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EMERGING FOOD DEMAND BEHAVIORS IN MALAYSIA: INCORPORATING QUALITY EFFECTS IN DEMAND ANALYSES

by

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ABSTRACT

In this study, the focus is on analyzing food demand behaviors in Malaysia. To be more specific, this study intends to estimate demand elasticities for twelve food categories with incorporation of food quality effects in the demand analyses. This study analyses the data from the Household Expenditure Survey 2004/2005 by Linear Approximate Almost Ideal Demand System (LA/AIDS) and unit value function. The estimated expenditure elasticities indicate that there will be growing demand for all the food categories, especially meat, fish, vegetables, oils and fats, and fruits. The own-price elasticities for rice, eggs, beverage, and oils & fats are more elastic than the rest of the food categories. This study also shows that there is quality effect in food demand.

Keywords: *Food, demand behaviors, quality effects, demand analysis*

JEL code: Q11

1.0 INTRODUCTION

While Malaysia has been experiencing gross domestic product growth of 6%-7% at average, agriculture industry has been developing slower than other industries like manufacturing and services industries over the years. With a new direction drawn in the Ninth Malaysian Plan, agriculture industry is targeted to be revived as the third engine growth in Malaysian economy. It is postulated that a big amount of investment from both government and private sectors will flow into the agricultural market. All these substantial investments are meant for agri-food products which are marketable and profitable. Hence, it is particularly timely to gain an in-depth understanding of food demand behaviors in Malaysia.

Current Malaysians' food consumption patterns can be characterized by diminishing consumption of staple food—rice and increasing consumption of nearly every other food items, especially wheat and meat based products. Statistically, per capita consumption of rice has decreased tremendously from 121kg in 1961 to 70.8kg in 2003. On another hand, per capita consumption of wheat has hiked from 27.7kg to 65.6kg

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within the same period. For meat products, per capita consumption of fish, poultry, pork, beef, and mutton has increased from 22.1kg, 3.5kg, 6.7kg, 1.3kg, and 0.4kg in 1961 to 55.9kg, 33.8kg, 8.4kg, 5.8kg, and 0.5kg in 2003 respectively.

The changes in food consumption patterns have a direct repercussion in Malaysian agri-food markets. The changes perhaps are the most important driver in determining the direction of Malaysian agricultural industry and trade. A closer look at the statistics above implies that the business opportunities have been created primarily in the production sector, especially those of commodities with low self-sufficiency level. While it is not possible to close the gap between insufficient domestic supply and growing demand in a short term, it indeed signals a need for local producers to gear up domestic productions as well as opportunities for them to build up and pioneer in the domestic agri-food market in long term.

While the need to steer up production has been identified, understanding Malaysians' food demand behaviors for predicting its food demand is essential so that the purpose of increasing production is meaningful. In this study, the focus is on analyzing food demand behaviors in Malaysia. To be more specific, this study intends to estimate demand elasticities for twelve food categories with incorporation of food quality effects in the demand analyses. The twelve food products comprise of rice, bread & other cereal, meat, fish, dairy, eggs, oils & fats, fruits, vegetables, sugar, beverage, and other foods.

2.0 METHODOLOGY

Most of previous studies on Malaysian food demand analysis used either single equation (Tee and Thiam, 1975; Hussein *et al.*, 1986; Ishida *et al.*, 2003; Radam *et al.*, 2005) or static model—conventional Linear Almost Ideal Demand System (LA/AIDS) (Baharumshah, A.Z. and Mohamed, 1993; Baharumshah, 1993; Nik Mustapha, 1994; Radam *et al.*, 2005; Nik Mustapha *et al.*, 1999, 2000 and 2001; Tey *et al.*, 2008). The previous studies did not take food quality effects into the estimations of expenditure elasticity, which in turn may have created biasness in the estimates of expenditure elasticity (Huang and Lin, 2000). The unit value of a food category at its average market price reflects consumers' choices of food quality (Huang and Lin, 2000). Hence, this study is interested in measuring price elasticities, original and quality-adjusted expenditure elasticities.

As household expenditure survey data consists of food expenditures at home and away from home, a utility for food (U) then consists of two categories and can be expressed as:

$$U = \sum_i \alpha_i \log(\lambda_i q_i), \text{ for } i=1, 2 \quad (1)$$

where λ_i is the ratio of unit value to average price of the i th food category and q_i is quantity of the i th food quantity. Maximization of the U subject to the food budget constraint (m) can be written as:

$$m = \sum_i \lambda_i p_i q_i \text{ for } i=1, 2 \quad (2)$$

where p_i is the average price of the i th food category. From equations (1) and (2), a demand equation can be expressed as:

$$q_i = \alpha_i m / [(\alpha_1 + \alpha_2) \lambda_i p_i], \text{ for } i=1, 2 \quad (3)$$

Through the duality properties of demand relationships, a demand equation can be derived from a cost function. While the purposes of consumer economics are to maximize utility and minimize cost, basic cost minimization (C) function can be expressed as:

$$C = \sum_i p_i \lambda_i q_i, \text{ for } i=1, 2 \quad (4)$$

subject to the logarithm form of utility function of equation (1) and the conditional factor demands can then be derived. Hence, the cost function can be written as:

$$C = \sum_i p_i \lambda_i q_i^* \quad (5)$$

$$\text{where } q_i^* = (\alpha_i p_j / \alpha_j p_i)^{\alpha_j / (\alpha_1 + \alpha_2)} + \lambda_i^{-1} U^{1 / (\alpha_1 + \alpha_2)}, \text{ for } i=1, 2, i \neq j. \quad (6)$$

The cost function can be used to generate a demand system. Original non-linear Almost Ideal Demand System (AIDS) by Deaton and Muellbauer (1980a) describes that at-home expenditure share of a food category is a function of average price of the i th food category (p_i) and the related food expenditures. In order to incorporate food quality effects in demand analysis, this study applies the approach suggested by Huang and Lin (2000) to replace the average price of the i th food category (p_i) with the unit value of the i th food category (v_i). The linear AIDS (LA/AIDS) can be estimated via:

$$w_i = \alpha_i + \sum_j \delta_{ij} \log v_j + \beta_i \log(m / v^*) + \sum_k \delta_k Z_k \quad (7)$$

where $i, j = 1, 2, \dots, 12$ food groups, $k = 1, \dots, n$ th household, w_i is the i th food expenditure share of total at-home food expenditures, m is per capita at-home food expenditures, Z is socio-demographic variables, and v^* is a Stone price index that can be defined by

$$\log v^* = \sum_i w_i \log v_i \quad (8)$$

However the LA/AIDS in equation (7) is expected to yield big elasticities (Chern, 2000) which are different from the estimates that can be obtained from the non-linear due to the fact that the utilization of the Stone price index will introduce the units of measurement (Moschini, 1995). It is more appropriate to replace the Stone price index with a Laspeyres price index (L^P) to yield more plausible results. Hence, the modified AIDS can be expressed as:

$$w_i = \alpha_i + \sum_j \delta_{ij} \log v_j + \beta_i \log(m / L^P) + \sum_k \delta_k Z_k \quad (9)$$

where the Laspeyres price index that can be defined by

$$\log(L^P) = \sum_j \bar{w}_j \log(v_j) \quad (10)$$

Theoretical properties of adding up ($\delta_{jk} = \delta_{kj}$), homogeneity ($\sum_j \beta_j = \sum_j \delta_{jk} = \sum_j \delta_{kj} = 0$) and symmetry ($\sum_j \alpha_j = 1$) are applied directly to the parameters. From equation (9), demand elasticities can be measured as,

$$\text{Expenditure elasticity: } \varepsilon_i = \beta_i / w_i + 1 \quad (11)$$

$$\text{Own-price elasticity: } e_{ii} = (\delta_{ii} - \beta_i w_i) / w_i - 1 \quad (12)$$

As the unit value of a food category at its average market price reflects consumers' choices of food quality, the variations of unit values can be explained as follow:

$$\log v_i = \pi_i \log m + \omega_i f_i + \sum_k \gamma_{ik} Z_k \quad (13)$$

where f_i is the portion of the total food budget spent on food away from home. Equation (14) can be estimated by ordinary least squares (OLS). Prais and Houthakker (1955) suggested that quality elasticity, $\pi_i = (\partial \log v_i / \partial \log m)$, can be used to correct the bias of measuring Engel relationships directly from equation (1) when food quality effects are ignored. By differentiating equation (1) and (2) with respect to prices and expenditure, Huang and Lin (2000) pointed out that quality-adjusted expenditure elasticity (η_i) can be estimated by

$$\eta_i = [\beta_i + \sum_j (\delta_{ij} - \beta_i w_j) \pi_j] / w_i + (1 - \pi_i) \quad (14)$$

The difference between the original expenditure elasticity (ε_i) and quality-adjusted expenditure elasticity (η_i) is the bias of estimate when quality effects are ignored.

3.0 DATA

This study utilizes the data from the Household Expenditure Survey 2004/2005. The data consists of a random sample of 14,084 households throughout Malaysia. The data comprises food expenditures at home and away from home. For food expenditures at home, the data was originally distributed to ten general categories, as depicted in Table 1.

Table 1. Food categories in the Household Expenditure Survey, 2004/2005

No.	Food Categories
1	Rice, bread and other cereal
2	Meat
3	Fish and aquatic product
4	Milk, cheese and egg
5	Oil and fat
6	Fruit
7	Vegetable
8	Sweet, jam, honey, chocolate and sweetener
9	Unclassified food items
10	Coffee, tea, cocoa and non-alcohol drink

In order to get better picture of important food categories (such as rice and eggs), the data of food expenditures at home was regrouped to form the following twelve categories.

Table 2. Restructured food categories

No.	Food Category
1	Rice
2	Bread & other cereals
3	Meat
4	Fish
5	Dairy

6	Eggs
7	Oils & fats
8	Fruits
9	Vegetables
10	Sugar
11	Others
12	Beverage

4.0 RESULTS

It is interesting to decide whether quality plays a role in determining consumers' demand for food products. Table 3 presents the estimates of expenditure elasticities with and without adjustments of food quality effects in Malaysia. The estimates show that measure of elasticities by incorporating the quality adjustment yield upward bias comparable to the ordinary expenditure elasticities, except for fish and dairy products. The difference of both elasticities shows that quality does play a role in determining consumers' demand for food products in Malaysia. The biggest adjustment is found in beverage, oils & fats, rice, and meat.

Table 3. Estimated expenditure elasticities for food categories, Malaysia

Food	Expenditure elasticity	Quality-adjusted expenditure elasticity
Rice	0.9082	1.0123
Bread & other cereals	0.3522	0.3292
Meat	1.3543	1.4102
Fish	1.2207	1.1797
Dairy	0.9476	0.9457
Eggs	0.8011	0.8322
Oils & fats	1.1165	1.2993
Fruits	1.0506	1.0506
Vegetables	1.1554	1.1658
Sugar	0.7706	0.7971
Others	1.4641	1.4867
Beverage	0.6457	1.0137

Ordinarily, the sole income effect in the estimated expenditure elasticities range from 0.3522 to 1.4641. The estimates imply that as per capita incomes increase, Malaysian consumers are more likely to increase their consumption on meat (1.3543), fish (1.2207), vegetables (1.1554), oils and fats (1.1165), and fruits (1.0506). On another hand, quality-adjusted expenditure elasticities range from 0.3292 to 1.4867. It is led by meat (1.4102), oils & fats (1.2993), fish (1.1797), vegetables (1.1658), and fruits (1.0506). With and without incorporation of quality effect, both of the elasticities provide similar indications that higher value food products (namely meat, oils & fats, and fish)

and healthy food products (vegetables and fruits) are expected to lead in the increase in Malaysians' diet.

Table 4 presents the estimated own-price elasticities for food items. The estimates of own-price elasticity are consistent with law of demand. The estimated own-price elasticities are negative and less than one with the exception of bread & other cereals (-0.9353) and dairy (-0.5263) products. It shows that the demand for rice (-1.9624), eggs (-1.3952), beverage (-1.2757), and oils & fats (-1.2373) is more sensitive to changes in unit value than other food groups. Comparative magnitudes of own-price elasticity estimates indicate several interesting observations. For instance, the demand for rice is more elastic than its closest substitute—bread & other cereals. This may indicate that the role of rice as staple food has been diminished and characterized by more prominent consumption of wheat based products. Hence, it is reasonable to obtain such inelastic own-price elasticity for bread & other cereals, which can be further interpreted that bread & other cereals have become a necessity in Malaysia. It means that Malaysian consumers are insensitive to the changes in the price of bread & other cereals.

Table 4. Own-price elasticities for food categories, Malaysia

Food	Own-price elasticity
Rice	-1.9624
Bread & other cereals	-0.9353
Meat	-1.1213
Fish	-1.0661
Dairy	-0.5263
Eggs	-1.3952
Oils & fats	-1.2373
Fruits	-1.1013
Vegetables	-1.1242
Sugar	-1.0574
Others	-1.0062
Beverage	-1.2757

5.0 CONCLUSIONS

Though food is not the most important central factor in the Malaysian economy, it still constitutes one of the biggest proportions of household budgets, accounting for 36 percent of household total expenditures. This paper presents demand elasticities from the estimation of a demand system, with and without incorporation of quality effect in food demand. The estimated expenditure elasticities indicate that there will be growing demand for all the food categories, especially meat, fish, vegetables, oils and fats, and fruits. The own-price elasticities for rice, eggs, beverage, and oils & fats are more elastic than the rest of the food categories.

This study also shows that there is quality effect in food demand. The quality effect is expected to be increasingly important in line with the growing per capita incomes in future. Hence, this study provides a basic insight of the need to regulate food

quality policy (e.g. Hazard Analysis Critical Control Point (HACCP), labelling and traceability systems). However, all these extra features imply extra costs that would eventually transfer to consumers. Based on the own-price elasticities for most of the food categories, these extra costs would affect quantity demanded for one food product more than the change in its own-price. For example, the own-price elasticity for rice (-1.9624) indicates that one percent increase in the price of rice would have 1.9624 percent decrease in the quantity demanded for rice, while other things remain constant.

REFERENCES

- Baharumshah, A.Z. 1993. Applying The Almost Ideal Demand System to Meat Expenditure Data: Estimation and Specification Issues, *Malaysian Journal of Agricultural Economics*, Vol. 10, pp. 23-37.
- Baharumshah, A.Z. and Mohamed, Z.A. 1993. Demand for Meat in Malaysia: An Application of the Almost Ideal Demand System Analysis, *Pertanika Social Science and Humanities*, Vol. 1, No.1, pp. 91 – 95.
- Chern, W.S. 2000. Assessment of Demand-Side Factors Affecting Global Food Security,” In Chern, W.S., Carter, C.A. and Shei, S.Y. (Ed), *Food security in Asia: Economics and Policies*. Cheltenham, UK: Edward Elgar Publishing Limited, pp. 83-118.
- Deaton, A.J. and Muellbauer, J. 1980. An Almost Ideal Demand System, *American Economic Review*, Vol. 70, pp. 312-326.
- Huang, S.K. and Lin B.H. 2000. Estimation of Food Demand and Nutrient Elasticities from Household Survey Data, United States Department of Agriculture, Economic Research Center, *Technical Bulletin*, Vol. 1887.
- Hussein, M.A., Mohayidin, M.G. and Shariff, S.K. 1986. Food Consumption in Malaysia – Present Levels and Future Prospects for Self-Sufficiency, *PKDP Report*, Vol. 5/86.
- Ishida, A., Law, S.H. and Aita, Y. 2003. Changes in Food Consumption Expenditure in Malaysia, *Agribusiness*, Vol. 9, No. 1, pp. 61-76.
- Moschini, G. 1995. Units of Measurement and the Stone Index in Demand System, *American Journal of Agricultural Economics*, Vol. 77, pp. 63-68.
- Nik Mustapha, R.A. 1994. Incorporating Habit in the Demand for Fish and Meat Products in Malaysia, *Malaysian Journal of Economic Studies*, Vol. 31, No. 2, pp. 25 – 35

- Nik Mustapha, R.A., Aziz, A.R.A., Radam, A. and Baharumshah, A.Z. 1999. Demand and Prospects for Food in Malaysia, In IDEAL UPM, *Repositioning of the Agriculture in the Next Millennium*, July 13-13 1999.
- Nik Mustapha R. A., Radam, A. and Ismail, M.M. 2000. Household Food Consumption Expenditure in Malaysia, In Malaysian Consumer and Family Economics Association, *5th National Seminar on Malaysian Consumer and Family Economics*, August 17 2000.
- Nik Mustapha, R.A., Aziz, A.R.A., Zubaidi, B.A. and Radam, A. 2001. Demand and Prospects for Food in Malaysia, In Radam, A. and Arshad, F.M. (Ed), *Repositioning of the Agriculture Industry in the Next Millennium*. Universiti Putra Malaysia Press, pp. 148-159.
- Prais, S.J. and Houthakker, H.S. 1955. *The analysis of family budgets*. New York: Cambridge University Press.
- Radam, A., Arshad, F.M. and Mohamed, Z.A. 2005. *The fruits industry in Malaysia: Issues and challenges*. UPM, Press.
- Tee, C.S. and Thiam, T.B. 1975. Food Consumption in Malaysia – Present Levels and Future Prospects for Self-Sufficiency, in Conference on *Malaysian Food Self-Sufficiency*, August 23-25.
- Tey, Y.S., Shamsudin, M.N., Mohamed, Z.A., Abdullah, A.M., and Radam, A. 2008. A Complete Demand System of Food in Malaysia, *ICFAI University Journal of Agricultural Economics*, Vol. 5, No. 3, pp. 17-29.

Appendix table 1
Maximum likelihood estimates of the LA/AIDS

	Rice	Bread & other cereals	Meat	Fish	Dairy	Eggs
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
	Std. Error	Std. Error	Std. Error	Std. Error	Std. Error	Std. Error
Intercept	0.0360 (0.0101)***	0.6729 (0.0149)***	-0.0688 (0.0127)***	-0.2267 (0.0148)***	0.1256 (0.0106)***	0.0513 (0.0035)***
log (price of rice)	-0.0939 (0.0030)***	0.0812 (0.0044)***	-0.0125 (0.0037)***	-0.0307 (0.0043)***	-0.0137 (0.0032)***	0.0079 (0.0010)***
log (price of bread & other cereals)	-0.0033 (0.0008)***	-0.0033 -	0.0040 (0.0014)***	0.0054 (0.0016)***	0.0034 (0.0012)***	-0.0020 (0.0004)***
log (price of meat)	0.0248 (0.0021)***	-0.0096 (0.0019)***	-0.0096 -	-0.0088 (0.0031)***	-0.0076 (0.0023)***	0.0008 (0.0007)
log (price of fish)	0.0254 (0.0030)***	-0.0009 (0.0043)	-0.0044 (0.0027)	-0.0044 -	-0.0029 (0.0032)	0.0110 (0.0010)***
log (price of milk & dairy)	-0.0032 (0.0009)***	-0.0251 (0.0013)***	-0.0012 (0.0012)	0.0268 (0.0007)***	0.0268 -	-0.0023 (0.0003)***
log (price of eggs)	0.0292 (0.0022)***	-0.0126 (0.0033)***	-0.0036 (0.0028)	0.0242 (0.0032)***	-0.0087 (0.0007)***	-0.0087 -
log (price of oils & fats)	-0.0009 (0.0009)	-0.0087 (0.0013)***	0.0085 (0.0011)***	0.0006 (0.0013)	0.0009 (0.0010)	-0.0067 (0.0002)***
log (price of fruits)	0.0107 (0.0013)***	-0.0243 (0.0019)***	0.0088 (0.0017)***	0.0113 (0.0019)***	0.0000 (0.0014)	0.0002 (0.0005)
log (price of vegetables)	0.0193 (0.0023)***	0.0256 (0.0034)***	-0.0099 (0.0029)***	-0.0359 (0.0033)***	0.0004 (0.0025)	0.0022 (0.0008)***
log (price of sugar)	-0.0093 (0.0008)***	0.0008 (0.0012)	0.0081 (0.0010)***	-0.0010 (0.0012)	0.0015 (0.0009)*	-0.0011 (0.0003)***
log (price of others)	-0.0062	-0.0011	0.0016	-0.0108	0.0004	-0.0016

	(0.0009)***	(0.0014)	(0.0012)	(0.0013)***	(0.0010)	(0.0003)***
log (price of beverage)	0.0074	-0.0220	0.0103	0.0234	-0.0006	0.0003
	-	-	-	-	-	-
log (x/P*)	-0.0089	-0.0887	0.0443	0.0443	-0.0030	-0.0043
	(0.0013)***	(0.0019)***	(0.0016)***	(0.0019)***	(0.0014)**	(0.0004)***
Log (household size)	0.0006	-0.0542	0.0279	0.0258	0.0148	-0.0012
	(0.0011)	(0.0016)***	(0.0013)***	(0.0016)***	(0.0011)***	(0.0004)***
Log (age of household head)	0.0155	-0.0317	0.0091	0.0449	-0.0312	-0.0033
	(0.0022)***	(0.0033)***	(0.0028)***	(0.0032)***	(0.0024)***	(0.0008)***
Urban dummy	-0.0178	0.0116	0.0071	-0.0087	0.0077	-0.0003
	(0.0013)***	(0.0019)***	(0.0016)***	(0.0019)***	(0.0014)***	(0.0004)
Male dummy	-0.0011	0.0033	0.0010	0.0011	0.0021	-0.0009
	(0.0016)	(0.0025)	(0.0021)	(0.0024)	(0.0018)	(0.0006)
Race-Malay dummy	-0.0216	0.0221	-0.0064	0.0181	0.0065	-0.0039
	(0.0021)***	(0.0031)***	(0.0027)**	(0.0031)***	(0.0023)***	(0.0007)***
Race-Chinese dummy	-0.0400	0.0077	0.0338	-0.0116	0.0061	-0.0066
	(0.0022)***	(0.0033)**	(0.0028)***	(0.0033)***	(0.0024)**	(0.0008)***
Race-Indian dummy	-0.0228	-0.0123	-0.0082	-0.0068	0.0212	-0.0076
	(0.0031)***	(0.0047)***	(0.0040)**	(0.0046)	(0.0034)***	(0.0011)***
Employed dummy	0.0065	-0.0116	0.0043	0.0005	-0.0054	-0.0002
	(0.0016)***	(0.0024)***	(0.0020)**	(0.0024)	(0.0017)***	(0.0006)
Region-Peninsular dummy	-0.0298	0.0188	-0.0432	0.0518	0.0076	-0.0042
	(0.0020)***	(0.0030)***	(0.0026)***	(0.0030)***	(0.0022)***	(0.0007)***
Region-Sabah dummy	0.0236	0.0181	-0.0563	0.0088	-0.0034	0.0027
	(0.0024)***	(0.0035)***	(0.0030)***	(0.0035)**	(0.0026)	(0.0008)***

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

Appendix table 1
Continued...

	Oils & fats	Fruits	Vegetables	Sugar	Others	Beverage
	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient	Coefficient
	Std. Error	Std. Error				
Intercept	0.0174 (0.0041)***	0.0071 (0.0103)	0.0130 (0.0086)	0.0832 (0.0050)***	-0.0230 (0.0129)*	0.3121 -
log (price of rice)	-0.0010 (0.0012)	0.0238 (0.0030)***	-0.0016 (0.0025)	0.0029 (0.0015)*	0.0110 (0.0038)***	0.0267 -
log (price of bread & other cereals)	-0.0008 (0.0004)*	0.0009 (0.0011)	0.0020 (0.0009)**	-0.0031 (0.0005)***	-0.0004 (0.0014)	-0.0028 -
log (price of meat)	0.0024 (0.0009)***	0.0059 (0.0022)***	-0.0031 (0.0018)*	0.0041 (0.0011)***	-0.0080 (0.0027)***	0.0088 -
log (price of fish)	0.0063 (0.0012)***	-0.0097 (0.0030)***	0.0004 (0.0025)	0.0009 (0.0015)	-0.0210 (0.0038)***	-0.0008 -
log (price of milk & dairy)	-0.0009 (0.0004)**	-0.0051 (0.0009)***	0.0056 (0.0008)***	-0.0041 (0.0005)***	-0.0026 (0.0012)**	-0.0146 -
log (price of eggs)	0.0016 (0.0009)*	-0.0079 (0.0023)***	0.0066 (0.0019)***	-0.0002 (0.0011)	-0.0125 (0.0029)***	-0.0075 -
log (price of oils & fats)	-0.0067 -	0.0047 (0.0009)***	0.0011 (0.0008)	-0.0010 (0.0004)**	0.0110 (0.0011)***	-0.0027 -
log (price of fruits)	-0.0042 (0.0005)***	-0.0067 -	0.0019 (0.0011)*	-0.0007 (0.0007)	0.0035 (0.0017)**	-0.0006 -
log (price of vegetables)	0.0048 (0.0009)***	-0.0115 (0.0014)***	-0.0115 -	0.0063 (0.0011)***	-0.0140 (0.0029)***	0.0242 -
log (price of sugar)	-0.0012 (0.0003)***	0.0078 (0.0008)***	-0.0023 (0.0003)***	-0.0023 -	0.0259 (0.0012)***	-0.0269 -
log (price of others)	-0.0018	0.0015	-0.0095	0.0010	0.0010	0.0255

	(0.0004)***	(0.0009)	(0.0008)***	(0.0004)**	-	-
log (price of beverage)	0.0003	0.0003	0.0003	0.0003	0.0003	-0.0205
	-	-	-	-	-	-
log (x/P*)	0.0033	0.0035	0.0167	-0.0080	0.0249	-0.0242
	(0.0005)***	(0.0013)***	(0.0011)***	(0.0006)***	(0.0016)***	-
Log (household size)	0.0008	-0.0115	0.0077	-0.0007	0.0128	-0.0228
	(0.0004)*	(0.0011)***	(0.0009)***	(0.0005)	(0.0013)***	-
Log (age of household head)	-0.0006	0.0152	0.0149	-0.0040	-0.0069	-0.0219
	(0.0009)	(0.0022)***	(0.0019)***	(0.0011)***	(0.0028)**	-
Urban dummy	-0.0005	0.0044	-0.0098	-0.0004	0.0003	0.0063
	(0.0005)	(0.0013)***	(0.0011)***	(0.0006)	(0.0016)	-
Male dummy	-0.0010	0.0010	-0.0068	-0.0034	-0.0016	0.0062
	(0.0007)	(0.0017)	(0.0014)***	(0.0008)***	(0.0021)	-
Race-Malay dummy	0.0019	0.0058	-0.0251	0.0047	0.0011	-0.0032
	(0.0008)**	(0.0021)***	(0.0018)***	(0.0010)***	(0.0027)	-
Race-Chinese dummy	0.0019	0.0186	0.0043	-0.0064	-0.0071	-0.0007
	(0.0009)**	(0.0023)***	(0.0019)**	(0.0011)***	(0.0028)**	-
Race-Indian dummy	0.0081	-0.0003	0.0171	-0.0019	0.0196	-0.0061
	(0.0013)***	(0.0032)	(0.0027)***	(0.0016)	(0.0040)***	-
Employed dummy	0.0000	0.0102	0.0017	0.0021	-0.0037	-0.0044
	(0.0006)	(0.0016)***	(0.0014)	(0.0008)***	(0.0021)*	-
Region-Peninsular dummy	-0.0006	0.0114	-0.0094	-0.0021	0.0142	-0.0145
	(0.0008)	(0.0021)***	(0.0017)***	(0.0010)**	(0.0026)***	-
Region-Sabah dummy	0.0023	-0.0067	-0.0098	0.0038	0.0217	-0.0048
	(0.0010)**	(0.0024)***	(0.0020)***	(0.0012)***	(0.0030)***	-

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

Appendix table 2
Coefficients of unit value equation

	Rice	Bread & cereals	Meat	Fish	Dairy	Eggs	Oils & fats	Fruits	Vegetables	Sugar	Others	Beverage
	Coefficient Std. Error	Coefficient Std. Error	Coefficient Std. Error	Coefficient Std. Error	Coefficient Std. Error							
Intercept	1.0748 (0.0266)***	1.7527 (0.0789)***	2.3117 (0.0393)***	2.1572 (0.0270)***	2.8611 (0.0951)***	0.7728 (0.0351)***	2.2176 (0.1051)***	2.0794 (1.21E-14)***	0.9565 (0.0365)***	2.0292 (0.1170)***	2.7237 (0.1007)***	1.7082 (0.1288)***
Log (x)	-0.0531 (0.0028)***	0.0246 (0.0084)***	-0.0498 (0.0042)***	0.0385 (0.0029)***	0.0038 (0.0102)	-0.0223 (0.0038)***	-0.1477 (0.0112)***	-7.61E-14 (1.29E-15)***	-0.0093 (0.0039)**	-0.0251 (0.0125)**	-0.0225 (0.0108)**	-0.2885 (0.0138)***
Share of food away from home	0.1734 (0.0085)***	0.3811 (0.0252)***	0.1526 (0.0125)***	0.1713 (0.0086)***	0.1300 (0.0304)***	0.0236 (0.0112)**	0.5615 (0.0336)***	-2.20E-13 (3.86E-15)***	0.1703 (0.0116)***	0.8937 (0.0374)***	0.6145 (0.0321)***	-0.7813 (0.0411)***
Log (household size)	-0.0693 (0.0030)***	-0.0259 (0.0088)***	-0.0929 (0.0044)***	-0.0078 (0.0030)***	0.0999 (0.0106)***	-0.0330 (0.0039)***	-0.2226 (0.0117)***	-3.49E-14 (1.35E-15)***	-0.0475 (0.0041)***	-0.0889 (0.0131)***	-0.0522 (0.0112)***	-0.2482 (0.0144)***
Log (age of household head)	-0.0300 (0.0056)***	-0.0496 (0.0165)***	-0.0101 (0.0082)	-0.0442 (0.0057)***	-0.2526 (0.0199)***	0.0324 (0.0074)***	-0.0123 (0.0220)	-2.21E-13 (2.53E-15)***	-0.0446 (0.0076)***	-0.3477 (0.0245)***	-0.2310 (0.0211)***	0.5704 (0.0270)***
Urban dummy	0.0123 (0.0034)***	0.0016 (0.0100)	-0.0014 (0.0050)	0.0289 (0.0034)***	-0.0196 (0.0121)	-0.0035 (0.0045)	0.0616 (0.0134)***	-1.31E-14 (1.54E-15)***	0.0246 (0.0046)***	0.1272 (0.0149)***	0.0668 (0.0128)***	-0.0572 (0.0164)***
Male dummy	0.0099 (0.0043)**	0.0241 (0.0128)*	0.0069 (0.0064)	0.0040 (0.0044)	0.0118 (0.0154)	0.0013 (0.0057)	0.0203 (0.0170)	-1.18E-14 (1.96E-15)***	0.0125 (0.0059)**	0.0387 (0.0190)**	0.0302 (0.0163)*	0.0290 (0.0209)
Race-Malay dummy	0.0027 (0.0055)	-0.1209 (0.0162)***	-0.0231 (0.0081)***	-0.0052 (0.0055)	-0.0197 (0.0195)	0.0236 (0.0072)***	0.0282 (0.0216)	-4.47E-14 (2.48E-15)***	0.0235 (0.0075)***	0.0224 (0.0240)	-0.0050 (0.0206)	0.0199 (0.0264)
Race-Chinese dummy	0.0402 (0.005)***	0.0486 (0.0174)***	0.0329 (0.0087)***	0.1025 (0.0060)***	0.1343 (0.0210)***	0.0160 (0.0077)**	0.1030 (0.0232)***	1.22E-14 (2.67E-15)***	0.0368 (0.0080)***	0.2831 (0.0258)***	0.1519 (0.0222)***	0.0452 (0.0284)
Race-Indian dummy	-0.0014 (0.0081)	-0.0427 (0.0241)*	-0.0762 (0.0120)***	0.0929 (0.0082)***	0.0910 (0.0290)***	-0.0068 (0.0107)	0.0509 (0.0321)	-2.93E-14 (3.69E-15)***	0.1098 (0.0111)***	0.1054 (0.0357)***	0.0837 (0.0307)***	0.0695 (0.0393)*
Employed dummy	-0.0145 (0.0042)***	-0.0136 (0.0124)	-0.0156 (0.0062)**	-0.0122 (0.0043)***	-0.0991 (0.0150)***	-0.0015 (0.0055)	-0.0113 (0.0166)	-7.99E-14 (1.91E-15)***	-0.0165 (0.0058)***	-0.0548 (0.0185)***	-0.0357 (0.0159)**	0.0268 (0.0203)
Region-Peninsular dummy	-0.0644 (0.0052)***	-0.1101 (0.0153)***	0.0222 (0.0076)***	-0.0404 (0.0052)***	-0.0718 (0.0185)***	-0.1035 (0.0068)***	0.0490 (0.0204)**	8.75E-15 (2.35E-15)***	0.0797 (0.0071)***	0.1517 (0.0227)***	-0.1265 (0.0196)***	-0.0063 (0.0250)
Region-Sabah dummy	-0.0655 (0.0062)***	-0.0804 (0.0184)***	0.0530 (0.0091)***	-0.0394 (0.0063)***	-0.0454 (0.0221)**	-0.0469 (0.0082)***	0.0248 (0.0245)	-6.09E-14 (2.82E-15)***	0.0403 (0.0085)***	0.1754 (0.0272)***	-0.3103 (0.0234)***	-0.1737 (0.0300)***

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