Food Quality and Preference 41 (2015) 225–236

Contents lists available at ScienceDirect

Food Quality and Preference

journal homepage: www.elsevier.com/locate/foodqual

Consumer willingness to pay for quality attributes of fresh seafood: A labeled latent class model

Thong Tien Nguyen [a,b,*], Wolfgang Haider [c,1], Hans Stubbe Solgaard [a,2], Lars Ravn-Jonsen [a,3], Eva Roth [a,4]

[a] Department of Environmental and Business Economics, University of Southern Denmark, Niels Bohrs Vej 9, 6700 Esbjerg, Denmark
[b] Faculty of Economics, Nha Trang University, No. 02, Nguyen Dinh Chieu, Nha Trang, Viet Nam
[c] School of Resource and Environmental Management, Simon Fraser University, TASC I #8405, 8888 University Drive, Burnaby, B.C. V5A 1S6, Canada

ARTICLE INFO

Article history:
Received 23 September 2013
Received in revised form 8 December 2014
Accepted 10 December 2014
Available online 24 December 2014

Keywords:
Seafood
Fish
Labeled choice experiment
Labeled latent class model
Alternative specific-effect
Willingness to pay
Rank ordered-intrinsic value

ABSTRACT

We applied a labeled choice experiment (LCE) to investigate consumer demand and choice behavior for fresh seafood in a retail market. The LCE was conducted for a large number of seafood alternatives (*i.e.*, seafood species) labeled by the respective seafood name (*e.g.*, cod, salmon, mussels). Consumer heterogeneity in preference was expressed by estimating a labeled latent class model with alternative-specific effects, which varies choice probability and model parameters over seafood alternatives and across classes. The willingness to pay (WTP) for extrinsic attributes (*e.g.*, product form, production method, and country of origin), and the rank ordered-intrinsic value were estimated for each seafood alternative within classes and the entire market. The WTP estimate in our study is expected to be more accurate than those derived from studies based on single product alternatives because the LCE allows respondents to evaluate choice alternatives through both attribute judgment and alternative comparison. Exploring a variety of product alternatives is also meaningful to firms with multiple products (*e.g.*, fresh seafood retailers) or firms with many direct competitors.

1. Introduction

The objective of this study is to investigate consumer demand and choice behavior for fresh fish and seafood[5] at the retail market. Seafood is an important food supply for the human diet. The contribution of seafood to global diets has reached a record of about 17.8 kg per person on average, supplying over three billion people with at least 15 of their average yearly animal protein intake (FAO, 2009). Annually, capture fisheries and aquaculture supply the world with about 140 million tons of fish, of which nearly half is from aquaculture (FAO, 2012). Seafood has emerged as one of the largest internationally traded commodities in the world, with the 2011 total trade value estimated at US$262.1 billion (FAO, 2014). Seafood products are diversified in species and in product forms.

During the last thirty years, many economic studies have been conducted to measure consumer preference and demand for seafood. Those seafood demand studies may be classified into two streams: total market demand studies (*e.g.*, Eales & Wessells, 1999; Manrique & Jensen, 2001; Thong, 2012; Xie & Myrland, 2011) and multi-attribute demand studies (*e.g.*, Alfnes, Guttormsen, Steine, & Kolstad, 2006; Jaffry, Pickering, Ghulam, Whitmarsh, & Wattage, 2004; Marette, Roosen, Blanchemanche, & Verger, 2008; Quagrainie & Engle, 2006; Wirth, Love, & Palma, 2007). Total market demand studies are based on neoclassical consumer theory assuming that the act of consumption expresses consumer utility in the form of revealed preferences. The assumption does not allow for variations of consumer taste and ignores the intrinsic properties of the good. Since most empirical demand analyses use aggregate market data to estimate the total demand for seafood they have limited managerial implications (Kinnucan & Wessells, 1997). The multi-attribute demand studies are based on Lancastrian consumer theory (Lancaster, 1966) assuming that consumer's utility stems from product properties rather than the products themselves. Thus, multi-attribute demand models can elicit the intrinsic value of the product attributes and have been applied widely in marketing research. However, to the best of

* Corresponding author at: Department of Environmental and Business Economics, University of Southern Denmark, Niels Bohrs Vej 9, 6700 Esbjerg, Denmark. Tel.: +45 65509379, mobile: +45 50328383.
E-mail addresses: ntt@sam.sdu.dk, thongtiennguyen@gmail.com (T.T. Nguyen), wolfgang_haider@sfu.ca (W. Haider), hso@sam.sdu.dk (H.S. Solgaard), lrj@sam.sdu.dk (L. Ravn-Jonsen), er@sam.sdu.dk (E. Roth).
[1] Tel.: +1 (778) 782 3066 6055 1528.
[2] Tel.: +45 6550 1528.
[3] Tel.: +45 6550 4208.
[4] Tel.: +45 6550 4186.
[5] Throughout this paper, when referring to seafood we actually mean fish and seafood which may be from wild stock or aquaculture.

http://dx.doi.org/10.1016/j.foodqual.2014.12.007
0950-3293/

our knowledge, most multiattribute demand studies for seafood involve a single seafood species only such as salmon (Alfnes et al., 2006), pangasius (Quagrainie & Engle, 2006), or shrimp (Wirth et al., 2007). The absence of comparisons between alternatives in these studies might lead to overestimate the consumers' willingness to pay (WTP) (Parker & Schrift, 2011; Swait & Adamowicz, 2001), not avoid a positive price bias (Rao & Sattler, 2003), and be of less relevance for firms marketing several products or for situations with several or many direct competitors (Lusk & Hudson, 2004).

Against this background our paper will elicit consumers' WTP for the salient attributes of a variety of fresh seafood species in the retail market. The French retail market has been selected for the study because France is one of the most important markets for seafood in the European Union. We focus on fresh seafood since the product is perceived as having the highest quality among the different product forms of seafood (Olsen, 2004) and in France about 70–80% of seafood is consumed at home (GLITNIR, 2008). We apply a discrete choice experiment (DCE) to accomplish this objective; this method is strongly consistent with economic demand theory (Louviere, Flynn, & Carson, 2010), and is highly flexible with respect to data collection and model specifications. DCE is based on random utility theory (Thurstone, 1927) about individual decision making, and seems realistic in imitating real shopping behavior (Louviere, Hensher, & Swait, 2000; Natter & Feurstein, 2002).

To accommodate the evaluation of choice alternatives through both attribute judgment and alternative comparison, we apply a labeled choice experiment (LCE), where choice alternatives are labeled by the respective names of the seafood (*e.g.*, salmon, cod, mussels, and shrimps). This model for seafood choice behavior is similar to the brand choice models that have been applied widely in marketing research (Boxall & Adamowicz, 2002; Kamakura & Russell, 1989, 1993; Wedel & Kamakura, 2000). However, we differentiate our model specification so that the constant terms, which represent intrinsic value of the alternatives, and attribute parameters are varied both over seafood alternatives and across latent classes.

Applying a LCE to a large number of seafood items our study is expected to overcome some limitations of single species focusing-studies. Our LCE allows respondents to not only judge product attributes but also to compare product alternatives at the same time. Comparative judgment is one of the fundamental dimensions of consumer quality perception because it reflects the interactions between the consumer and the product (Parker & Schrift, 2011; Steenkamp, 1990). Therefore, the WTP to be elicited in our study is expected to be more accurate than studies focusing on single species. In addition, allowing the comparison between alternatives assists us to estimate the intrinsic values of the respective seafood, which reflects that consumers in a real market might be very aware of these differences, for example a species' unique nutritional values (*e.g.*, salmon is rich in omega-3 fatty acid). Another advantage is that the LCE may alleviate the bias of the demand estimates because the labeled products or brands that often add information or product knowledge (Keller, 1993; Louviere et al., 2000) will take at least partly the positive effects of price (Rao & Sattler, 2003). Finally, our study conducted for a variety of products may be more meaningful for multiproduct firms and for firms with many direct competitors in optimization of product lines and development of marketing strategy (Lusk & Hudson, 2004).

The remainder of the paper is organized into five sections. The next section provides a brief outline of the labeled latent class model for seafood choice. The subsequent section describes the LCE design, the choice setting and the data collection process. The results are presented in section four, and are followed by a discussion in section five. The conclusion and limitations are contained in the final section.

2. Model

2.1. Labeled latent class model for seafood choice behavior

Consumers are widely recognized as heterogeneous in their taste and preferences (Wedel & Kamakura, 2000). Among many discrete choice models available, the mixed logit (and random coefficient, scaled-multinomial logit, and generalized-multinomial logit) model and the latent class model (LCM) are known as appropriate approaches for capturing unobserved heterogeneity (see Fiebig, Keane, Louviere, & Wasi, 2010; Greene & Hensher, 2003). We apply a LCM because the model can simultaneously perform market segmentation and segment-specific estimation of model parameters. Thus, the delineated segments exhibit different consumer preference and price sensitivity in connection with additional socio-demographic or attitudinal consumer characteristics which might have importantly managerial implications (Wedel & Kamakura, 2000).

Using a labeled latent class model (LLCM) for fresh seafood choice behavior, we assume that respondents are asked to choose one fresh seafood alternative from a large but finite number of seafood alternatives within a pre-specified set for their household consumption. A seafood alternative is labeled by its actual common name such as salmon, sole, and mussels. The seafood alternatives may have generic or unique attributes, and the attributes may have different levels. Also, we assume that a finite number of latent classes exist on the market under consideration. It follows that each class includes consumers who are assumed to have very similar part-worth utilities (*i.e.*, preferences) for the respective types of seafood.

The source of consumer heterogeneity in preference and choice can be explained by including the variables of consumer attitudes and perceptions, and individual characteristics in the estimated model (Boxall & Adamowicz, 2002; McFadden, 1986). These variables are called covariates and the model that estimates choice probability and latent classes simultaneously is called LLCM with covariates. Following previous studies (*e.g.*, Boxall & Adamowicz, 2002; Vermunt & Madgison, 2005), we express the unconditional choice probability (P_{itq}.) for seafood i in choice set t by the consumer q in the LLCM with covariates as:

$$P_{itq} = \sum_{c=1}^{C} \left[\frac{\exp\left(\vartheta \gamma^c Z_q\right)}{\sum_{c=1}^{C} \exp\left(\vartheta \gamma^c Z_q\right)} \right] \left[\frac{\exp\left(\alpha_i^c + \beta_i^c X_{itq} + \sum_A \gamma_{Ai}^c A_{itq}\right)}{\sum_j \left(\alpha_j^c + \beta_j^c X_{jtq} + \sum_A \gamma_{Aj}^c A_{jtq}\right)} \right] \tag{1}$$

where $i, j = 1,\ldots, I$ specific seafood alternatives; $t = 1,\ldots, T$ choice sets (replications); $q = 1,\ldots, Q$ respondents; $c = 1,\ldots, C$ latent classes; A = the quality attributes of the seafood; α_i^c is the intrinsic value of the seafood i estimated for consumers in class c; β_i^c is the specific-price effects of seafood i estimated for consumers in class c; γ_{Ai}^c is the specific-effects of attribute A of seafood i estimated for consumers in class c; X_{itq} and A_{itq} are levels of price P (continuous variable) and quality attributes A (nominal variables) of seafood i in choice set t, respectively, given to individual consumer q; Z_q is characteristics (*e.g.*, income and age) of individual q used as covariates; γ^c is vector of estimated parameters of the covariates in class c; ϑ is a scale factor of class membership function.

Now we define:

$$f^c = \frac{\exp\left(\vartheta \gamma^c Z_q\right)}{\sum_{c=1}^{C} \exp\left(\vartheta \gamma^c Z_q\right)} \tag{2}$$

in which f^c. represents the likelihood of finding an individual in class c or the class membership probability, and is equivalent to