Modelling the Demand for Fresh Meat in Malaysia

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ABSTRACT Malaysia is one of the most developing countries in Asia. Hence, there have been significant changes in Malaysians' food preference. These changes in consumption pattern have some impact on agri food industry in Malaysia. One of the changes is the preference towards fresh meat such as beef, poultry, mutton and other meat. This research will be focusing on demand of poultry meat in Malaysia. Data from Household Expenditure Survey 2014 will be used in order to build a statistical model in estimating the demand for poultry meat. The development of the demand model will be based on best subsets regression approach.

KEYWORDS: Household Expenditure Survey; poultry; demand model; best subsets regression.

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INTRODUCTION

One of the most significant industries in Malaysia is livestock industry because of its contribution in protein sources for Malaysian (MARDI, 2015). In addition, import of meats can be decreased and the food security can be ensured as this industry is growing each day.

As one of developing countries, there have been some changes in food preference among Malaysians. Hence, these changes have some significant effect on agri food industry (Tey, 2008) such as preference towards beef, poultry and mutton. This paper will be focusing on demand of poultry meat which is produced by smallholder farmers. The objective of this study is to develop a mathematical model for fresh meat which is poultry meat demand in Malaysia using best subsets regression.

The sector of agricultural contributed 8.9% of Gross Domestic Products (GDP) in 2015 (Department of Statistics Malaysia, 2016). Number of poultry increases from 1,572.8 tons in 2014 to 1,613.9 thousand tons in 2015 compared to other livestock that shows some decrement in the productions. This can be shown in Table 1 below.

Table 1. Productions of Livestock in 2014 and 2015

Livestock Products ('000 tons)	2014	2015
Beef	52.9	50.50
Mutton	4.5	4.40
Pork	217.6	215.80
Poultry	1,572.8	1,613.90
Chicken/Duck egg	727.6	775.10
Cattle Milk	75.3	76.00

(Source: Department of Veterinary Services Malaysia, 2016)

The purpose of imports of poultry is only for breeding (Mohamed, 2007) unlike the other meats such as beef and mutton that depend on imports to meet the local consumption. Self-sufficiency

level (SSL) is the ability of the local production to meet the local demand (MARDI, 2015). Table 2 illustrates the self-sufficiency level of livestock products in Malaysia from 2010 to 2015. It can be observed that poultry meat's SSL level reached more than 100% throughout the year of 2010 to 2015. Thus, it means that the local production exceeded the local consumption (MARDI, 2015). On the other hand, SSL of beef and mutton are lower than 100%.

Table 2. Self-Sufficiency Level of Livestock Products in Malaysia (%) 2010-2015

Year	Region	Livestock		
		Beef	Mutton	Poultry
2010	Malaysia	30.12	12.13	105.55
	Peninsular	31.10	12.41	106.86
	Sabah	11.24	n.a	101.09
	Sarawak	18.12	7.00	88.87
2011	Malaysia	29.17	11.73	105.36
	Peninsular	30.02	11.94	106.27
	Sabah	11.53	n.a	111.71
	Sarawak	18.45	7.73	87.72
2012	Malaysia	28.26	19.71	104.88
	Peninsular	29.60	20.08	105.84
	Sabah	8.72	n.a	107.41
	Sarawak	14.78	12.17	88.85
2013	Malaysia	25.66	15.51	104.85
	Peninsular	27.22	16.54	105.91
	Sabah	7.06	n.a	112.72
	Sarawak	12.09	4.44	84.80
2014	Malaysia	25.28	12.74	104.30
	Peninsular	26.69	13.58	105.13
	Sabah	7.47	n.a	119.49
	Sarawak	12.14	3.84	83.44
2015[E]	Malaysia	23.50	11.46	104.48
	Peninsular	24.80	12.22	105.04
	Sabah	6.81	n.a	115.05
	Sarawak	11.45	3.56	89.00

E: Estimates
(Source: Department of Veterinary Services Malaysia, 2015)

METHODOLOGY

The data of this study is obtained from Household Expenditure Survey 2014 (HES) conducted by Department of Statistics Malaysia. There are 14,838 number of households in this survey and these data will be used to build a statistical model of demand for poultry meat. Besides, there are two categories of variables in this study which are dependent variable and independent variables. Dependent variable consists of household expenditure's share on poultry meat while independent variables compromise of retail price of poultry (own price), retail price of beef (substitute price), retail price of mutton (substitute price), household income, number of households, state (area of Sabah, Wilayah Persekutuan Labuan and Sarawak), strata, ethnicity of head of households, nationality of head of household and education level of head of household (primary, secondary and tertiary).

The development of the model will be based on best subsets regression approach. The best subsets regression model equation can be written as equation (1):

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \ldots + \beta_k X_k + \mu \quad (1)$$

where Y is dependent variable, β_0 is constant, β_k is kth coefficient and X_k is kth independent variables, k=1,2,3…n.

There are several steps in order to build a statistical model. The procedures of model building based on best subsets approach is shown in the Figure 1 below.

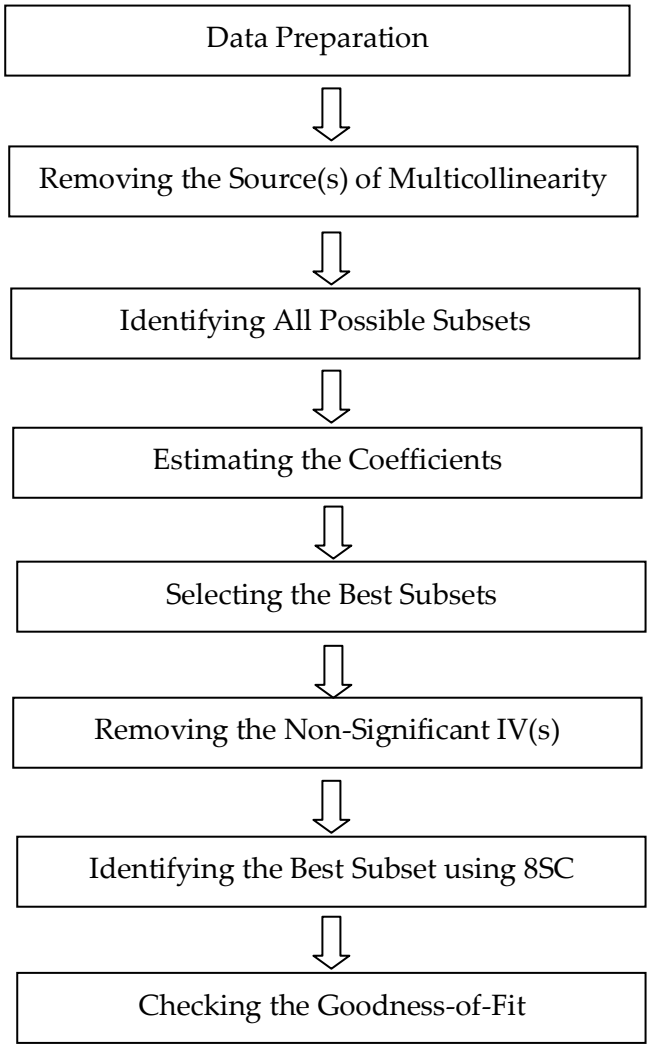

Figure 1. Model Building Procedure Based on Best Subsets Regression

RESULT AND DISCUSSION

This study is using the data from Household Expenditure Survey (HES) 2014 collected all across the country with 14,838 respondents. There are some variations among the respondents in term of state of respondents, strata, nationality of head of household, ethnicity of head of household and education level of head of household. Table 3 shows the state of respondents that are divided into three which are Peninsular Malaysia, Sabah and Wilayah Persekutuan Labuan and Sarawak.

Table 3. State of Respondents

Area	Frequency of Respondents	Percentage (%)
Peninsular	10,665	71.88
Sabah and Wilayah Persekutuan Labuan	1,992	13.42
Sarawak	2,181	14.70

Table 3 shows that the highest frequency of respondents is in Peninsular Malaysia with 10,665 respondents (71.88%) followed by Sabah and Wilayah Persekutuan Labuan and Sarawak. Meanwhile, strata are divided by two into urban and suburban. Table 4 illustrates the strata of the respondents.

Table 4. Strata of Respondents

Strata	Frequency of Respondents	Percentage (%)
Urban	10,246	69.10
Suburban	4,592	30.90

It can be seen in the table above that respondents are higher in urban area compared to suburban area with total of respondents 10,246 and 4,592 respectively. Next, Table 5 observes the nationality of head of household that consist of citizen and non-citizen.

Table 5. Head of Household's Nationality

Nationality	Frequency of Respondents	Percentage (%)
Citizen	14,470	97.50
Non-citizen	368	2.50

It is observed that frequency of respondents for citizen 14,470 while non- citizen is 365. Table 6 shows head of household's ethnicity. Number of respondents for Bumiputera surpassed non-Bumiputera with 10,116 respondents while number of respondents for non-Bumiputera is 4,722.

Table 6. Head of Household's Ethnicity

Nationality	Frequency of Respondents	Percentage (%)
Bumiputera	10,116	68.20
Non-Bumiputera	4722	31.80

Table 7 shows the education level of head of household. They are divided into four levels which are primary, secondary, tertiary and informal education. It can be seen that the most respondents have secondary education 8,410 respondents followed by tertiary level, primary level and informal education with 3,161, 2,608, and 656 respondents respectively.

Table 7. Head of Household's Ethnicity

Level of Education	Frequency of Respondents	Percentage (%)
Primary	2,608	17.60
Secondary	8,410	56.70
Tertiary	3,161	21.3
Informal	659	4.40

Best subsets are selected according to the model size. There are 11 model sizes in this study as there are 11 significant independent variables. Number of possible subsets for each subset size is calculated as follows:

$$_nC_r = \frac{n!}{r!(n-r)!} \quad (2)$$

where n is the number of possible independent variables and r is subset size.

Table 8 shows the symbols and labels of independent variables for poultry meat. Independent variables retail price of beef (X_2) and education level of head of household (secondary) (X_{12}) are removed because there are sources of multicollinearity. Meanwhile, Table 9 shows the selected best subsets for each subset size. The best subsets are selected based on the highest R squared value in each subset size.

Table 8. Symbols and Labels of Independent Variables

Symbols	Independent Variables	Labels
X_1	Retail price of poultry	A
X_3	Retail price of mutton	B
X_4	Households income	C
X_5	Number of households	D
X_6	Area of Sabah and Wilayah Persekutuan Labuan	E
X_7	Area of Sarawak	F
X_8	Strata	G
X_9	Head of household's ethnicity	H
X_{10}	Head of household's nationality	I
X_{11}	Education level of head of households (primary)	J
X_{13}	Education level of head of households (tertiary)	K

Table 9. Selected Best Subsets

Subset Size	R Squared	The Selected Subset
1	0.07028	C
2	0.10080	CE
3	0.13276	CEH
4	0.15878	CEFH
5	0.16851	CDEFH
6	0.17209	CDEFHK
7	0.17386	ACDEFHK
8	0.17438	ACDEFHJK
9	0.17470	ACDEFGHJK
10	0.17500	ABCDEFGHJK
11	0.17529	ABCDEFGHIJK

These selected subsets are then compared using the eight selection criteria (8SC) in order to find one best subset. Subset ABCDEFGHIJK is selected because it has the most minimum value (see Table 10).

Table 10. Selected Best Subsets

Subset	AIC	FPE	GCV	HQ	RICE	SCHWARZ	SGMASQ	SHIBATA
ABCDEFGHIJK	0.04938	0.04938	0.04938	0.07550	0.04938	0.04975	0.04938	0.04938

The equation of the best subset is as equation (1) above.

$$Y = \beta_0 + \beta_1X_1 + \beta_3X_3 + \beta_4X_4 + \beta_5X_5 + \beta_6X_6 + \beta_7X_7 + \beta_8X_8 + \beta_9X_9 + \beta_{10}X_{10} + \beta_{11}X_{11} + \mu \quad (1)$$

Normality test is conducted to test whether the data of best subsets is normal or not. Kolmogorov Smirnov is used because of the large data. Normality test shows that the data is normal due to p-value is smaller than 0.05.

CONCLUSION

The important variables in estimating the demand for fresh meat (poultry) in Malaysia are retail price of chicken, retail price of mutton, income, number of households, state, strata, ethnicity of head of household, nationality of head of household, education level of head of household.

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