Demand analysis of food in Malaysia: A study of Malay ethnic

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28 July 2008

DEMAND ANALYSIS OF FOOD IN MALAYSIA:
A STUDY OF MALAY ETHNIC

by

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ABSTRACT

The objective of this study is to provide an insight into demand patterns of the Malay consumers for specific food categories in Malaysia. By utilizing Household Expenditure Survey 2004/2005, a system of equations of Linear Approximate Almost Ideal Demand System (LA/AIDS) model for 12 aggregated food products is estimated using a two-step estimation procedure. A Working-leser form of Engel function is also estimated to derive income elasticities from the estimated expenditure elasticities. This study shows that Malay consumers appear to have different food consumption patterns as compared to the general Malaysian diets. Malay consumers tend to increase their consumption of rice more than higher-value (meat and fish) and functional (vegetables and fruits) foods. Malay consumers are found to be very sensitive to the own-price of most of the food products, especially rice (-2.0241).

Key words: *Food, Linear Approximate Almost Ideal Demand System, Engel function*

JEL code: Q11, I12

1.0 INTRODUCTION

The diversity of ethnic ratio within Malaysian communities is rapidly becoming a marketing challenge as well as an opportunity. For instance, the Malay population had the most dramatic growth during the past decade, numbering 13.77 million and accounting for 54.5% percent of the Malaysian population in 2007 (Department of Statistics, 2007).

The Malay household income had increased averagely at 6.4% rate since 2000. It then reached RM2711 in 2004 (Department of Statistics, 2007). The increasing household income can be directly translated as stronger buying power, suggesting that the Malay

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population be considered the leading growth market in Malaysia. The growth is obviously a mean of addressing market opportunities for *HALAL* agri-food products.

The objective of this study is to analyze the demand for food among Malay consumers in Malaysia. In view with Malaysian government aim to develop Malaysia as a world's *Halal* food hub, it is ultimately crucial to understand the food consumption patterns of Malay consumers, where it is a key indicator to forecast the future food consumption patterns of South East Asian Muslims.

2.0 DATA

The data set used in this study is from the *Household Expenditure Survey 2004/2005* data. The data provides detailed expenditure information along with various socio-demographic characteristics for 14,084 respondents in the survey. The data consists of 7966 Malay respondents, 3200 Chinese respondents, 810 Indian respondents, and 2108 respondents from other ethnics. This study only focuses on the data of Malay respondents.

Table 1 presents the trend of per capita allocations on the food budget on various food products by Malay consumers in 1999/2000 and 2004/2005. The share of cereal in total food expenditure is generally the largest, though the budget share had decreased from 24% in 1999/2000 to 23.8% in 2004/2005. This is immediately followed by the shares of fish, meat, and vegetable that recorded 21.8%, 10.4%, and 10.2% in 1999/2000 and 22.1%, 11.3%, and 9.5% in 2004/2005 respectively.

TABLE 1

Budget shares of various food items by Malay consumers, 1999/2000 and 2004/2005

	1999/2000		**2004/2005**	
	Sample size	**Mean of budget share**	**Sample size**	**Mean of budget share**
Cereal	4601	0.2408	7966	0.2388
Meat	4601	0.1042	7966	0.1132
Fish	4601	0.2180	7966	0.2209
Milk & eggs	4601	0.0799	7966	0.0781
Oils & fats	4601	0.0314	7966	0.0285
Fruit	4601	0.0823	7966	0.0674
Vegetable	4601	0.1029	7966	0.0955
Sweet	4601	0.0268	7966	0.0381
Beverage	4601	0.0541	7966	0.0552
Other	4601	0.0566	7966	0.0639

Source: *Household Expenditure Survey 1999/2000* and *2004/2005*.

3.0 METHODOLOGY AND MODEL SPECIFICATION

Previous studies (Baharumshah and Mohamed, 1993; Nik Mustapha, 1994; Nik Mustapha *et al.*, 1999, 2000 and 2001; Radam *et al.*, 2005; Tey *et al.*, 2007) of food consumption patterns in Malaysia utilized the premise of Linear Approximate Almost

Ideal Demand System (LA/AIDS). This is mainly due to the estimation simplicity of the linearized model compared to original non-linear Almost Ideal Demand System (AIDS) that developed by Deaton and Muellbauer (1980a, 1980b). However, there are two main shortcomings in the application process of the LA/AIDS model in the previous studies.

The ease of estimation of the LA/AIDS model is mainly attributed to the application of Stone price index that linearized the model. However, prices will never be perfectly collinear. Alston, Foster, and Green (1994), Asche and Wessells (1997), and Moschini (1995) argued that the application of the Stone price index introduce the units of measurement error. Moschini (1995) suggested that Laspeyres price index is able to overcome this measurement error. Chern (2000) and Chern *et al.* (2003) found that application of the Laspeyres price index also yielded plausible elasticities like the non-linear AIDS model.

All of the previous studies did not correct the possible bias created by the presence of zero consumption of food items. Zero consumption happens when respondents do not purchase food items during survey period. In order to handle the zero consumption problem, Heien and Wessells (1990) suggested a two-step estimation procedure that produces inverse Mills' ratio (IMR) via probit model and incorporates the IMR in the second step. The two-step estimation procedure was remarkably used by Gao and Spreen (1994), Gao *et al.* (1997), Nayga (1995), Park *et al.* (1996), and Chern (2000) in food demand analyses.

By adopting the techniques to overcome the shortcomings, this study utilizes a two-stage procedure used by Chern (2000). In the first stage, the two-step estimation procedure of Heien and Wessells (1990) is utilized to obtain IMRs via probit model. The IMRs are then incorporated into LA/AIDS model. The LA/AIDS model for the 12 food items can be estimated as follows:

$$w_i = \alpha_i + \sum_j \gamma_{ij} \log(p_j) + \beta_i \log(x / P^L) + \sum_k \gamma_k H_k + \theta_i imr_i + \mu_i \quad (1)$$

where i, j = 1, 2, ……., 12 food products, w_i is the budget share of the *i*th food product, p is the price of the *i*th food product, x is the aggregate total expenditure of food, H_k includes household size and dummy variable of urban, μ_i's are random disturbances assumed with zero mean and constant variance, and P^L is Laspeyres price index for the aggregate food that can be defined by:

$$\log(P) = \sum_i \overline{w_i} \log(P_i) \quad (2)$$

The adding up, homogeneity and symmetry restrictions are imposed for the LA/AIDS model. The adding-up restriction is satisfied with given $\sum_i w_i = 1$ for all *j*:

$$\sum_i \alpha_i = 1, \sum_i \gamma_{ij} = 0, \sum_i \beta_i = 0, \sum_i \theta_i = 0 \text{ and } \sum_i \kappa_{ki} = 0 \quad (3)$$

The homogeneity restriction is satisfied for the LA/AIDS model in and only if, for all *j*:

$$\sum_k \gamma_{jk} = 0 \tag{4}$$

The symmetry is satisfied by:

$$\gamma_{ij} = \gamma_{ji} \tag{5}$$

Followed procedures of Green and Alston (1990), the demand elasticities of the LA/AIDS model can be computed at sample means. The expenditure elasticities can be estimated by:

$$e_i = \frac{\beta_i}{\overline{w}_i} + 1 \tag{6}$$

The Marshallian measures of price elasticities can be computed by:

$$s_{ij} = -\delta_{ij} + \left(\frac{\gamma_{ij}}{\overline{w}_i}\right) - \left(\frac{\beta 1_i}{\overline{w}_i}\right)\overline{w_j} \quad \forall i, j = 1\ldots, n \tag{7}$$

where δ_{ij} is the Kronecker delta that is unity if $i = j$ and zero otherwise.

4.0 RESULTS AND DISCUSSIONS

The central focus of this study is on the demand elasticities. Table 2 presents the estimated own-price and expenditure elasticities for the various food items by Malay consumers. Generally, Malay consumers are found to be very sensitive to most of the food products, except bread & other cereals (-0.9488), fish (-0.9560), milk & dairy (-0.4667), and other foods (-0.9528). Unexpectedly, the estimated own-price elasticity for rice (-2.0241) is very elastic while bread & other cereals (-0.9488) are nearly least inelastic.

The demand for fish (-0.9560) is less price elastic than meat (-1.0468). This may indicate that Malay consumers are insensitive to changes in the price of fish. Facing similar results, Pomboza and Mbaga (2007) suggested that an increase in the expenditure on fish may not be caused by a price decrease but instead may be caused by an increase in income and probably also by the increase in the health consciousness of consumers.

TABLE 2
Estimated Own-price and Expenditure Elasticities for Food Items by Malay consumers

	Own-price Elasticity	Expenditure Elasticity
Rice	-2.0241	1.2140
Bread & other cereals	-0.9488	0.8066
Meat	-1.0468	1.0260
Fish	-0.9560	0.9897
Milk & dairy	-0.4667	0.8040
Eggs	-1.4673	1.0997
Oils & fats	-1.1717	1.0966
Fruits	-1.0645	1.0415
Vegetables	-1.0642	1.1177
Sugar	-1.0672	0.9905
Other foods	-0.9528	0.9338
Beverage	-1.3479	1.0491

United States Department of Agriculture (2007) defined that expenditure elasticity shows how the quantity purchased changes (how sensitive it is) in response to a change in the consumer's expenditure, which is a proxy for income. Therefore, the estimates of expenditure elasticities in this study must not be more than unity. This is because as income rises, the proportion of income spends on food falls, even if actual expenditure on food rises, according to Engel's law.

However, the estimated expenditure elasticities of seven food products are more than unity. Hence, this study follows Chern *et al.* (2003) and Chern (2000) to estimate an Engel function, which is useful to derive income elasticities from the estimated expenditure elasticities. The Engel function can be expressed as:

$$s = \alpha_0 + \alpha_1 \log X + \beta \log P^L + \sum_k \gamma_k H_k + \varepsilon \quad (8)$$

where s is share of aggregate food in total expenditures, X is total expenditures of food and non-food consumer goods and services, P^L is Laspeyres price index for the aggregate food, and ε is random disturbances assumed with zero mean and constant variance.

The responsiveness of expenditure on food items by income change can be derived by,

$$.e_e = 1 + \frac{\alpha_1}{s} \quad (9)$$

Hence, income elasticity can be estimated as follows:

$$e_y = e_i * e_e \quad (10)$$

From equation (9), the responsive of expenditure on food items by income change is estimated to be 0.5334. By multiplying the estimate of expenditure elasticity (0.5334) with the estimated expenditure elasticities of various food products, table 3 reports the estimated income elasticities for the various food products by Malay consumers in Malaysia. Overall, the estimated income elasticities are less than unity, showing that all of the food products are normal goods.

It is noteworthy that income elasticity for rice (0.6476) is the highest among all. This is followed by vegetable (0.5962), eggs (0.5866), oils & fats (0.5849), fruits (0.5555), and meat (0.5472). Surprisingly, the estimates of income elasticities for bread & other cereals (0.4303) and milk & dairy (0.4289) are relatively low. This means that Malay consumers are expected to increase their consumption of rice, vegetable, fruit, and meat faster than cereal based and dairy based products as per capita income increases.

TABLE 3
Estimated Income Elasticities for Food Items by Malay consumers

	Income Elasticity
Rice	0.6476
Bread & other cereals	0.4303
Meat	0.5472
Fish	0.5279
Milk & dairy	0.4289
Eggs	0.5866
Oils and fats	0.5849
Fruits	0.5555
Vegetables	0.5962
Sugar	0.5284
Other foods	0.4981
Beverage	0.5596

5.0 CONCLUSIONS

The objective of this study is to provide an insight into demand patterns of the Malay consumers for specific food categories in Malaysia. By utilizing Household Expenditure Survey 2004/2005, a system of equations of the LA/AIDS model for 12 aggregated food products is estimated using a two-step estimation procedure. A Working-leser form of Engel function is also estimated to derive income elasticities from the estimated expenditure elasticities.

This study shows that Malay consumers appear to have different food consumption patterns as compared to the general Malaysian diets found in Tey *et al.* (2007). In Tey *et al.* (2007), Malaysian consumers' demands for the higher-value and functional foods are expected to increase faster than the staple food. In this study, Malay consumers tend to increase their consumption of rice more than higher-value (meat and fish) and functional (vegetables and fruits) foods.

In term of own-price elasticities, this study obtains similar estimates like Tey *et al.* (2007) with a remarkable exception of rice. If this estimate represents the Malay consumers' behavior correctly, the recent hike in the price of rice should have led to a reduction in consumption of rice. This might have helped to relieve the pressure of supplies to meet domestic demands.

Facing the same scenario of high own-price elasticity for rice, Chern *et al.* (2003) explained that the survey data are observations of purchase behavior, which may not be the same as the consumption behavior. This is because consumers buy rice in response to changes in price. Specifically, there are substantial variations on price of rice caused by quality differences. High-income consumers tend to buy higher quality of rice than lower income consumers.

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APPENDIX 1

Regression results for Engel curve analysis

	Coefficient	**(Std. Error)**
Intercept	0.9710	(0.0136)***
Log (total expenditure)	-0.1185	(0.0020)***
Laspeyres price index	0.0180	(0.0047)***
Log (household size)	-0.0223	(0.0022)***
Urban dummy	-0.0290	(0.0024)***

Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.

APPENDIX 2

Maximum likelihood estimates of LA/AIDS

	Rice Coefficient (Std. Error)	**Bread & other cereals Coefficient (Std. Error)**	**Meat Coefficient (Std. Error)**	**Fish Coefficient (Std. Error)**	**Milk & dairy Coefficient (Std. Error)**	**Eggs Coefficient (Std. Error)**
Intercept	-0.0502	0.4088	0.0872	0.1742	0.0228	0.0058
	(0.0070)***	(0.0116)***	(0.0083)***	(0.0102)***	(0.0068)***	(0.0024)**
log (price of rice)	-0.0953	0.0821	0.0087	-0.0241	-0.0240	0.0055
	(0.0038)***	(0.0065)***	(0.0049)*	(0.0060)***	(0.0039)***	(0.0013)***
log (price of bread and other cereals)	0.0034	0.0034	-0.0013	-0.0053	0.0019	-0.0008
	(0.0010)***	-	(0.0017)	(0.0020)***	(0.0013)	(0.0004)*
log (price of meat)	0.0242	-0.0050	-0.0050	-0.0046	-0.0088	0.0002
	(0.0024)***	(0.0023)**	-	(0.0039)	(0.0025)***	(0.0009)
log (price of fish)	0.0159	-0.0650	0.0092	0.0092	0.0132	0.0087
	(0.0038)***	(0.0064)***	(0.0036)**	-	(0.0038)***	(0.0013)***
log (price of milk and dairy)	-0.0016	-0.0185	-0.0121	0.0298	0.0298	-0.0016
	(0.0011)	(0.0019)***	(0.0015)***	(0.0009)***	-	(0.0004)***
log (price of eggs)	0.0249	-0.0387	0.0096	0.0419	-0.0098	-0.0098
	(0.0028)***	(0.0048)***	(0.0037)***	(0.0045)***	(0.0009)***	-
log (price of oils and fats)	0.0037	0.0073	-0.0012	-0.0065	-0.0001	-0.0048
	(0.0010)***	(0.0017)***	(0.0013)	(0.0016)***	(0.0010)	(0.0003)***
log (price of fruits)	0.0106	-0.0106	-0.0021	0.0076	0.0036	0.0008
	(0.0015)***	(0.0027)***	(0.0020)	(0.0025)***	(0.0016)**	(0.0005)
log (price of vegetables)	0.0148	0.0217	0.0023	-0.0309	-0.0041	0.0009
	(0.0028)***	(0.0048)***	(0.0037)	(0.0045)***	(0.0029)	(0.0010)
log (price of sugar)	-0.0085	0.0178	-0.0015	-0.0140	0.0017	0.0001
	(0.0010)***	(0.0016)***	(0.0013)	(0.0016)***	(0.0010)*	(0.0003)
log (price of others)	-0.0033	0.0192	-0.0082	-0.0264	0.0004	-0.0003
	(0.0011)***	(0.0019)***	(0.0015)***	(0.0018)***	(0.0012)	(0.0004)
log (price of beverage)	0.0110	-0.0138	0.0015	0.0233	-0.0037	0.0010

	-	-	-	-	-	-
log (x/P)	0.0203	-0.0278	0.0029	-0.0023	-0.0112	0.0021
	(0.0010)***	(0.0017)***	(0.0013)**	(0.0016)	(0.0010)***	(0.0004)***
Log (household size)	0.0083	-0.0571	0.0238	0.0220	0.0093	0.0008
	(0.0012)***	(0.0021)***	(0.0016)***	(0.0020)***	(0.0013)***	(0.0004)*
Urban	-0.0122	0.0172	0.0082	-0.0238	0.0113	0.0007
	(0.0014)***	(0.0024)***	(0.0019)***	(0.0023)***	(0.0015)***	(0.0005)
IMR	0.0788	0.1264	0.0695	0.0724	0.0654	0.0271
	(0.0071)***	(0.0108)***	(0.0034)***	(0.0060)***	(0.0017)***	(0.0007)***

Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.

APPENDIX 2

Continued…

	Oils & fats Coefficient (Std. Error)	**Fruits Coefficient (Std. Error)**	**Vegetables Coefficient (Std. Error)**	**Sugar Coefficient (Std. Error)**	**Others Coefficient (Std. Error)**	**Beverage Coefficient (Std. Error)**
Intercept	0.0122	0.0878	0.0567	0.0465	0.0461	0.1021
	(0.0030)***	(0.0070)***	(0.0054)***	(0.0038)***	(0.0093)***	-
log (price of rice)	-0.0012	0.0145	-0.0032	0.0052	0.0094	0.0223
	(0.0016)	(0.0039)***	(0.0030)	(0.0021)**	(0.0051)*	-
log (price of bread and other cereals)	-0.0006	0.0013	0.0013	-0.0024	-0.0050	0.0042
	(0.0005)	(0.0013)	(0.0010)	(0.0007)***	(0.0017)***	-
log (price of meat)	0.0016	0.0041	-0.0066	0.0021	-0.0069	0.0045
	(0.0010)	(0.0025)	(0.0019)***	(0.0013)	(0.0032)**	-
log (price of fish)	0.0103	-0.0055	0.0053	-0.0037	0.0037	-0.0014
	(0.0016)***	(0.0038)	(0.0029)*	(0.0020)*	(0.0051)	-
log (price of milk and dairy)	-0.0014	-0.0037	0.0041	-0.0028	-0.0083	-0.0136
	(0.0005)***	(0.0012)***	(0.0009)***	(0.0006)***	(0.0015)***	-
log (price of eggs)	0.0000	-0.0025	0.0097	-0.0028	-0.0062	-0.0164
	(0.0012)	(0.0028)	(0.0022)***	(0.0015)*	(0.0037)*	-
log (price of oils and fats)	-0.0048	0.0022	-0.0001	0.0005	0.0043	-0.0006
	-	(0.0010)**	(0.0008)	(0.0005)	(0.0013)***	-
log (price of fruits)	-0.0042	-0.0042	0.0021	0.0016	-0.0019	-0.0034
	(0.0006)***	-	(0.0012)*	(0.0008)**	(0.0021)	-
log (price of vegetables)	0.0033	-0.0051	-0.0051	0.0051	-0.0165	0.0135
	(0.0012)***	(0.0017)***	-	(0.0015)***	(0.0038)***	-
log (price of sugar)	-0.0016	0.0049	-0.0026	-0.0026	0.0226	-0.0164
	(0.0004)***	(0.0010)***	(0.0004)***	-	(0.0015)***	-
log (price of others)	-0.0029	0.0013	-0.0139	0.0024	0.0024	0.0293
	(0.0005)***	(0.0011)	(0.0009)***	(0.0005)***	-	-
log (price of beverage)	0.0016	-0.0074	0.0089	-0.0028	0.0024	-0.0220
	-	-	-	-	-	-
log (x/P)	0.0028	0.0028	0.0112	-0.0004	-0.0037	0.0031

	(0.0004)***	(0.0010)***	(0.0008)***	(0.0005)	(0.0013)***	-
Log (household size)	0.0020	-0.0085	0.0080	-0.0001	0.0091	-0.0176
	(0.0005)***	(0.0013)***	(0.0010)***	(0.0007)	(0.0016)***	-
Urban	-0.0002	0.0012	-0.0109	0.0012	-0.0043	0.0115
	(0.0006)	(0.0014)	(0.0011)***	(0.0008)	(0.0019)**	-
IMR	0.0321	0.0471	0.0666	0.0409	0.0350	-0.6612
	(0.0010)***	(0.0027)***	(0.0040)***	(0.0018)***	(0.0039)**	-

Note: Significance levels are denoted by *** for 1%, ** for 5%, and * for 10%.