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Research report

Demand for functional and nutritional enhancements in specialty milk products

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ABSTRACT

This article investigates the socio-demographic determinants affecting the demand for functional and nutritional enhancements in milk products based on a two-stage model. In order to derive the implicit market values of these enhancements, first we estimated the relationship between the prices of differentiated dairy products and the amount or respectively the presence of specific characteristics in these products. Next, using these implicit prices along with the information on households' demographic background, we analyzed the socio-demographic factors that affect consumer demand for specific functional and nutritional enhancements. The model is estimated using a combined panel data set based on AC Nielsen Retail Homescan Panel and the USDA Nutrient Database. Our results indicate that being lactose/cholesterol free (LFCF) and organic implies substantially higher price premiums, whereas soy has a negative price. Socio-demographic factors such as income, racial profile, presence of children; education level and age have significant effects on the demand for functional enhancements. Specialty milk consumption increases with age, education, and presence of kids, whereas it declines with income. The ratio of specialty milk consumption to total milk consumption is substantially higher among Hispanic, Asian and African-American households.

Introduction

As consumers become more health-oriented, the demand for healthier products is rising in North America as well as in Europe (Menrad, 2003). The rise in consumer demand for such products provides not only key opportunities but also substantial challenges to the food sector. Producing functionally enhanced products might require substantial fixed investments, and additional marginal costs. The success of the functionally enhanced products depends on how consumers are likely to accept these products as part of their diet (Frewer, Lyly, & Urala, 2007). Therefore, it is of crucial importance for industry players to know what consumers demand, and how much they are likely to pay for these functional enhancements. Functional products are usually marketed as foods that can provide positive health effects beyond conventional foods (Diplock et al., 1999). Labels provide important information to households that allow them to make informed and healthier food choices (Drichoutis, Panagiotis, Nayga, & Kapsokefalou, 2008). That is one of the reasons why effective labeling forms an important step in the marketing of these products.

Due to the rising interest in healthier food, the world has witnessed an increased use of the term functional foods. There is no universally accepted definition of functional foods which can help us to distinguish it from the rest of the foods in the market. Academic perspectives might differ in terms of the definition and the use of the term functional products. In Europe, the use of this term in academia is generally restricted to only foods that go through special production procedures to promote health (Roberfroid, 2002; Tino & Klaus, 2003). In contrast, functional foods have a much wider definition in North America which even include the inherently healthy foods (Childs, 1997; Gilbert, 2000a, 2000b).

Milner (2002) suggests that all foods are probably functional to some extent as they may provide immediate or long-term benefits. Hasler (2002) defines functional foods as "*whole, fortified, enriched, or enhanced foods that provide health benefits beyond the provision of essential nutrients*". Throughout this article, we will follow the definition provided by International Life Sciences Institute (1999) which defines functional foods as foods that provide health benefits beyond basic nutrition. This definition is also in line with the working definition provided by the EC Concerted Action on Functional Food Science in Europe (FUFOSE). According to the European Commission's report (2010) even a natural food which may or may not be modified by any technology can be considered as a practical example of functional food. Using that working definition allows us to include even the inherently beneficial foods into

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the functional category as long as they provide health benefits beyond basic nutrition.

Since the early 1990s, marketing researchers, agricultural economists, and even health-care professionals turned their attention to analyze consumer perspectives on functionally enhanced products. Niva and Makela (2007) classify the research on functional enhancements as qualitative and quantitative studies. Qualitative studies tend to focus on the general meaning and interpretation of the functional foods among consumers (Annunziata & Vecchio, 2011; Brunso, Scholderer, & Grunert, 2004; Verbeke, 2006). Quantitative approaches focus on specific products or product types to analyze the type of enhancements favored by the consumers. Applications include functional breads (Vassalo et al., 2009), fat-free yogurt (Kahkonen, Tuorila, & Lawless, 1997), and even eggs (Gilbert, 2000a, 2000b).

Although functionally enhanced products have become available in all categories, they are not perceived as homogenous products (Siro, Kapolna, Beata, & Lugasi, 2008). In fact, studies show that functionally enhanced products have differentiated physiological and psychological effects on consumers (Urala & Lahteenmaki, 2004). Not only the type of enhancement, but also the product of concern affects the value of this enhancement (Bech-Larsen & Grunert, 2003). The same type of functional enhancement might have a different value in a different carrier (Ares & Gambaro, 2007). Functional enhancements in carriers with positive health image such as dairy products are deemed to be more valuable to consumers (Siegrist, Stampfli, & Kastenholz, 2008). In order to better analyze the factors that affect the value of these functional enhancements, one needs to consider the specific market conditions for each type of product and define the product as narrow as possible.

Milk is perceived by many consumers as a healthy product with substantial health benefits. Much research has been conducted on the health benefits of ingredients in milk products (Ouwehand & Salminen, 1998). The research mainly concentrates on the scientific benefits of conjugated linoleic acid (Koba & Yanagita, 2013) and other micro contents (Horrocks & Yeo, 1999). Nevertheless limited work has been done on how much consumers are willing to pay for nutritional enrichments in milk products (Dhar & Foltz, 2005; Kanter, Messer, & Kaiser, 2009; Kovalsky & Lusk, 2013).

In this article, we investigate the demand for nutritional enhancements in the retail fluid milk sector. Our goal is to estimate how much consumers are willing to pay for functional enhancements in fluid milk products such as being lactose free/cholesterol free, organic, vitamin/mineral content, reduced fat, and increased protein. We also estimated the demand for soy drink attribute as soy drink can be a milk substitute which is generally enhanced with several nutritional enhancements. It might be argued that being lactose free or cholesterol free is not a functional enhancement in soy drink as soy drink is naturally lactose/cholesterol free. However, based on our definition of functional foods, these enhancements can also be counted as functional since they might provide health benefits beyond nutrition – particularly to lactose intolerant consumers.

Soy drink goes through a totally different production process, but it is becoming a popular alternative to dairy-based milk albeit with a hefty price tag. While in the European Union the use of the milk term is exclusive to drinks made from mammary secretions, there is no restriction in North America. Soy drinks are usually marketed as soymilk and they are mostly located in the dairy section of the grocery. They not only compete for the consumers' budget on dairy spending, but they also compete for shelf space in major national and regional stores. It is of interest to see why some consumers are willing to pay higher prices for soy drink. Therefore, demand for soy drink is also included in our demand model.

In the next section, we present the data, sampling, aggregation issues, product attributes and household characteristics used in the estimation. The model section offers a brief overview of our demand model for milk products based on hedonic price theory. The methods section explains how we utilized the data to perform specific estimations. The details of first-stage estimation results for hedonic prices and the second stage estimation results for attribute demands are presented in the results section. Finally, the paper concludes with a summary of findings and directions for future research.

Data

Since we desire to have an exhaustive set of attributes that include not only the marketing variables, but also the nutritional contents, we combined AC Nielsen Homescan Panel with USDA – ERS Nutrient Database.

Homescan panel

Homescan Data is a panel data set in which each household records the purchases of products at the time of sales. Soon after making purchases, the panel participants record their purchases by using a scanner and subsequently the data are uploaded to a database. We selected a core of 3000 households, who regularly participated in the panel from 2002 until 2006. These households report purchasing fluid milk products at least 12 times a year. During this 4 year period we observe a total of 525,323 purchase occasions. That is about one weekly purchase occasion per participating household. The scanner data possess information on prices, discounts, volumes, expenditures and purchase dates of all dairy products purchased by consumers combined with specific demographic information. Although detailed information on consumers is available from the Homescan panel data, product attributes are limited to discrete marketing variables such as organic label, soy drink, LFCF, vitamin enrichment, container type, product type, product group, and size. Therefore, we enriched information about attributes using the USDA-ERS Nutrient Database to obtain detailed information on product contents. Continuous nutritional contents such as protein, carbohydrate, fat contents, along with sodium and cholesterol contents are obtained from the nutrient database.

Nutrient database

The USDA National Nutrient Database provides a reference to most food composition databases. This database specifies each product under a certain category based on its variety and characteristic information. There are about 50 different categories for a variety of milk types and substitutes. This number is large enough to classify each milk type under a certain category due to the tight rules imposed by USDA and FDA on food labels. Thus, the claims on the labels refer to the same nutritional information whether the product is produced by the same producer or not. The enrichments are covered by cross matching the AC Nielsen scanner data with the Nutrient Database.

Initially, we aimed at using every bit of detailed information on vitamins and minerals. Therefore, we started with all types of vitamins and minerals in the data analysis. However, that presented some problems. First, there are substantial differences in measurement units. Although most of the vitamins included in the database are given in terms of milligrams per 100 gram (mg/100 g), some vitamins such as vitamin B_{12} are measured in micrograms per 100 gram (μg/100 g) and some are measured in international units per 100 gram (IU/100 g) such as vitamin A. To overcome differences in measurement units, values for vitamins and minerals are transformed into percentages provided in a serving size (1 cup = 240 ml) as indicated by Daily Recommended Intake (DRI) values suggested by the Center for Food Safety and Applied Nutrition (2008). In general, the FDA data define these values for a caloric intake of