"Milk is Milk—The Simple Truth"? Consumer Response to Changes in Labeling Regulations under the NOP in the Fluid Milk Market[†]

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This paper empirically investigates consumer reactions to changes in information provision regarding organic production. Quantitative analyses focus on the actual implementation of mandatory labeling guidelines under the National Organic Program and preceding media coverage of these regulatory changes. The unique nature of the fluid milk market in combination with these regulatory changes allows us to place a value on information sets under different labeling regimes. Estimations of hedonic price functions define an initial reference point for average consumer willingness to pay in changes in labeling information. More flexible econometric discrete choice models—conditional logit, latent class logit, and mixed logit—relate the heterogeneous distribution of consumer preferences to observable household demographics and vary in the degree in which they allow for random taste variations, unrestricted substitution patterns, and correlation of unobserved factors over time. Welfare analyses in this context can contrast estimates of changes in consumer valuation under different labeling regimes with costs incurred by developing and implementing them. Policy implications regarding effectiveness of diverse informational aspects of organic regulations and beyond can be derived. Preliminary results indicate that the USDA organic seal significantly increases the probability of purchasing organic milk. The hedonic approach, as well as simulations within a conditional logit framework, suggests that consumers value the change in labeling regulations. But increases in sales are also found prior to the implementation of the USDA organic seal and coincide with relevant media coverage.

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1. Introduction

"Information is a valuable resource" (Stigler 1961, 213). Ever since Stigler's original critique, the role of disclosure of information by producers and acquisition of information by consumers and its implications for market efficiency has become a mainstay in economic literature. Nevertheless, many questions remain and a coherent consumer theory and welfare analysis of informational effects has not evolved.[1]

Labeling can be defined as the provision of product-specific information accompanied by regulations such as disclosure laws, certification requirements and labeling guidelines enforced by an industry itself, independent third parties or government agencies. Labeling is closely related to advertisement as another related source of consumer information. Information provision is a prominent and economically important activity, considering a total of $98.34 billion in advertisement spending by the 100 leading national advertisers in 2004 (Advertising Age 2005). But out of more 1000 advertising messages we are exposed to daily, we actively notice fewer than 80 (Nelson 2004).[2] And an enduring debate over persuasive versus informational effects of advertising further suggests that consumers need to use their own scare resources—time and money—to select and process different information sources for their purchase decisions.[3] It is in this context that consumer information is incomplete and changes in information provision can potentially be valuable to the consumer.

This paper focuses on changes in labeling regulations under the National Organic Program (NOP) as one example of health and environmental claims increasingly being used in the food sector, both as marketing tools and regulatory mechanisms aimed at altering consumer behavior. While the widespread use of these labels might be an indication that they are perceived as a successful tool of altering consumer behavior, availability of information does not necessarily ensure that it will be incorporated into consumer behavior (e.g. Mathios 2000, Ippolito and Pappalardo 2002, Leslie and Jin

[1] This generalization relates to the Dixit and Norman advertising debates as well as the Hausman "Apple-Cinnamon cheerios war" in the context of utility consistent temporal welfare analysis reviewed in section 2.
[2] This is cited as a rule of thumb in the advertising industry for an average American and exposure across all media channels.
[3] Other than a consumers time spent searching and processing information, both advertisement and labeling costs potentially affects product prices.

2003, Teisl, Bockstael and Levy 2001, Ippolito and Mathios 1995). Organic labeling regulations emphasize ecological production attributes, but taste and health concerns are often cited as primary purchase motivations in this growing $9.3 billion industry (e.g. McEachern and McClean 2002). These purchase motivations—despite the lack of scientific evidence on enhanced nutritional value or health benefits of organic food—relate and contrast organic labeling to the notion that the provision of nutritional and health related information has failed in light of increasing obesity rates and its adverse health effects. The recent "Food News Blues" (Newsweek 03. 13. 2006) further emphasizes the collision course of science and media in the search for answers in this context.[4] As more policies are being designed that either regulate marketing claims or directly provide information to the consumer, a better understanding of the interplay between regulation, media coverage, and product marketing is needed to determine which regulatory tools best serve consumers' interest and policy objectives at the same time.

The existence and extent of interdependent informational effects is foremost an empirical question. Empirical research on the effect of information in general is more limited, mainly because information changes are difficult to measure. Existing studies focus mainly on the existence of informational effects, but to a lesser extent on interdependent sources of information, temporal effects, and welfare implications. The implementation of the NOP in October 2002 with its national organic standard, mandatory labeling guidelines and a uniform USDA organic seal creates a quasi-natural market level experiment in a policy-relevant setting. It can be viewed as an exogenous change in information provision isolated from consumer's reaction to changes in product attributes and allows disaggregating diverse aspects of information provision such as prior media coverage.[5]

Milk is often considered a gateway to organic food, and the ethos of organic milk—pure goodness, happy cows and small family farming—is heavily reinforced on its cartons via marketing claims. The fluid milk market offers a variety of differentiated

[4] Media coverage devoted to health and science has quadrupled since 1980, but headlines and sound bites can not always capture complexity of research.
[5] See section 3 for further details.

products across categories, such as privately certified rBST-free labeled milk[6], third party and government certified labeled organic milk, and conventional milk. In addition, products differ regarding marketing claims and implemented labeling change. And finally, fluid unflavored milk as a relatively standardized and ubiquitously processed commodity permits abstracting from brand and taste preferences in general to take advantage of this rich product differentiation.[7] The following primary research questions are addressed in this research:

1. What is the impact of the NOP and changes in information provision on consumer preferences for organically produced milk?
2. Do these effects vary across consumer segments based on heterogeneous preferences and heterogeneous information costs?
3. How much are consumers willing to pay for these regulatory changes and how are benefits distributed across consumer segments?
4. How does purchase behavior change over time as related to prior relevant media coverage?

Welfare analyses in this context relate changes in consumer valuation under different labeling regimes to costs incurred by developing and implementing the NOP. And ultimately, this research aims at providing policy implications regarding effectiveness of diverse informational aspects of the NOP regulations and beyond.

Two unique data sets are utilized in this study.[8] AC Nielsen Homescan® data tracks individual purchases by participating households across all chosen food channel and provides household demographics. Consumer valuation of the NOP is accessed in an initial hedonic price function approach as well as through simulations in discrete choice models. Three alternative logit specifications—conditional logit, latent class logit, and mixed logit—are presented, varying in the degree in which they allow for random taste variations, unrestricted substitution patterns, and correlation of unobserved factors over time. An additional weekly store-level data set provided by a mainstream supermarket

[6] Recombinant Bovine Somatotropin, is a genetically modified version of a growth hormone that occurs naturally in cows and is injected to enhance milk production by 10 to 15%.
[7] Figure 1 and 2 lend support to this motivation in observed product and brand choices of panel members in the primary data set analyzed in this paper.
[8] Access to a third data set that allows comparison of purchase patterns between natural and specialty stores and mainstream supermarkets has just recently been granted.

chain combined with newspaper coverage of organic labeling regulations compiled from LexisNexis™, Proquest®, and Vanderbilt Television News Archive is analyzed via regression discontinuity approaches and difference-in-differences estimations. This reduced form approach motivates incorporating temporal effects in the welfare analysis of discrete choice models, an important aspect that has rarely been implemented in the literature.

Preliminary results indicate that the USDA organic seal increased the probability of purchase during the time period under consideration. And both the hedonic price function approach and simulations using conditional logit regressions suggest that consumers value the changes in labeling regulations under the NOP. An initial analysis of the store-level data further showed increases in organic milk sales after the introduction of the USDA seal, but sales were also affected by prior media coverage.

The paper proceeds as follows. In the next section we provide an overview of the relevant literature, and section 3 describes the market for organic milk. The data are described in section 4. Section 5 outlines econometric models, while section 6 presents the preliminary empirical results. The paper concludes and discusses implications for future research in section 7.

2. Literature Review

We focus on an empirical investigation of labeling effects in this paper. But both theoretical and empirical literature needs to be reviewed, as welfare estimation in this context hinges on a specification of a utility-consistent framework of labeling changes.

Theoretical literature

In response to Stigler's original critique about the lack of attention to the role of information in economics (Stigler 1961), many classical papers addressed informational aspects in different market settings and implications for market efficiency (e.g. Akerlof 1970, Nelson 1970, Salop and Stiglitz 1977, Weitzmann 1979, Grossmann 1981, Shapiro 1982). The advertisement debate over informative and persuasive effects further contributes useful theoretical approaches in an attempt to link consumer theory to estimable sales-advertising functions and welfare effects of advertising (e.g. Stigler and Becker 1977, Dixit and Norman 1978, Verma 1980, Grossman and Shapiro 1984, Becker and Murphy 1993). While most of the debate centers around the notion that advertising creates "wants" and changes tastes, the latter of which precludes a welfare analysis in a utility consistent framework, Becker and Murphy (1993) focus on the complimentary character of advertising with other products attributes in favor of a fixed preference approach. If one follows this approach and views advertising or labeling as an additional or differentiated product attribute, evaluation of information changes in directly linked to the Industrial Organization literature on welfare analysis of new product introduction and its empirical applications (e.g. Bresnahan and Gordon 1997 as a collection of articles in this context and Hausman 1996, Hausman and Leonard 2002, also see empirical literature).

Literature on decision-making under uncertainty is another relevant area of theoretical research. The use of the term uncertainty in this paper follows Knigth's (1921) distinction of uncertainty (a condition in which probabilities of events are unknown and no unique assignment of them can be obtained) and risk (a situation in which relative odds of events are known and uncertainty eventually gets resolved).[9] Kirzner's (1973) ideas directly connect this concept of uncertainty or errors in the decision-making process to incomplete consumer information. He objects to mainstream economics as errors are embedded in a concept of knowledge as a process of selective and limited awareness. Consumer information is incomplete not because of limited availability of information but because of ignorance or preoccupation with other needs. Pollak and Wales (1969) also proposed to link a disturbance term in empirical demand systems to an introduction of a stochastic element directly into the utility function.[10]

Literature on non-market valuation also needs to address preference uncertainty and possible information biases. Recent work by van Kooten *et al* (2001) introduces similar ideas in employing a fuzzy logic approach in that respondents will never fully

[9] This distinction is important in a model context as the expected utility (von Neumann and Morgenstern) framework which only applies to risk.
[10] Other sources of randomness in terms of unobserved attributes of alternatives by the researcher and varying preferences across consumers are discussed in the empirical section of the literature review.

know their preferences due to their cognitive inabilities, even if commodities themselves are well defined and their attributes completely known.

Research in the field of behavioral economics questions and extends the classical utility maximization objective in the context of heuristics and possible biases (Twersky and Kahneman 1974, Rabin and Schrag 1999, Mullainathan 2004), and in the context of attention focus and anchoring (e.g. Ariely, Loewenstein, and Prelec 2003, Hsee 1999, Hsee and Rottenstreich 2004). Ariely *et al* (2003), for instance, address consumer valuation of initially unfamiliar products and subsequent consumption in their "coherent arbitrariness" hypothesis. They argue that even arbitrary information can serve as an anchor in assigning an initial value to a new product, and that consumers attempt to make subsequent coherent choices. Hsee (e.g. Hsee 1999; Hsee and Rottenstreich 2004) focuses on rational explanations for consumer choice decisions that depart from a consideration of immediate consumption utility.[11]

In addition, a number of theoretical analyses directly address the effects of product labeling on consumer demand by modeling the decision-making process based on generalized Lancaster demand models or hedonic (Houthakker-Theil) demand models based on product attributes (e.g. Smallwood and Blaylock 1991, Caswell and Padberg 1992, Teisl and Roe 1998, Teisl, Roe and Hicks 2002, Golan, Kuchler, and Mitchell 2000). Of particular interest is the emphasis Teisl *et al* (1998, 2002) put on the role of cognitive abilities, information, and time in defining the process by which labeling information is translated into consideration of product attributes. Teisl, Roe, and Hicks (2002) adjusted Stigler and Becker's (1977) general model of advertising to incorporate environmental awareness into an individual's utility function. Environmental information is extracted and translated into a subjective assessment of a product's environmental impact through a household production process. Individual assessment depends on information at the point of purchase (such as dolphin-safe tuna labels in their case), consumer's prior stock of information, and the time an individual devotes to processing the label.

[11] He for instance introduces a value seeking rationale, where in addition to the expected utility associated with the product, the decision is influenced by what the consumer perceives as the 'better deal'.

Empirical findings of this research will be used to refine a preliminary utility-consistent framework that addresses changes in information provision under inherent consumer uncertainty due to incomplete information in a household production approach.

Empirical literature

Previous empirical studies of the effects of food product labeling have tended to focus on the provision of nutritional information and exhibits mixed results regarding effectiveness of information provision. For example, Ippolito and Mathios (1990) found that voluntary nutritional labeling had significant effects on consumer choices, while Mojduszka and Caswell (2000) suggested that labeling information provided by firms prior to the Nutrition, Labeling and Education Act (NLEA) was incomplete and not necessarily reliable. Ippolito and Mathios (1995) assessed the impact of a regulatory change regarding health claims in advertising after the NLEA to investigate if these new opportunities have added information to the market and concluded that even the most educated benefited from this new source of information. Advertisement with respect to health claims might have increased awareness in the broad population and might simply serve as a reminder or attention getter. In a similar attempt, but purely focusing on brand advertisement, Ackerberg (2001) distinguishes and measures informative and prestige or image effects of advertisement by investigating the relationship of household purchases and advertising exposure for newly introduced brand of yogurt over time. He argues that information on inherent brand characteristics should primarily affect inexperienced buyers, while image and prestige associating of advertising should also affect experienced buyers. Contrary to Ippolito and Mathios' findings, his data only indicates significant effects of advertising on inexperienced buyers.

Mathios (2000) further employed pre- and post-NLEA scanner data to investigate the effects of mandatory disclosure laws on consumer choice of salad dressings, finding that mandatory labeling can impact consumer choice. In a similar study, Teisl, Bockstael, and Levy (2001) found that consumer's purchase behavior was significantly altered, but that purchases of "healthy" goods increased only in some food product categories. In their evaluation of labeling regulations issued under NLEA, Ippolito and Pappalardo (2002) concluded that the nutritional focus in advertising had narrowed substantially and labeling for "healthy" foods did not increase. Evaluating eco-labels, Teisl, Roe, and Hicks (2002) report that dolphin-safe labels resulted in changes in aggregate tuna consumption. Jin and Leslie (2003) examined effects of an increase in product quality information in the L.A. restaurant market, and concluded that consumer demand was sensitive to mandatory display of hygiene quality grade cards.

Empirical studies of informational effects on milk demand, such as the use of rBST and organic production have been mainly limited to the analysis of survey responses (e.g. McGuirk, Preston and Jones 1992, Grobe and Douthitt 1995, Misra and Kyle 1998). Aldrich and Blisard (1998) utilized monthly pooled time-series and regional data for 1978 -1996 to examine whether the use of rBST and consumer concern reduced aggregate fluid milk consumption, but found no evidence of such an effect. Focusing on organic milk, Glaser and Thompson (2000) identified price premiums as high as 103 %, and high own-price elasticities for organic milk products. Most recently, Dhar and Foltz (2005) used a quadratic almost ideal demand system (AIDS) for differentiated milk types in combination with supermarket scanner data. They found significant consumer valuation of organic milk, and to a lesser extend of rBST-free milk. Following a different approach that focuses on product attribute uncertainty faced by the consumer and his/her search costs addressed in a random utility framework, Kiesel, Buschena, and Smith (2005) reported similar findings. In addition, by identifying rBST-free labeled and unlabeled products, their results suggest that the provision of relevant information on a label might be required if market segmentation is to take place.

While following the tradition of utilizing regulatory changes to separate effects of changes in information provision, we will also make use of recent advancements in discrete choice models products that are derived from a random utility framework (e.g. Berry, Levinsohn and Pakes 1995, McFadden and Train 2000, Nevo 2000 and 2001, Swait et al 2004).[12] These approaches can be contrasted to Hausman's (1996, 2002) systems-of-equations approach based Gorman's two stage budgeting approach that estimates welfare effects of the introduction of new products. Random coefficient or mixed logit models add more flexibility for demand estimations for highly differentiated

[12] As outlined above, product specific information provision can be viewed as a complement or additional potentially valuable product attribute and randomness arises from the point of view of the researcher due to unobserved product attributes and households preferences.

product markets. These approaches decrease dimensionality as compared to Hausman's approach by projecting products onto a space of product attributes and addressing heterogeneity beyond the existence of an aggregate or average consumer.[13] By defining the consumer product as a bundle of perceived attributes, including labeling and advertisement as complements to desired attributes, this approach offers flexibility in incorporating consumer heterogeneity with regard to organic preferences as well as information search and processing costs. Counterfactual simulation of restricted choice sets can be used to derive changes in consumer valuation (Small and Rosen 1981)[14].

While mixed logit specifications can be generalized to allow repeated choices by each sampled decision maker over time, nearly all applications assume that coefficients vary across consumers, but are constant over time (Train 2002, Swait, Adamowicz, and van Bueren 2004). This is partly due to the use of aggregated market data in most of the literature[15] We observe repeated individual choices and demographics over time and can exploit both differences across consumer segments and adjustments in purchase decisions over time.

3. The Market for Organic Milk

While still a niche market, the U.S. organic market is one of the fastest-growing categories in food business. Organic products as a whole are projected to reach a value of $30.7 billion by 2007, with a five-year compound annual growth rate of 21.4 percent between 2002 and 2007 (Organic Trade Association 2006, OTA). Nearly two thirds of U.S. Consumers bought organic foods and beverages in 2005, up from about half in 2004

[13]Hausman does not incorporate heterogeneity beyond this assumption. And furthermore, he criticizes criticizes this approach as he claims it will lead to biased welfare estimates. His critique mainly related to e independence of irrelevant alternatives property which is only a limitation of the traditional or conditional logit model. Interestingly, most economists find his consumer surplus estimates to high, especially his extrapolation to an overall bias of 20 to 25% in the CPI and raise questions regarding his identification strategy and demand estimates which indicate steep single product demand curves (e.g. Breshnahan 1997). He estimates consumer surplus using the post introduction demand structure to calculate the price effect on existing products and to construct a virtual price that would set the demand of the new product to zero. Integrating under the derived demand curve for the new product from the observed price up to this virtual price allows him to calculate the variety effect.

[14] Kim (2004) for instance uses this approach to estimate the variety and price effect of an introduction of a new brand of cheese on consumer surplus

[15] In the context of environmental valuation, Swait et al (2004) addresses temporal welfare effects by considering prior behavior and past attribute perception applied to fishing site choice.

(Consumer Reports 2006, CR). Organic products sell at a significant price premium (50% on average) compared to their conventional counterparts which prices often doubling for milk and meat (CR 2006). These price premiums and market trends sparked an interest in organic production among large food companies in recent years.[16] *General Mills*, *Kraft*, *Dean Foods*[17], and *Dannon* already market or own many of the branded organic products, and some supermarkets such as *Safeway*, *Kroger* and *Costco* offer store brands. Most recently, *McDonald's* and *Wal-Mart* entered the playing field in an attempt to milk the "organic cash cow" (*The New York Times* 11. 1. 2005 and 11.8. 2005). As organic food products went mainstream, the debate over what organic really means is ongoing. Two recent debates for instance include approval of artificial ingredients and industrial chemicals such as boiler additives, disinfectants and lubricants, as well as stricter requirements for access to pasture in organic dairy production. This paper focuses on changes in information provision that relate to the implementation of the NOP in October 2002. The program included a uniform national standard, new labeling guidelines and the appearance of a USDA organic seal on organic products.

The NOP was initiated as a direct consequence of the Organic Foods Production Act in the 1990 Farm Bill, calling for regulations of production, handling and marketing of organically produced agricultural products under the management of the U.S. Department of Agriculture (USDA). While the regulatory changes were long anticipated and the USDA considered over 275,000 public comments after their first proposal in 1997 and over 38,000 comments after their revised rule in 2000, the initiation precedes much of the industry growth and controversy. This is especially true for organic milk. While organic foods trace back to the natural foods movement of the 1960's, organic milk has only been available for a little more than a decade. But organic milk sales have been one of the fastest growing market segments ever since as "people who don't buy any other organic products are purchasing organic milk" (DiMatteo, OTA in DuPuis 2000). This rapid growth of organic milk is often linked to the controversy about the use of the genetically modified growth hormone rBST and its wide media coverage (DuPuis 2000). Ongoing health and safety concern by some consumers are at the heart of this

[16] One could even argue that the NOP induced this take off and changes in industry structure.
[17] *Dean foods* for instance bought out *Horizon Organics* in June 2003.

controversy as approximately 35% of the U.S. dairy herds, about 9 million dairy cows, currently receive rBST supplements that increase milk production by 10 to 15% (Monsanto 2006). Milk from treated cows is not subject to any labeling requirements since the FDA has determined it to be safe and not significantly different from milk from non-treated cows.[18] Voluntary labeling for milk products that come from untreated cows is used by dairy processors to address these concerns by consumers, but is required to be accompanied with a disclaimer citing the lack of scientific evidence for differences between milk produced with and without rBST. This controversy was also the birth place of the ongoing "Milk is Milk—The Simple Truth" campaign initiated by the Center of Global Food Issues (CGFI) and its coalition[19] in hopes of ending the battle over appropriate milk labeling for hormone, antibiotic, and pesticide use in production-oriented claims. The campaign focuses on the many claims found on mainly organic milk labels today, such as: "Produced without the use of dangerous pesticides, added growth hormones or antibiotics", "our cows make milk the natural way", and "a clean-living cow ... makes really good milk." The media attention regarding rBST and these marketing claims that appear on milk cartons in addition to the uniform USDA seal illustrates the need of addressing policy evaluation in a context of other sources of information. One interesting feature of the milk market is that product or brand specific advertising or marketing clams mainly targets the container design. Comparison of organic milk containers before and after the appearance of the USDA labeling seal suggests that advertisement and marketing claims did not change over the investigated time period.[20]

In addition, we address consumer heterogeneity regarding complex organic production attributes in general. "Organic food is produced by farmers who emphasize the use of renewable resources and the conservation of soil and water to enhance environmental quality for future generations" (USDA, NOP 2002). It is therefore not directly linked to other commonly analyzed food demand dimensions and consumer preferences for these attributes are not well understood. Some consumers buy organic products to support its producer's environmentally friendly practices, but most are trying

[18] The Center for Disease Control also agrees with this position.
[19] The CGSI campaign is supported by the Center for Science in the Public Interest, the Federal Trade Commission, the National Consumers League, and the U.S. Food and Drug Administration (FDA): http://www.milkismilk.com/
[20] Of course, the added USDA seal could be viewed as a validation or reinforcement of these claims.

to cut their exposure to chemicals and other unwanted ingredients such as genetically modified ingredients (CS 2006).[21] *Horizon Organic*, the leading organic milk brand, describes its consumers as “concerned about toxic pesticides, growth hormones and antibiotics in their food and in the environment, and place[ing] value on animal welfare and ecological sustainability.” And for the second largest brand, *Organic Valley*, these targeted “cultural creatives” represent nearly one-quarter of the population, potentially capturing a large segment of the total fluid milk sales that amounts to $11 billion. But for Nobel laureate agronomist Norman Borlaug and others, the claim that organic is better for human health and the environment is not even worth a debate as “you couldn’t feed more than 4 billion people …and would have to increase cropland area dramatically, spreading out into marginal areas and cutting down millions of acres of forest…If some consumers want to believe that it’s better from the point of view of their health …let them pay a bit more” (*The Wall Street Journal*, 08.26. 2002).[22] He is referring to the conundrum that taste and health concerns are consistently determined as primary purchase motivations when it comes to organic food consumption (e.g. McEachern and McClean 2002) despite missing scientific evidence on enhanced nutritional value, health benefits for the consumer and animal welfare (Williams 2002; Roesch, Doherr, and Blum 2005).[23] “Food is an emotional issue” says Elizabeth Whelan of the American Council on Science and Health (*The Wall Street Journal,* 10. 25. 2002). While “the very presence of the [USDA organic] stamp is going to increase awareness that there is something different called organic” and probably boost sales as *Horizon Organic* Chief Executive Chuck Marcy (*The Wall Street Journal,* 9.11. 2002) puts it, the question remains of how and why.

4. The Data

[21] Another often discussed consideration could be support of small farming. While advertised on it’s milk cartons, the organic farming sector is often more concentrated and vertically integrated than its conventional counterpart.

[22] Newspaper references in 2002 are not separately listed in the Reference section as they are part of the data analyzed in this research and listed in a table in the appendix.

[23] While some research suggests higher levels of vitamin E, omega 3 essential fatty acids and antioxidants in organic milk relative to conventionally produced milk (e.g. Soils Association 2005), nutritionists point out that people are likely to meet their dietary needs for these nutrients by consuming other foods (e.g. British Nutrition Foundation 2005).

Two data sets are utilized in this study. The primary data set was extracted from AC Nielsen Homescan© household panel data that tracks household purchases in 52 markets nationwide over a time period of four years (2000-2003). This data set is unique in that it tracks individual purchases of its participating households across all marketing channels, and provides detailed household demographics.[24] For any reported product purchase, information on price and price promotions such as sales and coupon use, as well as detailed product attributes are available. The data include a separate indicator for organic claims and the USDA organic seal. Lactose-free and kosher milk products are also identifiable in the data. Information on rBST-free labeling was not included in the data set and was added at the brand level utilizing a list of rBST-free products provided by *Rural Vermont and Mothers and Others* combined with information regarding rBST-free labels provided by the CGFI.[25]

This study focuses on fluid milk, excluding buttermilk, flavored milk, and non-dairy alternatives (such as soy or rice milk) to ensure comparisons of fairly homogeneous products. Only the actual choices by a given household are observed in the data such that the relevant choice set needs to be inferred based on observed product choices of the other household panel members at a given store. Only three major markets out of the initial 52 markets include enough observed organic milk purchases to constructs the relevant choice sets. Out of these three markets, one specific market located on the West Coast was selected for the preliminary regression analysis presented in this paper.[26] Table 1 compares selective average sample household demographics both for the complete household panel of this market and the subset of households that purchased milk over the relevant time period to market and national population averages reported in the 2000 census. Compared to the national average, the selected market exhibits a significantly more diverse race distribution, higher mean income, and fewer married couples and household with children. However, the sample approaches national averages for some of these demographics. It is also worth noting that the sub-sample of households that buy milk does not differ significantly from the entire household sample for this market. Only

[24] Access to fluid milk purchases only was provided through a cooperative agreement with the USDA, ERS.
[25] This information is currently only available at the brand level.
[26] The market cannot be disclosed due to data confidentiality agreements.

the number of married couples and households with children increases somewhat, which seems reasonable in the case of milk consumption.

The final data set is restricted to brands that were purchased 20 times or more over the entire time period and stores with at least two observed alternative products at a given month. Furthermore, only half gallon and gallon milk containers, the most common sizes, were considered. The final data set consists of 40.341 daily purchases by 927 households choosing among 182 different milk products (16 brands) in 21 alternative stores.

The analysis focuses on the discrete purchase decision only, although information on purchase amounts is included in the data.[27] Whenever a household purchase was observed in a given store, it was assumed that this product was available to households over the entire month at this store. The minimum observed purchase price at the relevant store was used to construct prices for alternatives to actual purchases.[28] As we confine the created alternative choices to the store in which the household purchased milk—mainly to ensure feasibility of the data analysis—we implicitly assume that the decision of what store to go to is made prior to deciding on the specific milk purchase and is not modeled here (e.g. Swait and Sweeney 2000 for similar approach). Creating the complete choice sets for each observed choice in this way, inflates the data set to a total of 449.879 observations.

Commodity trading prices at the *Chicago Mercantile Exchange* of nonfat dry milk powder and whole milk powder reported in *Dairy Market News* were also added to the data set. Descriptive statistics of the resulting data set are reported in Table 2.

This primary data set is supplemented by 2001-2003 weekly aggregated product sales for 121 different milk products in 255 stores of a major supermarket chain for a West Coast region that includes the selected major market described above.[29] As availability of organic products in mainstream supermarkets was still limited at the beginning of this time period, only one organic brand and one product of this brand was

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[27] This information is not utilized in a discrete choice framework such that a households inventories and stockpiling behavior is not captured. But this limitation should be less restrictive for milk due to its relative short shelf life and the fact that purchased quantities mainly reflect a given household composition (see also Swait and Sweeny 2000 and Ackerberg 2001)
[28] The minimum price rather than a mean or median price is used to capture a specific choice and consumer preferences while accounting for possible sales on alternative milk products.
[29] 246 out of the 255 stores carried organic milk.

identified in these data. Seven similar conventional alternatives in terms of size and fat content were identified and are used in the comparison of sales and comparisons are only made with regards to this category. The final data set consists of 52135 observations of weekly sales of 8 milk products in 255 stores.

The data can be linked to a data set of newspaper and television coverage of organic labeling regulations compiled from LexisNexisTM, Proquest®, and Vanderbilt Television News Archive. Coverage of new mandatory labeling regulations under the NOP by both local and national newspapers intensified starting on the 6th of October 2002, about two weeks before they went into effect. National newspapers that featured the regulatory changes include *The New York Times*, *The Wall Street Journal*, *The Washington Post* and *USA Today*. Western regional papers also featured these changes around the above dates.[30] Two related articles that specifically address milk appeared as early as August, 20th and September, 11th in *The Wall Street Journal*. TV news coverage prior to October 21st, the day the regulations became effective, could not be detected.

5. Econometric Framework

In this section, we describe several aspects of our employed structural and reduced form approaches. We will start with the econometric models used to analyze consumer response in the primary panel data set. A hedonic price function approach provides an initial reference point for estimates of consumer valuation of labeling changes and motivates more flexible discrete choice models. A discussion of three alternative discrete choice model—conditional logit, latent class logit, and mixed logit models—follows. Possible controls for endogeneity of product prices in the discrete choice demand regression specifications are also addressed. The empirical analysis of the additional time-series store-level sales data will employ regression discontinuity design and difference-in difference estimators.

[30] Regional papers cannot be named due to a confidentiality agreement as they would allow identifying the market.

5.2 Hedonic Approach

The hedonic price method (Rosen 1974) presents an approach of estimating consumer valuation of goods or product attributes for which no explicit market exists. It is based on the simple intuition that the utility of differentiated products implicitly allows to recover the contribution of each attribute to the overall utility. The price of a given milk product m_i can be written as:

(1) $price_{m_i} = price(a_1, ..., a_n)$,

where the partial derivative of price(•) with respect to the n^th^ attribute $\partial price / \partial a_n$, defines the marginal implicit price. The hedonic price schedule is determined by interactions between consumers and producers in a given market, such that each point of the schedule represents an individual's marginal willingness to pay for that attribute. The following econometric specification will be empirically estimated:

(2) $price_{m_i} = A_i\ \beta + \varepsilon_i$,

with the vector A_i defining the attributes of milk product m_i, and the vector β typically interpreted as the average implicit price gradient or average marginal willingness to pay. The random term here relates to unobservable product attributes, data collection and measurement error. Under a distributional normality assumption, this specification can be estimated using *Ordinary Least Squares* (OLS).[31]

Critiques that surfaced almost immediately after Rosen's original paper highlight empirical difficulties of this approach (e.g. Small 1975, Chay 2005). The average implicit price gradient estimated by the regression coefficient captures an average willingness to pay only, if preferences are homogeneous across the entire population.[32] If market

[31] The natural logarithm of prices will also be considered in an OLS regression. Average willingness to pay for changes in labeling regulations can be estimated directly, as the USDA organic seal can be included as one relevant product attribute.
[32] Furthermore, this model assumes a competitive equilibrium of producers offer curves and consumer's bid functions.

response is a result of preference heterogeneity, however, one might only recover an average across subpopulations that sort themselves according to their valuation of specific product characteristics. More importantly, the estimated average might not even correspond to any true preferences of population segments in this case (Chay 2005). Therefore, coefficient estimates in this approach will mainly be used as a reference point for estimation results in the below described discrete choice models.

5.2 Random Utility Model and Logit Specifications

The unique household panel data—household-specific purchase information and household demographics for its panel members—enables consideration of heterogeneous preferences in econometric discrete choice models.

If preferences vary systematically along observed household demographics, heterogeneity can be incorporated into a conditional logit model. Mixed or random parameter logit models are appropriate if organic production can be described as a general preference, such that weighted choice probabilities can be estimated, with weights given by the underlying distribution of varying willingness to pay. Latent class logit models, on the other hand, allow simultaneous estimation of distinct consumer segments (e.g. consumers that consider and do not consider organic production in their product choice in the simplest case) and their specific average valuations.

Starting from a random utility framework (e.g McFadden 1975, Train 2002) where both the product attributes as well as a random term are assumed to enter linearly, the utility from consuming a certain milk product can be described as[33]:

(3) $$U_i = A_i\beta + r_i .$$

In equation (1), the vector A_i indicates the attributes of milk product m_i, the vector β represents the weights placed on each of these attributes, and r_i denotes remaining

[33] This form of utility can be derived from a quasilinear utility function with regard to income and price, which is free of wealth effects. While this functional form in general is very restrictive, it might be less so in the case of milk purchases as they represent a vary small fraction of a households expenditure.

randomness or uncertainty. If there are a number of heterogeneous households *(h)* that choose among different milk products *(i)* at different points in time *(t):*

(4) $U_{iht} = A_{iht}\beta_{ht} + r_{iht}$.

Note that the attributes have an additional index h to address possible heterogeneity in attribute perception across households such as in the case of organic production.[34] The vector A_{iht} therefore indicates attributes as perceived by a given household and β_{ht} indicates household-specific weights placed on them. One deviation from the classical random utility model should briefly be mentioned. The classical model assumes that the household observes the product attributes and knows the weights he places on them with certainty. Randomness arises only from the standpoint of the researcher. The specification in this paper varies in that it postulates some unresolved uncertainty in the utility derivation of the household such that the household chooses milk product m_i if :

(5) $\Pr\left(m_{it} = 1\right) \equiv \Pr\left(U_{iht} > U_{jht}\right) \equiv \Pr\left(r_{jht} < r_{iht} + (A_{iht} - A_{jht})\beta_{ht}\right)$, for all $i \neq j$.

The product choice of a given household depends on the product attributes as perceived by this household, as well as the marginal value assigned to them. The remaining uncertainty about true product attributes and its potential risks and benefits further determine the household choice. While this household specific random component might empirically not be separable from the additional source of randomness that arises from an econometrician's point of view due to unobservable household and product characteristics that could influence household choices in the existing models, it is conceptually important. Remaining uncertainty about true product attributes and/or its potential benefits would result in changes in consumer behavior due to changes in information provision and enable a utility consistent estimation of welfare effects. [35] This conceptual

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[34] While product attributes remain constant over the time period investigated, the attribute vector is further indexed by t to account for variations in product prices over time.
[35] It is important to note that we do not assume changes in information result in changes in household tastes or preferences. Rather, consumers demand a joint product of attributes, labeling and advertisement such that these changes are directly related to models of product differentiation and product quality. In this

extension would further allow incorporating behavioral and informational effects such as anchoring and attention focus, but also prestige effects discussed in the advertisement literature (e.g. Ackerberg 2001). Of course, this underlying uncertainty might vary by households such that better informed consumers are less responsive to changes in labeling information and heterogeneity across households is potentially twofold: Households vary according to their underlying preferences for observed product attributes as well as their informational background and remaining uncertainty.

Redefining the above specifications from the researcher's point of view would result in a replacement of r_{iht} with ε_{iht}, where ε_{iht} now incorporates both sources of uncertainty. It relates the observable part of the stochastic decision-making process of the household to remaining unobservable choice determinants and data problems. Distributional assumptions about this combined error term drive the econometric model choice at this point, but also affect estimation results in a variety of ways.[36] The likely complexity of the household's decision-process in combination with similar alternatives and possible unobserved preference heterogeneity and repeated choice over time motivates a flexible random coefficient or mixed logit specification. However, a conditional logit model will be introduced first, mainly on the basis of simplicity and computational convenience. This estimation technique and the currently presented preliminary results can be viewed as an initial step to investigate the possibilities and limitations of the available data.

Conditional Logit Specification

The conditional logit model can capture preference heterogeneity if tastes vary systematically with respect to observed variables. Observable household demographics,

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context, information changes could resolve some uncertainty with respect to appropriate monetary valuation of relevant attributes, might change benefits through prestige or image effects that add value to the consumer, or simply point out attributes previously not recognized. All of these effects could increase or decrease the utility assessment of a specific product and change its ordering relative to other choice alternatives without changing underlying household preferences.

[36] This research is currently extended to potentially separate these two sources of randomness in a econometric extension of a mixed logit specification that allows for random taste variations over time.

D, will be used to account for preference heterogeneity and can be incorporated into the indirect utility formulation as follows:[37]

$$(6) \qquad U_{iht} = A_{it}\beta + (A_{it} \times D_h)\gamma + \varepsilon_{iht} \, .$$

If ε_{iht} are assumed to be independently, identically extreme value distributed (type I extreme value distribution), the following closed form solution can be derived for the probability that a household's product choice corresponds to milk product m_i:

$$(7) \qquad \Pr_{ht}(m_i = 1) = \frac{e^{A_{it}\beta + (A_{it} \times D_h)\gamma}}{\sum_{k=1}^{n} e^{A_{kt}\beta + (A_{kt} \times D_h)\gamma}}$$

These response probabilities constitute what is usually called the conditional logit model. The underlying distributional assumptions have some important limitations. The most important restriction relates to the independence of irrelevant alternatives property, as the relative probabilities for any two alternatives depend only on the attributes of those two alternatives due to the *iid* assumption. It contradicts the intuition that the probability of choosing between one specific conventional and organic milk product is likely to be affected by changes with regard to other similar milk products. Related to this limitation is the ability to address taste variation in this model. Only if tastes vary systematically with respect to observed household demographics, can they be incorporated. But if preferences are at least partly random due to unobserved household characteristics (such as differences in attribute perception that depart from differences in household demographics) the model is misspecified. In the case of preferences regarding organic production it is likely that unobserved portions of preference heterogeneity regarding one milk product might be related to the unobserved portion of another alternative such that the *iid* assumption for the error terms cannot possibly hold. In addition, the assumption is

[37] Only differences in utility are identified in this model such that household demographics need to be interacted with product attributes. Differences in attribute perceptions can not be investigated empirically and will enter into the error term.

problematic in a time series setting, as households chose repeatedly over time.[38] Despite these limitations, as an approximation, conditional logit estimations might still capture average tastes fairly well as the logit formula has been found fairly robust to misspecification (Train 2002).

Consumer valuation

Estimates of changes in consumer surplus (CS) can be derived through simulation of restricted choice sets. They correspond to a household's compensating variation for a change in product attributes (Small and Rosen 1981) and in our case, a change in information provision about attributes. Given its beliefs and available information set, a household chooses the product alternative that provides the highest stochastic utility. Expected consumer surplus, CS_{nt} can therefore be defined as:

(8) $$CS_{ht} = \frac{1}{\alpha_h} \max_j \left(U_{hjt} \forall j \right),$$

where α_h denotes the marginal utility of income. The negative of the price coefficient can be used as an estimate of $\alpha_{ht.}$ in this formulation.[39]

Since the maximum utility is unobservable, the following expected consumer surplus formulation from the researcher's perspective can be specified:

(9) $$E\left(CS_{ht}\right) = \frac{1}{\alpha_h} E\left[\max_j \left(A_{jt}\beta + (A_{jt} \times D_h)\gamma + \varepsilon_{jht} \forall j \right) \right]$$

If each ε_{iht}, is *iid* extreme value and utility is linear in income, then:

(10) $$E\left(CS_{ht}\right) = \frac{1}{\alpha_h} \ln\left(\sum_{j=1}^{J} e^{A_{jt}\beta + (A_{jt} \times D_h)\gamma} \right) + C .$$

The change in consumer surplus that results from a change in product alternatives or product choices can be computed as:

(11) $$\Delta E\left(CS_{ht}\right) = \frac{1}{\alpha_h} \left[\ln\left(\sum_{j=1}^{J} e^{A^1_{jt}\beta + (A^1_{jt} \times D_h)\gamma} \right) - \ln\left(\sum_{j=1}^{J} e^{A^0_{jt}\beta + (A^0_{jt} \times D_h)\gamma} \right) \right] ,$$

[38] These time series concerns can be alleviated through clustering of standard errors by households in the regression specifications.

[39] A mentioned earlier, this formulation assumes that the marginal utility of income stays constant for a given household. Hence, a one unit decrease in price amounts to a one unit increase in income.

where the superscripts 0 and 1 refer to prior to and after the change, respectively. This measure of consumer valuation can be computed using estimated regression coefficients and simulating the counterfactual where labeling changes would have not taken place by restricting the choice set through an exclusion of organic milk carrying the USDA seal.[40]

Mixed and Latent Class Logit Specifications

Only if the researcher observes exact taste variations can choice probability be specified as a standard logit conditional on β_n as a result of the *iid* assumption. As household characteristics rather than tastes are observed in the data, the unconditional probability under a generalized extreme value assumption of the error term can be defined as:

$$(12) \qquad \Pr_{ht}(m_i = 1) = \int \left(\frac{e^{A_{it}\beta'}}{\sum_{k=1}^{n} e^{A_{kt}\beta'}} \right) f(\beta)\, d\beta .$$

Keeping the linearity assumption of (1), the argument of the exponential function represents the observed portion of the utility specification, which depends on the parameters β. The mixed logit probability is a weighted average of the logit specification evaluated at different values of β, with weight given by the density $f(\beta)$. The above specified conditional model is a special case in that the mixing distribution—the density that provides the weights—is degenerate at fixed parameters b. A normality assumption with regards to the mixing distribution, where the mean b and the covariance W describe the density $f(\beta)$ would be appropriate if organic production can be characterized as a general preference.

An alternative approach specifies the mixing distribution of preferences with regards to organic production preferences as discrete. It allows simultaneous estimation of distinct consumer segments and coefficients in the below latent class specification based on household characteristics and random variations in tastes:

[40] Estimated regression coefficients for the USDA organic seal will be forced to zero in this restricted choice set. It is possible to extend this effect to account for possible price changes in existing products prior to the implementation of the USDA by adding a second term that compares pre and post regulation prices of these products (e.g. Kim 2004).

(13) $$\Pr_{ht}(m_i = 1) = \sum_{m=1}^{M} s_m \left(\frac{e^{A_{it}\beta'}}{\sum_{k=1}^{n} e^{A_{kt}\beta'}} \right).$$

Intuitively, one can think of splitting the population into two segments—people that care and do not care about organic production—and investigate how the share of households in a given segment changes as a result of changes in labeling regulation.[41] It would also be possible to further differentiate between households that did sporadically buy organic products and households that did not buy organic products prior to labeling changes.[42]

Analogous to the conditional logit model, the estimated coefficients can be employed in a modified calculation of consumer valuation of changes in labeling regulations. Differentiated values and observed changes in population shares in the specific consumer segments can be used to place upper and lower bounds on aggregated measures of consumer benefits. These can be compared to cost estimates of development and implementation of the NOP in a final welfare analysis.

Endogeneity Controls

The choice of milk products in this framework is captured as a choice on a bundle of observable attributes including labels and price. But retailers consider all product characteristics when setting prices and account for changes in characteristics as well as consumer valuation. This introduces a simultaneity problem in that both choice probabilities and prices are affected by unobserved attribute characteristics implying that prices are correlated with disturbances included in the discrete choice demand regressions. Input prices for milk production are used as instruments for prices set by the retailer as it seems reasonable to assume that they are not correlated with unobserved product characteristics and product choice, but raw milk prices account for 62% of retail milk prices (U.S.G.A.O. 2001). Raw milk prices cannot directly be used as they are regulated under marketing orders and support price mechanisms and do not vary over time. Instead weekly commodity trading prices at the *Chicago Mercantile Exchange* of

[41] While this approach is very intuitive, assuming a discrete mixing distribution could introduce an identification problem as no unique assignment based on the data might exist.
[42] In a specification like this one needs to address dynamics over time.

nonfat dry milk powder and whole milk powder are used as they might capture seasonality and supply shocks as well.[43] These input costs (c_t) are interacted with brand specific fixed effects (B_i) for whole and low fat milk respectively to allow for cross-sectional variation by fat content and brand. Store fixed effects (S_i) are also included to account for varying operational costs and services by the store that might affect retail prices. An indicator of package material (*carton*) is further added to capture possible cost differences in packaging. And finally, observable demand shifters other than price are included as it is assumed that these are exogenous to weekly or monthly pricing decisions as decisions about the offered product mix require long term investment choices.

Rivers and Vuong (1988) discuss a two-step approach for discrete choice models followed in this study. Their procedure leads to a simple test for endogeneity. The first stage is specified as an OLS regression of the price of product *i* in week *t* on the above explanatory variables:

$$p_{it} = S_i + \beta_1 B_i \, \mathrm{c}_t + \beta_1 carton_i + \beta_1 Z_i + \varepsilon_{it},$$

The vector of OLS first stage residuals is then included in the second stage conditional logit estimations to correct for potential bias of the price coefficients due to endogeneity. While this procedure offers a straight forward way of correcting for endogeneity, it also adds another source of scaling. Each coefficient increases in value relative to its un-scaled counterpart, unless price is truly exogenous.[44]

5.3. Reduced Form Models of the Effects of Changes in Information on Quantity Sold

The primary data set does not allow us to credibly address media effects at it point. It requires a specification of intertemporal effects that cannot be incorporated into the conditional logit model, due to its restrictive distributional assumptions. Within the

[43] One argument would be that processors usually offer a range of dairy products and while raw milk prices are regulated, their prices might reflect overall variations in dairy input prices.
[44] In this model, coefficients are estimated relative to the variance of unobserved factors such that only the ratio of "original" coefficients over this scaling parameter is estimated. If prices are endogenous and the first stage residual is included in the regression, the variance of the unobservable factors should be reduced.

mixed logit specification, such an extension is possible and currently pursued. Meanwhile, an additional data set that consists of weekly supermarket store-level data is used to investigate possible changes of consumer demand prior to the actual implementation of the USDA organic seal. The effects of specified media events and the appearance of the USDA organic seal on milk products will be investigated using reduced form approaches such as regression discontinuity design (RDD) and difference-in-differences (DD) estimations. If media coverage of labeling regulations attracts consumer attention to these attributes and serves as an anchor for their initial valuation or reevaluation of these products, we would expect an immediate increase of organic milk sales after a given media event and prior to the actual appearance of the USDA organic seal on milk cartons. Similarly, if people pay close attention to the label on a product, the USDA organic seal will increase sales of the products that display it.

RDD (e.g. Hahn, Todd, van der Klauuw 2001, Chay 2005) approaches will employ a nonparametric mean smoother to detect discontinuities in the general trend of organic sales. While this approach would not be able to capture price effects and possible changes in availability, one could alternatively estimate a fixed or random effects model of organic milk sales over time. If one does not include the change in labeling, but does include changes in media coverage, and smoothes the estimated residuals, detect discontinuities might be a result of labeling changes. Similarly, one could leave out the media effects and compare detected discontinuities to media events.

For an illustration of the DD model specifications, we focus on specific media events such as the intensified media coverage of the NOP and it labeling regulations on October 9th, 10th, 14th, 2002, approximately one week before they went into effect. Both, national newspapers such as *The New York Times*, *The Wall Street Journal*, and *USA Today* as well as relevant Western regional papers featured a number of articles that discussed new regulations and labeling guidelines [45] These identified events correspond to week 41 in the store level data set. Looking at the difference in conventional versus organic milk sales, the DD estimator can be expressed as:

[45] The Wall Street Journal ran a story titled "Is that $5 Gallon of milk really organic?" as early as August 2002 and published another related article September 11th. The media focus significantly increased at the beginning of October, however with articles in several papers at the above mentioned dates. A complete list of identified media events can be found in the appendix. The names of the regional papers can not be disclosed due to confidentiality agreements.

(14) $\hat{\delta}_1 = (quantitysold_{week_{200441},conv} - quantitysold_{week_{200441},org}) - (quantitysold_{week_{200440},conv} - quantitysold_{week_{200440},org})$

$\hat{\delta}_1$ can be directly estimated and Wald tests can be used to establish statistical significance of these differences in the following specification that uses pooled data across the two selected weeks:

(15) $$quantitysold = \beta_0 + \delta_0 week_{200241} + \beta_1 org + \delta_1 week_{200241} * org + \gamma\overline{C} + \varepsilon$$

Weekly store-level product sales will be considered in this formulation as a dependent variable. The intercept captures average sales of conventional milk products in week 40, while δ_0 captures changes in all milk sales over the selected weeks. The parameter of interest, δ_1, measures the increase in organic milk sales due to media coverage. The vector $\overline{C}$ represents a number of included store level controls such as prices and additional milk product characteristics that might affect demand of these products in a given week. Effects of detected media events could simultaneously be estimated in a single regression specification and cross sectional differences identified by differences in media coverage in local papers can also be investigated.[46] One shortcoming of this formulation is that it assumes that sales of organic milk did not disproportional increase for other reasons, and are not affected by general market trends that are not accounted for with the included controls (see e.g. Bertrand, Duflo, and Mullainathan 2004 for discussion of DD estimation and limitations). Comparison of these regression results to RDD results can provide a possible indication of such biases and serves as a robustness check.

6. Preliminary Results

[46] The retailer just recently granted access to an additional market that would allow comparisons across markets.

Table 3 summarizes estimates of average consumer valuation of product attributes included in the hedonic price function regressions. Three regression specifications were estimated. The base model includes an intercept, different sizes, package materials, fat content, lactose-free product labeling as well as the main attributes of interest with regard to organic labeling —rBST-free labels, organic labels and the USDA organic seal. The second model additionally accounts for time trends in organic preferences and the third model estimates a log-linear functional form to transform the dollar amounts into percentage price changes. All three models were estimated separately for the time period prior and subsequent to the effective date on the new labeling standards. Products that carry a USDA seal after October 21, 2002 are also indexed in the early time period to account for the possibility that they were preferred for other reasons than the added labeling information.

Overall, the estimated regression coefficients indicate that consumers are willing to pay a premium for half gallon containers, carton packaging, whole fat content and lactose-free milk, as well as for all of the labels that address health and environmental related concerns. Depending on the regression specifications, some consumers are willing to pay an extra 192 cents for milk labeled as organic, which increase to 214 cents in the period following labeling changes. These price premiums correspond to a 39.4% and a 45.8% price increase as estimated in the third model specification. Products that carry the USDA organic seal do not significantly differ in terms of price premiums from organic milk in general prior to the implementation of the NOP, but consumers are estimated to pay an extra 63 cents once the seal was added to milk containers. This estimate is about twice as large as the estimated yearly organic time trend in the second specification and amounts to an 11.4% price increase.

Preliminary results based on conditional logit regression specifications are presented in Table 4. Product prices that are adjusted for size, sales and coupon use, and first stage residuals that address potential endogeneity of these prices, are added to the product attributes used in the hedonic regressions. In relating final regression specifications back to the comparison of random utility differences in equation (3), it is important that the absolute level of utility is irrelevant to the household’s choice. The choice probability depends only on differences in utility. Therefore, not all of the parameters can be identified from the data. Only differences across products can be investigated, such that the product specific utility of one product is normalized to zero.[47] Related to this issue is the scaling parameter implied by a normalization of the error variance in the derivation of the underlying logit formula. The true error variance can be expressed as a multiple of the normalized variance, and the estimated coefficients indicate the effect of each observable variable relative to the variance of the unobserved factors.[48] Marginal rates of substitutions are not affected by this scaling, since the scale parameter drops out of the ratios. Marginal effects are reported in Table 4 rather than the actual regression coefficients and a comparison of results across specification need to look at ratios of these effects e.g. relative to the estimated price effect. Five alternative model specifications that vary by inclusion of an indicator for branded products, brand and store dummies, and organic time trends, are estimated.

The inclusion of residuals from the first stage regression of product prices as a function of exogenous supply and demand shifters allows rejecting the null hypothesis of no endogeneity at the 1% significance level using a Wald test in all reported five model specifications. While the first stage regression results are not reported, the combined F-statistics are included on the bottom of Table 4. Overall, estimates seem fairly robust to the alternative model specifications reported in Table 4.[49] The second model that includes an indicator for branded products, rather than individual brand fixed effects, is used to derive estimates for changes in consumer surplus. While not accounting for individual brand preferences, this model specification allows capturing a general preference for branded products due to unobserved differences in product attributes and preferences.[50]

The average predicted probability of a specific milk product choice is estimated at 3.52 % and 3.4% in the two separately estimated time periods prior and subsequent to labeling changes. As prices are measured in cents, price responsiveness of product choice

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[47] In the regression specification, this reference is defined as a private label gallon of whole conventional milk sold at the biggest supermarket included in the data.
[48] The error variance in the logit model is not separately identified and only information about the signs of the error terms is available post estimation.
[49] Almost all included instruments were statistically significant individually and they were significant jointly.
[50] An inclusion of individual brand dummies resulted in multicolliniarity problems in preliminary attempts of interacting observed product attributes with observed household demographics and might suggest no systematic variation in unobserved preferences across brands beyond these attribute specifications.

as reported in this table relates to a unit increase of 1 cent. This increase corresponds to average price increase of .22%. In model 2, an increase in price by 1 cent is estimated to decrease the average choice probability by .13%. A 1% increase in price is therefore estimated to decrease the average choice probability by .59%. Labeling a milk product as organic has significant and very sizable effects on average choice probabilities as it increases by an estimated 11.99%. And while milk products that added the USDA labeling seal after the NOP went into effect, were more likely to be chosen prior these labeling changes (8.67%) in model 2, the marginal effect almost doubled to 16.13% when consumers could observe the seal on milk containers. This difference in choice probabilities can not be attributed to a general trend in increased organic purchases as the alternative organic milk products do not portray the same increase. When including brand fixed effects, USDA labeled organic products were not more likely to be chosen prior to the labeling changes.

The estimated marginal effects for rBST-free labels exhibit counterintuitive negative and significant values, and therefore indicating small decreases in choice probabilities for these differentiated products at the margin. These estimates could be influenced by the fact that this labeling characteristic was added to the data set and could only be obtained at the brand level. But these estimates might also indicate that consumers do not focus in these attributes as much in the investigated time period anymore as studies of earlier time periods concluded (e.g. Kiesel, Buschena, and Smith 2005). Consumers might also view the related organic labeling information as more reliable and therefore substitute away from these products if they are concerned about the use of rBST.

Table 5 summarizes the estimated consumer surplus measures. On average, households are estimated to value the added USDA organic seal on milk containers at 45 cents. This average valuation is derived by first averaging differences in consumer surplus for each individual household and in a second step, averaging across households.[51] The consumer surplus and compensating variation measures were derived as nonlinear functions of coefficient estimates and variable values in a simulation of

[51] The alternative derivation of averaging over the observed purchases results in an estimate of 46 cents but in a wider distribution.

restricted choice sets described in the econometric framework.[52] A nonparametric bootstrap procedure with 20 repetitions was used to derive standard errors and confidence intervals reported in the same table. These estimates do not astray far from the hedonic price function estimate of 63 cents. The difference in value could indicate the discussed biases in the estimation of an implicit price in the hedonic approach due to sorting by the consumers. The distribution of consumer surplus measures across households is graphed in Figure 4. The skewness to the right could potentially suggest preference heterogeneity across households that will be addressed by incorporating of observable household demographics as a next step. Robustness of these results will also be investigated in the alternative, more flexible mixed and latent class logit specifications described in the previous section.

A first look at the second store-level data set reveals significant jumps in organic milk sales relative to total milk sales even prior to the actual appearance of the USDA organic seal (Figure 5). While these jumps coincide with identified media events, organic milk prices also vary in these relevant weeks (Figure 6). In addition, figure 7 plots variation in availability of organic milk across stores and shows a consistent increase in availability.[53]

Figure 8 represents a first regression discontinuity design analysis and shows a discontinuity at the time of the label change. Organic sales relative to conventional milk sales discontinuously increased by about 2%. This graphical analysis further indicates a systematically increase in organic milk sales prior to the USDA seal, compared to a flat slope afterwards. While DD results are not available at this point an initial OLS regression of organic sales in 2002 prior to the implementation of the USDA seal on media coverage (separated by positive and negative national paper coverage and positive local paper coverage) controlling for price effects, increases in availability and a general weekly trend are reported in table 6. OLS was modified using a Newey-West procedure

[52] These estimates are based on the variety effect of the USDA seal only and price effects are not incorporated yet. However Figure 3 plots mean prices across milk categories over time. While organic milk shows a lot more variation in prices relative to conventional milk, a general price increase or decrease can not be detected.
[53] One should focus on the upper bound as some of the variation across stores and weeks might be a result of no purchase or stocking irregularities.

to correct standard errors for heteroskedasticity and autocorrelation. Estimated coefficients indicate significant effect of media coverage on weekly organic sales.

Consideration of preference heterogeneity along observable household demographics

Preliminary regression results that incorporate preference heterogeneity based on observable household demographics are not reported, mainly because of the restrictive nature of the conditional logit specification. Rather, distributions of observable demographics are compared for households that purchase organic versus conventional milk. Similarly, households that purchase organic milk in general are compared to households that purchase milk products carrying the USDA seal. These graphical summary statistics are presented in Figure 9 to 16.[54] As expected, income levels increase preferences for organic products as they allow a household to consider additional product characteristics beyond price and nutritional value. Potential long term environmental and health risks or benefits might be of particular concern for families with children, especially families with young children.[55] And, it could be hypothesized that younger people might be more sensitive to these issues and more likely to alter their consumption pattern than older people with well established consumption habits.[56] The graphs also show significant differences regarding education level and occupation.[57]

Regarding labeling preferences, the graphs show additional potentially interesting differences that might relate to informational effects. With regards to household composition, single males for instance, are more likely to purchase milk with the USDA label while the same difference is not detected for single females. And differences for more educated households are less significant than differences for medium educated households, while differences switch for less educated in this sample. One could argue

[54] When applicable, a female household demographics for the female head of a household are used as women traditionally have more influence on purchase grocery purchase decisions. In the case of median age, median age of the male household member is substituted if there is no female household member present.
[55] This effect might be understated as families with children might have a more restricted grocery budget which would work in the opposite direction.
[56] This effect is also hard to detect and separate in this initial investigation as it is noisy due to income effects.
[57] But these trends might just be a proxy for income effects.

that the more educated are already better informed, which reduces labeling effects on these groups relative to others. The switch for lower levels might be a result of income effects. There are also significant differences regarding race that might suggest that households with potentially strong ethical beliefs and consideration of animal welfare in the group of households specified as oriental (e.g. Indian and and Arabic nationalities) view the USDA seal as more credible.

7. Conclusions and Future Research Extensions

This paper empirically investigates how several aspects of changes in information provision regarding organic production under the NOP may have altered consumer purchase decisions of fluid milk products. Detailed purchase data over a four year period (2000-2003), including household demographic information of purchasing individuals are used to estimate hedonic price functions and contrast to econometric discrete choice models: conditional logit, mixed and latent class logit specifications. These three specifications vary in their underlying distributional assumptions and have important implications on how preference heterogeneity with regard to organic production can be incorporated in regression specifications. In all three model specifications, consumer valuation of the NOP can be estimated through simulation of restricted choice sets and resulting changes in consumer surplus.

Due to limitations in the preliminary model structure regarding addressing temporal effects, additional weekly store level data is utilized that allows a reduced form analysis of purchase adjustments over time due to prior media coverage.

Preliminary results suggest that consumer purchase behavior is significantly affected by both the actual appearance of the USDA organic seal on milk containers and media coverage prior to their appearance. Estimates of average consumer valuation of the USDA seal in the hedonic price function approach resulted in higher estimates than simulations of restricted choice sets within a conditional logit framework. These differences might point to possible biases in the hedonic approach as consumers sort themselves according to their marginal willingness to pay. The graphical analysis of distributional difference in household demographics further motivates possible patterns for an inclusion of household demographics in the model.

Future Research Extensions

While the preliminary nature of the presented results preclude further welfare analysis at this point, these estimates could be aggregated to annual average consumer benefit based on the sample average annual consumption of 34.91 gallons of milk or based on population average milk consumption. Consideration of heterogeneous preferences would allow derivation of upper and lower bounds for estimated consumer benefits that then can be compared to cost estimates of development and implementation of the NOP forecasted in ERS publications.[58]

Less restrictive structures of consumer heterogeneity that allow for random taste variations, unrestricted substitution patterns, and correlation of unobserved factors over time can be incorporated in mixed logit and latent class logit regression specifications. Mixed logit models seem appropriate if organic production can be described as a general preference such that weighted choice probabilities can be estimated, with weights given by the underlying distribution of varying willingness to pay. Latent class logit models, on the other hand, allow simultaneous estimation of distinct consumer segments (e.g. consumers that consider and do not consider organic production in their product choice in the simplest case) and their specific average valuations. Here, the challenge and contribution will be in a dynamic analysis of purchase behavior over time.[59]

And finally, the estimated labeling effects and its interdependencies with advertisement and marketing efforts by producers and processors could be compared to similar studies in the context of nutritional labeling. As findings in Ippolito and Pappalardo (2002) for instance indicate, regulatory rules and enforcement policy in this

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[58] The USDA estimated that the costs of accreditation and labeling under the National Organic Program (NOP) alone may approach $1 million and $1.9 million respectively. A number of other potential costs such as enforcement, record keeping, and production and handling costs are also discussed but not quantified (USDA 2000).

[59] There is another aspect of dynamics over time that has not been addressed so far and potentially biases the results. Availability and variation of organic products increased significantly over the investigated time period such that one could argue that we have an several introductions of a new products both by product differentiation and availability over time. We might be able to alleviate these concerns by intended aggregation of product and brand alternatives to reduce the dimensionality of the data..

context might have induced firms to move away from reinforcing nutritional or health claims and might have ultimately reduced consumers' attention focus on these choice determinants. In the context of organic labeling however, the USDA seal seems to have boosted an already growing specialty food segment and initiated the movement of organic into mainstream.

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Table 1: Average household demographics

Descriptive statistics (household demographics)				
	National population *	Selected market population *	Sample data (all households)	Sample data (milk consumption only)
gender (female)	50.9	49.2	66.28	69.21
median age	35.3	39.2	42**	42**
median income	$41,994	$60,031	$55,000***	$55,000***
race				
white	75.1	49.7	61.88	62.36
black	12.3	7.8	14.05	13.88
asian	3.6	30.8	13.79	13.4
other	10	7.4	10.28	10.37
hispanic	12.5	14.1	13.83	15.2
household composition				
household size	2.59	2.3	2.49	2.64
married	51.7	33.38	52.72	57.04
with children under 18	25.7	14.5	30.09	34.4
with children under 6	7.3	4.1	4.18	4.84
number of households			1041	927

* based on 2000 census data
**median age category is 40-42 (age of children not included in derivation for data set)
***median income category is $50000-$59999

Table 2: Descriptive statistics (AC Nielsen data)

Descriptive statsistics (product charcteristics)	original choices					data including created choice sets				
Variable	Observations	Mean	Std. Dev.	Min	Max	Observations	Mean	Std. Dev.	Min	Max
choice						449879	0.090	0.286	0	1
number of choices at store by month						449879	25.057	7.585	2	40
price										
price (adjusted to gallons, using maximum price below)	40341	343.951	130.637	0		449879	448.295	166.667	0	860
price alternative choice (maximum price)						409538	458.574	166.298	0	860
price alternative choice (minumum price)						409538	431.473	174.945	0	858
price alternative choice (median price)						409538	445.701	170.626	0	858
residual from first stage regession						449879	$2.46*10^{-7}$	75.954	-589.680	367.848
in store promotion	40341	0.213	0.410	0	1	449879	0.338	0.473	0	1
customer coupon	40341	0.007	0.084	0	1	449879	0.001	0.025	0	1
private label	40341	0.759	0.428	0	1	449879	0.538	0.499	0	1
fat content										
fat free	40341	0.238	0.426	0	1	449879	0.213	0.409	0	1
lowfat	40341	0.543	0.498	0	1	449879	0.249	0.432	0	1
whole	40341	0.219	0.414	0	1	449879	0.538	0.499	0	1
package										
half	40341	0.461	0.498	0	1	449879	0.577	0.494	0	1
glass	40341	0.002	0.045	0	1	449879	0.004	0.066	0	1
carton	40341	0.364	0.481	0	1	449879	0.504	0.500	0	1
labeling characteristics										
lactose free label	40341	0.013	0.114	0	1	449879	0.070	0.254	0	1
no rBST label	40341	0.195	0.397	0	1	449879	0.274	0.446	0	1
organic label	40341	0.043	0.202	0	1	449879	0.159	0.366	0	1
usda label	40341	0.019	0.137	0	1	449879	0.069	0.253	0	1
unit measures (adjusted to gallons)										
product units purchased (per shopping trip)	40341	1.120	0.696	0.5	22					
units of non-organic milk purchased by month	40341	942.404	135.885	628	1103	449879	954.738	124.634	628	1103
units of organic milk purchased by month	40341	25.276	8.051	5.5	38.5	449879	26.084	7.645	5.5	38.5
ratio organic units purchased/non-organic units purchased	40341	0.026	0.006	0.009	0.036	449879	0.027	0.006	0.009	0.036
distribution of observations by year										
2000	7286	0.181	0.385	0	1	62880	0.140	0.347	0	1
2001	11012	0.273	0.445	0	1	119398	0.265	0.442	0	1
2002	11127	0.276	0.447	0	1	138254	0.307	0.461	0	1
2003	10916	0.271	0.444	0	1	129347	0.288	0.453	0	1

Table 3: Hedonic price function regression results

Hedonic price function regressions

dependent variable: price (adjusted for size, feature and coupon)

independent variables	**1 (base model)**				**2 (organic time trend)**				**3 (log price)**			
	before NOP		after NOP		before NOP		after NOP		before NOP		after NOP	
intercept	264.339	***	263.002	***	263.970	***	263.002	***	5.537	***	5.537	***
	3.692		4.349		3.680		4.349		0.012		0.015	
no rBST label	22.427	***	36.832	***	22.320	***	36.832	***	0.096	***	0.143	***
	5.411		7.561		5.428		7.561		0.016		0.021	
organic label	192.310	***	224.209	***	153.065	***	224.209	***	0.394	***	0.458	***
	20.688		13.257		18.613		13.257		0.024		0.038	
organic label*year					33.094	***			0.052	***		
					6.915				0.015			
USDA seal	35.639		62.984	***	31.069		62.984	***	0.006		0.114	***
	25.004		14.121		22.566		14.121		0.041		0.042	
<u>other controls</u>												
size (half gallon)	154.936	***	157.346	***	155.260	***	157.346	***	0.481	***	0.491	***
	6.279		4.813		6.278		4.813		0.016		0.015	
package material (carton)	-8.895		11.831		-9.176		11.831		-0.015		0.022	
	6.788		8.613		6.776		8.613		0.015		0.018	
fat free	-36.119	***	-42.217	***	-35.578	***	-42.217	***	-0.123	***	-0.146	***
	4.830		5.859		4.773		5.859		0.016		0.021	
low fat	-3.513		2.790		-3.101		2.790		-0.012		-0.007	
	4.161		5.299		4.159		5.299		0.013		0.016	
lactose free	307.874	***	301.161	***	307.783	***	301.161	***	0.583	***	0.566	***
	6.389		12.708		6.389		12.708		0.012		0.022	
R squared	0.6758		0.7228		0.6758		0.7228		0.6298		0.6504	
Number of observations	27526		12815		27526		12815		27526		12815	

Note: robust and clustered (by brand) standard errors are reported, *, **, and *** denote values that are statistically different from 0 at the 10%, 5% and 1% level.
USDA prior to organic standard just indicates the organic products that later carry the standard
NOP=National Organic Program

Table 4: Conditional logit regression results

Conditional logit regressions

dependent variable: choice of milk product

	1		2		3		4		5	
	before NOP	after NOP	before NOP	after NOP	before NOP	after NOP	before NOP	after NOP	before NOP	after NOP
mean	0.0352	0.0340	0.0352	0.0340	0.0340	0.0352	0.0352	0.0340	0.0352	0.0352
independent variables										
price	-0.0013 ***	-0.0013 ***	-0.0013 ***	-0.0014 ***	-0.0020 ***	-0.0021 ***	-0.0022 ***	-0.0022 ***	-0.0021 ***	-0.0021 ***
	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001	0.0001
no rBST label	-0.0226 ***	-0.0078 ***	-0.0656 ***	-0.0747 ***	-0.2841 ***	-0.0576 ***			-0.2881 ***	-0.0576 ***
	0.0028	0.0038	0.0068	0.0146	0.0193	0.0101			0.0194	0.0101
organic label	0.1285 ***	0.1325 ***	0.1199 ***	0.1125 ***	0.2928 ***	0.2995 ***	0.3189 ***	0.3209 ***	0.3228 ***	0.2995 ***
	0.0108	0.0153	0.0119	0.0230	0.0120	0.0133	0.0130	0.0143	0.0134	0.0133
USDA seal	0.0894 ***	0.1676 ***	0.0867 ***	0.1613 ***	0.0160	0.1538 ***	0.0107	0.1551 ***	0.0946 **	0.1538 ***
	0.0118	0.0166	0.0118	0.0166	0.0128	0.0107	0.0126	0.0103	0.0308	0.0107
other controls										
size (half gallon)	0.1733 ***	0.1812 ***	0.1767 ***	0.1873 ***	0.2818 ***	0.2917 ***	0.3028 ***	0.3061 ***	0.2876 ***	0.2917 ***
	0.0111	0.0157	0.0101	0.0144	0.0104	0.0101	0.0122	0.0117	0.0098	0.0101
package material (carton)	-0.0044 *	-0.0094 ***	0.0081 ***	-0.0050	-0.0031	-0.0079 ***	-0.0089 ***	-0.0095 ***	-0.0038	-0.0079 ***
	0.0034	0.0023	0.0034	0.0033	0.0031	0.0023	0.0029	0.0023	0.0031	0.0023
lactose free	0.0152 **	-0.0076	0.0147	-0.0033	-0.0138	-0.0096			0.0946 **	-0.0096
	0.0082	0.0083	0.0080	0.0083	0.0083	0.0087			0.0308	0.0087
fat free	0.0135 ***	0.0068 *	0.0145 ***	0.0064	0.0152 ***	0.0107 ***	0.0147 ***	0.0116 ***	0.0161 ***	0.0107 ***
	0.0036	0.0036	0.0036	0.0036	0.0033	0.0032	0.0032	0.0032	0.0034	0.0032
low fat	0.0135 ***	0.0124 ***	0.0139 ***	0.0127 ***	0.0133 ***	0.0133 ***	0.0138 ***	0.0142 ***	0.0142 ***	0.0133 ***
	0.0029	0.0029	0.0029	0.0028	0.0028	0.0029	0.0028	0.0029	0.0028	0.0029
brand name			0.0469 ***	0.0728 ***						
			0.0065	0.0140						
brand dummies	No	No	No	No	Yes	Yes	Yes	Yes	Yes	Yes
store dummies	No	No	No	No	No	No	Yes	Yes	No	No
time trend (year)	No	No	No	No	No	No	No	No	Yes	No
pseudo R squared	0.3889	0.3809	0.389	0.4099	0.5804	0.6313	0.6327	0.6871	0.5913	0.6313
Number of observations	296258	153575	296258	153575	296258	153575	296258	153575	296258	153575
first stage instruments:										
whole milk powder, nonfat milk powder										
F-statistic										
observed prices	1798.28	1798.28	1798.28	1798.28	1798.28	1798.28	1798.28	1798.28		
constructed prices	33163.65	33163.65	33163.65	33163.65	33163.65	33163.65	33163.65	33163.65		

Note: Marginal effects rather than regression coeficients and robust and clustered (by household) standard errors are reported.
*, **, and *** denote values that are statistically different from 0 at the 10%, 5% and 1% level.
Estimates are not directly comparable across regressionsdue to scaling effects, such that one should look at relative effects (e.g relative to marginal effect of price increase)
Regressions are adjusted for endogeneity of prices (including first stage residuals allows to reject the null hypothesis of no endogeneity of price in all regressions)
USDA prior to organic standard just indicates the organic products that later carry the standard
NOP=National Organic Program

Table 5: Estimated consumer surplus measures

Estimated consumer surplus measures				
Estimated average consumer valuation	observations	mean	95% Confidence Intervall	
unrestricted consumer surplus	927	249.81 ***	249.06	250.57
		0.39		
restricted consumer surplus[1]	927	204.42 ***	201.22	207.62
		1.63		
consumer surplus difference	927	45.46 ***	41.90	48.89
		1.78		

Note: Values are averaged across households, *, **, and *** denote values that are statistically different from 0 at the 10%, 5% and 1% level.

[1] These values correspond to the counterfactual that restricts the household choice by excluding organic milk carrying the USDA-seal .

[2] Standard errors and 95% confidence intervals were computed using a nonparametric bootstrapping procedure with 20 repetitions.

Table 6: Newspaper Coverage

Date	Source	Title	Promo week id
08. 20. 2002	The Wall Street Journal	Is that $5 Gallon Milk Really Organic?	200233
08. 26.2002	The Wall Street Journal	Would World Starve on Organic Farming	200234
09. 11. 2002	The Wall Street Journal	Stamp of Approval from U.S. to Help Horizon Organic	200236
10. 25. 2002	The Wall Street Journal	Taste—Review & Outlook: Hard to Swallow	200243
10. 9. 2002	The Washington Post	A Guide to New Organic Terminology	200240
10. 21. 2002	The Washington Post	The New Standards; What Does 'Organic' Really Mean?	200243
05.08. 2002	The New York Times	Study finds far less Pesticide Residue on Organic Produce	200219
10. 14. 2002	The New York Times	Small Organic Farmers pull up Stakes	200241
10. 16. 2002	The New York Times	A Definition at Last, but What Does It All Mean?	200242
10. 18. 2002	The New York Times	Clearly Organic	200242
10. 20. 2002	The New York Times	The 'Organic' Label: Who Wins at the Bank?; [Interview]	200242
10. 20. 2002	The New York Times	Going Organic	200242
10. 20. 2002	The New York Times	Eat, and buy organic	200242
10. 21. 2002	The New York Times	Organic Gets an Additive: A U.S.D.A. Seal to	200242

		Certify It	
10. 21. 2002	The New York Times	A New Organic Era; [Editorial]	200242
10. 23. 2002	The New York Times	Sharing the Organic Harvest	200242
10. 29. 2002	The New York Times	How Foods earn the Organic Seal	200243
10. 16. 2002	USA TODAY	USDA gives bite to organic label	200242
10. 21. 2002	USA TODAY	With new organic labels, each purchase equals a vote	200242
06. 26. 2002	Regional Paper 1	Alliance gives milk and earth-friendly boost	200226
10. 13. 2002	Regional Paper 1	Agribusiness goes organic, New law and growing appetite for wholesome foods bring mega growers to the Table	200241
10. 13. 2002	Regional Paper 1	Standards Grew out of Long Process	200241
07. 16. 2002	Regional Paper 2	Learning More About Organic	200228
07. 16. 2002	Regional Paper 2	Getting to the Root of Organic	200228
10. 6. 2002	Regional Paper 2	Organic Foods Definitely Worth Price	200240
10. 9. 2002	Regional Paper 2	USDA Organic Rule Takes Effect in 12 Days	200241
10. 9. 2002	Regional Paper 2e	Why Organic Costs More	200241
10. 9. 2002	Regional Paper 2	Organic Rules: Government’s New Standards Aim to Take Guesswork Out of Buying Organic	200241

Note: red indicates negative coverage.

Figure 1: Alternative product choice by panel members

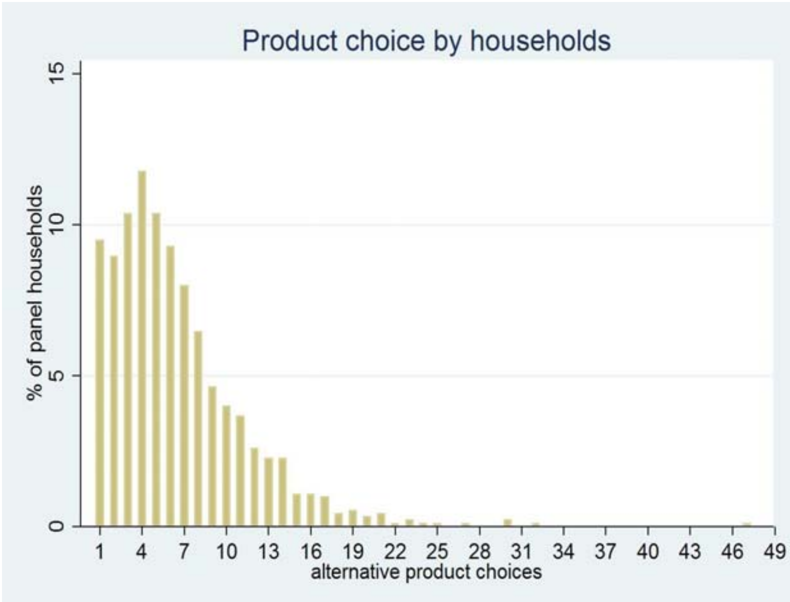


Figure 2: Alternative brand choice by panel members

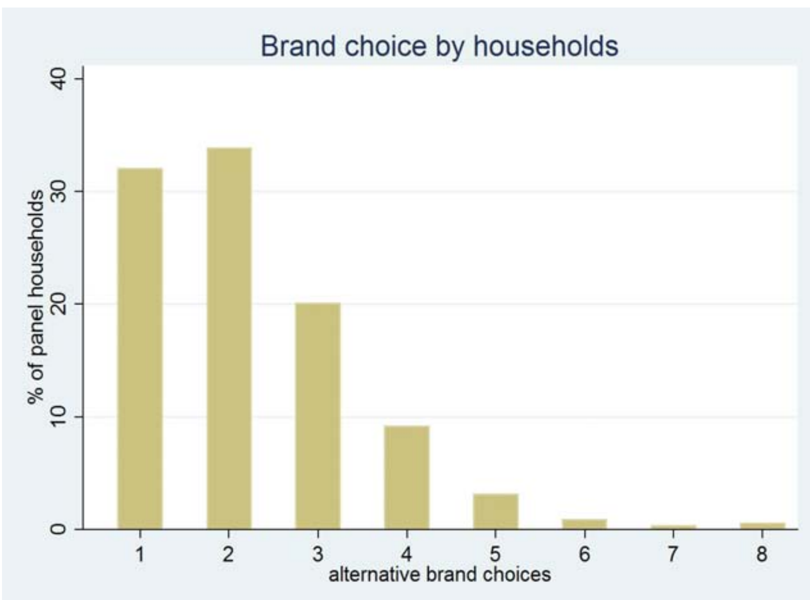


Figure 3: Mean prices across organic categories over time

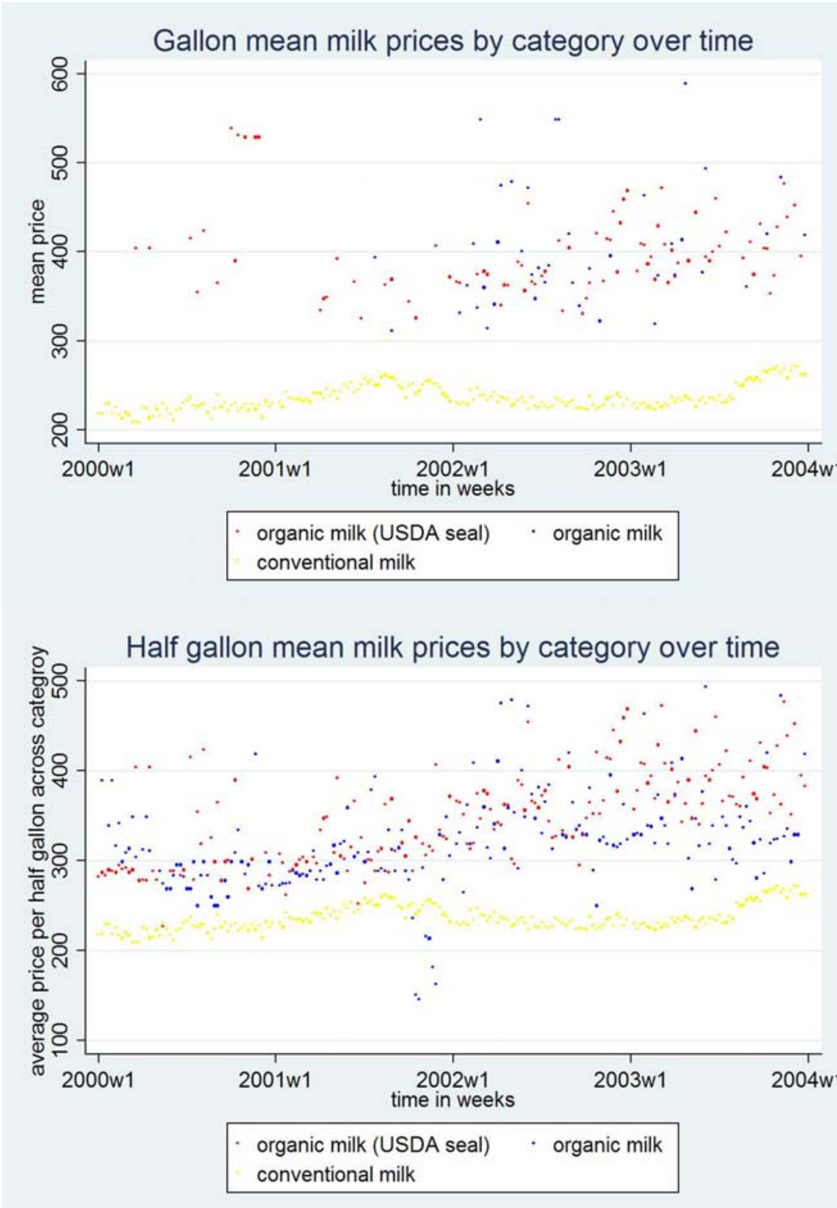


Figure 4: Distribution of estimated consumer surplus over time

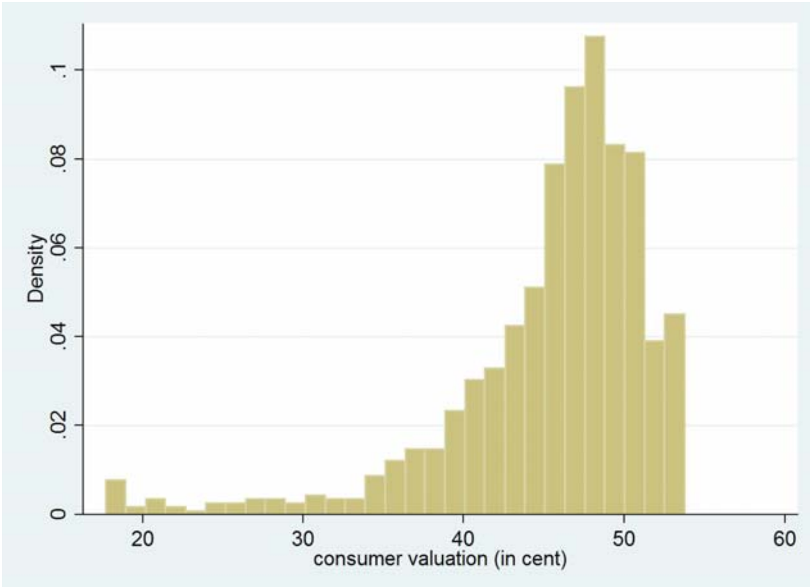


Figure 5: Trend in organic milk sales over time:

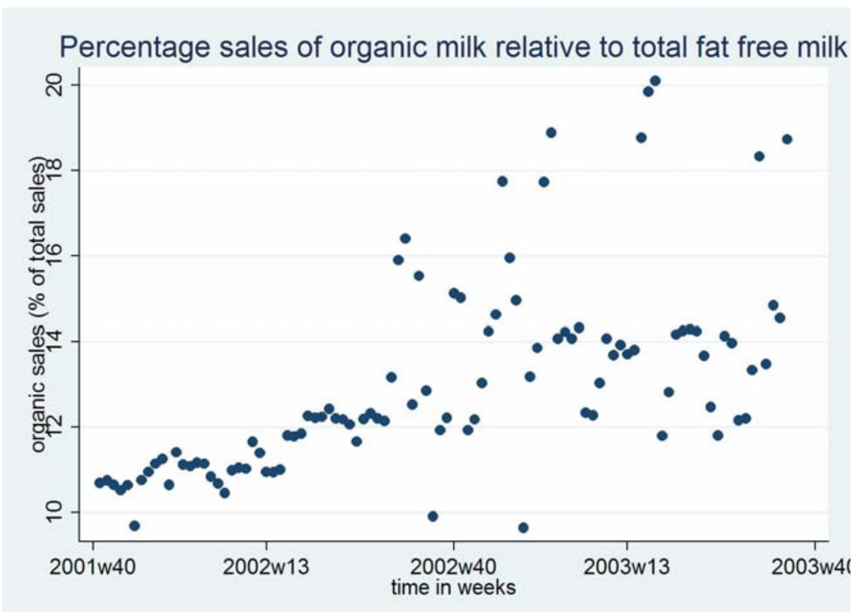


Figure 6: Trend in mean organic and conventional milk sales over time

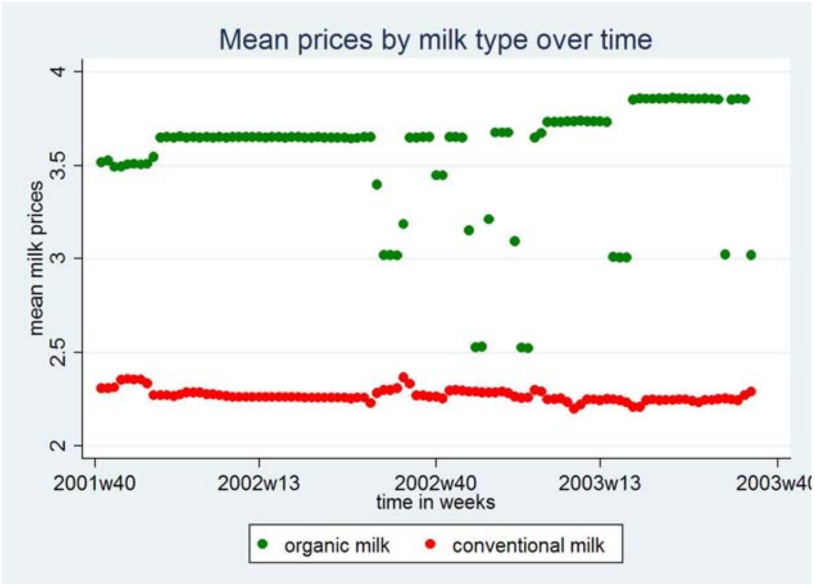


Figure 7: Trend in availability of organic milk across stores

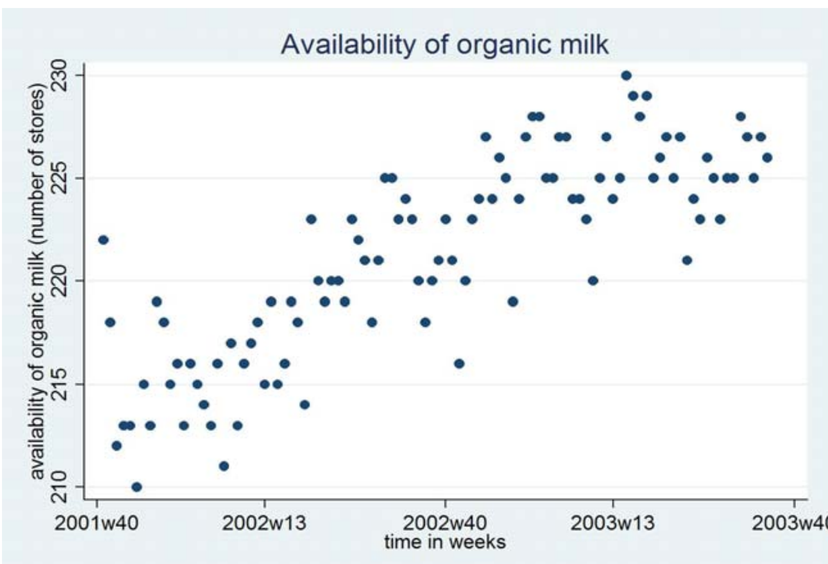


Figure 8: Regression discontinuity design: Change in organic milk sales due to Implementation of NOP

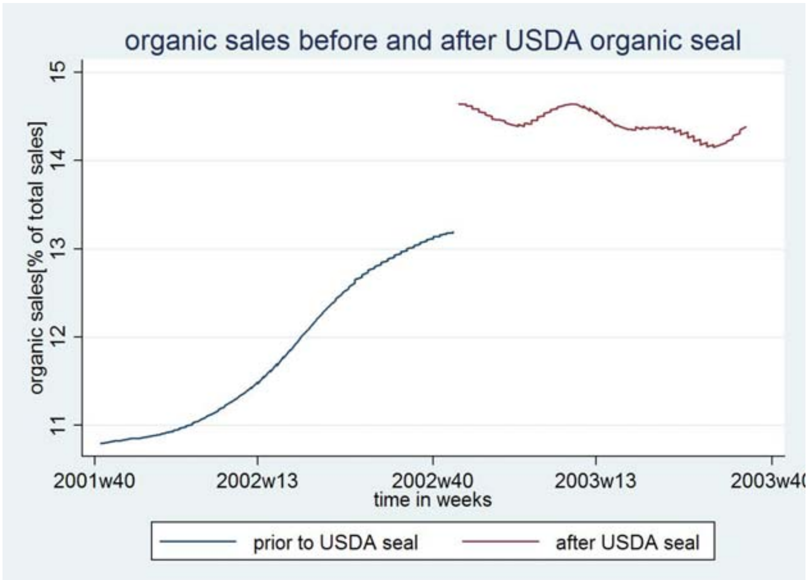
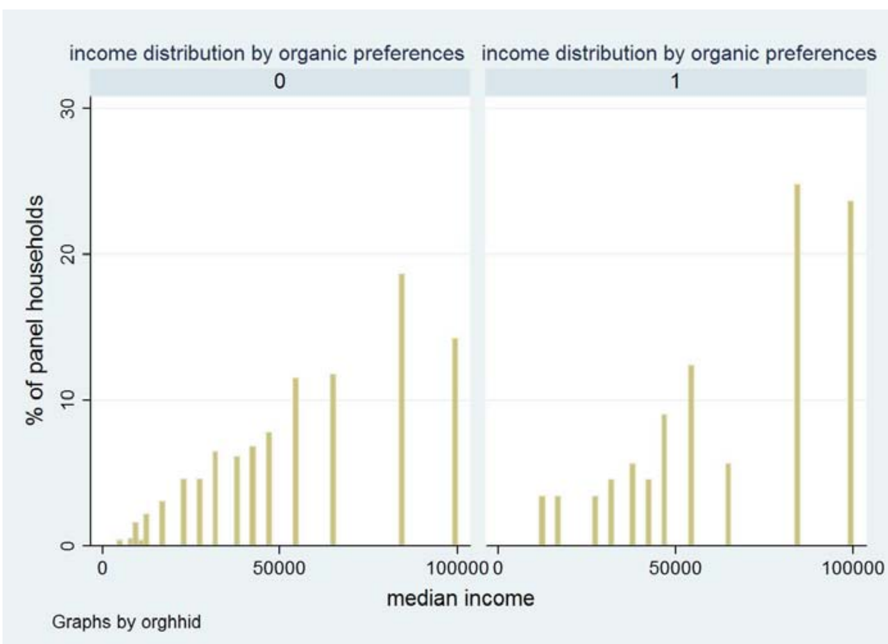
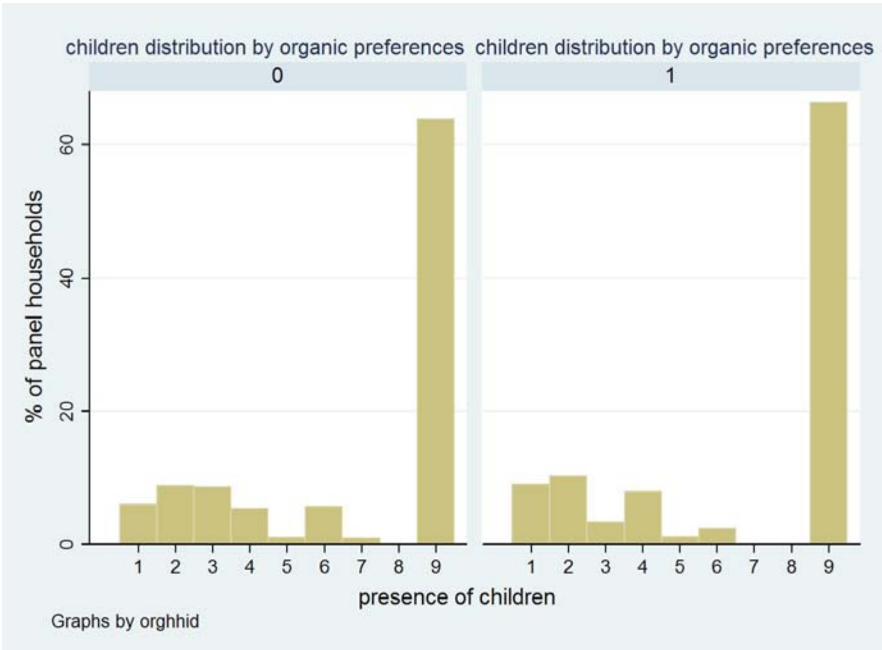


Figure 9: Income distribution by organic preferences (0= conventional purchases, 1= organic purchases)



Note: median income brackets are: 5000, 7500, 9000, 11000, 13000, 17500, 22500, 7500, 32500, 37500, 42500, 47500, 55000, 65000, 85000, 100000

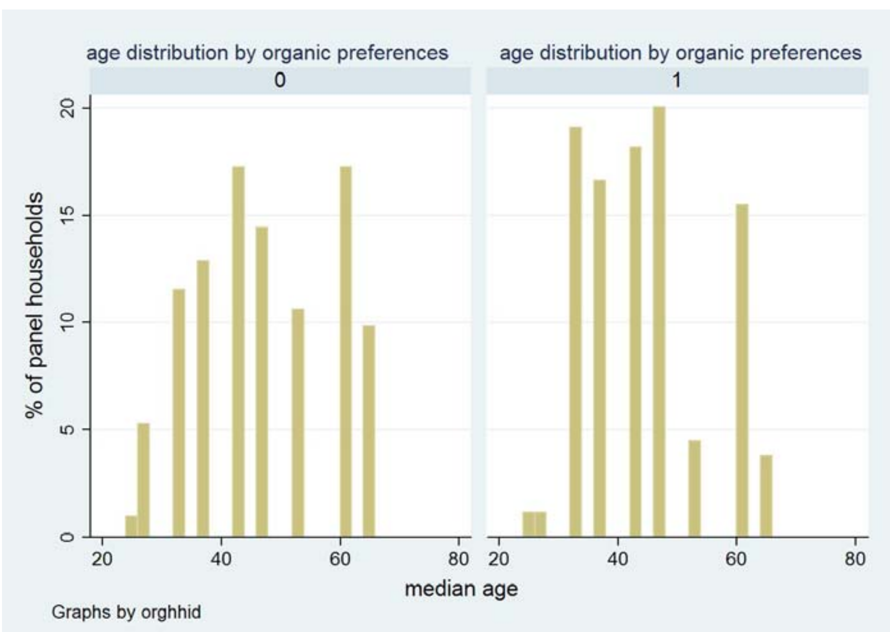
Figure 10: Presence and age of children by organic preferences (0= conventional purchases , 1= organic purchases)



Note: Presence and age categories are:

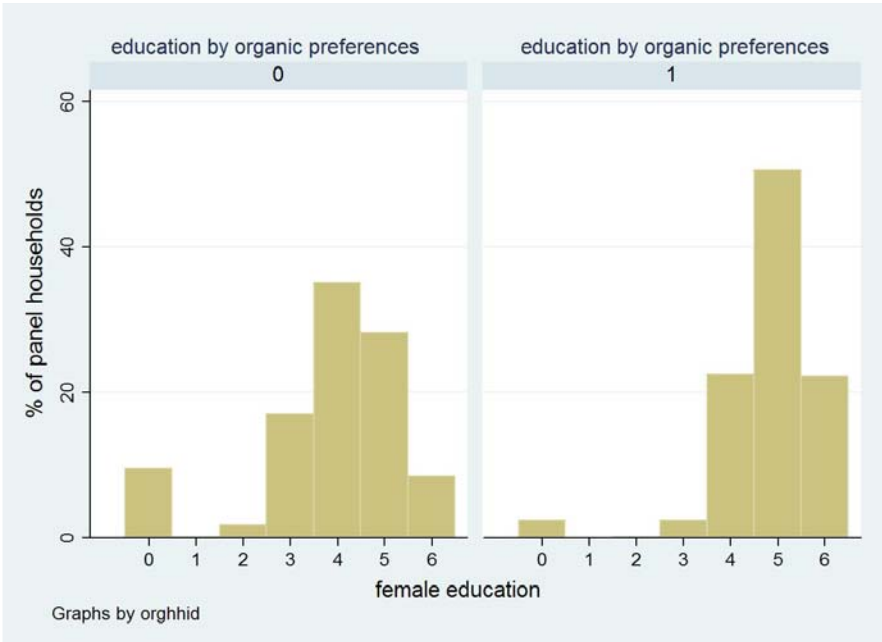
Under 6 only	1
6-12 only	2
13-17 only	3
Under 6 & 6-12	4
Under 6 & 13-17	5
6-12 & 13-17	6
Under 6 & 6-12 & 13-17	7
No Children Under 18	9

Figure 11: Age distribution by organic preferences (0= conventional purchases , 1= organic purchases)



Note: Median age brackets are: 25, 27, 32, 37, 42, 47, 52, 60, 65

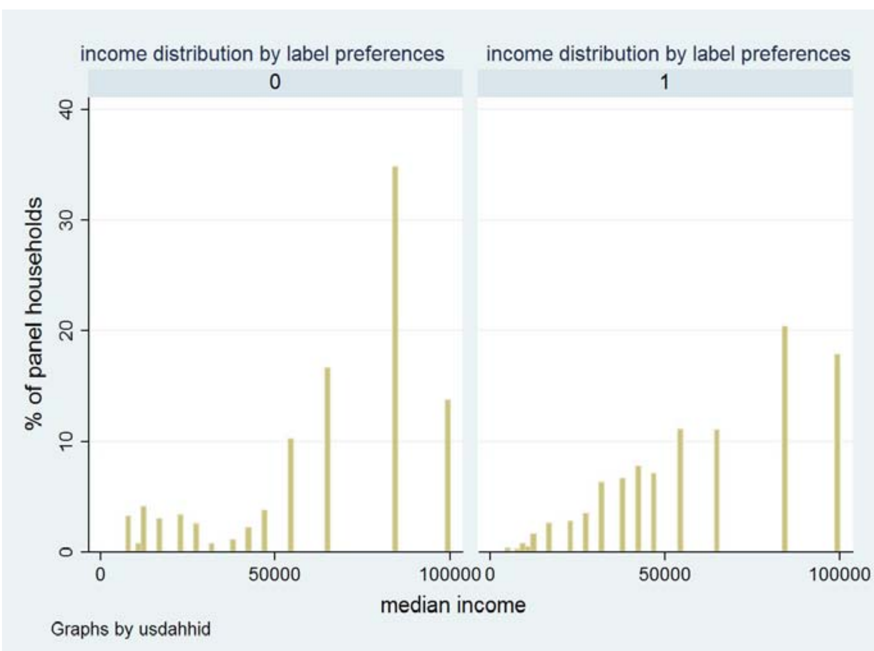
Figure 12: Levels of education by organic preferences (0= conventional purchases , 1= organic purchases)



Note: Education levels are:

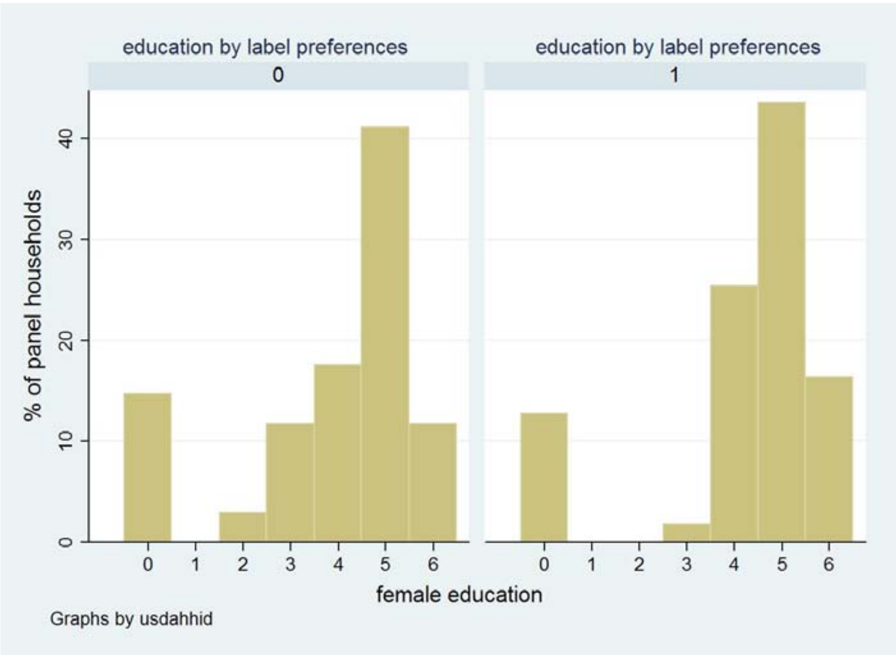
Grade School	1
Some High School	2
Graduated High School	3
Some College	4
Graduated College	5
Post College Grad	6
No Female Head or Unknown	0

Figure 13: income distribution by label preferences (0= organic purchases , 1= USDA organic seal purchases)



Note: median income brackets are: 5000, 7500, 9000, 11000, 13000, 17500, 22500, 7500, 32500, 37500, 42500, 47500, 55000, 65000, 85000, 100000

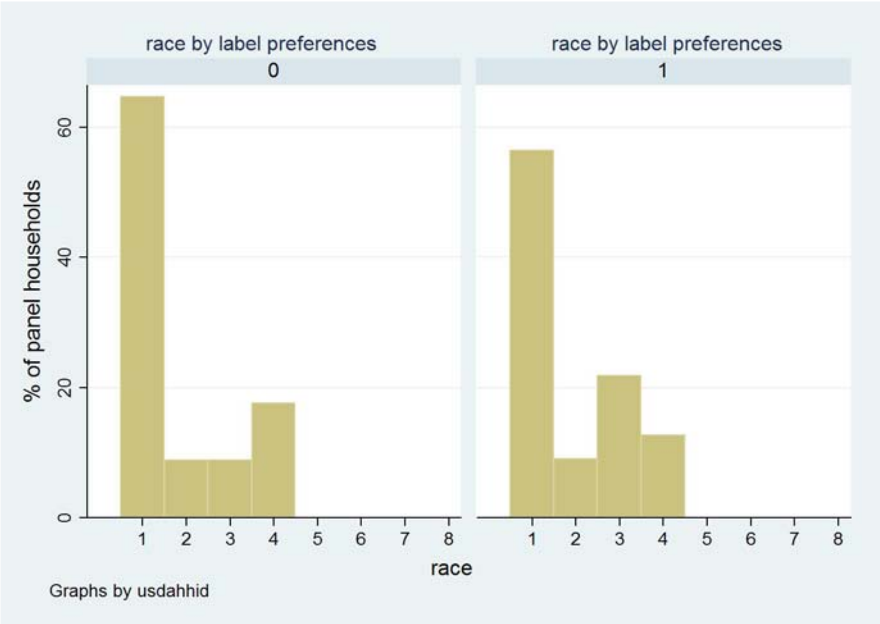
Figure 14: income distribution by label preferences (0= organic purchases , 1= USDA organic seal purchases)



Note: Education levels are:

Grade School	1
Some High School	2
Graduated High School	3
Some College	4
Graduated College	5
Post College Grad	6
No Female Head or Unknown	0

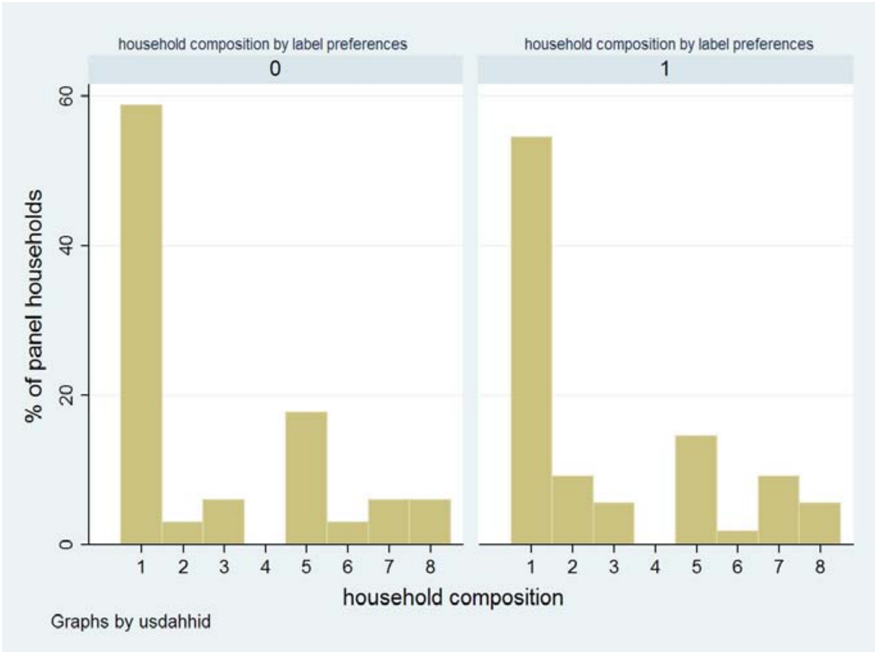
Figure 15: Race distribution by label preferences (0= organic purchases , 1= USDA organic seal purchases)



Note: Race categories are:

White	1
Black	2
Oriental	3
Other	4

Figure 16: Household composition by label preferences (0= organic purchases , 1= USDA organic seal purchases)



Note: composition specifications are:

Married	1
FH Living with Others Related	2
MH Living with Others Related	3
Female Living Alone	5
Female Living with Non-Related	6
Male Living Alone	7
Male Living with Non-Related	8