending on this item if monthly household income increases by RM100 (US\$23.32).

Meanwhile, the electrical appliances usages cost (EAC) and number of rooms (NR) strongly significant and do affect the expenditure on electricity. The results display that an increase in the usage costs of electricity appliances by RM1 (US\$0.23) will increase the electricity expenditure by RM5.05 (US\$1.18) a month. More on, household expenditures on electricity will increase by RM4.40 (US\$1.03) a month if there is an increase in electrical appliance usage costs by RM1 (US\$0.23) for the entire sample. There is a tendency of the middle-income household that participate in the survey to increase their electricity spending by RM3.38 (US\$0.79) a month among those who have spent in it during the survey period if there is an increase in electrical usage costs by RM1 (US\$0.23) a month. The probability for those who have not spent on electricity will increase by 0.4 per cent if there is an increase in electrical usage costs by RM1 (US\$0.23) a month.

Additionally, upgrading a house neither by buying or renting a new house that have more rooms compare to previous house by 1 room, the middle-income household tend to spend more on electricity by RM18.28 (US\$4.26) a month. For all sample, there is a rise in electricity expenditures by RM15.92 (US\$3.71) a month if the number of rooms increases. However, middle-income household during the survey period tend to spend more by RM12.21 (US\$2.85) a month on electricity give each additional number of rooms. For those who have not spent on electricity, there is 14.5 per cent probability of spending on this item to increase.

Lastly, there is a difference on electricity spending pattern in three major cities. Another possibility is that middle-income household in George Town have to spend more by RM138.21 (US\$32.23) a month and RM93.58 (US\$21.82) a month in Johor Bahru compared to Kuala Lumpur. When considering the entire sample, George Town households have to spent more by RM120.37 (US\$28.07) and RM81.49 (US\$19) a month in Johor Bahru. By holding assumption of *ceteris paribus*, households in George Town and Johor Bahru will spend more on electricity by RM92.35 (US\$21.53) and RM62.53 (US\$14.58) a month, respectively, compared to Kuala Lumpur. There is a positive probability of 74.4 and 9.9 per cent for households in Johor Bahru and George Town, respectively that do not spend on electricity to pay more than Kuala Lumpur.

Petrol expenditure

The model is considered as a good fit model and significant at 1 per cent level by looking at Wald test results. The results showed that household income (M), gender and age of household heads are statistically insignificant and does not influence the spending pattern on petrol in the three major cities in Malaysia. In between, the family size (FS) and number of private cars (NPC) are statistically significant in explaining the petrol expenditures.

According to *Table 5*, if the number of household member increases by 1 person, there is a tendency for petrol expenditure to increase by RM13.33 (US\$3.11) a month and RM12.95 (US\$3.02) a month for the entire sample. For those who took part during the survey period, there is a tendency to increase their spending on petrol by RM11.56 (US\$2.69) a month and 9.3 per cent probability for those who have not spent on petrol to increase their consumption.

Table 5. *The Tobit estimated coefficient and marginal effect of petrol expenditure.*

Variables	Coefficient	z-statistics	$\frac{\partial E[y_i x]}{\partial x_j}$	$\frac{\partial E[y_i y_i > 0]}{\partial x_j}$	$\frac{\partial P[y_i > 0 x]}{\partial x_j}$
C	92.085***	3.0037	89.45	79.87	0.6416
M	-0.0020	-0.7501	-0.002	-0.002	0.0000
FS	13.332***	2.6707	12.95	11.56	0.0929
GH	5.9770	0.3274	5.81	5.18	0.0416
AH	0.1424	0.1562	0.14	0.12	0.0010
NPC	65.743***	6.0845	63.86	57.02	0.4581
D _c	25.210	1.4154	24.49	21.87	0.1757
D _i	32.859	1.2910	31.92	28.50	0.2289
D _o	179.70***	2.9884	174.6	155.86	1.2521
JB	42.870**	2.5493	41.64	37.18	0.2987
GT	14.776	0.8759	14.35	12.82	0.1030
Log-likelihood	-2982.9		$x\beta$	272.89	
Wald statistic	9.6470***		SF ₁	0.8674	
Uncensored Obs	466		SF ₂	0.9714	

Note: ***, ** and * indicate significance at 1%, 5% and 10%, respectively.

SF₁ Scale factor or adjustment factor in equation (7)

SF₂ Scale factor or adjustment factor in equation (8)

As illustrated in *Table 5* indicates that if there is additional number of private cars by 1 unit, the petrol expenditures will rise by RM65.74 (US\$15.33) a month. From other perspective by considering all sample, if the number of private cars increases will lead to a rise of RM63.86 (US\$14.89) a month in household expenditures on petrol compare to those who spent on petrol during the survey period by RM57.02 (US\$13.29) a month. For those who have not spent on petrol, their probability of spending on these items will increase to 45.8 per cent. On the other hand, there is a significant difference between Malay and other races in terms of their spending pattern on petrol. From different angle, there is no significant difference between Chinese, Indians and Malays in their spending patterns on petrol in the three major cities.

Furthermore, there is a significant different between households' expenditure on petrol between Johor Bahru and Kuala Lumpur, but not in George Town. Middle-income households in Johor Bahru will pay more than Kuala Lumpur by RM42.87 (US\$9.99) a month on petrol. While considering all sample, households in Johor Bahru

pay more than Kuala Lumpur by RM41.64 (US\$9.71) a month on petrol. Meanwhile, household in Johor Bahru for those who took part in the survey will spend more on petrol by RM37.18 (US\$8.67) a month compared to Kuala Lumpur.

Discussion

The monthly household income is the solid factors that influence electricity and petrol expenditure and concurrent with the household expenditure theory and fits to our expectations on this analysis. One of the factors that increase the electricity expenditure in these three major cities is whether. By considering the weather in Malaysia, which is always hot, rainy and humid throughout the year, the use of electrical appliances in order to help in household management, middle-income households have to pay the costs of energy consumption. Also, to live in comfort and have higher willingness to pay for basic needs, the use of electrical appliances becomes a requirement. High average power of electrical appliances allows some proportions of electrical expenses need to be allocated and increase the electricity expenditure.

Additionally, upgrading a house neither by buying or renting a new house that have more rooms compares to previous house by 1 room, the middle-income household tends to spend more on electricity. Generally, houses in Malaysia are built with 3 bedrooms but with different in price due to the physical characteristics of the house itself such as the size of the built area, number of rooms, type of house and other factors. There is a tendency to own a house with more rooms if the number of family member's increases and this requires more expenditure on basic needs. Houses with more rooms should be more expensive that reflecting greater willingness to pay of middle-incomes.

More on, urban cities like Kuala Lumpur, George Town and Johor Bahru were cities that have a higher car population rate and too congested particularly in the city center. On average, a middle-income household tends to have two units of private cars, and thus, the number of private cars is significant and complement with petrol expenditure. On the other hand, there is a significant difference between Malay and other races in terms of their spending pattern on petrol compare to electricity expenditure. This probably due to the number of samples for other race is significantly low compared to Malay, Chinese and Indians. The analysis revealed that family size, gender, age of household head, races and ethnicity are statistically insignificant in electricity expenditure. These demographic factors are not significant may due to the similarity in their electricity expenditure pattern.

Also, there is a difference on electricity spending pattern in three major cities where middle-income household in George Town and Johor Bahru have to spend more compared to Kuala Lumpur. People living in Kuala Lumpur may have perception that living in Kuala Lumpur requires higher cost of living and they have to cut their budget on certain items that as much as they can. In terms of petrol expenditure, there is a significant different between Johor Bahru and Kuala Lumpur, but not in George Town. Middle-income households in Johor Bahru will pay more than Kuala Lumpur may due to the border effect with Singapore. Singaporean people also can access and consume Malaysia petrol at different prices but they have higher purchasing power compare to local citizen.

Conclusion

As mentioned early, electricity power and the production of petrol are depending on non-renewable resources. By looking at the results, demographic factors that include races do not influence the spending pattern on electricity and petrol in the three major cities except the number of family size. This implies that the higher the number of family member's or population of a country will influence the number of petrol consumption. The analysis also indicates that expenditures on petrol is become necessity compared to electricity expenditures. Without regard to household income, spending on petrol is necessary and households have to pay petrol for their surviving. In different perspective, if the household has and gains more disposable income, there is an option for those households to pay more or less on electricity and also living in more or less comfortable by using more modern electrical appliances that require higher electrical consumptions and willingness to pay. Increase in the standard of living and technology advancement has affected household energy consumption in Malaysia. This reflects the increasing desire for comfort and discretionary energy consumption (Dzioubinski and Chipman, 1999). Based on these kind of results, petrol is considered as an undesirable purchase in Malaysian domestic market, whereas petrol is an important expenditure particularly for middle-income earners. To be more specific, petrol should not be considered as an undesirable purchase because expenditure on petrol is for facilitating accessibility to other places employment and represent the quality of life or their standard of living. Furthermore, the results also indicate that the electricity expenditure made by middle-income households in Johor Bahru, George Town and Kuala Lumpur are totally different from each other compared to petrol expenditure, whereby only Johor Bahru city has different spending pattern on petrol expenditures. It can be concluded that the most expensive city to live in across the city is Johor Bahru because they have to pay more on petrol and electricity compared to Kuala Lumpur and George Town.

As conclusion, it can be observed from the results and we expected that the expenditure patterns on electricity and petrol will continue to increase alongside with the increase in income and standard of living of the middle income households especially for those who are living in the major cities. Thus, it is highly recommended to the authority to improve the subsidies delivery system particularly on petrol in order to reach the targeted households. The targeted groups need to be expanded by including the M40 groups because it is the biggest income group in Malaysia. Due to the inefficient allocation of subsidies and market distortions, the subsidies provided by the government failed to reach the targeted group. Hence, Malaysia's subsidy system is skewed in favor of high income groups only and the price-setting is associated with political decision making.

In terms of power generation, the use of nuclear reactor for electricity may become an option in the future and locate in the major cities. There is also a need and requirement for Malaysia to search new resources in the future to replace petrol as main energy source and meet that challenge effectively. For example, providing more economic and social incentive to the producer and consumer by using hybrid car as an alternative for vehicles is highly recommended and thus, it can reduce the cost and fuel consumption. Apart from that, more research and development efforts need to be carried out on developing the green energy in order to reduce the dependencies on traditional petroleum fuels. The changes in energy consumption, production and price play an important role in determining the Malaysian economy outlook.

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