DISSERTATION

THE VALUE AND ROLE OF FOOD LABELS: THREE ESSAYS EXAMINING INFORMATION FLOWS IN THE FOOD SYSTEM FOR EXPERIENCE AND CREDENCE ATTRIBUTES

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ABSTRACT

THE VALUE AND ROLE OF FOOD LABELS: THREE ESSAYS EXAMINING INFORMATION FLOWS IN THE FOOD SYSTEM FOR EXPERIENCE AND CREDENCE ATTRIBUTES

This dissertation investigates the role of food labels as means of conveying information about food product characteristics, with particular attention to experience and credence attributes. Unobserved product characteristics such as taste, food safety, nutrition, or quality are inherently difficult to quantify but are frequent determinants of demand. Since not all these characteristics are measurable (e.g., food safety) or directly observable (e.g., nutrition), there exists information asymmetry in the market between firms and consumers. Product labeling is a way for information that is initially hidden to eventually be disseminated in the marketplace. Different labeling schemes serve different roles in the marketing system. For example, nutrition information is critical in consumption decisions, while other product characteristics (such as “organic”, or “fair trade”), may be valued by consumers but not essential for decision-making.

Across three essays, we provide an assessment of how different types of labels are used in the food system. We focus equally on labels that have a long and rich history of usage in the food system (such as nutrition labels, and more recently, geographical

indication (GI) labeling which denote a relationship between the product origin and specific product characteristics), but also labels that address emerging, public-minded issues which may be increasingly relevant in the future (such as environmental impact labeling and Corporate Social Responsibility (CSR) labeling).

First, we meta-analyzed the literature regarding GI valuation to generate a set of guidelines, independent of any particular study, outlining the factors that are instrumental for a GI product to capture a price premium. Our findings across many studies indicate that agricultural produce and minimally processed foods such as grains, fresh meats, fruits and vegetables, benefit the most from association with GIs. These product categories generally do not develop own private reputations (brands), and thus, the premia received from association with GI collective reputations is relatively high. On the other hand, in addition to GIs, products with high value-added and longer supply chains such as wines and olive oils may also use private brands more effectively for differentiation. This suggests that brands and GIs have at least a partial substitute relationship. So, as the most broadly framed of the studies here, this cross-sectional analysis would suggest a further exploration of targeted labeling strategies, used jointly or independently of specific brand-name products, is warranted.

Next, using original survey data and looking at nutrition label information, we find that truncated nutrition searches (looking only at the front label), or misleading product claims (such as "organic) are among a broad set of reasons current nutrition labeling practices may be ineffective in uniformly conveying information to consumers. We find that a nutrition index summarizing the information on the back nutrition panel, coupled with the information on the front label, may help to mitigate the incomplete

information problems presented above. Moreover, we find that the environmental impact of food production is hard to identify by consumers if there is a lack of proper certification. But, until more consensus about key outcomes is framed by relevant government or consumer-oriented NGOs, a similar "informational index" solution will not be possible, so policy options are more limited.

Finally, using original survey data we identify consumer preferences for CSR actions in the dairy industry. We find animal welfare to be the most preferred CSR activity and a top priority for most consumers. Sustainable agricultural practices, energy consumption, and waste management are second, third, and fourth, respectively, in importance for consumers; while company involvement in the community has the lowest priority amongst consumers. Furthermore, we monetize the value of animal welfare claims, identified as the most important CSR activity by consumers, in the context of a trusted third-party certification such as the Validus animal welfare certification program.

Together, these empirical analyses provide a diverse set of findings on consumer perceptions, use of information, part-worth valuation of specific characteristics, as well as how these findings may vary by segments of consumers and product categories. By exploring these issues from a variety of perspectives and methods, the studies make both market-relevant and methodological contributions to the food labeling field.

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CHAPTER ONE

Introduction

Consumers make an average of 200 to 300 decisions regarding food consumption in any given day (Wansink et al., 2007). However, many product attributes, especially in the food industry, can be hard to assess at the moment of purchase. Whether there is uncertainty and imperfect information about the product characteristics, prices, or quality across the universe of products available, food choices are generally made in an incomplete informational environment. When firms have more information than consumers about the products in the marketplace, there is a loss of efficiency and an overall lower total economic surplus achieved in that market (Caswell, 1996). This lower surplus may be due to the lower utility achieved by consumers from transactions in the presence of incomplete information, an overall lower number of transactions and/or higher overall transaction costs.

While information asymmetry can be manifested on a multitude of levels, this research focuses on information flows for experience and credence attributes at the retail level within the food system. Starting with Nelson (1970) and a subsequent contribution by Darby et al. (1973), the literature identifies three categories of product attributes classified depending on how easy it is for consumer to acquire information about them. Some product characteristics such as color or aspect are *search* attributes. Consumers can easily identify them by visiting and comparing across multiple stores. *Experience*

attributes, like taste or quality are revealed to consumers only after consumption. Generally, firm reputations develop as a response to the incomplete information associated with experience attributes (Caswell, 1996). Reputations are viewed as an expectation of high quality (Shapiro, 1982) when they lead to returning (as opposed to one-time) customers whose loyalty offers sufficient returns to incentivize investments in quality. The most difficult food attributes to collect information on are *credence* attributes (e.g., food safety, fair taste, or nutrition). The outcomes associated with credence attributes are very difficult or impossible to assess even after consumption. In this case, the government often chooses to play a role in making it feasible for consumers to assess credence-based qualities by requiring informational labeling (Caswell, 1996).

Generally, four approaches to government labeling can be identified (Caswell et al., 2011). First, consumers may "*need to know"* specific information (such as nutrition, environmental sustainability, or food safety) when making purchase decisions. For example, disclosing nutrition facts in a standardized fashion is mandatory in North America because of governmental priorities related to public health. Second, information the public has the "*right to know"* is frequently regulated by mandatory or voluntary labeling because of popular, consumer-driven demands on policymakers. For example, GMO labeling (now required in Europe, but not the U.S.) is the most popular example of right-to-know labeling. Third, information consumers generally "*want to know"* about the products and production process (such as organic farming) is administered through minimum requirements that serve as the basis for voluntary labeling, and because they are voluntary, are more commonly used by food companies that feel they can effectively target consumers seeking such attributes. Fourth, product information relevant to the

regulatory oversight mission of "*prevention of fraud"* or deception of consumers is also subject to labeling.

This dissertation investigates the role of food labels as means of conveying information about food product characteristics, with particular attention to experience and credence attributes. Across three essays, we provide an assessment of how different types of labels are used in the food system. We focus equally on labels that have a long and rich history in the food system (such as nutrition labels or geographical indication labeling, which denote a relationship between the product origin and specific product characteristics), but also labels that address novel, current issues and may be have a widespread implementation in the future (such as environmental impact labeling and corporate social responsibility labeling).

In the context of government's role in labeling, "*need-to-know*" labels such as nutrition information are implemented to correct market failures associated with credence nutrition information that cannot be asses even after consumption of the product. Nutrition labeling is mandatory in the United States; however, low rates of use are reported with respect to these labels (Viswanathan, 2002; Roe, 1999; Black, 1992; Higginson, 2002). Research shows that consumers generally do not check nutrition labels or use only one or two nutrition attributes (such as sugar or fat) when they do consult them. This results in an ongoing debate in the literature regarding the effectiveness of these labels in relaying information within the framework of their low use. Are nutrition labels accurately interpreted by consumers? Do they transmit uniform nutrition information to consumers? What is the effect of low (or truncated) usage of nutrition labels?

Similar to nutrition labels, geographical indication (GI) voluntary labels were implemented in the early 1990s. GIs have been successful (valued by consumers) in signaling a specific link (referred to as *terroir*) between the origin of production and product characteristics (Hermann et al., 2011). Prominent examples of GIs are Parmigiano-Reggiano cheese and Champagne wine, which are believed to be of higher quality, or display increased heritage connectedness. GIs are "*want-to-know*" labels signaling experience attributes that are valued by consumers, but given this designation, there is interest in how valued they are, particularly given that they are used in the same retail market environment as brand names. A very large volume of research quantifies the values consumers have for GI labeling for a variety of products in different regions of the world. However, the high variation in price premia associated with GIs raises the question concerning what factors drive GI valuation. Do institutional characteristics in each country play a role in GI valuation? Are some product categories associated with a higher price premium than others? This dissertation attempts to answer these questions.

In addition to already existing labels with an established history in retail markets, such as nutrition and GI, current world trends and events give rise to consumer demand for new product information. The environmental impact of food products may qualify as "as "*want-to-know*" information. The environmental impact of food products has mostly been studied in the context of eco-labeling. Research finds that demand for eco-labeled products exists and consumers are willing to pay a price premium for more environmentally-friendly products (Johnston et al., 2006, Blend et al., 1999). However, in the lack of standardized labeling, it is hard to assess the environmental impact of food products. Individuals tend to develop personal norms (such as favoring product

packaging like cardboard, or buying organic foods) when choosing environmentally friendly products, and these norms are a significant predictor of their propensity to choose environmentally friendly options in the supermarket (Thøgersen, 1999). This suggests that when credence attributes, such as the environmental impact of a product, are hard to assess, experience or search product attributes can be used as proxies for harder to assess credence attributes. However, how successful are environmental product cues in conveying information to consumers? Are they a substitute for standardized labeling? Can these cues bridge the information gap due to lack of standardized environmental labeling?

Similar to environmental labeling research, research related to corporate social responsibility (CSR) information labeling is especially relevant today given the current growing importance of CSR claims for consumers, producers, NGOs, and the media. Company CSR actions are meant to internalize negative firm externalities on society and the environment and work on decreasing them. The popularity of CSR initiatives have been increasing, however, it has been documented that only a limited number of consumers use it as a purchase criterion. Out of the consumers who are likely to make a CSR-based purchase, only a minority (21%) actually use a company's CSR position as a purchase criterion (Mohr et al., 2001). The wedge between the popularity of CSR and its use in product selection is minimally addressed in the literature. Some of the first attempts to explain it call it "the paradox" of CSR in consumer behavior (Öberseder et al., 2011). Also, since CSR information qualifies as "*want-to-know*" information, it means that only a subset of the population may be interested in it. Identifying consumer preferences and values for CSR actions is part of identifying whether demand for CSR

information exists. Our research attempts to clarify this issue further by addressing unanswered questions in the literature: do consumers value CSR actions enough to pay a price premium for them? What are the most valued CSR actions by consumers in the dairy sector? Given the lack of standardized CSR information labeling, how does CSR information reach consumers?

Across three essays, this dissertation attempts to provide answers to the questions outlined above for nutrition labeling, voluntary geographical indication certification, environmental impact labeling, and CSR labeling. Together, these empirical analyses provide a diverse set of findings on consumer perceptions, use of information, part-worth valuation of specific characteristics, as well as how these findings may vary by segments of consumers and product categories. By exploring these issues from a variety of perspectives and methods, the studies make both market-relevant and methodological contributions to the food labeling field.

The first essay presented in Chapter II, "A Meta-Analysis of Geographical Indication Food Valuation Studies: What Drives the Premium for Origin Based Labels?" uses a meta-analytical approach of the empirical literature on geographical indications (GIs) in order to establish a link between the price premium received by the evaluated products and specific product, industry, or institutional characteristics. Presumed higher quality, specific sensory attributes, heritage production methods or other particular characteristics of these products (associated with the region geographical microclimate) are primarily experience attributes that can be evaluated through consumption (Hermann et al., 2011). GIs as voluntary government certifications have developed in this case to signal the presence of product characteristics associated with specific geographical

origins. The presence of GI certification is generally valued positively by consumer, but some types of foods may benefit from associations with GI names more than others. In cases where GIs coexist with other forms disclosing hidden product information (such as product brands), we explore the dynamics between private (brands) and collective means (GIs) of signaling quality for experience goods.

Chapter III, "Exploring Product Differentiation through Environmental Impact Claims and Metrics", focuses on two important characteristics of food products: nutrition and environmental impact. Nutrition and environmental characteristics are food credence attributes, whose effect cannot be immediately determined even after consumption. Government regulation is generally the most appropriate means of resolving information asymmetry problems in markets for credence attributes (Caswell, 1996). In the US, there is a long history of nutrition regulation culminating with the Nutrition Labeling and Education Act (NLEA) passed by Congress in 1990 (Drichoutis et al., 2011). The NLEA regulates the uniform transmission of nutrition information through standardized nutrition facts and serving sizes on all packaged foods. However, increases in obesity rates (Berning et al., 2008, 2010) and reported low levels of use of information on the regulated product label (Higginson, 2002) suggest the need for improvement of product label standards or format. On the other hand, the use of rudimentary product cues (such as packaging material) by consumers to assess the environmental impact of food products (Thøgersen, 1999) may be an indication that government intervention is this area is necessary. But, beyond the appropriate role of the government in labeling, this study will focus on how consumers currently process the information they receive in the retail marketplace for dairy products.

Chapter IV, “Corporate Social Responsibility Initiatives and Consumer Preferences in the Dairy Industry”, investigates how information about ethical product claims of food can be transmitted to consumers. Ethical product claims, such as those featured in corporate social responsibility reports about commitments towards increased air quality, low energy use, or animal welfare, are credence attributes whose outcome cannot be immediately determined by consumers even after consumption. In this case, government regulation, or that from another trustworthy third-party certification program, is necessary to make these claims credible (Caswell, 1996, 2011). In lack of specific government regulations, CSR information may be communicated through indirect channels, such as labels instituted by the government for other purposes. For example, Organic product labels may be indicative of higher standard for livestock animal welfare in dairy products, even though organic production does not imply the adoption of the most rigorous animal welfare protocols held as standards by some certification programs. However, trusted third-party certification (such as Validus animal welfare certification) is also suitable, in this case, for highlighting credence attributes, but may be less commonly known or understood by buyers because of its relatively smaller scope in the marketplace.

Each of the essays included in this dissertation provides an original contribution to the literature on information asymmetry of intrinsic product characteristics. Experience attributes derived from the connection with a specific geographical region are regulated under geographical indication voluntary schemes. The current dissertation contains the only meta-analysis in the literature investigating the reasons behind the premium for GI valuation. We use published GI valuation studies to generate a set of guidelines,

independent of any particular study, outlining the factors that are instrumental for a GI based product differentiation scheme to capture a price premium.

In addition to identifying the reasons behind GI valuation, we provide consumer valuation for product CSR credence attributes in the dairy industry. An original survey instrument is developed to elicit consumer preferences for CSR activities in dairy and value these activities in the context of current milk labels. This is the only study that we are aware of that identifies CSR preferences in dairy and provides a monetized value for them. Another contribution of this dissertation lies in measuring the information gap arising from lack of environmental product labeling. We use original survey data to statistically measure the environmental information gap by comparing it to nutrition, an area which currently benefits from standardized labeling. The boundaries of current knowledge in each of these labeling areas are identified and an original contribution is presented for each of them.

The Economics of Information: a Literature Review

Imperfect information has profound effects upon the market structure of consumer goods (Nelson, 1970) and on consumer behavior in the market. The market structure may change, for example, when asymmetric product information leads to product differentiation and the creation of monopolistic competition (Wolinsky, 1984; Stiglitz, 1979; Schultz, 2004).

Across several disciplines like economics, psychology, sociology, social psychology, and anthropology, researchers have attempted to explain individual human choice behavior under imperfect information (Hansen, 1972). Information has economic value because it allows individuals to make choices that yield higher expected payoffs or expected utility than they would obtain from choices made in the absence of information.

The food industry provides an especially suitable example of the effect of asymmetric information on markets. Many food attributes and characteristics can be hard to assess by consumers. Unobserved product characteristics such as taste, style or quality are inherently difficult to quantify but are frequent determinants of demand. In some markets, products may be physically similar but differ in consumers' perceptions about quality, durability, or status (Berry, 1994). Lancaster (1966, 1991) proposes that consumers are not interested in goods per se, but in their properties or characteristics. In Lancaster's approach, the major food product attributes related to quality include food safety (e.g., levels of microbial pathogens, residues), nutrition, value (e.g., compositional integrity, taste), package, and process (e.g., animal welfare, environmental impact) attributes (Hooker et al., 1996). However, not all these characteristics are measurable

(e.g., food safety) or directly observable (e.g., nutrition). In other words, there exists an information asymmetry in the market between firms (who are more knowledgeable than consumers about, for example, food safety or nutrition of a product), and consumers. Caswell (1996) suggests that the distinction developed by Nelson (1970, 1974, 1976, 1981) between search and experience goods, when applied to product attributes, is powerful in understanding how information that may be initially hidden, can be eventually disseminated in the marketplace.

Nelson (1970) proposes two actions which consumers can take to assess quality and overall utility derived from a product: *search* (inspecting prior to purchasing), and *experience* (consuming the good). Search attributes (or goods) are defined by product attributes for which full information can be acquired prior to purchase. Clothing, footwear and furniture fare typically cited as examples of search goods (Seigel, 2006). Search attributes related to food are color, smell, and physical appearance. Experience goods are dominated by attributes that cannot be evaluated until purchase and consumption of the product. Examples of experience goods and services are automobiles, appliances, or weight control programs (Seigel, 2006). For food, experience attributes relate to taste, cooking properties, or texture of product when consumed. In 1973, Darby et al. added credence goods (or attributes) to this classification. Claims associated with credence attributes are difficult or impossible to determine even after consumption. For example food safety, nutrition, or ethical product claims (such as fair trade) fall into this category.

Each of these types of attributes has specific information asymmetry problems in the market and solutions that alleviate these problems. In the market for search goods,

consumer information is easier to obtain. Search goods are more susceptible to substitution, as consumers can more easily identify and evaluate alternatives by visiting other outlets and stores. For food products, most search attributes (e.g., color) are not related to life-altering events associated to safety and nutrition so the "cost of being wrong" is not high (Caswell, 1996).The market for search goods has relatively minor regulatory activities, because consumers are in a position to provide direct incentives to firms to produce the search attributes that are most popular (Caswell, 1996).

In markets for experience goods, quality information is the most important product characteristic (Caswell, 1996). Akerlof (1970) provides an example of market failure due to information asymmetry by describing the "lemon" problem in the market for used cars. A lack of credible quality signals creates incentives for sellers to misrepresent the quality of their goods. Buyer's willingness to pay for high quality decreases. This creates the problem of adverse selection where high quality is crowded out by low quality resulting in a collapse of the market for high quality (Akerlof, 1970). In the market for experience goods, there exists a moral hazard problem of firms to misrepresent their products as high-quality and sell them to a one-time customer. One way firms navigate the moral hazard problem, reveal information and signal quality to consumers is through labeling, advertising, warranties, and building reputations. Reputations are costly to build and they require returning (as opposed to one-time) customers. Developing reputations is a good solution to alleviate information problems related to experience goods.

The outcomes related to credence attributes are hard to assess by consumers even after consumption. Reputations rarely develop in response to credence attributes because

the consumer cannot learn it from his or her previous experience in consuming the product and cannot form a quality expectation related to a particular brand or name (Caswell, 1996). Reputational models of quality do not apply here, but quality signaling may still be used if it involves a third-party reputable certification agent whom consumers trust (Caswell, 1996). The government can play a role in increasing the number of informed consumers by facilitating communication through official and consistent labeling and certification. Labeling changes the amount or type of information that is available in the market and has the advantage to certify the effect of individual product attributes (the Lancasterian approach) as opposed to entire goods and services (Caswell et al., 2011).

While information asymmetry is an important factor affecting consumer product selection and the product purchasing process, consumers' tastes and preferences also affect market behavior. Individual preferences determine the relative importance given by each consumer to various product attributes, and different consumers make different choices based on their unique preference map. Consumer purchase behavior (buying a specific product when other substitutes are available) can be used to infer what product attributes consumers value (revealed preferences) and what their underlying preferences are (McFadden, 2001). However, while consumer choices for market goods can change based on the situation surrounding the decision-making process (Fishhoff, 1993), it has been shown that people's values are more stable (Lusk et al., 2005). Values are defined as meta-preferences (Lusk et al., 2005), or "underlying preferences" (Becker, 1976) that people hold with respect to the essential aspects of human life. The desire to have a healthy lifestyle, be compassionate towards others, respect the environment, or achieve

fame and prestige are some of these values (Lusk et al., 2005). These values motivate the choice of products individuals make more so than individual preferences over a set of attributes, which can be circumstantial and contextual. Also, while consumers may not have specific preferences for individual product characteristics, they do hold underlying values that help them make decisions. For example, while people may not have specific preferences for vitamin A relative to vitamin B12 content of a specific food, they are likely to know whether "nutrition", as a value, is important for them and make choice that support outcomes that are nutrition-friendly (Lusk et al., 2005). The means-end chain literature pioneered by Gutman (1982) upholds the idea that goods are the means (objects, or activities) in which people engage in order to achieve desired end-states such as "happiness, security, or accomplishment". These recent developments of consumer theory provide a more profound insight into consumer choice.

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CHAPTER TWO

A Meta-Analysis of Geographical Indication Food Valuation Studies: What Drives the Premium for Origin Based Labels?

1. Introduction

Agricultural and food products have long been associated with unique characteristics and heritage aspects associated with their origin. Geographical names have been used since classical times to identify products of exceptional quality; for example, historical documents reveal the notoriety of olive oils from Baetica in Rome (Blasquez et al., 1992). Through the ages, a number of products identified by their origins emerged and, more recently, have established a niche in food and beverage markets. Well-known examples of Geographical Indications (GIs) are the wines of Bordeaux and Porto, the cheeses of Parma and Rochefort, and the hams from Parma and Bayonne. In general, the association of food products and geographic names identifies distinct agro-ecological conditions, typically raised animal breeds and plant varieties, and human capital uniquely suited to the region. These conditions are often associated with the definition of *terroir* (Joslin, 2006). In addition, the names of GI products may signal specific modes of production, and commonly emerged based on the collective reputation of numerous producers.

In an increasingly industrialized and standardized food market, GI labels seem to suggest consumers a more genuine, unique and higher quality food (Broude, 2005); while offering producers an opportunity to differentiate their products and, perhaps, obtain higher prices. Thus, firms may use a GI to signal intrinsic quality attributes to consumers, and thus, capture a reputation rent (Menapace et al., 2011). A measure of a GI label's success might, then, be partially evaluated by the price differential between a GI product and its branded or commodity competitors in the market. Based on this criterion, and using the empirical literature documenting how GI products' valuations measure up relative to commodities in the same product category, it is possible to identify which food categories have secured higher premia. To this end, we compiled a pool of 25 empirical studies analyzing GI labels and observed that the statistical and economic significance of estimated price differentials vary substantially. Using these studies we aim to provide preliminary answers to the following questions: what critical factors determine price premiums? Do these factors vary across products and countries? When do GIs add more value to products than alternative differentiation strategies?

Food producers, namely those producing processed products, such as cheeses or wines, have, and use, alternative marketing strategies to differentiate their products based on individual reputations. In fact, there is a wide variety of products in the food and beverage sectors that have achieved widespread recognition and popularity using brand names rather than geographic designations. Thus in some product categories there may co-exist GIs and branded products (or trademarks). While indications of origin have mainly been used in Southern European countries, they are becoming increasingly common in Northern Europe, the New World and in developing countries. Examples

include wines from specific viticultural areas in North America, Australia and New Zealand; Jamaica's Rum and Blue Mountain coffee, as well as India's Basmati rice and Darjeeling tea (Costanigro et al., 2009; Schamel et al., 2006; Das 2006; Gautam et al., 2010; Deppeler et al. 2011).

To the best of our knowledge there is no previous study attempting to compare GI price premiums across product categories. Still such information could help both producers and policy makers decide in which cases the labeling of origin might be suitable marketing instrument. A suitable methodology to compile and investigate common patterns in the published work is meta-analysis regression. This technique is quite common in the medical science to establish common patterns in related studies and reconcile possible conflicting evidence (Hunt, 1997). It is also increasingly used in economics to perform "a more formal and objective process of reviewing an empirical literature" (Stanley, 2001, pp. 147-148). Our intent is to generate a set of guidelines, independent of any particular study, outlining the factors that are instrumental for a GI based product differentiation scheme to capture a price premium.

More specifically, the primary objective of this study is to (meta-) analyze the empirical literature on GIs in order to establish a link between the GI premium and specific product, market characteristics and/or institutions. We consider three major dimensions of each product examined: 1) broad food categories, degree of food processing and product prices; 2) existence/absence of an alternative differentiation mechanism (i.e. branding) and; 3) the institutions and laws regulating the use of GIs. We proceed by summarizing the relevant literature on why consumers and producers may

value GI labels, describing the data and methodology employed here, presenting the findings and discussing marketing and policy implications in the following sections.

2. Background

Economists suggest that GIs are used in food markets to signal intrinsic qualities of foods that consumers attribute to certain origins (Menapace et al., 2011). Indeed, Costanigro et al (2010) emphasize how GIs may essentially provide a means to broadly categorize food choices, thereby facilitating consumer learning and the articulation of quality expectations (a reputation effect).

However, the reasons behind consumers' and producers' use of GIs are likely to be complex and multi-faceted. Scarpa et al (2005) suggest one potential rationale, arguing that consumers' ethnocentric preferences or home bias may explain some of the preferences for origin labeled foods. In other words, the argument is that consumers tend to prefer products from the region or country with which they identify. Another reason, suggested by Broude (2005), is that GIs may counteract the perception that increased globalization has led to overly standardized food choices imposed by international brands. Still another argument is that GIs reveal and represent some sort of authenticity, cultural heritage or the ability to trace food choices to their origin (Herrman et al., 2010). In short, there seems to be a renewed interest by some segment of consumers in "authentic," "traditional," "wholesome," and "traceable" food which seems related to a range of factors such as increased awareness of food safety, the socio-cultural status of

consuming certain foods and renewed interest in, or nostalgia of, one's culinary heritage (Ilberry et al., 2000).

Farmers may use GI designation to differentiate their products and avoid competition in commodity markets, where brand-based product differentiation is otherwise impractical. That is, farmers and primary food processors using GI labels may have easier or cost effective access to niche markets, and have the ability to extract premium prices (Bramley et al., 2009). A theoretical framework explaining the use of GIs and trademarks has been proposed by Menapace et al, (2011), extending an earlier model from Shapiro (1983) on the relationship between minimum quality standards, reputation, and price premia. In both articles, premia for high quality are modeled as (lagged) returns from investment in quality. Since reputations develop slowly over time, a price premium (above cost of production) is necessary to induce firms to produce at any quality level above the minimum standard imposed on all firms. The farther away a firm moves from the minimum standard in the quality spectrum, the longer it will take to build the reputation, the larger the premium needs to be. Thus, for producers with limited resources who are located in a GI area, it may be a sensible strategy to use the origin labels rather than to develop their own reputation through a brand.

Along these lines, policy-makers have long acknowledged consumer interest and the potential of GIs to impact product valuation, international trade flows and farm policy (Herrmann et al., 2010). Most importantly, GIs may represent a key option to raise farmers' incomes and promote rural development (Josling, 2006). After a long period of spontaneous and informal development, designations of origin have been the object of

increasing policy and regulatory efforts, most notably in Europe. In the early 1990's, the European Union conferred legal protection to foods and foodstuffs with a GI through Regulation (EEC) 2081/92 (EEC Council, 1992). At the core of this regulation is the idea that products originating from certain regions are *sui generis,* in that there is a direct link that can be demonstrated between the product origin and its final quality (Herrmann et al., 2010). This link occurs either via a set of standardized processing practices typical of a region or by the concept of *terroir*. The varying strength of this link is the rationale behind the use of two labels: in the case of a PGI, either production, processing or preparation of a product need to occur in the geographical area; while for a PDO *all* stages must occur in the same region (O'Connor, 2007). In other words, PDOs have more stringent standards of production and signal a stronger link between origin and the product's attributes. Finally, this regulation confers protection from "abusive" or unwarranted use of a protected designation of origin (PDO) or a Protected Geographical indication (PGI).

While the EU legislation on GIs is perhaps the most fully articulated and comprehensive (Josling, 2006), other countries have their own systems. In the US, GIs are protected within the standard trademark system, and most often simply verify the geographical origin of a product (Menapace et al., 2009). Names or signs, which otherwise would be considered primarily geographically descriptive, can be registered as quality assurance programs (USPTO, 2011). The process of establishing and using such a verification process is straightforward. First, an agency (at the state or regional level) establishes the standards governing a GI based trademark (e.g.: Idaho Potatoes must be grown in Idaho, and must be of a specific variety, e.g. Burbank, see O'Connor, 2007). It

is up to the agency to choose how strict these standards are based on their perceptions of the existence of differentiation opportunities in the marketplace. Then, anyone who meets these standards is permitted to use the geographical name to market their product. In the case of GIs, the geographical origin is usually the main attribute that is regulated by the quality assurance program or trademark (USPTO, 2007). However, the allowance of multiple criteria suggests that trademark programs may display a weaker link between origin and product attributes than the PGI and the PDOs, and instead, require a broad set of practices to truly differentiate the product in the consumer's eyes.

In short, both food producers and consumers seem to benefit from the use of GI labels. From a producer's perspective, origin can be an inexpensive way to differentiate a product and obtain a price premium. For consumers, it is a way to reduce search costs, as GI can incorporate a heuristic with which consumers limit the number of options on a choice set for a product category of interest (Costanigro et al., 2010). When origin is a valuable attribute, there will be a strong incentive to free ride. Consequently consumers may distrust the origin label unless there is some form of assurance that the product they face is genuine. This is why some origin labels, notably those regulated and recognized by the EU, have a standard, third-party monitoring and certification scheme to which all producers using the label must comply.

3. Methodology and Data Description

As already mentioned, this research employs a meta-analysis to determine what factors influence the variation of price premium across products using GI labels. This methodology is increasingly popular in economics and recent examples of its application include Lusk et al (2005) on the valuation of genetically modified foods; Brander et al, (2011), on the value of urban open space; and Lagerkvist et al, (2011), on consumer willingness to pay for animal welfare.

The meta-analysis methodology entails to quantitatively analyze the results of empirical studies that investigate the same topic. This is a popular analysis in social studies, medical and clinical research, and psychology (Hedges et al., 1998). The objective of meta-analyses is to provide an overview of the research on a particular topic by summarizing and synthesizing the results in the field, as well as testing theoretical and practical hypotheses that cannot be tested in the primary research (Brannick et al., 2008). Generally, this is accomplished by estimating the mean of the distribution of effect sizes (coefficient estimates) from multiple studies, and estimating and explaining the variance in the distribution of these coefficient estimates (Brannick et al., 2008). Examining the variance in coefficient estimates explains how study characteristics affect research results and helps draw overarching relevant conclusions about the topic of study.

Some advantages and disadvantages of meta-analyses emerge when compared to traditional literature reviews. One advantage is that, while traditional literature reviews may only selectively include studies based on the reviewer's own subjective view of the quality of the study, meta-analyses include studies based on clearly defined rules and thus

are less biased (Wolf, 1986). In addition, the subjective weighting of studies or the failure to examine study characteristics as explanations of results across studies are addresses in meta-analyses compared to traditional literature reviews (Wolf, 1986). On the other hand, one of the main criticisms of meta-analyses is that it includes published research that is biased in favor of significant findings because insignificant findings are rarely published (Rosenberger et al., 2009; Wolf, 1986). However, this is also the pitfall of traditional literature reviews, since publication bias affects both.

Statistical issues arise when analyzing data compiled from numerous studies that use different methods to generate their own estimates. Some of the ways biased conclusions may be obtained in meta-analyses include a strong bias towards publishing positive but not negative results (Rosenthal, 1979), weighing equally the results of all studies even through there may be qualitative differences among them, or including multiple results from a single study. This latter problem of within-study correlation of estimates is one of the main analytical criticisms of meta-analyses. Two statistical models have been historically used to examine this type of data: fixed-effects and random-effects models (Hedges et al., 1998; National Research Council, 1992). In the fixed-effects model, it is assumed that the underlying effect of each study is the same. The variation in investigated outcome will therefore reflect only the random variation within each study but not any potential heterogeneity across studies (Schulze et al., eds., 2003). Random-effect models have been used to account for within-study correlation of estimates (Lusk et al, 2009). The random effects model incorporates variation between the models. It is assumes that each study has its own effect.

In other words, if there is reason to believe that the effect sizes are homogeneous in nature and the researcher wishes to make inferences only about the parameters in the set of studies that are observed, then fixed effects model is appropriate. In contrast, if estimates are not homogeneous and inferences need to be generalized beyond the observed studies, random effects model can be used (Hedges et al., 1998). Recently, however, meta-analysis studies test for the existence of fixed or random effects and may choose neither (Lusk et al, 2009; Ehmke, 2006). In these cases, a simple OLS model may be appropriate. It can also be argued that not all studies synthesized in a meta-analysis should be given equal weight (Wolf, 1986). Some studies may be based on very small or unrepresentative samples of subjects. Assigning equal weights may lead to less representative studies contributing equally to results as more well-designed studies (Wolf, 1986). Using the sample size as weight gives higher weights to studies that provide "more evidence" and more precise parameter estimates (Schulze et al., 2003).

Most meta-analysis methodologies originate from the psychology literature, where most meta-analyses are done. While psychology data may be different than, for example, economics data, the general rules and framework developed in psychology also applies to social sciences studies. While the debate about the usefulness of meta-analyses is on-going (Hunter et al., 1996; Feinstein, 1995), it a useful tool frequently adopted by researchers (Schulze et al., eds., 2003). Meta-analysis is not a strictly standardized technique and criticisms originate not only on statistical grounds but also on conceptual and philosophical grounds (Schulze et al., eds., 2003). However, the technique is helpful in highlighting gaps in the literature and providing insights into new directions for research (Wolf, 1986).

In order to compile the database used in this study, we searched several applied economic and food industry databases for studies estimating consumers' willingness to pay (WTP) or market premium for GIs in a variety of food products. More specifically, EconLit, Web of Science, EBSCO Business Source Premier, and Google Scholar were consulted in early 2011. Studies published after this date or in other databases may not be included. Since the first transnational regulation on GI products was introduced in the EU in 1992, we only included studies dated from 1990 onwards. To identify relevant studies we used the following keywords and keyword combinations: "geographical indication", "protected designation origin", "protected geographical indication", "PDO", "PGI", "trademark", "WTP label". To be included in the sample, the studies had to meet two general criteria: 1) GI valuation estimates were reported as a premium/discount with respect to a generic, non-GI, product, and, 2) the product has a strong geographical connotation, identifying a specific region of production.

To be precise, the first criterion implied including only articles for which it was possible to obtain valuation estimates (either directly or as a function of the reported estimates) calculated with respect to a generic (non-GI) reference product or a superordinal product categorization[1] (for example, Bordeaux wine valued with respect to a pool of other European wines, or other French wines). As for the second criterion, all estimates relative to products carrying a PDO, PGI, or trademarked geographical label were included, as well as products originating from a very specific region that may not have an official GI label (e.g. wine from Hunter Valley, Australia). Studies estimating consumer valuation of country of origin labels (COOL) were excluded from the sample

[1] Examples of GIs studies excluded under this criterion include Mtimet, 2006; Santos, 2005; Schamel, 2003; Ali, 2007; Combris, 1997.

because the link between geographic name and specific growing conditions (the concept of *terroir*) was considered too weak. That is, a WTP differential for similar food products made in U.S. vs. made in China might have more to do with perceived differences in food safety standards than differences in growing conditions. Finally, we did not consider studies estimating the premium for locally-grown products, as products marketed as "local" rarely identify specific enough characteristics of the region of production. For local products, the geographic connotation relates more to the *distance* (rather than product *origin*) between location of production and the location of consumption, and is therefore a relative concept. In short, what is perceived as local by a New York consumer is certainly not local for a San Francisco one, and vice-versa.

In total, 25 studies were identified and relevant information was compiled in a dataset for further analysis. These studies often report estimates for more than one GI, leading to a total sample size of 141 product-specific estimates. The sample was adjusted to exclude extreme outliers, yielding a final sample size of 134 observations collected from 22 papers. Table 2.1 lists each study, the food product involved, the broadly defined methodological approach of each study, as well as the number of GI estimates collected.

(See Table 2.1)

As in other meta-analysis studies involving valuation of labeled attributes (Ehmke, 2006; Lusk et al., 2005), estimates of the GI premia were normalized across articles as the percentage price (or valuation) difference between labeled and unlabeled products. Thus, to construct our dependent variable, we use the formula:

$$\% \text{ Premium} = \left(\frac{\text{Price of GI Product- Price of Reference Product}}{\text{Price of Reference Product}} \right) * 100 .$$

This specification normalizes the estimates across the different years, units of measure (i.e., kilograms, pounds, cc, etc) and currencies reported.

It should be noted that several challenges emerged in compiling the data. In a study using an experimental design where a reference price was not given, (Groot et al., 2009), the median of the price treatments is used as reference price (following Lusk et al., 2005). Furthermore, many studies (more than 30% of our sample) reported only point estimates, and not the associated standard errors. Even for the cases in which some measure of the precision of the estimates was provided, we found them to be extremely heterogeneous[2]. Another limiting data issue regarded the demographics of the sample, and particularly income, which were either missing or reported inconsistently across studies (for example, "high" vs. "low" income instead of income categories or levels)[3].

While we acknowledge these limitations, the compiled dataset contains a wealth of information that does allow for some useful comparisons and analysis including: location and period covered by the study, type of GI scheme (PDO, PGI, GI-based trademarks or generic geographical references), sample size and type of data used in the original study (i.e. survey, experiment, scanner data, etc), and methodology used to

[2] The metrics used included standard errors, t-statistics, exact p-values or cutoff p-values (e.g., 0.01, 0.05, and 0.1). While all these measurements could be transformed into a uniform variable, for 44 out of a total of 141 observations (31.2% of our sample size) no measurement of precision of the WTP estimate was reported.

[3] Income was considered an important variable *a priori* since studies that include a larger proportion of more affluent consumers may have inflated willingness to pay estimates.

estimate the price premium (hedonic methods, contingent valuation, other)[4]. The valuation estimates were also categorized by broad food classes (cheese, meat, fruit, etc) and three super-categories based on the level of processing that the base agricultural commodity underwent (highly processed for cheese and wine; low/intermediate for olive oil, grain, coffee, meat; and fresh produce for fruits and vegetables). A final categorization was based on the perceived propensity for firm branding within each product market, which we consider as another important product differentiation mechanism. Wine and olive oil where characterized as markets in which brands are almost always present, while cheese and meat both may be branded or generic, and at least in this time frame, branding was more rare for grain, fresh fruits and vegetables. A description of the variables and their descriptive statistics is provided in Table 2.2.

(See Table 2.2)

The percentage premium for all GIs varies widely from a minimum of -36.73% for Provolone Valpadana Cheese (Galli, 2010) to +181.92% for Valle d'Aosta Fromadzo Cheese in Italy (Galli, 2010). The average percentage premium for GIs is 15.12% once extreme outliers[5] were removed. While the mean WTP is positive, indicating that consumers are generally willing to pay more for GI products, there is a great deal of variability in the reported premia(a estimated standard deviation of 35.5%). It should be

[3] Methodologies coded as "other" include simple reporting of a price differential between the labeled product and an unlabeled substitute (Galli et al.), auctions/ bids (Stefani, 2005; Akaichi et al., 2009), random utility models (Botonaki et al., 2004), and contingent valuation methods (Skuras et al, 2002).
[5]To reduce the effect of extreme (and perhaps suspicious) observations on our estimates, we eliminated 7 observations falling outside a +/- 2 standard deviations from the mean estimated percentage premium. (see Table 2.1 for excluded studies). One std.dev. in this sample is 38% and the mean is 21.3%, so estimates outside the -54% and +94% range were excluded.

also noted that the majority of studies in this sample (55%) are based on valuations by European consumers, followed by North and Central American studies (31%) and, finally, Australian and New Zealand studies (14%).

Figure 2.3 shows the broad product categories represented in our sample by the GI scheme (PDO, PGI, or trademark).

(See Figure 2.3)

From a statistical viewpoint, it would be ideal to have all product categories represented within each GI-based quality assurance scheme, with similar frequencies. Instead, PDO-protected products are mostly cheese, followed by wine, olive oil, fruits and vegetables, and meat. The majority of PGI certified products in our sample are meats, followed by grains and olive oil; while GI trademarks are mostly used with wine products[6] (73%), and fruits and vegetables, such as Washington apples and Idaho potatoes. Comparing PDO and PGI product lists, it appears that, with the exception of fresh produce, the more processed products such as cheese, wine, and olive oil self-select into the more complex PDO quality assurance, while the less processed meats and grain products are mostly certified by the less onerous process associated with a PGI.

[6] Wines are coded as trademarks when the original study specifies that they are produced in a specific American Viticultural Area (AVA)

4. Model and Estimation Methods

The main advantage of meta-regression analysis is the ability to describe the variation existing in the selected studies (Stanley 2001), but there are still several options for model specification which depend on priors about what variables may explain the variation.

We estimate three model specifications, the most descriptive of which (Model 1) takes the form:

(1)

$$\begin{aligned} \%Premium_{ij} = {} & \alpha_0 + \alpha_1 (Wine_i) + \alpha_2 (Cheese_i) + \alpha_3 (Meat_i) + \alpha_4 (Grain_i) + \alpha_5 (OliveOil_i) + \alpha_6 (FruitVeggie_i) \\ & + \beta_1 (PDO_i) + \beta_2 (PGI_i) + \beta_3 (CertMark_i) + \\ & + \gamma_1 (Primary\ Data_j) + \gamma_2 (Conjoint_j) + \gamma_3 (Hedonic_j) + \varepsilon_{ij} \end{aligned} ;$$

where $\%Premium_{ij}$ indicates the i^{th} estimated premium from the j^{th} study. Thus, the general modeling framework assumes that the percentage WTP/price premium for GI certified food products depends on product/market specific characteristics (as captured by the alpha coefficients), the quality assurance scheme (beta coefficients), and a series of study-specific controls (gamma coefficients) accounting for the data and methods used in each original study. The reference categories for each set of dummy variables are respectively coffee, unregulated regional designations of origin, and studies using methods "other" than conjoint and hedonic analyses.

Model 2 and 3 aim to abstract from specific product categories and investigate general product and market characteristics which may explain variations in GI premia. In Model 2 we replace the product category dummies with variables quantifying the level of processing, to obtain the specification:

(2) $Premium_{ij} = \alpha_0 + \alpha_1 \left(HighlyProcessed_i \right) + \alpha_2 \left(Fresh\ Produce_i \right) + \beta_1 \left(PDO_i \right) + ... + \varepsilon_{ij}$

In Model 3 we focus on the degree of firm branding observed for each product:

(3) $Premium_{ij} = \alpha_0 + \alpha_1 \left(FullBrand_i \right) + \alpha_2 \left(MixedBrand_i \right) + \beta_1 \left(PDO_i \right) + ... + \varepsilon_{ij}$

Admittedly, these two ”umbrella” categories are somewhat collinear, as longer supply chains seem to be typical of markets in which brand names have developed.

As it was not possible to directly include reliable measures of the variance of the estimates in our meta-analysis, our approach was to designate statistically insignificant estimates as zero. For the remaining estimates, we follow the approach of Lusk et al (2005) and use the sample size of the original study as a measure of precision. The argument is that, as long as a study employed a consistent estimator, we expect the variance to decrease as the sample size increases. Thus, all three models are first estimated via ordinary least squares and then by weighted least squares, where the weights are proportional to the sample size of each study. This implies that estimates of GI premia generated from a larger sample size will have a greater effect on our estimated coefficients than estimates coming from a smaller sample.

Regarding the error term of our model, it seems reasonable to assume that the residuals are uncorrelated across studies, but some degree of correlation should be expected when premium estimates are obtained from the same study. As a cautionary measure, we use a robust (clustered on the individual study) estimator of the variance-

covariance matrix. Random and fixed effect (panel) models were also estimated. For the fixed effects model, the null hypothesis that all fixed effects are jointly equal to zero cannot be rejected with a joint F-stat (prob>F=0.943). For the random effects model, the null hypothesis that within-study variances are zero, tested with the Breusch-Pagan LM Test, cannot be rejected (prob>Chi^2=0.218). This suggests that the weighted OLS regression estimation method may be appropriate.

5. Results

Estimation results are reported in Table 2.4. Both un-weighted and weighted results are provided for Model 1, while Model 2 and 3 are presented only in the weighted version. As a robustness check, Model 1 was also estimated (via WLS) using only the data from Europe-based studies. For Model 1, the weighted model is superior to the un-weighted model in that it provides more precise estimates (lower standard errors), and overall model fit (R-squared increases from 0.241 to 0.666). Thus, we focus the discussion on the results estimated via WLS.

(See Table 2.4)

The first notable result is that GI labeling for grain, meat and fresh produce commands the highest price premium, 121.5%, 72% and 64%, respectively. Cheese follows with a percentage increase in premium of 43.5%. In contrast, the lowest

percentage price increase for GI labeling are associated with olive oil and wine, with 31% and 21.5% premia, respectively. All these estimates are statistically significant at the 1% level. It should be noted that, as average prices are quite different across product categories, this ranking of premia may change if they are considered in absolute monetary terms. However, we find the percentage representation preferable as it normalizes for differences in cost of production and added value. When only European studies are used in the estimation, the magnitude of the premia changes (and statistical significance is lost because of the smaller sample size), but the ordinal ranking is generally preserved (see Figure 2.5).

(See Figure 2.5)

Controlling for product-specific differences, a European product with a PDO certification commands a price premium 21% higher than one using a non-regulated regional name. In short, the PDO percentage premium is higher than the average PGI value, which aligns with our expectations, considering that the PDO certification process is more complex and requires a stronger connection between raw materials, stages of production, final product characteristics and the geographical area of production. While this ordinal ranking in premium for PDO and PGI certifications appears clear, little more can be said regarding the magnitude of the PGI premium since Table 2.3, shows that the point estimate for PGI certification is imprecise, with very large standard errors, weak significance and changing signs.

In the US, the presence of a GI trademark is associated with an even higher price premium than the PDO, 39%. This finding is worthy of further discussion given that the process surrounding these designations is relatively unregulated, which would suggest weaker quality assurance. Moreover, in terms of methodology, valuation methods such as conjoint analyses and hedonic models tend to generate higher premia estimates than the reference group of "other" methods, by an average of 54% and 64%, respectively.

Results from Model 2 suggest that the categorization by level of processing is not informative with respect to cross-product differences in price premia observed in Model 1. GIs in fresh produce provide the largest premium (27.8%), but the processing intercept shifters have weak significance and most of the product-specific premia seem to transfer to the PDO and PGI estimates, which increase to 30.7% and 10%, respectively. Model 3 is slightly superior in fit (see adjusted R^2) to Model 2, and produces results that are more consistent with those obtained with the more product-driven Model 1. According to Model 3, the GI premium for fully branded products (wine and olive oil) is 34.5% lower than products not generally carrying a private label. Products that sometimes display brand names (meats, cheeses) also register a decrease in their price premium, albeit a smaller and insignificant one.

6. Discussion

Findings from this study may provide an interesting survey of the field's understanding of location-based price dynamics. Based on a meat-analysis, GIs constitute an effective differentiation instrument in food markets. However, the magnitude of the price premium associated with GIs varies rather significantly across products. Comparing high (percent) premium (grain, meats, fruits, vegetables and produce) and low premium products (wine, olive oil, cheese), a set of key differentiating characteristics emerge.

(See Table 2.6)

The prevalence of high GI premia seem to correspond to minimally processed foods with short supply chains, and a large number of atomistic, undifferentiated producers. In contrast, price premia are smaller when the products are processed, the supply chain is long and the firm brands are known to consumers. This result is in line with the theoretical prediction of Menapace and Moschini (2011) and Costanigro et al (2010).

Given the nature and collinearity of the existing literature's valuation studies (which is the data available for analysis), it is hard to determine which factor is the most critical in triggering some pricing power for affiliated agriculture and food producers. However, our results are consistent with the hypothesis that the extent and importance of firm branding is one of the most important factors. Indeed, the inversely proportional

relationship between the presence of firm branding in a product category and the price premium that GIs can capture is quite evident (see Figure 2.5), and robust to the type of consumers (rest of the world vs. European only).

An interpretative framework for this finding is provided by Costanigro et al (2010) who found that, at parity of quality, shifting from cheap to expensive wines induces reputation premia to migrate from collective names (viticultural areas) to brand names (specific wineries). When interpreting this finding, one must consider the economic tenet of search costs: when buying cheap products (such as grains, fruits and vegetables), it may not be worth it for the consumer to critically differentiate across many individual producers. GIs are therefore the main product differentiation tool because they provide a simple categorization of the available choices. When purchasing more expensive products (such as wine and olive oil), the incentive to learn about differences in quality across brand names is more pronounced. Indeed, the quality of individual firms is likely more consistent than the quality of groups of producers, and therefore, firm reputations provide a better assurance of quality and consistency than GIs.

This reasoning does not necessarily imply that GIs have little use in markets for expensive food products. As a matter of fact, the ubiquitous presence of denominations of origin in wine and cheese (see Figure 2.3) is a proof to the contrary. A possibility is that, for expensive food products, consumers may use GIs to narrow down the large choice set of competing firms to a specific group(s) of producers for which learning about individual firm differences is worth the time. Then, consumers can investigate the subset of selected brands (identified by the GI) more thoroughly, or invest in directly

experiencing a specific product. This hypothesis is worthy of future investigation, as it is not testable given the summary nature of the current analysis.

The institutional framework regulating GIs and its effect on price premium is interesting to consider given its implications for marketing policies. In Europe, more stringent regulations for the PDO appear to secure a higher price premium than its less cogent quality assurance counterpart (PGI). Stricter regulations may signal increased benefits to consumers in the form of food safety, quality assurance, stronger cultural/ heritage connection, etc., prompting a higher willingness to pay for products that are more closely regulated.

It is therefore surprising that the GI trademarks in the United States, representing a less stringent accreditation process than the PDO or PGI, command a premium (39%) higher than both the PGI and PDO. Even though the results is robust to alternative econometric specifications of the model (see Table 2.4), one caveat is that the product classes carrying PDO or PGI labels are much more heterogeneous than what we report for trademarks. Also, country-specific factors and sample demographic controls which could not be controlled for in the model (especially sample income), may make GI estimates across such diverse countries not directly comparable.

In summary, our work confirms the work of Shapiro (1983) and Menapace and Moschini (2012) regarding the relationship between minimum quality standards, reputation price premia, and use of GI labels. In both articles, premia for high quality are modeled as (lagged) returns from investment in quality (see Figure 2.7).

(See Figure 2.7)

Since reputations develop slowly over time, a price premium (above cost of production) is necessary to induce firms to produce at any quality level above the minimum standard imposed on all firms (q_0^1 in Figure 2.7, upper panel). The farther away a firm moves from the minimum standard in the quality spectrum, the longer it will take to build the reputation, and the larger the premium needs to be to work as an incentive for producing higher quality.

The economic rationale for the lower reputation premium is that the presence of an additional label shortens the lag between producing at high quality and developing a corresponding reputation. In short, GI labels would benefit consumers by lowering the reputation costs for buying high quality food products.

7. Conclusions and future research

Agricultural and food products have long been associated with unique quality attributes strongly associated with the agro-ecological characteristics and culinary traditions of their origin. GIs formalize this connection in the marketplace, typically leading to positive price premia. In this study, we investigate this market dynamic further by analyzing how price premia for GIs vary by product, regional designation, and intrinsic product characteristics. In terms of percentage price premium, agricultural produce and minimally processed foods benefit the most from GI differentiation. We interpret this finding in light of the fact that, in addition to GIs, products with valued

added characteristics and longer supply chains may use private brands to capture reputation premia. In other words, brands and GIs may play a similar role in product differentiation, and thus, be substitutes for each other.

The institutional framework for the GI was found to matter: within the same country, quality assurance schemes with higher quality standards such as the PDO receive a higher premium than less stringent ones (PGI). Moreover, when multiple labeling schemes with different minimum quality standard coexist (as for PDOs and PGIs in Europe), the price premium associated with the labels is lower than when a single label is used (as for the GI trademark in the US). Our interpretation is that reputations for high quality are easier to achieve (and thereby less costly for the consumer) when multiple quality assurance schemes segment the quality spectrum.

This analysis identified a number of possibilities for future research both from a consumer's and producer's perspective. As mentioned above, consumers may be using a GI label to narrow the set of choices when searching for certain (branded) types of food. We envision using experimental methods to test this hypothesis, varying the labels across products and labeling options. This may even provide information to retailers who continue to fine-tune their sourcing and point-of-purchase strategies in efforts to maintain market share among an increasingly diverse set of customers that seek attributes aligned to their specific preferences.

In considering producer strategies and decisions, it would be interesting to explore what motivates or prevents a producer from using a GI available in their location, given that these designations seem to be an accessible way to differentiate their output and secure a premium. Another would be to formally evaluate GI use and branding in the

context of alternative product and advertising strategies by individual producers or regional producer associations.

8. Tables and Figures

Table 2.1. Summary of GI valuation studies included in the final analysis:

No.	Authors	Year	Food Category	Methods	No. of Estimates
1	*Akaichi et al.	2009	Fruit-Veggie	Other	1
2	Bombrun et al.	2003	Wine	Hedonic	12
3	Bonnet et al.	2001	Cheese	Other	1
4	Botonaki et al.	2004	Wine	Other	1
5	Costanigro et al.	2009	Wine	Hedonic	7
6	Fotopoulos et al.	2001	Olive Oil	Conjoint	1
7	Fotopoulos et al.	2003	Fruit-Veggie	Conjoint	2
8	**Galli et al.	2010	Cheese	Other	31
9	*Groot et al.	2009	Fruit-Veggie	Conjoint	1
10	Hassan et al.	2006	Cheese/ Meat	Hedonic	2
11	Ittersum et al.	2007	Cheese/ Fruit-Veggie/ Meat	Other	6
12	Loureiro et al.	2000	Meat	Hedonic	6
13	McCluskey et al.	2007	Fruit-Veggie	Conjoint	1
14	Menapace et al.	2011	Olive Oil	Conjoint	3
15	Mesias et al.	2010	Meat	Other	1
16	Mueller-Loose et al.	2011	Wine	Hedonic	11
17	Oczkowski et al.	1994	Wine	Hedonic	20
18	Quagrainie et al.	2003	Fruit-Veggie	Other	5
19	Sanjuan-Lopez et al.	2009	Fruit-Veggie	Hedonic	3
20	Santos et al.	2005	Olive Oil/ Cheese/ Wine	Hedonic	9
21	Schamel et al.	2006	Wine	Hedonic	6
22	*Skuras et al.	2002	Wine	Other	1
23	Stefani et al.	2005	Grain	Conjoint	3
24	Stefani et al.	2006	Grain/ Meat/ Fruit-Veggie	Other	3
25	Teuber et al.	2010	Coffee	Hedonic	4

*Excluded from final sample due to outlier estimates

**Four estimates excluded from final sample due to outlier estimates

Table 2.2. Description of variables:

Variable	Description	Mean	St. Dev.	Min	Max
WTP (%)	Value of the product in percentage price premium (+/ -) %	21.32	37.8	-36.73	181.9
WTP no outliers	Observations lying outside +/- 2 standard deviations from the mean are excluded	15.12	26.13	-36.73	90.6
WINE	Binary variable coded 1 if the product is in Wine Category, 0 otherwise	0.47	0.50	0	1
CHEESE	Binary variable coded 1 if the product is in Cheese Category, 0 otherwise	0.24	0.43	0	1
COFFEE	Binary variable coded 1 if the product is in Coffee Category, 0 otherwise	0.03	0.17	0	1
MEAT	Binary variable coded 1 if the product is in Meat Category, 0 otherwise	0.07	0.25	0	1
FRUIT/VEGGIE	Binary variable coded 1 if the product is in Fruit/Veggie Category, 0 otherwise	0.10	0.31	0	1
OLIVE OIL	Binary variable coded 1 if the product is in Olive Oil Category, 0 otherwise	0.05	0.22	0	1
GRAIN	Binary variable coded 1 if the product is in Grain Category, 0 otherwise	0.04	0.19	0	1
PDO	Binary variable coded 1 if product is PDO, 0 otherwise	0.45	0.50	0	1
PGI	Binary variable coded 1 if product is PGI, 0 otherwise	0.09	0.28	0	1
TRADEMARK	Binary variable coded 1 if product is defined as a Trademark or AVA (for wines) in original paper, 0 otherwise	0.21	0.41	0	1
REGIONAL	Binary variable coded 1 if product is regional (no specific geographic regulation), 0 otherwise	0.35	0.44	0	1
PRIMARY DATA	Binary variable coded 1 if primary data, 0 if secondary data sources are used	0.18	0.38	0	1
CONJOINT	Binary variable coded 1 if methodology is Conjoint, 0 otherwise	0.07	0.26	0	1

HEDONIC	Binary variable coded 1 if methodology is Hedonic, 0 otherwise	0.60	0.49	0	1
OTHER	Binary variable coded 1 if methodology is not Conjoint, Hedonic; 0 otherwise	0.33	0.47	0	1
LOW/INTERMEDIATE PROCESSED	Binary variable coded 1 if product involves low to intermediate processing, 0 otherwise(meat, grain, olive oil, coffee)	0.19	0.39	0	1
HIGHLY PROCESSED	Binary variable coded 1 if product involves a high level of processing, 0 otherwise (cheese, wine)	0.71	0.45	0	1
FRESH PRODUCE	Binary variable coded 1 if product is retailed fresh, 0 otherwise (fruit/ veggies)	0.10	0.31	0	1
FULL-BRAND	Binary variable coded 1 if product is most likely to have a brand (wine, olive oil), 0 otherwise	0.52	0.50	0	1
MIXED-BRAND	Binary variable coded 1 if product could have a brand (meat, cheese), 0 otherwise	0.31	0.46	0	1
NO BRAND	Binary variable coded 1 if product most likely does not have a brand (fruit/veggie, grain, coffee), 0 otherwise	0.17	0.38	0	1

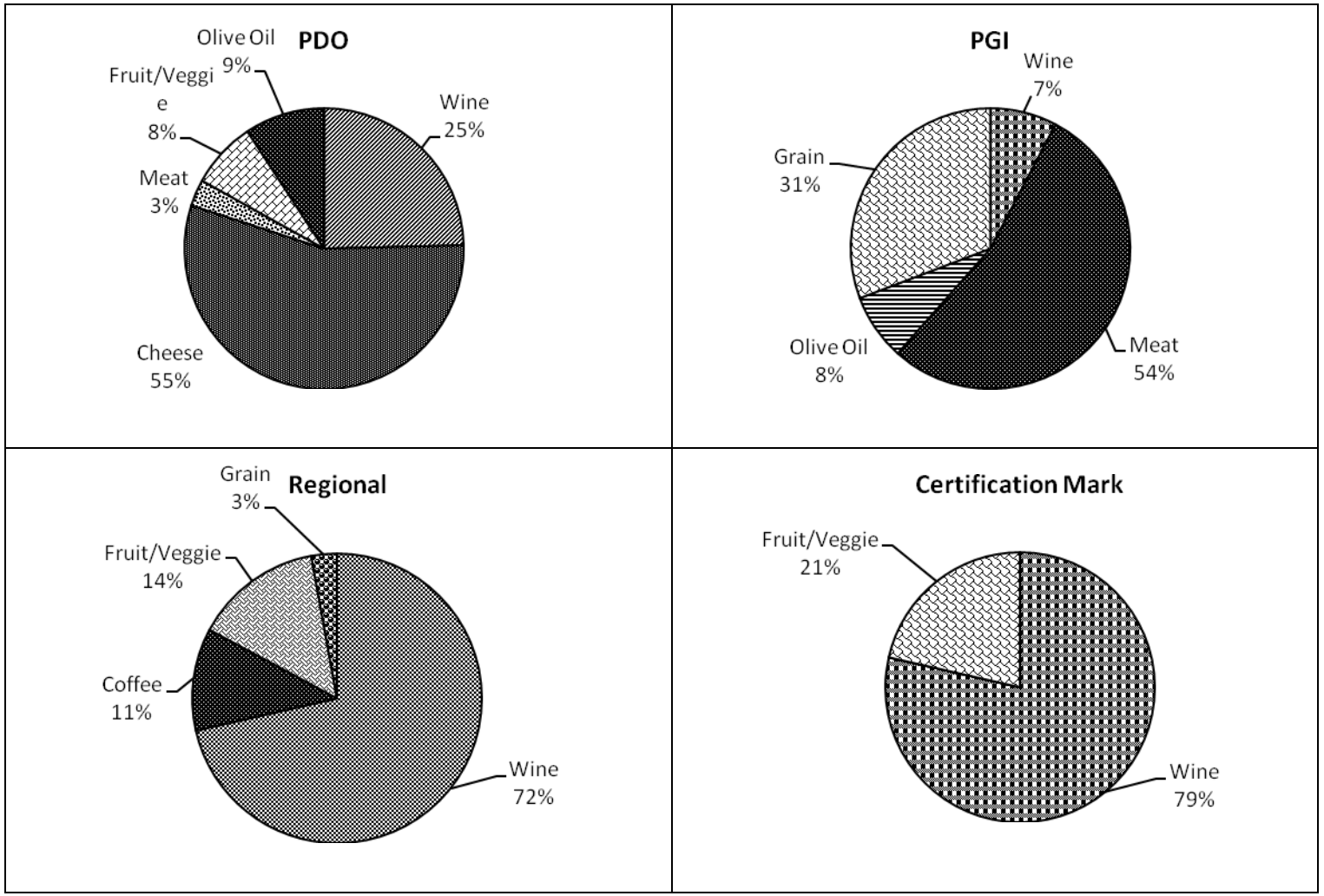


Figure 2.3. Product categories by quality assurance scheme

Table 2.4. Estimation Results[a]

Variable	Model 1 OLS all	Model 1 WLS all	Model 1 WLS Europe	Model 2 WLS all	Model 3 WLS all
Wine	22.96*	21.57***			
	(12.17)	(0.69)			
Cheese	26.6	43.48***	19.59***		
	(16.47)	(5.03)	(2.48)		
Meat	32.26	72.03**	66.01**		
	(19.68)	(25.97)	(21.95)		
Fruit/Veggie	24.88*	63.88***	18.06		
	(14.83)	(16.44)	(19.21)		
Olive Oil	26.30	31.19***	0.66		
	(16.74)	(6.47)	(2.54)		
Grain	51.76**	121.54***	107.33***		
	(21.80)	(22.12)	(17.72)		
Full Brand					-34.49*
					(17.09)
Mixed Brand					-14.02
					(17.01)
Highly Processed				-3.09	
				(10.32)	
Fresh Produce				27.76	
				(18.15)	

PDO	12.03*	20.69***	8.58***	30.69***	21.91***
	(6.63)	(4.13)	(1.78)	(7.96)	(3.53)
PGI	5.77	-37.23	-69.07***	10.29	-7.65
	(14.89)	(25.41)	(20.48)	(12.78)	(4.62)
Trademark	35.05***	39.01***		39.08***	39.56***
	(6.11)	(0.92)		(0.93)	(1.03)
Primary Data	-10.05	-1.28	-0.99	-0.95	1.82
	(9.83)	(9.65)	(10.55)	(9.36)	(11.07)
Conjoint	17.57	53.75***	60.41***	44.67***	58.29***
	(13.64)	(15.87)	(18.02)	(15.37)	(15.94)
Hedonic	1.43	63.78***	65.36***	51.68***	62.65***
	(10.18)	(3.5)	(2.46)	(7.98)	(4.20)
Constant	-23.45	-85.81***	-50.28***	-49.05***	-29.07*
	(15.28)	(3.5)	(2.64)	(15.42)	(17.02)
Adjusted-R2	0.241	0.666	0.814	0.636	0.656
F-stat	4.51	-	319.4	344.58	330.3
	(0.000)	-	(0.000)	(0.000)	(0.000)
Obs.	134	134	71	134	134

a: robust clustered SE in parentheses, ***significant at 1%, **significant at 5%, *significant at 10%

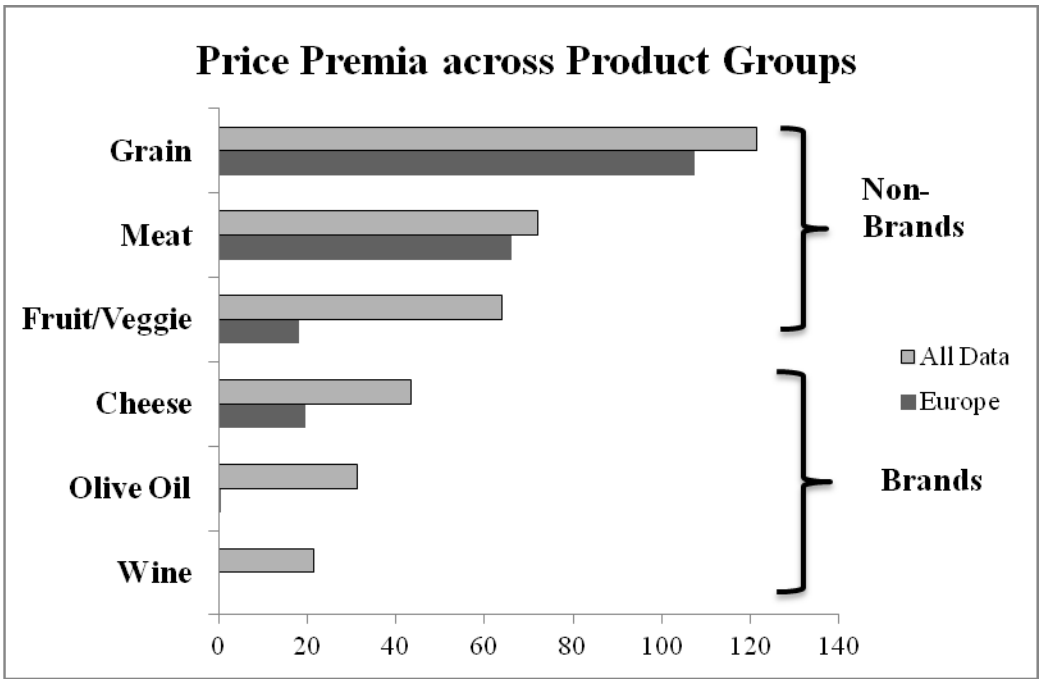
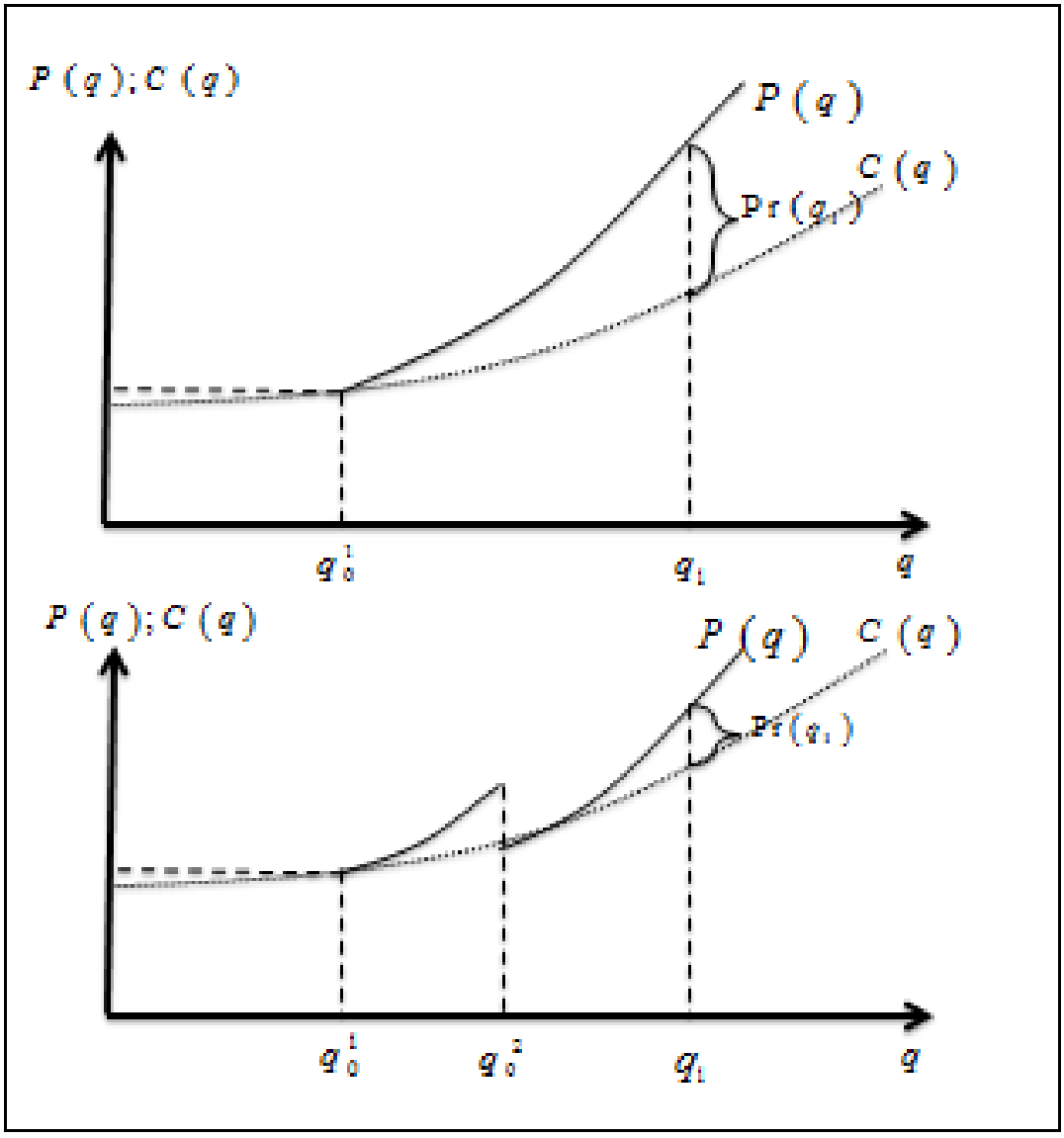


Figure 2.5. Price premia across product groups (comparison between all data and European data)

Table 2.6. Product Characteristics influencing GI price premium

Characteristic	High Percent Premium	Low Percent Premium
Product	Grain, fruits, vegetables, agricultural produce	Wine, olive oil, cheese
Length of Supply Chain	Short	Long
Numbers of Producers	More (farmers)	Less (Food Industry)
Brand Names	Generally No	Generally Yes
Processing level	Generally Low	Generally High
Product/ Quality Differentiation	Lower, depends on product variety cultivar	Higher, depends on food processor



Source: adapted and simplified from Shapiro (1983) and Menapace and Moschini (2012)

Figure 2.7. Equilibrium reputation premium $(\Pr)$ for producing at quality level (q_1) with single (q_0^1, upper panel) and double (q_0^1 and q_0^2, lower panel) minimum quality standards. $C(q)$ represent cost of production, $P(q)$ is the market price.

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CHAPTER THREE

Assessing Consumer Response to Nutrition Labeling Information and Environmental Product Cues

1. Introduction

The main objective of food labeling is to inform consumers about product characteristics that play an important role in the purchase decision-making process, but are hard to observe and assess by consumers (Caswell et al., 2011). For example, the effect of food nutrients on human health cannot be immediately determined even after consumption. Thus, nutrition-based food labels have been implemented to educate consumers about healthy eating and enable them to make healthy food choices (Higginson, 2002). In the US, there is a long history of nutrition regulation culminating with the Nutrition Labeling and Education Act (NLEA) passed by Congress in 1990 (Drichoutis et al., 2011). The NLEA went into effect in 1994 and gave the Food and Drug Administration (FDA) the authority to require specific nutritional labeling. The regulation also required a new format for the nutrition information panel and standardized serving sizes. Prior to implementation of the NLEA, food manufacturers provided nutritional information on a voluntary basis (Drichoutis et al., 2011).

However, even though nutritional labeling is assumed to allow consumers to make healthier food choices, obesity rates as one of the most important consequences of

poor consumption decisions, are still rising in the USA (Berning et al., 2008, 2010). The World Health Organization (2008) reports 1.5 billion overweight adults and at least 500 million obese adults in the world. By 2015, these figures are expected to rise to 2.3 billion overweight and 700 million obese adults (WHO, 2008). Research reveals generally low levels of use of the information on product labels (Higginson, 2002). In Europe, Higginson (2002) reports that only 22-59% of British adults look particularly for nutrition information when shopping, while a study with US consumers (Roe, 1999) finds that truncated information searches (looking only at front product label) decreases the level of accurate health benefit inferences made by consumers. When the back nutrition panel is also used, the amount of nutrition information is hard to compare across products and only one or two nutrition facts (generally fat or sugar) are used in decision-making (Black et al., 1992; Higginson et al., 2002).

Similar to nutrition, other credence aspects of foods such as the environmental impact of food products, present information asymmetry problems for buyers. The environmental impact of a product has been revealed to be a significant food value to consumers (Lusk et al., 2009) and studies show that demand for more environmentally friendly foods does exist (Blend et al., 1999). Yet, there is no standardized way of conveying environmental information to consumers.

With these general guidelines in mind, fluid milk is chosen as the researched product. Soy milk is also included in the study as a milk substitute with varied nutrition and environmental outcomes. Milk is a commonly used consumer product in the US and a very familiar product to consumers. In terms of nutrition, milk may have a variety of effects on human health depending on its levels of fat, sugar, carbohydrates, etc. Milk

production also has various potential harmful effects on the environment. These negative effects influence air quality (through production and transportation), soil quality (via appropriate grazing and waste management practices), water quality (by monitoring waste runoff), etc. (Center for US Dairy, 2010; EPA, 2007). As evidence of dairy's significant connection to environmental concerns, surveying more than 500 farms and 50 processing plants across the U.S, a greenhouse gas (GHG) Life Cycle Assessment (LCA) for fluid milk found that that the carbon footprint of a gallon of milk, from farm to table, is 17.6 pounds of carbon dioxide. In conjunction with other secondary research, the study finds that U.S. dairy contributes approximately 2 percent to the total U.S. GHG emissions (Innovation Center for US Dairy, 2010).

Our study objectives are threefold. First, we assess how objective or subjective the interpretation of food labels is by measuring the cross-consumer concordance in perceptions regarding the healthiness of alternative fluid milk products under three information regimes: (1) only front label information, (2) front and back panel information, or (3) a product-specific nutrition index presented in conjunction with regular labels. In addition to assessing the nutritional and environmental information carried by front and back of package labels, we also consider the use of an index-type label summarizing nutritional information to probe further into what the literature has found about potential need for a more truncated search process by consumers. Indices, as summarized information, are found to be easier to read and compare across products (Viswanathan et al., 2002). For example, the Ratio of Recommended to Restricted food components (RRR Score) is a scientific measure of the product's overall nutrient quality, based on the nutrients found on the back panel label (Scheidt et al., 2004). The

RRR Score is easily calculated as the ratio of food components that are beneficial for consumption (i.e., protein, dietary fiber, calcium, iron, vitamins A and C) compared with those that should be restricted (i.e., calories, sugars, cholesterol, saturated fat, and sodium) (Scheidt et al., 2004). The nutrition score takes values from 1-10, with 10 suggesting a product having the most recommended to restricted food components and 1 suggesting a product having the least recommended to restricted food components. We include the RRR index in our study to test whether it facilitates the transmission of detailed nutrition information in a concise and easy to use manner.

Second, we want to determine whether consumers can determine the environmental impact of a product by using product cues. More specifically, we will test the null hypothesis that, while regulated nutritional information is consistently interpreted across consumers, interpretation of the environmental impact remains more subjective.

Third, we want to test if more concise information delivered in the form of an index (available only for the nutritional value), can effectively substitute for a complete list of product attributes. Previous studies suggest that alternative formats of highlighting back panel nutrition information, such as shelf edge nutrition information emphasizing health claims (e.g., reduced sodium, or fat) significantly affects consumer preferences and behavior (Berning et al., 2008, 2010). How information is presented on the label is important in conveying a clear and uniform nutrition message. These findings can generate policy implications to inform future environmental labeling criteria by investigating various labeling methods to determine which of them conveys information to consumers in a more uniform fashion.

As a set, the findings from these research questions are empirically important in informing food businesses who differentiate themselves with credence attributes on how to effectively provide information to their customer base. Moreover, each provides some important information for policy formulation and implementation in government-based labeling programs if public agencies seek to provide the most credible, useful information to consumers in hopes of increasing confidence in food markets.

2. Background

The traditional belief in classical economic theory is that consumer choices on food products are based on consumer preferences over food attributes. A representative consumer maximizes utility by consuming commodities having specific characteristics (McFadden, 2001). Alternatively, it has been shown that consumers may not have clear preferences over particular product attributes, but in turn, select products that are consistent with some internal values they have or some desired end-states they want to achieve through the act of consumption (Lusk et al., 2009; Gutman, 1982). Lusk et al (2009) speculate that while consumers may not have specific preferences over Calcium or Vitamin A intake (i.e., specific product attributes), they do have internally consistent rankings of "food values" such as high nutritional content, appearance or taste. Food values are a stable set of meta-preferences that drive consumers' preferences for specific food attributes. These food values are abstract in nature (i.e., "convenience," "tradition," or "fairness") and directly map into desired end-states consumers aspire towards (Lusk et

al., 2009). In other words, the labeled nutrition information maps into more general values consumers have with respect to health outcomes. In turn, these values translate into choices over competing products.

The connection between psychological values and consumer behavior in the marketplace has been formalized in the means-end chain literature (Gutman, 1982). This theory specifies that people engage in activities (means) that guide them towards desired states of being (ends) such as happiness, belonging, accomplishment, etc. As a result, products are not only grouped into categories, but also into the functions they have in generating desired end-states. Choosing a product with a particular set of attributes over one with a different set of attributes is linked to specific consequences of the consumption act (Gutman, 1982). Consumers choose the product-attributes combination that maximizes their desired end-state.

Nutrition or health is generally believed to be one of the most important end-states sought by consumers. As one example, in a series of surveys assessing consumer motives for buying organic food, "Personal health/it is better for me/my family" was listed as a motive for 53% of surveyed participants in 1999, for 49% of surveyed participants in 2002, and 66% of surveyed participants in 2004 (Soil Association surveys in Padel et al., 2005).

Nutrition is a credence attribute whose effect on human health cannot be immediately determined even after consumption. Government intervention in the form of standardized nutrition labeling is expected to alleviate the information asymmetry in the market where producers hold more information about product characteristics than consumers (Caswell, 1996). Nutrition labeling reduces moral hazard for producers to

misrepresent their products. For example, tasty food (an experience attribute) is generally unhealthy since it tends to have a high content of sodium, sugar, or fat. In absence of trusted nutrition labeling, producers will manufacture tasty (yet unhealthy) food over less tasty but healthier alternatives. Government mandated labeling acts as a "warranty" preventing producers from misrepresenting food products, as consumers have access to nutrition information that was previously "hidden".

Ideally, the mechanism (labeling) conveying this information to consumers is easy to read, use, and compare across products. In terms of *how* nutrition information is presented to consumers, several research contributions are worth mentioning. When a large amount of nutrition information is offered, poor performance in identifying healthier alternatives is often observed (Levy, et al., 1996), possibly because too much information may lead to "information overload" (Golan et al., 2000). Listed daily values for each nutrient are found to have positive results in helping consumers identify healthier alternatives (Levy, et al., 1996). However, Viswanathan et al (2002) found that summary information (in the form of averages, or ranges) outperforms percent daily values in helping consumers judge the nutritional content of a brand when multiple brands are available for comparison. Alternative formats of highlighting back panel nutrition information, such as shelf edge nutrition information emphasizing some health claims (e.g., reduced sodium, or fat) significantly affects consumer preferences and behavior (Berning et al., 2008, 2010), suggesting that label format is important. Kiesel et al (2010) also find that labels that reduce search costs by summarizing the information on the nutrition panel change consumer purchase behavior. Overall, it appears that consumers do not perform well when they have to do math calculations or handle

quantitative information (Eves et al., 1994; Hawkes, 2004; Levy and Fein, 1998). Therefore, formats that allow consumers to avoid quantitative tasks in order to derive information are preferred (Drichoutis et al., 2006).

While health is indeed a top priority for consumers, other reasons underlying food choice have been increasing in importance for consumers lately. "Better for the environment/better for wildlife" was listed as a motive of buying organic food by 28% of surveyed participants in 1999 (Soil Association surveys in Padel et al., 2005). In a more broadly framed question in a 2002 study, 59% of surveyed participants list the environment as a motive for purchasing organic foods, and in 2004 this number increased to 78% of surveyed participants (Soil Association surveys in Padel et al., 2005). In five years, the percentage of people using the environment as a purchase criterion for organic foods more than doubled. Relative to other motives for buying organic foods listed in this survey (such as "taste" or "genetically-modified free"), product impact on the environment was the reason experiencing the highest rise in popularity among consumers across those years. Lusk et al (2009) also conclude that the environment (the effect of food production on the environment) is a significant value guiding consumer choice.

While nutrition is a vital contributor to human health and misinformation on this front can potentially be life-threatening, environmental impact of food production generally does not have immediate life-threatening consequences. This may be one of the reasons for its delayed certification and lack of priority for the government to play a role. However, future impacts on quality of life due to environmental problems may affect human welfare in the long run. In addition, firms can misrepresent products as environmentally-friendly (by advertising "local" production, for example, as means of

reducing carbon footprint). While local products may reduce food miles, they can be environmentally damaging in other aspects (through other forms of energy consumption, for example). When consumers do not have access to overall environmental impact, firms highlight positive claims while ignoring or omitting negative implications of their production and marketing systems.

One way to signal environmental friendly products to consumers is through voluntary eco-labeling. Eco-labels entail an assessment of the product's impact on the environment including production process, use, and disposal of the product (van Raveswaay et al., 1997). Since they are not directly regulated by the government, eco-labels are considered market-oriented (Loureiro et al., 2001). Voluntary use of eco-labels by producers must suggest some benefits such as increased demand, product differentiation, or obtaining a price premium. However, products that are more environmentally friendly identify as such, while products that are damaging for the environment are not identified or penalized as "bads". In the context where only top environmental performers are labeled, consumers may purchase a particularly "bad" product for the environment believing that it is actually "average" or "good" for the environment. In short, eco-labeling rewards "good" performers, while it does not penalize "bad" ones.

Investigating seafood products, Johnston et al (2006) find that, at parity of taste, consumers may consider switching to less-preferred fish species that carry the eco-label. This indicates that demand for environmentally-friendly goods may increase if other characteristics, such as taste, are at par with similar, less environmentally-friendly, products. In a laboratory experiment, Cason (2002) finds evidence that certified green

labeling by governments mitigates asymmetric environmental information and can elicit higher valuation from consumers. A study on eco-labeled apples also finds substantial demand for this product compared to similar, non-labeled, apples (Blend et al., 1999). At a zero price premium per pound, 72.6% of the surveyed consumers said they would buy eco-labeled apples. As the price premium increases to $0.40, the purchase probability of labeled apples decrease, but about 40% of the sample would still buy the eco-labeled good.

A study with Danish consumers finds that individuals develop personal norms (such as product packaging) when choosing environmentally friendly products, and these norms are a significant predictor of their propensity to choose environmentally friendly options in the supermarket (Thøgersen, 1999). This suggests that when credence attributes, such as the environmental impact of a product, are hard to assess, experience or search attributes can be used as proxies for harder to assess credence attributes. For example, food safety may be too costly to measure (e.g., the absence of pesticide residues) but management practices (e.g., organic farming) can be used as proxies for the final product characteristics (Grolleau et al., 2005). When a lack of mandated environmental information exists, consumers can use product cues such as packaging material, location of production relative to point of sale, method of production (organic or conventional), etc., to determine which products are in their preferred environmentally-friendly product set.

The literature above outlines several concepts related to consumer behavior regarding nutrition and the environment. First, new additions to consumer choice theory suggest that individuals make purchase decisions in order to achieve desired end-states.

While individual product attributes factor into this decision, consumer preferences over attributes are less meaningful than preferences over desired end-states. Second, the best means for conveying credence information are still under debate for nutrition (summaries, percent daily values, list of attributes), and are very rudimentary (product cues) for the environment. Under the current labeling regime, what is the most consistent way of transmitting nutritional credence information to consumers? And, what lessons can be learned to inform future environmental labeling efforts? The rest of this paper attempts to examine these questions.

3. Methodology

The first objective of this study is to evaluate the effectiveness of current nutrition labels in conveying information uniformly across consumers. To this end, we administer a best-worst scaling survey to rank 10 milk products according to their perceived nutritional impact. We use the progressive release of label information to observe how participants change their ranking when additional, perhaps more relevant, nutrition information is revealed. The resulting health rankings can be compared against the products' actual nutrition values (provided by the RRR score) to identify ranking inconsistencies across participants under each treatment. In addition, agreement regarding rankings between participants can be measured for each information treatment.

Best-worst choice experiments gained momentum in the early '90s with a publication by Finn et al (1992). Originally proposed in 1990 by Louviere and

Woodworth in a working paper, the best-worst method is rooted in Thurstone's (1927) psychological method of paired comparisons. Sometimes also called *max-diff*, the method makes consumers compare all the pairs of alternatives available in a set and choose the one which maximizes the utility difference (between the *best* and the *worst*). The underlying assumption is that consumers have an intrinsic continuum of a value or degree of interest, and this method places the alternatives in the choice set along this continuum (Finn, 1992).

In our case, this continuum is the "impact on my health" of our set of products. Best-worst has several advantages over traditional measures of measurement such as Likert scales. First, it forces people to make trade-offs by choosing a best and a worst alternative. On the other hand, on a scale system, all alternatives could be viewed as "best/ important" or "worst/ least important" (Lusk, 2009). Second, people interpret ordinal scales differently. When a person chooses a 5 from a scale of 1 to 5, this can actually represent a 4 for another respondent (Lusk, 2009). However, there is no measurement bias in the best-worst scale relative to the Likert scale as there is only one best-worst pair each consumer can choose (Cohen et al., 2002). Therefore, best-worst coefficients are directly comparable between people and result in individual as well as aggregate ranking scales. Third, despite the sometimes large number of choice sets and the repetitiveness of the exercise, participants find the task easy and quick to complete (Goodman et al., 2005, Auger et al., 2004, Cohen et al., 2002). Fourth, compared to simply ranking products directly from 1-10, best-worst ranking is more accurate as it reduces the cognitive burden for participants and is able to discriminate between products that, at first glance, appear to be equally important.

In this study, the best-worst task follows an orthogonal design that distributes the alternatives (products) across choice sets. A balanced incomplete block design (BIBD) was created with our ten products, such that across 15 choice sets, each product appears the same number of times (6 times) and each individual set contains 4 products[7]. Some experimental designs used in the literature so far (Finn et al., 1992, Lusk et al, 2009, Goodman et al., 2005) are not uniform in the sense that the choice sets are of unequal size (for example, some have 4 alternatives, while others have 5). This can be confusing or difficult for participants to adjust to. Experimental designs such as BIBDs overcome this weakness (Lusk, 2009). BIBDs also have the advantage that each alternative (product) is shown the same number of times (in this study, 6 times) and that the pair-wise frequencies are equal (Kuhfeld, 2010). This ensures that no one product is under- or over-represented in the experiment, and consumers see each product the same number of times individually and paired with the rest of the products.

Ten actual milk products that differ in their nutritional characteristics are selected for the experiment based on several nutrition attributes. As nutrition characteristics that are important to consumers, we include: organic (yes/no), chocolate flavoring (yes/no), fat (whole milk vs. reduced fat), and soy (yes/no). Soymilk increases the variation in nutritional and environmental outcomes across products, which is a desired characteristic in our product selection process. Table 3.1 presents the design matrix yielding the ten milk products of various nutrition outcomes.

(See Table 3.1)

[7] In SAS, the %mktbsize and %mktbibd macros were used to generate a BIBD design with 10 attributes, 4 attributes per choice set, and 6 total appearances of each product

Throughout this process, our goal is not to create a perfect experimental design, but to uniformly integrate real-life products into a laboratory experiment. The main purpose of this design matrix is to ensure that the products entering the experiment cover a wide spectrum of nutritional outcomes. The RRR scores of our selected products are provided in Table 3.2 and a visual interpretation in Figure 3.3, where it is evident that most of the chosen attributes cannot be used to immediately predict the RRR score: chocolate milk has scores ranging from 5.2 to 5.9; soy milk (not flavored) ranges from 9.9-10. While the RRR score does not show any nutritional improvements for "organic" products, some consumers believe organic products to be healthier (Magnusson et al., 2001 and 2003; Emma, 2005).

(See Table 3.2 and Figure 3.3)

In the literature, most conjoint and choice experiments use theoretical combinations of product attributes and attribute levels in order to distinguish the effect of each treatment individually on the choice consumers make. However, these hypothetical product choices are artificially constructed and generally do not represent real alternatives consumers encounter in everyday life. At the expense of relaxing design characteristics, this study distinguishes itself by providing respondents with real choices (products) they could encounter in a local grocery store on any given day. One advantage of this approach is that consumers are already familiar with the products in the study and the information on product label. While in real-life shopping experiences consumers

purchase milk according to different reasons (taste, price, craving a particular flavor); we asked our study participants to inspect the label with a specific focus on health outcomes, so that we can distinguish the effect of product characteristics on perceived nutrition.

The label information treatments included in the survey progress from the lowest to the highest information content: (1) Front label; (2) Front + back label; (3) Front label + RRR score; (4) Front label + back label + RRR score. In total, 148 people participated in the nutrition survey, and each participant was exposed to more than one treatment. The information delivered in each treatment is shown in Figure 3.4.

(See Figure 3.4)

In the end, 101 participants were exposed to the Front label only, 51 to the Front and Back labels, 97 to the Front, Back and RRR, and, finally, 47 to the Front and RRR. Examples of the best-worst questions with different label treatments are provided in Figures 3.5 and 3.6.

(See Figures 3.5 and 3.6)

The motivation for sequencing label treatments from the lowest to the highest information resolution is rooted in grocery store behavior. In the grocery store, consumers are presented with several options for the same product category on the store shelf. These products have the front label facing out, and generally, browsing the front label is enough for some consumers to make a purchase decision. Others prefer to pick up

the product and consult the more detailed nutrition information on the back nutrition panel. When back panel information is hard to read or compare across products, summarized information such as the RRR may be easier to interpret. In the survey, the RRR Score is incorporated in the product label as a number in a black square in the right-hand side corner of the front of the milk container (see Figure 3.5).

The second study objective is to measure the information gap following the lack of environmental labeling. A similar best-worst ranking exercise to nutrition is performed, this time asking participants to choose the best and the worst product form several options according to their perceived environmental impact.

Research shows consumers use product cues such as product packaging to determine a product's impact on the environment (Thøgersen, 1999). We use several popular environmental cues to identify milk products with various impacts on the environment: organic (yes/no), local (Colorado Proud label vs. none), container type (plastic vs. cardboard). Soy milk is also included as an option in the environmental section of the survey, as soy milk production may be perceived as environmentally different from animal milk production. Scientifically, it is not clear yet which milk type (soymilk or cow milk) has a larger impact on the environment. While the production process of soymilk could be more environmentally friendly (less methane emissions), processing soybeans into milk can be more energy-intensive than processing milk (Silverman, 2010). Table 3.7 provides summarized information of the design matrix and the products chosen for this task.

(See Table 3.7)

A similar best-worst ranking exercise following a BIBD with 15 sets of 4 products each is implemented for participants to determine the environmental impact of the products. In the environmental survey, 96 consumers participated in ranking options.

In the overall survey (nutrition and environment), a total of 244 people participated. In the summer of 2011, and in a subsequent recruitment session in spring 2012, survey participants were recruited amongst Colorado State University (CSU) administrative staff and general Colorado population based on a first-reply policy to our invitation e-mail. Multiple sessions of 20-25 participants each were delivered via computer in a controlled setting in a laboratory on CSU premises. A catalog with enlarged pictures of the products included in the survey was provided to each participant as an additional visual support complementing the product pictures on the computer screen. The survey completion time varied from 25-50 minutes and participants were paid a flat compensation of $25 for their time. In addition to the best-worst nutrition and environmental sections described above, socio-demographic questions identical for all versions of the survey were included. They solicited information about household composition, education, income, gender, age, and ethnicity.

Responses assessing participants' dietary habits and environmental attitudes were collected to be used in subsequent analyses as controls for individual dietary preferences. The dietary questions, provided in Table 3.8, are a subset of the Index of Diet Quality (Leppala et al., 2010). Based on several specific dietary habit responses, a diet index is calculated to summarize each participant's diet quality and habits at the time.

(See Table 3.8)

The same rationale motivates questions assessing participants' environmental concern. These questions are a subset of the New Environmental Paradigm (NEP) Scale, which is considered the standard instrument in the social and behavioral sciences for measuring concern about the environment (Dunlap et al., 2000). Following Kotchen et al (2007), five statements from the NEP scale presented in Table 3.9 were included in the survey as a control for the respondent's environmental attitudes in subsequent analyses.

(See Table 3.9)

4. Sample Demographics

The study sample statistics provided in Table 3.10 are comparable to Colorado state-wide demographics provided by the US Census Bureau (US Census Quick facts, 2012). Demographics are provided separately for participants in the health and the environmental sections of the survey. In terms of racial composition the statistics show: whites (non-Hispanic) 70% of the population in Colorado, but ranging from 83% to 93% in our sample; black constituted 4% of Coloradans, but only 1-4% in our sample; Asians were 2.8% of Coloradans and 1-2% of our sample; and Hispanics were 11.3% of the Colorado population but only 2-5.2% of our sample. The median household income in

the state of Colorado (years 2006-2010) is $56,456. This is comparable to our sample median of $50,000-75,000.

(See Table 3.10)

Most households have up to two members (83-89%) or more (10-17%). This is indicative of young families with no kids (75% of the sample also has no children). However, 25% of the sample does have one or more kids. This is especially useful in the context of our survey since families with kids tend to buy milk frequently and are very familiar with the product.

In terms of demographics, 71-74% of our sample is female. This is in agreement with the fact that most of our respondents are primary shoppers (80-88%), since generally it is the female in house household who also takes the lead in grocery shopping.

Regarding other socio-economic characteristics, the average education level in our sample is probably higher than the national average. Most participants have a graduate degree (39-49%). 30-37% of respondents have a college degree, while the rest have technical (9-12%), some graduate (7-10%), and high school studies (2-3%). For income, there is a wide variation with the lowest income under $20,000 and the highest one of over $150,000. Generally however, the highest percentage of respondents report a household income of about $50-74,000 (25-30%), followed by $35-49,000 (15-19%) and $75-99,000 (16-19%).

5. Empirical Methodology

The first objective of the data-analysis is to investigate consumer ranking of milk products according to their perceived environmental impact and perceived nutrition outcome under different information treatments.

To this purpose, best-worst data is analyzed using the counting method (Lusk et al, 2009). This implies that the final "rank" of a particular product, *j*, is calculated as the difference between the amount of times it has been voted "best" and the amount of times it has been voted "worst" across all study participants:

$$Rank_j = \sum_{k=1}^{15} Best_{ij} - \sum_{k=1}^{15} Worst_{ij}$$

Where *i*=individual, *j*=product, *k*= choice sets

When the resulting rankings are sorted in decreasing order, the product with the highest "score" is ranked first and interpreted as being the overall most important to consumers, the next one is the second highest in importance, and so on. This analysis will provide a complete ranking under each information treatment.

The second study objective is to test the null hypothesis that, while regulated nutritional information is consistently interpreted across consumers, interpretation of the environmental impact remains more subjective. Here, we can also investigate whether a nutrition index can substitute an entire list of nutrition attributes. In order to achieve this goal, we compare the concordance in environmental ranking to the concordance in nutrition ranking under different information treatments.

Kendall's coefficient of concordance (W) is a measure of the agreement among *m* judges who are assessing a given set of *n* products. If product *i* is given rank $r_{i,j}$ by judge number *i*, then the total rank given to product *j* is $R_j = \sum_{i=1}^{m} R_{i,j}$.

The sum-of-squares deviation (S) from the total rank given to product *j* is defined as:

$$S = \sum_{j=1}^{n} (R_j - \bar{R})^2,$$

Where $\bar{R}$ is the mean value of all the ranks: $\bar{R} = \frac{1}{2}m(n+1)$. Kendall's W statistic is calculated from the previous as:

$$W = \frac{12\,S}{m^2(n^2 - n)}$$

Kendall's W ranges from 0 (meaning no agreement, responses may be regarded as essentially random) to 1 (complete agreement between raters). Intermediate values of W indicate a greater or lesser degree of unanimity among respondents. In this study, the W test is calculated for each nutritional information treatment individually and separately for the environmental ranking.

The third objective of this study is to investigate how consumers assess environmental and nutrition product outcomes by using environmental product cues and nutrition attributes. To this end, a rank ordered logistic regression model is used to link nutrition and environmental outcome rankings to product characteristics. The rank ordered logistic model is an application of the conditional logit model for ranked

outcomes proposed by McFadden (1974). In the economics literature, this model was developed by Beggs et al (1981) and later by Hausman et al. (1987). In the marketing literature where it developed independently (Punj etal., 1978; Chapman et al., 1982), the term ‘‘exploded logit model’’ has been used (Drewes et al., 2006; Allison et al., 1994). However, both models are equivalent and are based on the random utility framework that also justifies the standard multinomial logit model (Luce, 1959; Allison et al., 1994).

In a typical logit model measuring utility via revealed preference, consumers are presented with *j* alternatives which must be ranked. Individual *i* associates each alternative *j* with a specific level of utility U*ij* he or she derives from it (Drewes et al., 2006).

In our study, however, we ask participants to rank products according to their perceived nutritional or environmental impact. Nutrition and environment are only some of the factors mapping into consumer utility derived from milk consumption. Other characteristics of products in set *J* affecting utility across consumers *I* are, for example, taste, value, price, texture, etc:

$$U_{ij} = (Nutrition_{ij};\ Environment_{ij};\ Taste_{ij};\ Price_{ij};\ etc.)$$

In our experiment, individual *i* associates each product *j* with a specific level of nutrition (N_{ij}) or environmental (E_{ij}) outcome, and uses this latent scale to choose the best and worst products in a choice set. We assume that nutrition and environmental outcomes, N_{ij} and E_{ij} respectively, are composed of a systematic (μ_{ij}) and a random (ε_{ij}) component (following Allison et al., 1994; Drewes et al., 2006, on the structure of utility).

$$N_{ij}, E_{ij} = \mu_{ij} + \varepsilon_{ij} \quad (1)$$

The systematic component μ_{ij}, in turn, is generally assumed to be a linear function of the characteristics of the individual, X*i*, and of the attributes of the alternatives *Zj* (i.e., the milk products). In this case, product attributes *Zj*, such as whole or organic milk do not vary across consumers *i*, but only across products *j*:

$$\mu_{ij}(Z_j, X_i) = \beta Z_j + \delta X_j + \varepsilon_{ij} \quad (2)$$

Parameters β and δ capture the impact on perceived nutrition and environmental outcomes of changes in product attributes or personal characteristics. Because X_j, the characteristics of individual participants do not vary across choice sets (the same individual makes a series of choices across multiple choice sets), δX_j drops out of the model. This is a feature of the conditional and rank ordered logit models. If the effect of individual characteristics on choices is a relevant result, interaction terms between these characteristics (age, income, gender, etc.) and product characteristics that vary across choice sets (whole, chocolate, soy, etc.) can be created and included in the model in order to capture this effect.

The conditional logit model where only one choice is considered allows maximum likelihood estimation of the parameters when participants make a "best choice" from a set of alternatives (Allison et al., 1994). However, in a best-worst setup, a series of choices are made and a complete ranking of alternatives (sometimes with ranking ties) can be inferred from these choices. In this case, the conditional logit model can be applied to each choice separately, creating an "exploded" logit model accounting for all choices an individual makes within a set of alternatives.

For example, within a choice set containing 4 items (A, B, C, and D), the probability for individual *i* to rank the products in this specific order can be expressed as the probability of choosing alternative A from the set A, B, C, D, multiplied by the probability of choosing alternative B from the remaining alternatives B, C, D, multiplied by the probability of choosing alternative C from the remaining alternatives C and D (Train, 2009).

$$Prob(ranking\ A,B,C,D) = \frac{e^{\mu A}}{\sum_{j=A,B,C,D} e^{\mu k}} * \frac{e^{\mu B}}{\sum_{j=B,C,D} e^{\mu k}} * \frac{e^{\mu C}}{\sum_{j=C,D} e^{\mu k}} \quad (3)$$

When ties in ranking between two alternatives occur, as is the case with the current dataset, the assumption is that the respondent has a preference ordering for the tied items, but we don't know what it (this approach is formalized in Allison et al., 1994). In our dataset, from a set of 4 products, the respondent may assign rank 1 to A, the "best" product, and rank 4 to D, the "worst" product. The remaining two products, named here 2.5B and 2.5C, are tied for rank 2.5 (the average between rank 2 and rank 3). Here, there are two possibilities: item 2.5B is preferred to item 2.5C, or item 2.5C is preferred to item 2.5B (Allison et al., 1994). Because these alternatives are mutually exclusive, Pr (2.5B or 2.5C) = Pr(2.5B) + Pr(2.5C). Following this logic, the probability for tied items accounting for the remaining item D, ranked fourth, is:

$$\left(\frac{e^{\mu 2.5B}}{e^{\mu 2.5B} + e^{\mu 2.5C} + e^{\mu D}}\right)\left(\frac{e^{\mu 2.5C}}{e^{\mu 2.5C} + e^{\mu D}}\right) + \left(\frac{e^{\mu 2.5C}}{e^{\mu 2.5B} + e^{\mu 2.5C} + e^{\mu D}}\right)\left(\frac{e^{\mu 2.5B}}{e^{\mu 2.5B} + e^{\mu D}}\right) \quad (4)$$

The final model contains the product of 15 choice sets of the form displayed in equation (3) above, with ties. To obtain a generalized expression, within a choice set of

four items, let Y_{ij} be the rank given by respondent *i* to item *j*. Then let $\delta_{ijk} = 1$ if $Y_{ij} \geq Y_{ik}$, and $\delta_{ijk} = 0$ otherwise. Finally, in an abbreviated form, following Allison et al (1994), the likelihood function L_i for one individual across all choice sets (ignoring ties for simplicity) can be generalized as:

$$L_i = \prod_{j=1}^{15} \left[\frac{exp(\mu_{ij})}{\sum_{k=1}^{4} \delta_{ijk}\, exp(\mu_{ik})} \right] \tag{5}$$

For a sample of *n* respondents, the expression (5) above yields the following model which can be estimated via maximum likelihood:

$$logL_i = \sum_{i=1}^{n}\sum_{j=1}^{15} \mu_{ij} - \sum_{i=1}^{n}\sum_{j=1}^{15} log\left[\sum_{k=1}^{4} \delta_{ijk} exp\,(\mu_{ik}) \right] \tag{6}$$

As mentioned previously, the systematic component μ_{ij} is a linear function of the characteristics of the individual, X*i*, and of the attributes of the products Z*j* (in this case, the milk products). Substituting the expression for μ_{ij} defined in (2) into expression (6) above results in the models to be estimated in this study.

Four different models of this type are estimated in this study.

Model (1) quantifies the impact of nutrition product attributes (such as whole, organic, chocolate flavored, or soy) on nutritional outcomes under different information treatments. The systematic component $\mu_{ij}(Z_j, X_i) = \beta_1 Whole_j + \beta_2 Organic_j + \beta_3 Choco_j + \beta_4 Soy_j + \varepsilon_{ij}$ is substituted in equation (7).

Model (2) quantifies the impact of environmental product attributes (such as organic, local, cardboard, or soy) on environmental outcomes. The systematic component $\mu_{ij}(Z_j, X_i) = \alpha_1 Local_j + \alpha_2 Organic_j + \alpha_3 Cardboard_j + \alpha_4 Soy_j + \varepsilon_{ij}$ is substituted in equation (6).

Model (3) quantifies the impact of nutritional information on the back panel label (such as fat content, protein content, etc) on nutritional outcomes. The systematic component $\mu_{ij}(Z_j, X_i) = \rho_1 Fat_j + \rho_2 Carbs_j + \rho_3 Protein_j + \rho_4 Iron_j + \varepsilon_{ij}$ is substituted in equation (6). The nutrition categories included in this specification are chosen while attempting to decrease the high correlation coefficients between the different attributes. For example, calories are highly correlated to cholesterol level, sodium levels, and carbohydrates. In this case, only one of these attributes (carbohydrates) was included in the model. A correlation matrix detailing these connections is provided in Table 3.11.

(See Table 3.11)

Model (4) quantifies the cumulative impact on ranking of all information available under each information treatment (nutritional information, product attributes, and the RRR score). The systematic component is specified here is an example including the maximum resolution of information (currently under the front + back panel + RRR score). The systematic component for the maximum information treatment is:

$$\mu_{ij}(Z_j, X_i) = \lambda_1 Fat_j + \lambda_2 Carbohydrates_j + \lambda_3 Protein_j + \lambda_4 Iron_j + \lambda_5 Whole_j + \lambda_6 Organic_j + \lambda_7 Chocolate_j + \lambda_8 Soy_j + \lambda_9 Front_j + \lambda_{10} FrontBack_j + \lambda_{11} FrontRRR_j + \lambda_{12} FrontBackRRR_j + \varepsilon_{ij}$$

is substituted in equation (6).

For the rest of the information treatments, the specification above changes to include only the existing information within each individual treatment.

Within the framework defined above, product ranking is assumed to correspond to the different levels of environmental and nutrition outcomes. A product that is ranked higher (i.e., closer to rank 1 which is the "best") signals an increased nutritional or environmental outcome to the consumer. Due to the "panel" nature of the data (each participant is linked to 15 choice sets each containing four rankings), we use a robust (clustered on each participant) estimator of the variance-covariance matrix in conjunction with the ranked ordered logit models specified above.

While the individual coefficients of these models cannot be interpreted in probabilistic terms without a transformation in the form of log odds ratio or likelihood (Long et al., 2006), their sign and magnitude can be considered to be the relative impact of product attributes on nutritional or environmental outcomes. A positive coefficient is interpreted, in this case, as the increase in rank due to a marginal increase in the product attribute. However, an increase in rank implies, for example, going from 1st place to 2nd place, which is actually a decrease in perceived outcome due to the attribute. In other words, positive coefficients indicate that consumers believe the attribute to be "bad" for health or environmental outcomes and rank products containing it lower.

6. Results

(1) Results for Nutrition

Regarding nutrition outcomes, the results consist of the product rankings under different information treatments, concordance of rankings, and effect of product and nutrition attributes on the ranking structure.

Tables 3.12-3.15 illustrate how the 10 milk products were ranked according to their perceived nutritional impact under four different information treatments. The ranking for the Front label only are presented in Table 3.12. The first product is ranked in first place (Horizon Organic Fat Free Milk) with a sizeable agreement of 74 favorable votes more than the following product that would be ranked 2nd place (Silk Organic Unsweetened Soymilk). Participants also identify the least healthy product by a high margin (119 votes). Comparison to the true nutritional ranking offered by the RRR score reveals that most of the products (8 out of 10) are inconsistent with the RRR ranking.

(See Table 3.12)

When participants are exposed to the Front and Back nutritional label, the RRR score reveals that again 8 out of 10 products are inconsistent with the RRR as shown in Table 3.13. In Table 3.14, under the Front and RRR treatment only 4 out of 10 products are inconsistent with the RRR ranking, while under the Front, Back and RRR treatment (Table 3.15), 6 products are assigned an incorrect rank.

(See Tables 3.13, 3.14 and 3.15)

The least healthy product is consistently identified as "Lucerne Reduced Fat Chocolate Milk", while this product does not have the lower scientific nutritional score. "Horizon Organic Whole Milk" and "364 Whole Milk" have a lower score than their chocolate milk alternatives that are reduced fat. Products that are organic tend to be ranked higher in the nutritional rankings than similar products featuring conventional farming. For example, "365 Organic Soymilk Chocolate" is ranked consistently higher than its counterpart "Silk Chocolate Soymilk", even though their RRR scores are the same.

Under all information treatments, consumers appear to rely the most on the nutritional information found on product labels to make decisions. Table 3.16 presents the most cited reasons for consumer rankings (where each participant could choose up to three reasons).

(See Table 3.16)

When the RRR score is available, its usage is secondary to other nutritional information contained on the product. Familiarity with the product and other reasons (such as medical conditions or organic farming) are less frequently used than the nutrition information and the RRR score. Product brand and attractiveness of the label are used the least in making nutrition outcome decisions.

The coefficient of concordance, Kendall's W, measuring ranking agreement amongst consumers under different label information treatments, is presented in Table 3.17. The statistic is accompanied by a p-value associated with the null hypothesis that there is no agreement between judges (in other words, when the p-value lacks statistical significance, W=0). The W reveals that when participants are only exposed to the front label of the product, their agreement on ranking products according to their perceived healthiness is less than average. On a scale of 0 to 1, with 0 expressing no agreement and 1 denoting complete agreement, participants are measured with a coefficient of 0.4 when exposed to the front label only.

(See Table 3.17)

When the back label is also available, participants tend to make more consistent decisions (amongst each other) and the concordance score is as high as 0.6. Adding the RRR score to the front and back label maintains the concordance at 0.6. An interesting result, however, is that when the RRR score is added to the front label only, the concordance coefficient is 0.6 suggesting that the RRR score may provide equivalent product cues compared to the information on the back of the label.

Examining the results from the different specifications of the rank ordered logistic model we observe the effect of product attributes and nutrition characteristics on perceived nutrition outcomes for consumers.

The effect of product attributes (whole milk, organic, chocolate, and soy milk) on consumer health ranking derived from Model (1) is presented in Table 3.18.

(See Table 3.18)

Whole milk has a positive sign consistently across treatments, meaning that an increase in fat content of milk increases the health rank of that milk. An increasing rank (for example, going from number 1 to number 2) represents a lower nutrition outcome the product brings to consumers. In this case, milk that is whole or with chocolate flavor tends to be ranked lower. On the other hand, there is consensus that milk that is organic and soy milk tend to be better for human health and are ranked relatively higher.

The effect of product attributes on perceived nutrition outcomes changes under different information treatments. When RRR information is revealed, whole milk is penalized more than when front label only or front and back panel information is available (its estimate increases from 0.798 to 1.16 and 1.27). Organic farming improves nutritional perceptions among consumers. However, its positive effect on perceived nutrition outcomes is diminished by almost half under the RRR score (decreases from 0.27 to 0.14). The effect of chocolate flavoring on nutrition ranking remains consistent under different information treatments. Its effect on health outcomes remains negative and is accentuated slightly under the RRR regime (from 1 to 1.18). Finally, soymilk has a stronger positive effect on nutrition outcomes when the back label or the RRR score are revealed (increasing from 0.1 to 0.38).

The effect of the back label nutritional attributes on health ranking is summarized from Model (3) in Table 3.19. Increasing the amount of total fat and carbohydrates in milk makes the product less healthy in the eyes of consumers. Increasing the amount of protein and iron in milk results in higher ranking as these products are perceived to be connected with positive health outcomes.

(See Table 3.19)

When participants only have access to the front label, the detailed nutritional information is not available to them. However, guided by the product attributes reported on the front label, nutritional elements such as fats, carbohydrates, protein and iron have underlying effects on their health rankings. When participants also have access to the back label, the effect of nutritional information on product ranking becomes stronger. Fats and carbohydrates have a stronger effect in leading consumers to rank products lower, with coefficients increasing from 0.07 to 0.095, and 0.116 to 0.150 respectively. Iron has a stronger effect in ranking the products as healthier (from 0.23 to 0.30) when the back nutrition panel is revealed.

When the composite nutritional score, the RRR score, is revealed (in conjunction with the front and back or only with the front label) the effect on nutrition outcomes is similar in magnitude with the front and back label treatment.

The cumulative effect on ranking of all information available under different information treatments is revealed in the Model (4) results presented in Table 3.20. Under

the front label information treatment, the only information available to consumers includes the product attributes whole, organic, chocolate, and soy. These results are identical with those from Model (1).

(See Table 3.20)

Under the front and back treatment, consumers are exposed to nutrition attributes in addition to the binary product attributes on the front. There is a high correlation between front binary attributes and back nutritional characteristics, documented in Table 3.21. For example, carbohydrates are highly correlated to chocolate, fat is correlated to whole, and soy correlates with protein. Despite these issues, when consumers are exposed to the front and back labels we see an increase in significance of the nutritional information on the back label and a decrease in importance of the binary attributes contained on the front.

(See Table 3.21)

When the RRR score is added to the front and back labels, there is hardly any significance probably due to collinearity among these informational messages.

(2) Results for the Environment

Regarding environmental outcomes, the results we present consist of product rankings consumers make based on product cues such as packaging (plastic/cardboard),

method of farming (organic/conventional), origin of production (local/not local), and type (milk/soy milk). Agreement among consumers about these perceptions of product cues is also measured, as well as if and how product cues affect ranking.

Table 3.22 illustrates the overall ranking of 10 milk products according to their perceived environmental impact. Unlike in the case of nutrition, there is no environmental measure similar to the RRR score to scientifically assess the environmental impact of these products. However, consumers agree, with a margin of 60 "best" votes, that "Organic Valley Reduced Fat Milk (Cardboard)" has the perceived lowest negative impact on the environment.

(See Table 3.22)

All the cardboard carton milk products group into the upper half the ranking spectrum, except for the "Lucerne Reduced Fat Milk (Cardboard)" which is ranked in 9th place. Local products are located both at the top and in the mid-range of the ranking. The product with the most negative environmental impact as perceived by consumers is "Lucerne Reduced Fat Milk (Plastic)", by a margin of 172 "worst" votes. While the most and least environmentally friendly products are notably separated by a high difference in the vote margins, products in ranks 3 through 7 have closer voting scores, which may indicate they are more difficult for consumers to distinguish amongst.

Agreement in rankings across consumers is measured by the Kendall W concordance coefficient presented in Table 3.17. In this case, the W statistic is low, 0.245. This low statistic suggests that, lacking clear environmental labeling and using

only product cues to inform their ranking, consumers appear to be in disagreement about their perceptions of the environmental effect of various milk products.

Regardless of this variability in perceptions, participants do use existing product cues to infer the environmental impact of a product. The effect of product cues on ranking is presented in Table 3.23. Results show that the product is ranked higher (it is better for the environment) if it is produced by organic farming methods (as opposed to conventional), it is marketed in cardboard (as opposed to plastic) packaging, it is locally produced (versus non-local), and it is soy based (as opposed to more traditional cow milk).

(See Table 3.23)

Soy milk has the biggest effect (0.093) on perceived environmental outcomes. The second largest effect is from local (0.057), followed by cardboard (0.039) and organic (0.032).

Similar results relative to consumer attitudes towards the environment are presented in Table 3.24. We measured participants' concern for the environment using a subset of the questions in the New Environmental Paradigm questionnaire (Kotchen et al., 2007). The environmental concern score obtained this way follows a scale from 0-25, with higher numbers representing less concern for the environment. With the sample split on the median of the score (which is 15), 35 people are identified to be less concerned for the environment (with a score >15), and 61 are relatively more concerned for the environment (with a score <15). Consumers that are more concerned about the

environment in general display a higher sensitivity towards product cues such as organic farming and soy. For example, while the positive effect organic has on the environmental impact of a product is only -0.239 for people who are less concerned for the environment, this effect increases to -0.367 for people who are more concerned for the environment. Similarly for soy, the effect increases from -0.87 to -0.96. Cardboard packaging and local products have a similar effect regardless of the consumers' environmental attitudes.

(See Table 3.24)

7. Discussion

This study finds that the amount and type of information on the product label can change consumer nutrition perceptions about the product using milk products as an empirical example. When the product search and comparison process is limited to commonly used front label indicators, there is less agreement regarding nutrition outcomes compared to situations where the more detailed back panel label and/or the RRR score are revealed. Chocolate and whole milk are generally ranked lower, and this negative effect on perceived nutrition is accentuated for whole milk under the RRR treatment. In contrast, organic and soy milks are generally ranked higher. While for soy this positive effect is enhanced under more information (back label, RRR), for organic it is reduced by half.

Generally, consumers have a low level of consensus about the environmental impact of food based on product cues. Soy milk has the biggest effect on perceived environmental outcomes. The second largest effect is from local production sourcing, followed by use of cardboard cartons and organic certification. For participants with higher concern for the environment, soy and organic have a higher positive effect on perceived environmental outcomes than for participants with less environmental concern.

A direct implication of our research is that, while nutrition labels are tightly regulated by the government to assure standardized data and uniform communication of nutrition information, consumers still make choices that are inconsistent with scientific nutrition indices (such as the RRR) regarding the healthiness of food products. When the information available is limited to the front label, only two products (out of 10) are ranked "correctly" when compared to the scientific RRR ranking of products. But, this number increases to 4-6 products correctly ranked when the RRR score is revealed, so it does appear there is a logical response to better information by some consumers.

Claims made on the front label both highlight and augment the information available in the nutrition facts panel. In some cases, however, front label claims can be misleading with respect to the overall perceived healthiness of the product. Here, claims such as organic farming play an important role in decisions about nutrition when the back panel information is not available or not consulted (such as in the case of truncated searches by time-constrained consumers). The positive impact of organic on perceived nutritional outcomes is second highest (-0.271), followed by the whole milk category (0.798). However, the link between healthier products and organic farming is inconclusive at best. Some studies have found that organic farming does not directly

contribute to a product's nutritional makeup (Woese, 1997), while others have found a possible connection between the two (Worthington, 2001). When more detailed nutrition information is revealed, the importance of organic decreases (-0.205 when back panel is also available and -0.142 when the back panel and the RRR are also available), but it never disappears.

In the meantime, the importance of other product claims such as soy is undermined in a situation where only the front label is consulted. The effect of soy on perceived nutritional outcomes (0.099) is lower than that of whole (0.798), chocolate (1.00), or organic (0.271) attributes. While soy signals low fat, increased protein and fiber content, and an overall healthy product, stronger perceived nutrition outcomes result from organic claims that are scientifically unsubstantiated (0.27) rather than the soy claims that are factual in nature (0.09).

While tastes and preferences also play a role in the food purchase decision, we specifically asked the consumers in our study to select products based only on their nutritional/health impact. Inspecting consumer reasons behind their health ranking, we notice that their most quoted reason is the nutrition information on the label. Since they were allowed to choose more than one reason underlying their choice (generally there are multiple factors affecting consumer choice), for the front label treatment familiarity with the product is quoted next, along with "other" reasons (for example: "medical conditions", "organic or not", "personal wellness goals", "sugar" and "fat" contents) as detailed in Table 3.16.

If consumers are generally using nutrition information to motivate their choice of healthy products, it may be that either the overall labels or the process of buying are misleading in some way.

First, the overall product label can be misleading in several ways. Panel nutrition information can be difficult to comprehend and read (Black et al., 1992) or only one item on the nutrition label (usually fat or sugar) is used to guide judgments on the healthiness (Black et al., 1992; Higginson et al., 2002). Comparing different products based on an entire list of attributes is generally time-consuming. According to (Roe et al., 1999), the presence of health claims (on the front label) or positive product claims (such as organic farming) are associated with (1) a positivity bias, in which consumers provide a product better ratings merely because a health claim is present; (2) a halo effect, in which the presence of a health claim induces the consumer to rate the product higher on other attributes not mentioned in the claim; (3) a magic-bullet effect, in which consumers attribute inappropriate health benefits to the product.

Second, the process of buying may also be misleading when only part of the information available is used (for example, the front label) while other sources (such as the back panel) are ignored. Respondents in a study by Roe et al. (1999) who either used a truncated information search (to front label only) or viewed claims on front label were more likely to purchase the product, regardless of whether a real claim is present and are less likely to result in health benefits not mentioned in the claim. When exposed only to the front labels, consumer concordance is low in ranking products according to nutritional values (W coefficient is 0.4). Front label attributes correlate to underlying nutritional attributes on the back panel, but they are generally less informative than

actually inspecting the back panel or consulting the RRR score. In short, these signaling indicators used by product marketers may exacerbated prior opinions consumers have about product categories (organic, soy), and these priors may be very heterogeneous among consumer groups.

Additional information in the form of the RRR score or the product back nutrition panel corrects the asymmetric information and results in more concordant rankings across consumers. When the RRR score is posted on the front label of the product, it yields the same results (in terms of agreement across consumers) as thoughtful inspection of the back panel information. Thus, in order to improve the information asymmetry or truncated search behavior related to the product front label, the RRR score may be an easy-to-read add-on to the front label that yields similar results as exposure to the product's back nutrition panel.

Similar to the nutrition attribute, the environmental impact of a product is a credence outcome that cannot be evaluated even after consumption. Government regulation is the most effective way of correcting the information asymmetry problems related to credence attributes (Caswell, 1996), although reputations have also been known to help. Given the lack of government mandates on environmental labeling, product cues can be used even more strategically as a proxy for environmental impact. As a result, consumers are even more dispersed in their ability to determine the environmental impact based on these cues. The Kendall W coefficient of agreement amongst consumers regarding these ranking is 0.245, which indicates almost no agreement about the environmental impact of these products. Our results show that out of the four cues

investigated in this study (organic, cardboard, soy, local), consumers generally believe that soy milk has the biggest impact on whether a milk product is environmentally friendly or not (estimate is 0.093). However, there is no consensus in the scientific community on this matter yet (Silverman, 2010, Nicholson et al, 2011). Soy-bean production may have more ”direct” impacts on the environment, such as deforestation in rapidly growing production regions such as the Amazon basin, while dairy cow production systems may have an entirely different set of impacts, such as acidification and eutrophication (contamination of aquatic ecosystems). Given the different nature of such impacts, comparisons, or distillation down to one indexed number may be impossible to achieve (compared to the consensus surrounding nutritional compounds and their impacts on health).

On the other hand, the smallest perceived positive impact on the environment quantified by study participants is organic farming (0.032). Research comparing LCA for organic versus conventional farming methods is more conclusive than that comparing soy to cow milk. Findings show that in terms of acidification, both methods yield the same impact on the environment (Thomassen et al., 2008; de Boer, 2003), but lower impact from organic farming is reported in terms of lesser eutrophication (due to low fertilizer and pesticide use) and energy use (Thomassen et al., 2008; de Boer, 2003). While organic farming can be better for the environment than conventional farming, consumers in this study associate it weakly with environmental outcomes. On the other hand, soy milk may not be better for the environment than cow milk, but generates the highest gain in utility for consumers. In this case, environmental product cues are found to be misleading and

regulation in this area is necessary if consumers are to be correctly informed of these environmental consequences.

Informing consumers through a list of attributes (for example, by listing the products' impact on air, water, soil, energy use, etc.) may suffer from the same shortcomings as the nutritional list of attributes highlighted above. Here, we suggest that indices summarizing a list of attributes are just as accurate as and perhaps easier to interpret and compare than the former. But, it may be that the set of potential environmental indicators is too great or heterogeneous to allow for some simplification, or that different indices may be used depending on the environmental outcome of interest. As an example, land conservation and wildlife protection may be important to some consumers, and there are now certification programs that address these specific outcomes.

8. Conclusions

This study uses best-worst scaling in a survey with a total of 244 participants to evaluate the effectiveness of current nutrition labels for milk products. Moreover, the analysis allows one to compare communication outcomes from labels for a information category that is currently regulated (nutrition labeling) to those in an area that is not regulated (the environmental impact of food).

The use of only front label information in making nutritional decisions leads to "incorrect" choices (8 out of 10 products are ranked incorrectly) and low agreement

between consumers regarding these choices (Kendall's W is only 0.4 on a scale of 0 to 1 where 1 implies complete agreement). Increasing the information resolution by adding the back nutrition panel or the RRR nutrition score to the front label improves ranking (only 4-6 products are assigned a "wrong" rank) and agreement (W coefficient increases to 0.6) relative to what one would expect for the information shared.

One marketing (or policy) implication is that it may be appropriate to use the RRR score on the front label to help alleviate the information asymmetry derived either from a faulty product search process (i.e., truncated searches that only use front labels) or from the complex nature of labels themselves (lists of attributes are hard to compare across products). Other similar approaches, such as the "traffic light" sign have been suggested as possible solutions to this information problem (Drichoutis, 2006). By "traffic light" labeling, producers place colors next to each nutrient of a product, similar to traffic lights, which will indicate low, medium and high assessments of the nutrient (Drichoutis, 2006). However, this can make it hard for some "fat" products to sell even though they might be beneficial as part of the whole diet (Hawkes, 2004). Similarly, this form of labeling would just indicate the lack of "bad" components rather than the presence of "good" components (Drichoutis, 2006). For example components that might increase good cholesterol are not indicated by this labeling format. The RRR, on the other hand, summarizes the information on the back label in an Index and only penalizes the "bad" components (calories, sugars, cholesterol, saturated fat, and sodium) that surpass an upper limit set by the Dietary Guidelines for Americans (Schdeit et al., 2004). But, regardless of approach, it does seem that an update of how nutritional information is shared with consumers may be warranted.

While regulated nutritional information is more consistently interpreted across consumers when the full extent of information is available (back nutrition label and/or RRR score), interpretation of the environmental impact remains more subjective. Agreement between consumers in ranking 10 milk products according to their perceived environmental impact is low (W coefficient equals 0.2). In the context of occasions when consumers make purchase decisions based on environmental impact, this is an indication that more regulated labeling of environmental outcomes may be needed. Alternatively, since the intended outcomes among consumers may vary more in this realm, marketing innovations may be sufficient, as long as there is oversight of whether claims portray accurate outcomes.

9. Tables and Figures

Table 3.1. Design Matrix for Health

Nutrition and Health Focus (# Products=10)				
	Milk		Soymilk	
	Whole	Reduced Fat	Unflavored/unsweetened	Chocolate
Organic	(1)	(3) Chocolate (4)	(7)	(9)
Not Organic	(2)	(5) Chocolate (6)	(8)	(10)

Note: Products that fit design characteristics are: (1) Horizon Organic Whole Milk, (2) 365 Whole Milk, (3) Horizon Organic Fat Free Milk, (4) O Organics Organic Reduced Fat Chocolate Milk, (5) 365 Fat Free Milk, (6) Lucerne Reduced Fat Chocolate Milk, (7) Silk Organic Unsweetened Soymilk, (8) Silk Unsweetened Soymilk, (9) 365 Organic Soymilk Chocolate, (10) Silk Chocolate Soymilk

Table 3.2. RRR Score of identified products for nutrition

Product Ref. No.	Alternatives	RRR Score
Milk		
(5)	365 Fat Free Milk	8.0
(3)	Horizon Organic Fat Free Milk	7.7
(4)	O Organics Organic Reduced Fat Chocolate	5.9
(6)	Lucerne Reduced Fat Chocolate Milk	5.2
(1)	Horizon Organic Whole Milk	4.5
(2)	365 Whole Milk	4.5
Soymilk		
(7)	Silk Organic Unsweetened Soymilk	10.0
(8)	Silk Unsweetened Soymilk	9.9
(10)	Silk Chocolate Soymilk	5.7
(9)	365 Organic Soymilk Chocolate	5.7

Source: www.goodguide.com

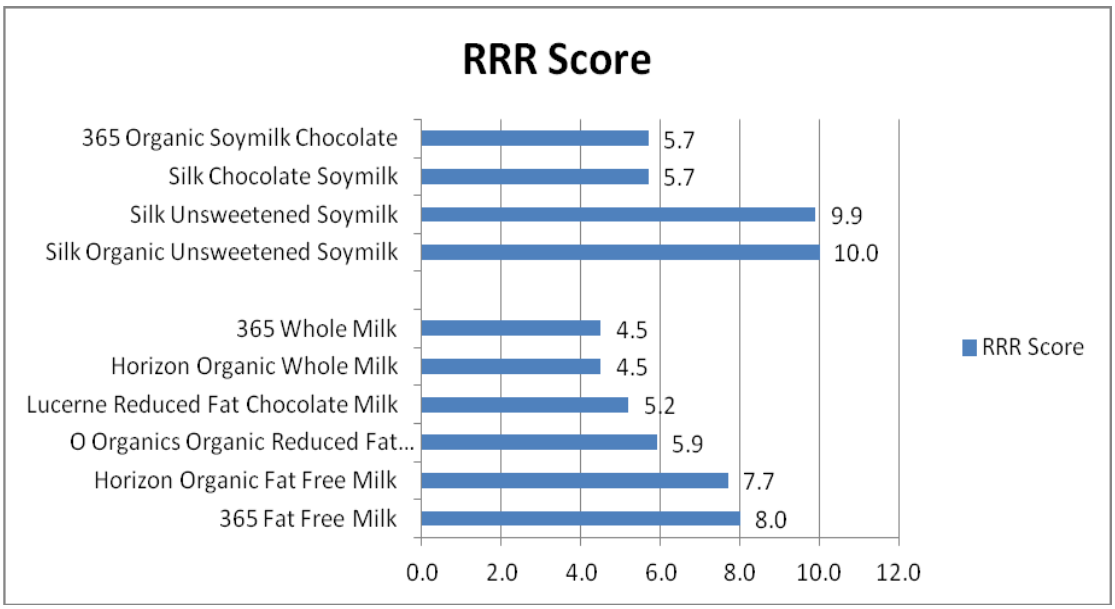

Figure 3.3. RRR Score of products for nutrition

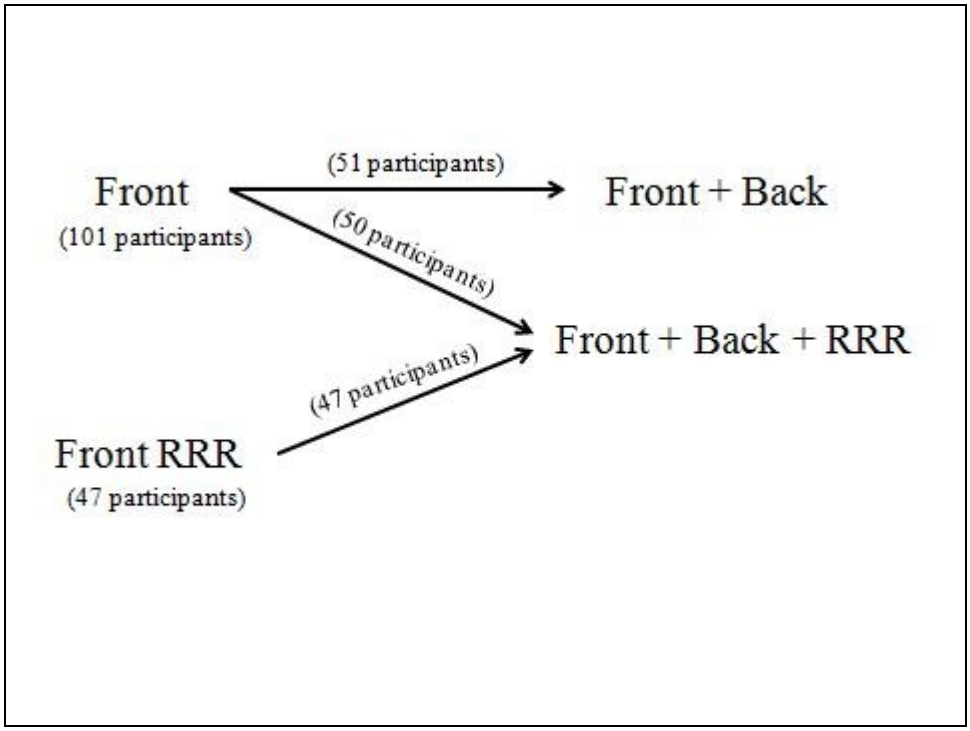

Figure 3.4. Label information treatments

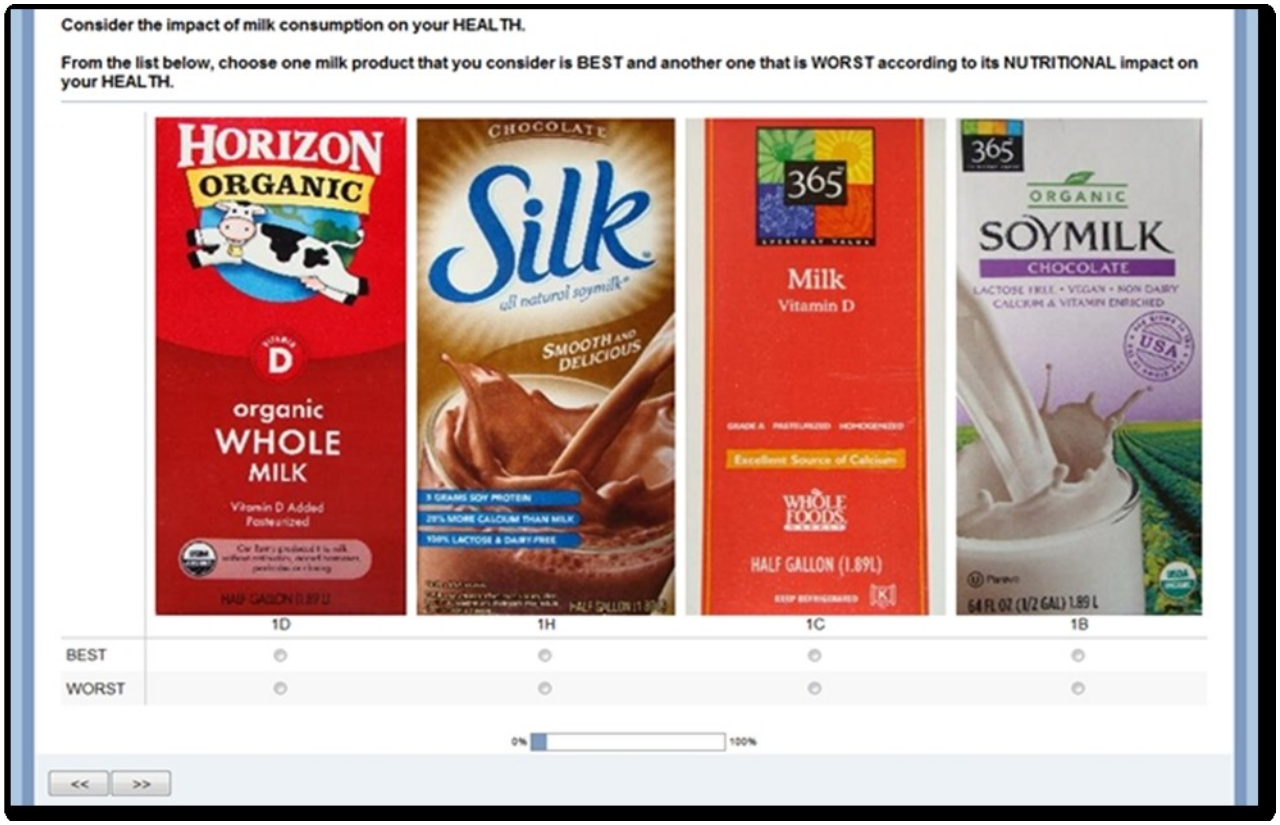

Figure 3.5. Best-worst question sample: Front Label treatment

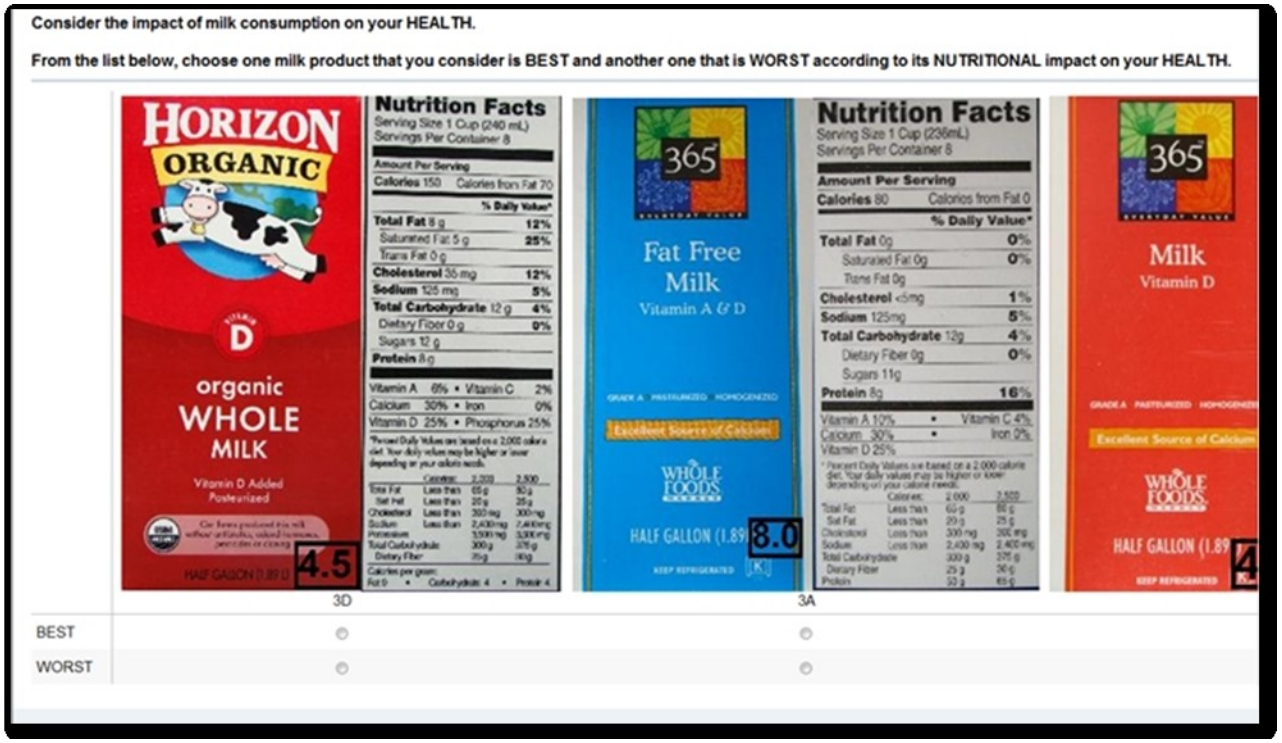

Figure 3.6. Best-worst question sample: Front label + RRR Score treatment

Table 3.7. Design Matrix for Environmental Impact

Environmental Impact (# Products=10)					
	Milk Reduced Fat				Soymilk
	Cardboard		Plastic		Cardboard
Organic	CO proud (1)	Not CO proud (2)	CO proud (5)	Not CO proud (6)	(9)
Not organic	Not CO proud (3)	CO proud (4)	Not CO proud (7)	CO proud (8)	(10)

Note: Products that fit design characteristics are: (1) Organic Valley Reduced Fat Milk (Cardboard), (2) O Organics Reduced Fat Milk (Cardboard), (3) Lucerne Reduced Fat Milk (Cardboard), (4) Robinson Dairy Reduced Fat Milk (Cardboard), (5) Organic Valley Reduced Fat Milk (Plastic), (6) Horizon Organic Reduced Fat Milk (Plastic), (7) Lucerne Reduced Fat Milk (Plastic), (8) Farmer's All Natural Reduced Fat Milk (Plastic), (9) 365 Organic Soymilk (Cardboard), (10) Silk Original Soymilk (Cardboard)

Table 3.8. Subset of Index of Diet Quality Questionnaire

Subset of Index of Diet Quality Questionnaire
How many days per week do you eat whole-grain products (e.g., wheat bread, oatmeal)?
The milk you usually drink is: a) whole milk b) semi-skimmed with 2% fat c) milk with 1% fat d) fat free milk e) I don't drink milk
How many days per week do you consume dairy products (e.g., milk, cheese, sour cream, yoghurt, etc)?
How many days per week do you eat vegetables?
How many days per week do you eat fruits and/or berries?
How many days a week do you eat sweets (including chocolate)?

Source: Adapted from Leppala et al., 2010

Table 3.9. NEP statements to determine environmental attitudes

NEP scale questions subset:
1. Plants and animals have as much right as humans to exist.
2. The so-called "ecological crisis" facing humankind has been greatly exaggerated.
3. Human ingenuity will insure that we do not make the earth unlivable.
4. The earth is like a spaceship with very limited room and resources.
5. The balance of nature is strong enough to cope with the impacts of modern industrial nations.

Notes: The 6-point Likert response scale: Strongly Disagree, Mildly Disagree, Neither agree not disagree, Agree, Mildly Agree, Strongly Agree

Table 3.10. Sample Characteristics

Characteristic		Health % of Sample	Environment % of Sample
Gender	Male	28.38	26.04
	Female	71.62	73.96
Race	White, Non-Hispanic	92.57	83.33
	Black, Non-Hispanic	1.35	4.17
	Hispanic	2.03	5.21
	Asian	1.35	2.08
	Other	2.7	5.21
Education	Some technical, business school or college	12.16	29.17
	Completed B.S., B.A. or College work	37.84	9.38
	Some graduate work	7.43	10.42
	Graduate degree (Ph.D.,M.S.,M.D.,J.D., etc)	39.19	48.96
	High school graduate or equivalent	3.38	2.07
Household income	Less than $20,000	7.43	2.08
	$20,000 to 34,000	9.46	10.42
	$35,000 to 49,000	16.89	18.75
	$50,000 to 74,000	25.68	30.21
	$75,000-99,000	15.54	18.75
	$100,000-124,000	14.19	7.29
	$125,000- $149,000	5.41	7.29
	Over $150,000	5.4	5.21
Diet Score	Unhealthy (<=3)	70.95	NA
	Healthy (>3)	29.05	NA
Adults in HH	More than two	10.14	16.67

	Less than two, including two	89.86	83.33
Primary Shopper	Yes	79.73	88.54
	No	20.27	11.46
Kids	Yes	25.68	25
	No	74.32	75
Environmental Score (0-25)	High Concern (<=15)	NA	63.54
	Low Concern (>15)	NA	36.46

Table 3.11. Correlation Matrix for Nutrition Label Attributes

	Calo-ries	Calories from Fat	Total Fat	Cho-lesterol	Sodium	Carbo-hydrates	Protein	Iron
Calories	1							
Calories from Fat	0.51	1						
Total Fat	0.12	0.79	1					
Cholesterol	0.68	0.74	0.34	1				
Sodium	0.77	0.26	0.09	0.44	1			
Carbohydrates	0.91	0.12	-0.23	0.4	0.7	1		
Protein	0.35	0.14	-0.08	0.59	0.6	0.25	1	
Iron	-0.09	-0.086	0.12	-0.64	-0.14	0.01	-0.7	1

Table 3.12. Product ranking under Front label treatment (N=101)

Front					
Best	**Worst**	**Best-Worst**	**Rank**	**Product Name**	**RRR Score**
345	-10	335	1	Horizon Organic Fat Free Milk	7.7
289	-28	261	2	Silk Organic Unsweetened Soymilk	10
274	-39	235	3	365 Fat Free Milk	8
242	-43	199	4	Silk Unsweetened Soymilk	9.9
119	-203	-84	5	Horizon Organic Whole Milk	4.5
80	-140	-60	6	365 Organic Soymilk Chocolate	5.7
42	-184	-142	7	O Organics Organic Reduced Fat Chocolate	5.9
55	-262	-207	8	365 Whole Milk	4.5
33	-242	-209	9	Silk Chocolate Soymilk	5.7
36	-364	-328	10	Lucerne Reduced Fat Chocolate Milk	5.2

Table 3.13. Product ranking under Front and back label treatment (N=51)

Front Back					
Best	**Worst**	**Best-Worst**	**Rank**	**Product Name**	**RRR Score**
175	-2	173	1	Silk Organic Unsweetened Soymilk	10
157	-17	140	2	365 Fat Free Milk	8
150	-12	138	3	Horizon Organic Fat Free Milk	7.7
139	-12	127	4	Silk Unsweetened Soymilk	9.9
52	-27	25	5	365 Organic Soymilk Chocolate	5.7
33	-68	-35	6	Silk Chocolate Soymilk	5.7
21	-106	-85	7	365 Whole Milk	4.5
21	-129	-108	8	Horizon Organic Whole Milk	4.5
12	-141	-129	9	O Organics Organic Reduced Fat Chocolate	5.9
5	-246	-241	10	Lucerne Reduced Fat Chocolate Milk	5.2

Table 3.14. Product ranking under Front and RRR label treatment (N=47)

Front RRR					
Best	**Worst**	**Best-Worst**	**Rank**	**Product Name**	**RRR Score**
178	-4	174	1	Silk Organic Unsweetened Soymilk	10
160	-12	148	2	Silk Unsweetened Soymilk	9.9
136	-5	131	3	365 Fat Free Milk	8
128	-3	125	4	Horizon Organic Fat Free Milk	7.7
36	-54	-18	5	365 Organic Soymilk Chocolate	5.7
11	-63	-52	6	O Organics Organic Reduced Fat Chocolate	5.9
19	-92	-73	7	Silk Chocolate Soymilk	5.7
18	-143	-125	8	Horizon Organic Whole Milk	4.5
11	-165	-154	9	365 Whole Milk	4.5
8	-163	-155	10	Lucerne Reduced Fat Chocolate Milk	5.2

Table 3.15. Product ranking under Front, Back and RRR label treatment (N=97)

Front RRR Back					
Best	**Worst**	**Best-Worst**	**Rank**	**Product Name**	**RRR Score**
393	-10	383	1	Silk Organic Unsweetened Soymilk	10
314	-5	309	2	365 Fat Free Milk	8
308	-23	285	3	Silk Unsweetened Soymilk	9.9
229	-10	219	4	Horizon Organic Fat Free Milk	7.7
57	-89	-32	5	365 Organic Soymilk Chocolate	5.7
47	-148	-101	6	Silk Chocolate Soymilk	5.7
27	-183	-156	7	O Organics Organic Reduced Fat Chocolate	5.9
23	-287	-264	8	365 Whole Milk	4.5
44	-297	-253	9	Horizon Organic Whole Milk	4.5
13	-400	-387	10	Lucerne Reduced Fat Chocolate Milk	5.2

Table 3.16. Reasons for ranking (multiple choices per person)

	Reasons For Best-Worst Answers (%)					
	Familiarity with Product	Nutrition Info. On Label	Brand	RRR Score	Attractiveness of Label	Other
Front	22.16	36.60	11.86	NA	7.73	21.65
FrontBack	13.98	49.46	8.60	NA	4.30	23.66
FrontRRR	18.58	32.74	11.50	19.47	6.19	11.50
FrontBackRRR	13.18	37.73	5.45	25.00	3.64	15.00

Table 3.17. Agreement in ranking within information treatments

Treatment	Kendall's W	P-value	Sample Size
Front	0.4154	0.000	101
Front Back	0.6168	0.000	51
Front Back RRR	0.6155	0.000	97
Front RRR	0.6051	0.000	47
Environment	0.2452	0.000	96

Table 3.18. The effect of product attributes on ranking under different information treatments

Model (1)	Front	Front Back	Front Back RRR	Front RRR
Whole	0.798***	0.593***	1.159***	1.27***
	(0.085)	(0.071)	(0.080)	(0.122)
Organic	-0.271***	-0.205***	-0.142***	-0.181***
	(0.031)	(0.043)	(0.024)	(0.033)
Chocolate	1.000***	1.093***	1.181***	1.101***
	(0.053)	(0.079)	(0.043)	(0.047)
Soy	-0.099***	-0.507***	-0.381***	-0.323***
	(0.070)	(0.064)	(0.053)	(0.089)
No. people	101	51	97	47
No. Obs.	6060	3060	5820	2820

Note: ***Significant at 1%, **5%, *1*; Robust SE in parentheses

Table 3.19. The effect of back label nutrition attributes under different information treatments

Model (3)	Front	Front Back	Front Back RRR	Front RRR
Fat	0.07***	0.095***	0.094***	0.099***
	(0.007)	(0.009)	(0.006)	(0.009)
Carbs.	0.116***	0.150***	0.143***	0.132***
	(0.009)	(0.012)	(0.008)	(0.009)
Protein	-0.077***	-0.002	-0.048***	-0.092***
	(0.011)	(0.012)	(0.011)	(0.014)
Iron	-0.023***	-0.030***	-0.055***	-0.077***
	(0.009)	(0.010)	(0.009)	(0.014)
No. people	101	51	97	47
No. Obs.	6060	3060	5820	2820

Note: ***Significant at 1%, **5%, *1*; Robust SE in parentheses

Table 3.20. The cumulative effect on ranking of all information available under different information treatments

Model (4)	Front	Front Back	Front Back RRR	Front RRR
Whole	0.798***	-0.023	-2.854	1.165***
	(0.085)	(0.057)	(4.698)	(209)
Organic	-0.271***	-0.018	-0.115*	-0.178
	(0.031)	(0.056)	(0.064)	(0.033)
Choco	1.000***	-1.778***	-0.315	1.008***
	(0.053)	(0.637)	(3.039)	(0.156)
Soy	-0.099***	-0.194	2.438	-0.288***
	(0.070)	(0.875)	(3.384)	(0.098)
Fat		0.094***	0.169	
		(0.009)	(0.191)	
Carbs.		0.341***	0.011	
		(0.052)	(0.215)	
Protein		-0.028	0.157	
		(0.059)	(0.264)	
Iron		-0.098	-0.321	
		(0.126)	(0.399)	
RRR			-0.636	-0.029
			(0.684)	(0.048)
No. people	101	51	97	47
No. Obs.	6060	3060	5820	2820

Note: ***Significant at 1%, **5%, *1*; Robust SE in parentheses

Table 3.21. Correlation between binary product characteristics and nutritional attributes

	Whole	Organic	Choco.	Soy	Fat	Carbs	Protein	Iron
Whole	1							
Organic	0.206	1						
Choco.	-0.277	0.166	1					
Soy	-0.275	0.166	0.284	1				
Total Fat	0.419	-0.262	-0.175	-0.330	1			
Carbs	-0.047	0.174	0.891	-0.027	-0.229	1		
Protein	0.267	0.322	-0.117	-0.647	-0.075	0.245	1	
Iron	-0.570	-0.083	0.445	0.65	0.121	0.005	-0.707	1

Table 3.22. Environmental product ranking

Environment				
Best	**Worst**	**Best-Worst**	**Rank**	**Product Name**
281	-31	250	1	Organic Valley Reduced Fat Milk (Cardboard, Local)
262	-72	190	2	365 Organic Soymilk (Cardboard)
186	-119	67	3	Robinson Dairy Reduced Fat Milk (Cardboard, Local)
116	-62	54	4	O Organics Reduced Fat Milk (Cardboard)
182	-135	47	5	Silk Original Soymilk (Cardboard)
149	-126	23	6	Organic Valley Reduced Fat Milk (Plastic, Local)
130	-157	-27	7	Farmer's All Natural Reduced Fat Milk (Plastic, Local)
71	-209	-138	8	Horizon Organic Reduced Fat Milk (Plastic)
44	-191	-147	9	Lucerne Reduced Fat Milk (Cardboard)
19	-338	-319	10	Lucerne Reduced Fat Milk (Plastic)

Table 3.23. The effect of product cues on environmental ranking

Model (2)	Estimate
Organic	-0.0321***
	(0.044)
Cardboard	-0.039***
	(0.084)
Local (CO Proud)	-0.057***
	(0.049)
Soy	-0.093***
	(0.121)
No. people	96
No. Obs.	5760

Note: ***Significant at 1%, **5%, *1*; Robust SE in parentheses

Table 3.24. The effect of environmental product cues on ranking with varying degrees of environmental concern

	Environmental Concern Score (0-25)	
	Less (>15)	More (<=15)
Organic	-0.239***	-0.367***
	(0.084)	(0.049)
Cardboard	-0.375***	-0.399***
	(0.122)	(0.133)
Local (CO Proud)	-0.576***	-0.574***
	(0.069)	(0.066)
Soy	-0.870***	-0.964***
	(0.199)	(0.154)
No. people	35	61
No. Obs.	2100	3660

Note: ***Significant at 1%, **5%, *1*; Robust SE in parentheses

10. Online Access to Survey Instrument:

Front to Front and Back version:

https://acsurvey.qualtrics.com/SE/?SID=SV_9FV7krCTq3JCUo4

Front to Front, Back, and RRR version:

https://acsurvey.qualtrics.com/SE/?SID=SV_0oktI7TnIxdUmW0

Front, RRR to Front, Back, and RRR version:

https://acsurvey.qualtrics.com/SE/?SID=SV_0un7UF5MO712Suo

The Environmental Impact version:

https://acsurvey.qualtrics.com/SE/?SID=SV_exM5eIimT0OZr1O

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CHAPTER FOUR

Corporate Social Responsibility Initiatives and Consumer Preferences in the Dairy Industry

1. Introduction

Since the early 1990s, companies have been under increased pressure to develop more sustainable business practices and become active partners in the community (Mohr et al., 2001). Increased pressure from consumers, employees, media, and various groups, but also a desire to innovate and differentiate own products in the marketplace have been some of the drivers of this development. Specific involvement actions in social and environmental issues are usually defined by companies in their Corporate Social Responsibility (CSR henceforth) reports. Mohr, et al (2001) define CSR as "a company's commitment to minimizing or eliminating any harmful effects and maximizing its long-run beneficial impact on society".

The potential for environmental externalities and the rising consumer awareness of animal welfare issues in livestock operations (Lusk et al., 2011) make the dairy industry a particularly relevant testing ground for CSR-based product differentiation strategies. By committing to specific CSR goals firms may improve animal welfare as well as mitigate potential harmful effects to air quality (by reducing methane and/or other

emissions), soil (via appropriate grazing and waste management practices), and water (by monitoring waste runoff) (Center for US Dairy, 2010, EPA, 2007). According to industry sources, large distributors such as Costco and WalMart (Martinez and Kaufman, 2008) have been a major driver of CSR implementation in the dairy supply chain in an effort to reduce the risk of media scandals or other negative publicity. CSR efforts may also be driven by a desire to counter the negative stereotype implying that large, profit-driven companies have little interest in the well-being of their employees and society in general.

CSR activities can serve both environment stewardship missions, but also as a tool to enhance firm reputations and create a loyal base of consumers (Pirsch et al., 2012), attract a quality workforce (Greening, 2011), or differentiate own products from competitors and charge a price premium. In other words, CSR activities can be positioned at the intersection between the disinterested provision of public benefits and profit-maximizing firm behavior (Kitzmueller, 2010). Even though CSR activities are generally not expected to directly change product characteristics in a tangible way, the portfolio of CSR activities may influence consumers' perceptions about the product sold by a firm. As one example, Harper (2002) finds that animal welfare is one of the main reasons for buying organic food, and consumers may associate animal well-being with food quality outcomes. It is not yet clear to what extent consumers are motivated by concern for the animal or concern about the impact of the animal's quality of life on the food product. While demand for CSR actions has been increasing, there is limited evidence that firms are able to collect a price premium for these products (Mohr et al., 2001).

This study investigates the ability of CSR to serve as a profit-maximizing tool in the context of product differentiation. The principal objectives of this study are: I) to assess consumer preferences and priorities for specific CSR initiatives in dairy operations, II) to examine if and how existing, commonly used milk labels convey information related to CSR activities, and III) determine whether willingness to pay (WTP) for fluid milk increases when specific CSR activities are implemented.

2. Background

The popularity of Corporate Social Responsibility (CSR) has increased in the past 20 years due to pressures from both the supply (firms and retailers, equity shareholders) and demand side (consumer advocate groups, media and stakeholders).

From a theoretical economics perspective, CSR entails internalizing negative externalities on the society and the environment, or, the provision (reduction) of a good (bad). Even though it is provided by private firms, CSR has the characteristics of a public good (Hartmann, 2011). The public goods aspect of CSR has been criticized by neoclassical economists as being outside the responsibilities of a profit-maximizing firm, and under the jurisdiction of law-enforcing governments (Kitzmueller, 2010; Benabou and Tirole, 2010). Indeed, neoclassical economics defines the responsibility of a firm only as the increase in owner's welfare and pursuit of a profit-maximizing strategy (Hart, 1989; Friedman, 1970). However, some economists believe that CSR may not be incompatible with firm profit-maximizing behavior. "Profit-maximizing CSR" behavior

is defined by firm actions that are socially responsible with the anticipation of driving benefits from these actions (Baron, 2001; McWilliams and Siegel, 2001; Bagnoli and Watts, 2003). To this purpose, Baron (2001) coined the phrase "strategic CSR", which blends private provision of public goods with firm profit-maximizing behavior. CSR can be a part of the profit-maximizing strategy as long as company stakeholders (consumers, employees) have preferences that map directly into it (Kitzmueller, 2010). Kitzmueller (2010) creates a taxonomy of CSR based on shareholder and stakeholder preferences. This categorization is reproduced in Table 4.1.

(See Table 4.1)

The CSR classification identifies two types of preferences that consumers and producers can experience: classical preferences (relating to rational market agents that following profit-maximizing strategies), and social preferences (relating to a direct gain in utility from good deeds or indirect gain in utility from reputation earned in the eyes of society, Kitzmueller, 2012). In order for the "strategic CSR" to exist and generate a positive effects on profits, it is essential for consumers to display social preferences and be willing to pay more (or take a wage cut) for CSR. On the firm side, classical preferences will lead to CSR being part of the firm's profit-maximizing strategy. Acting on these preferences generates utility for stakeholders and profits for the company. The utility derived from CSR can be either monetary, i.e., consumer reward of CSR firms through payment of higher product prices or employees accepting lower wages, or non-monetary, i.e., social prestige, feeling good about firm's actions. The literature integrates

both the monetary and non-monetary aspects as complementary parts of the total utility derived from having a CSR (Kitzmueller, 2010).

Regardless of whether it is "strategic" or not, once in place, CSR may have several consequences for firms and consumers alike.

On the producer side, CSR may prove useful in attracting a quality workforce (Greening, 2011). In the supply chain, it can play the role of insurance against scandals and negative media releases about firm business practices. Competitive trends related to brand positioning, marketing and innovation (Spar et al., 2003; Maignan et al., 2002) and increased pressure from the institutions of globalization, regulations, and sustainable development (Panapanaan, 2003) are added reasons for CSR adoption.

On the consumer side, CSR may help create a loyal base of consumers (Pirsch et al., 2012) and positively contribute to the development of firm reputations. From a social welfare perspective, CSR is beneficial when it takes into account negative firm externalities on society and the environment and works on decreasing them. In a retail setting, provided that it aligns with consumer preferences for certain initiatives, CSR could be used as a purchase criterion. At parity other characteristics important to consumers, a product displaying a better CSR record may be purchased at a price premium if CSR-based product differentiation is feasible. This is especially true in the context of a shift in preferences and values, especially of the more affluent Western consumers, towards more environmentally and socially friendly products in the wake of more rapid spread of information through advancing communication technologies (Moon and Vogel, 2009; Benabou and Tirole, 2010).

However, while consumer popularity of CSR has been increasing, only a limited number of consumers use it as a purchase criterion. Out of the consumers who are likely to make a CSR-based purchase, only a minority (21%) actually use a company's CSR position as a purchase criterion (Mohr et al., 2001). The wedge between consumer popularity of CSR and its use in product selection is currently minimally addressed in the literature. Some of the first attempts to explain it call it the paradox of CSR in consumer behavior (Öberseder et al., 2011).

Interviews about how people incorporate CSR information in purchase decisions reveal three factors that predict consumer behavior with respect to CSR *(core, central,* and *peripheral* factors), Öberseder et al., 2011. *Core* decision-making factors include obtaining information about CSR initiatives and the presence of personal concern from consumers towards these initiatives. While the former lies mostly within company's power, the latter is subjective, personal, and cannot be influenced by companies. The c*entral* factor is the price, or how much the consumer is able and willing to pay for the product based on company CSR initiatives. *Peripheral* factors include (1) the image of the company, (2) the credibility of CSR initiative (i.e., must be aligned with company's core business and must have a credible channel of communication), and (3) the influence of peer groups (word-of-mouth about the reputation of the company).

Based on these factors, the literature suggests that there exists a hierarchical purchase decision-making process involving CSR (Öberseder et al., 2011). Once the core factors are met (obtaining information about CSR initiatives and personal concern towards these initiatives), consumers can initiate the CSR-based purchase if the central factor (price) corresponds to their willingness to pay. Peripheral factors explain why

some consumers are still skeptical about purchasing even when the core and central factors are met.

The core factors are essential in initiating the purchase decision-making process. While personal identification with CSR initiatives is subjective and cannot be influenced by companies, corporations can investigate what most of its customers are interested in and prioritize those CSR areas. In addition, identifying the best ways to convey CSR information to consumers is critical in initiating the purchase.

In fact, research indicates that consumers rarely have access to CSR information in market situations (Hartmann et al., 2011). According to the theory exposed above, this is a major obstacle in allowing firms to use CSR as a marketing and product differentiation tool (Mohr et al., 2001; Du et al., 2010).

Drawing on the literature outlined above, this study investigates the possibility of having a "strategic CSR" in the dairy industry in the context of product differentiation. The CSR-purchase core factors of (1) identifying consumer preferences for CSR activities and (2) obtaining information about CSR overlap perfectly with the first two objectives of this study.

The first objective is to assess consumer preferences and priorities for specific CSR initiatives in dairy operations. The second goal is to examine if and how existing, commonly used milk labels convey information related to CSR activities. Alternatively, the third objective investigates product differentiation based on CSR. In particular, we wish to determine whether willingness to pay for fluid milk increases when specific CSR activities are implemented.

3. Survey Methodology

A survey of milk consumers recruited amongst Colorado State University (CSU) was carried out in the summer of 2011. A total of 96 individuals were included in the study, based on a first-reply policy to an invitation e-mail which was sent to the entire *administrative staff* population at CSU. The invitation *was not* sent to CSU students and faculty. The survey was administered via computer in a controlled setting in a computer laboratory on CSU premises. Survey sessions included 20-25 participants each. In addition to a section soliciting socio-demographic information, surveys consisted of three types of tasks, which directly relate to each one of the stated research objectives.

I. Best-worst ranking

In a best-worst exercise (Finn et al., 2006) participants ranked by perceived importance the involvement of a hypothetical dairy farm in nine alternative CSR activities: animal welfare, energy consumption, water consumption, air pollution, community involvement, employee opportunities, local operation, waste management, and sustainable agricultural practices. The description of each CSR activity provided to the participants is reproduced in Table 4.2.

(See Table 4.2)

A balanced incomplete block design (BIBD) was used to create 12 choice sets of six CSR alternatives each[8]. Respondents were asked to choose the most important and the least important CSR area to them, as it is shown in Figure 4.3.

(See Figure 4.3)

Best-worst choice experiments became popular in the early '90s with a publication by Finn et al, (1992). Sometimes also called *max-diff*, the method extracts a final ranking of consumer preferences by repeatedly asking them to compare all the pairs of alternative CSR actions available in a set and choose the one which maximizes the utility difference between the best and the worst (Finn et al., 1992).

The method has several advantages over traditional measures of measurement such as Likert scales. First, it forces people to make trade-offs by choosing a best and a worst alternative. On the other hand, on a scale system, all alternatives could be viewed as "best/ important" or "worst/ least important" (Lusk, 2009). Second, people interpret ordinal scales differently. When a person chooses a 5 from a scale of 1 to 5, this can actually represent a 4 for another respondent (Lusk, 2009). However, there is no bias in the best-worst scale as there is only one best-worst pair each consumer can choose (Cohen et al., 2002). Therefore, best-worst coefficients are directly comparable between people and result in individual as well as aggregate ranking scales. Third, despite the sometimes large number of choice sets and the repetitiveness of the exercise, participants

[8] In SAS, the %mktbsize and %mktbibd macros were used to generate a BIBD with 9 attributes, 6 attributes per choice set, and 6 overall appearances across choice sets

find the task easy and quick to complete (Goodman et al., 2005, Auger et al., 2004, Cohen et al., 2002).

II. Label mapping

Next, participants were asked to use a quantitative scale (from -5 "much worse" to + 5 for "much better", in increments of one) to express how fluid milk displaying a specific label certification (USDA Organic, RBST-free, Validus, and Local Colorado Proud) was perceived to perform in the nine selected CSR areas when compared to a similar fluid milk without the labeled certification. A description of each of the labels used in this study and is provided in Table 4.4.

(See Table 4.4)

The slider bar for this exercise covers the -5 to +5 range, and initially it is set at zero. By moving it left (performs worse), right (performs better), or leaving it at zero (performs the same), respondents indicate the degree they associate the milk label with each specific CSR area. The set-up of this type of question is shown in Figure 4.5.

(See Figure 4.5)

III. Valuation

Finally, for each of the four mentioned labels, participants used a sliding bar tool (from -$2.00 to +$2.00 in increments of 10 cents) to express how much more or less they

would be willing to pay for a gallon of milk displaying the label (USDA Organic, RBST-free, Validus, and Local Colorado Proud), compared to a gallon of milk without it. The exercise was then repeated, but, rather than their own valuation, participants were asked to estimate how much the general consumer population would be willing to pay for the label[9]. Examples of this type of question eliciting own and peer valuation are provided in Figure 4.6.

(See Figure 4.6)

4. Data Description and Survey Participants Characteristics

The study sample statistics provided in Table 4.7 are comparable to state of Colorado demographics provided by the US Census Bureau (US Census Quick facts, 2012). In terms of racial composition the statistics show: whites (non-Hispanic) 70% in Colorado, 83% in our sample, black 4% both samples, Asian 2.8% in Colorado and 2% in our sample, Hispanic 11.3% in Colorado and 5.2% in our sample. The median household income in the state of Colorado (years 2006-2010) is $56,456. This is comparable to our sample median of $50,000-75,000.

(See Table 4.7)

[9] Research shows that individuals under scrutiny (in a research survey situation, for example) tend to over-state their WTP on socially desirable issues (Fisher, 1993). If their own reported WTP is inflated perhaps due to the social desirability bias phenomenon, a question eliciting their peers' WTP can offer a more realistic statistic

Demographic data on gender, age, and race is presented in Figure 4.8. Most of the participants are female (74%). Since females are generally the primary shopped in the household, and the most represented gender in grocery stores, this may be the target demographic for milk consumption.

(See Figure 4.8)

The average age is 42 years old, with most of the sample falling into the 30-39 years old bracket (34%), followed by the 50-59 age group (24% of the sample). Generally, respondents are white (83%), but other races are also represented: Hispanic (5%), Black (4%), Asian (2%), and others (5%, mostly Native-Americans and multi racial).

Some of the household characteristics of our sample are presented in Figure 4.9. Most of our survey-takes are also primary household shoppers (88%), as we expect.

(See Figure 4.9)

Generally, the sample is composed of families of two members (55%) or one member (28%). In terms of children who are generally frequent milk-consumers, 24% of the sample has one or more kids.

Education and household income statistics are presented in Figure 4.10. In terms of socio-economic characteristics, our sample may be slightly more educated than the nation's average. Almost half of the sample (49%) has a graduate degree.

(See Figure 4.10)

Next, 29% of respondents have a college degree, while the rest have technical (9%), some graduate (10%), and high school (2%) studies. In terms of income, there is a wide variation with the lowest income under $20,000 and the highest one of over $150,000. Generally however, the highest percentage of respondents report a household income of about $50-74,000 (30%), followed by $35-49,000 (19%) and $75-99,000 (19%).

Figure 4.11 presents the average willingness to pay (WTP) statistics for our sample. The average own WTP is consistently higher at a sample level and by label than the peer WTP.

(See Figure 4.11)

The largest gap in valuation is for the Validus label (about $0.3), while the smaller is for Colorado Proud label (under $0.1). The Organic label commends the highest own average WTP, followed by Validus, RBST-free and Colorado Proud. In terms of average peer WTP, the Organic label is still associated with the highest average WTP, but it is followed by Colorado Proud, RBST-free, and finally, Validus.

5. Data Analysis

The data analysis follows our three objectives closely. Related to the first objective, we use a best-worst (max-diff) exercise to rank of the nine CSR activities based on consumer preferences. If there is heterogeneity in consumer CSR ranking, segmenting consumers based on the similarity of their CSR preferences is the follow-up to this analysis.

The best-worst data is analyzed using the counting method (Lusk et al, 2009). This implies that the final "score" of a particular alternative, *j*, is calculated as the difference between the amount of times it has been voted "best" and the amount of times it has been voted "worst" across all study participants:

$$Rank_j = \sum_{k=1}^{n} Best_{ij} - \sum_{k=1}^{n} Worst_{ij}$$

Where *i*=individual, *j*=CSR activity, *n*=1-12 choice sets

When the results obtained in this fashion are sorted in decreasing order, the CSR activity with the highest "score" is ranked first and interpreted as being the overall most important to consumers, the next one is the second highest in importance, and so on.

When ranking heterogeneity is high, groups of consumers displaying similar CSR preference may be identified. A principal component analysis (PCA) is applied to individual person ranking of each activity. Our goal is to extract the underlying patterns in people's ranking preferences that make them behave similarly in the marketplace. These underlying principal components that capture behavior can be subsequently used to segment consumers with similar preferences. K-means clustering of these principal

components is used to identify these consumer clusters. The K-means method computes the distance of every individual from the mean of each cluster and assigns the participants to their nearest cluster (Wishart, 2001). While K-means clustering is criticized for problems with determining the appropriate distance measure and appropriate number of clusters (Green et al., 1967, Frank et al., 1968), anchoring it in principal components that are orthogonal and linearly uncorrelated can help improve the quality of this analysis.

Next, the valuation data is examined. As a general framework of this analysis, Figure 4.12 illustrates that when consumer preferences for CSR activities map into consumer perceptions of milk labels as CSR information mediums, they may lead to consumer valuation of milk products.

(See Figure 4.12)

In the first regression model (1) we investigate if and how any of the CSR and non CSR factors included in our study influence consumer WTP for fluid milk. An OLS fixed-effects panel regression is applied to the pooled data of label valuations. The dependent variable in Model (1) is peer (rather than personal) WTP for each of the four labels in our study, and the regressors are consumers subjective perceptions of the label across the nine CSR dimensions in the study, plus four label-specific dummy variables (fixed effects). Model (1) is expected to capture the individual effects of CSR actions on (any) label valuations.

(1)

$$WTP\ Others_{ij} = \alpha_1 AnimalWelfare_{ij} + \alpha_2 AirPollution_{ij} + \alpha_3 Community_{ij} + \alpha_4 Employees_{ij} + \alpha_5 Energy_{ij} + \alpha_6 Local_{ij} + \alpha_7 Sustainable\ Ag_{ij} + \alpha_8 Waste_{ij} + \alpha_9 Water_{ij} + \alpha_{10} Taste_{ij} + \alpha_{11} Safety_{ij} + \alpha_{12} Nutrition_{ij} + \beta_1 OrganicLBL_1 + \beta_2 ValidusLBL_2 + \beta_3 RbstLBL_3 + \beta_4 COProudLBL_4 + \varepsilon_{ij}$$

Where *i*=individual, *j*=label

Model (2) investigates the effect of CSR label perceptions on each label separately. Certain CSR activities might be relevant only to specific labels. Own and peer WTP measures are used as dependent variables one at a time. The independent variables consist of the CSR areas that display "spikes" in each of the label mappings (that is, other areas are omitted). These independent variables are mean-centered to indicate an average perception of the CSR activities. In this case, the constant term, α_0, represents the contribution of all other non-CSR factors to the valuation of the label. We expect these contributions to own WTP to be generally higher than peer WTP, if social desirability bias exists in this sample.

(2)

$$WTP\ Own/Peers_{ij} = \alpha_0 + \alpha_1 \left[RelevantActivity_{ij} - Mean\left(RelevantActivity_{ij}\right)\right] + \varepsilon_{ij}$$

Where *i*=CSR Activity, *j*= label

6. Results

CSR Priorities for Consumers

Table 4.13 presents the overall ranking of the CSR activities obtained from the best-worst exercise. The overwhelming majority of participants stated that investment in improving Animal Welfare practices is the most important CSR activity. Next, sustainable agriculture practices showing the company's commitment to maintain good soil health, ranks second. The third issue of high importance to consumers is energy consumption. According to our results, the least important activities are water management (somewhat surprisingly) and community involvement.

(See Table 4.13)

While the low popularity of some CSR activities is perhaps surprising, we find evidence of heterogeneous preferences amongst consumers. That is, a specific CSR activity may not be very important for the general population, but be extremely significant for a niche of consumers. For example, "local" was voted most important practice in 100 times (third highest in terms of "best" votes) but its overall rank is 7^{th}. Similarities in individual ranking patterns between consumers can be used to identify groups of consumers (segments) with similar priorities. While areas unanimously ranked as "best" (animal welfare) and "worst" (community involvement) are not expected to change ranking across consumer segments, the importance of other "mid-range" activities may.

In order to identify consumer segments, we used a K-means clustering algorithm identifying similarities in the pattern of best-worst responses (more precisely, five principal component factor scores extracted from the data). This clustering approach simultaneously maximizes within-group similarity and cross-group differences in stated CSR priorities (Bond et al., 2008). CSR preferences within each group as well as group characteristics are provided in Table 4.14. Two specific consumer sub-groups emerge from the results: one emphasizes local business, equal opportunities for employees, and sustainable agricultural practices; while the other prioritizes air pollution, energy consumption, water quality, and waste management. The CSR preferences of the third group (Mixed) are quite similar to the ones we previously identified for the general population.

(See Table 4.14)

While all the nine investigated CSR activities entail desirable social and public welfare outcomes, the difference between the first two consumer segments seem to reside in the link between the proposed CSR activity and the nature of the resulting outcome. The first group of consumers prioritizes outcomes which the individual firm can accomplish independently (e.g. enforcing equal opportunities for their employees). We label this cluster as the "local" group as the beneficiaries of these CSR activities are the local communities and employees of the company. The second group prioritizes more "global" or collective outcomes: air and water quality, energy consumption, and proper waste management imply the concerted efforts of a large number of firms. The

beneficiaries of these CSR activities are not only the communities around the firm, but also the general world population and ecosystems.

The local development consumer cluster has a high household income, the highest average own willingness to pay (WTP) for milk labels and 85.7% of them drink milk "Often". However, this is a rather small segment (22%) of our sample. The Mixed group represents the bulk of our sample (60%) and despite their relatively smaller household income, their average own WTP for milk labels is second highest. They are also heavy milk drinkers (72.5% drink it "Often"). Plain milk consumption patterns of our sample are provided in Figure 4.15.

(See Figure 4.15)

Do Milk Labels Convey CSR Information?

Product labels may be a vehicle for transmitting CSR involvement information in a grocery store setting where consumer purchase decisions are made. Figure 4.16 shows how perceived CSR outcomes (averaged across study participants) map into existing labels/certifications. A profile of the information carried by each label is thus created. Results suggest that the Organic label is positively associated with animal welfare, energy, sustainable agriculture, waste management, taste, nutrition. The RBST-free label strongly maps to taste, safety and nutrition, and mildly into animal welfare, energy and sustainable agriculture. The Colorado Proud labels is associated with reduced air pollution, community involvement, local business, and taste, while the Validus label transmits strong information cues about animal welfare, and minor signals regarding

employee opportunities, sustainable agriculture, waste management, taste, safety, and nutrition.

(See Figure 4.16)

Examining Figure 4.16, we note that milk labels can be categorized according to the dimensionality of the information carried. Multidimensional labels (e.g. Organic) communicate cues mapping into a wide spectrum of outcomes and may have the advantage of appealing to a large number of consumers having various preferences. Mono-dimensional labels (Colorado Proud, Validus) present a single major "spike" in one product attribute and may have the advantage of transmitting a single strong, clear message to consumers.

Do CSR Claims contribute to label valuations?

Two key pre-requisites have been identified for the occurrence of a CSR-based purchase: (1) whether consumers personally identify with the CSR activity portrayed; and (2) if they have access to information on that CSR activity at the moment of purchase (Öberseder et al., 2011). In the following results, we try to establish a link between consumer preference for CSR actions, consumer perceptions of these labels, and consumer valuation of existing milk labels as vehicles for transmitting CSR information in the store at the moment of purchase. Thus, the connection between consumer WTP and CSR actions is not direct, but rather disentangled from how consumer perceptions contribute to their valuation of these labels.

Results from this model (1) presented in Table 4.17 show that the only CSR activity that is positive and statistically significant (at 1% level) is animal welfare. We estimate that, across the four labels, increasing animal welfare perceptions by one unit (on an importance scale of 1 to 5) contributes to WTP by an average of $0.07 per gallon of milk. CSR activities that do not influence WTP are either not valued by consumers, or are not sufficiently conveyed by the labels investigated in this study.

(See Table 4.17)

Estimates of the label-specific fixed effects are presented in Table 4.18. Controlling for the CSR contribution to valuation, all the other (non-CSR) contributions collect a WTP amounting to $0.45 per gallon for the Colorado Proud label, $0.44 per gallon for the Organic label, $0.32 per gallon for the RBST-free label, and $0.2 per gallon for the presence of the Validus label (all estimates are significant at the 1% level). The contribution of the CSR-related consumer perceptions to label valuation is presented in the last column of the table. The valuation attributable to CSR outcomes is largest for the Validus label ($0.26), followed by the Organic label ($0.20). If introduced in the market the Validus label has the potential, among the labels investigated, to collect the highest price premium due to CSR perceptions.

(See Table 4.18)

Model (2) investigates each label separately. Results presented in Table 4.19 show whether consumer label perceptions of CSR areas contribute to the valuation of that label. For example, a 1-unit increase (on a scale of 1-5) of animal welfare perceptions contributes to the valuation of the Validus label by $0.12/gal. A one-unit increase in perceptions of community involvement and water management associated with the Colorado Proud label contribute, respectively, $0.11/gallon and $0.08/gallon to the label valuation. For the Organic label, increase in perceptions of sustainable agricultural practices contributes to label valuation by $0.08, while water consumption perceptions can negatively impact this label.

(See Table 4.19)

7. Conclusions and Marketing Implications

This study investigates three dimensions of consumer perceptions of CSR activities relevant to the dairy industry. First, we examine consumer preferences and priorities over a set of nine alternative CSR-related activities. Second, we assess if and how four milk labels may convey information related to CSR outcomes. Finally, we obtain consumer willingness to pay for each milk label, and explore whether, at least for some labels, a link between CSR activities and WTP can be established.

Based on the results of the ranking exercise, animal welfare is clearly identified as the most preferred activity and a top priority for most consumers. This finding was

somewhat expected given increased consumer sensitivity towards livestock production practices, but the overwhelming consensus for prioritizing animal welfare initiatives is striking. Sustainable agricultural practices, energy consumption, and waste management are ranked as second, third, and fourth respectively; while company involvement in the community has the lowest priority amongst consumers.

With the exception of animal welfare, rankings of CSR initiatives display some degree of heterogeneity across participants. Two differentiated groups of milk consumers can be identified using clustering techniques based on consumer preferences for local (employee opportunities, sustainable agricultural practices) vs. global (air or water pollution) CSR actions. A third group, containing the majority of our sample (60%) does not seem to make this distinction so discriminating among consumers solely on the basis of CSR preferences may not be particularly insightful.

In the second part of the study, we mapped the perceptual profiles of four labels: USDA Organic, CO Proud, RBST-free and Validus (animal welfare). The profiles disentangle the information content of each label by mapping them into perceived outcomes across several CSR dimensions, as well as taste, nutrition and food safety. As one may expect, consumers associate the Validus certification primarily to improved animal welfare, but also to somewhat better nutrition, taste and food safety. Similarly, Colorado Proud sends a strong message related to locality and community involvement. USDA Organic and RBST-free convey a more complex message: Organic maps into sustainable agricultural practices (as expected), but also is aligned with better nutrition, taste, and animal welfare in the minds of consumers. Similarly, RBST-free is associated

with animal welfare, food safety, and sustainable agricultural practices among potential buyers.

The distinction between single-dimension (Validus and Colorado Proud) and multidimensional (Organic and RBST) labels arising from the perceptual label profiles has relevant marketing implications. While multidimensional labels are able to convey a more elaborate and complex message, one-dimensional labels deliver a focused message and can elicit a "perceptual spike". Thus, it is possible that multidimensional labels may be suitable for targeting a broader consumer population (with heterogeneous preferences), while one-dimensional ones may appeal to more specific consumer niches.

While we find that consumers are willing to pay a premium for fluid milk carrying the Organic, RBST-free, Colorado Proud and Validus labels, the link between label valuation and CSR is generally weak, either because consumers are not willing to pay extra for such activities, or because CSR messages are not properly transmitted by the examined labels. The Validus certification is a clear exception: out of all the CSR activities considered, study participants attributed the highest priority to animal welfare, and the Validus label triggered an increase in product valuation because, as currently framed, it is aligned with animal welfare improvements. This suggests that product differentiation based on animal welfare may be a viable option for the dairy industry to effectively target a large cross-section of milk consumers.

8. Tables and Figures

Table 4.1. Taxonomy of CSR

		SHAREHOLDERS	
STAKEHOLDERS		Social (S) Preferences	Classical (C) Preferences
	S	*Not for Profit CSR* Mixed effects on profits	*Strategic CSR* Profit maximization
	C	*Not for Profit CSR* Reduction on profits	*No CSR* Profit maximization

Source: Replicated from Kitzmueller, 2010

Table 4.2. CSR activities included in study

Dairy CSR Activities	Description
Animal welfare	There is a commitment to maintaining animal health through monitored nutrition and on-staff veterinarians, and reproduction by natural breeding rather than artificial insemination. Also, animals are kept outdoors rather than enclosed barns.
Energy consumption	Refers to the use of energy saving equipment in milk processing, and also to making transportation of milk to processing plants and retailers more energy efficient.
Water consumption	Implement recycling water programs through a water treatment facility and save water by using limited irrigation schedules to irrigate pastures and crops.
Air pollution	Manage the release of bovine methane by managed grazing and carbon soil sequestration. Also, decrease air pollution by making transportation from farm to plant and retailer more fuel efficient.
Community involvement	Company should be involved in charitable organizations, should implement volunteering days, and create and support local community programs.
Employee opportunities	The company should provide fair or above market wages, medical benefits, vacations, and retirement plans to employees. Employee advancement in company hierarchy is encouraged, as well as diversity in the workplace.
Local operation	The company uses local resources and generates local growth. The local economy is stimulated by creating jobs locally.
Waste management	Waste management refers mainly to composting solid waste to be used as fertilizer and monitoring waste runoff to the local water table.
Sustainable agricultural practices	Commitment to maintaining good soil health for a sustainable future of the business and the environment. Soil health implies practices such as the use crop rotation; using compost as natural organic fertilizer, and never using chemicals in maintaining a fertile soil.

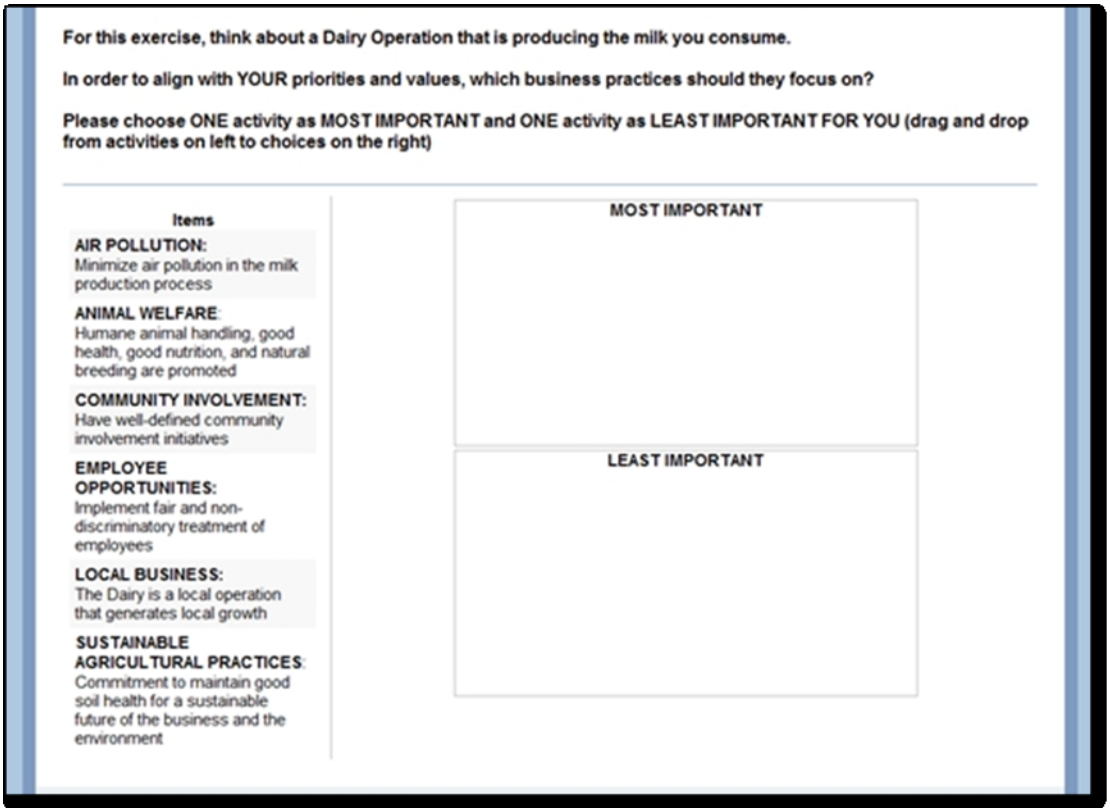

Figure 4.3. Best-worst question example with CSR development actions

Table 4.4. Labels included in survey and their descriptions

Certification	Logo	Description
Certified USDA Organic		Indicates that this product is produced using organic methods or made with organic ingredients. Certification is conducted by entities that have been approved by the US Department of Agriculture, using national standards that define organic production.
Validus Animal Welfare		The Dairy Animal Welfare Review Program verifies a farmer's animal welfare practices Specific areas reviewed include: Animal handling practices, Body condition, Feed and water access and quality, Herd health, Facilities/housing, Animal hygiene, Special needs management, Parlor management, Animal behavior, Management and employee training.
Colorado Proud		This label indicates that the product is produced locally in Colorado.
No rbST		This label indicates that the company does not use rbST on its cattle.

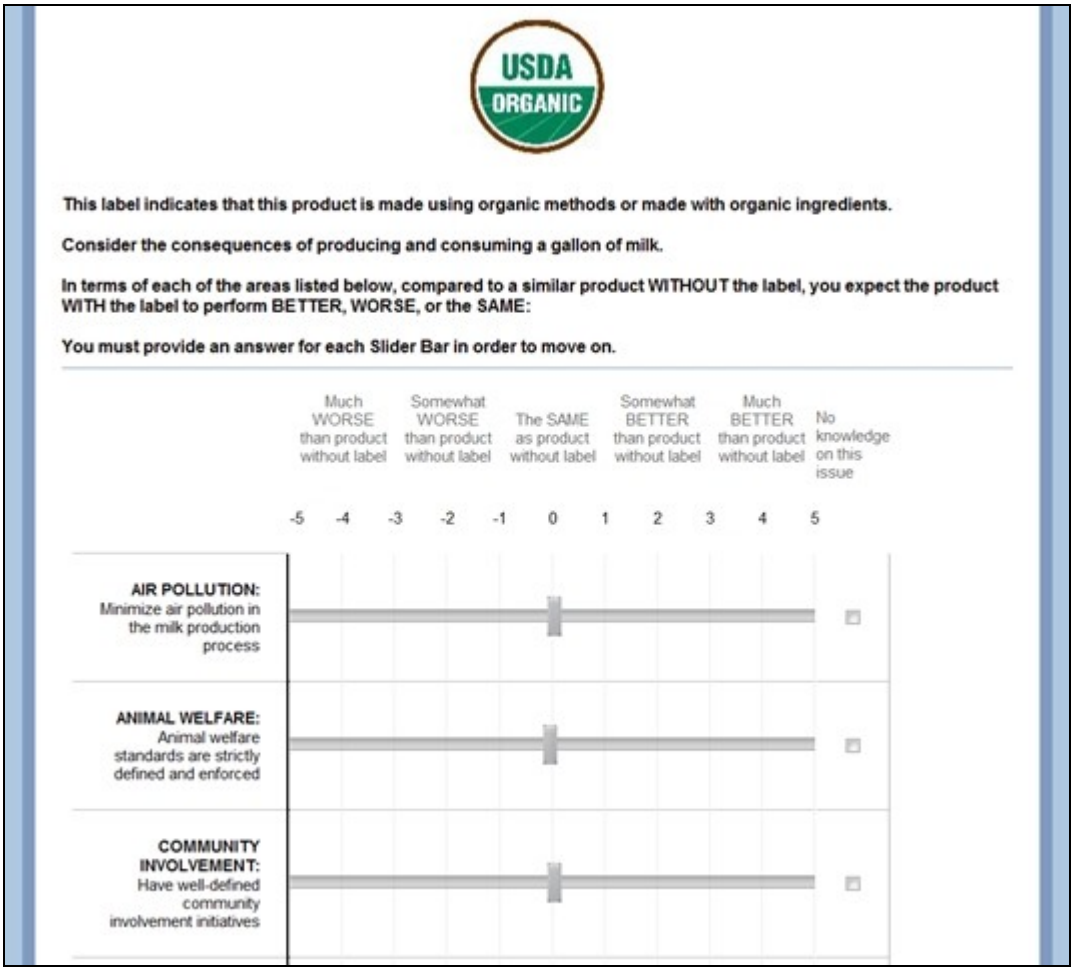

Figure 4.5. Slider-bar question example with milk labels and CSR development factors

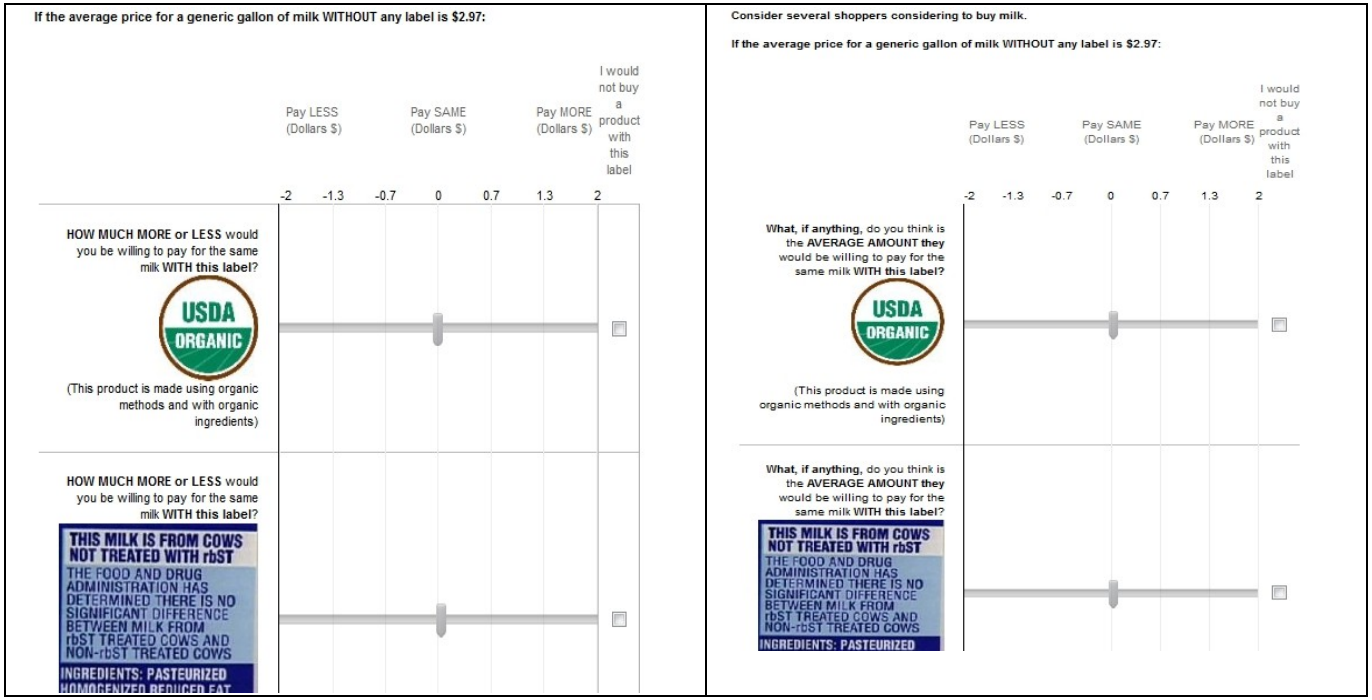

Figure 4.6. Own and Peer valuation question example

Table 4.7. Sample Characteristics

Characteristic		**% of Sample**
Gender	Male	26.04
	Female	73.96
Race	White, Non-Hispanic	83.33
	Black, Non-Hispanic	4.17
	Hispanic	5.21
	Asian	2.08
	Other	5.21
Education	Some technical, business school or college	9.38
	Completed B.S., B.A. or College work	29.17
	Some graduate work	10.42
	Graduate degree (Ph.D.,M.S.,M.D.,J.D., etc)	48.96
	High school graduate or equivalent	2.08
Household income	Less than $20,000	2.08
	$20,000 to 34,000	10.42
	$35,000 to 49,000	18.75
	$50,000 to 74,000	30.21
	$75,000-99,000	18.75
	$100,000-124,000	7.29
	$125,000- $149,000	7.29
	Over $150,000	5.21

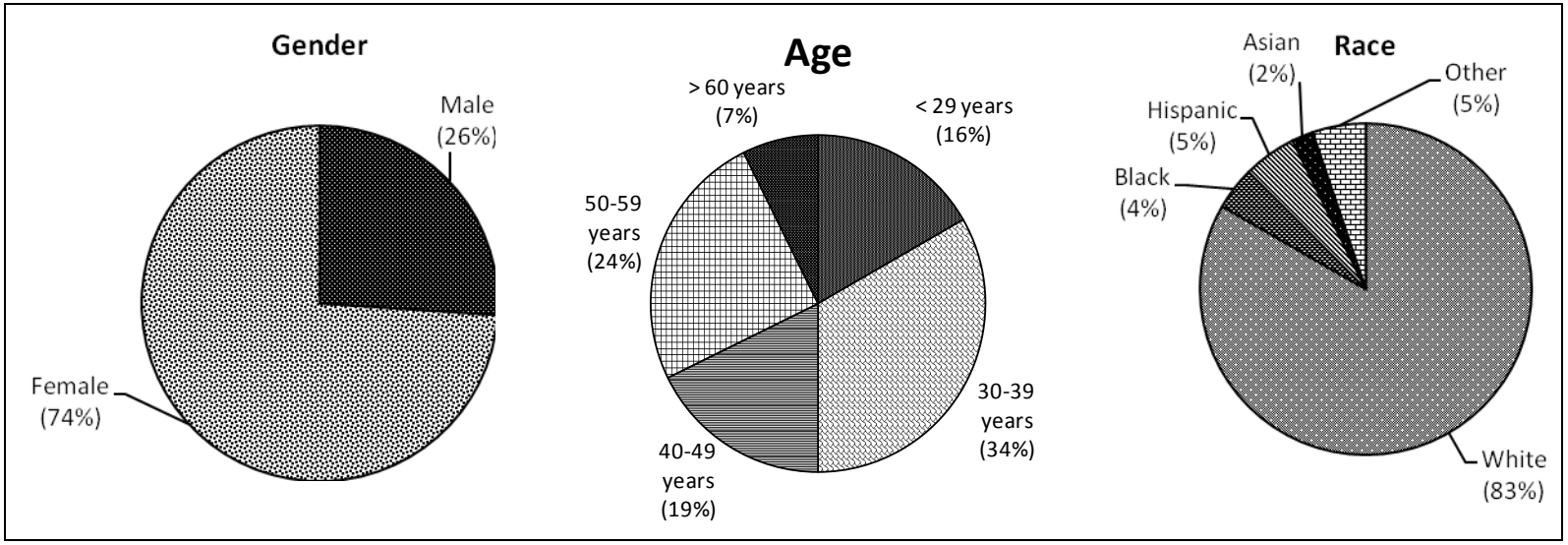

Figure 4.8. Sample Demographics: Gender, Age, Race

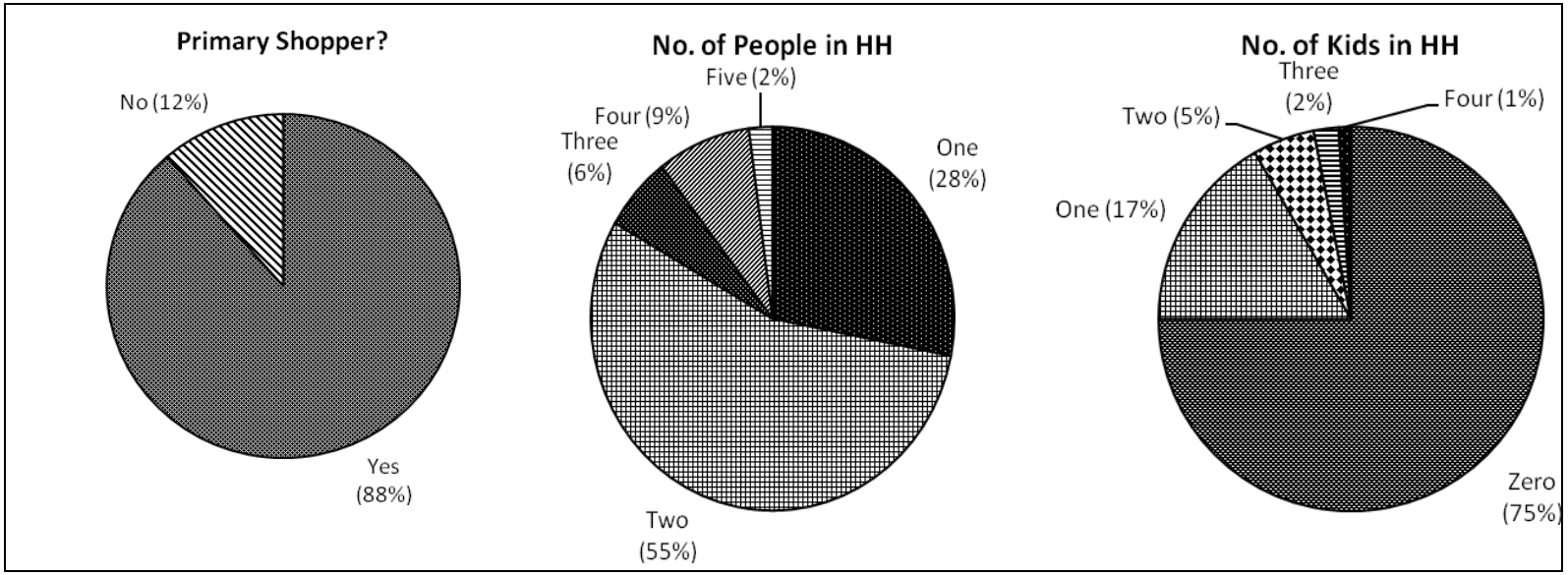

Figure 4.9. Sample Household Characteristics

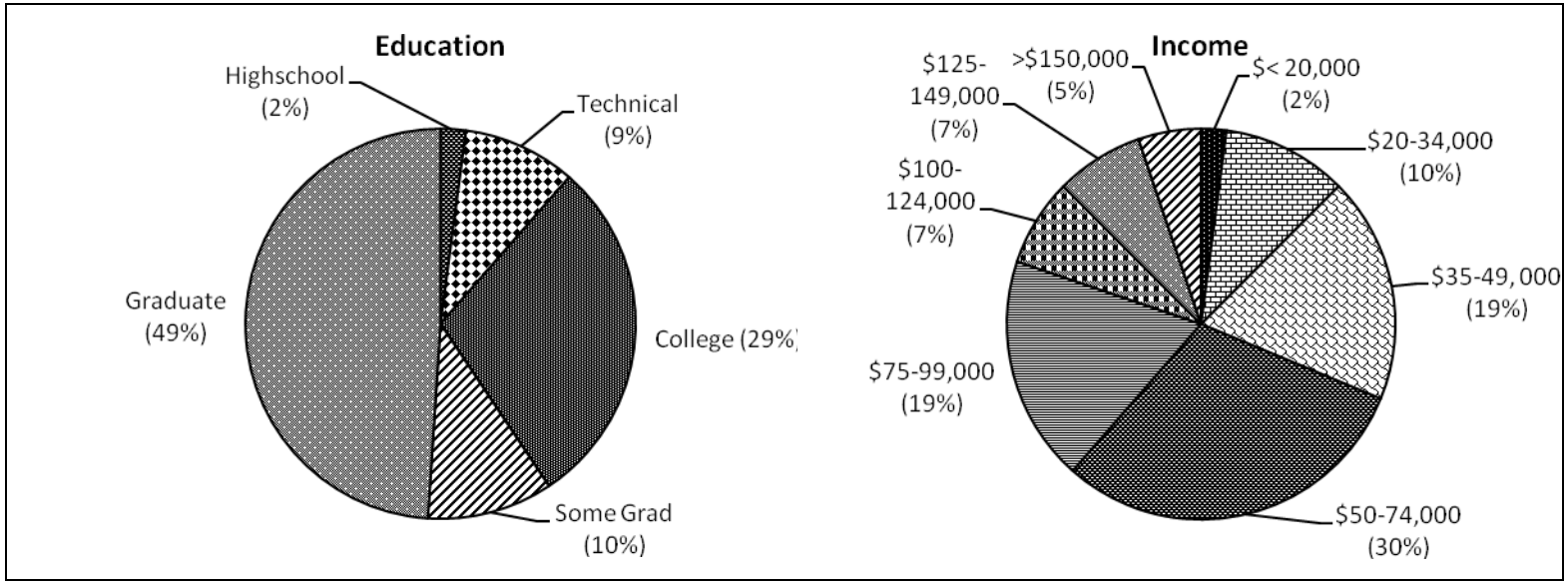

Figure 4.10. Sample socio-economic characteristics: Education and Income

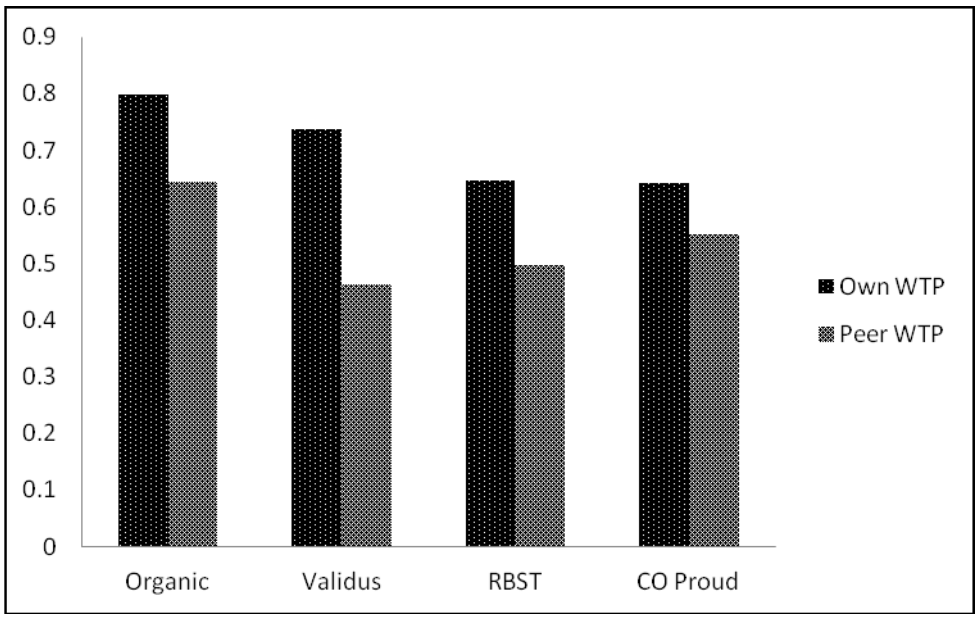

Figure 4.11. Average Own and Peer WTP ($), by label

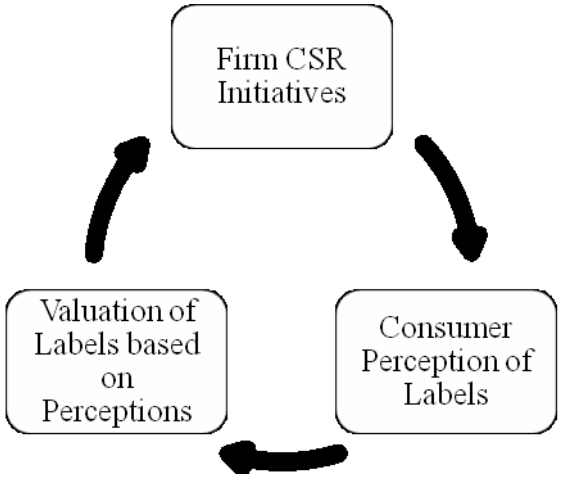

Figure 4.12. CSR Valuation Diagram

Table 4.13. Consumer ranking of CSR activities

Attribute	Best	Worst	Best-Worst	Rank
Animal Welfare	508	-10	498	**(1)**
Sustainable Ag. Practices	215	-18	197	**(2)**
Energy Consumption	62	-51	11	**(3)**
Waste Management	61	-67	-6	**(4)**
Employee Opportunities	68	-84	-16	**(5)**
Air Pollution	27	-66	-39	**(6)**
Local Company	100	-209	-109	**(7)**
Water Management	19	-144	-125	**(8)**
Community Involvement	11	-420	-409	**(9)**

Table 4.14. CSR preference by cluster

Cluster	Local Development (22% sample)	Global Impact (18% sample)	Mixed (60% sample)
Rank	1. Animal Welfare **2.Local Business** **3. Employee Opportunities** **4. Sustainable Ag. Practices** 5.Energy Consumption 6.Water Management 7.Air Pollution 8.Waste Management 9. Community Involvement	1.Animal Welfare 2. Sustainable Ag. Practices **3. Waste Management** **4. Energy Consumption** **5. Water Mgmt** **6. Air Pollution** 7. Employee Opportunities 8. Local Business 9. Community Involvement	1.Animal Welfare 2. Sustainable Ag. Practices 3. Energy Consumption 4. Air Pollution 5. Employee Opportunities 6. Waste Mgmt 7. Local Business 8.Water Mgmt 9. Community Involvement
HH Income	High (24% over 100K, 81% over 50K)	Medium (average 50k)	Low (majority 55% under 49k)
Age	Middle Aged (66% between 40-60yr)	Young &Old (extremes, 52% under 39yr, 33% over 50yr)	Young (59% under 39yr)
Education	High and low (graduate, college 67%, and the rest technical, high school only)	Generally high (graduate, college 76.5%)	Highly educated (graduate, college 83%)
WTP	Highest (avg. $0.837)	Lowest (avg. $0.525)	2nd highest(avg. $0.7)
Milk Consumption	Highest (85.7% drink it "Often")	Lowest (47% drink it "Often")	2nd highest (72.5% drink it "Often")

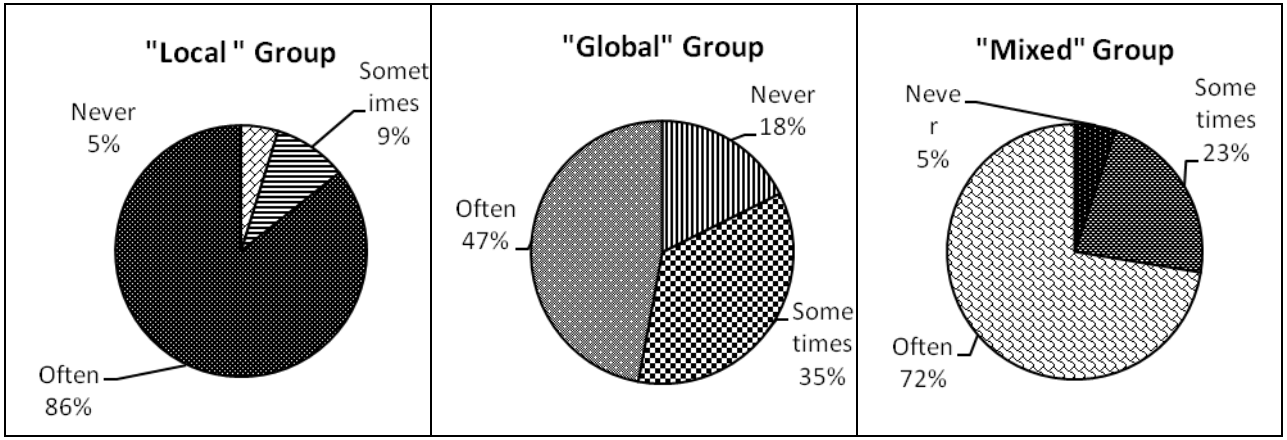

Figure 4.15. Milk Consumption by Cluster

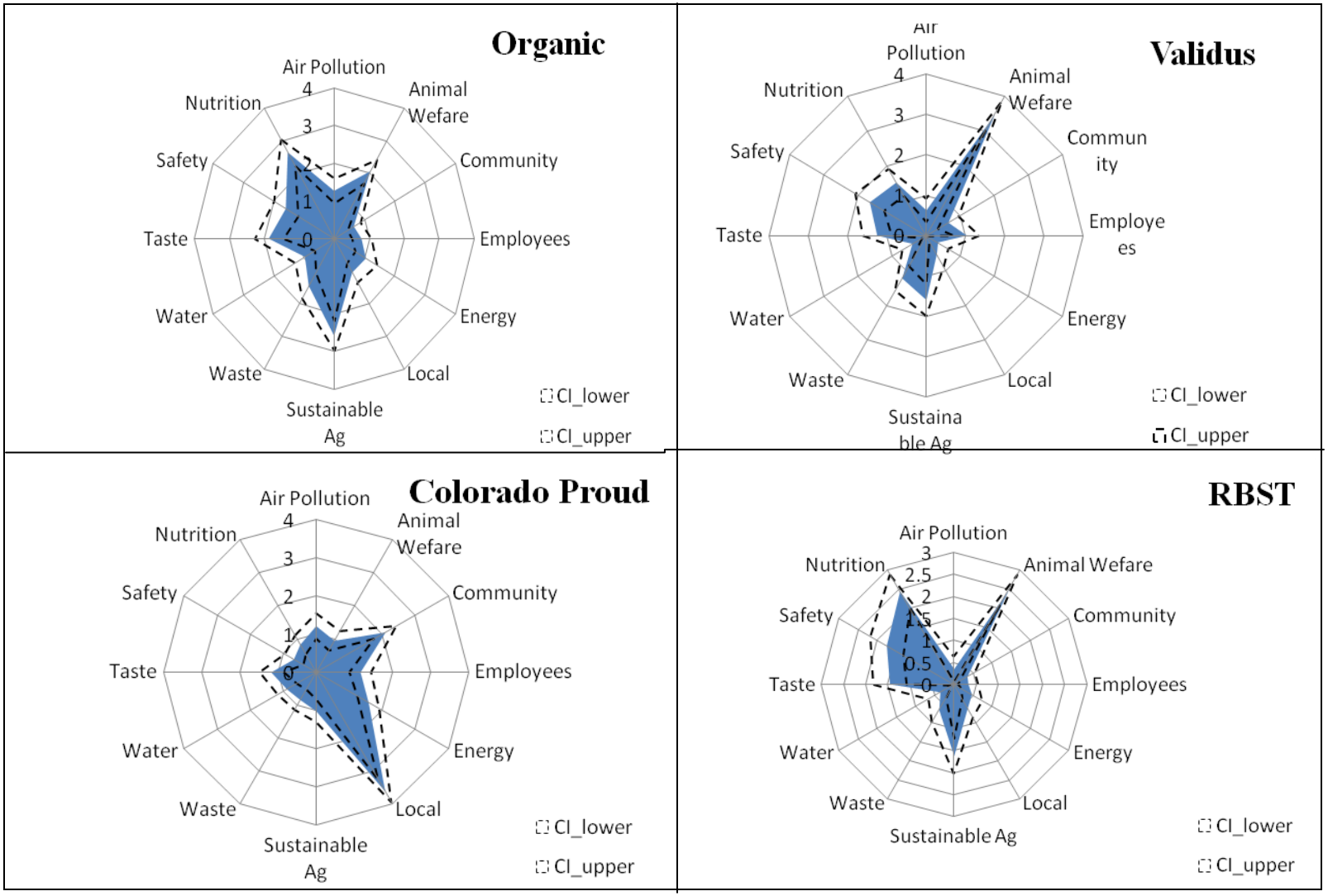

Figure 6.16. How CSR perceptions relate to current milk labels

Table 4.17. Pooled label valuation model

Peer WTP	Estimate	T-stat
Air Pollution	0.026	0.98
Animal Welfare	0.068***	3.32
Community Involvement	0.02	0.78
Employee Opportunities	-0.025	-0.1
Energy Consumption	-0.015	-0.57
Local Business	0.005	0.21
Sustainable Ag. Practices	0.009	0.44
Waste Management	0.037	1.42
Water Management	-0.033	-1.13
Taste	0.018	0.79
Safety	-0.013	-0.66
Nutrition	-0.007	-0.30
Organic Label	0.444***	6.22
Validus Label	0.201**	2.6
RBST Label	0.314***	4.49
CO Proud Label	0.453***	5.15
Obs	350	
Adj. R2	0.546	

****Significant at 1% level, **Significant at 5% level, *Significant at 10% level*

Table 4.18. WTP Estimates for fluid milk labels and perceived CSR outcomes

Label	Avg. Valuation ($)	Valuation Attributable to non-CSR outcomes($)	Valuation Attributable to CSR
CO Proud	0.55	0.45	0.10
USDA Organic	0.64	0.44	0.20
RBST-free	0.49	0.32	0.17
Validus Animal Welfare	0.46	0.20	0.26

Table 4.19. Valuation model by label

	Organic		RBST-free		Validus		CO Proud	
	Own WTP	Peer WTP	Own WTP	Peer WTP	Own WTP	Peer WTP	Own WTP	Peer WTP
Constant	0.79***	0.648***	0.655***	0.502***	0.746***	0.472***	0.637***	0.55***
Air Pollution							0.057	-0.028
Animal Welfare	0.041	-0.012	0.023	0.072*	0.154***	0.116***		
Community Involvement							0.141***	0.112***
Employee Opportunities					-0.006	-0.006		
Energy Consumption	0.005	0.062	0.018	-0.017				
Local Business							0.045	0.029
Sustainable Ag. Practices	0.042	0.084**	0.013	-0.027	-0.009	0.016		
Waste Management	-0.044	-1.053**	-0.024	0.034	-0.017	0.084**		
Water Management								
Taste	0.081*	0.04	-0.042	0.053	-0.043	-0.078	0.0394	0.028
Safety			-0.002	-0.028	-0.037	0.007		
Nutrition			0.14***	0.001	0.049	-0.008		
Obs.	92	92	89	88	90	89	92	90

****Significant at 1% level, **Significant at 5% level, *Significant at 10% level*

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CHAPTER FIVE

Concluding Remarks

This dissertation adds to the literature on information asymmetry in the food industry by assessing the role of various food labels as a means of conveying information about food product characteristics. Voluntary geographical indication certification, mandatory nutrition labeling, and potential environmental and ethical/sustainability labeling are investigated across three empirical essays. The unifying theme of these essays was how such label information affects purchase decisions, valuation and consumer perceptions. But, the diversity in methods, and choice to move from the broader food sector (in the meta-analysis) to a specific product category that allows for analysis of more specific attributes (for dairy), provides an interesting comparative context on these labeling issues.

First, we meta-analyzed the literature regarding GI valuation and we compiled a unique dataset to help us generate a set of guidelines, independent of any particular study, outlining the factors that are instrumental for a GI product to capture a price premium. One of the most important contributions of this meta-analysis to the knowledge in the field rests in defining industry and product characteristics of goods that derive the most benefit (measured in terms of price premium) from the association with GIs. Our findings across many studies indicate that agricultural produce and minimally processed foods such as grains, fresh meats, fruits and vegetables, benefit the most from association with

GIs. These product categories generally do not develop own private reputations (brands), and thus, the premium received from association with GI collective reputations is relatively high. On the other hand, in addition to GIs, products with high value-added and longer supply chains such as wines and olive oils may also use private brands for differentiation. As explained within the Shapiro (1983) and Menapace et al (2010) framework of multiple minimum quality certification schemes, the GI premium associated with already branded products is smaller than for un-branded products since some of the information symmetry is already resolved through those mechanisms. This suggests that brands and GIs have a substitute, albeit imperfect, relationship.

Next, using original survey data, we learn that mandatory labeling of need-to-know product information like nutrition provides consumers the knowledge to make informed nutrition decisions, but may suffer from an inadequate format in a food environment that encourages consumers to use more truncated search processes. Information on product characteristics lacking clear labeling such as environmental product impact information finds other, informal avenues (product cues), to reach consumers. However, the message conveyed in this manner is not clear or consistent. Truncated nutrition searches (looking only at the front label), or misleading product claims (such as "organic) are among a broad set of reasons current labeling practices may be ineffective. We find that a nutrition index summarizing the information on the back nutrition panel, coupled with the information on the front label, helps mitigate the problems presented above. This may have implications for those agencies that oversee, update and evaluate the impacts this information has with consumers.

As a comparison to nutrition labeling, where there are fairly agreed upon standards about requirements and standards, we find that the environmental impact of food production, another credence attribute of food, is hard to identify by consumers, possibly due to the lack of proper certification. Analogous to nutrition labeling, we suggest future environmental labeling schemes will be most effective if concise, easy to read and easily comparable across products, possibly in the form on an LCA index of environmental impact rather than a list of attributes highlighting product impact on water, soil, air, etc.

Finally, another important contribution of our original survey data, relevant to the CSR literature, is the identification of consumer preferences for CSR actions in the dairy industry. We are not aware of any other study examining CSR priorities for consumers in a best-worst survey format. Relevant to the dairy industry, we find animal welfare to be the most preferred CSR activity and a top priority for most consumers. Sustainable agricultural practices, energy consumption, and waste management are second, third, and fourth respectively in importance for consumers; while company involvement in the community has the lowest priority amongst consumers. Furthermore, we monetize the value of animal welfare claims, identified as the most important CSR activity by consumers, in the context of a trusted third-party certification such as the Validus animal welfare certification program.

The radar diagrams mapping CSR activities in to common milk labels are another innovation of this study. Consumer perceptions of the CSR profiles of milk labels are represented here in a visual fashion that is easy to read and compare across labels. And, the message that is conveyed from these graphics is that there are differences among

labels in terms of the expectations that consumers place on their relationship with various outcomes. In short, there are varying levels of complexity surrounding consumer perceptions of labels, and this may influence how much they are willing to pay for these labels.

The data set collected from our original survey (supporting the nutrition, environment, and CSR results) although small (a total of 244 consumers participated in the survey), is of high quality. The best-worst scaling methodology used in our original survey has been shown to have many advantages over traditional measures of measurement such as Likert scales. First, it forces people to make trade-offs by choosing a best and a worst alternative. Second, best-worst coefficients are directly comparable between people and result in individual as well as aggregate ranking scales because they present no measurement bias like the Likert scale coefficients (Cohen et al., 2002). Third, compared to simply ranking products directly, best-worst ranking is more accurate as it reduces the cognitive burden for participants and is able to discriminate between products that, at first glance, appear to be equally important. The data obtained in such a manner is of superior quality than that generated by using other scales.

Limitations and Directions for Future Research

Several limitations of this research also are worth mentioning. The GI meta-analysis, while useful in identifying what drives the GI price premium, may suffer from some of the weaknesses attributed in the literature to the meta-analysis methodology itself. The most important one, in this case, may concern the data collected from existing GI valuation research. This dataset may not cover all the existing research on GI valuation, although an extensive search has been made to identify as many published GI studies as possible. In addition, the data may suffer from publication bias. Publication bias exists when published research is biased in favor of significant findings because insignificant findings are rarely published. As such, we may be missing a significant portion of the findings on GIs which may bias our results; however, the studies that are included have been analyzed in an appropriate manner and with a high attention to detail.

Another weakness of this study relates to how nutrition labeling and environmental impact are based on a conjoint-type design that helped us identify real milk products we included in this study. The choice of real milk products is both innovative in terms of offering realistic marketing implications, but also, a potential weakness of the study. In the literature, most conjoint and choice experiments use theoretical combinations of product attributes and attribute levels in order to distinguish the effect of each treatment individually on the choice consumers make. Nevertheless, these hypothetical product choices are artificially constructed and generally do not represent real alternatives consumers encounter in everyday life. At the expense of relaxing design characteristics, this research distinguishes itself by providing respondents

with real choices (products) they could encounter in a local grocery store on any given day. One advantage is that this approach mimics a real grocery store retail market setting where real milk products are evaluated by consumers and is more realistic in terms of actual product options people have on a daily basis. However, the disadvantage of this approach is that the wealth of other product information such as product packaging, branding, attractiveness of product design, or any other unique product features, available for real products may interfere with research findings. In other words, there may be a confounding effect between the conjoint product attributes we are interested in and any "extra" product information that may unintentionally play a role in consumer decisions.

In terms of the CSR activities chapter, one weakness is related to the segmentation methodology used identify groups of consumers with similar CSR preferences. We use K-means clustering of underlying principal components that capture behavior to identify consumer clusters with similar CSR preferences. While this consumer clustering methodology is widely used in the literature, applying it to a small dataset of consumers (96 study participants) yields results that should be regarded as general guidelines, not exact findings. More recent consumer segmentation techniques, such as latent class analyses, can be used in future research to improve the accuracy of this analysis. While the limited data set is still a weakness even with latent class segmentation, this method has the advantage of statistically determining the probability of each consumer to belong in each cluster and identifying the optimal number of clusters within the model, while K-means clustering requires subjective user input to determine the number of consumer clusters. The limitations of this dissertation, as well as other noteworthy questions, should be addressed in future research on food labeling.

More specific future research avenues can be suggested for each of the labeling themes investigated in this dissertation. In terms of GI valuation, a number of opportunities for upcoming research are identified both from a consumer's and producer's perspective. As a hypothesis mentioned in the discussion of our results, consumers may be using a GI label to narrow the set of choices when searching for certain (branded) types of food. We envision using experimental methods to test this hypothesis, varying the labels across products and labeling options. This may even provide information to retailers who continue to fine-tune their sourcing and point-of-purchase strategies in an effort to maintain market share among an increasingly diverse set of customers that seek attributes aligned to their specific preferences. In considering producer strategies and decisions, it would be interesting to explore what motivates or prevents a producer from using a GI available in their location, given that these designations seem to be an accessible way to differentiate their output and secure a premium. Another suggestion would be to formally evaluate GI use and branding in the context of alternative product and advertising strategies by individual producers or regional producer associations.

Concerning nutrition labeling, knowing that consumers tend to use truncated nutrition searches to make food consumption decisions may have implications about the design of nutrition labels. Future research in this area should focus on statistically assessing consumer response to index-type nutrition indicators that can be added to the front label as an easy to read and compare nutrition information for food products. For example, the introduction of healthy eating indices such as the NuVal (taking values from 1-100) in the King Soopers grocery store chain represents a unique opportunity to collect

the necessary data to test whether such nutrition indicators change consumer behavior. Working on developing a similar index measure denoting the environmental impact of a product is also an avenue for future research. Labeling of farm practices (e.g., organic) or other isolated food supply practices does not properly convey the environmental impact of food consumption. Ultimately, all forms of food production, transport, storage, and handling are environmentally disruptive and use of lifecycle analyses that focus on input use and output generation is a way to account for all these disruptive environmental effects. Future research should focus on providing a more agreed upon set of metrics and procedures to measure these environmental effects in a comparable fashion across products.

In terms of CSR claims of food production, identifying consumer preferences for CSR activities in dairy is only the first step in determining whether CSR-based product differentiation is possible. We suggest that identifying the potential of product differentiation CSR activities is one of the priorities of economic research in this area. Future research should focus on ways of transmitting CSR information to consumers. How should CSR labels be designed and would they certify one CSR aspect or a bundle of actions? What certifiers are more appropriate depending on the type of CSR activity: independent third parties, firms, or the government? Are certain CSR activities (perhaps related to the environment, animal treatment, human treatment, etc) preferred and valued more by consumers?

In conclusion, product labeling is a way to at least partially (e.g., nutrition) mitigate the information asymmetry surrounding experience and credence food attributes. Private, third-party, and government labeling schemes pursue similar objectives (e.g.,

inform consumers, promote certain production practices, influence demand), but in different ways (Caswell, 2011). Unlike private and third-party initiatives which are generally focused only on their own role, the government also has responsibilities in regulating private and third-party labeling schemes, providing guidelines for private and third-party schemes, or monitoring these schemes.

As an objective entity focusing on policies that serve the best interest of the public, the government not only administers its own portfolio of mandatory and voluntary labels, but also provides standards, guidelines, and monitoring for a variety of other labels and certification schemes. For "need-to-know" information labels, the government is instrumental in defining standards, administering, and monitoring the labeling process. For "want-to-know" labels, monitoring third-party certifications and perhaps defining the guidelines for these certifications may be a government role. Yet another role of the government in mitigating food information asymmetry is to direct resources towards areas of labeling research that are in need of further clarification (such as nutrition) and provide incentives for public as well as private entities to address these issues through research, scientific discovery, and human ingenuity. The present research is proof that existing, as well as future labeling schemes, may benefit from research associated with issues regarding their implementation and consequences in the market.

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