Food Policy 47 (2014) 97–106

Contents lists available at ScienceDirect

Food Policy

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

Combining attitudinal statements with choice experiments to analyze preference heterogeneity for functional dairy products

Kai-Brit Bechtold, Awudu Abdulai *

Department of Food Economics and Consumption Studies, University of Kiel, Germany

ARTICLE INFO

Article history:
Received 22 July 2013
Received in revised form 16 April 2014
Accepted 11 May 2014

Keywords:
Functional food attributes
Choice experiments
Preference heterogeneity
Attitudinal statements
Willingness-to-pay

ABSTRACT

In this article, we employ a discrete choice experiment to examine preferences for functional dairy product attributes and willingness-to-pay estimates for consumers in Germany. We estimate preference heterogeneity by linking stated preference choice data not only to socioeconomic characteristics but also to attitudinal statements in a latent class framework. The empirical results indicate the existence of class-specific preference heterogeneity based on the consumers' attitude towards functional foods, emphasizing the importance of attitudinal data in explaining consumers' choice behavior. Our estimates demonstrate that within a class, consumers' preferences are in accordance with their responses to attitudinal statements, that is functional food skeptics prefer non-functional dairy products, while functional food advocates have a negative preference for non-functional dairy products. The findings also show that all consumers place high value on dairy products enriched with known functional ingredients such as omega-3 fatty acids.

Introduction

In most industrialized countries, the markets for functional foods have been growing rapidly over the last two decades (Chema et al., 2006). In general, functional food is defined as a food product fortified with specific ingredients providing health benefits beyond basic nutrition.[1] Estimates show that the market share of functional foods in Europe is expected to increase from less than 1% in 2000 to about 5% in 2013 (Menrad, 2003). Between 2004 and 2007, the sales of functional products in Western Europe experienced a growth rate exceeding 10% (The Economist, 2009), reaching a value of 0.8 billion U.S. $ in 2006 (Datamonitor, 2007). This trend is mostly due to the fact that consumers have increasingly recognized the link between health and diet, and as such are taking special interest in functional foods. Furthermore, developments in the functional foods market are being driven by changes in demographic patterns combined with advances in food technology and nutritional sciences (Labrecque et al., 2006).

Considering the fact that functional foods are increasingly gaining significance in consumers' food choices in industrialized countries, several studies have investigated consumers' choice behavior in terms of functional foods (e.g., Labrecque et al., 2006; Peng et al., 2006). However, there are only a few studies that have recently considered German consumers, although Germany belongs to the four biggest functional food markets in Europe, with estimated value sales of 2.4 billion U.S. $ (Bech-Larsen and Scholderer, 2007). Hence, the present study contributes to the literature by examining consumers' preferences and willingness-to-pay (WTP) estimates for functional dairy products, using choice experiment (CE) data of 1309 consumers in Germany. Dairy products are considered in this study because they represent the most important product category within the functional food segment (Menrad, 2003). According to Menrad (2003), the functional dairy market is continuously growing, raising the market volume in Germany from around 5 million U.S. $ in 1995 to 419 million U.S. $ in 2000.

Although consumers have accepted many different functional products, there is evidence that consumers differ by the extent to which they purchase food products with explicit functional properties (Bitzios et al., 2011). Given that new technologies are used to produce functional foods, some consumers even reject these kinds of food products. This may be attributed to the fact that they perceive the use of new technologies in food as risky. Other

* Corresponding author. Address: University of Kiel, Olshausenstrasse 40, 24118 Kiel, Germany. Tel.: +49 431 880 4426; fax: +49 431 880 7308.
E-mail address: aabdula@food-econ.uni-kiel.de (A. Abdulai).

[1] The problem with functional foods is that there is no legal definition of functional foods in Europe. However, according to a widely used definition "a food can be regarded as functional if it is satisfactorily demonstrated to affect beneficially one or more target functions in the body, beyond adequate nutritional effects, in a way that is relevant to either an improved state of health and well-being and/or reduction of risk of disease" (Diplock et al., 1999).

http://dx.doi.org/10.1016/j.foodpol.2014.05.007
0306-9192/

consumers prefer to consume "natural" foods and describe functional foods as "unnatural" and "potentially unsafe" (Markosyan et al., 2009). These findings give some support to the idea of heterogeneity in preferences for functional foods within the population. It is reasonable to assume that preferences are not unique to the individual, but rather a group of individuals (e.g., Hu et al., 2004), and as such the present study employs a latent class approach that accounts for heterogeneous class-specific preferences.

The viewpoint underlying this study is that heterogeneity in preferences is important and should be fully examined using both objective and attitudinal data. Specifically, we assume that we are able to observe socioeconomic characteristics and indicators of an individual's general attitude. Given that functional foods are foods providing health benefits beyond basic nutrition, the present study accounts for the consumers' attitudes towards functional foods and healthy diet. According to Swait (1994), preferences are indirectly affected by attitudes through the latent class to which the consumer belongs, and as such attitudinal data are quite important in explaining choice behavior. However, very little work has been undertaken to incorporate attitudinal data in the estimation of discrete choice models describing the choice behavior of functional food consumers (e.g., Bitzios et al., 2011). Calls advocating the use of attitudinal data and combining choice data with attitudinal data go back to McFadden (1986), Swait (1994), and Morikawa et al. (2002).

The objective of this study is to examine heterogeneous consumers' preferences for functional dairy products in Germany by analyzing primary data from a discrete choice experiment. Specifically, a latent class model is employed to investigate the sources of heterogeneity in preferences across classes of consumers and to estimate class-specific WTP measures for the attributes. We incorporate all sources of heterogeneity, including socioeconomic and attitudinal data. To the extent that the markets for functional dairy products have shown a rapid growth, the study is partly designed to provide a better understanding of heterogeneous consumers' preferences for functional dairy products and to derive some implications for future development of these kinds of food products. We define segmented consumer markets (that is, the classes) on the basis of socioeconomic and attitudinal data, as well as on observed choice behavior and product characteristics, potentially making the classes more directly relevant to management decision-making. Our study makes a contribution to the empirical literature by incorporating insights from behavioral sciences (such as attitudinal variables) in micro-econometric choice models.

The rest of the paper is organized as follows. The next section presents the econometric formulation of the general CE framework, followed by a description of the design of our survey and the data in the third section. Empirical results of the latent class model are then reported in section four. The final section provides concluding remarks and implications.

Estimation technique and econometric model

The random utility model of McFadden (1974) is the standard statistical economic framework for CEs used to estimate behavioral models of consumer choice. In this framework, an individual chooses from a number of alternatives (e.g., dairy products) and selects the one that yields the highest utility level on any given choice occasion. The overall utility of an alternative can be decomposed into separate utilities for its constituent attributes (Lancaster, 1966). In terms of the utility function, this translates into using the attributes of alternatives as the arguments of the function. For functional food, this permits the analysis of consumers' preferences in terms of the utility they perceive to result from several functional food attributes.

A consumer n receives utility U from choosing an alternative j equal to $U_{nj} = U(X_{nj})$, where X_{nj} is a vector of the attributes of j. Utility is modeled as two components, where one component is deterministic and depends on the attributes of the alternative, and the remainder is stochastic. Hence, $U_{nj} = V(X_{nj}, \beta_n) + \varepsilon_{nj}$, where V is the deterministic and ε_{nj} the stochastic component. The deterministic component V is a function of the attributes X_{nj} and the coefficient vector β_n. The probability that alternative j is chosen is equal to the probability that the utility received from its choice is greater than, or equal to the utilities of choosing another alternative k within the choice set C. Hence, the probability, π, of choosing j can be expressed as:

$$\pi(j) = Prob\{V_{nj} + \varepsilon_{nj} \geqslant V_{nk} + \varepsilon_{nk}; j \neq k, \forall k \in C\}. \quad (1)$$

Unlike the conditional logit model where consumers' preferences are assumed to be homogeneous, heterogeneity in preferences for functional dairy product attributes is accounted for using a latent class model (Boxall and Adamowicz, 2002). The latent class model simultaneously groups consumers into relatively homogeneous classes and explains the choice behavior of class members (Swait, 1994).[2] Within each latent class (that is, not observable by the analyst), preferences are assumed to be homogeneous, but can vary between classes (Train, 2003). An advantage of the latent class approach is its ability to enrich the traditional economic choice model by including attitudinal data. This is particularly beneficial in our study since the present study focuses on functional food. Several studies emphasize the importance of attitudinal factors influencing the consumers' food decisions (e.g., Labrecque et al., 2006; Peng et al., 2006; Pugliese et al., 2013). McFadden (1986) also advocates the use of attitudinal data and posed an integration of information from choice models with attitudinal and socioeconomic factors using a latent variable system. Furthermore, it is reasonable to assume that preferences are not unique to a consumer, but rather a group of consumers (e.g., Hu et al., 2004).

Given that the number of classes cannot be defined in advance, this must be imposed by the analyst and statistical criteria must be used to select the "optimal" number of classes (Boxall and Adamowicz, 2002). The minimum Akaike Information Criterion (AIC) and the minimum Bayesian Information Criterion (BIC) are the most widely used criteria in determining the number of classes.

The latent class model can be employed to estimate class-specific WTP values for the different attributes. The class-specific WTP values for the attributes can be estimated as the rate of change in the attribute divided by the rate of change of the price coefficient (marginal rate of substitution) represented as:

$$WTP = -\left(\frac{\partial U/\partial X}{\partial U/\partial P}\right) = -\frac{\beta_{as}}{\gamma_{ps}}, \quad (2)$$

where X is a vector of the dairy product attributes and P denotes the price. β_{as} is a class-specific non-monetary coefficient and γ_{ps} is the class-specific monetary coefficient on price. Ninety-five percent confidence intervals for the class-specific WTP estimates can be calculated using a parametric bootstrapping technique proposed by Krinsky and Robb (1986). More specifically, a distribution of 2000 observations for each WTP estimate can be simulated by drawing from a multivariate normal distribution parameterized with the coefficient and variance terms obtained from the models. This technique generates analogous results to estimating a standard error, using the delta method. However, it relaxes the assumption that WTP is symmetrically distributed (Hole, 2007).

[2] A detailed mathematical representation of the latent class model can be found in Boxall and Adamowicz (2002).