Household Level Welfare Effect of Organic Milk Introduction

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Abstract

This study analyzes the factors that determine the demand for milk products and the consumer benefits from organic milk introduction. Estimating a structural model, the welfare effect is decomposed into two parts: the effect of having an additional product and the effect from the price changes in existing products due to the enhanced competition. In order to take heterogeneous tastes for different product characteristics into account, the unit of analysis is defined at the Universal Product Code (UPC) level and the demand is estimated for each household. The estimates from mixed logit demand approach indicate that households with younger head, higher income or higher education value more for the organic attribute. The distribution of estimated variety effect shows similar implications as the parameter estimates. The compensating variation and price effects indicate that the overall benefits take about 8 percent of the current expenditure and half of it is from increased competition in the market.

I. Introduction

Firms have been seeking market power by constantly differentiating their products from competitors. Firms can make more profits associated with first movers' advantage by introducing new products. Consumers also benefit from the new product developments. How much consumers benefit from the quality improvement or additional attributes of the new good, variety effect (VE), and how much consumers benefit from the price changes of existing products driven by enhanced competition on the supply side, price effect (PE), are important economic questions to firms that formulate innovation and competition policy and to policy makers who regulate the market. Moreover, the welfare analysis at individual household level will provide more complete information for their decision-making procedure.

Although new product introduction is more frequent in high tech industries, recent innovations in the agricultural industry also make new products, such as Genetically Modified (GM) food and

Organic food, available to consumers. While various opinions on the effect of GM food products are not in agreement, consumers' concern on health and environment increase demand for organic food. As part of the organic food market, the organic milk market has also been growing. According to the United States Department of Agriculture (USDA), organic cow milk and soy milk drinks are the top two categories among processed organic products next to fresh products. Many studies analyze the demand for organic milk in various contexts in a timely manner, but very few studies are done in the context of welfare effects. To my knowledge, Dhar and Foltz (2005) is the only paper that analyzes the demand for organic milk in the context of its welfare impacts. They estimate the demand for milk and the welfare effect of specialty milk at the industry level categorizing milk products into three segments: recombinant bovine growth hormone (rBST) free labeled milk, organic labeled milk, and unlabeled (conventional) milk. The main weakness of their study is that their model does not take consumers' heterogeneous tastes into account. The absence of taste variables might lead to inaccurate estimates of welfare effects because the expected utility accounted for by taste variables will fall into the idiosyncratic error terms which will not be accounted in the welfare computation.

In this light, this study analyzes demand for milk at the disaggregated level of the industry, i.e., individual households' demand for milk products at the brand level. The demand model is specified at the individual household level to account for heterogeneous consumer behavior. The unit of analysis is defined at the Universal Product Code (UPC) level to accommodate product characteristics and consumer preferences. A discrete choice approach is employed to avoid dimensionality and missing value problems that usually occur in neo-classical demand systems defined at disaggregate levels. The model is specified with a random coefficient (or Mixed) logit following Berry et al. (2004) to incorporate both observed and unobserved heterogeneous consumer tastes. However, the model is estimated for individual households utilizing household level data while Berry et al. (2004) estimate the model at the market level utilizing aggregate data. The welfare effects of organic milk are measured with compensating variation in a partial equilibrium framework by computing both variety effects and price effects. The variety effects measure consumer's willingness-to-pay for the utility increase from the additional products holding the existing product prices constant at the post-introduction level. The price effects measure the welfare change from the existing products' price changes that are due to enhanced competition among suppliers after the introduction of new goods.

The results indicate that the age, income and education of the head in each household are associated with the preferences on the different types of milk products. For example, the parameter estimates evidence the preferences for organic milk of households with higher income, higher education or younger head. The estimated distributions of variety effects show that households with higher income or/and higher education value organic option more than households with lower income or/and lower education do. Households with elder heads do not value the organic characteristic as much as ones with younger heads.

The literature will be reviewed in section II and the structure of dairy industry is summarized in Section III. Section IV and section V discuss the model and the estimation methods, respectively. The results are presented in section VI and section VII concludes the study.

II. Literature Review

Discrete Choice Models

Different types of discrete choice models are developed in the studies where heterogeneous consumer tastes as well as the quality of products matter. In the discrete choice framework, the rational behavior of heterogeneous consumers is defined such that the consumer is assumed to choose one utility maximizing alternative from a set of choices that are mutually exclusive, exhaustive and finite. The utility an individual receives from choosing one alternative is known to the decision maker, but it is not completely observed by the researcher. Under the Random Utility Maximization (RUM) framework, different types of discrete choice models are derived depending on the distributional assumptions on unobserved component of the utility function.

The logit model can be derived if and only if the error term of RUM is independent and identically distributed and has a type I extreme value (or Gumbel) distribution. McFadden (1984) shows that the logit formula necessarily implies that unobserved utility is distributed extreme value. While the logit model is proven to work well in many applications, the model exhibits the

Independence from Irrelevant Alternatives (IIA) property which states that the ratio of purchasing probabilities for any two alternatives does not depend on any alternatives other than the two given alternatives. As pointed out by Chipman (1960) and Debreu (1960), this property is not behaviorally plausible in many cases although it may be realistic in some applications. The weakness of this property is well explained throughout the literature using the famous red bus/ blue bus problem developed by McFadden (1974).

In order to overcome the limitations of IIA property, models with more general dependence on explanatory variables and distributions that permit more general substitution patterns are introduced. For example, Ben-Akiva (1973) and Train et al. (1987) use nested logit models in which the set of alternatives faced by a decision maker can be partitioned into subsets so that IIA does not exist for alternatives in different subsets. However, the application of this model is limited because IIA still holds within each subset/nest, and the model does not explain unobserved preferences to the product characteristics. The probit model is derived by Marschak (1960) under the assumption of joint normal distribution of the error terms. The probit model not only overcomes the IIA property, but also represents random taste variation unlike standard logit or nested logit models. However, the model is restrictive in the sense that it requires normal distributions for all unobserved components of utility and its choice probability does not have a closed form so that the estimation requires exhaustive simulation.

Mixed logit models can be an alternative that is flexible and computationally practical. Defined as a multinomial logit model with random coefficients drawn from cumulative distributions, the mixed logit model accounts for unobserved taste variations and relaxes the IIA property. The underlying mixing distributions can be any parametric family such as multivariate normal or log normal. However, by keeping the idiosyncratic error term as iid extreme value, the model presents some properties of standard logit such that the choice probability has a closed form so that the simulation is relatively simple. In addition, mixed logit can approximate any Random Utility Maximization model under mild regulatory conditions (McFadden and Train 2000), while nested logit cannot represent all RUM consistent behavior and RUM consistent probit model requires special restrictions on covariance structures (McFadden 1981, 1984). Mixed logit approach has been known for many years, but full application with individual consumer tastes was not available until recent years mainly due to the difficulties of simulation and the unavailability of revealed consumer level preference data. In early applications, such as Boyd and Mellman (1980) and Cardell and Dunbar (1980), explanatory variables are invariant over individual households and the dependant variable is market share rather than individual choice. Later, BLP used socioeconomic variables but the choice probabilities are estimated at the market level utilizing aggregate data. Empirical studies at the individual consumer level, Train et al (1987) and Ben-Akiva et al. (1993), are also conducted, but only one or two dimensions of random coefficients are included due to the intensity of computation. Only a few recent papers in recreational cite choices, such as Murdock (2006) and Timmins and Murdock (2007), show the full power of mixed logits[1].

Demand for Differentiated Goods and Welfare Studies

Studies on the welfare effects of new product introduction have been conducted in many industries in various contexts from competitive structure of the industry to the true cost of living price index. As the industries become competitive, new product introduction is not an unusual phenomenon and new products are usually in the form of differentiated goods which are closely related but not identical. Accordingly, various methodologies estimating demands for a set of differentiated products are also developed to describe the market in the analysis.

Hausman and Leonard (2002) estimate the benefits to consumers associated with the introduction of a brand of bath tissue product adopting Gorman's multi-stage budgeting approach. Under the assumption of weakly separable preferences, Gorman argues that consumers allocate their income into broad groups of commodities at higher stages of budgeting and more detailed within-group allocation happens at lower levels. Thus, the demand functions at each stage depend only on group expenditure and prices of products within the group. Hausman and Leonard show that one can use this framework to formulate and estimate demand systems of differentiated goods in the Neoclassical demand framework. However, the main limitation of this approach is that it is difficult to apply at the individual household level because one can encounter a lot of zero purchasing observations and the estimation requires the integrals of

[1] To my knowledge, this paper is the first application of consumer level mixed logit in milk (food) demand literature.

multivariate probability density function that can be computationally cumbersome. Moreover, the model is somewhat restricted in its ability to accommodate a large number of commodities.

An alternative to the market-level representative agent approach is to incorporate consumer preferences over products as a function of consumer characteristics and product attributes in a discrete choice framework. There have been many efforts to analyze the demand for differentiated goods that reflects individual preferences. A few examples that are studied in the context of the welfare effects of new goods are summarized here. Trajtenberg (1989) suggests a discrete choice model with consumer and product attributes to measure the welfare change from computed topography (CT) scanners innovation although the characteristic variables could not be included in the actual estimation due to computational difficulty presented at that time. Berry, Levinsohn and Pakes (1995), BLP hereafter, provide techniques to estimate demand and supply for a class of differentiated products which only requires aggregate market-level data on the prices, quantities sold, and characteristics of the products. They incorporate consumer characteristics into the model by drawing pseudo data from Census data. BLP (1993) show that their procedure makes it possible to construct a price index closer to the true cost of living index that accounts for new product introduction with the application to the automobile industry. Petrin (2002) also studies the consumer benefits from the minivan introduction in the automobile industry. He estimates a market-level demand function that accounts for consumer-level heterogeneity in tastes using market-level data on sales and characteristics, with information that relates the average demographics of consumers to the characteristics of the products they purchase. He also finds that models without micro data yield much larger welfare numbers, primarily because the micro data appear to free the model from a heavy dependence on the idiosyncratic logit taste error. Although his method provides more precise estimates of demand when a researcher is constrained to market level data, it cannot substitute for a model incorporating consumer-level data.

One thing noticeable in this literature is that past studies in this area have mostly focused on developing estimation techniques to incorporate consumer taste variations under the constraint that only market level data are available and there are computational difficulties of multi-dimensional integration.

III. The Model

Following Nevo (2002) a structural model is proposed to measure the consumer welfare from organic milk introduction in a partial equilibrium framework. As mentioned, a mixed logit model is specified to describe the demands for milk. The consumer welfare is measured with compensating variation that is decomposed into two effects: variety effects and price effects. Hausman and Leonard (2002) estimate the price effects through “direct” and “indirect” methods. The direct price effects estimate price changes for existing products using both pre- and post-introduction data without putting any competitive structure on the model. The indirect price effects only use post-introduction data utilizing profit maximizing behavior of firms to simulate counterfactual prices at which consumers would have to pay for the existing products if the new product were not introduced.

In many welfare studies, indirect estimation is frequently used to predict price effects even if enough series of data are available due to the difficulties that may occur in some applications of direct estimation. First, it is hard to clearly distinguish pre- and post-introduction data when the exact time of introduction is not known or the product is gradually introduced over time and region. Second, it is difficult to control other variables that affect the prices if the emergence of other factors coincides with the introduction of the new product. Finally, welfare estimates differ according to the length of time period before and after the introduction included in the direct computation as shown in Ferrier and Zhen (2010). Since the time of organic milk introduction cannot be represented as a single point, although the data for organic purchases in this region are recorded from 2004, this study employs indirect estimation of price effects that incorporate the optimization conditions of firm behavior.

Demand

In a discrete choice framework, consumers are assumed to purchase one unit among alternatives that gives the maximum utility and ties are assumed to occur with zero probability. For simplicity, this model defines the set of alternatives as one package of different milk products within the cross section. The model does not consider multiple purchases in the same week or multiple trips[2] over the given year mainly to avoid complicated modeling and computations. While these issues[3] can be taken into account as an extension, each purchase is modeled as an independent event because the main concern of this paper is which factor has more of an impact on an individual's choice of milk products rather than how many products (or how often the products) are purchased by an individual. In addition, unlike the products in other industries, dairy products are perishable so that it is not likely that a household would purchase a large number of products in each trip. Thus, the single unit purchase assumption is reasonable although multiple purchases in the same week are still observed from the data[4]. Finally, it is also assumed that the model is conditional on the occasions when the consumers choose a type of milk product from the choice set. The model does not allow the possibility of not buying a milk product and probabilistic demand derived in the following section is conditional on participation in milk consumption. The utility obtained from purchasing a milk product in a Random Utility Maximization (RUM) framework is given by

$$U_{ij} = X_j \beta_i + Z_i X_j \theta + \gamma_i \left(y_i - p_{ij} \right) + \omega_j + \varepsilon_{ij}\,, \tag{1}$$

where X_j is a vector of observable attributes of alternative j; Z_i is a vector of observed attributes of household i; y_i is the income of household i; p_{ij} is the price household i faces in choosing j; β_i and γ_i are random coefficients that vary over consumers; ω_j is unobservable attributes of alternative j; ε_{ij} is an idiosyncratic source of utility for household i at choice j.

Equation (1) implies that the level of utility attained by alternative j is a function of the attributes of the alternative, consumer characteristics, and the economic variables that determine the budget constraint: income and price. p_{ij} is defined as price per gallon and y_i is defined as income allocated to gallon milk purchase. The term $(y_i - p_{ij})$ represents the money left over for household i associated with the purchase of choice j and the coefficient γ_i represents the

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[2] For simplicity in this study, the repeated trips by the same households are considered as the purchases of different households with same demographics taking cross-sectional approach.

[3] Dube (2005) accommodates assortment decisions of soft drink purchase following Hendel's (1999) multiple discreteness model. He derives the expected aggregate demand for each individual household where the consumption points and the shopping points are assumed not to coincide and consumers are assumed to purchase the aggregate amount of consumptions anticipated at the point of shopping.

[4] Detailed numbers are given in the data section.

marginal utility of income. The price varies across items and across individuals because the prices for the same item are different depending on which store the consumer purchased the product and whether he/she used discount coupon or a membership card[5]. The impacts of expenditure purchasing item j, γ_i, are specified to vary over individuals in order to avoid IIA restrictions and the mixing distribution is specified with a lognormal distribution to impose a downward sloping demand curve.

Heterogeneous consumer tastes on the product characteristics are accounted for in the model both systematically and randomly. The systematic (observed) consumer preferences can be captured by the interaction terms of observed consumer characteristics and alternative attributes. θ is a vector of parameters on the interaction terms and it represents the preferences of different types of consumers on the product characteristics. The random (unobserved) consumer preferences can be accounted for by allowing the coefficients of product characteristics to vary across decision makers with density a function $f(\beta)$. Thus, the random coefficients β_i capture the remaining taste variations that cannot be explicitly linked with individual's demographic characteristics. Following the convention of mixed logit applications, $f(\beta)$ is specified with a normal distribution and the random utility can be rewritten as

$$U_{ij} = X_j\bar{\beta} + X_j\sigma u_i + Z_iX_j\theta + \gamma_i(y_i - p_{ij}) + \omega_j + \varepsilon_{ij} \tag{2}$$

where $\bar{\beta}$ and σ are the mean and the standard deviation, respectively, of the normal distribution to be estimated. Observed product characteristics include fat content, organic claim and the package size of milk product. Observed consumer characteristics include family size, the age and education of head and income of family.

There may be additional factors related to the product attributes that are difficult to quantify or unobserved by the researcher but are frequent determinants of demand. These unknown alternative characteristics are captured in ω_j . Including this term is important in the sense that its absence will produce inconsistent parameter estimates. Berry (1994) argues that ignoring the

[5] Price data are recorded by each consumer with hand-held scanner at home rather than collected from supermarket counter. Different consumers can purchase the same items at different prices depending on which store or branch they purchase at.

unobserved characteristics will cause severe price endogeneity because the unobserved characteristics which are included in the error term are correlated with price. Murdock (2006) finds that failing to address unobserved characteristics causes welfare estimates for improvements to be biased. Her Monte Carlo simulations show that parameter estimates are less efficient and standard errors are biased.

The probability that the household i chooses alternative j can be derived following McFadden (1974).

$$P_{ij} = Prob\left(V_{ij}(\beta) + \varepsilon_{ij} > V_{ik}(\beta) + \varepsilon_{ik} \ \forall\, j \neq k \right)$$

$$= Prob(\varepsilon_{ik} < \varepsilon_{ij} + V_{ij}(\beta) - V_{ik}(\beta) \ \forall\, j \neq k) \tag{3}$$

where $V_{ij}(\beta) = X_j \bar{\beta} + X_j \sigma u_i + Z_i X_j \theta - \gamma_i p_{ij} + \omega_j$ and β is a vector of random and fixed coefficients.

Assuming the independently identically distributed extreme values for the idiosyncratic error term, ε_{ij}, the choice probabilities of random coefficient model are the integrals of standard logit probabilities over a density of parameters;

$$P_{ij} = \int L_{ij}(\beta)\, f(\beta) d\beta, \tag{4}$$

where

$L_{ij} = \frac{\exp\left(V_{ij}(\beta)\right)}{\sum_{k=1}^{J} \exp\left(V_{ik}(\beta)\right)}$ and $f(\beta)$ is the probability density function of mixing distributions.

Given the mixing distributions, the choice probability can be written;

$$P_{ij} = \int \frac{\exp\left(V_{ij}(\beta)\right)}{\sum_{k=1}^{J} \exp\left(V_{ik}(\beta)\right)}\, f(\beta | b, W) d\beta \tag{5}$$

where the lognormal density is assigned for $f(\beta|b,W)$ of price coefficient and the normal distribution is assigned for the parameters of other characteristics. b and W are the vectors of mean and covariance to be estimated.

Supply and Equilibrium

The marginal cost of each product is assumed to be constant before and after introduction of organic milk. The milk processing industry is assumed to exhibit constant returns to scale and its marginal cost assumed to be constant. Finally, supermarkets set retail prices as a fixed markup over the wholesale prices of the corresponding products.

Suppose there are F multiproduct firms competing in the market and each of them produces J_f items where $J_f \in J$ is a subset of j=1,2,…, J products. Then the profit that an individual firm f expects from producing J_f products can be presented as follows:

$$\Pi_f = M \sum_{j \in J_f} (p_j - mc_j) s_j(p, X; \theta) + C_f$$

where M is the market size, mc_j is the constant marginal cost of product j, C_f is the fixed cost, p_j is the price of product j, $s_j(p, X; \theta)$ is the market share of product j and $q_j(p, X; \theta) = Ms_j(p, X; \theta)$. The first order conditions for static price competition are given by

$$s_j(p, X; \theta) + \sum_{j \in J_f} (p_r - mc_r) \frac{\partial s_r(p, X; \theta)}{\partial p_j} = 0$$

This set of J equations implies that the price of single product is determined at the equilibrium where each multi-product firm maximizes its profits from all products produced within the firm. In vector notation, the equations above can be presented as follow.

$$s(p) + \Omega(p - mc) = 0 \qquad (6)$$

where s(p), p and mc are Jx1 vectors of market shares, prices and marginal costs. Ω is a JxJ matrix with $\Omega_{jr} = \Omega^*_{jr} * S_{jr}$, $S_{rj} = \partial s_r / \partial p_j$, $j, r = 1, \ldots, J$ and Ω^*_{jr} is defined as

$$\Omega_{jr}^{*} = \begin{cases} 1, & if\ \exists f:\{r,j\} \subset J_f \\ 0, & otherwise \end{cases}$$

This matrix is called the ownership matrix which implies competition and ownership structure among the brands and firms. The definition given above implies that firms maximize their profits from all the brands they produce. If the firms separately maximize their profits from single brands no matter how many brands of milk each firm produces, the ownership matrix should be defined with an identity matrix. If the firms collude in price, all the elements of the matrix should be ones.

Equation (6) can be rewritten as below to infer the unknown marginal costs for each firm. Given the equilibrium prices and demand estimates, marginal costs can be obtained by solving Equation (7) for marginal costs.

$$mc = p + \Omega^{-1}s(p) \tag{7}$$

The new equilibrium prices when there is no organic milk in the market can be estimated by solving the set of markup equations in Equation (6) using the marginal costs obtained in Equation (7) and a new ownership matrix where organic milk is removed. The dimension of the new matrix is (J-1)x(J-1) in this application since the number of new product is one. The new equilibrium prices hold under the assumption that the marginal costs do not change before and after introduction of organic milk.

IV. Data and Estimation

Data

AC Nielsen Homescan panel data are used for the estimation. The sample is selected among volunteers based on both demographic and geographic targets. Stratification is done by AC Nielsen to ensure that the sample matches the U.S. Census. The nationally representative sample consists of purchase histories of milk products at the Universal Product Code (UPC) level including price paid for the item, product characteristics and demographic information. The recorded price data for the same item may vary across households depending on the type of outlet, store location or whether the coupon/discount is applied or not. In addition to the characteristics variables, brief descriptions on each UPC are provided so that additional information on the products can be obtained.

For this study, weekly data in 2005 are collected. The unit of the item to be analyzed is defined with UPCs in order to examine the market at a very disaggregated level. UPC is the smallest unit of product that identifies the manufacturer and the category of the item. According to the dataset, there exist approximately 7,000 different UPCs in the nation in 2005. One thing notable about the dairy industry is that the market is fairly localized so that specific brands of milk only appear in specific regions although there exist, of course, some national brands. Thus, focusing on a specific regional market is inevitable in order to analyze milk product at the disaggregate level of industry. Some of metropolitan areas in North Carolina, which include Raleigh, Durham, Chapel-Hill (RDU) and Charlotte, are chosen for the study. Another point to note about the dairy industry is that the market is dominated by a few suppliers and supermarket brand products have the largest market shares. Although a specific regional market is selected for the study, there exist 600 UPCs and 86 brands in this market. It is difficult to manage the whole list of UPCs so top items with larger than 0.8% market shares are selected. As a result, this paper analyzes 39 items defined by UPCs, and the total market share of these 39 items is about 65% of milk sales. An interesting point is that 34 items out of 39 are private labeled milk products that account for 56%[6] of the market share.

50 UPCs among the 600 UPCs and 6 brands among the 86 brands fall into the organic category and each of UPCs in organic category takes on average less than 0.1% of the milk market. Thus, the organic products are aggregated across UPCs and considered as one product that is assumed to be produced by a single firm, Dean Food, the largest milk process company in the nation, because the company leads the organic milk market by taking more than 70 percent of market share among the organic milk brands.[7] In this way, the welfare analysis does not need to

[6] The market share for private labeled milk will be even larger if it considers the products not included in 39 items.

[7] Only the organic products in half gallon packages are included in the estimation because the gallon size products take only 0.17% of the market share while the half gallon take about 4% of the market share. Gallon size products

consider path dependence in which the order of introduction of each organic milk product affects the welfare estimate. The aggregate market share of the top selling items and combined organic products is about 70% and organic alone takes 4% of the market share. In order to represent the whole market, an outside good is defined. The rest of the products that account about for 30% of the market are aggregated and considered as one product called the "outside good". The items in the outside goods are assumed to be homogeneous. The mean values are used for the characteristics variables, but prices are left to vary because they vary across consumers. Therefore, 41 items are considered for the analysis and the individual unit of analysis is the individual household's probability of choosing each item defined here. A set of price data for the products that household i does not purchase is also created to compute the logit formula defined in Equation (4). If the item is purchased by other consumers in the same store of the same region in the same week, the average of the prices sold in the same store of the region in that week is used for the items not purchased by household i. If there is no record of sales for the item in the same store of the region in the same week, the average price of the same store of other regions in the same week is used. Finally, multiple purchases from the same trip are split into multiple shopping trips because this paper assumes each purchase is an independent event. The total number of purchases observed from the data is 38,689 purchases. Table 1 shows the ownership relations and market shares of milk brands. Table 2 shows summary statistics of the 41 items considered in the model. Table 3 summarizes demographic information.

Retailer and Manufacturer Relation

Note that the price data used here reflect retail prices while this paper analyzes manufacturers' behavior. As described in section II, raw milk is produced by dairy farmers and sold to processors usually through cooperatives as middle men. The milk products that consumers purchase are processed through pasteurization and homogenization, bottled and distributed by processors. There usually is another level of distribution between consumers and processors in the milk industry, which can be represented by retail stores, such as convenient stores, grocery

are not aggregated with the half gallon because it is considered that the prices are affected by package size and combining different size of organic milk might cause different estimation results.

stores and supermarkets[8]. Since the data observed are retail prices rather than wholesale prices that milk processors receive, and because this study excludes direct transactions between processors and commercial consumers, an additional assumption is necessary for the profit equations of manufacturers described in Equation (2) to hold. Following the convention in many of empirical Industrial Organization papers, I assume that retailers set price as a fixed markup or a constant margin over the corresponding wholesale price. Hausman and Leonard (2002) show that retail prices and retail demand elasticities can be used for the first order conditions of manufacturers under the assumption of constant margin or markup. Suppose that w is the wholesale price that processors receive and grocery stores charge b over w. Then the profit of milk processors is:

$$\Pi = (w - c)Q(w + b)$$

The first order conditions are

$$\partial \Pi / \partial w = Q(w + b) + (w - c)\, \partial Q(w + b)/\partial w = 0$$

or

$$Q(p) + (p - (c + b))\, \partial Q(p)/\partial p = 0$$

Therefore, by redefining manufacturers' marginal costs to be c+b in the constant margin case and c(1+b) in the constant markup case, retail prices can be used instead of wholesale prices.

The study on brand competition among saline crackers by Slade (1995) gives a rationale for the assumption of non competitive pricing strategy of grocery stores[9]. She interviewed grocery-chain marketing managers and found that most households shop at the same store each week and their choice of store is determined by location and the quality of the store rather than the pricing

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[8] Milk products can be distributed through both processors and retailers. Households purchase milk from retail stores, such as convenient store, supermarket, conventional grocery store and gourmet food store, but commercial customers, such as schools and restaurants, usually purchase directly from the manufacturers. The data obtained for this study reflect the prices at retail outlets.

[9] This does not mean that grocery stores fail to compete. Their competition is more through overall pricing policies, freshness of produce, consumer service, etc rather than through individual items.

policies of the store. Therefore, she finds it is reasonable to assume that competition is among brands within a store.

Demand

This section describes the procedure used for estimating the parameters in Equation (2). First, the terms in Equation (2) that only vary across alternatives are combined into one term following Murdock (2006). The alternative specific constant δ_j represents both observed and unobserved product characteristics as shown in Equation (9).

$$U_{ij} = X_j \sigma u_i + Z_i X_j \theta - \gamma_i p_{ij} + \delta_j + \varepsilon_{ij}\,, \tag{8}$$

$$\delta_j = X_j \bar{\beta} + \omega_j\,. \tag{9}$$

In the first step of the estimation, coefficients in Equation (8), along with alternative constants δ_j, are estimated. In the second step, the vector $\bar{\beta}$ in Equation (9) can also be estimated by regressing the estimated alternative specific constants from Equation (8) on the product characteristics variables with the OLS estimator.

Maximum Simulated Likelihood Estimator (MSLE) is used to estimate the random and fixed coefficients in Equation (8). First, the choice probabilities in Equation (5), where the expected utility is defined with a full set of alternative specific constants as explained in this section, are approximated by simulation. Random numbers are drawn by Halton[10] sequences and inverted into the numbers drawn from the each distribution[11] assigned for the parameters by the researcher. In each iteration, the logit formula $L_{ij}(\beta^r)$ is calculated with each draw and any given value for the parameters. The simulated probabilities are obtained by averaging the logit formula:

$$\widetilde{P_{ij}} = \frac{1}{R}\sum_{r=1}^{R} L_{ij}(\beta^r) \tag{10}$$

[10] 50 random numbers are drawn for each individual.

[11] The taste variations u_i are specified to be drawn from standard normal distribution, and the random parts of the parameter on price are specified to be drawn from log normal distribution with log(mean)=m and log(standard deviation)=s.

where R is the number of draws. Then the simulated probabilities are inserted into the log-likelihood function to find a simulated log-likelihood:

$$SLL = \sum_{i=1}^{I} \sum_{j=1}^{J} d_{ij}\, ln\, \widetilde{P_{ij}} \tag{11}$$

where d_{ij} is an indicator variable that has value 1 if individual i chooses alternative j, otherwise 0. The MSLE is the value of parameters that maximizes SLL. The Broyden-Fletcher-Goldfarb-Shanno (BFGS) Quasi-Newton method is used for searching the maximum numerically.

Elasticities

Mixed logit does not exhibit independence from irrelevant alternatives (IIA) or the restrictive substitution patterns of logit. The ratio of mixed logit probabilities depends on all the data since the denominators of logit formula are inside the integral so that do not cancel. The own price elasticities of alternative j and the cross price elasticities of alternative j and s for household i are respectively

$$E_{i,jj} = \frac{\partial P_{ij}}{\partial \mathrm{X}_{\mathrm{ij}}^{\mathrm{m}}} \frac{\mathrm{X}_{\mathrm{ij}}^{\mathrm{m}}}{P_{ij}} = \mathrm{X}_{\mathrm{ij}}^{\mathrm{m}} \int \frac{\beta^m}{P_{ij}} \left(1 - \frac{\exp\left(V_{ij}(\beta)\right)}{\sum_{k=1}^{J} \exp\left(V_{ik}(\beta)\right)}\right) f(\beta)\, d\beta \tag{12}$$

$$E_{i,js} = \frac{\partial P_{ij}}{\partial \mathrm{X}_{\mathrm{is}}^{\mathrm{m}}} \frac{\mathrm{X}_{\mathrm{is}}^{\mathrm{m}}}{P_{ij}} = -\mathrm{X}_{\mathrm{is}}^{\mathrm{m}} \int \frac{\beta^m}{P_{ij}} \frac{\exp\left(V_{ij}(\beta)\right)}{\sum_{k=1}^{J} \exp\left(V_{ik}(\beta)\right)} \frac{\exp\left(V_{is}(\beta)\right)}{\sum_{k=1}^{J} \exp\left(V_{ik}(\beta)\right)} f(\beta)\, d\beta \tag{13}$$

where β^m is the m-th element of vector β, the coefficient of price, and $\mathrm{X}_{\mathrm{ij}}^{\mathrm{m}}$ is the m-th element of vector X_{ij}, which is the price variable in this model. P_{ij} is the probability that household i chooses alternative j.

Welfare Analysis

With the logit assumptions, the consumer surplus associated with a given set of alternatives has a closed form and is easy to calculate. Denote $CS_i = \frac{1}{\alpha_i} \max\left(U_{ij},\ \forall j\right)$ as the consumer surplus for household i, where α_i is the marginal utility of income of household i. $\frac{dU_i}{dy_i} = \alpha_i$, with y_i the income of household i. The division by α_i translates utility into dollars. Since the researcher cannot observe U_{ij} but V_{ij}, the researcher is able to calculate the expected consumer surplus as $E(CS_i) = \frac{1}{\alpha_i}\mathrm{E}[\max(V_{ij} + \varepsilon_{ij}\,\forall j)]$, where the expectation is over all possible values of ε_i. Small and Rosen (1981) shows that, if each error ε_{ij} is i.i.d. type I extreme value and utility is linear in income, the expected consumer surplus can be derived as:

$$E(CS_i) = 1/\alpha_i \ln[\textstyle\sum_{j=1}^{J} \exp(V_{ij})] + C \tag{14}$$

where C is an unknown constant. Therefore, when the choice set for the consumers change from the observed scenario (post introduction of organic milk) to the counterfactual scenario (without organic choices), the change in expected consumer welfare for household i is

$$CV_i = \Delta e = \frac{1}{\alpha_i}\left[\ln[\textstyle\sum_{j=1}^{J} \exp(V_{ij}^{w}(p_1))] - \ln[\textstyle\sum_{j=1}^{J-1} \exp(V_{ij}^{wo}(p_0))]\right] \tag{15}$$

Compensating variation can be decomposed into the variety effect and the price effect as follows:

$$CV_i = \frac{1}{\alpha_i}\left[\ln\left[\textstyle\sum_{j=1}^{J} \exp\left(V_{ij}^{w}(p_1)\right)\right] - \ln\left[\textstyle\sum_{j=1}^{J-1} \exp\left(V_{ij}^{wo}(p_1^{e})\right)\right]\right]$$

$$+\frac{1}{\alpha_i}\left[\ln\left[\textstyle\sum_{j=1}^{J-1} \exp\left(V_{ij}^{wo}(p_1^{e})\right)\right] - \ln\left[\textstyle\sum_{j=1}^{J-1} \exp\left(V_{ij}^{wo}(p_0)\right)\right]\right] \tag{16}$$

where $\mathrm{V_{ij}} = \mathrm{X_j}\bar{\beta} + \mathrm{X_j}\sigma \mathrm{u_i} + \mathrm{Z_i X_j}\theta + \gamma_\mathrm{i}(\mathrm{y_i} - \mathrm{p_{ij}}) + \omega_\mathrm{j}$, $\mathrm{V_{ij}^{w}}$ is the indirect utility evaluated with organic milk, $\mathrm{V_{ij}^{wo}}$ is the indirect utility evaluated without organic milk, $\mathrm{p_1}$ is the vector of prices of all items after organic milk is introduced into the market, $\mathrm{p_1^{e}}$ is the vector of conventional milk prices at the original equilibrium and $\mathrm{p_0}$ is the vector of counterfactual prices of conventional milk when organic milk is not introduced into the market. The first bracket presents the variety effects and the second part measures the price effects.

The marginal utility of income α_i is approximated by γ_i in Equation (2) for welfare estimation in this study. It is notable that ω_j plays an important role in welfare estimation. If the new product has desirable unobserved characteristics, excluding this term will lead the welfare effects to be underestimated because $\mathrm{V_{ij}^{w}}$ will not take the positive characteristics into account. On the other hand, the welfare effects will be overestimated if the undesirable unobserved product characteristics are ignored.

As described in the previous section, p_0 is estimated by reverse engineering firm behavior under the Bertrand-Nash competition. Since the data for marginal costs, such as raw milk price paid to dairy farmers and bottling costs, are not available at the individual firm/processor level, marginal costs are inferred by solving Equation (7) using the ownership matrix with organic milk brand. The derivative terms in Equation (6) are computed with the elasticity estimates from the demand analysis. Counterfactual prices are evaluated using the ownership matrix without organic milk. Equation (6) is solved for prices utilizing the estimated marginal costs under the assumption that marginal costs do not change over the time when organic milk is introduced and not introduced yet. Marginal costs and counterfactual prices are evaluated for each city in each week since it is detected that the same items in different cities are sold at different prices and the price varies by week. Two cities, Charlotte and RDU (Raleigh-Durham-ChapelHill) are identified from the dataset.

V. Results

Parameter Estimates

The econometric approach outlined above is applied to the A.C. Nielsen Homescan data to estimate the probabilistic demand equations at the disaggregate level of industry. A variety of starting values are attempted in estimation and the model converged to the same values in each attempt.

Table 4 presents the parameter estimates for Equation (8) and (9). The random coefficient γ_i is assumed to follow a lognormal distribution in which the log of γ_i is normally distributed. I parameterize the lognormal distribution in terms of the underlying normal. In other words, I estimate parameters m and s which are the mean and variance of the log of the coefficient. Then the mean and variance of γ_i are derived from the estimates of m and s. The median is exp(m), the mean is exp(m+s/2), and the variance is exp(sm+2)[exp(s)-1]. The point estimates of m and s, which are -0.67 and 0.0016 respectively, imply that the coefficient γ_i has the mean, median and variance of 0.51, 0.51, and 0.009 respectively as shown in Table4. In other words, the average of marginal utility of income in this sample is 0.51 and its standard deviation is 0.095.

The interaction terms of product and demographic characteristics have the expected signs. Households with higher income or/and higher education value organic milk more than households with lower income or/and lower education do. However, the results indicate that households with older heads do not value the organic characteristic as much as the ones with younger heads. Note that the parameter estimates of product characteristics alone do not provide any implication on the overall impact of the attributes. The overall impact of organic factors on utility is calculated using the mean and median values of demographic characteristics given in Table3 and it is found that average households prefer organic milk to conventional milk. The overall impact of fat content also can be interpreted in the same manner. Households with average demographic characteristics prefer lower fat milk to higher fat milk.

Elasticities for each consumer are computed following the Equation (12) and (13). Table 5 presents the median of own and cross price elasticities of the consumers in the sample. Own price elasticities are ranged from -2.6 to -1.4, which are reasonable compared to the estimates in other studies in milk demand. For example, Dhar and Foltz (2005) find own price elasticities between -4.4 and -1.04, and Alviola (2010) finds between -2.0 and -0.87.

Cross price elasticities are all positive as expected. In the discrete choice model, cross price elasticities are positive as long as the parameter estimates of price is negative because all the variables in cross price elasticities are in a form of exponential function, thus the parameter estimates of price solely determine the sign of cross price elasticities. Therefore, organic milk and conventional milk are always substitutes to each other in this study unlike the findings from the aggregate demand in the previous chapter. This can be a very restrictive property in some applications, but it is intuitively sound in this application because one type of milk is usually thought to be a substitute for other types of milk product at the UPC level rather than to be a complement. Of course different milk products can be complements for some households, but this model rules out those cases. Although this study cannot test whether two products are complements, cross price elasticities provide implications on the strength of substitution patterns.

For example, the conventional milk is more substitutable for organic milk than what organic milk is substitutable for conventional milk. In addition, consumers tend to switch to the same package size milk products when there is an increase in the price of one good. Unlike the previous chapter, fat content and the labels of products do not determine substitution patterns in this model. Although some of the cross price elasticities in Table 5 look the same for the same sized products, it is hard to say that the model presents IIA property because they differ in higher decimal points (6^{th} decimal point) and the ratio of the largest elasticity to the smallest one is between 3 and 5.

Following Wold and Jureen (1953), group elasticities are also computed by taking weighted average where the weights are the market shares of each item in the group. The group cross-price elasticities shown in Table 6 also indicate the substitutability among the same size products. This result is consistent with the findings in the other studies in the demand for soft drinks at the UPC level. Although there is no previous study in milk demand at the UPC level, some studies in soft drinks, such as Guadagni and Little (1983) and Dube (2005), show that households tend to switch among products of the same package size.

Variety Effect

The variety effects (VE) are computed by subtracting the counterfactual indirect utility in which consumers do not have organic option from the actual indirect utility. Indirect utility is transformed into dollar terms dividing by the marginal utility of income estimated from random coefficient logit. The estimated total amount that consumers are willing to pay for the organic option is \$4595.4 in this sample. This is equivalent to 4% of the total milk expenditure in the sample. Demographic distributions of welfare effects are shown in Table 7 ~ Table 12. Each table presents the distribution of average variety effects of demographic groups. This information would be very useful in the sense that it provides insight into the characteristics that differentiate the potential organic household from the potential conventional household.

Household income and education of the head of the household seem to be associated with the valuation of organic milk. The results indicate that the households with higher income value the organic milk more than the households with lower income do in general. The results also indicate that the households headed by someone with higher education appreciate the organic milk more than the ones with lower education. This could be because income and education are correlated, and higher education probably enhances the understanding of organic process of dairy produce and its impact on environment. Or this might be because the marginal utility of income is larger for low income households than for higher income households and the welfares in dollar term are smaller for lower income households since the welfare numbers are the utility divided by marginal utility of income.

The age of head in a household also seems to be a factor that distinguishes the consumer who values organic milk. Table 7 shows that households with an older head appreciate organic option less than the ones with younger heads. The results imply that households with a head between 25 and 29 years old benefit the most from organic milk. Households headed by someone between 30 and 34 years old are ranked next. This can be explained by the fact that younger people have a tendency to accept new products more easily than older people. However, households with a head younger than 25 years old do not value organic milk as much as the others. This might be because consumers in this category do not earn income as much as older ones who are more experienced.

The presence of child does not have the expected effect. According to the results, consumers without a child benefit more from organic milk than ones with children although it is expected that young mothers tend to want organic milk for their children. However, among the households with children, welfare is greater as the age of child is smaller.

Although it is impossible to compare directly with other studies because there are no welfare studies on organic milk at the household level, the welfare distributions in this study are similar to the distributions of demand for organic milk at the household level. For example, according to Dimitri and Venezia (2007) households with higher education and income are more likely to purchase organic milk. Alviola and Capps (2010) also find that income and education play an important role in organic milk purchase while the presence of children does not affect the organic purchases.

Although the distributions of welfare effects present similar implications as the parameter estimates, it should be noted that each demographic variable in the distribution cannot be interpreted as a ceteris paribus factor that determines the amount of welfare effects of each individual while the demographic variable in utility function is a factor that determines the utility holding other variables constant. In other words, each distribution is estimated without controlling other demographic characteristics. Thus, the distribution depends on the set of demographic characteristics for each individual.

Price Effect

Utilizing the estimated marginal costs, the first order conditions are solved again for the counterfactual prices of conventional milk when organic milk is not introduced. Table 13 and Table 14 present the median current and counterfactual prices in Charlotte and Raleigh-Durham-ChapelHill (RDU), respectively. The last columns of the tables indicate that overall milk prices are decreased after the organic milk introduction. This can be interpreted as increased competition in the market due to the new product. The average change is larger in RDU than in Charlotte, and the number of items whose prices are decreased is larger in RDU. Pricing policies on individual items are mixed across the cities and the firms. For example, firm A lowered the prices of most items that it sells in Charlotte but raised the prices in RDU after the organic introduction. On the other hand, firm B and firm C raised the prices for most of its items sold in Charlotte while they decreased prices in RDU. Firm F, which is the firm introduced organic milk, also shows different pricing strategies in two cities. It lowered the prices of items sold in RDU, but raised the prices in Charlotte. The pricing strategy in Charlotte shows cannibalization effects in which the new product introducer raises the prices of existing brands to promote the sales of new product. However, note that firm F decreased the price of the most popular brand among its brands[12].

The price effect that is the second part of the Equation (16) is evaluated with the estimated counterfactual prices. The results imply that non-organic purchasers in this region benefit about $4,048 from the enhanced competition in fluid milk market. This is equivalent to 3.47% of milk expenditure in this data set. Together with the variety effect whose estimate was $4,591 from the

[12] Brand ID is assigned in the order of market share.

previous chapter, total consumer welfare translated is $8,639 and it is 7.41% of the expenditure in this data set.

This study does not provide the welfare analysis of manufacturers, but some intuitions can be gained by observing the changes in individual firms' margins. Table 15 and Table 16 report the estimated marginal costs and the margins of individual items sold in Charlotte and RDU, respectively. The post-introduction margins indicate that fluid milk is a high profit industry with the average margins of 57% in RDU and 62% in Charlotte. The estimated margins seem realistic given that the average conventional milk price is about $3.6 per gallon and the wholesale price is about $14.4 per cwt, which is equivalent to $1.2 per gallon. It is notable that the price-cost margin of organic milk is less than the industry average. Some brands produced by firm F and firm C are ranked as highest margins independent from the existence of organic milk. The estimated marginal costs are larger and the price-cost margins are smaller in Charlotte than in RDU, but it does not necessarily mean that firms make less profit in Charlotte because the quantity sold is larger in Charlotte. The last columns of the table indicates that, upon introduction of organic milk, the margins of conventional milk brands decreased in both cities although the changes are greater in RDU than in Charlotte. Decreased margins imply that the prices are decreased while marginal costs are constant regardless of whether organic milk is sold. However, the decrease in margins does not mean that profits are reduced since the quantity changes after the introduction of organic milk are not known.

VI. Conclusion

The objective of this study is to investigate individual households' welfare improvement from organic milk introduction in the partial equilibrium framework. Welfare studies with individual household level data can yield more information than studies with aggregate level data because one can estimate the distributions of welfare effects according to consumers' demographic characteristics. The decomposed welfare measurements, price effects and variety effects, provide comprehensive understanding in the sources of consumer benefits.

The demands for milk products are estimated for each individual household by adopting discrete choice approach. In order to take both observed and unobserved heterogeneous preferences, random coefficient logit model is specified for each household's probability to choose an alternative. Parametric distributions for the random coefficients are estimated. The results indicate that consumers with higher income and education are more likely to purchase organic product, but less likely to buy higher fat milk. It is also found that the households with elder heads are more likely to prefer higher fat milk and conventional milk. Cross price elasticities show that conventional milk is more substitutable to organic milk than organic milk is substitutable for conventional milk. Cross price elasticities also indicate the substitutability among the same package size products. The variety effects are computed for each individual whose distributions yield similar implications as the parameter estimates and total measure takes approximately 4% of total milk expenditure in the sample. Finally, the benefits from price changes in conventional milk prices are quantified. The supply-side approach is incorporated with price sensitivity from the demand analysis to approximate the equilibrium in the fluid milk market. Marginal costs are estimated assuming that multiproduct firms compete in a Bertrand-Nash fashion where the firms choose prices to maximize profits.

The mixed logit model employed for this study is well known for its competence in modeling individual economic behavior. The model has the advantage that it requires substantially fewer parameters to be estimated than a typical flexible functional form such as Almost Ideal Demand System requires. Thus, the number of alternatives that a system of demand equations can accommodate in the choice set is not limited in this model, and qualitative variables such as demographic characteristics can also be included in the model as many as desired. Secondly, the number of zero observations, which a researcher frequently encounters when s/he estimates demand equations with disaggregate level data, is relatively small while a lot of zero purchases occur in the estimation of flexible demand functions because the functions are generally in the form of share equations. Modeling the zero purchasing behavior can be computationally cumbersome because it requires the integrals of multivariate density function. In addition, the model satisfies the restrictions of consumer demand theory, does not hold IIA properties, and is flexible enough to approximate any RUM consistent choice probabilities. However, it is worth to mention the limitations of this model for other applications. Although the model yields more flexible cross price elasticities than the standard logit model, it still imposes certain degree of restrictions on the substitution patterns compared with the conventional flexible demand functions. In addition, this study assumes that consumers choose only one alternative on each shopping trip for computational simplicity as mentioned above. This assumption can be very restrictive in the applications of highly storable goods market such as wine and soft drinks, and one will face difficulties when s/he models multiple choices. Finally, the linear dependence of systematic utility on economic variables makes this model quite restrictive.

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<Table 1 Description of Items>

item	market share	brand	Firm	organic	Size	fat
1	4.2	private label	Food Lion	0	1	2
2	4.0	Composite Product of Organic	Dean Food	1	2	.
3	3.3	private label	Harris Teeter	0	1	0
4	2.8	private label	Food Lion	0	1	3
5	2.8	private label	Food Lion	0	1	0
6	2.8	private label	Wal Mart	0	1	2
7	2.4	private label	Food Lion	0	2	2
8	2.2	private label	Harris Teeter	0	2	2
9	2.3	private label	Wal Mart	0	1	0
10	2.0	private label	Food Lion	0	2	3
11	2.0	private label	Friendly Farms	0	1	2
12	2.0	private label	Bi-Lo	0	1	2
13	1.8	private label	Food Lion	0	1	1
14	1.8	private label	Wal Mart	0	1	3
15	1.7	private label	Harris Teeter	0	1	2
16	1.7	PET	Dean Food	0	1	3
17	1.8	private label	Friendly Farms	0	1	0
18	2.4	Country Fresh	Dean Food	0	1	0
19	1.6	private label	Harris Teeter	0	2	0
20	2.1	Country Fresh	Dean Food	0	1	2
21	1.6	private label	Harris Teeter	0	1	1
22	1.5	private label	Bi-Lo	0	1	0
23	1.4	private label	Wal Mart	0	1	1
24	1.2	private label	Bi-Lo	0	1	3
25	1.1	private label	Food Lion	0	2	1
26	1.1	private label	Food Lion	0	2	0
27	1.1	PET	Dean Food	0	1	2
28	1.0	private label	Bi-Lo	0	2	2
29	0.9	private label	Wal Mart	0	2	0
30	0.9	private label	Harris Teeter	0	2	3
31	0.9	private label	Lowes	0	1	2
32	0.9	private label	Wal Mart	0	2	2
33	1.0	private label	Friendly Farms	0	1	3
34	1.3	private label	Dean Food	0	1	3
35	0.9	private label	Harris Teeter	0	2	1
36	0.9	private label	Lowes	0	1	3
37	1.0	private label	Lowes	0	1	1
38	0.9	private label	Harris Teeter	0	1	1
39	1.0	private label	Lowes	0	1	0
40	0.7	private label	Wal Mart	0	2	3
41	31.2	outside goods	.	0	1.5	1.6

all of organic milk products are included in item2. Fat contents vary within item 2. Size1=Gallon, Size2=Half Gallon.
fat 0=fat free, 1=1% low fat, 2= 2% reduced fat, 3=whole milk, 2.3=soy milk
values for item 41(outside goods) are mean values

<Table2 Market Share by Product Attributes>

		Market Share
size	Gallon	49.0
	Half Gallon	19.8
	outside	31.2
fat	Fat Free	18.7
	Low Fat	8.6
	Reduced Fat	23.2
	Whole milk	18.2
	outside	31.2

<Table 3 Demographic Description>

	Mean	Standard Deviation	Min	Max	Median
Income	10.7	0.6	8.5	11.5	10.8
Education	4.1	1.1	1.0	6.0	4.0
Age of Head	5.0	0.9	2.5	6.0	5.2
Household Size	2.6	1.3	1.0	9.0	2.0

note: The values for income are the log of income
Education 1= Grade School, 2=Some High School, 3= Graduate High School,
4= Some College, 5= Graduated College, 6= Post College Grad
Age of Head is divided by 10

<Table 4 Parameter Estimates>

Variable	Parameter	Value	Standard Error
income-price	Mean of ln(coefficient)	-0.67***	0.08
	Std dev of ln(coefficient)	0.04***	0.05
	Mean of coefficient	0.51	
	Median of coefficient	0.51	
	Std dev of coefficient	0.095	
Fat	Mean	1.08***	0.3
	std. dev.	-0.02	0.04
fat*age	Coefficient	-0.04***	0.01
fat*edu	Coefficient	-0.13***	0.01
fat*income	Coefficient	-0.11***	0.01
Organic	Mean	-4.09*	2.48
	std. dev.	2.60	0.25
organic*age	Coefficient	-0.16**	0.05
organic*edu	Coefficient	1.06***	0.06
organic*income	Coefficient	0.63***	0.08
size	Mean	-2.49***	0.42
	std. dev.	2.27	0.18
size*family size	Coefficient	-0.52***	0.03
	SLL at convergence	115959.09	

Note: values for price related parameters are estimated in the form of ln(coefficient).
The estimates for size variables should be interpreted as an opposite direction since the values of size are assigned in opposite way, i.e. gallon=1 and half gallon=2.

<Table 5 Elasticity Estimates, Mean Values>

Item				2	3	5	9	17	22	39
	brand			Organic	CTL	CTL	CTL	CTL	CTL	CTL
		fat			FF	FF	FF	FF	FF	FF
			size	2	1	1	1	1	1	1
2	Organic		2	-2.029	0.027	0.022	0.014	0.011	0.011	0.008
3	CTL	FF	1	0.042	-1.900	0.066	0.043	0.033	0.031	0.023
5	CTL	FF	1	0.042	0.081	-1.798	0.043	0.033	0.031	0.023
9	CTL	FF	1	0.042	0.081	0.066	-1.477	0.033	0.031	0.023
17	CTL	FF	1	0.042	0.081	0.066	0.043	-1.424	0.031	0.023
22	CTL	FF	1	0.042	0.081	0.066	0.043	0.033	-1.604	0.023
39	CTL	FF	1	0.042	0.081	0.066	0.043	0.033	0.031	-1.859
19	CTL	FF	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
26	CTL	FF	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
29	CTL	FF	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
13	CTL	LF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
21	CTL	LF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
23	CTL	LF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
37	CTL	LF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
38	CTL	LF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
25	CTL	LF	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
35	CTL	LF	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
1	CTL	RF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
6	CTL	RF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
11	CTL	RF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
12	CTL	RF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
15	CTL	RF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
31	CTL	RF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
7	CTL	RF	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
8	CTL	RF	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
28	CTL	RF	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
32	CTL	RF	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
4	CTL	WH	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
14	CTL	WH	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
24	CTL	WH	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
33	CTL	WH	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
36	CTL	WH	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
10	CTL	WH	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
30	CTL	WH	2	0.119	0.031	0.025	0.016	0.013	0.012	0.009
40	CTL	WH	2	0.119	0.031	0.025	0.017	0.013	0.012	0.009
18	CNTY	FF	1	0.042	0.081	0.066	0.043	0.034	0.031	0.023
20	CNTY	RF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
27	PET	RF	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
16	PET	WH	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
34	CNTY	WH	1	0.042	0.081	0.066	0.043	0.033	0.031	0.023
41	Outside			0.079	0.055	0.045	0.029	0.023	0.021	0.016

Item				19	26	29	13	21	23	37	38
	Brand			CTL	CTL	CTL	CTL	CTL	CTL	CTL	CTL
		fat		FF	FF	FF	LF	LF	LF	LF	LF
			size	2	2	2	1	1	1	1	1
2	Organic		1	0.044	0.030	0.019	0.015	0.013	0.009	0.007	0.007
3	CTL	FF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
5	CTL	FF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
9	CTL	FF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
17	CTL	FF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
22	CTL	FF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
39	CTL	FF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
19	CTL	FF	2	-2.570	0.056	0.035	0.017	0.015	0.011	0.009	0.009
26	CTL	FF	2	0.082	-2.496	0.035	0.017	0.015	0.011	0.009	0.009
29	CTL	FF	2	0.082	0.056	-1.763	0.017	0.015	0.011	0.009	0.009
13	CTL	LF	1	0.018	0.012	0.008	-1.832	0.040	0.028	0.023	0.023
21	CTL	LF	1	0.018	0.012	0.008	0.044	-1.954	0.028	0.023	0.023
23	CTL	LF	1	0.018	0.012	0.008	0.044	0.040	-1.505	0.023	0.023
37	CTL	LF	1	0.018	0.012	0.008	0.044	0.040	0.028	-1.801	0.023
38	CTL	LF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	-1.983
25	CTL	LF	2	0.082	0.056	0.035	0.017	0.015	0.011	0.009	0.009
35	CTL	LF	2	0.082	0.056	0.034	0.017	0.015	0.011	0.009	0.009
1	CTL	RF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
6	CTL	RF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
11	CTL	RF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
12	CTL	RF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
15	CTL	RF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
31	CTL	RF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
7	CTL	RF	2	0.082	0.056	0.034	0.017	0.015	0.011	0.009	0.009
8	CTL	RF	2	0.082	0.056	0.034	0.017	0.015	0.011	0.009	0.009
28	CTL	RF	2	0.082	0.056	0.034	0.017	0.015	0.011	0.009	0.009
32	CTL	RF	2	0.082	0.056	0.035	0.017	0.015	0.011	0.009	0.009
4	CTL	WH	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
14	CTL	WH	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
24	CTL	WH	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
33	CTL	WH	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
36	CTL	WH	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
10	CTL	WH	2	0.082	0.056	0.034	0.017	0.015	0.011	0.009	0.009
30	CTL	WH	2	0.082	0.056	0.034	0.017	0.015	0.011	0.009	0.009
40	CTL	WH	2	0.082	0.056	0.034	0.017	0.015	0.011	0.009	0.009
18	CNTY	FF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
20	CNTY	RF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
27	PET	RF	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
16	PET	WH	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
34	CNTY	WH	1	0.018	0.012	0.008	0.044	0.040	0.028	0.023	0.023
41	Outside			0.044	0.030	0.018	0.030	0.027	0.019	0.015	0.015

item				25	35	1	6	11	12	15	31
	brand			CTL	CTL	CTL	CTL	CTL	CTL	CTL	CTL
		fat		LF	LF	RF	RF	RF	RF	RF	RF
			size	2	2	1	1	1	1	1	1
2	Organic		1	0.031	0.025	0.033	0.019	0.012	0.014	0.014	0.007
3	CTL	FF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
5	CTL	FF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
9	CTL	FF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
17	CTL	FF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
22	CTL	FF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
39	CTL	FF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
19	CTL	FF	2	0.059	0.047	0.038	0.023	0.015	0.016	0.016	0.008
26	CTL	FF	2	0.059	0.047	0.038	0.023	0.015	0.016	0.016	0.008
29	CTL	FF	2	0.059	0.047	0.039	0.023	0.015	0.016	0.016	0.008
13	CTL	LF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
21	CTL	LF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
23	CTL	LF	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
37	CTL	LF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
38	CTL	LF	1	0.013	0.011	0.101	0.059	0.038	0.042	0.042	0.021
25	CTL	LF	2	-2.517	0.047	0.039	0.023	0.015	0.016	0.016	0.008
35	CTL	LF	2	0.059	-2.627	0.039	0.023	0.015	0.016	0.016	0.008
1	CTL	RF	1	0.013	0.011	-1.776	0.059	0.038	0.043	0.042	0.021
6	CTL	RF	1	0.013	0.011	0.101	-1.592	0.038	0.043	0.042	0.021
11	CTL	RF	1	0.013	0.011	0.101	0.059	-1.464	0.043	0.042	0.021
12	CTL	RF	1	0.013	0.011	0.101	0.059	0.038	-1.646	0.042	0.021
15	CTL	RF	1	0.013	0.011	0.101	0.059	0.038	0.043	-1.955	0.021
31	CTL	RF	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	-1.875
7	CTL	RF	2	0.059	0.047	0.039	0.023	0.015	0.016	0.016	0.008
8	CTL	RF	2	0.059	0.047	0.039	0.023	0.015	0.016	0.016	0.008
28	CTL	RF	2	0.059	0.047	0.039	0.023	0.015	0.016	0.016	0.008
32	CTL	RF	2	0.059	0.047	0.039	0.023	0.015	0.016	0.016	0.008
4	CTL	WH	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
14	CTL	WH	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
24	CTL	WH	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
33	CTL	WH	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
36	CTL	WH	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
10	CTL	WH	2	0.059	0.047	0.039	0.023	0.015	0.016	0.016	0.008
30	CTL	WH	2	0.059	0.047	0.039	0.023	0.015	0.016	0.016	0.008
40	CTL	WH	2	0.059	0.047	0.039	0.023	0.015	0.016	0.016	0.008
18	CNTY	FF	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
20	CNTY	RF	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
27	PET	RF	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
16	PET	WH	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
34	CNTY	WH	1	0.013	0.011	0.101	0.059	0.038	0.043	0.042	0.021
41	Outside			0.031	0.025	0.068	0.040	0.026	0.029	0.029	0.014

item				7	8	28	32	4	14	24	33	36
	brand			CTL	CTL	CTL	CTL	CTL	CTL	CTL	CTL	CTL
		fat		RF	RF	RF	RF	WH	WH	WH	WH	WH
			size	2	2	2	2	1	1	1	1	1
2	Organic	.	1	0.067	0.057	0.024	0.019	0.021	0.012	0.008	0.006	0.006
3	CTL	FF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
5	CTL	FF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
9	CTL	FF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
17	CTL	FF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
22	CTL	FF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
39	CTL	FF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
19	CTL	FF	2	0.130	0.109	0.045	0.036	0.025	0.014	0.009	0.007	0.008
26	CTL	FF	2	0.130	0.109	0.045	0.036	0.025	0.014	0.009	0.007	0.008
29	CTL	FF	2	0.130	0.109	0.046	0.036	0.025	0.014	0.009	0.007	0.008
13	CTL	LF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
21	CTL	LF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
23	CTL	LF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
37	CTL	LF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
38	CTL	LF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
25	CTL	LF	2	0.130	0.109	0.045	0.036	0.025	0.014	0.009	0.007	0.008
35	CTL	LF	2	0.130	0.109	0.045	0.036	0.025	0.014	0.009	0.007	0.008
1	CTL	RF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
6	CTL	RF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
11	CTL	RF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
12	CTL	RF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
15	CTL	RF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
31	CTL	RF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
7	CTL	RF	2	-2.443	0.109	0.046	0.036	0.025	0.014	0.009	0.007	0.008
8	CTL	RF	2	0.130	-2.525	0.046	0.036	0.025	0.014	0.009	0.007	0.008
28	CTL	RF	2	0.130	0.109	-2.193	0.036	0.025	0.014	0.009	0.007	0.008
32	CTL	RF	2	0.130	0.109	0.046	-1.975	0.025	0.014	0.009	0.007	0.008
4	CTL	WH	1	0.029	0.024	0.010	0.008	-1.820	0.037	0.025	0.018	0.020
14	CTL	WH	1	0.029	0.024	0.010	0.008	0.065	-1.658	0.025	0.018	0.020
24	CTL	WH	1	0.029	0.024	0.010	0.008	0.065	0.037	-1.740	0.018	0.020
33	CTL	WH	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	-1.528	0.020
36	CTL	WH	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	-1.900
10	CTL	WH	2	0.130	0.109	0.046	0.036	0.025	0.014	0.009	0.007	0.008
30	CTL	WH	2	0.130	0.109	0.046	0.036	0.025	0.014	0.009	0.007	0.008
40	CTL	WH	2	0.130	0.109	0.046	0.036	0.025	0.014	0.009	0.007	0.008
18	CNTY	FF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
20	CNTY	RF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
27	PET	RF	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
16	PET	WH	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.018	0.020
34	CNTY	WH	1	0.029	0.024	0.010	0.008	0.065	0.037	0.025	0.019	0.020
41	Outside			0.069	0.058	0.024	0.019	0.044	0.025	0.017	0.012	0.013

item				10	30	40	18	20	27	16	34
	brand			CTL	CTL	CTL	CNTY	CNTY	PET	PET	CNTY
		fat		WH	WH	WH	FF	RF	RF	WH	WH
			size	2	2	2	1	1	1	1	1
2	Organic		1	0.052	0.025	0.016	0.013	0.012	0.007	0.011	0.007
3	CTL	FF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
5	CTL	FF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
9	CTL	FF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
17	CTL	FF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
22	CTL	FF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
39	CTL	FF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
19	CTL	FF	2	0.099	0.048	0.031	0.014	0.014	0.008	0.014	0.009
26	CTL	FF	2	0.099	0.048	0.031	0.014	0.014	0.008	0.014	0.009
29	CTL	FF	2	0.099	0.048	0.031	0.015	0.014	0.008	0.014	0.009
13	CTL	LF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
21	CTL	LF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
23	CTL	LF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
37	CTL	LF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
38	CTL	LF	1	0.022	0.010	0.007	0.038	0.037	0.022	0.036	0.023
25	CTL	LF	2	0.099	0.048	0.031	0.014	0.014	0.008	0.014	0.009
35	CTL	LF	2	0.099	0.048	0.031	0.014	0.014	0.008	0.014	0.009
1	CTL	RF	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
6	CTL	RF	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
11	CTL	RF	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
12	CTL	RF	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
15	CTL	RF	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
31	CTL	RF	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
7	CTL	RF	2	0.099	0.048	0.031	0.014	0.014	0.008	0.014	0.009
8	CTL	RF	2	0.099	0.048	0.031	0.014	0.014	0.008	0.014	0.009
28	CTL	RF	2	0.099	0.048	0.031	0.014	0.014	0.008	0.014	0.009
32	CTL	RF	2	0.099	0.048	0.031	0.014	0.014	0.008	0.014	0.009
4	CTL	WH	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
14	CTL	WH	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
24	CTL	WH	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
33	CTL	WH	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
36	CTL	WH	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	0.023
10	CTL	WH	2	-2.446	0.048	0.031	0.014	0.014	0.008	0.014	0.009
30	CTL	WH	2	0.099	-2.542	0.031	0.014	0.014	0.008	0.014	0.009
40	CTL	WH	2	0.100	0.048	-2.127	0.014	0.014	0.008	0.014	0.009
18	CNTY	FF	1	0.022	0.010	0.007	-1.208	0.037	0.022	0.036	0.023
20	CNTY	RF	1	0.022	0.011	0.007	0.038	-1.359	0.022	0.036	0.023
27	PET	RF	1	0.022	0.011	0.007	0.038	0.037	-1.655	0.036	0.023
16	PET	WH	1	0.022	0.011	0.007	0.038	0.037	0.022	-1.629	0.023
34	CNTY	WH	1	0.022	0.011	0.007	0.038	0.037	0.022	0.036	-1.502
41	Outside			0.053	0.025	0.016	0.026	0.025	0.015	0.024	0.016

<Table 6 Group Level Elasticities>

Size			2	1	1	1	1	2	2	2	2	1	1	1
	Brand			CTL	CTL	CTL	CTL	CTL	CTL	CTL	CTL	CNTY	PET	CNTY
		Fat	Organic	FF	LF	RF	WH	FF	LF	RF	WH	FF	RF	WH
		Organic	-2.03	0.09	0.05	0.10	0.05	0.09	0.06	0.17	0.09	0.01	0.02	0.02
1	CTL	FF	0.04	-1.47	0.16	0.30	0.16	0.04	0.02	0.07	0.04	0.04	0.06	0.06
1	CTL	LF	0.04	0.28	-1.68	0.30	0.16	0.04	0.02	0.07	0.04	0.04	0.06	0.06
1	CTL	RF	0.04	0.28	0.16	-1.46	0.16	0.04	0.02	0.07	0.04	0.04	0.06	0.06
1	CTL	WH	0.04	0.28	0.16	0.30	-1.62	0.04	0.02	0.07	0.04	0.04	0.06	0.06
2	CTL	FF	0.12	0.11	0.06	0.12	0.06	-2.23	0.11	0.32	0.18	0.01	0.02	0.02
2	CTL	LF	0.12	0.11	0.06	0.12	0.06	0.17	-2.51	0.32	0.18	0.01	0.02	0.02
2	CTL	RF	0.12	0.11	0.06	0.12	0.06	0.17	0.11	-2.15	0.18	0.01	0.02	0.02
2	CTL	WH	0.12	0.11	0.06	0.12	0.06	0.17	0.11	0.32	-2.30	0.01	0.02	0.02
1	CNTY	FF	0.04	0.28	0.16	0.30	0.16	0.04	0.02	0.07	0.04	-1.21	0.06	0.06
1	PET	RF	0.04	0.28	0.16	0.30	0.16	0.04	0.02	0.07	0.04	0.04	-1.43	0.06
1	CNTY	WH	0.04	0.28	0.16	0.30	0.16	0.04	0.02	0.07	0.04	0.04	0.06	-1.55

<Table 7 Variety Effects by Age>

Age	_FREQ_	Total	Average
~25	40	5.2	0.129
25~29	558	113.4	0.203
30~34	2286	384.9	0.168
35~39	3250	453.6	0.140
40~44	4372	543.8	0.124
45~49	5420	665.8	0.123
50~54	5242	647.1	0.123
55~59	8709	886.0	0.102
60~	8812	891.7	0.101

<Table 8 Variety Effects by Education>

Edu	_FREQ_	Total	Average
Grade school	450	4.2	0.009
Some high school	1608	28.1	0.017
Graduate high school	10621	457.4	0.043
Some college	10906	980.1	0.090
Graduate college	10860	1852.7	0.171
Post college graduate	4244	1268.9	0.299

<Table 9 Variety Effects by Income>

income	_FREQ_	Total	Average
Under $5000	295	15.1	0.051
5000-7999	373	12.2	0.033
8000-9999	211	7.4	0.035
10,000-11,999	417	24.3	0.058
12,000-14,999	1184	65.3	0.055
15,000-19,999	2391	126.6	0.053
20,000-24,999	2545	218.7	0.086
25,000-29,999	2683	217.6	0.081
30,000-34,999	3504	329.7	0.094
35,000-39,999	2655	275.3	0.104
40,000-44,999	2264	243.4	0.108
45,000-49,999	2383	230.9	0.097
50,000-59,999	5000	629.2	0.126
60,000-69,999	3392	483.4	0.143
70,000-99,999	6261	1125.2	0.180
100,000 & Over	3131	587.0	0.187

<Table 10 Variety Effects by Family Size>

HHSize	_FREQ_	Total	Average
1	6491	1028.6	0.158
2	16157	1922.3	0.119
3	6870	808.5	0.118
4	5692	656.7	0.115
5	2379	149.8	0.063
6	980	21.5	0.022
7	96	3.3	0.034
9	24	0.7	0.028

<Table 11 Variety Effects by the Presence of Child>

Child	_FREQ_	Total	Average
0	27298	3347.1	0.123
1	11391	1244.3	0.109

<Table 12 Variety Effects by Average Age of Children>

Average age of children	_FREQ_	Total	Average
3	3349	451.7	0.135
9	2327	285.7	0.123
12	2216	158.4	0.071
15	3499	348.5	0.100

<Table 13 Predicted Price Change in Raleigh, Durham and Chapel-Hill, median values>

item	Firm	size	fat	Counterfactual	actual price (post intro)	change after introduction
1	A	1	2	3.65	3.83	0.19
4	A	1	3	3.82	3.85	0.03
5	A	1	0	3.84	3.85	0.01
7	A	2	2	5.26	5.29	0.02
10	A	2	3	5.32	5.24	-0.07
13	A	1	1	3.84	3.84	0
25	A	2	1	6.25	5.18	-1.07
26	A	2	0	5.35	5.3	-0.05
3	B	1	0	3.85	3.98	0.13
8	B	2	2	5.23	5.38	0.15
15	B	1	2	3.99	3.92	-0.07
19	B	2	0	5.41	5.38	-0.03
21	B	1	1	3.96	3.89	-0.07
30	B	2	3	6.22	5.38	-0.84
35	B	2	1	5.43	5.38	-0.05
38	B	1	1	6.09	3.9	-2.19
6	C	1	2	3.19	3.35	0.16
9	C	1	0	3.03	2.92	-0.11
14	C	1	3	3.3	3.3	-0.01
23	C	1	1	3	3.08	0.08
29	C	2	0	3.62	3.51	-0.11
32	C	2	2	3.96	3.96	0
40	C	2	3	4.44	4.29	-0.15
11	D	1	2	2.96	2.89	-0.07
17	D	1	0	2.87	2.79	-0.08
33	D	1	3	3.1	3.02	-0.09
12	E	1	2	3.48	3.45	-0.03
22	E	1	0	4.98	3.41	-1.56
24	E	1	3	3.49	3.24	-0.25
28	E	2	2	6.14	4.43	-1.71
16	F	1	3	3.28	3.13	-0.14
18	F	1	0	2.52	2.45	-0.07
20	F	1	2	2.59	2.67	0.08
27	F	1	2	3.3	2.99	-0.31
34	F	1	3	4.94	2.97	-1.97
31	G	1	2	3.73	3.85	0.12
36	G	1	3	3.77	3.85	0.08
37	G	1	1	3.71	3.89	0.18
39	G	1	0	3.67	3.85	0.18
41	outside			4.68	4.04	-0.64
average				4.13	3.87	-0.26

<Table 14 Predicted Price Change in Charlotte, median values>

Item	Firm	size	fat	Counterfactual	actual price (post intro)	change after introduction
1	A	1	2	3.67	3.62	-0.05
4	A	1	3	3.69	3.64	-0.05
5	A	1	0	3.59	3.6	0
7	A	2	2	5.02	4.93	-0.09
10	A	2	3	4.95	4.92	-0.03
13	A	1	1	3.62	3.62	0
25	A	2	1	5.03	4.97	-0.05
26	A	2	0	4.97	4.92	-0.05
3	B	1	0	3.84	3.83	-0.01
8	B	2	2	5.05	5.12	0.08
15	B	1	2	3.79	3.85	0.06
19	B	2	0	5.07	5.13	0.06
21	B	1	1	3.82	3.87	0.05
30	B	2	3	5.07	5.01	-0.06
35	B	2	1	4.99	5.14	0.15
38	B	1	1	3.87	3.9	0.02
6	C	1	2	3.22	3.2	-0.03
9	C	1	0	2.92	2.96	0.04
14	C	1	3	3.3	3.29	0
23	C	1	1	2.99	2.96	-0.03
29	C	2	0	3.5	3.49	-0.01
32	C	2	2	3.88	3.92	0.04
40	C	2	3	4.17	4.2	0.04
11	D	1	2	2.93	2.93	0
17	D	1	0	2.84	2.85	0.01
33	D	1	3	3.01	3	-0.02
12	E	1	2	3.28	3.26	-0.02
22	E	1	0	3.2	3.15	-0.05
24	E	1	3	3.38	3.44	0.05
28	E	2	2	4.35	4.34	-0.01
16	F	1	3	3.31	3.22	-0.09
18	F	1	0	2.35	2.42	0.07
20	F	1	2	2.71	2.72	0.01
27	F	1	2	3.25	3.28	0.03
34	F	1	3	2.96	2.97	0.01
31	G	1	2	3.65	3.63	-0.03
36	G	1	3	3.54	3.64	0.1
37	G	1	1	3.54	3.53	-0.01
39	G	1	0	3.61	3.6	-0.01
41	outside			4.56	4.08	-0.48
	average			3.76	3.75	-0.01

<Table 15 Marginal Costs in Raleigh, Durham and Chapel-Hill, median values>

item	Firm	Marginal Cost (MC)	Margins w/ organic	Margins w/o organic	changes in margin
1	A	1.2	68.28	67.1	1.18
4	A	1.39	65.15	63.55	1.6
5	A	1.43	63.58	62.92	0.65
7	A	2.75	48.61	47.74	0.87
10	A	2.8	46.59	47.33	-0.74
13	A	1.42	62.3	62.97	-0.66
25	A	3.74	26.02	40.22	-14.2
26	A	2.84	36.48	46.89	-10.41
3	B	1.62	53.07	57.96	-4.89
8	B	2.95	31.92	43.65	-11.72
15	B	1.79	44.83	55.19	-10.37
19	B	3.12	30.31	42.29	-11.98
21	B	1.77	41.34	55.13	-13.79
30	B	3.94	21.69	36.6	-14.91
35	B	3.17	29.67	41.57	-11.9
38	B	3.89	1.09	36.08	-34.99
6	C	0.96	70.66	69.78	0.88
9	C	0.8	73.28	73.64	-0.36
14	C	1.04	66.25	68.42	-2.17
23	C	0.77	64.67	74.32	-9.65
29	C	1.45	38.21	59.87	-21.66
32	C	1.81	41.6	54.3	-12.7
40	C	2.26	27.22	49.05	-21.83
11	D	0.9	40.93	69.7	-28.77
17	D	0.81	55.01	71.81	-16.79
33	D	1.04	52.54	66.54	-13.99
12	E	1.41	35.94	59.47	-23.53
22	E	2.96	31.64	40.46	-8.82
24	E	1.45	37.25	58.56	-21.3
28	E	4.14	21.67	32.61	-10.94
2	F	3.04	49.14	N/A	N/A
16	F	1.06	59.97	67.56	-7.59
18	F	0.33	89.47	86.9	2.57
20	F	0.39	76.94	84.98	-8.04
27	F	1.12	57.82	66.21	-8.39
34	F	2.74	35.72	44.47	-8.75
31	G	1.68	54.59	54.92	-0.33
36	G	1.72	55.23	54.32	0.92
37	G	1.66	49.32	55.18	-5.86
39	G	1.62	48.83	55.88	-7.05
41	outside	1.45	63.99	68.94	-4.95

<Table 16 Marginal Costs in Charlotte, median values>

Item	Firm	Marginal Cost (MC)	Margins w/ organic	Margins w/o organic	changes in margin
1	A	1.28	64.66	65.13	-0.47
4	A	1.29	64.68	65.17	-0.49
5	A	1.2	66.5	66.48	0.02
7	A	2.53	48.63	49.55	-0.92
10	A	2.47	49.9	50.16	-0.26
13	A	1.23	66.1	66.1	0
25	A	2.55	48.69	49.23	-0.54
26	A	2.5	49.16	49.73	-0.56
3	B	1.61	58.07	58.13	-0.06
8	B	2.71	47.16	46.36	0.8
15	B	1.57	59.25	58.63	0.62
19	B	2.74	46.55	45.95	0.6
21	B	1.59	58.79	58.3	0.49
30	B	2.72	45.73	46.35	-0.62
35	B	2.68	47.86	46.27	1.59
38	B	1.65	57.74	57.49	0.25
6	C	1.01	68.38	68.65	-0.27
9	C	0.71	75.97	75.61	0.36
14	C	1.08	67.23	67.26	-0.03
23	C	0.77	73.87	74.16	-0.29
29	C	1.34	61.73	61.84	-0.11
32	C	1.71	56.48	56.01	0.47
40	C	1.99	52.77	52.37	0.4
11	D	0.85	70.85	70.87	-0.03
17	D	0.77	73.08	72.99	0.09
33	D	0.93	68.79	68.95	-0.16
12	E	1.19	63.38	63.56	-0.17
22	E	1.13	64.2	64.77	-0.57
24	E	1.3	62.2	61.62	0.59
28	E	2.3	46.89	46.99	-0.1
2	F	3.04	49.81	N/A	N/A
16	F	1.1	65.7	66.68	-0.98
18	F	0.15	93.68	93.48	0.2
20	F	0.5	81.6	81.53	0.07
27	F	1.03	68.44	68.16	0.28
34	F	0.76	74.56	74.51	0.05
31	G	1.61	55.62	55.92	-0.31
36	G	1.49	59.11	57.92	1.2
37	G	1.49	57.67	57.76	-0.1
39	G	1.56	56.57	56.67	-0.09
41	outside	1.47	63.99	67.76	-3.77