

**The Impact of Awareness of Aquatic Food and Consumers' Beliefs About
Product Attributes on Fish Consumption Behavior in China**

by

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Abstract

A five equation partially-recursive model is estimated to determine the effects of consumer awareness of farmed fish, beliefs about product attributes, and socio-economic-psychometric variables on fish consumption in three major cities in China, namely Beijing, Shanghai, and Xi'an. Results suggest the three most important drivers of fish consumption are *i*) the consumer's perception of product safety, *ii*) the place of purchase (whether from a fish monger or supermarket), and *iii*) whether the consumer distinguishes farm-raised from wild-caught fish. Average monthly income, education level, the consumer's susceptibility to advertising, and product form (whether the consumer prefers processed or unprocessed fish) are also drivers of fish consumption, but their effects are relatively modest. Nutrition, price, household size, and gender were found to have no effect on fish consumption. Overall, results suggest if policy makers want to expand fish consumption, they should focus on improving perceptions about product quality and safety, as this variable was found to be twice as important as place of purchase, which in turn is about 50% more important than source of production (whether wild-caught or farm-raised).

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List of Abbreviations

EKB Engel-Kollat-Blackwell Model (named by the founders' first names)

The Impact of Awareness of Aquatic Food and Consumers' Beliefs About Product Attributes on Fish Consumption Behavior in China

Introduction

Previous research has been done about consumer preference for aquatic products focusing on factors influence consumers' preferences (Kinnucan and Venkateswaran, 1990). Among previous studies, several socio-demographic factors such as income, education level and household size were mentioned because they have a significant direct impact on consumers' preferences (Hu and Wang, 2009). Moreover, attribute characteristics such as nutrition, price, and safety are often considered as exogenous variables to join in the regression relation with consumer's decision-making. However, those were defined as endogenous variables because a structural model was used to make research about direct and indirect relations between the awareness of ads and consumers' attitudes toward catfish consumption in Kinnucan and Venkateswaran (1990). Typically, investment on nutrition and high quality may be a significant motivation to encourage consumers to choose aquatic products. In contrast, price may efface their enthusiasm of purchase since people do not prefer commodities that have higher costs compared with substitutes. Similarly, a lack of the knowledge of the products would also reduce consumers' want to purchase, thus increasing the awareness of aquatic products may positively affect consumers' safety consciousness indirectly (Olsen, 2003; Olsen, 2004; Sun et al., 2008). Moreover, the proliferation of advertisement has also been considered as a practical way to enhance consumer's awareness. This useful tool also increased aquatic purchases at-home and for restaurants (Kinnucan and Venkateswaran, 1990).

The foregoing theory mainly focuses on the relationship between the consumer preference

and its relative influencing factors. Nevertheless, how the inverse effect of awareness (i.e., distinguishing between farm-raised and wild fish) affects a consumer's behavior is still at an early stage and limited research has been conducted on this area. Meanwhile, the correlation between these factors is a profound topic, especially in terms of China as the object of study. There is a tendency that China is facing an abundant incremental demand of aquatic products, particularly with the highest output. According to previous reports, China has ranked first on the output of aquatic products in the world since the 1990s. Until 2013, China's gross product has reached nearly 6 million tons (Gao et al., 2013). Since China has the highest output as well as a large aquatic products consumption, it is important to investigate Chinese consumers' attitudes and behaviors toward aquatic products.

The objective of this research is to determine the effects of consumer beliefs on the consumption of aquatic fish products through their awareness in China, based on the classical consumer decision-making model---EKB (Engel et al., 1968). A structural model including 5 equations would be estimated, which links awareness to consumers' beliefs and their behaviors for aquatic products. The second objective is to determine the extent to which improving consumers' awareness of the distinction between farmed and wild fish would increase the demand for farmed fish. The study could provide extra illustration for the literature about the factors which stimulate aquatic products' demand. Particularly, the thesis' results may lend support to Kinnucan and Venkateswaran's (1990) findings, which concluded that ad campaign could improve consumers' awareness and make consumers' perception toward catfish, because the ads were regarded as an important control variable in this study. The final insight could be used as a reference to expand consumption when considering to apply policies.

Theoretical Framework

We have mentioned that model-building would be closely associated with the EKB model. In figure 1, we apply this model (Engel et al., 1968) as the theoretical framework for specifying the empirical model. The model indicates one consumer behavior pattern followed by a process of decision-making. EKB consists of five steps and there exists internal linkage between certain steps to form a circle.

Firstly, the model identifies that the motivation for consumers' behavior starts from an internal or external stimulus. For example, when realizing the desire for more nutrition intake, one consumer may feel more interested in a nutrient carrier. Then it comes to the second step: Search for Problem (For solution). Via advertisements, media release or personal experience, the potential consumer tries to collect more information for the decision-making. It is more closely about the cognitive aspect of awareness since the information flow could strengthen consumer's awareness. Accordingly, the next step is to assess among different options in the light of the information at hand. Typically one consumer starts evaluation from nothing but a products' attributes (e.g., price, brand, quality, shopping place and purchase way). What is more, consumer's awareness (e.g., personal experience) also affects his or her subjective feeling to make the choice.

Then the purchase happens after combining both sides (attribute rating and awareness) together. However, referred to the difference between EKB and other consumer behavior models, EKB emphasizes that the final choice, which is uncertain to benefit one consumer most, would reproduce a feedback for the consumption experience, like satisfaction or dissonance (Kinnucan and Venkateswarn, 1990). In turn, the results affect the personal awareness again

and deepen one consumer's experience on attribute rating. Foxall (2005) considered the importance of post-purchase evaluation and that it was key because of its influences on future purchase patterns.

Above all, we would set the model conducted by EKB's logical process and the steps from assessment to final effect of choice are our key parts. The circulation results in our model's core concept: How the awareness would exert effect on consumer's behavior and attribute rating which can be regarded as consumer's belief.

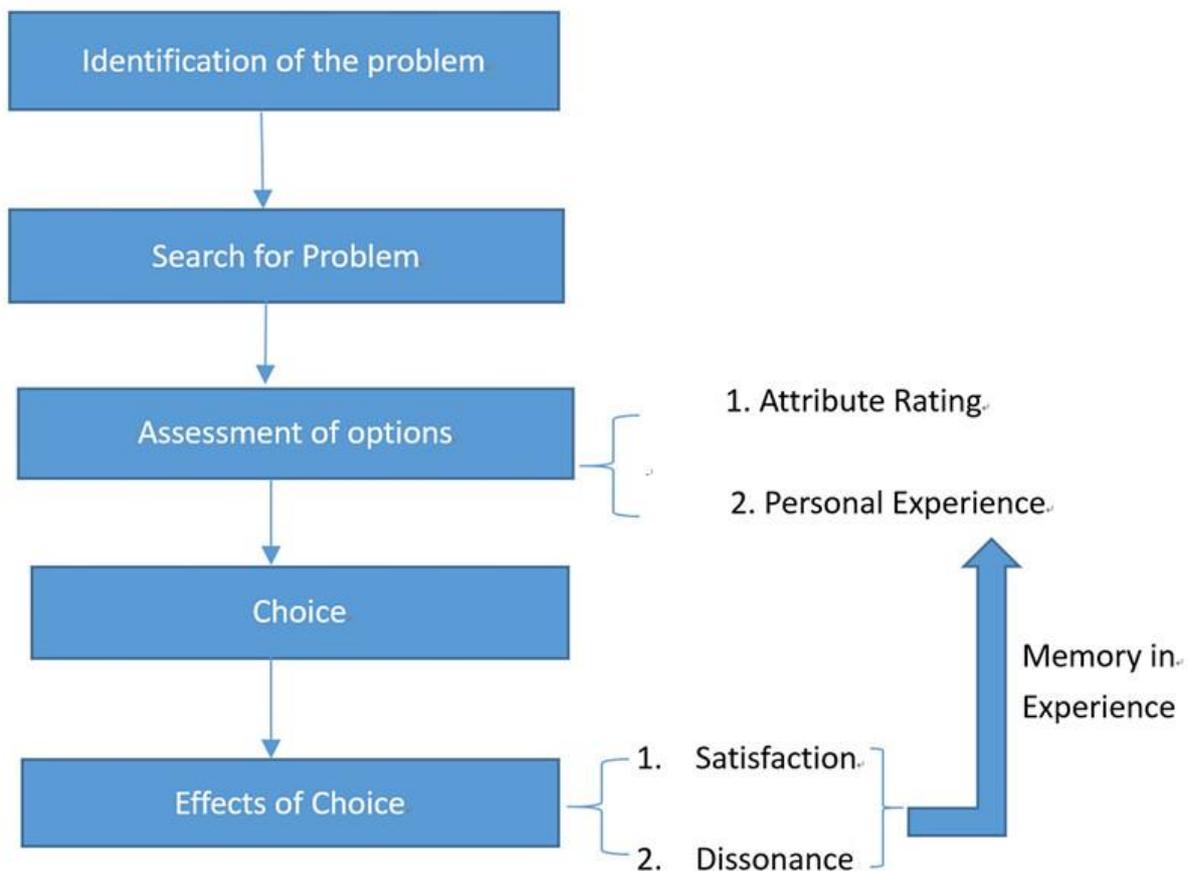


Figure 1. A Theoretical Model for Consumer Decision-making (EKB model)

(Source: Engel et al., s.32)

Empirical Model

The definition of some variables are characterized necessarily to avoid the misunderstanding when designing the model. In Schwitzgebel's (2006) opinion, belief is

“the state of mind in which a person thinks something to be the case, with or without there being empirical evidence to prove that something is the case with factual certainty.

Another way of defining belief is, it is a mental representation of an attitude positively oriented towards the likelihood of something being true.”

Thus, we can interpret that belief is a subjective concept which can indirectly affect people's judgement via effect on their attitudes. Moreover, consumers' belief structures could be affected by commodities' attributes and then influence their attitudes (Fishbein, 1963).

In this study, some representative factors were defined as belief variables to make connection with awareness and behavior (the relative question setting can be found in the Data chapter). Based on the foregoing theoretical framework, nutrition, safety and price were chosen to represent the belief, since they are the three options for the attribute rating question in this questionnaire. Meanwhile, aquatic products are classified into commodities. Thus price becomes one of their attribute because price represents the quantity of payment or compensation given by one party to another in order to get goods or services (Schindler, 2012). Afterwards these three attributes of aquatic products were set as dependent variables in belief equations. Based on the above theoretical framework and analysis, the model is as follows with 5 equations:

Awareness Equation:

$$(1) \textit{AWARE} = h(Z)$$

Belief Equations:

$$(2) \textit{NUTR} = g(\textit{AWARE}, Z)$$

$$(3) \textit{SAFETY} = g(\textit{AWARE}, Z)$$

$$(4) \textit{PRICE} = g(\textit{AWARE}, Z)$$

Behavior Equation:

$$(5) \textit{FE} = f(\textit{PRICE}, \textit{SAFETY}, \textit{NUTR}, \textit{AWARE}, \textit{INC}, Z_1)$$

Where *AWARE* is a binary variable that equals 1 if the respondent can distinguish between farm-raised and wild fish and 0 otherwise; *NUTR*, *SAFETY* and *PRICE* are the three factors which become the motivation (attribute rating) to purchase aquatic products for consumers. *NUTR* is also set as a binary variable that equals 1 if the respondent considered nutrition is the most important factor among the three belief factors and 0 otherwise. *SAFETY* and *PRICE* are defined with the similar way as binary variables, too; *FE* represents the frequency of purchase monthly for each respondent measured by number of times; *Z* is a series of control variables which include socio-demographic characteristics defined for consumers and some other exogenous variables to have impact on consumers' beliefs and purchase behavior. They consist of one consumers' income, education level, the requirement of products form, household size, gender and choice of shopping place. Likewise, the effect of the ads also belongs to *Z* in order to fulfill the objective of the ad's influence on consumers' behaviors. The definition of *Z*₁ is nearly the same as *Z*, except that there is no income variable included because income is often set as an explicit variable in the function about consumption. All values of the variables stem

from the survey.

Data

The data used to be estimated for the model comes from the survey which lasted four months through March to June in 2013 and was conducted by the Fisheries Bureau belonging to The People's Republic of China Ministry of Agriculture. The objective of the survey was to get the information of aquatic food consumption of city dwellers. We got the commission from the bureau and commenced the survey from three Chinese main cities: Beijing, Shanghai and Xi'an. They have strong representatives in North China (Beijing), East China (Shanghai) and North West China (Xi'an) because of their highly marked economy status in their own districts. For the randomness of the samples, systematic sampling was used among three cities and four counties were chosen from every city randomly. Finally, we got a population of 300 completed interviews with an average distribution to each district in the cities (we choose four districts from every city randomly, and then gave away the same amount of questionnaires for each district).

The questionnaire consisted of respondents' awareness of aquatic food, the factors which affect respondents' consumption behavior, frequency of consuming monthly, and preference for consuming place and products' form. Some socio-demographic information was also recorded for the research convenience. The description and summary statistics of all variables' to be used are reported in Table 1.

In order to get the data, every interviewee was asked a series of questions for comprehensive aquatic food consumption behavior. The questionnaire consisted of three parts: preference, beliefs and purchase for aquatic products. There were also some detailed questions

being asked which helped us understand the interviewee's mind better. For example, whether the aquatic products would be preferred compared with meat or other protein carrier and if so, the reason, amount and the purchasing percentage for different kinds of aquatic products: fish, shrimp, shell, algae and mollusks. Owing to the thesis's theme, we just picked three categories of questions (awareness, belief and behavior) corresponding to three parts in the model as the data base.

For the awareness part, the question was posed as: "Could you tell the difference between farm-raised products and fishing products, yes or no?" For the belief part, the question with simple selection was stated by the following: "Which factor would affect you mostly when you process the consumption for aquatic products? (a) Price (b) Safety or (c) Nutrition." The behavior part would be asked directly by the monthly frequency of purchasing aquatic products.

However, considering the distinctive features of Chinese aquatic markets, we have to think about some other practical aspects. In particular, Lu et al. (2008) and Ma et al. (2010) pointed out currently peddler's market dominates in the circulation channel of aquatic products in China, which is quite different from other developed countries, such as Japan.

Besides, Chinese consumers have a strong preference on the fresh product compared with a processed one because of the cultural tradition. Live aquatic markets also play an important role in products sale (Sun and Che, 2012; Venkata S. Puduri et al., 2011). Thus for enriching more details about consumption, some questions around the purchasing place and products form were also set. Since the marketing promotion could improve the image of products and sometimes guide consumers directly (Barazi-Yeroulanos, 2011), the question "whether you would be affected by ads when purchasing aquatic products" is also adopted. The results would

be transferred to proper numerical forms for the model estimation. All descriptions for these questions are reported in Table 1.

The final part for each respondent is some demographic information collection. It covers the respondent's income, household size, gender, occupation, age, and education level. Since we processed the interview on the street randomly, every survey nearly took 15 minutes to complete.

Estimation Procedures

After the sorting out, we got 300 observations and the data would be used in the 5-equation model designed above. By theory, the determinants in equations (1)-(4) are all binary variables. Thus Probit could be used to estimate and the coefficients could be explained through possibility after every variable's corresponding marginal effect being got.

Since the whole model is fully recursive, the behavior equation could be estimated separately by single-equation procedures (e.g., OLS) and *t*-test would be used as the hypothesis test for these repressors in equation (1) to (5). Unless otherwise mentioned, all critical values for the statistics are based on the 5 percent level of significance for a two-tailed test.

Econometric Results

Equation to Explain Consumer Awareness of Farmed Fish

This part mainly focuses on the impact from a series of socioeconomic variables for awareness of the difference between farmed and wild fish. There are three estimated variables significantly related to awareness in the awareness equation: Income level, products form and susceptibility of advertising (Table 1). The result reveals some similar information with

Kinnucan and Venkateswaran's (1990) finding: The income level would have a positive effect on consumer's awareness of products source. On the other hand, to some extent, ad also has an obvious influence on awareness. Rather, the negative sign provides an opposite insight in terms of the stated conclusion in Kinnucan and Venkateswaran (1990), which suggested the awareness of Farm-Raised Catfish could be raised through the relative ads' proliferation. Inversely, the regression results imply the probability of being aware of farm-raised products is 17 percent higher for those who do not care about ads compared to those who are aware of the ads. Apparently, the ads become the barrier for the public to understand more about aquatic products.

However, two factors could perhaps provide explanations to the situation: Firstly, in our survey, only 67 among the population of 300 respondents indicated the ads were effective. Thus these 67 samples did not produce a strong positive linkage to ads and awareness; Secondly, Chinese citizens prefer to choose aquatic products according to their life experience or local food tradition rather than the direct shock from ads (Chen et al, 2005). Moreover, regional differences also play an important role. For example, a number of the respondents from Xi'an admitted their primary aquatic food is Largehead hairtail (Xi'an is not a main place of production for aquatic products). Hence, ads have no significant effect on strengthening consumer's awareness.

Another significantly estimated variable "FORM" also has Chinese characteristics: the fresh form of aquatic products still dominates in Chinese consumers' minds (Sun et al., 2012), so our survey also reported 267 respondents named original products as their first choice. The marginal probability suggests that consumers who preferred the fresh product is 19 percent higher than others due to better awareness levels.

Table 1. Descriptive Statistics of the Variables Used in the Study, 2013 Survey Data, China

Variable Name	Description	Mean (N=300)
<i>FE</i>	Frequency of purchasing aquatic food monthly	6.60
<i>PRICE</i>	1 if price factor is the most important factor in purchase decision ; 0 otherwise	0.12
<i>SAFETY</i>	1 if safety factor is the most important factor in purchase decision; 0 otherwise.	0.11
<i>NUTR</i>	1 if nutrition factor is the most important factor in purchase decision; 0 otherwise.	0.78
<i>AWARE</i>	1 if respondent can tell farm-raised from wild fish;0 otherwise	0.56
<i>INC</i>	1 means the average monthly income range (RMB)less than 1000 RMB; 2 means 1000-3000; 3 means 3000-5000; 4 means 3000-5000; 5 means 5000-7000; 5 means 7000-10000; 6 means 10000-15000; 7 means 15000-20000; 8 means higher than 20000.	3.87
<i>EDU</i>	Education level of respondent.1 less than primary school, 2= primary school; 3 = middle school;4= high school; 5=bachelor' degree; 6=master's degree or higher;	3.70

<i>HHSIZE</i>	Household size	3.60
<i>FORM</i>	Product form: equals 1 if respondent prefers fresh product; 0 if respondent prefers processed products.	0.86
<i>FEMALE</i>	1 means female; 0 means male.	0.69
<i>AD</i>	1 means the respondent would be affected by advertisements when purchasing; 0 otherwise	0.22
<i>SPLACE</i>	1 means peddler's market; 0 means supermarket.	0.65

Table 2. Maximum Likelihood Probit Estimates of Awareness Equation, 2013 Survey Data, China

Awareness of Farmed Fish(AWARE)		
Variable	MLE of the Parameter	Marginal Probability
<i>INC</i>	0.1207 ** (0.018)	0.0476
<i>EDU</i>	-0.0905 (0.234)	-0.0357
<i>HHIZE</i>	-0.0128 (0.817)	-0.0051
<i>SPLACE</i>	0.1717 (0.272)	0.0678
<i>FEMALE</i>	-0.1739 (0.239)	-0.0686
<i>FORM</i>	0.4827** (0.023)	0.1907
<i>AD</i>	-0.4528** (0.012)	-0.1791
<i>INTERCEPT</i>	-0.2447 (0.574)	0.5573
Preudo R ²	0.0553	
Prob > Chi2	0.0015	

Note: The figures in parentheses are the corresponding *p* values. Double asterisk (**) indicates significance at the 5% probability level.

Equations to Explain which Attributes are Most Important in Purchase Decisions

These equations address the extent to which awareness of farmed fish, advertising, and selected sociodemographic variables affect consumers' perceptions about the relative importance of nutrition, safety, and price in the purchase decision. Results are reported in Table 3, 4 and 5. They identify total eight variables of theoretical significance: HHIZE and AD in equation (2); EDU, SPLACE and AD in equation (3); INC and SPLACE in equation (4).

However, overall the results suggest awareness of farmed fish has no significant relation with the dependent variables. An interesting point is that the coefficients have both negative signs for SAFETY and PRICE and positive sign for NUTR. Coincidentally, Kinnucan and Venkateswaran (1990) has found awareness of farmed fish to have a positive effect on attribute ratings for nutrition. The size of the coefficient (0.7405) suggested it was an important determinant of the consumers' assessment of the importance of nutrition as a decision variable.

Therefore, it is hard to interpret the meaning of the relationship between AWARE and NUTR in this study entirely. Perhaps the insignificance resulted from small scale population (300 samples) makes the mutual relation hazy. Meanwhile there may exist potential indication that consumers who were aware of farmed fish considered nutrition factor mostly in their purchase.

Except awareness, some socioeconomic variables reveal statistically significant correlation with the attitudinal variables. Firstly, ads again play an important role in this part. It is indicated that ads have a positive effect on the nutrition and safety factor (with corresponding marginal effect of 1.2 and 6.7 percentage). But negative sign appearing in equation (2) indicates consumers who were affected by ads would have a lower possibility to

choose nutrition as their main consideration. In turn, the affected consumers would pay more attention to the products' safety in equation (3). It can be explained that China is facing a serious problem about the safety of aquatic food in recent years. Thus the television commercials often emphasize the good quality for their products (Sun et al, 2009). In addition, the nutrition of the aquatic food, like high protein, has been valued in China. Therefore, no doubt Chinese consumers would put safety at the first place when they consider to purchase aquatic products.

While the price factor is not so sensitive to the advertisements, consumers' income level and the choice of shopping place have negative relationship with it. It can be partly supported from Hu and Wang's (2009) finding: higher income could provide a stimulus to aquatic products consumption. From the other side we can conclude that consumer would not care too much about the price if their income level can afford that. In terms of shopping place, consumers who preferred peddler's market cared less about price. By theory as the domination in the circulation channel of aquatic products in China, peddler's market can bridge producers and final retailers. It is also open to public, which means consumers could get an economical price compared with other retailers, such as supermarkets or specialty stores because of the lower circulation costs.

Moreover, SPLACE's significance in the equation (3) indicates that consumers who quite often visited peddler's market would think about the safety seriously because there are many kinds of products from different peddlers. Thus, sometimes it is difficult to tell the quality.

Table 3. Maximum Likelihood Probit Estimates of Attribute Equation for Nutrition, 2013 Survey Data, China

Nutrition(NUTR)		
Variable	MLE of the Parameter	Marginal Probability
<i>AWARE</i>	0.0795 (0.636)	0.0235
<i>INC</i>	0.1005 (0.081)	0.0297
<i>EDU</i>	-0.1225 (0.147)	-0.0362
<i>HHIZE</i>	-0.0454* (0.060)	-0.0134
<i>SPLACE</i>	-0.0633 (0.715)	-0.0186
<i>FEMALE</i>	0.0394 (0.814)	-0.0186
<i>FORM</i>	-0.0437 (0.856)	-0.0127
<i>AD</i>	-0.2703** (0.042)	-0.0127
<i>INTERCEPT</i>	0.1600 (0.574)	0.7746
Preudo R ²	0.4615	
Prob > Chi2	0.0236	

Note: The figures in parentheses are the corresponding *p* values. Single (*) and double (**) asterisks indicate significance at the 10% and 5% probability levels, respectively.

There are two significant variables which also demonstrate obvious effects on consumers' beliefs. Firstly, household size takes negative effect on the nutrition variable. The reason is that larger family size may have to undertake more cost for living. Nutrition hardly comes first. However, it is strange there is also no significant evidence that HHIZE has a positive relation with the price factor, although the coefficients represent a positive side. Secondly, the positive sign of EDU in equation (3) indicates consumers with higher education level would think highly of products' safety when purchasing. This could lend partial support to Li and Feng's (2009) one viewpoint: consumers who experienced high education (Bachelor's degree or above) easily paid the attention to media publicity about the quality of aquatic food.

Table 4. Maximum Likelihood Probit Estimates of Attribute Equation for Safety, 2013 Survey Data, China

Safety(SAFETY)		
Variable	MLE of the Parameter	Marginal Probability
<i>AWARE</i>	-0.0311 (0.878)	-0.0056
<i>INC</i>	-0.0379 (0.580)	-0.0068
<i>EDU</i>	0.2075** (0.043)	0.0373
<i>HHIZE</i>	0.0186 (0.802)	0.0033
<i>SPLACE</i>	0.4055* (0.069)	0.0678
<i>FEMALE</i>	0.0690 (0.730)	0.0124
<i>FORM</i>	-0.1047 (0.713)	-0.0197
<i>AD</i>	0.3314** (0.036)	0.067
<i>INTERCEPT</i>	-2.2269*** (0.000)	0.1144
Preudo R ²	0.2522	
Prob > Chi2	0.0468	

Note: The figures in parentheses are the corresponding *p* values. Single (*), double (**), and triple (***) asterisks indicate significance at the 10%, 5%, and 1% probability levels, respectively.

Table 5. Maximum Likelihood Probit Estimates of Attribute Equation for Price, 2013 Survey Data, China

Price(PRICE)		
Variable	MLE of the Parameter	Marginal Probability
<i>AWARE</i>	-0.0856 (0.665)	-0.0162
<i>INC</i>	-0.1458** (0.039)	-0.0275
<i>EDU</i>	0.0017 (0.986)	0.0003
<i>HHIZE</i>	0.0825 (0.248)	0.0155
<i>SPLACE</i>	-0.2557* (0.071)	-0.0505
<i>FEMALE</i>	-0.0922 (0.646)	-0.0174
<i>FORM</i>	0.0920 (0.749)	0.0166
<i>AD</i>	-0.0044 (0.985)	-0.0008
<i>INTERCEPT</i>	-0.7637 (0.183)	0.1177
Preudo R ²	0.5584	
Prob > Chi2	0.0307	

Note: The figures in parentheses are the corresponding *p* values. Single (*) and double (**) asterisks indicate significance at the 10% and 5% probability levels, respectively.

Behavior Equation

The final equation is the joint effect of the consumers' behavior (defined by consumption frequency in the equation as a function of awareness, socioeconomic, and the belief variables).

The results of direct and indirect effects through awareness are reported in Table 6. There are three coefficients of variables with statistical significance: AWARE, INC and SPLACE. It is clear that consumers who were aware of products' sources preferred to purchase aquatic products nearly 2 times more than those who were not, with other variables constant. This direct effect is consistent with previous research (Olsen, 2003) which considered that the relative knowledge could help consumers build confidence and trust for the products.

No belief variables have a significant relationship with purchase frequency at the 5% level of significance. However, the safety factor may exert a positive effect on consumers' behavior at 10% level (Its p values is 0.8). Thus, to strengthen the spreading of products' reliable quality may become a popular way to stimulate the market demand.

Still, some socioeconomic variables indicate their influence on behavior. The result reports that INC and SPLACE have very significant positive effects on FE. But in terms of the coefficient size, apparently higher level income would not influence the increment of frequency (close to 1 time) as much as the choice of shopping place. The latter variable could provide an additional time on frequency if people choose peddler's market as their favorite option. The reason can refer to previous analysis for equation (4): Peddler's market has lower prices, which can attract more consumers.

Likewise, although FORM is not significant in this regression, we could not easily say consumers' requirement of product form has no effect on their behavior whatsoever. Rather,

because in the first part FORM affects AWARE directly in a positive way, which in turn increases consumption frequency (as indicated by the positive coefficient for AWARE in Table 6). Therefore we can induce the consumers who prefer fresh product has a higher possibility to become the main growth for aquatic market.

**Table 6. OLS Estimates of Behavior Equation,
2013 Survey Data, China**

OLS Estimated Coefficients of:	
Variable	Frequency(FE)
<i>NUTR</i>	3.0243 (0.492)
<i>SAFETY</i>	6.0636* (0.082)
<i>PRICE</i>	2.2590 (0.600)
<i>AWARE</i>	1.8075** (0.012)
<i>INC</i>	0.9356*** (0.001)
<i>EDU</i>	-0.3831 (0.278)
<i>HHIZE</i>	-0.0970 (0.709)
<i>SPLACE</i>	2.3171*** (0.002)
<i>FEMALE</i>	0.9301 (0.186)
<i>FORM</i>	1.2432 (0.221)
<i>AD</i>	0.6207 (0.472)
<i>INTERCEPT</i>	-2.8781 (0.554)
R ²	0.1515
Adjusted R ²	0.1198

Note: The figures in parentheses are the corresponding *p* value.
Single (*), double (**), and triple (***) asterisks indicate
significance at the 10%, 5%, and 1% probability levels, respectively.

Empirical Significance

The empirical significance of the results can be improved by adding a sub-section that quantifies the effects of the statistically significant variables on consumption behavior. The statistically significant variables are summarized in equations (6) – (8). The numbers above the variables in the FE equation are estimated coefficients; the numbers above the variables in the SAFETY and AWARE equations are estimated marginal probabilities.

$$(6) \quad FE = f(\overset{6.06}{\widehat{SAFETY}}, \overset{2.32}{\widehat{SPLACE}}, \overset{1.81}{\widehat{AWARE}}, \overset{0.94}{\widehat{INC}})$$

$$(7) \quad SAFETY = g(\overset{0.068}{\widehat{SPLACE}}, \overset{0.067}{\widehat{AD}}, \overset{0.037}{\widehat{EDU}})$$

$$(8) \quad AWARE = h(\overset{0.191}{\widehat{FORM}}, \overset{-0.179}{\widehat{AD}}, \overset{0.048}{\widehat{INC}}).$$

The primary drivers of purchase frequency are *SAFETY*, *PLACE*, *AWARE*, and *INC*. They are primary because they affect consumption directly. The secondary drivers are *AD*, *EDU*, and *FORM*. These variables are secondary because they affect consumption indirectly, i.e., through their effects on the primary drivers. For example, *EDU* has no direct effect on consumption (since its estimated coefficient in the consumption function is statistically insignificant). However, *EDU* indirectly affects consumption through its effect on *SAFETY*. Similarly, *AD* has no direct effect on consumption, but it does have an indirect affect through its effect on *SAFETY* and *AWARE*. *SPLACE* and *INC* are primary and secondary drivers in that they are significant in both the consumption function (equation (6)) and in either the attribute equation (equation (7)) or the awareness equation (equation (8)).

Which driver is most important as a determinant of behavior? The answer may be found by computing the total effect for each driver, and then converting the total effect to an elasticity.

Total Elasticity for INC

The total effect of income on behavior can be determined by taking the partial derivatives of equations (6) and (8) with respect to *INC* to yield:

$$(9) \quad \frac{\partial FE}{\partial INC} = \frac{\partial f}{\partial INC} + \frac{\partial f}{\partial AWARE} \frac{\partial AWARE}{\partial INC} = 0.94 + 1.81(0.048) = 1.03.$$

The total effect (1.03) is 9.6% larger than the partial or direct effect (0.94). The total effect takes into account the induced effect of income on awareness. An increase in income increases awareness of farmed fish, which in turn increases consumption.

The total income elasticity is obtained by converting absolute changes in purchase frequency and income to percentage changes. The average purchase frequency is 6.60 times per month and the average income level is 3.87 (table 1). A one unit increase in income (from 3.87 to 4.87) represents a 25.8% increase in income when evaluated at the sample mean. A 1.03 unit increase in purchase frequency (from 6.60 to 7.63) represents a 15.6% increase in purchase frequency. Dividing these percentages yields a total elasticity for income of 0.61. A 1% increase in income is expected to increase purchase frequency by 0.61%, all else equal.

Total Elasticity for SPLACE

The total effect of *SPLACE* (whether the consumer buys fish from fish mongers or from a supermarket) can be determined by taking the partial derivatives of equations (6) and (7) with respect to *SPLACE* to yield:

$$(10) \quad \frac{\partial FE}{\partial SPLACE} = \frac{\partial f}{\partial SPLACE} + \frac{\partial f}{\partial SAFETY} \frac{\partial SAFETY}{\partial SPLACE} = 2.32 + 6.06(0.068) = 2.73.$$

Consumers who buy fish from a fish monger purchase fish 2.73 times more often per month than consumers who buy fish from a supermarket. The sample mean of *FE* is 6.60. Thus, a 2.73 unit increase in *FE* from its sample means represents a 41.4% increase in

purchase frequency. Consumers who buy fish from a fish monger can be expected to have a 41.4% higher purchase frequency than consumers who buy from supermarkets, all else equal. The total semi-elasticity of purchase frequency with respect to place of purchase is 41.4.

Total Elasticity for SAFETY

The third primary driver is SAFETY. However, there is no induced effect, which is different from the above three primary drivers. Thus the total effect can be calculated by taking the first derivative of equation (6):

$$(11) \quad \frac{\partial FE}{\partial SAFETY} = \frac{\partial f}{\partial SAFETY} = 6.06 .$$

The result suggests that consumers who have strong beliefs on safety purchase 6.06 times more frequently than consumers who consider nutrition or price factors mostly, all else equal. Dividing 6.06 by the sample mean of FE (6.60) yields 0.92, the semi-elasticity of purchase frequency with respect to SAFETY is 0.92. The monthly purchase frequency of consumers who view safety as most important is 92% higher than consumers who do not view safety as most important, all else equal.

Total Elasticity for AWARE

AWARE also has only a direct effect on frequency without induced effect. Thus, following the same procedures as SAFETY's. Total elasticity for AWARE could be found by calculating AWARE's total effect first:

$$(12) \quad \frac{\partial FE}{\partial AWARE} = \frac{\partial f}{\partial AWARE} = 1.81$$

The results report that consumers who can tell farm-raised from wild fish have a 1.81 higher purchase frequency per month relative to consumers who cannot. Then evaluated at sample means of FE (6.60), the percentage increase is 27.4%. The corresponding total semi-

elasticity of purchase frequency with respect to AWARE is 27.4. The monthly purchase frequency of consumers who are aware of farm-raised fish is 27.4% higher than consumers who are unaware, all else equal.

Total Elasticity for AD, EDU and FORM

The foregoing discussion focuses on the variables that impact the frequency direct at least. However, EDU, FORM and AWARE have only indirect relations with consumers' behavior.

Firstly, the total effect of advertising on behavior can be found by taking the partial derivatives of equations (6) – (8) with respect to AD to yield:

$$(13) \frac{\partial FE}{\partial AD} = \frac{\partial f}{\partial SAFETY} \frac{\partial SAFETY}{\partial AD} + \frac{\partial f}{\partial AWARE} \frac{\partial AWARE}{\partial AD} = 6.06(0.068) + 1.81(-0.179) = 0.088.$$

Consumers who are responsive to advertisements when purchasing have a 0.088 higher purchase frequency per month relative to consumers who are unresponsive, all else equal. Evaluated at sample means, the percentage increase is 1.33%. The total semi-elasticity of purchase frequency with respect to AD is 1.3. The tiny response is due to the offsetting effects of ad responsiveness on awareness and safety.

Secondly, FORM's total effect can be found by taking the partial derivatives of equations (6) and (7) with respect to AWARE and FORM, respectively:

$$(12) \frac{\partial FE}{\partial FORM} = \frac{\partial f}{\partial AWARE} \frac{\partial AWARE}{\partial FORM} = 1.81 * 0.191 = 0.346$$

Consumers who prefer to purchase fresh aquatic food have a 0.346 higher purchase frequency per month than consumers who do not. Combined with the sample means of FE, the percentage increases by 5.2%. Then the total semi-elasticity of purchase frequency with respect to products forms is 5.2. The monthly purchase frequency of consumers who prefer the fresh fish is 5.2% higher than consumers who prefer processed fish, all else equal.

Last, EDU is a continuous variable. The procedure could follow the steps to compute the income elasticity. Its total effect can be figured out by taking the partial derivatives of equations (6) and (8) with respect to SAFETY and EDU, respectively:

$$(12) \frac{\partial FE}{\partial EDU} = \frac{\partial f}{\partial SAFETY} \frac{\partial SAFETY}{\partial EDU} = 0.224$$

Specifically, the effect indicates that monthly purchase frequency increases by 0.224 per one unit increase in the educational level of the respondent. The average purchase frequency is 6.60 times per month and the average education level is 3.70 (table 1). Thus, one unit increase in education (from 3.70 to 4.70) represents a 27.0% increase in education when evaluated at the sample mean. A 0.224 unit increase in purchase frequency (from 6.60 to 6.82) represents a 3.39% increase in purchase frequency. Dividing these percentages, the total elasticity for education is yielded of 0.13. Therefore, a 1% increase in the educational level of the respondent is expected to increase monthly purchase frequency by 0.13%, all else equal.

The elasticities are summarized in Table 7. The most important drivers of fish consumption (as measured by purchase frequency) are SAFETY, SPLACE and AWARE.

Table 7. Total Elasticities for the Main Drivers of Fish Consumption

Driver	Elasticity
<i>SAFETY</i>	92
<i>SPLACE</i>	41.4
<i>AWARE</i>	27.4
<i>INC</i>	0.61
<i>EDU</i>	0.13
<i>AD</i>	1.33
<i>FORM</i>	5.2

Discussion and Conclusion

The econometric model with 5 equations linking awareness to consumers' belief and behavior yields insights into the literature of influencing factors for aquatic products' demand. The following empirical research about the extent of the effect on consumers' behavior by different significant variables' total elasticities revealed direct results to solve the question of "Which factor could provide bigger stimuli to increase the consumption?". The results suggest consumers' awareness (i.e., the ability to distinguish between farmed and wild fish) impacted the purchase behavior directly via the improvement of perception. However, the research suggests that no significant sign indicated the awareness could apply influence on consumers' belief to affect their purchases indirectly, but its indirect effect can be measured by its semi-elastic of 27.4. In turn, consumers' belief about safety toward aquatic products provided a stimulus to more purchases and the factor had the strongest effect on the incremental among total semi-elasticities (92) of purchase frequency with respect to different variables.

Some socioeconomic variables indicate their effects on consumers' behavior, which proves consumers' behavior is quite complicated. In particular, the research suggests relative advertisements had a comprehensive effect on consumer's behavior indirectly. The spreading of ads not only enhanced consumer's awareness for aquatic products, but also recalled their consciousness of products' quality. Nevertheless, ads' total indirect impact's semi-elastic is 1.33, which is weaker than other variables with semi-elasticities. The belief factor could also boost purchases concluded above. Therefore, the appropriate spread of ads for business is a positive way to expand consumers' relative demand.

Meanwhile, like consumers' income level and shape requirement for fresh products, the

results suggests that both of them indirectly affected consumers' purchase frequency positively via improving their awareness. What is more, consumers' income level also helped increase the consumption from a direct side. Moreover, from the aspect of total elastic, income level has a higher influence on behavior than education level (0.61 to 0.13). It can be concluded that money is still one of the most important motivators to stimulate consumption. On the other hand, peddler's market also guided consumers to increase their consumption because of its lower price. Thus, the circulation channel construction could not be underestimated by policy makers.

In conclusion, awareness plays an important role in terms of mediating the relationship between consumers' beliefs and their purchasing behaviors, although it is difficult to conclude that awareness had a strong effect on consumers' beliefs to increase their purchase frequency through changing consumers' attitudes. Meanwhile, besides awareness, shopping-place options and the safety factor are the main drivers to promote the purchase. Thus, policy makers could follow the insight of some other influencing factors (e.g., some significant socioeconomic variables from the results) to improve consumers' awareness or guide their attribute rating directly to expand the market demand. Moreover, those factors are very important because markets are dynamic, subject to rapid change of consumer preference, income level and price of products or substitute. Therefore, it is more scientific to observe the market as a whole system with many factors correlating together.

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Appendix A

Questionnaire code

Investigator name:

Questionnaire of Consumption of Aquatic Product for Urban Residents.

Investigation Place:

Province:

City:

District:

Street:

Date:

Respondent:

Phone number:

January, 2013

A. Consumers' behavior.

1. Compared with meat, do you prefer to consumer aquatic food in 2012? (1=Yes; 2=No; 3=No care) ; If so, what's the reason (Multiple choice).
2. Compared with meat, do you prefer to consumer aquatic food in 2007? (1=Yes; 2=No; 3=No care) ; If so, what's the reason (Multiple choice).

The reason for preference: 1=Nutrition; 2=Safety; 3=Habit; 4=Price; 5=Vanity; 6=other (text description).

3. Which factor do you consider mostly when you purchase aquatic products in 2012? (single choice)
4. Which factor do you consider mostly when you purchase aquatic products in 2007? (single choice)

The reason for purchase : 1=Price; 2=Brand; 3=Size; 4=Freshness; 5=Convenience for cooking ; 6=Safety; 7=Pack; 8=Other (Text)

5. Place "√" on the blank for your answer.

Question	2012		2007	
	Yes	No	Yes	No
1) Could you distinguish between fresh water or sea water products?				
2) Do you care they are fresh water or sea water products?				
3) Could you distinguish between farm-raised or fishing products?				
4) Do you care they are farm-raised or fishing products?				

6. Do you care whether the products are organic in 2012 ? (1=Yes; 2=No)

7. Do you care whether the products are organic in 2007? (1=Yes; 2=No) .
 Would you like to pay higher for organic products in 2012? (1=Yes; 2=No) , .
 If so, how many times can you accept for the price in 2012? (1= 1/2 time; 2=one time; 3=two times; 4=above two) .
 Would you like to pay higher for organic products in 2007? (1=Yes; 2=No) , .
8. If so, how many times can you accept for the price in 2007? (1= 1/2 time; 2=one time; 3=two times; 4=above two) .
9. Have your family tried imported aquatic products in 2012? (1=Yes; 2=No) ; If so, what is the reason? (multiple choice) .
 Have your family tried imported aquatic products in 2007? (1=Yes; 2=No) ; If so, what is the reason? (multiple choice) .
- The reason for imported products:** 1=no production in domestic area; 2=Better safety ; 3=Better quality ; 4=Vanity; 5=Other (Text) .
10. Your shape requirement of aquatic products in 2012: (multiple choice) .
 Your shape requirement of aquatic products in 2007: (multiple choice) .
- Shape of requirement:** 1=Original (e.g. no processing) ; 2=Primary processing (e.g. no organs) ; 3=Deep processing (e.g. scrod) ; 4=Surimi (e.g. fish ball) ; 5=Precooked products (canned fish) ; 6=Other (Text) .
11. How much(RMB) and how often did you purchase aquatic products monthly in 2012? ; The proportion of the payment in total food expenditure? %; .
 How much(RMB) and how often did you purchase aquatic products monthly in 2007? ; The proportion of the payment in total food expenditure? %; .
12. Would you be affected by ads when purchasing aquatic products? (1=Yes; 2=No) .

B. Consumer behavior.

1. Kinds of aquatic products which you bought.

Kind	2012	2007
	The proportion in total purchase quantity (%) .	The proportion in total purchase quantity (%) .
1) Fish	.	.
2) Shrimp	.	.
3) Shellfish	.	.
4) Algae	.	.
5) Mollusca	.	.
6) Other (Text) .	.	.

2. Did you or your family try squid before? (1=Yes; 2=No(skip to next question)) ; Where was the place? (multiple choice) .
 The reason that you did not choose to consume squid at home? (multiple choice) .
 If you buy some squid to be consumed at home, what is your shape of requirement? (multiple choice) .

Places: 1=Home; 2=Hotel; 3=Restaurant; 4=Canteen; 5=Other (Text) .

Reason of no consumption at home: 1=Do not know how to process; 2=Troublesome; 3=Do not know how to cook; 4=Other (Text) .

Shape of requirement: 1=Original (e.g. no processing) ; 2=Primary processing (e.g. no organs) ; 3=Deep processing (e.g. scrod) ; 4=Surimi (e.g. fish ball) ; 5=Precooked products (canned fish) ; 6=Other (Text) .

3. Please rank the importance of places where you bought aquatic products in 2012. .
 Please rank the importance of places where you bought aquatic products in 2007..

Places: 1=Peddler market; 2=Supermarket; 4= specialty stores; 5=Online; 6=Other (Text)

4. The proportion of consumption quantity of aquatic products among different consuming places.

	2012	2007
	The proportion of the quantity to total (%)	The proportion of the quantity to total (%)
1) Home		
2) Hotel		
3) Restaurant		
4) Canteen		
5) Other(Text)		

C Basic information of respondents.

- For 2012:What was your household size (live together more than six months one year) ? ; What is your education level? ; What is your age? What is your gender= (1=Male, 2=Female) .
- For 2012, what is your monthly family income level(RMB)? ; What is your occupation (Text description) .

Education level: 1=illiteracy; 2=Primary school; 3=Middle school; 4=High school; 5=Bachelor ; 6=Master ; 7=PHD.
 Income level: 1=Below 1000; 2=1000-3000; 3=3000-5000; 4=5000-7000; 5=7000-10000; 6=10000-15000; 7=15000-20000; 8=Above 20000.