Factors Affecting the Decision Process of Catfish Consumers: An Empirical Study in the Two Biggest Cities in Vietnam

Master thesis in International Fisheries Management

(30 credits)

By

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Cover pictures

Large picture: The cages for catfish farming on the Mekong River, Viet Nam (Source: Le Tran Phuc)

Small picture: Catfish (Source: http://www.globefish.org/index.php?id=3392)

Abstract

The consumption of catfish in Vietnam has not grown enough to match their increased production. The objective of this study is to explore the factors that influence the decision process of catfish consumers in Vietnam. The findings provide information for the Vietnamese catfish industry to better attract more domestic consumers to eat catfish. This study seeks to address its objective by examining the relationships that exist between the experiences, perceptions of product attributes, preference, market constraints, and consumption levels of consumers for catfish products. Non-catfish consumers are also investigated. Data collected in the two biggest cities in Vietnam is analyzed by using multivariate techniques based on a partially-recursive model. Factors such as age, region, ease of preparation, perceptions of catfish taste, odour, and fat along with beliefs that catfish are available, safe and inexpensive are found to significantly influence the decision-making process.

Key words catfish, decision process, experience, perception, preference, market constraint, consumption level.

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Tromsø, May 15th 2007

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1. INTRODUCTION

Catfish have been regarded as one of the most popular scaleless fishes in Vietnam. There are two main catfish species cultured in Vietnam, the “tra” catfish *Pangasius hypophthalmus* and the “basa” catfish *Pangasius bocourti.* They are raised mainly in river cages or ponds by small-scale farmer along the Mekong River. Low production cost and opened export market opportunities are the main reasons for the recently rapid growth of catfish output. In the previous nine years (1997-2005), catfish production increased impressively from 22 000 tonnes to 376 000 tonnes (FAO Globefish, 2006). With an estimated 1 million tonnes in 2007, the Vietnamese catfish industry will be ahead of the Norwegian salmon or Chilean salmon industry. Following the positive production direction, catfish export has also increased strongly and contributed more than US$700 million to the Vietnamese economy in 2006 (FAO Globefish, 2007).

Attention to the domestic consumption of catfish hadn’t been paid until the imposition of anti-dumping tariff in the U.S. market in relation to catfish from Vietnam in 2003. Many enterprises and farmer faced the threat of a reduced market share in the US, which was the biggest importer of Vietnamese catfish. In order to adapt to the changed market conditions, the catfish producers have switched to other export markets and expanded the domestic market.

However, more attention has been paid to export markets and catfish still hasn’t found much of a place in the domestic market. According to information released by catfish processing businesses in 2004, there were only 10% of the catfish output consumed domestically. Catfish consumption accounted only for about 1.2 percent of the total average fish consumption per person in Vietnam in 2004. Reasons are varied, but market observers believe that the main reasons are the high price and the poor marketing (Vietnamnews, 2004).

With a population of more than 80 million, the domestic market for catfish has much unexploited potential. Expanding the domestic catfish market will not only provide an improvement of the food consumption pattern for millions of Vietnamese people but also protect catfish producers from the risk of unstable international markets. Marketing and demand research on catfish products is a prerequisite for achieving this.

Marketing and demand analysis for the seafood industry and aquaculture has become critical due to their international, dynamic and heterogeneous characteristics (Anderson, 1995). Over the past few years, there have been a number of studies exploring different characteristics of seafood marketing. These studies have addressed issues such as the relationship between price and product attributes (Carroll, Anderson, & Martinez-Garmendia 2001; Wang & Kellogg, 1988); the conjoint analysis of the specific species (Anderson & Bettencourt, 1993; Harrison, Ozayan, & Meyers, 1998); seafood safety and health considerations (Lin & Milon, 1993; Trondsen, Braaten, Lund, & Eggen, 2004); preferences for ecolabled seafood (Wessells, Johnston, & Donath, 1999); relationship between economic factors and seafood demand (Cheng & Oral Capps, 1988), impact of socio-economic, demographic, lifestyle and attitudinal factors on seafood consumption (Foltz, Dasgupta, & Devadoss, 1999; Gempesaw, Bacon, Wessells, & Manalo, 1995; Herrmann, Rauniyar, Hanson, & Wang, 1994; Kinnucan & Nelson, 1993; Myrland, Trondsen, Johnston, & Lund, 2000) among others.

Marketing and demand analyses for catfish have mainly been conducted in the United States. The descriptive statistical results from the national surveys of catfish consumers in the U.S. were presented by Engle, Carpps, Dellenbarger, Dillard, Hatch, Kinnucan, & Pomeroy (1990) for the survey conducted in 1988 and by House, Hanson, Sureshwaran, & Selassie (2003) for the survey conducted in 2000-2001. Previous studies regarding the impact of socio-economic and demographic factors on the choice of catfish consumers have focused on the following: expenditure on catfish (Dellenbarger, Luzar, & Schupp, 1988); probability of restaurant catfish consumption (Israel, Kahl, & Pomeroy, 1991); probability of catfish consumption at home and away from home (Dellenbarger, Dillard, R.Schupp, O.Zapata, & T.Young, 1992); catfish product types (Dellenbarger, Schupp, & August, 1996), among others. Kinnucan & Venkateswaran (1990) investigated the effects of catfish advertising on product awareness, beliefs, attitude, and consumption level. Catfish preference of restaurateurs from stated choice data were examined by Quagrainie & Engle (2006).

Most of the previous seafood marketing studies in Vietnam concerned only the general seafood consumption and were primarily descriptive in nature, e.g. Anrooy (2003), Lem, Tietze, Ruckes, & Anrooy (2004). In particular, there has been no research formally exploring the factors influencing the choice behaviour of catfish consumers in

Vietnam. Research and development programmes promoting catfish culture have been dominated by biological considerations, with little attention directed towards the marketing. Lack of knowledge about the consumer choice behaviour is an impediment to the formulation of successful marketing strategies that augment the domestic catfish consumption.

This study aims to examine the crucial factors affecting the decision process of catfish consumers. This question is addressed by analyzing the relationships that exist between the experiences, perceptions of product attributes, preference, market constraints, and consumption levels of catfish consumers. It is interesting for the catfish marketers to know who don't eat catfish, thus the non-catfish consumers are also investigated. A survey of catfish consumers was conducted in the two biggest cities in Vietnam, Ha Noi and Ho Chi Minh City. The survey data is analyzed by using multivariate techniques based on a partially-recursive model. The findings of this study are aimed at assisting those who wish to encourage the marketing of catfish in Vietnam, particularly in urban areas.

The next part of the thesis begins by discussing the theoretical approach which includes the literature review and the conceptual framework. The methodology section covers the description of the data set applied, the basis of the models used, and the data analysis. The results and discussion are presented in the following section. The thesis ends with the conclusion part which summarizes the study findings.

2. THEORETICAL APPROACH

2.1. Literature review

Traditional demand analysis has focused on explaining the relationships between quantity demanded and its determinants. The main attention is to determining consumer response to income and price changes. These studies are based on the neo-classical model in which the consumer choice is determined by preference and constraints. Constraints are defined to include the consumer's income and market prices while preferences are regarded as fixed and static (Stigler & Becker, 1977). The application of traditional demand analysis based on generally available, secondary, aggregated market data is inadequate to address a wide range of marketing research problems involving consumer behaviour. These problems could be solved by modelling explicitly the cognitive mechanisms that govern consumer behaviour and using survey data on consumer attitudes, perceptions and intentions to fit this model.

The "lens" model developed by Hauser & Simmie (1981) also determines consumer choice by preference and constraints but preferences are suggested as changeable and to be formed in a sequential manner as showed figure 1.

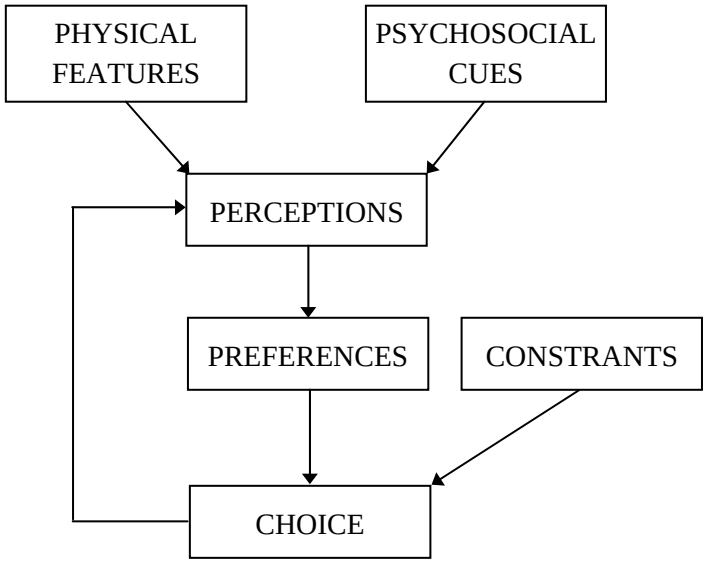

Figure 1. *Simplified "lens" model of consumer decision making (Hauser & Simmie, 1981, p.36)*

Preferences in the “lens” model are considered endogenous, influenced by consumer perceptions of product characteristics. Perceptions are affected by the physical characteristics of the product, such as size and colour and by psychosocial cues, such as advertising and peer pressure. Perceptions are also influenced by choice. This means that the consumer may change his/her perceptions and therefore preferences depending on the choice situation.

Another theoretical structure of consumer choice behaviour considering cognitive mechanisms was proposed by McFadden (1986). Figure 2 gives a path diagram for the decision – making process. Terms in white boxes are observed directly or measured by suitable experiments, while shaded boxes are theoretical or latent variables.

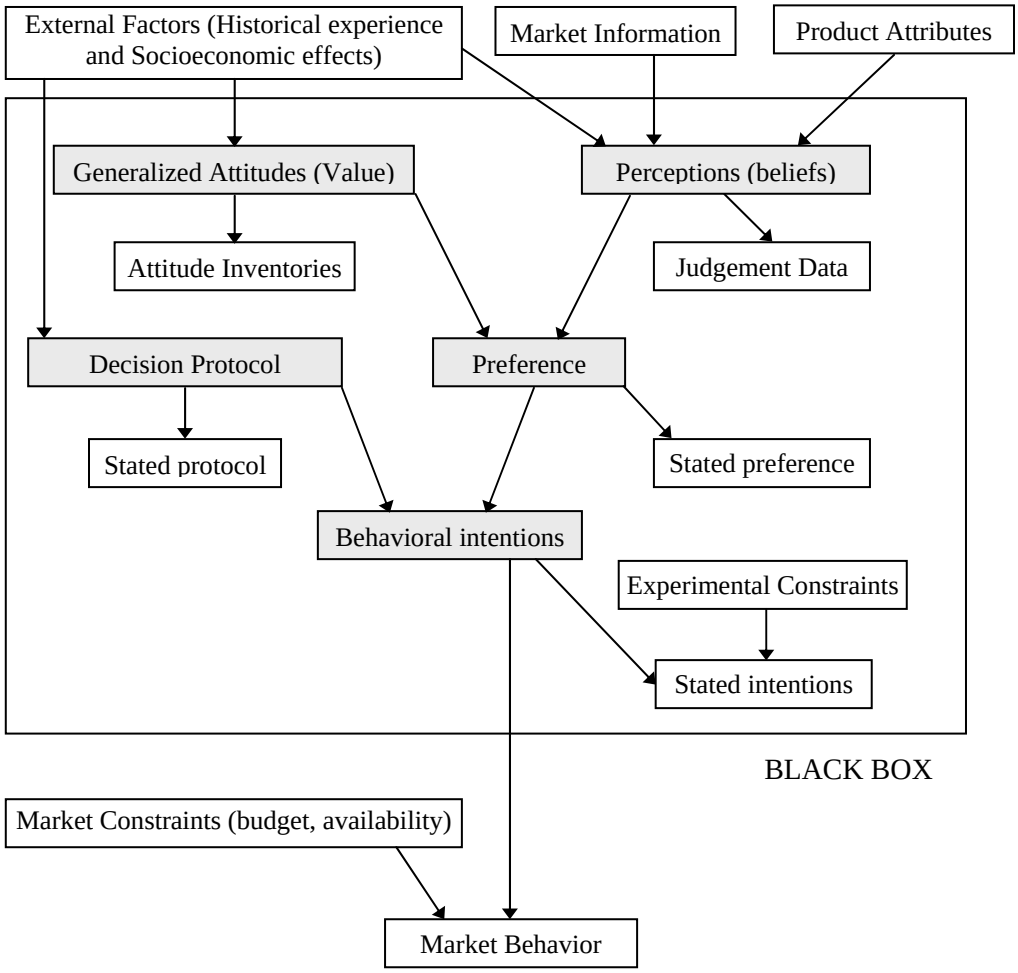

Figure 2. *Path diagram for the consumer decision process (McFadden, 1986, p.276)*

Terms outside the “black box” which can be obtained from available market data have been used in economic choice theory to produce market demand forecast. The consumer is treated as an “optimizing black box”. The direct measurable inputs to the decision process are product attributes, information from marketing programs and other sources, historical experiences, socioeconomic factors, and market constraints, including budget and product availability. Measurable output of the process is market behaviour which can be product purchases, brand switching, etc.

The impacts on demand of innovative product designs or marketing programs however could not be addressed without delving into the inner workings of the “black box”. Cognitive decision process was modelled by some crucial constructs. They are perceptions or beliefs regarding products, generalized attitudes or values, preference among products, decision protocols that map preference into choices, and behavioural intentions for choice. For example, the purchaser of a package of frozen fish may have perceptions of the nutrition value of alternative species, attitudes regarding the importance of nutrition, preference among specific species, a protocol to maximize preference taking into account the opportunities cost of the money spent for the product, and a behaviour intention to choose a specific species.

Perceptions regarding products are affected by market information and product attributes. Generalized attitudes, decision protocol, and perceptions are all influenced by historical experiences and socioeconomic effects. Preferences among products depend on generalized attitudes and perceptions. Decision protocol and preference together determine behaviour intentions which lead to final choice taking into account of market constraints.

In the model of McFadden (1986), the choice is not permitted to affect perceptions and therefore the perception and preference constructs are clearly defined, make it more easy to operate compared to the “lens” model. The underlying assumption of this choice model is that utility or preferences are random and the market behaviour is determined by maximizing preference. Preference might contain random components due to fluctuations in perceptions, attitudes, or other unmeasured factors.

In seafood consumption research, it is suggested that consumers’ preference for seafood do change over time (Edwards, 1992). Seafood markets have been increasingly diverse

with the vast array of species and their origins, along with many different product forms. As a result, seafood preferences have become more diverse and therefore the knowledge of these differences can improve understanding of seafood demand and lead to more effective allocation of marketing resources (Kinnucan & Nelson, 1993).

Over the past few years, there have been some seafood consumption studies that examined the consumer decision process in which the structure of consumer preferences was investigated. Kinnucan & Nelson (1993) introduced the concept of evoked sets to analyze preference formation and consumption behaviour for seafood products, including shrimp, lobster, catfish, scallops, flounder, and salmon. Engle & Kouka (1995) used a simplified structural model of consumer choice to investigate the consumer preference and purchase decisions for canned bighead carp product. Nauman, Gempesaw, Bacon, & Manalo (1995) employed a modified evoked set framework to analyze the relationships between consumer's experiences, perceptions, preference, and the decision to purchase fresh hybrid striped bass, trout and salmon. Myrland et al., (2000) based on the evoked set framework to assess the influence of socioeconomic and demographic factors, consumption of other dinner dishes, lifestyle variables, and attitudes towards seafood on the consumption of three major seafood categories.

2.2. A conceptual framework

The present study investigates the decision-making process of catfish consumers using a partially-recursive conceptual model consisting five sets of equations specified as follows:

$$\text{Experiences} = f(\text{Demographic factors}) \quad (1)$$

$$\text{Perceptions} = f(\text{Demographic factors, Experiences}) \quad (2)$$

$$\text{Preference} = f(\text{Demographic factors, Experiences, Perceptions}) \quad (3)$$

$$\text{Market constraints} = f(\text{Demographic factors}) \quad (4)$$

$$\text{Consumption levels} = f(\text{Demographic factors, Market constraints, Preference}) \quad (5)$$

The underlying assumption of this model is that experiences of catfish lead to perceptions of catfish attributes. Experiences together with perceptions determine preference for catfish. Consumption levels are assumed to be explained by preference and market constraints. Experiences, perceptions, preference, market constraints, and

consumption levels are all influenced by demographic factors. The structure of choice behaviour of catfish consumers are illustrated in figure 3.

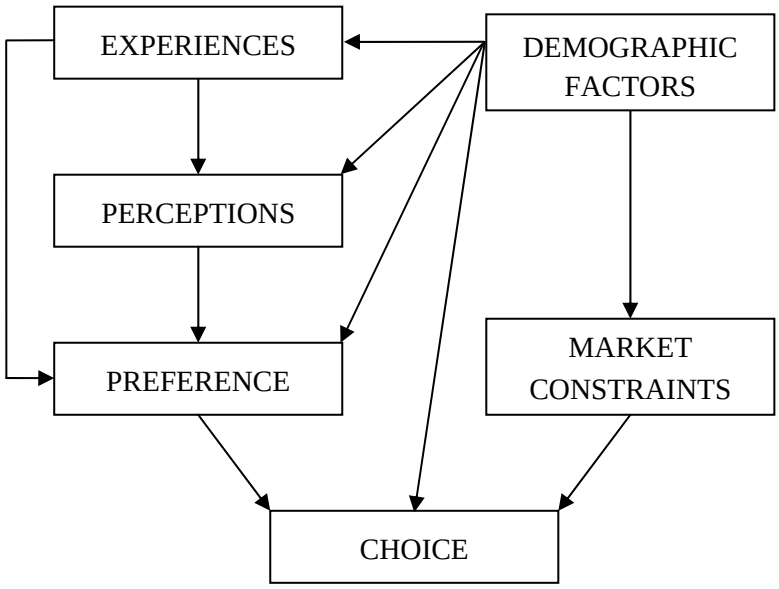

Figure 3. *A conceptual model for the decision process of catfish consumers*

Consumer decision-making formed in the manner that experiences with the product lead to beliefs about product attributes, which lead to preference, which, in turn, leads to consumption follows the evoked-set frame work in the study of Kinnucan & Nelson (1993) while the presence of market constraints at the final stage when a choice is made is consistent with the "lens" model (Hauser & Simmie, 1981) and the choice model of McFadden (1986).

Experience variables used in some previous studies was often defined as the frequency of seafood or fish purchases, e.g. Gempesaw et al., (1995), Kinnucan & Nelson (1993), Nauman et al., (1995). The experience variables used in the present study are related to catfish product and are attitudinal variables. They are defined as the consumer's rating of the ease of preparation and her family habit of eating catfish. The perceptions of catfish attributes are measured by the consumer's rating of catfish taste, odour, nutrition and fat.

The consumer's rating of catfish compared to other seafood is used as the preference variable. There have been some other ways of preference construction. Kinnucan &

Nelson (1993) measured preference as a binary variable indicating whether a particular seafood item appears in the consumer's evoked set which is determined as the products a consumer considers in a choice situation. Gempesaw et al., (1995) and Nauman et al., (1995) determine preference by using the ratio of the number of persons in the household eating a particular species relative to the total number of persons in the household. Myrland et al., (2000) used the ratio of fish meal to total dinner consumption to determine preference. These approaches are based on the respondent's actual choice and hence preference in these studies is a behavior-related variable (Myrland et al., 2000). The construction of preference variable in the present study is similar to the research of Kinnucan & Venkateswaran (1990). Rating catfish compared to other seafood is not based on the actual choice but related to the attitude of the consumer towards catfish. Therefore, preference in the present study is an attitudinal variable.

While constraints indicated in the lens model (Hauser & Simmie, 1981) and the choice model of McFadden (1986) can be measured directly from market data, market constraints used in the present study are measured as the consumer's rating of catfish availability, safety and price. It is not unreasonable to say that "I like catfish very much compared to other seafood but because it is not available, or it is not safe, or it is too expensive that I don't eat catfish frequently". The consumption levels of catfish are represented by the frequency of eating catfish and the last time eating catfish. These variables are measured on rank ordinal categories.

In addition, non-catfish consumers are also examined by the following equation:

Non-consumers = f (Demographic factors) (6)

The incidence of not eating catfish is hypothesized to be influenced by demographic factors. The non-catfish consumers are measured by two binary variables indicating whether a consumer has eaten catfish and whether a consumer has eaten catfish once then stopped eating.

3. METHODOLOGY

3.1. Data

In order to gather information regarding the choice behaviour of catfish consumers, a survey was conducted in the two biggest cities in Vietnam, Ha Noi and Ho Chi Minh City in August 2006. The survey queried respondents about socioeconomic and demographic characteristics, experiences, perceptions of product attributes, preference, market constraints, and the consumption levels of consumers for catfish products. The questionnaire was pre-tested prior to implementation to incorporate suggestions, clarify ambiguous questions, and deal with omitted items that may have bearings on consumers' attitudes. The final questionnaire was then conducted on 410 respondents, in which, 200 respondents were interviewed in Ha Noi and 210 respondents were interviewed in Ho Chi Minh City. The questionnaire and the responses description can be found in appendix 1 and 2, respectively.

A convenience sampling procedure was used to choose the sampled households, local markets and supermarkets in Ha Noi and Ho Chi Minh City. It was not possible to reach larger group of potential respondents because of the budget constraints to cover a lager geographic area. Given that the adult female is more likely to be the person who makes seafood purchase decision in Vietnam, only women aged 18 years or higher were interviewed.

The interview commenced by asking whether the respondent had ever eaten catfish. There were three possible answers: *No; Yes, but only once then stopped; Yes and still eating.* For respondents who have never eaten catfish or have eaten catfish once, interviewed questions simply included some demographic questions. Demographic information was collected including age, number of persons living in the household, number of old people and children in the household, education, occupation and the household monthly income.

The consumers' experiences about catfish and the perception of catfish availability were determined by asking the question: *Using a scale of 1 to 7, where 1 means strong disagreement and 7 means strong agreement, do you agree or disagree with the following statements? You may use any number in between.*

(a) My family has the habit of eating catfish (FAMILY)

(b) I find it easy to prepare a good meal with catfish (COOK)

(c) Catfish is available (AVAILB)

The consumers' beliefs of taste, odour, nutrition value, safety and price of catfish were determined by asking the respondent to assess these attributes of catfish using a 7 point scale, where 1 means a negative attitude and 7 means a positive attitude. The consumers' perception of catfish fat was determined by asking the respondents to indicate how they like or dislike catfish fat using a scale of 1 to 7, where 1 means *dislike very much* and 7 means *like very much*. The respondents may use any number in between.

The consumer's preference for catfish was determined by asking the question: *On a 10 point scale where 1 means catfish is worst and 10 means catfish is best, how would you compare catfish to other seafood?*

The frequency of eating catfish was measured by the following question: *How often do you eat catfish?* The responses were grouped into five rank ordinal consumption categories:

(1) Less than twice per month

(2) 2 – 3 times per month

(3) 1 – 2 times per week

(4) 3 – 4 times per week

(5) More than 4 times per week

In order to have another variable representing the consumption levels of catfish, a question was asked to determine when the last time the respondent ate catfish. The responses were coded in the following five rank ordinal consumption categories:

(1) More than 3 weeks ago

(2) 2 – 3 weeks ago

(3) 1 week ago

(4) 3 – 6 days ago

(5) Less than 3 days ago

Definitions of the variables along with their corresponding sample mean values and standard deviations are presented in Table 1.

Table 1. *Definition of variables, sample means and standard deviations*

Variable name	Description	Mean	Standard deviation
NOCONS	1 if respondent hasn't consumed catfish yet; 0 otherwise	0.207	0.406
CONSONCE	1 if respondent has eaten catfish once then stopped eating; 0 otherwise	0.144	0.351
HANOI[a]	1 if respondent is in Ha Noi; 0 otherwise	0.448	0.500
HCMC	1 if respondent is in Ho Chi Minh City; 0 otherwise	0.512	0.500
AGE	Respondent age	35.217	10.671
HHSIZE	Household size	4.585	1.593
NOOLD	Number of old people in the household	0.468	0.699
NOCHILD	Number of children in the household	1.049	0.924
ELEMT	1 if respondent has an elementary education; 0 otherwise	0.079	0.265
HIGHS	1 if respondent has a high school education; 0 otherwise	0.254	0.436
COLED	1 if respondent has a college education or higher; 0 otherwise	0.667	0.472
OCCP_1	1 if respondent is blue collar, farmer, huckster, retired, student, or unemployed; 0 otherwise	0.322	0.468
OCCP_2	1 if respondent is a housewife; 0 otherwise	0.107	0.310
OCCP_3	1 if respondent is white collar; 0 otherwise	0.251	0.434
OCCP_4	1 if respondent is a professional or administrator; 0 otherwise	0.320	0.467
HHINC_1	1 if household income is 4 million dong per month or lower; 0 otherwise	0.354	0.416
HHINC_2	1 if household income is between 4.1 and 9 million dong per month; 0 otherwise	0.461	0.499
HHINC_3	1 if household income is more than 9 million dong per month; 0 otherwise	0.185	0.389
COOK	Respondent's rating of ease of catfish preparation (scale 1-7)	5.741	1.391
FAMILY	Respondent's rating of family habit of eating catfish (scale 1-7)	4.748	1.751
TASTE	Respondent's rating of catfish taste (scale 1-7)	5.771	0.892
ODOUR	Respondent's rating of catfish odour (scale 1-7)	5.211	1.318
NUTRITION	Respondent's rating of catfish nutrition (scale 1-7)	5.827	1.024
FAT	Respondent's rating of catfish fat (scale 1-7)	3.526	1.874
AVAILB	Respondent's rating of catfish availability (scale 1-7)	6.312	1.128

Table 1 *(Continued)*

Variable name	Description	Mean	Standard Deviation
SAFELCM	Respondent's rating of catfish safety in local market (scale 1-7)	4.846	1.208
SAFESPM	Respondent's rating of catfish safety in super market (scale 1-7)	6.109	0.927
PRICELCM	Respondent's rating of catfish price in local market (scale 1-7)	4.462	1.006
PRICESPM	Respondent's rating of catfish price in super market (scale 1-7)	3.812	1.083
PREF	Respondent's rating of catfish compared to other seafood (scale 1-10)	6.590	1.390
FREQUENCY	Frequency of eating catfish 0, Less than twice per month; 1, 2-3 times per month; 2, 1-2 times per week; 3, 3-4 times per week; 4, More than 4 times per week	1.722	1.041
LASTIME	Last time eating catfish 0, More than 3 weeks ago; 1, 2-3 weeks ago; 2, 1 week ago; 3, 3-6 days ago; 4, Less than 3 days ago	2.511	1.289

[a] Variables in italics represent omitted categories in the respective econometric equations.

3.2. Logit model and ordered probit model

In recent decades, survey data have been increasingly used in consumption research. These data are related to the consumers' attitudes, behaviours, characteristics, and decisions. They are measured in discrete, nominal, ordinal, or in short, noncontinuous way. Linear regression technique which requires a continuous dependent variable is not appropriate for the analysis of these data. Therefore, qualitative variable models are increasingly popular in applied econometric consumer modelling. The following text presents the general structure of the logit and the ordered probit regression models which are used in the present study to analyze the behaviour-related variables.

3.2.1. Logit model

For binary dependent variable, logit regression technique is employed. In order to describe this model, an underlying response variable y_i^* is assumed to be defined by the regression relationship:

$$y_i^* = \beta x_i + u_i \qquad (1)$$

where y_i^* is a latent unobservable dependent variable, x_i are the independent explanatory variables, β are the unknown slope parameter to be estimated, and u_i is the error term. Instead of observing y_i^*, the binary variable y_i is observed and assumes values of either '0' or '1' and

y = 1 if $y^*>0$

y = 0 otherwise

The analytical form of the logit model which is based on the cumulative logistic probability function where the probability that a consumer makes a certain choice given the consumer's attributes is specified as follows:

$$P_i = F(z_i) = F(\beta x_i) = \left[\frac{\exp(z_i)}{1+\exp(z_i)}\right] \qquad (2)$$

where P_i is the probability that $Y_i = 1$, $F(\beta x_i)$ is the cumulative probability function and z_i is a theoretical choice index, which is determined by explanatory variable x_i.

From equation (2), we can easily derive the probability of $Y_i = 0$ as follows:

$$(1-P_i) = [1-F(z_i)] = \left[1-\frac{\exp(z_i)}{1+\exp(z_i)}\right] \qquad (3)$$

Dividing equation (2) by equation (3) and taking natural log on both sides, we finally have the following for logit model:

$$\ln\left(\frac{P_i}{1-P_i}\right) = z_i = \beta x_i \qquad (4)$$

The dependent variable in equation (4) is called log-odds ratio that is the natural logarithm of the odds (the ratio of expressing the probability) that a particular choice is made. The estimated coefficient β reflects the effect of a change in an independent variable x_i on log-odds ratio.

Marginal effect of the independent variable on the probability of the event is expressed as the partial derivative of probability with respect to x_i. The effect is given by the following equation:

$$\frac{\partial P_i}{\partial x_i} = \frac{\exp(z_i)}{\left[1+\exp(z_i)\right]^2}\beta = P_i(1-P_i)\beta \qquad (5)$$

3.2.2. Ordered probit model

The ordered probit model is another natural extension of the binary-outcome model, built around a latent regression as equation (1). What we do observe is:

y = 0 if $y^* \le \mu_0$

y = 1 if $\mu_0 < y^* \le \mu_1$

y = 2 if $\mu_1 < y^* \le \mu_2$

. . .

y = J if $\mu_{j-1} < y^*$.

where y is observed as ordinal dependent variable, which has J+1 categories, and μ are unknown threshold parameters separating the adjacent categories to be estimated with β. The general form for the probability that the observed y falls into category J is:

$$P(y_i = j) = \Phi(\mu_j - \beta x_i) - \Phi(\mu_{j-1} - \beta x_i) \qquad (6)$$

where β and μ are to be estimated with a probit model, Φ is the normal cumulative distribution function. In order to have all probabilities to be positive, we must have:

$$\mu_0 < \mu_1 < \mu_2 < \ldots < \mu_{j-1}$$

The first threshold parameter μ_0 is typically normalized to zero so that we have J-1 number of μ to estimate. Marginal effect of the explanatory variable on the probability of an event $y_j = j$ is given by the following equation:

$$\frac{\partial P(y_i = j)}{\partial x_i} = \left[\Phi\left(\mu_{j-1} - \beta x_i\right) - \Phi\left(\mu_j - \beta x_i\right)\right]\beta \qquad (7)$$

3.3. Model specification

In the present study, in order to avoid the problems associated with using ordinal-scale data in regression analysis, the attitudinal variables of experiences, perceptions, market

constraints and preference are considered as interval variables. This allows using linear regression technique to analyze these variables. The behaviour-related variables regarding non-consumers and consumption levels are analyzed by qualitative variable models.

Linear regression models for Experiences

To investigate how demographic factors influence experiences, linear regression technique is used. The equation for experiences models is specified as:

$$E_i = \beta_0 + \beta_1 \text{HCMC} + \beta_2 \text{AGE} + \beta_3 \text{HHSIZE} + \beta_4 \text{NOOLD} + \beta_5 \text{NOCHILD} + \beta_6 \text{HIGHS} + \beta_7 \text{COLED} + \beta_8 \text{OCCP\_2} + \beta_9 \text{OCCP\_3} + \beta_{10} \text{OCCP\_4} + \beta_{11} \text{HHINC\_2} + \beta_{12} \text{HHINC\_3} + e$$

where E_i measures the respondent's experiences of catfish (i = COOK, FAMILY) and e is the random error term.

Linear regression models for perceptions

The perceptions of catfish attributes are investigated using linear regression models specified as follows:

$$B_j = \beta_0 + \beta_1 \text{HCMC} + \beta_2 \text{AGE} + \beta_3 \text{HHSIZE} + \beta_4 \text{NOOLD} + \beta_5 \text{NOCHILD} + \beta_6 \text{HIGHS} + \beta_7 \text{COLED} + \beta_8 \text{OCCP\_2} + \beta_9 \text{OCCP\_3} + \beta_{10} \text{OCCP\_4} + \beta_{11} \text{HHINC\_2} + \beta_{12} \text{HHINC\_3} + \beta_{13} \text{COOK} + \beta_{14} \text{FAMILY} + e$$

$$\text{FAT} = \beta_0 + \beta_1 \text{HHSIZE} + \beta_2 \text{NOCHILD} + \beta_3 \text{OCCP\_3} + \beta_4 \text{OCCP\_4} + \beta_5 \text{HHINC\_2} + \beta_6 \text{FAMILY} + e$$

where B_j measures the respondent's beliefs of catfish attributes (j = TASTE, ODOUR, NUTRITION). In order to have a statistically significant model, some insignificant variables were excluded for the FAT model using an F-test procedure.

Linear regression model for preference

Preference which is measured as the consumer's rating of catfish compared to other seafood is analyzed by a linear regression model specified as:

$$PREF = \beta_0 + \beta_1 HCMC + \beta_2 AGE + \beta_3 HHSIZE + \beta_4 NOOLD + \beta_5 NOCHILD + \beta_6 HIGHS + \beta_7 COLED + \beta_8 OCCP\_2 + \beta_9 OCCP\_3 + \beta_{10} OCCP\_4 + \beta_{11} HHINC\_2 + \beta_{12} HHINC\_3 + \beta_{13} COOK + \beta_{14} FAMILY + \beta_{15} TASTE + \beta_{16} ODOUR + \beta_{17} NUTRITION + \beta_{18} FAT + e$$

Linear regression models for market constraints

Linear regression models are used to determine the relationships between the market constraints on catfish consumption and demographic factors. The equations used for the market constraints are specified as follows:

$$M_k = \beta_0 + \beta_1 HCMC + \beta_2 AGE + \beta_3 HHSIZE + \beta_4 NOOLD + \beta_5 NOCHILD + \beta_6 HIGHS + \beta_7 COLED + \beta_8 OCCP\_2 + \beta_9 OCCP\_3 + \beta_{10} OCCP\_4 + \beta_{11} HHINC\_2 + \beta_{12} HHINC\_3 + e$$

$$PRICE = \beta_0 + \beta_1 HCMC + \beta_2 HHSIZE + \beta_3 HIGHS + \beta_4 OCCP\_4 + \beta_5 HHINC\_2 + \beta_6 HHINC\_3 + e$$

where M_k measures perceived market constraints on catfish consumption (k = AVAILB, SAFETY). In order to have a statistical significant model, some insignificant variables were excluded for the PRICE model using an F-test procedure. It is important to note that variable SAFETY is a factor constructed from the two high correlated variables, SAFELCM and SAFESPM. The same is applied for variable PRICE which is constructed from PRICELCM and PRICESPM.

Ordered probit models for consumption levels

Consumption levels of catfish are measured as the frequency of eating catfish and the last time eating catfish using ordinal consumption categories. Ordered probit models are employed to analyze consumption levels and specified as:

$$C_m = \beta_0 + \beta_1 AGE + \beta_2 HHSIZE + \beta_3 NOOLD + \beta_4 NOCHILD + \beta_5 HIGHS + \beta_6 COLED + \beta_7 OCCP\_2 + \beta_8 OCCP\_3 + \beta_9 OCCP\_4 + \beta_{10} HHINC\_2 + \beta_{11} HHINC\_3 + \beta_{12} AVAILB + \beta_{13} SAFETY + \beta_{14} PRICE + \beta_{15} PREF + e$$

where C_m measures catfish consumption levels (m = FREQUENCY, LASTIME). Due to highly correlated relationships between the region variable and the market constraints variables, HCMC was excluded for the consumption levels models in order to avoid multicollinearity problem.

Logit models for non-catfish consumers

In order to investigate non-catfish consumers, logit models are employed as follows:

$$N_n = \beta_0 + \beta_1 \text{HCMC} + \beta_2 \text{AGE} + \beta_3 \text{HHSIZE} + \beta_4 \text{NOOLD} + \beta_5 \text{NOCHILD} + \beta_6 \text{HIGHS} + \beta_7 \text{COLED} + \beta_8 \text{OCCP\_2} + \beta_9 \text{OCCP\_3} + \beta_{10} \text{OCCP\_4} + \beta_{11} \text{HHINC\_2} + \beta_{12} \text{HHINC\_3} + e$$

where N_n is a binary variable which determines the respondents who don't eat catfish (n = NOCONS, CONSONCE).

3.4. Data analysis

Descriptive statistics was used first to clarify all of the variables used in the study. Principle component analysis was employed in order to construct the variable SAFETY from the high correlated variables, perceive safety in local market (SAFELCM) and perceived safety in supermarket (SAFESPM). The same was applied for the variable PRICE which is constructed from perceived price in local market (PRICELCM) and perceived price in super market (PRICESPM). Factors and correlated variable loadings are presented in table 2.

Table 2. *Factors and correlated variable loadings*

PRICE		SAFETY	
Items	Factor loading	Items	Factor loading
Price at local market	0.879	Safety at local market	0.783
Price at supermarket	0.879	Safety at supermarket	0.783
Total variance explained	77.223%	Total variance explained	61.366%

Next, logistic regression, linear regression and ordered probit regression analyses were conducted to analyze the models in the study. All of the analyses were conducted using the statistical package SPSS version 14.0 and the econometric software package LIMDEP version 8.0.

4. RESULTS AND DISCUSSION

The empirical results are shown in Table 3 to 14. The various measures of the model goodness of fit indicate that the estimated models fit the data reasonably well. The results are statistically significant at the 0.097 to 0.000 levels. All of the logit models have an overall percentage of correct predictions ranging from 71.8 to 85.6%. For the qualitative variable models, the discussion of the findings focuses on the change in marginal probabilities since the estimated coefficients of these models do not have straightforward interpretation.

4.1. Models for experiences

COOK model: Ease of preparation is found to be significantly influenced by the variables HCMC, AGE and HHSIZE (Table 3).

Table 3. *Linear regression results of experiences equations*

	COOK			FMHB		
Variables	Coefficient	*t*-ratio	*p*-value	Coefficient	*t*-ratio	*p*-value
Constant	4.459****	8.097	0.000	4.528****	6.246	0.000
HCMC	1.079****	5.534	0.000	0.803****	3.130	0.002
AGE	0.028****	3.251	0.001	0.005	0.423	0.673
HHSIZE	-0.098*	-1.568	0.118	-0.098	-1.183	0.238
NOOLD	-0.048	-0.375	0.708	-0.061	-0.362	0.718
NOCHILD	0.057	0.569	0.570	0.303***	2.289	0.023
COLED	-0.015	-0.044	0.965	-0.384	-0.890	0.374
HIGHS	-0.051	-0.149	0.882	-0.336	-0.749	0.454
OCCP_2	0.280	0.923	0.357	0.437	1.096	0.274
OCCP_3	-0.062	-0.253	0.801	0.073	0.225	0.822
OCCP_4	0.171	0.677	0.499	-0.063	-0.191	0.849
HHINC_2	-0.179	-0.873	0.383	-0.272	-1.007	0.315
HHINC_3	0.029	0.114	0.909	0.209	0.623	0.534
Summary statistics:						
R^2	0.178			0.095		
F	4.549			2.196		
Prob value	0.000			0.012		

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

Consumers in Ho Chi Minh City rate ease of preparation 1.079 score higher than do those_in Ha Noi, indicating that consumers in Ho Chi Minh City find it is easier to prepare a good meal with catfish. This can be explained that Ho Chi Minh city has a long tradition of eating catfish that the consumers there have more experience in cooking catfish. The catfish promotions in Ha Noi may need to focus on cooking skills.

Age is found to be positively related to the respondent's rating of ease of preparation. On average, an increase of 10 years in age enhances the consumer's rating of ease of preparation by 0.28. This may reflect the busy schedules of the younger generations who spend less time cooking. This suggests that cooking skills should be stressed for young people, particularly with quick and easy recipes. The other way is to develop value-added products that are easy to prepare.

An increase of one person in the household reduces the rate of ease of preparation by 0.098. This indicates that the number of persons in the household has a negative relationship with ease of preparation. A possible explanation is that respondents from larger households are less likely to contribute to cooking activities, and this may lead to their perception of catfish as difficult to prepare.

FAMILY model: The family habit model is found to be influenced significantly by the variables HCMC and NOCHILD (Table 3).

Consumers in Ho Chi Minh City give family habit of eating catfish 0.803 score higher than do those in Ha Noi. This may also reflect the fact that consumers in Ho Chi Minh City has a long tradition of eating catfish that people living there have more family habit of eating catfish. An increase of one child in the household enhances the consumer's rating of family habit by 0.303. This indicates that the presence of children in the household has a positive affect on the family habit of eating catfish.

4.2. Models for perceptions

TASTE model: Taste as a perceived attribute of catfish is significantly influenced by the variables AGE, NOOLD, COOK, and FAMILY (Table 4).

An increase of 10 years in age enhances the rate of catfish taste by 0.14. This indicates that the older the consumers are, the more they perceive catfish as tasty. The number of old people in the household is also found to be positively related to the score of catfish

taste. One more old person increases the rate of catfish taste by 0.117. This might be explained that the perception of catfish taste of a respondent may be positively affected by the perception of catfish as tasty from the old people living in the household. However, Kinnucan & Venkateswaran (1990) did not found any significant relationship between age and the consumer's rating of catfish flavour.

Both of the two experience variables are found to have positive impacts on the consumer's rating of catfish taste. An increase of one score rating of ease of preparation and family habit enhances the rate of taste by 0.156 and 0.124, respectively. This suggests that cooking skills should be stressed in promotional activities to improve the consumer's perception of catfish as tasty.

Table 4. *Linear regression results of taste and odour equations*

	TASTE			ODOUR		
Variables	Coefficient	t-Ratio	p-value	Coefficient	t-Ratio	p-value
Constant	3.864 ****	9.907	0.000	3.667 ****	5.933	0.000
HCMC	-0.030	-0.231	0.817	-0.073	-0.357	0.721
AGE	0.014 ***	2.498	0.013	0.014 *	1.617	0.107
HHSIZE	0.008	0.193	0.847	0.052	0.840	0.402
NOOLD	0.117 *	1.459	0.146	0.123	0.970	0.333
NOCHILD	-0.057	-0.913	0.362	-0.037	-0.376	0.708
HIGHS	0.020	0.101	0.920	-0.334	-1.034	0.302
COLED	-0.110	-0.520	0.603	-0.368	-1.098	0.273
OCCP_2	-0.073	-0.386	0.700	-0.029	-0.096	0.924
OCCP_3	-0.104	-0.686	0.493	-0.151	-0.626	0.532
OCCP_4	0.034	0.217	0.828	0.189	0.758	0.449
HHINC_2	0.036	0.279	0.780	-0.266	-1.315	0.190
HHINC_3	0.027	0.169	0.866	-0.304	-1.213	0.226
COOK	0.156 ****	3.688	0.000	0.222 ****	3.305	0.001
FAMILY	0.124 ****	3.846	0.000	0.014	0.267	0.790
Summary statistics:						
R^2	0.236			0.122		
F	5.506			2.472		
Prob value	0.000			0.003		

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

ODOUR model: The consumer's rating of catfish odour is found to be influenced positively by the variables AGE and COOK (Table 4).

The impact of the variable AGE on the odour rating is identical to one found in the TASTE model but with lower statistical significance. However, age was also not found to be significantly related to the consumer's rating of catfish odour in the study of Kinnucan & Venkateswaran (1990). The impact of ease of preparation is greater for the odour rating than for the taste rating. This would indicate that cooking skills demonstration should be included in marketing activities to enhance the consumer's rating of catfish odour.

NUTRITION model: Nutrition as a perceived attribute of catfish is influenced significantly by the variables HCMC, AGE, OCCP_2, OCCP_3, and FAMILY (Table 5). Kinnucan & Venkateswaran (1990) also found a significant relationship between region and the nutrition rating of catfish but others variables pertaining to age and occupation were not found having any relationship with the nutrition rating.

Table 5. *Linear regression results of nutrition equation*

	NUTRITION		
Variables	Coefficient	t-Ratio	p-value
Constant	4.565 ****	9.507	0.000
HCMC	0.424 ****	2.687	0.008
AGE	0.012 **	1.729	0.085
HHSIZE	-0.011	-0.230	0.818
NOOLD	0.065	0.662	0.509
NOCHILD	-0.069	-0.891	0.374
HIGHS	0.358	1.426	0.155
COLED	0.278	1.065	0.288
OCCP_2	-0.358 *	-1.543	0.124
OCCP_3	-0.318 **	-1.700	0.090
OCCP_4	-0.127	-0.655	0.513
HHINC_2	0.171	1.087	0.278
HHINC_3	0.131	0.672	0.502
COOK	-0.040	-0.761	0.447
FAMILY	0.138 ****	3.490	0.001
Summary statistics:			
R^2	0.123		
F	2.513		
Prob value	0.002		

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

Consumers in Ho Chi Minh City rate catfish nutrition value 0.424 score higher than do those in Ha Noi. This indicates that consumers in Ho Chi Minh City tend to have a higher evaluation of catfish nutrition value. Promotion of catfish products may want to emphasize nutrition value of catfish in Ha Noi. The impact of the variable AGE on nutrition rating is almost identical to those found in the TASTE and ODOUR models. The consumers who are housewives and white collar give catfish nutrition value 0.358 and 0.318 score, respectively lower than those who are blue collar, farmers, hucksters, retired, students, or unemployed. The influence of family habit is a little higher for the nutrition rating than for the taste rating.

FAT model: Liking fat of catfish is significantly influenced by the variables OCCP_4 and FAMILY (Table 6).

Table 6. *Linear regression results of fat equation*

Variable	Coefficient	*t*-Ratio	*p*-value
Constant	2.507 ****	4.798	0.000
HHSIZE	0.080	1.059	0.290
NOCHILD	-0.169	-1.217	0.225
OCCP_3	0.221	0.775	0.439
OCCP_4	0.421 *	1.540	0.125
HHINC_2	-0.295	-1.275	0.204
FAMILY	0.160 ***	2.409	0.017
Summary statistics:			
R^2	0.040		
F	1.810		
Prob value	0.097		

Note: *** p<0.05; ** p<0.1; * p<0.15

Consumers who are professional or administrator give catfish fat 0.421 score higher than those who are blue collar, farmers, hucksters, retired, students, or unemployed. Family habit of eating catfish is also play a positive role in the perception of catfish fat. An increase of one point rating of family habit enhances the fat rate by 0.16. It is worth noting that among the perceptions of catfish attributes, catfish fat gets the lowest mean score (3.526) and the highest standard deviation (1.874) (Table 1). There is 58.6% of the respondents showed negative attitude towards catfish fat. This suggests that catfish

producers may need to develop catfish products that are excluded fat to better attract consumers who have negative attitude towards catfish fat.

4.3. Model for preference

Factors having significant impact on the preference for catfish are NOOLD, NOCHILD, COOK, TASTE, ODOUR, and FAT (Table 7).

Table 7. *Linear regression results of preference equation*

Variable	Coefficient	t-Ratio	p-value
Constant	0.738	1.068	0.286
HCMC	-0.132	-0.737	0.462
AGE	0.005	0.594	0.553
HHSIZE	-0.003	-0.060	0.952
NOOLD	-0.186 *	-1.679	0.094
NOCHILD	0.142 *	1.633	0.104
HIGHS	-0.322	-1.138	0.256
COLED	-0.273	-0.932	0.352
OCCP_2	0.173	0.258	0.414
OCCP_3	0.067	0.819	0.797
OCCP_4	-0.018	-0.081	0.935
HHINC_2	-0.082	-0.464	0.643
HHINC_3	-0.187	-0.853	0.394
COOK	0.123 ***	2.020	0.045
FAMILY	0.059	1.264	0.208
TASTE	0.614 ****	6.512	0.000
ODOUR	0.150 ****	2.618	0.009
NUTRITION	0.113	0.764	0.446
FAT	0.056 ****	2.989	0.003
Summary statistics:			
R^2	0.413		
F	9.617		
Prob	0.000		

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

With an increase of one old person in the household, the rate of catfish compared to other seafood reduces by 0.186, indicating that the number of old people in the household has a negative influence on preference. Meanwhile, the number of children in the household is found to be positively associated with preference. An increase of one child in the household enhances the preference for catfish by 0.142 point.

The perception of catfish as easy to prepare increases the preference for catfish. An increase of one score rating of ease of preparation enhances preference for catfish by

0.123 score. This illustrates the importance of demonstrating cooking skills in marketing activities in order to improve consumers' preference for catfish.

The perceptions of catfish taste, odour, and fat are found to have positive impact on the preference for catfish. An increase of one score rating of taste, odour, and fat enhances preference by 0.614, 0.150, and 0.056 score, respectively. Those wishing to positively influence the consumer's preference for catfish should notice the important impacts of these perception factors.

The finding that perceptions of taste and odour have positive affects on catfish preference is consistent with the finding of Kinnucan & Venkateswaran (1990). However, the present study does not find any relationship between nutrition perception and preference for catfish as was found by Kinnucan & Venkateswaran (1990).

4.4. Models for market constraints

AVAILABILITY model: Availability as a perceived market constraint on catfish consumption is significantly influenced by the variables HCMC, AGE, HHSIZE, NOOLD, and HIGHS (Table 8).

The consumers in Ho Chi Minh City rate catfish availability 0.853 score higher than do those in Ha Noi, indicating that the consumers in Ho Chi Minh City are more likely to perceive catfish as available. This may reflect the fact that catfish is raised closed to Ho Chi Minh City therefore they are more available there. Attention should be paid to the availability of catfish in Ha Noi.

Age is found to be positively related to the rate of catfish availability. An increase of one year in age enhances the rate of catfish availability by 0.021. This might be explained that the older people tend to spend more time on food shopping than do busy younger people. This may improve the perception of catfish as available for older people.

Household size has a negative effect on availability perception. One more person in the household reduces the rate of catfish availability by 0.158. One possible explanation for this is that the respondent from a larger household is less likely to contribute in food shopping activities. This may negatively effect their perception of catfish availability.

Table 8. *Linear regression results of availability and safety equations*

	AVAILABILITY			SAFETY		
Variables	Coefficient	*t*-Ratio	*p*-value	Coefficient	*t*-Ratio	*p*-value
Constant	5.959 ****	13.551	0.000	-0.319	-0.912	0.362
HCMC	0.853 ****	5.480	0.000	1.222 ****	9.877	0.000
AGE	0.021 ****	2.999	0.003	0.002	0.374	0.709
HHSIZE	-0.158 ****	-3.147	0.002	-0.150 ****	-3.757	0.000
NOOLD	0.160 *	1.552	0.122	0.113	1.377	0.170
NOCHILD	0.046	0.575	0.566	0.196 ****	3.071	0.002
HIGHS	-0.391 *	-1.492	0.137	0.014	0.070	0.945
COLED	-0.354	-1.300	0.195	0.109	0.505	0.614
OCCP_2	0.042	0.173	0.863	0.117	0.610	0.543
OCCP_3	-0.097	-0.496	0.620	-0.472 ****	-3.040	0.003
OCCP_4	-0.065	-0.322	0.748	-0.317 ***	-1.976	0.049
HHINC_2	-0.060	-0.365	0.715	-0.119	-0.911	0.363
HHINC_3	0.127	0.622	0.535	0.144	0.889	0.375
Summary statistics:						
R^2	0.359			0.201		
F	11.781			5.293		
Prob value	0.000			0.000		

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

The number of old people in the household is found to have positive influence on the perceived availability. This might be explained based on the foregoing finding of positive relationship between age and availability perception. The respondent's perception of catfish availability may be positively affected by the perception of catfish as available from the old persons living in her household.

Consumers with high school education rate catfish availability 0.391 score lower than those with elementary education, indicating that the high educational consumers perceive catfish as less available. This may be explained that the high educational consumers tend to be busier that they spend less time on food shopping. This might negatively influence their perception of catfish availability.

SAFETY model: Safety as a perceived market constraint on catfish consumption is significantly influenced by the variables HCMC, HHSIZE, NOCHILD, OCCP_3, and OCCP_4 (Table 8).

The impact of HCMC is greater for the perceived safety than for the availability perception. The consumers in HCMC rate catfish safety 1.222 score higher than do those in Ha Noi. One possible explanation is that the consumers in Ha Noi have less experience with catfish, which may lead to a higher suspicion that catfish are unsafe. Marketing campaigns may need to stress the safe aspect of catfish products in Ha Noi.

The impact of household size on the safety perception is almost similar to that found in the availability model. The presence of children in the household is found to positively influence the safety perception. An increase of one child enhances the rate of catfish safety by 0.196. Consumers who are white collar and professional give catfish safety 0.472 and 0.317 score, respectively less than those who are blue collar, farmers, hucksters, retired, students, or unemployed. This means that occupational level is inversely related to the respondent's rating of catfish safety. One possible explanation is that high occupational consumers might be those who have more knowledge of food safety. This perhaps leads to a high suspicion of food as unsafe, which, in turn leads to a negative impact on the perception of catfish safety.

PRICE model: Price as a perceived market constraint on catfish consumption is influenced significantly by the variables HCMC, OCCP_4, and HHINC_2 (Table 9).

Table 9. *Linear regression results of price equation*

Variable	Coefficient	*t*-Ratio	*p*-value
Constant	-0.323	-1.409	0.160
HCMC	0.247 **	1.708	0.089
HHSIZE	-0.032	-0.842	0.401
HIGHS	0.184	1.162	0.246
OCCP_4	0.286 **	1.971	0.050
HHINC_2	0.222 *	1.451	0.148
HHINC_3	0.228	1.199	0.231
Summary statistics:			
R^2	0.042		
F	1.901		
Prob value	0.081		

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

The consumers in Ho Chi Minh City give catfish price 0.247 score higher than do those in Ha Noi. This may reflect the fact that Ha Noi is in the north of Vietnam but catfish are raised in the south, hence the price of catfish sold in Ha Noi is higher than in Ho Chi

Minh City due to transportation fee. This may negatively influence the price perception of catfish consumers in Ha Noi. OCCP_4 and HHINC_2 are found to be positively related to price perception. Consumers who are professional or administrator give catfish price 0.286 score higher than do those who are blue collar, farmers, hucksters, retired, students, or unemployed. Consumers who have household monthly income between 4.1 and 9 million dong rate catfish price 0.222 score higher than do those who have household monthly income of 4 million dong or lower. This indicates that high-occupational and high-income consumers are less likely to perceive catfish as expensive.

4.4. Models for consumption levels

As mentioned in the models specification chapter, due to high correlated relationships with market constraints variables, HCMC was excluded for the consumption levels models. It is worth investigating the difference in the consumption levels between the two cities before analyzing the consumption levels models without the region variable.

Table 10. *Sample means and standard deviations of consumption levels for the two cities*

	FREQUENCY		LASTIME	
	Mean	Standard deviation	Mean	Standard deviation
Ho Chi Minh City	1.989	0.981	2.638	1.235
Ha Noi	1.077	0.894	2.205	1.371

It could be seen from table 10 that for Ho Chi Minh City, the mean values for the frequency of eating catfish and the last time eating catfish are both higher than for Ha Noi, while the respective standard deviations are quite similar. This indicates that consumers in Ho Chi Minh City consume catfish more frequently than do those in Ha Noi. Tradition and availability of catfish in Ho Chi Minh City tend to explain this relationship.

FREQUENCY model: The frequency of eating catfish is significantly affected by the variables AGE, HIGHS, COLED, SAFETY, PRICE, and FREF (Table 11).

Given a ten years increase in age, the probability of eating catfish once per week or more increases by 5%, indicating that the older the consumers are, the more frequently they eat catfish. This finding might be explained by the foregoing findings of positive relationships between age and perceptions of ease of preparation, taste, odour and

nutrition. Another possible explanation is that older people tend to pay more attention to their health and thus they eat more seafood. This might have a positive impact on catfish consumption.

Table 11. *Ordered probit regression results of frequency of eating catfish equation*

Variable	Coefficient	*t*-Ratio	*p*-value	Marginal effects				
				Prob (y = 0)	Prob (y = 1)	Prob (y = 2)	Prob (y = 3)	Prob (y = 4)
Constant	0.103	0.148	0.882					
AGE	0.012 **	1.686	0.092	-0.2%	-0.2%	0.2%	0.2%	0.1%
HHSIZE	-0.034	-0.633	0.527	0.6%	0.6%	-0.5%	-0.6%	-0.2%
NOOLD	0.122	1.131	0.258	-2.3%	-2.2%	1.6%	2.1%	0.8%
NOCHILD	-0.011	-0.132	0.895	0.2%	0.2%	-0.2%	-0.2%	-0.1%
HIGHS	-0.406 *	-1.493	0.135	8.8%	6.8%	-7.0%	-6.2%	-2.3%
COLED	-0.680 ***	-2.434	0.015	10.9%	12.4%	-5.1%	-12.0%	-6.2%
OCCP_2	-0.093	-0.370	0.711	1.8%	1.7%	-1.4%	-1.5%	-0.6%
OCCP_3	0.223	1.105	0.269	-4.0%	-4.1%	2.5%	3.9%	1.7%
OCCP_4	0.010	0.045	0.964	-0.2%	-0.2%	0.1%	0.2%	0.1%
HHINC_2	-0.045	-0.266	0.790	0.8%	0.8%	-0.6%	-0.8%	-0.3%
HHINC_3	0.119	0.566	0.571	-2.1%	-2.2%	1.4%	2.0%	0.9%
AVALB	-0.008	-0.113	0.910	0.1%	0.1%	-0.1%	-0.1%	-0.1%
SAFETY	0.272 ****	3.544	0.000	-5.1%	-5.0%	3.6%	4.6%	1.9%
PRICE	0.102 *	1.470	0.142	-1.9%	-1.9%	1.4%	1.7%	0.7%
FREF	0.203 ****	3.962	0.000	-3.8%	-3.7%	2.7%	3.4%	1.4%
μ_1	0.839 ****	10.654	0.000					
μ_2	2.249 ****	22.927	0.000					
μ_3	3.102 ****	21.997	0.000					

Summary statistics:	
Log likelihood	-338.441
χ^2 score (15 degrees of freedom)	66.342
Prob (ChiSqd>critical value)	0.000

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

Educational level is found to play an important role in explaining frequency of eating catfish. Consumers with high school and college education or higher are less likely to eat catfish once per week or more by 15.5% and 23.3% respectively, compared to those who have elementary education. This indicates that high educational level has a negative impact on the frequency of eating catfish.

Among the perceived market constraints on catfish consumption, safety and price are found to have a significant impact on the frequency of eating catfish. With a one score

increase in the rate of catfish safety, the probability of eating catfish once per week or more increases by 10.1%, indicating that the belief in catfish safety has a positive effect on the frequency of eating catfish. This illustrates the importance of improving the hygienic safety standard of catfish products and stressing catfish safety in marketing campaigns. The increased marginal probability of eating catfish once per week or more for price perception is 7.5%. This indicates that the perception of catfish as inexpensive would increase eating frequency. Those who wish to increase catfish consumption should consider the price aspect of catfish products.

Preference of catfish is found to have an important role in enhancing catfish consumption. A one score increase in the rating of catfish compared to other seafood increases the probability of eating catfish once per week or more by 7.5%.

Finding no relationship between the frequency of eating catfish and income, household size, and number of children in the household contradicts the findings by Dellenbarger et al., (1988) in their study of the Louisiana catfish demand, while supports those of Kinnucan & Venkateswaran, (1990) in their nationwide U.S. study. Relationship between occupation and catfish consumption were not found by this study, and neither by Dellenbarger et al. (1988) nor Kinnucan & Venkateswaran (1990). While education is found to be negatively associated with catfish consumption in the present study, this was not the case in the study of Kinnucan & Venkateswaran (1990). The positive impact of preference on catfish consumption found by this study is consistent with that of Kinnucan & Venkateswaran (1990).

LASTIME model: The last time eating catfish is significantly influenced by the variables HIGHS, OCCP_3, AVAILB, and PREF (Table 12).

Consumers with high school education are 26.1% more likely to eat catfish 6 days ago or less compared to those who have elementary education. This finding is inconsistent with the finding that high educational level has negative effect on the frequency of eating catfish. Occupation is not found to have any significant impact on the frequency of eating catfish but it plays an important role in the last time eating catfish model. For consumers who are white collar, the likelihood that they eat catfish 6 days ago or less is 14.7% greater than those who are blue collar, farmers, hucksters, retired, students, or unemployed.

The perceived availability does not appear to have a significant effect on the frequency of eating catfish, but it does on the last time eating catfish. The increased marginal probability of eating catfish 6 days ago or less for availability perception is 6%. This indicates that the perception of catfish as available enhances the consumption level of catfish. Any effort to increase the consumption level of catfish should consider the availability issue.

Consistently with the model for the frequency of eating catfish, preference is found to have a positive impact on the last time eating catfish. The change in marginal probability of eating catfish 6 days ago or less for preference is as high as 6.2 %.

Table 12. *Ordered probit regression results of last time eating catfish equation*

Variable	Coefficient	*t*-Ratio	*p*-value	Marginal effects				
				Prob (y = 0)	Prob (y = 1)	Prob (y = 2)	Prob (y = 3)	Prob (y = 4)
Constant	-1.539 ***	-2.203	0.028					
AGE	0.010	1.279	0.201	-0.1%	-0.2%	-0.1%	0.1%	0.3%
HHSIZE	0.005	0.099	0.921	-0.1%	-0.1%	-0.1%	0.0%	0.2%
NOOLD	0.105	0.966	0.334	-1.4%	-1.6%	-1.2%	0.6%	3.6%
NOCHILD	0.037	0.439	0.661	-0.5%	-0.6%	-0.4%	0.2%	1.3%
HIGHS	0.689 ***	2.530	0.011	-6.8%	-9.6%	-9.6%	0.8%	25.3%
COLED	0.352	1.278	0.201	-5.2%	-5.4%	-3.4%	2.5%	11.4%
OCCP_2	0.045	0.180	0.857	-0.6%	-0.7%	-0.5%	0.3%	1.6%
OCCP_3	0.375 **	1.844	0.065	-4.4%	-5.6%	-4.7%	1.5%	13.2%
OCCP_4	0.106	0.495	0.621	-1.4%	-1.6%	-1.2%	0.6%	3.6%
HHINC_2	0.010	0.059	0.953	-0.1%	-0.2%	-0.1%	0.1%	0.3%
HHINC_3	0.233	1.109	0.267	-2.8%	-3.5%	-2.9%	1.0%	8.2%
AVALB	0.149 ***	2.211	0.027	-2.0%	-2.3%	-1.7%	0.9%	5.1%
SAFETY	0.033	0.575	0.666	-0.4%	-0.5%	-0.4%	0.2%	1.1%
PRICE	0.040	0.431	0.565	-0.5%	-0.6%	-0.5%	0.2%	1.4%
FREF	0.157 ****	3.074	0.002	-2.1%	-2.4%	-1.8%	0.9%	5.3%
μ_1	0.673 ****	8.690	0.000					
μ_2	1.423 ****	18.593	0.000					
μ_3	2.057 ****	23.313	0.000					
Summary statistics:								
Log likelihood				-386.129				
χ^2 score (15 degrees of freedom)				38.442				
Prob (ChiSqd>critical value)				0.000				

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

4.5. Models for non-catfish consumers

There are 35.5% of the respondents that haven't eaten catfish or have eaten catfish once then stopped eating. Before excluding these non-catfish consumers out of the other analyses, it is interesting from the marketing standpoint to know who they are.

NOCONS Model: There are 20.7% of the respondents that haven't eaten catfish. Factors that significantly influence the incidence of having never eaten catfish are HCMC, AGE, COLED, OCCP_3, HHINC_2, HHINC_3 (Table 13).

Table 13. *Binary logistic regression results of equation for consumers who haven't eaten catfish*

Variables	Coefficient	t-Ratio	p-value	Marginal Effect
Constant	2.262	2.388	0.947	27.9%
HCMC	-1.928****	-5.438	0.000	-25.0%
AGE	-0.043****	-3.063	0.002	-0.5%
HHSIZE	0.058	0.509	0.611	0.7%
NOOLD	0.004	0.018	0.985	0.0%
NOCHILD	-0.106	-0.600	0.548	-1.3%
HIGHS	-0.448	-0.741	0.459	-5.1%
COLED	-1.058**	-1.662	0.097	-14.8%
OCCP_2	-0.653	-1.315	0.189	-6.7%
OCCP_3	-0.643*	-1.495	0.135	-7.1%
OCCP_4	-0.326	-0.817	0.414	-3.9%
HHINC_2	-0.810****	-2.598	0.009	-9.8%
HHINC_3	-0.983***	-1.983	0.047	-9.8%
Summary statistics:				
Log likelihood			-166.818	
χ^2 score (12 degrees of freedom)			84.877	
Prob (ChiSqd>critical value)			0.000	
Pseudo R^2			0.203	
% of correct predictions			82.6	

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

For the respondents in Ho Chi Minh City, the probability of not having eaten catfish is 25% less than in Ha Noi indicating that the respondents in Ho Chi Minh City are more likely to have eaten catfish. This reflects the fact that catfish is a new product in Ha Noi

while respondents in Ho Chi Minh City have a long tradition of eating catfish. Marketing campaigns to encourage consumers to try catfish need to be stressed in Ha Noi.

Age is found to be negatively related to the incidence of not having eaten catfish. Given a 10 years increase in age, the probability of not having eaten catfish is expected to decrease by 5% indicating that the younger respondents are less likely to have eaten catfish. This suggests that 'try taste' marketing campaigns should be emphasized for young people.

Education and occupation are found to play a significant role in the incidence of not having eaten catfish. The decreased marginal probability of not having eaten catfish for the respondents who have college education or higher compared to those with elementary education is 14.8%. Respondents who are white collar are found to be 7.1 % less likely to have not eaten catfish than those who are blue collar, farmers, hucksters, retired, students or unemployed. This might be explained that high-educated and high-occupational respondents have more opportunities to try catfish due to their wider social relationships.

Household income is also found to be positively related to the incidence of not having eaten catfish. Respondents who have household monthly income between 4.1 and 9 million dong and over 9 million dong are both found to be 9.8% less likely to have not eaten catfish than those with household monthly income of 4 million dong or lower. This may indicate that price of catfish products is a resistance to attract more consumers to try catfish, especially in Ha Noi where catfish price is higher than in Ho Chi Minh City.

CONSONCE model: There are 14.4% of the respondents that have eaten catfish once then stopped eating. The incidence of having eaten catfish once is significantly influenced by the variables HCMC, AGE, HHSIZE, and HHINC_2 (Table 14).

For respondents in Ho Chi Minh, the probability of having eaten catfish once is 0.255% less than in Ha Noi. This might be explained that catfish is a new product in Ha Noi thus the consumers there are less likely to accept catfish. Marketing research to find out the reasons why consumers have eaten catfish once may want to focus in Ha Noi. This would provide information to improve catfish products in order to encourage consumers to keep on eating catfish.

Age is found to have a positive relationship with the incidence of having eaten catfish once. There is an increase of 0.03% in the probability of eating catfish once given a ten years increase in age. This may imply that it is more difficult to accept a new product for the older people.

An increase of one person in the household is found to decrease the probability of eating catfish once by 0.023%. This indicates that household size is negatively related to the incidence of eating catfish once. Consumers who have household monthly income between 4.1 and 9 million dong is found to be 0.043% more likely to eat catfish once compared to those who have household monthly income of 4 million dong or lower. This indicates that the high-income consumers are more likely to stop eating catfish after trying them.

Table 14. *Binary logistic regression results of equation for consumers who have eaten catfish once*

Variables	Coefficient	t-Ratio	p-value	Marginal Effect
Constant	-2.370**	-1.739	0.082	-0.192%
HCMC	-2.426****	-5.373	0.000	-0.255%
AGE	0.038****	2.675	0.007	0.003%
HHSIZE	-0.281**	-1.818	0.069	-0.023%
NOOLD	-0.269	-0.983	0.325	-0.022%
NOCHILD	0.152	0.746	0.456	0.012%
HIGHS	1.038	0.945	0.345	0.072%
COLED	0.886	0.793	0.428	0.084%
OCCP_2	0.218	0.409	0.683	0.023%
OCCP_3	0.264	0.564	0.573	0.019%
OCCP_4	-0.533	-1.135	0.256	-0.040%
HHINC_2	0.518*	1.447	0.148	0.043%
HHINC_3	0.436	0.766	0.444	0.041%
Summary statistics:				
Log likelihood			-133.911	
χ^2 score (12 degrees of freedom)			70.005	
Prob (ChiSqd>critical value)			0.000	
Pseudo R^2			0.207	
% of correct predictions			85.6	

Note: **** p<0.01; *** p<0.05; ** p<0.1; * p<0.15

5. CONCLUSION

This study gives insight into the decision process of Vietnamese catfish consumers by analyzing a partially-recursive model linking the experiences, perceptions of product attributes, preference, market constraints and consumption levels of consumers for catfish products. Factors influencing non-catfish consumers are also explored. Such knowledge is important for the catfish marketers to develop efficient marketing strategies for the domestic market.

Among the experience variables, ease of preparation appears to play an important role in the formation of both perceptions of catfish attributes and preference. It positively effects the perceptions of catfish taste, odour, and the rating of catfish compared to other seafood. This finding illustrates the importance of demonstrating cooking skills of catfish, especially with quick and easy recipes in marketing activities. Value-added catfish products that are easy to prepare should also be developed.

Perceptions of catfish taste, odour, and fat are found to have positive impacts on the consumers' preference for catfish. This suggests that any effort to increase preference for catfish should stress the taste and odour attributes of catfish. For the perception of catfish fat, there is a high percentage of respondents showing a negative attitude to this, which, in turn leads to a negative effect on preference. Therefore, catfish products that are excluded fat need to be developed in order to improve catfish preference for these consumers.

The finding that preference positively affects the consumption levels demonstrates the indirect positive impacts of ease of preparation, perceptions of catfish taste, odour, and fat on the ultimate choice of catfish by improving consumers' preference for catfish. Perceived availability, safety, and price are found to be positively related to the consumption levels. This suggests that those who wish to positively influence the consumption of catfish should not overlook the importance of these market constraints factors.

Region and age are the main determinants influencing the decision process of catfish consumers among the socioeconomic and demographic factors. The model's results suggest that Ha Noi, which is a new market for catfish, should be the place where marketing activities are emphasized with the purpose of improving cooking skills and

enhancing the perceptions of catfish availability, safety and price. Efforts to increase catfish consumption should focus on young consumers in order to improve their perceptions of ease of preparation, taste and odour of catfish.

The results of the non-catfish consumer models suggest that “try taste” campaigns should be stressed in Ha Noi and should target the young generations. Marketing research to find out the reasons why the consumers have eaten catfish once then stopped may need to focus in Ha Noi.

This study is limited to responses from the two biggest cities in Vietnam, Ha Noi and Ho Chi Minh City. Additional research is needed in other regions of the country, especially in rural areas.

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***Appendix 1**: Questionnaire*

Question 1. Have you ever eaten catfish?

☐ No ☐ Yes but only once then stopped ☐ Yes and still eating

Question 2. How would you evaluate catfish along several different characteristics?

	1	2	3	4	5	6	7	
Bad taste	☐	☐	☐	☐	☐	☐	☐	Good taste
Bad odour	☐	☐	☐	☐	☐	☐	☐	Good odour
Low nutrition	☐	☐	☐	☐	☐	☐	☐	High nutrition
Not safe (Local market)	☐	☐	☐	☐	☐	☐	☐	Safe (Local market)
Not safe (Supermarket)	☐	☐	☐	☐	☐	☐	☐	Safe (Supermarket)
Expensive (Local market)	☐	☐	☐	☐	☐	☐	☐	Cheap (Local market)
Expensive (Supermarket)	☐	☐	☐	☐	☐	☐	☐	Cheap (Supermarket)

Question 3. How do you like or dislike catfish fat?

Dislike very much Like very much

1	2	3	4	5	6	7

Question 4. Using a scale of 1 to 7, where 1 means strong disagreement and 7 means strong agreement, do you agree or disagree with the following statements? You may use any number in between.

	Strongly disagree ⟷ Strongly agree						
My family has the habit of eating catfish.	☐	☐	☐	☐	☐	☐	☐
I find it easy to prepare a good meal with catfish.	☐	☐	☐	☐	☐	☐	☐
Catfish is available.	☐	☐	☐	☐	☐	☐	☐

Question 5. On a 10 point scale where 1 means catfish is worst and 10 means catfish is best, how would you compare catfish to other seafood?

1	2	3	4	5	6	7	8	9	10

Question 6. On average how often do you eat catfish?

Question 7. When was the last time you ate catfish?

☐ Less than 3 days ago ☐ 2 – 3 weeks ago ☐ 3 months

☐ 3 – 6 days ago ☐ 4 – 5 weeks ago ☐ More than 3 months

☐ 1 week ago ☐ 6 – 8 weeks ago ☐ Don't rememeber

Question 8. Your age:

Question 9. How many persons live in your household, including yourself?

Question 10. How many persons over 60 years old live in your household, including yourself?

Question 11. How many persons under 18 years old live in your household?

Question 12. Your education:

☐ No schooling ☐ Primary school ☐ Secondary school

☐ High school ☐ College ☐ University

☐ Postgraduate

Question 13. Your occupation:

☐ Entrepreneur (self employed) ☐ Blue collar

☐ Middle manager ☐ Farmer

☐ Professional (doctor, lawyer..) ☐ Huskster

☐ Teacher ☐ Retired

☐ White collar ☐ Student

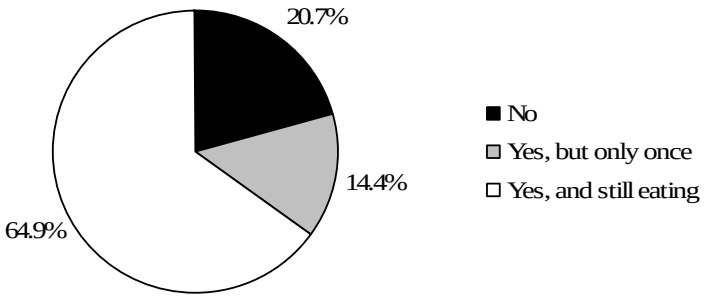
☐ Housewife ☐ Unemployed

Question 14. What is your household's monthly income?

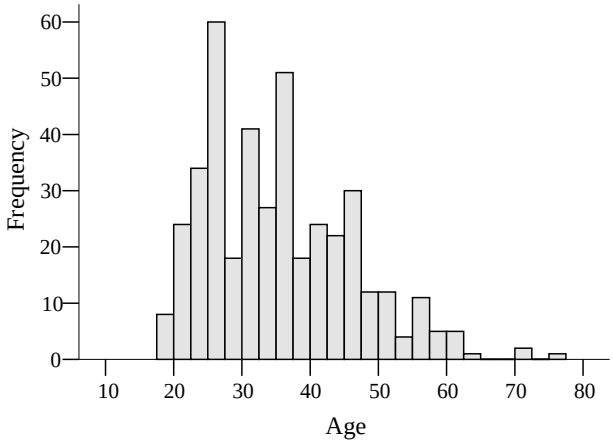
- ☐ 500 000 dong or lower
- ☐ 510 000 – 1 000 000 dong
- ☐ 1 100 000 – 1 500 000 dong
- ☐ 1 600 000 – 2 000 000 dong
- ☐ 2 100 000 – 3 000 000 dong
- ☐ 3 100 000 – 4 000 000 dong
- ☐ 4 100 000 – 5 000 000 dong
- ☐ 5 100 000 – 7 000 000 dong
- ☐ 7 100 000 – 9 000 000 dong
- ☐ 9 100 000 – 12 000 000 dong
- ☐ 12 100 000 – 15 000 000 dong
- ☐ 15 100 000 – 20 000 000 dong
- ☐ 20 100 000 – 25 000 000 dong
- ☐ Over 25 000 000 dong

Appendix 2. *Description of the responses*

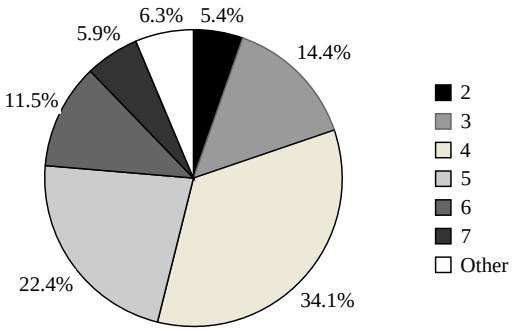
1. Have you ever eaten catfish?



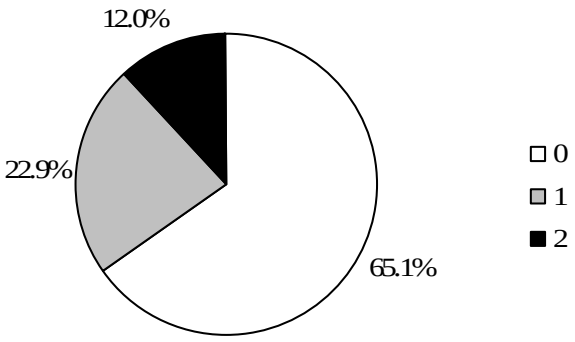
2. Respondents's age



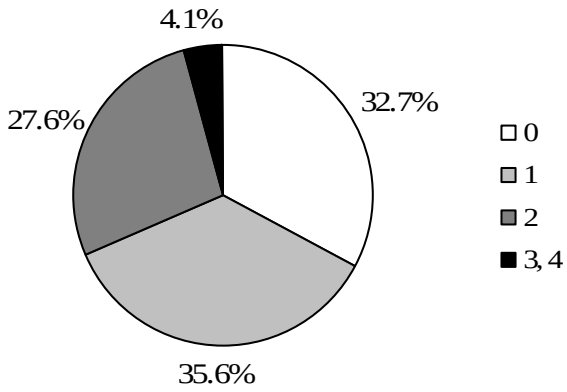
3. Household size



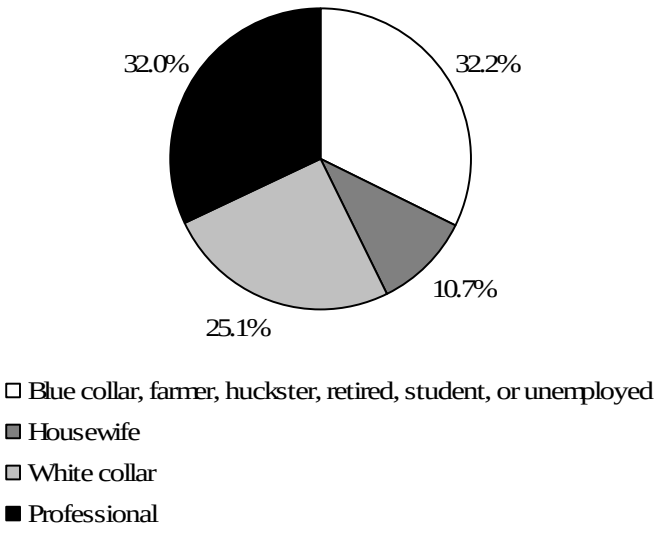
4. Number of old persons in the household



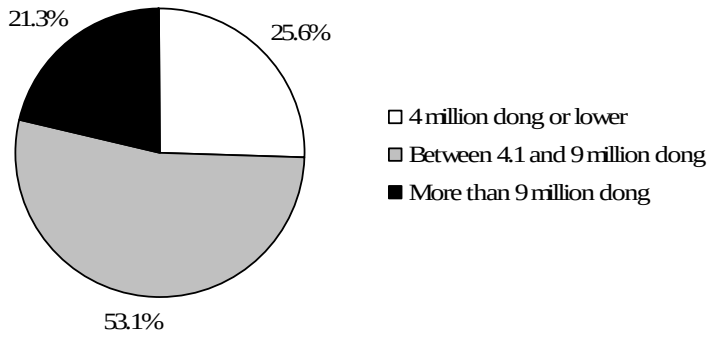
5. Number of children in the household



6. Occupation



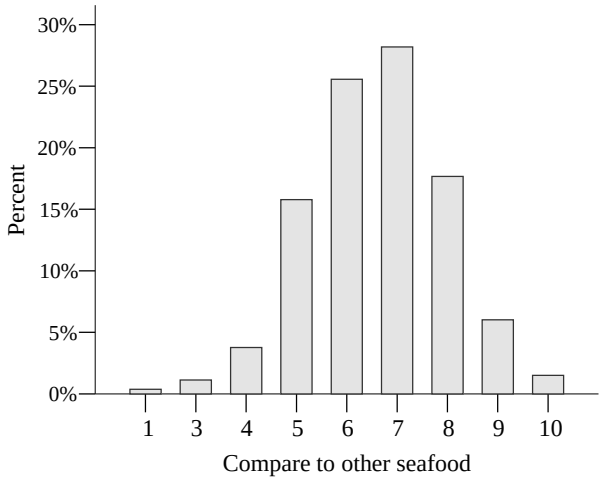
7. Household monthly income



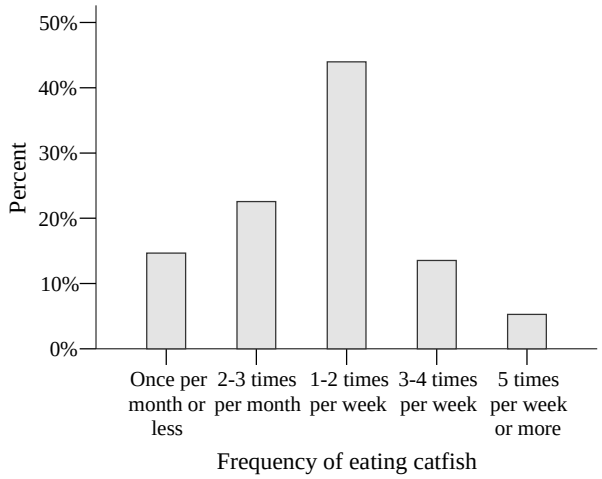
8. Experiences, perceptions of product attributes and perceived market constraints (Frequency in percent, 1 means a negative attitude, 7 means a positive attitude).

	1	2	3	4	5	6	7
COOK	1.9	1.9	4.1	7.9	17.3	30.5	36.5
FAMILY	3.4	8.6	19.9	4.5	23.3	21.8	18.4
TASTE	0.0	0.0	0.4	6.8	31.2	38.7	22.9
ODOUR	0.0	1.9	8.6	20.3	25.6	22.9	20.7
NUTRITION	0.0	0.0	0.4	14.3	17.3	38.3	29.7
FAT	7.1	35.7	15.8	12.8	7.1	10.2	11.3
AVAILB	0.8	1.5	1.9	2.3	8.3	25.9	59.4
SAFELCM	1.9	1.1	9.0	23.3	33.5	25.6	5.6
SAFESMP	0.0	0.0	0.9	5.3	17.7	35.0	41.4
PRICELCM	0.8	1.1	12.8	38.3	31.2	15.0	0.8
PRICESMP	1.5	5.6	37.2	27.4	22.6	5.3	0.4

9. Consumer preference for catfish



10. Frequency of eating catfish



11. Last time eating catfish