DETERMINANTS OF MALAYSIAN HOUSEHOLD EXPENDITURES ON FRESHFISH, SHELLFISH, AND PROCESSED FISH

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Abstract

The censored Tobit model is used to examine how socio-demographic factors affect the demand for seafood products in Malaysia. Results of the study indicate that households with matured and retired individuals appear to be more health-conscious and are more inclined to increase the frequency with which freshfish appears in the household's diet compared to their younger counterparts. When number of household family members increases, expenditures on the respective fish products increases concomitantly. In addition, while expenditure levels are positively related to income for shellfish and processed fish, Chinese households tend to consume significantly more of the former and less of the latter compared to the others.

Policy implications arising from this study include suggestions to the government authorities to reconsider educating the public and promoting freshfish consumption in a more aggressive manner. The Malaysian government authorities should also consider investing more in its relatively infant aquaculture industry so as to control the prices and supply of these items. Steps should be undertaken to boost the processed fish industry due to its potential marketability. Lastly, small price changes may not precipitate substantial long-term adjustments in the eating habits of consumers since seafood products are generally considered as staple items in the Malaysian diet.

Keywords: censored demand, fish and seafood, household expenditures, Malaysia

JEL Classification: C24, D12, Q22

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Introduction

Changing lifestyle and eating habits amongst Malaysians have seen a gradual increase in consumption of fish and seafood products over the years. In the 1980s and 1990s, per capita consumption of fish and seafood in Malaysia accounted for an average of about 44 kg. and 54 kg. respectively. In recent years, the average per capita consumption increased to 58 kg. between 2000-2002 (Figure 1) (FAOSTAT Data 2004).

This upward trend can be attributed to two primary reasons. First, fish and seafood have gained wide publicity and popularity due to its proclaimed healthful attributes compared to red meats products. Second, based on traditional demand theory and from the experiences of other developing countries, increases in income and population, coupled with urbanization, leads to diet diversification from lower-priced calories to higher-priced calories food sources, such as fish and seafood, once basic needs are met (Delgado *et. al.* 2003).

From an economic standpoint, Malaysia's fish and seafood supply was estimated to be worth approximately US$1.6 billion in landed cost in 2002. In addition, total value of fish catch has risen steadily from approximately US$1 billion, US$1.1 billion, US$1.2 billion and US$1.3 billion for 1996, 1997, 1998, and 1999 respectively (Department of Fisheries, Ministry of Agriculture, as cited by Borris, 2002). From a dietetic standpoint, oily fish such as mackerel, salmon, herring, sardine, tuna and other seafood products contain high levels of protein, minerals, vitamins, and omega-3 fatty-acids content attributed to lower the risks of coronary heart diseases and stroke (Din, Newby, and Flapan 2004). In addition, the omega-3 fatty acids are also found to be anti-inflammatory with anti-blood clotting actions and are believed to be able to prevent and treat depression (Foreman 2005).

Despite its upward demand trend, economic significance, and health and dietetic importance, certain aspects of the Malaysian fisheries industry have been neglected over the years. While micro-level studies of fish and seafood consumption in Western cultures have been extensively conducted using household consumption data (Manrique and Jensen 2001; Hanson,

Herrmann, and Dunn 1995; Gempesaw *et. al.* 1995; Nauman *et. al.* 1995; Cheng and Capps, Jr. 1988), little attention has been devoted to examining the fish and seafood consumption patterns of people in the local region. A survey of regional and local fishery economics studies indicate that almost all have concentrated on feasibility impacts (Barbier, Strand, and Sathirathai 2002, Kuperan *et. al.* 2002; Tai, Noh, and Abdullah 2000; Squires 1977), policy implementation (Alam, Ishak, and Squires 2002), and management strategies (Kirkley *et. al.* 2003; Alam, Ishak, and Squires 1996; Yew and Heaps 1996; Ishak 1988). Other studies use aggregate data for time series analysis of fish price and quantity (Kusumastanto and Jolly 1997; Mohd and Strong 1984). Only a handful have looked at regional consumer demand for fish and seafood products in a disaggregated manner (Burger, Fleischer, and Gochfeld 2003; Madan 2000).

To date, little research attention has been focused on the demand side of the Malaysian fisheries industry. By simply concluding that demand is on the uptrend and will likely continue to do so in the near future would be impetuous as little is known about the shifters of the consumer demand function related to changes in socioeconomic and demographic (socio-demographic) characteristics of the Malaysian population. Even within the wide range of fish and seafood products, there may be differences in preferences and tastes for those varied products due to differing perceptions, tastes, preferences, and socio-demographic classes. These aspects are especially important because demand studies based on micro-level type of data have proven to provide better insights on how different groups within the population behave compared to studies assuming average effects for all members of the population based on aggregated data (Manchester 1977 as cited in Yen and Huang 2002; Blaylock and Blisard 1992).

This study aims to gain a better understanding of how socio-demographic factors affect the demand of fish and seafood products in Malaysia, while taking into account the aforementioned limitations. Understanding how socio-demographic factors influence consumption behavior and demand is important to marketers who want to target marketing campaigns to specific target groups. In addition, a better understanding of these factors enables the government authorities to formulate sound public policies for the Malaysian fish and seafood industry.

Model Development

The selection of variables likely to affect Malaysian household expenditures on fish and seafood products (freshfish, shellfish, and processed fish)[1] relies on the previous studies by Manrique and Jensen (2001), Myrland *et. al.* 2000, Gempesaw *et. al.* (1995), Hanson, Herrmann, and Dunn (1995), Nauman *et. al.* (1995), Nayga, Jr. and Capps, Jr. (1995), and Cheng and Capps, Jr. (1988). The following socio-demographic characteristics are therefore hypothesized to influence household expenditures on the respective fish products in the current study: (1) age of household head, (2) ethnicity/race, (3) educational level, (4) gender, (5) household size, (6) total household monthly income, and, (7) strata (refer Table 1).

INSERT TABLE 1

Age of the household head (in number of years) is used in the current model with the assumption that differences in age lead to differences in preferences and expenditure patterns on the respective fish products (Myrland *et. al.* 2000; Huang 1995; Nayga, Jr. and Capps, Jr. 1995). In this study, the household head's age range is classified into dummy variables that consist of those between 16-30 years old (Age1), 31-45 (Age2) (base)[2], 46-56 (Age3), and 57 years old and above (Age4). This classification characterizes the younger, middle-aged, matured, and retired household heads respectively.

It is therefore hypothesized that the likelihood for matured (Age3) and retired (Age4) household heads to spend more on freshfish is expected to be higher compared to shellfish and processed fish due to increasing health and dietary concerns. In general, shellfish and processed fish are believed to contain higher cholesterol, sodium, and allergy contents than freshfish. As such, those in the older age groups who are more health conscious would typically avoid these items. In contrast, younger or middle-aged households may be more concerned with convenience as well as the various timesaving attributes of fishmeal preparations. At the same time, younger households with babies or small children generally do not prefer freshfish due to its unpleasant smell. As such, it is possible that the younger or middle-age group may be partial towards

shellfish or processed fish products instead of freshfish (Manrique and Jensen 2001; Myrland *et. al.* 2000). On the other hand, it may also be plausible for the older generation to prefer traditional processed fish delicacies such as *belacan* and *cencaluk* (fermented shrimp), *budu* (fermented fish), *pekasam* (pickled shellfish), salted fish, and so forth in their daily meals. Consequently, the expected relationship between older household heads and processed fish expenditures may turn out to be positive as well.

The ethnicity of households may affect household expenditures on different fish products through cultural, ethnic, and religious differences. Previous studies by OEHHA (2001), Nauman *et. al.* (1995), Cheng and Capps, Jr. (1988), and Hu (1985) also suggest that a dummy variable based on ethnicity be included in household demand studies to allow for the possibility of cultural and ethnic differences to influence food expenditure patterns. Studies have also shown that Asians, in particular, have a higher penchant for seafood (Degner *et. al.* 1994; Hu 1985). In the current study, respondents are segregated into Malay (Race1), Chinese (Race2), Indian (Race3) and others (Race4) (base group) to examine the possibility of cultural, ethnic, and religious differences to influence seafood consumption patterns amongst Malaysians. The Malaysian experience is unique as its citizens comprise three distinct races (Malay, Chinese, Indian) and a small proportion consisting those of various other races. Each of these races may have a distinct preference for each seafood product. For example, Malays have traditionally prepared dishes using processed fish products such as *cencaluk* (fermented shrimp), *budu* (fermented fish), and *ikan bilis* (anchovy), while the Chinese preference for shark's fin is well documented. In addition, since religious beliefs forbid the consumption of pork and beef amongst Malays and Indians (but to a lesser extent Chinese as well) respectively, the choice of available food substitute is relatively more restricted compared to the Chinese (Nik Mustapha 1994). However, it is the hypothesis of the current study that all three races would have a positive effect on household expenditures on the respective fish products as it is observed that Malaysians of all races are generally not averse to consuming fish and seafood products.

The level of education of the household head reflects the degree of awareness of food substitutes and healthy lifestyle living, and as such, is hypothesized to affect fish and seafood

consumption decision patterns (Manrique and Jensen 2001; Huang 1995; Nauman *et. al.* 1995; Cheng and Capps, Jr. 1988). In the current model, the number of years of formal education of the household head is used. The range varies from those without formal education (zero) to those with tertiary education (seventeen). Similar to results from other studies, it is hypothesized that household heads with higher education levels will purchase more freshfish as opposed to shellfish or processed fish due to their better awareness of health issues. A positive relationship between this variable and freshfish is thus expected while negative relationships are expected with shellfish and processed fish, which are generally considered to be less healthy[3].

Fristad *et. al.* (2004), Manrique and Jensen (2001), Gempesaw *et. al.* (1995), and Nauman *et. al.* (1995) suggests the inclusion of gender to account for gender preferences among consumers of seafood products. Previous studies have also shown that males tend to be higher consumers of fish and shellfish (in terms of grams per day or per meal) than females (OEHHA 2001; Gempesaw *et. al.* 1995; Degner *et. al.* 1994). On the other hand, Manrique and Jensen (2001) noted that single-woman household heads had a significantly negative influence on decisions to consume fresh seafood products. This could be because of the fear of eating freshfish such as kind mackerel, shark, swordfish, and tilefish due to government warnings of particularly high mercury levels in these species (Foreman 2005). However, like most Asian countries, while males in Malaysia have a greater degree of decision-making power and responsibilities in socioeconomic aspects, females play a very integral role in household food preparation decisions as well. Therefore, the direction of this variable on household expenditures on fish products could yet be either positive or negative[4].

OEHHA (2001), Huang and Bouis (1996), and Cheng and Capps, Jr. (1988) provide evidence to suggest that household size, represented by the number of individuals living in the household, determines decision making on seafood consumption expenditures. If seafood products are considered a normal or even a necessary good in the Malaysian diet, increases in household size would result in proportional increases in its consumption levels. However, if seafood is not considered a necessity or even an inferior food item instead, an inverse relationship between household expenditures and household size may result. Given its customary

nature in the Malaysian diet, it is hypothesized that a positive relationship between household size and expenditures would result for all three types of seafood products.

Total monthly household income (in Ringgit) is included in the model to account for spending patterns of the households. Previous researchers have found fish to be a luxury commodity for the poor and a necessity for the rich (Delgado *et. al.* 2003; WorldFish Center 2002; Goletti 1992) while others have noted that consumption levels of seafood products (particularly shellfish) are positively related to household income (Manrique and Jensen 2001; Degner *et. al.* 1994; Cheng and Capps, Jr. 1988). Given these possibilities, the direction of influence of this variable on freshfish and shellfish is expected to be positively correlated as households substitute lower-priced calories with higher-priced ones, once basic food necessities are met. However, the eventual effect on processed fish will have to be further examined since it may be viewed as inferior given the processed nature of the good.

Strata or regional differences may be an important factor in determining seafood consumption patterns (Myrland *et. al.* 2000; Cheng and Capps, Jr. 1988). In the current study, a dummy variable is assigned a value of 1 for those households classified as urban and a value of 0 for those in the rural regions. Studies have shown that per capita fish expenditure is significantly higher for urban compared to rural population, *ceteris paribus* (OEHHA 2001). Huang and Bouis (1996) and Huang, Liu, and Li (2002) also noted that urbanization induces increased fish consumption through changing preferences (as cited by Delgado *et. al.* 2003). This phenomenon could perhaps be due to the ease of availability of such fish and seafood products in the urban areas compared to the more remote or central regions. In such cases, rural households may spend more on processed seafood products, which have a relatively longer shelf life than fresh seafood products. This is plausible since rural households may be lacking refrigeration and storage facilities in comparison with urban households. However, given the geographical location of Malaysia, it is conceivable that some of the more rural areas may in fact be located in closer proximity to coastal and fishing villages. As such, availability of fish and seafood products in such rural areas would not be a major factor. Therefore, the respective relationships with the

dependent variables would have to be further ascertained as the direction may be either positively or negatively related.

The regressand in the model is defined as the amount of household expenditures spent on freshfish, shellfish, and processed fish products during the month of survey. The model regressors (Table 1) range in nature from continuous/integers (number of years of formal education, household size, total monthly household income) to binary/dummy variables (age range of household head, race, gender, strata).

Data

The data set used in this study is the Malaysian Household Expenditure Survey 1998/1999 (MHES) from the Department of Statistics of Malaysia. This data set is the most recent available of the national household food consumption survey. Data collection for this data set started in July 1998 and continued through June 1999. The sample was designed using a stratified multi-stage, area probability sampling method, thus ensuring that socio-demographic and geographical considerations are taken into account to reflect the Malaysian population.

In the survey, respondents were asked to record their monthly expenditures on freshfish, shellfish, and processed fish. In addition, socio-demographic characteristics of the respondents were also recorded. While a total number of 9198 households responded to this survey, several households in the sample have incomplete socio-demographic and other relevant information. As a result, 9184 observations were subsequently retained after deleting those with missing or suspect relevant information.

Characteristics of Survey Respondents[5]

Descriptive statistics of variables in the statistical model are presented in Tables 2 & 3. For the total sample, the average age of the household head is 44.8 years, with the youngest being 16 years old and the oldest 98 years old (Table 2). Approximately 16% of the total sample consists of those in the 16-30 years old age group; 40% between 31-45; 23% between 46-56; and 21% who are 57 years old and above. In terms of ethnicity, 49% of the entire sample household

heads are Malay; 28% Chinese; 7% Indian; and 14% other races. Within the entire sample, a household head averages about 8 years of formal education (at least secondary/high school education), comprising those without formal education to those having tertiary education.

INSERT TABLES 2 & 3

The whole sample consists of about 83% male and 17% female household heads, with an average household size of approximately 4 persons, consisting of a single person to 23 persons in a household. These households have an average monthly income of about RM2,333, ranging from a minimum of RM1.00 to a maximum of RM56,638. About 57% of the total sample resides in urban areas while 43% reside in rural areas. Lastly, monthly expenditures on freshfish, shellfish, and processed fish average RM48.76, RM13.89, and RM11.73 respectively for the overall sample (Table 2).

From the sub-sample, whereby respondents are categorized under purchasers or non-purchasers of freshfish, shellfish, and processed fish products respectively, 8272 (90.10%), 6104 (66.46%), and 7740 (84.27%) respondents reported that their respective monthly expenditures on those items are *above the limit value of zero* (i.e. those who have purchases worth a positive amount of Ringgit during the survey period) while 912 (9.9%), 3080 (33.53%) and 1444 (15.72%) respondents reported that their respective monthly expenditures are *at the limit value of zero* (i.e. those who did not purchase those items at all during the survey period)[6] (Table 3). The average monthly expenditures for freshfish, shellfish, and processed fish products among these sub-purchasing groups are approximately RM54.14, RM20.90, and RM13.92 respectively.

The average ages of household heads who purchased freshfish, shellfish, and processed fish products do not vary widely at 45.9, 46.0, and 45.3 years old respectively, while the average ages for those who did not purchase those items are relatively younger at 34.9, 42.3, and 41.9 years old respectively. Amongst freshfish purchasers, 13% of the household heads are between 16-30 years old; 40% between 31-45 years old; 24% between 46-56 years old; and 23% who are 57 years old and above. For shellfish purchasers, 11% are between 16-30 years old; 42%

between 31-45 years old, 25% between 46-56 years old; and 22% who are 57 years old and above. Amongst the sub-sample of processed fish purchasers, 14% are between 16-30 years old; 41% between 31-45 years old; 24% between 46-56 years old; and 21% who are 57 years old and above (Table 3). From another point of view, amongst those in the 16-30 years old age group, about 70%[7], 47%, and 72% purchased freshfish, shellfish and processed fish products respectively. This is in contrast to over 92%, 68%, and 86% who purchased the respective products for those between 31-45 years old; 95%, 74%, and 88% between 46-56 years old; and 95%, 68%, and 85% for those 57 years old and above (Tables 4-6). These preliminary results suggest that age may indeed be an important factor in affecting monthly expenditures since those who expend on freshfish products tend to be those from the older age range.

INSERT TABLES 4-6

The Tobit Model

In this study, the dependent variable (Y_i) measures the monthly expenditures by the i^{th} respondent on the respective freshfish, shellfish, or processed fish products, while the corresponding independent variables (X_i) comprise the various socio-demographic characteristics in question. In this case, the *censored regression* or Tobit model (Tobin 1958) is appropriate because 9.9% (912 out of 9184), 33.5% (3080 out of 9184), and 15.72% (1444 out of 3184) of the respective samples reported that they did not purchase any of the items during the survey period[8].

The standard censored or Tobit model for the research study is written as follows:

$$
\begin{aligned}
Y_i^* &= X_i'\beta + u_i, \qquad i = 1, 2, \ldots, n \\
Y_i &= Y_i^* \qquad \text{if } Y_i^* > 0, \\
Y_i &= 0 \qquad \text{if } Y_i^* \leq 0,
\end{aligned}
\tag{1}
$$

where, Y_i = observed dependent variable (monthly expenditures on freshfish, shellfish, or processed fish);

Y_i^* = latent variable (the optimal amount of expenditures of the respondent; it can also be construed as the solution to a utility maximization problem);

X_i' = k-dimensional vector of known regressors as listed in Table 1;

β = k-dimensional vector of unknown parameters;

u_i, = stochastic disturbance term of the regression assumed to be $N(0,\sigma^2)$.

The β coefficients are estimated using the method of maximum likelihood (assuming normality of the disturbance term). This maximum likelihood estimation procedure assures the large sample properties of consistency and asymptotic normality of the estimated coefficients so that conventional tests of significance are applicable. The likelihood function for this model is:

$$L(\theta) = \prod_0 \left[1 - \Phi\left(\frac{X_i'\beta}{\sigma}\right)\right] \prod_1 \sigma^{-1}\phi\left[\frac{(Y_i - X_i'\beta)}{\sigma}\right], \qquad (2)$$

where, $\prod_0$ denotes the product over values of i such that $Y_i^* \leq 0$; $\prod_1$ denotes the product over values of i such that $Y_i^* > 0$; $\theta = (\beta', \sigma^2)$; and $\Phi(\bullet)$ and $\phi(\bullet)$ are, respectively, the cumulative distribution and probability density function of the standard normal variable (Greene 2003; Amemiya 1973).

Results

The resulting Tobit coefficients (column 1) and associated z-statistics (column 2) are reported in Tables 7-9. Each estimated Tobit regression coefficient (β_i) reflects the propensity to purchase for the underlying population due to a unit change in the relevant independent variable (Kennedy 1998). In addition, the marginal effect of each of the explanatory variables on the

expected value of the dependent variable (amount of expenses evaluated at the means) for all cases (column 3), for cases above the limit (column 4), and changes in the probability for cases at the limit (i.e. those who did not purchase any items but might) (column 5) are calculated (McDonald and Moffitt 1980).

INSERT TABLES 7-9

The Goodness-of-Fit tests indicate that the Log-Likelihood Ratio (LR) is 1203.188 while the Wald Statistic is 24.923 for the freshfish model. As for shellfish and processed fish, the LR tests are 508.695 and 798.829 respectively, while the Wald Statistic tests are 5.298 and 25.818 respectively. All tests have a probability value (P-value) of 0.000. Thus, it is concluded that the respective models fit the data well.

a. *Age (Age1, Age3, Age4)*

Expenditures on freshfish are significantly dependent on all three age groups of the household head (Age1, Age3, Age4) (Table 7). While a negative relationship is found between expenditures on freshfish and Age1, positive relationships are established for both Age3 and Age4. Those in the younger age group also have less per capita expenditures on freshfish (RM22.86) compared to the retired age group (RM57.73) (Table 10). These results conform to expectations that younger household heads expend significantly less on freshfish compared to those in the middle-age group, while older household heads spend significantly more on freshfish compared to the middle age group. In other words, as age increases, expenditures on freshfish would increase as well. This can be explained by the fact that older households may be more concerned about their health and dietary intake compared to their younger counterparts. On the other hand, younger households with babies or small children may also shun freshfish due to its unpleasant smell.

INSERT TABLE 10

On the other hand, while both Age3 and Age4 are positively related and Age1 is negatively related to expenditures on shellfish, the effects are statistically significant only for Age4 (Table 8). In fact, a more indepth examination of the share of expenditures show that retired households expend on freshfish and shellfish on a 3.5:1 ratio, and this ratio is comparable even to that of the other age-groups as well (Table 10). This surprising finding suggests that, contrary to *a priori* expectations, older households consume significantly more shellfish compared to their younger cohorts. As such, retired households may in actual fact not be fully aware of the health consequences in consuming shellfish as even those in the higher health risks age groups are expending significantly more on shellfish.

Age1 and Age4 are negatively related while Age3 is positively related to expenditures on processed fish (Table 9). The effects, however, are statistically significant only for Age1. This indicates that younger households spend significantly less on processed fish compared to the other age groups. One possible explanation is that these younger households may not be attracted to the processed (dried, salted, canned, fermented) nature of such products.

b. *Race (Race1, Race2, Race3)*

Expenditures on freshfish are found to be statistically significant and positively related for Malay (Race1) and Chinese (Race2) but statistically insignificant and negatively related for Indian (Race3) households (Table 7). In addition, the share of expenditures for the various seafood items indicate that Malay households expend approximately 4 times more freshfish than shellfish and 4.2 times more freshfish than processed fish (Table 11). On the other hand, while Chinese households expend only 2.7 times more freshfish than shellfish, the preference is about 5 times more for freshfish compared to processed fish. These results collaborate the notion that Malay and Chinese households have a higher preference for freshfish compared to the other races.

INSERT TABLE 11

Expenditures on shellfish are found to be not statistically dependent for both Malay (Race1) and Indian (Race3) households while the effect is statistically significant for Chinese (Race2) households (Table 8). However, a positive relationship is established for all three ethnic groups. These results suggest that while the three main races in Malaysia are not averse to consuming shellfish, this effect is especially so for Chinese households who seem to be more partial towards this type of seafood. A likely rationalization is that Chinese households utilize a large amount of shellfish products (such as prawns, cuttlefish and so forth) as a complementary item in their varied food preparation menus.

On the other hand, expenditures on processed fish are found to be negatively related to all the three races (Table 9). However, while processed fish expenditures are not significantly related to Race1 and Race3, the effects are found to be statistically related to Race2. This implies that Chinese households spend significantly less on processed fish compared to the others. The reasoning that Chinese households do not utilize as much processed fish products in their daily meal preparations may hold true in this case.

c. *Education Level*

Education level is negatively related to expenditures on freshfish, shellfish and processed fish but the effects are not statistically significant (Tables 7-9). From the total sample, an additional year of education leads to a RM0.05, RM0.02, and RM0.04 decrease in expenditures on freshfish, shellfish, and processed fish respectively, *ceteris paribus* (column 3). While observing the sample for those who have positive expenditures during the survey period, an additional year of education results in RM0.03, RM0.01, and RM0.04 decrease in expenditures on freshfish, shellfish, and processed fish respectively, other things being equal (column 4). The results also indicate that each additional year of education implies a 0.03%, 0.002%, and 0.13% lower probability of making a purchase among those who have not purchased freshfish, shellfish, and processed fish respectively during the survey period (column 5). These results suggest that, contrary to *a priori* expectations, education levels appear to play only an indirect role on the amount of expenditures with which freshfish, shellfish, and processed fish dishes are consumed.

d. *Gender*

The gender variable is positively related to expenditures on freshfish and shellfish but is negatively related to expenditures on processed fish (Tables 7-9). This indicates that male household heads expend more on freshfish and shellfish and less on processed fish compared to female household heads, *ceteris paribus*. However, the effects are not statistically significant for all three types of seafood products. This can be rationalized by the fact that since the female counterpart makes most Malaysian household food preparation decisions, there exist no variations in the expenditure patterns on the seafood products in question.

e. *Household Size*

A larger household size induces higher financial burden, and therefore, should increase expenditures on goods consumed. Following *a priori* expectations, the effects of this variable on expenditures are positively related and statistically significant to all three fish products (Tables 7-9). When observing the total sample, an additional member in the family leads to a RM5.07, RM0.92, and RM1.08 increase in expenditures on freshfish, shellfish, and processed fish respectively, *ceteris paribus* (column 3). For those who have positive expenditures during the survey period, an additional member of the family results in RM3.60, RM0.66, and RM0.76 increase in expenditures on freshfish, shellfish, and processed fish respectively, other things being equal (column 4). The results also show that each additional member in the family infers a 2.91%, 1.05%, and 2.55% higher probability of making a purchase among those who have not purchased freshfish, shellfish, and processed fish respectively (column 5).

f. *Household Income*

Results from Tables 7-9 reveal a positive and statistically significant relationship between monthly household income and expenditures on all three types of seafood products. This suggests that fish and seafood products may be considered as a normal good amongst Malaysians as consumption and income levels significantly increase in tandem. When income increases by RM1000, expenditures on freshfish, shellfish, and processed fish increases by RM0.70, RM0.50,

and RM0.40 respectively when considering the total sample (column 3). If only respondents who have positive expenditures are considered, a RM1000 increase in monthly household income induces an increase in expenditures on freshfish, shellfish, and processed fish by as much as RM0.50, RM0.40, and RM0.30 respectively, other things being equal (column 4). For those who have not purchased those respective products, each additional increase of RM1000 induces a 0.4%, 0.6%, and 0.9% higher probability of making a purchase, *ceteris paribus* (column 5).

g. *Strata*

The strata variable is negatively related to expenditures on freshfish and processed fish but positively related to shellfish expenditures (Tables 7-9). However, the statistical insignificance for all three seafood products indicate that regional differences, at least in the case of Malaysia, do not have any variations on seafood expenditure patterns.

Conclusions and Policy Implications

Results of this study may have important implications for the fish and seafood industry in Malaysia as it indicates that matured and retired households tend to spend more on freshfish and even shellfish than their younger counterparts. As family size becomes larger and household income increases, total expenditures on freshfish, shellfish, and processed fish are expected to increase as well. At the same time, while Malay and Chinese households prefer freshfish, the latter also have a higher penchant for shellfish but not processed fish.

As expected, households with matured and retired individuals are more inclined to increase the frequency with which freshfish appears in the household's diet compared to their younger cohorts. This can probably be explained by the fact that older people are more conscious of their health and thus prefer freshfish due to its healthier and more nutritious benefits compared to the other types of red meat products. However, an unexpected finding showed that older households also expend significantly more on shellfish as well. This surprising result suggests that older households may not yet be fully aware of the health consequences in consuming

shellfish eventhough this type of seafood is known for its generally higher cholesterol and sodium contents.

The results of this study also show that younger households may be substituting more other meats to their diet than are older people. This can be due to the fact that freshfish meal preparation methods are relatively more tedious and time consuming. Other possible negative perceptions that may dissuade younger households from consuming freshfish include its unpleasant smell (especially to babies and small children), difficulty to judge freshness, and lack of knowledge of species and preparation methods. As such, some possible recommendations may be put forth based on the results of this study.

One avenue could be in the area of educating the general public as to the beneficial cummulative health effects of consuming freshfish. At present, while much of the younger population are oblivious to the fact that stroke and heart diseases are some of the major causes of death in the country, even less are aware that freshfish, especially oily fish, have proven medical benefits to safeguard against these and other diseases. For example, little is known about the American Heart Association's recommendation to consume fish at least twice a week. On the other hand, older households should also be fully informed that shellfish generally contain higher levels of cholesterol and sodium contents and should therefore be avoided by those in the at-risk age groups. As such, the Health Ministry of Malaysia, in tandem with the Fisheries Development Authorities of Malaysia (LKIM), should consider promoting freshfish consumption in a more aggressive manner, while at the same time, publicize the possible risks of consuming shellfish amongst the older households. Steps should also be undertaken to educate the public as to the various methods of judging the freshness of freshfish as well as promoting the various types of available freshfish. For example, a recent newspaper advertisement by a leading hypermarket listed a total of sixty-two types of various seafood products while encouraging its consumers to stay healthy by eating more fish (*The Sunday Star*, 23 April 2005). In addition, various quick and simple preparation methods should be introduced in order to attract more consumers who may lack the knowledge or time available to consider at-home freshfish meal preparations.

Results of this study also indicate that, conforming to *a priori* expectations, higher income households significantly spend more on all three types of seafood products. This suggests that seafood are essentially considered as normal goods to Malaysians. On the other hand, as the results also show that lower income households will have a lower propensity to spend on seafood, the government authorities should consider investing more in the relatively infant aquaculture industry in Malaysia so as to control the prices and supply of these items. Since poorer households consume mainly small or less expensive types of seafood, technological improvements in the culture of these types of seafood can be expected to increase the welfare of these poorer consumers. Meanwhile, the government should also consider steps to boost the processed fish industry by giving subsidies and incentives, and even promote this cottage-based industry to a larger extent since the potential market of this product certainly exists even amongst the more affluent society.

The outcomes of this study show that while both Malay and Chinese households tend to consume significantly more freshfish, Chinese households also prefer shellfish but not processed fish. This result is not surprising considering the fact that Chinese meal preparation menus generally consist of a high proportion of freshfish and shellfish (such as prawns, lobsters, cockles, cuttlefish, crabs) and less processed fish[9]. As such, there still remains a potentially untapped market amongst the Indians in the freshfish market and amongst the non-Chinese in the shellfish market. Thus, hypermarkets such as Tesco, Makro, and Carrefour with wet market sections should consider more advertisements in Malay or Indian language based newspapers (such as Berita Harian, Utusan Melayu, Tamil Nesan, or Malaysia Nanban) to promote the virtues of consuming freshfish and shellfish amongst the non-Chinese races in Malaysia.

Another interesting observation that arise from this study is larger households tend to spend significantly more on freshfish, shellfish, and processed fish than their smaller sized household counterparts. In this case, even though household burden increases, as represented by the increased number of family members in the household, total expenditures on the respective fish products would increase concomitantly. This could be due to fish and seafood products being generally considered as staple items in the Malaysian diet. As such, small changes in

future fish and seafood prices may not precipitate substantial long-term changes in the eating habits of consumers, as households would still purchase their daily requirements. Even adverse reports such as the recent tsunami related or other coastal contamination seafood scare would not dampen the long-term outlook for fish and seafood, as consumers are expected to resume consumption after a short period of time.

While other independent variables such as *education level, gender, and strata* are not statistically significant factors in explaining expenditures on freshfish, shellfish, and processed fish, a brief discussion on the direction and some their effects may be noteworthy. For instance, contrary to *a priori* expectations, respondents with higher education levels are less likely to be affected by the arguments of nutritionists that substituting seafood and other non-meat dishes for meat improves health. One would expect that given the wide-ranging positive effects of fish and seafood products, those with higher education levels would be more receptive while expenditures and consumption levels should be positively related to education levels instead. This phenomenon, although statistically insignificant, can possibly be explained by the fact that as respondents have higher levels of education, the tendency to participate in work-related activities outside the household increases. As such, this decreases the possibility to purchase fresh seafood products for household consumption as the demand for convenience increases instead[10]. To reverse this trend, increased efforts should be undertaken to publicize the benefits of eating fish and seafood products amongst the better educated too. This is because if education levels are taken as an indicator of work-stress due to increasing work responsibility, it is precisely this group that needs to heed the call to increase their fish intake. Hence, the Health Ministry of Malaysia should consider producing more information-packed health brochures and newspaper advertorials to inform and inculcate fish eating habits even amongst the higher educated. Not enough attention and action has been focused at present.

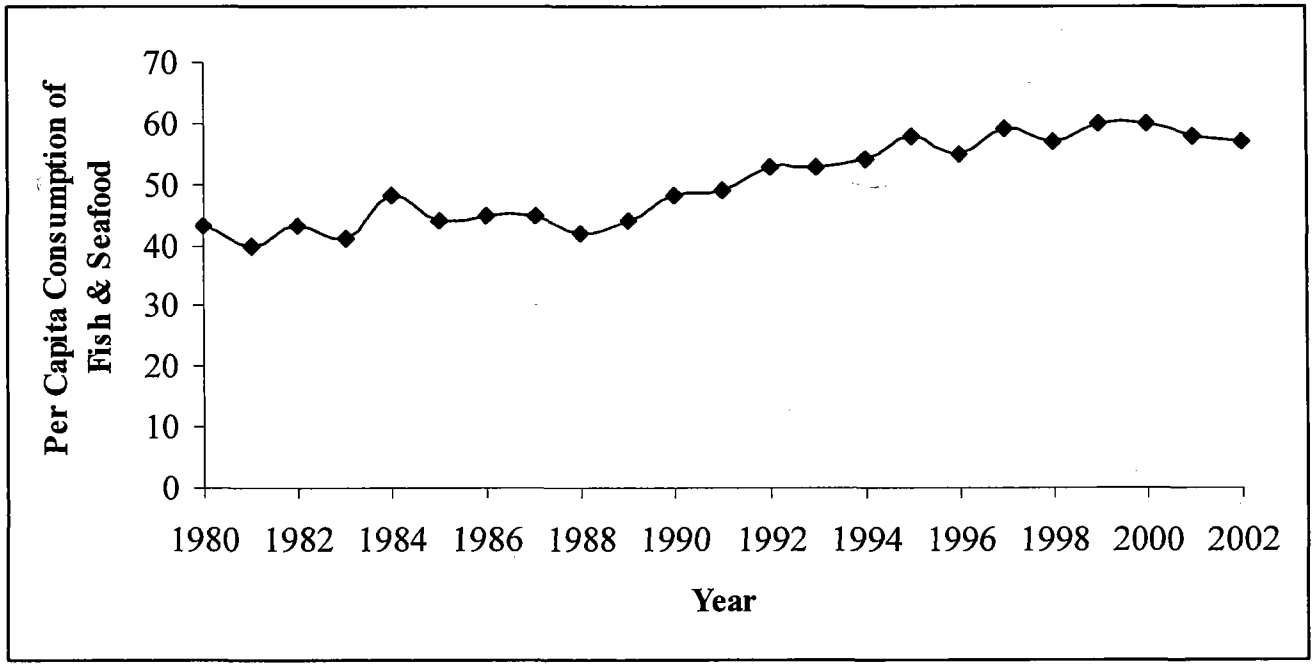
In addition, the lack of gender difference in the respective models suggests that there is no difference between male or female household heads in explaining expenditure patterns on seafood products. One possible reason is that in Malaysia, household food preparation decisions are predominantly made by the female spouse for the whole family. As such, there exist little

variations to this variable in explaining seafood expenditure decisions. To capitalize on this finding, the Malaysian seafood industry marketers and government authorities may consider directing future seafood marketing programs towards the female household population instead of the general public. Such focused campaigns should yield a more direct impact since the female spouses in the household are deemed to make most of the household food preparation decisions.

Limitations of the Study

While this study acts as a catalyst to further research on household expenditure patterns in Malaysia, several inherent limitations are acknowledged. First, this study incorporates data based on expenditures of fish and seafood for at-home consumption only. Various studies have shown that the percentage of food-away-from-home consumption has been rising over the years. This effect could carry over to seafood consumed in restaurants, food outlets, and other eateries. As such, total consumption of freshfish, shellfish, and processed fish may be understated in the current study. Second, complete information about the surveyed households is important in order to enhance the statistical findings. However, pricing information and others such as marital status, number of children and their ages, types of restaurants and eateries frequented, working hours, health status, and reasons for consumption or non-consumption are unavailable due to the nature of the data.

Figure 1
Fish & Seafood Consumption,
Malaysia (1980 – 2002)
(metric ton per 1000 capita)[1]



Source: FAOSTAT Data 2004

[1] Metric ton = 1000 kg. Consequently, the figures above correspond to per capita consumption in kg.

Table 1
Description of Explanatory Variables in the Statistical Model &
Expected Relationship with the Dependent Variables

Variable	Description	Expected Relationship		
		Fresh Fish	Shellfish	Proc. Fish
Age1	1 if age of household head between 16-30 years old; 0 otherwise	+/-	+	+
Age3	1 if age of household head between 46-56 years old; 0 otherwise	+	-	+/-
Age4	1 if age of household head is 57 years old and above; 0 otherwise	+	-	+/-
Race1	1 if Malay household head; 0 if non-Malay	+	+	+
Race2	1 if Chinese household head; 0 if non-Chinese	+	+	+
Race3	1 if Indian household head; 0 if non-Indian	+	+	+
Education Level	No. of years of formal education of the household head	+	-	-
Gender	1 if male household head; 0 if female	+/-	+/-	+/-
Household Size	Total number of family members in the household	+	+	+
Household Income	Total gross monthly household income (in Ringgit)	+	+	+/-
Strata	1 if urban household; 0 if rural	+/-	+/-	+/-

Table 2
Descriptive Statistics of Variables in the Statistical Model
(Total Sample)

Variables	Total Sample (N = 9184) Mean	Std. Dev.	Min	Max
Age (years)	44.80	13.95	16	98
16 – 30 years old (Age1)	0.16	0.37	16	30
31 – 45 years old (Age2)*	0.40	0.49	31	45
46 – 56 years old (Age3)	0.23	0.42	46	56
≥ 57 years old (Age4)	0.21	0.41	57	98
Race				
Malay (Race1)	0.49	0.50	0	1
Chinese (Race2)	0.28	0.45	0	1
Indian (Race3)	0.07	0.26	0	1
Others (Race4)*	0.14	0.35	0	1
Education Level (years)	7.9	4.65	0	17
Gender				
Male	0.83	0.37	0	1
Female*	0.17	0.37	0	1
Household Size (number of occupants)	4.4	2.35	1	23
Household Income (RM)	2333.40	2486.90	1	56638
Strata				
Urban	0.57	0.49	0	1
Rural*	0.43	0.49	0	1
Monthly Expenditures				
Freshfish	*48.76*	*43.02*	*0*	*1053.60*
Shellfish	*13.89*	*23.11*	*0*	*778.10*
Processed Fish	*11.73*	*12.88*	*0*	*266.80*

* Refers to the omitted category in the analysis

Table 3
Descriptive Statistics of Variables in the Statistical Model
(Freshfish, Shellfish, Processed Fish)

Variables	Freshfish						Shellfish						Processed Fish					
	Those who purchased freshfish (n = 8272)			Those who DID NOT purchase (n = 912)			Those who purchased shellfish (n = 6104)			Those who DID NOT purchase (n = 3080)			Those who purchased proces. fish (n = 7740)			Those who DID NOT purchase (n = 1444)		
	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max	Mean	Min	Max
Expenditure (RM)	*54.1*	*0.6*	*1053.6*	-	-	-	*20.9*	*0.2*	*778.1*	-	-	-	*13.9*	*0.1*	*266.8*	-	-	-
Age1 (dummy)	0.13	17	30	0.48	17	30	0.11	17	30	0.26	17	30	0.14	17	30	0.29	17	30
Age2 (dummy)	0.40	31	45	0.31	31	45	0.42	31	45	0.37	31	45	0.41	31	45	0.35	31	45
Age3 (dummy)	0.24	46	56	0.11	46	56	0.25	46	56	0.17	46	56	0.24	46	56	0.16	46	56
Age4 (dummy)	0.23	57	98	0.10	58	94	0.22	57	96	0.20	57	98	0.21	57	98	0.20	57	94
Race1 (dummy)	0.52	0	1	0.31	0	1	0.55	0	1	0.39	0	1	0.53	0	1	0.34	0	1
Race2 (dummy)	0.26	0	1	0.50	0	1	0.27	0	1	0.32	0	1	0.25	0	1	0.49	0	1
Race3 (dummy)	0.07	0	1	0.08	0	1	0.07	0	1	0.07	0	1	0.07	0	1	0.07	0	1
Race4 (dummy)	0.15	0	1	0.10	0	1	0.11	0	1	0.22	0	1	0.15	0	1	0.11	0	1
Educ. Level (yrs)	7.61	0	17	10.5	0	17	7.8	0	17	8.0	0	17	7.7	0	17	9.2	0	17
Gender (dummy)	0.84	0	1	0.78	0	1	0.85	0	1	0.81	0	1	0.84	0	1	0.82	0	1
Household Size (no. of occupants)	4.7	1	23	1.9	1	12	4.8	1	23	3.6	1	17	4.7	1	23	2.9	1	14
Household Inc.	2317.7	30	56638	2475.6	1	26850	2420.9	30	55000	2159.9	1	56638	2286.5	30	56638	2584.8	1	51027
Strata (dummy)	0.54	0	1	0.79	0	1	0.56	0	1	0.60	0	1	0.54	0	1	0.72	0	1

Table 4
Breakdown of Responses According to Age-Group, Ethnicity, Level of Formal Education, Gender, Income Level, Strata, and Those Who Purchased / Did Not Purchase (Freshfish)

	Purchased		Did Not Purchase		Total
Age					
16-30 years old	1040	(70.1%)	444	(29.9%)	1484
31-45 years old	3376	(92.3%)	283	(7.7%)	3659
46-56 years old	1993	(95.4%)	96	(4.6%)	2089
≥ 57 years old	1863	(95.4%)	89	(4.6%)	1952
Ethnicity					
Malay	4297	(93.8%)	283	(6.2%)	4580
Chinese	2175	(82.5%)	460	(17.5%)	2635
Indian	577	(88.4%)	76	(11.6%)	653
Others	1223	(93.0%)	93	(7.1%)	1316
Education Level					
No Education	1058	(96.1%)	43	(3.9%)	1101
Primary	2982	(95.0%)	158	(5.0%)	3140
Secondary	3575	(87.5%)	508	(12.4%)	4083
Tertiary	657	(76.4%)	203	(23.6%)	860
Gender					
Male	6948	(90.8%)	707	(9.2%)	7655
Female	1324	(86.6%)	205	(13.4%)	1529
Household Income					
≤ RM1500	3589	(88.7%)	457	(11.3%)	4046
RM1501 – RM7999	4479	(91.7%)	406	(8.3%)	4885
RM8000 ≥	204	(80.6%)	49	(19.4%)	253
Strata					
Urban	4504	(86.2%)	722	(13.8%)	5226
Rural	3768	(95.2%)	190	(4.8%)	3958
Total	8272	(90.1%)	912	(9.9%)	9184 (100%)

Table 5
Breakdown of Responses According to Age-Group, Ethnicity, Level of Formal Education, Gender, Income Level, Strata, and Those Who Purchased / Did Not Purchase (Shellfish)

	Purchased		Did Not Purchase		Total
Age					
16-30 years old	692	(46.6%)	792	(53.4%)	1484
31-45 years old	2512	(68.7%)	1147	(31.3%)	3659
46-56 years old	1555	(74.4%)	534	(25.6%)	2089
≥ 57 years old	1345	(68.9%)	607	(31.1%)	1952
Ethnicity					
Malay	3376	(73.7%)	1204	(26.3%)	4580
Chinese	1648	(62.5%)	987	(37.5%)	2635
Indian	429	(65.7%)	224	(34.3%)	653
Others	651	(49.5%)	665	(50.5%)	1316
Education Level					
No Education	685	(62.2%)	416	(37.8%)	1101
Primary	2161	(68.8%)	979	(31.2%)	3140
Secondary	2759	(67.6%)	1324	(32.4%)	4083
Tertiary	499	(58.0%)	361	(42.0%)	860
Gender					
Male	5172	(67.6%)	2483	(32.4%)	7655
Female	932	(61.0%)	597	(39.0%)	1529
Household Income					
≤ RM1500	2378	(58.8%)	1668	(41.2%)	4046
RM1501 – RM7999	3569	(73.1%)	1316	(26.9%)	4885
RM8000 ≥	157	(62.1%)	96	(37.9%)	253
Strata					
Urban	3388	(64.8%)	1838	(35.2%)	5226
Rural	2716	(68.6%)	1242	(31.4%)	3958
Total	6104	(66.5%)	3080	(33.5%)	9184 (100%)

Table 6
Breakdown of Responses According to Age-Group, Ethnicity, Level of Formal Education, Gender, Income Level, Strata, and Those Who Purchased / Did Not Purchase (Processed Fish)

	Purchased		Did Not Purchase		Total
Age					
16-30 years old	1070	(72.1%)	414	(27.9%)	1484
31-45 years old	3158	(86.3%)	501	(13.7%)	3659
46-56 years old	1853	(88.7%)	236	(11.3%)	2089
≥ 57 years old	1659	(85.0%)	293	(15.0%)	1952
Ethnicity					
Malay	4093	(89.4%)	487	(10.6%)	4580
Chinese	1932	(73.3%)	703	(26.7%)	2635
Indian	549	(84.1%)	104	(15.9%)	653
Others	1166	(88.6%)	150	(11.4%)	1316
Education Level					
No Education	972	(88.3%)	129	(11.7%)	1101
Primary	2779	(88.5%)	361	(11.5%)	3140
Secondary	3364	(82.4%)	719	(17.6%)	4083
Tertiary	625	(72.7%)	235	(27.3%)	860
Household Income					
≤ RM1500	3423	(84.6%)	623	(15.4%)	4046
RM1501 – RM7999	4133	(84.6%)	752	(15.4%)	4885
RM8000 ≥	184	(72.7%)	69	(27.3%)	253
Gender					
Male	6478	(84.6%)	1177	(15.4%)	7655
Female	1262	(82.5%)	267	(17.5%)	1529
Strata					
Urban	4189	(80.2%)	1037	(19.8%)	5226
Rural	3551	(89.7%)	407	(10.3%)	3958
Total	7740	(84.3%)	1444	(15.7%)	9184 (100%)

Table 7
Summary Statistics for Tobit Analysis of Household Expenditures on Freshfish

	1	2	3	4	5
Independent Variables	**Coefficients (β)**	**Z-statist.**	$\frac{\partial E(Y)}{\partial X_i}$	$\frac{\partial E(Y \mid Y > 0)}{\partial X_i}$	$\frac{\partial P(Y > 0)}{\partial X_i}$
Constant	-0.7681	-0.0964	-0.5626	-0.3999	-0.0032
Age1	-9.7472	-2.1372**	-7.1389	-5.0752	-0.0411
Age3	13.0591	3.2437***	9.5645	6.7997	0.0550
Age4	16.2205	3.6145***	11.8799	8.4458	0.0683
Race1	10.4087	1.9194*	5.4197	5.4197	0.0438
Race2	9.9096	1.8312*	7.2578	5.1598	0.0417
Race3	-2.5005	-0.3183	-1.8314	-1.3020	-0.0105
Education Level	-0.0652	-0.1568	-0.0477	-0.0339	-0.0003
Gender	5.7305	1.2887	4.1970	2.9838	0.0241
Household Size	6.9201	11.3145***	5.0683	3.6032	0.0291
Household Income	0.0009	1.7924*	0.0007	0.0005	0.000004
Strata	-0.7432	-0.2262	-0.5444	-0.3870	-0.0031

Note: The unconditional expected value of y (at mean x) = 61.0429; the conditional expected value of y (at mean x) = 83.3464; the standard error around the Tobit model index = 78.1588; the predicted probability that y>0 (at the mean x) = 0.7324; z = 0.62; f(z) = 0.3292.
*** at 1% of significance
** at 5% of significance
* at 10% of significance
Source: Columns 3 - 5 computed by authors.

Table 8
Summary Statistics for Tobit Analysis of Household Expenditures on Shellfish

	1	2	3	4	5
Independent Variables	**Coefficients (β)**	**Z-statist.**	$\frac{\partial E(Y)}{\partial X_i}$	$\frac{\partial E(Y \mid Y > 0)}{\partial X_i}$	$\frac{\partial P(Y > 0)}{\partial X_i}$
Constant	-5.5879	-1.2014	-2.9813	-2.1183	-0.0340
Age1	-2.7800	-0.8756	-1.6715	-1.1877	-0.0191
Age3	2.8321	1.0086	1.2780	0.9081	0.0146
Age4	5.2679	1.7720*	2.6335	1.8712	0.0300
Race1	2.9928	0.9738	1.8046	1.2823	0.0206
Race2	8.2139	2.5668**	4.8034	3.4131	0.0548
Race3	2.1589	0.4442	1.3080	0.9294	0.0149
Education Level	-0.0115	-0.0427	-0.0209	-0.0148	-0.0002
Gender	2.3968	0.8315	1.3772	0.9786	0.0157
Household Size	1.6106	3.6049***	0.9233	0.6560	0.0105
Household Income	0.0009	3.0442***	0.0005	0.0004	0.000006
Strata	0.4503	0.1960	0.2618	0.1860	0.0030

Note: The unconditional expected value of y (at mean x) = 29.8131; the conditional expected value of y (at mean x) = 51.8219; the standard error around the Tobit model index = 59.6948; the predicted probability that y>0 (at the mean x) = 0.5753; z = 0.19; f(z) = 0.3918.
*** at 1% of significance
** at 5% of significance
* at 10% of significance
Source: Columns 3 - 5 computed by authors.

Table 9
Summary Statistics for Tobit Analysis of Household Expenditures on Processed Fish

	1	2	3	4	5
Independent Variables	**Coefficients (β)**	**Z-statist.**	$\frac{\partial E(Y)}{\partial X_i}$	$\frac{\partial E(Y \mid Y > 0)}{\partial X_i}$	$\frac{\partial P(Y > 0)}{\partial X_i}$
Constant	6.1777	4.3185***	4.3721	3.0948	0.1034
Age1	-1.8013	-1.8253*	-1.2722	-0.9005	-0.0301
Age3	1.0902	1.4267	0.8117	0.5746	0.0192
Age4	-0.1866	-0.2088	-0.0572	-0.0405	-0.0014
Race1	-0.4825	-0.5100	-0.3552	-0.2514	-0.0084
Race2	-2.4934	-2.5162**	-1.7946	-1.2703	-0.0425
Race3	-0.1858	-0.1293	-0.1410	-0.0998	-0.0033
Education Level	-0.0815	-1.0306	-0.0548	-0.0388	-0.0013
Gender	-0.4536	-0.5298	-0.3204	-0.2268	-0.0076
Household Size	1.5031	11.4362***	1.0779	0.7630	0.0255
Household Income	0.0005	7.1997***	0.0004	0.0003	0.000009
Strata	-1.0054	-1.5181	-0.7168	-0.5074	-0.0170

Note: The unconditional expected value of y (at mean x) = 14.9263; the conditional expected value of y (at mean x) 20.8556; the standard error around the Tobit model index = 20.0275; the predicted probability that y>0 (at the mean x) = 0.7157; z = 0.57; f(z) = 0.3391.
*** at 1% of significance
** at 5% of significance
* at 10% of significance
Source: Columns 3 - 5 computed by authors.

Table 10
Per Capita Expenditures and Share of Expenditures for Freshfish, Shellfish, and Processed Fish (By Age Group)

	Per Capita Expenditures		
	Freshfish (RM)	**Shellfish** (RM)	**Proc. Fish** (RM)
Age1 (16-30)	22.86	6.75	7.60
Age2 (31-45)	47.81	13.76	12.56
Age3 (46-56)	60.45	16.78	13.70
Age4 (≥ 57)	57.73	16.46	11.20

	Share of Expenditures		
	Freshfish / Shellfish	**Freshfish / Proc. Fish**	**Shellfish / Proc. Fish**
Age1 (16-30)	3.39	3.00	0.88
Age2 (31-45)	3.47	3.80	1.10
Age3 (46-56)	3.60	4.41	1.22
Age4 (≥ 57)	3.51	5.15	1.47

Table 11
Per Capita Expenditures and Share of Expenditures for Freshfish, Shellfish, and Processed Fish (By Ethnicity)

	Per Capita Expenditures		
	Freshfish (RM)	**Shellfish (RM)**	**Proc. Fish (RM)**
Race1 - Malay	52.32	13.09	12.35
Race2 - Chinese	50.45	18.42	10.10
Race3 - Indian	39.32	12.42	12.68
Race4 - Others	37.69	8.32	12.36

	Share of Expenditures		
	Freshfish / Shellfish	**Freshfish / Proc. Fish**	**Shellfish / Proc. Fish**
Race1 - Malay	4.00	4.24	1.06
Race2 - Chinese	2.74	5.00	1.82
Race3 - Indian	3.17	3.17	0.98
Race4 - Others	4.53	3.05	0.67

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[1] In this study, fish and seafood products are separated into freshfish, shellfish, and processed fish. These products are further categorized by: (a) Freshfish – kembong (mackerel), tenggiri (Spanish mackarel), bawal hitam/putih (black/white pomfret), parang (herring), merah (red snapper), kurau (treadfin), keli (catfish), siakap (seabass), kerapu (grouper); (b) Shellfish – cockles, crabs, prawns, cuttlefish, octopus, oysters, lobsters, clams; and (c) Processed Fish – cencalok (fermented shrimp), budu (fermented fish), ikan bilis (dried anchovy), dried prawns, various types of salted fish, canned sardine, keropok udang/ikan/sotong (prawn/fish/cuttlefish crackers), fish balls, shark's fin etc.

[2] This age range was chosen as the omitted base group because the majority of the household heads are categorized into this age-group (Table 2).

[3] Education level of the respondent may not just pick up seafood preferences but also household income (since those with higher education levels may invariably have better paying jobs). To test its significance, we regressed Education*Income in a separate Tobit regression as an interaction variable. The results obtained showed a failure to reject the Null and that there exists statistical significance for this interaction variable. Nevertheless, we still included both variables in the study for two reasons: (i) both these variables play important roles in explaining expenditures on seafood consumption, and (ii) signs and significant variables do not differ at all even when one of the variables is left out. However, it is acknowledged that parameter estimates should be interpreted with care.

[4] Gender of the respondent may not just pick up seafood preferences but also income (since females who are single parents generally have lower income). Therefore, to test whether gender may affect income, we regressed Gender*Income in a separate Tobit regression as an interaction variable. The results obtained showed that the Null is accepted and that there exists no significance for this interaction variable. Therefore, the variables gender and income do not affect one another and have thus been retained in the model.

[5] In the interest of brevity, only a succinct discussion of the characteristics of the survey respondents is provided. A more comprehensive discussion can be obtained from the authors upon request.

[6] Respondents not recording purchases during the specified period but having otherwise complete records of socioeconomic and demographic characteristics are included in the sample. Monthly expenditures containing zero as well as positive (Ringgit) amounts are thus consequently distributed over a limited range.

[7] E.g. $\frac{(0.13 \times 8272)}{(0.13 \times 8272) + (0.48 \times 912)} \approx 70\%$ (approximate due to rounding error)

[8] Even though no purchases were reported by these respondents, the data do contain otherwise corresponding socioeconomic characteristics for each of these respondent. Thus, the sample is censored at the limit value of zero. Altering or disposing of such data would result in the loss of valuable information on users and non-users (Heckman 1979). The use of ordinary least squares regression, on the other hand, would result in biased, inconsistent, and inefficient parameter estimates (Greene 1981 & 1983; Nelson 1981; Judge *et. al.* 1988).

[9] Despite sharks' fin being a favourite delicacy of the Chinese community, and is incidently categorized as processed fish, the effect is not as evident.

[10] A cursory examination of the trend between level of education and food-away-from-home expenses using the same survey data indicate a positive relationship between the two variables. This supports the notion that higher educated households are more likely to partake in away-from-home consumption activities.