The Impact of Food Environment on Branded vs. Private Label Produce Choice

Christiane Schroeter, PhD*
Assistant Professor
Agribusiness Department
California Polytechnic State University
San Luis Obispo, CA 93407

Xiaowei Cai, PhD
Assistant Professor
Agribusiness Department
California Polytechnic State University
San Luis Obispo, CA 93407

*Corresponding Author

The Impact of Food Environment on Branded vs. Private Label Produce Choice

Abstract

Over the past two decades, U.S. food retailers are providing more organic private label foods (PLs) which are directly competing with the National Brand (NB) products. From a policy perspective, an increased availability of high-quality PL products might provide consumers with a more affordable way to cover their produce consumption. Using a two-step Heckman selection model, we estimate the impact of purchase information, demographics, and food environment on the purchasing likelihood and expenditure shares of PL organic vs. conventional spinach. Results show that food context, most notably food availability, access, and adult obesity rate, significantly influences organic PL spinach choice.

Keywords: Brand Loyalty, Quality, Private label, Food Environment

JEL codes: I18, D12, R23

The Impact of Food Environment on Branded versus Private Label Produce Choice

Introduction

Over the past two decades, U.S. food retailers are providing more private label foods (PLs) which are directly competing with the National Brand (NB) products (Volpe 2011). Most supermarkets offer at least one PL option in nearly all product categories. Originally, PLs competed as generic and cheaper versions with their high-priced NB substitute (Anders and Ahmad 2011; Connor and Peterson 1992). As shown in previous economic studies, NB products aim to convince consumers that the brand name should be associated with quality (e.g. Rao and Monroe 1989; Dodds et al. 1991). Branding increases consumer awareness, loyalty, and leads to increased willingness-to-pay for the product (Ubilava et al. 2011).

Given the increasing popularity of PLs, consumers are starting to develop loyalty towards these goods (Karp 2012). Formerly perceived to be of lower quality and limited to product categories such staple foods, modern PLs have improved in product quality relative to NBs. PL brands are now available in the premium, organic, and even produce sections with the goal to distinguish themselves from their competitors' product lines (Volpe 2011). This quality improvement has led to two consequences. First, an improvement in the objective quality of a good enhances its subjective consumer perception (Grunert 1995). Second, quality modifications of PLs increase the competition with branded products. This price-quality competition is particularly pronounced in sectors such as organic produce, which shows the highest growth rates in annual sales of organic foods and beverages (Organic Trade Association (OTA) 2011). An increased availability of high-quality PLs might provide consumers with a more affordable way to cover their produce consumption.

Declining produce consumption patterns are commonly attributed to rising demands for convenience foods and declining food preparation skills (Biltstein, Snider, and Evans 2012). Given its convenience, triple-washed cello-packed spinach has become one of the fastest growing segments in the produce industry (USDA-ERS 2007). Figure 1 shows the sales trend of conventional and organic PL bagged spinach in the Western U.S. over time. Organic PL spinach sales increased from $10 million to $27 million 2007 to 2010, with a growth rate of 170%. In comparison, conventional PL spinach sales increased by over five times from $4 million to $25 million during the same time (Information Resources, Inc. (IRI) 2011).

Figure 1 here

This organic produce sales trend is of particular interest to policy makers who aim at increasing the U.S. per-capita produce consumption to reduce adult obesity. In particular, food environmental factors such the number of grocery stores may have an increasingly important effect on a household's produce choice (Sturm and Datar 2005). As such, given an increasing density of specialty foods stores that offer their own line of PLs, organic produce has shifted from niche to mainstream goods. This has created a more diverse demographic customer base with regard to age, income, and education. Thus, there is need for research that estimates a consumer profile of PL consumers, together with information about food environmental factors.

The objective of this study is to analyze the purchasing decision of PL spinach. Specifically, this study compares the impact of spinach purchase information, demographics, and the food environment on (1) the purchasing likelihood of PL organic spinach consumers, PL conventional spinach consumers, and all spinach consumers, and (2) expenditure shares of PL organic, PL conventional, and all PL spinach consumers. Furthermore, we investigate whether there is any differences in PL selection and expenditure between the organic and conventional consumers.

Developing a better understanding of factors that impact the purchasing behavior of PL vs. NB consumers will provide important insight to researchers, industry and policy makers. Given the success of this healthy convenience product, a better understanding of its consumer profile could help manufacturers develop products which better correspond to consumer tastes and preferences. Food distributors will benefit by developing more effective marketing strategies in a more competitive and saturated produce market. Finally, policy makers may be able to gain understanding about the food environmental impacts on consumer profiles and needs with the goal to specify targeted nutrition education.

Conceptual Model and Data

We evaluate two groups of spinach consumers: organic and conventional consumers. For each group, consumers make a sequential decision of (1) whether to choose PL or NB spinach; and (2) how much to spend on it. In order to derive a better understanding with regard to the purchasing and expenditure decisions of these two groups of spinach buyers, we will investigate their sequential purchase decisions separately.

In the first step, household i makes the product choice to maximize utility. For example, household i's utility from selecting product j is given as:

$$U_{ij} = V_{ij} + \epsilon_{ij} \qquad (1)$$

where household i's random utility U_{ij} consists of a determinant part V_{ij} and an uncertain part ϵ_{ij}. ϵ_{ij} can be observed by the consumers, but not the researchers. V_{ij} can be determined by a set of observable variables X_{ij} such as household demographics and brand characteristics (Dettmann and Dimitri 2007; Zhuang, Dimitri and Jaenicke 2009). Based on McFadden (1974), the probability of household i selecting product j is:

$$p_{ij} = \frac{e^{X_{ij}\gamma}}{\sum_j e^{X_{ij}\gamma}} \quad (2)$$

where γ denotes a set of coefficients related to the corresponding observable variables X_{ij}.

In the first step, household i's probability of selecting PL is $p(U_{ipl} \geq U_{inb})$ since PL is chosen over NB when the utility of selecting PL, U_{ipl}, is higher than the utility U_{inb} derived from NB. Therefore, we observe a PL selection, i.e., $PL_i = 1$, for household i if and only if this household's latent utility $PL_i^* = U_{ipl} - U_{inb} \geq 0$. Therefore, household $i's$ observed PL purchase choice is given by:

$$PL_i = X_i\gamma + \mu_i \quad (3)$$

Where $PL_i = 1$ when $PL_i^* \geq 0$ and $PL_i = 0$ when $PL_i^* < 0$.

In the subsequent stage, household $i's$ PL expenditure E_i^{PL} is analyzed. The optimal expenditure amount results from the household's utility maximization, i.e., $E_i^{PL} = argmax_E(U_i|PL_i = 1)$. Because E_i^{PL} is only occurs when the household purchased a PL product, household i's PL expenditure in each category (organic or conventional) is then determined by:

$$E_i^{PL} = Z_i\beta + \theta\lambda_i + \varepsilon_i \quad (4)$$

where β is a set of coefficients related to the selected set of variables Z_i that influence household i's PL expenditure decision, and λ is the inverse Mill's ratio from the first step in (3).

We use the 2007 Symphony IRI Group of Information Resources Inc. (IRI) National Consumer Network Panel on individual households' pre-packaged spinach purchases in the U.S. Western region (IRI 2011). The panel is based on a demographically representative sample of 100,000 households nationwide. Panel members could either be volunteers or recruited by IRI. After their purchase, participating households used hand-held scanners to record the dates of

spinach purchases, Universal Product Code (UPC) code, purchase volume, and total expenditures. Random weight purchases, such as of fresh loose-leaf spinach, are not included in the data set (Lusk and Brooks 2011). The IRI Consumer Panel also provides associated household demographic information (IRI 2011). In addition, we added food environmental factors that might influence the individual household's purchase of PL spinach, and their expenditure shares.

The food environmental variables are collected from the 2007 Food Environment Atlas based on each household's Federal Information Processing Standards (FIPS) code (USDA-ERS 2010). FIPS codes uniquely identify geographic areas (U.S. Census Bureau 2011). The data from the Food Environment Atlas include FIPS code-specific information about food accessibility, two different related price ratios, local per-capita at-home food consumption, food availability and adult obesity rate.

Our full sample includes 2,607 households residing in the U.S. West that purchased spinach at least once during year of 2007. This spinach purchase could be either PL vs. NB, and within these categories either or conventional spinach. This study employs three groups of variables: household spinach purchase information, demographics, and food environment information.

Table 1 shows the definitions, means and standard deviations of each variable used in the estimations. The table is divided into four categories. While the purchase of PL spinach and its expenditure share served as our dependent variables, the remaining three variable categories were used as independent variables in our analyses.

Table 1 here

As indicated in Table 1, there are three samples: the general spinach consumer sample, organic consumer sample and conventional consumer sample. The full sample includes all the households in the dataset, with a total observation of 2,607. The organic sample includes 753 households that purchased organic spinach, while the conventional sample has a total of 1,854 households that purchased conventional spinach. Figure 2 shows the structural relationship between our estimated models.

Figure 2 here

In the full sample, 18% of the households purchased PL spinach during 2007, where PL spinach represents an 11% expenditure share of total spinach purchase. Interestingly, nearly 40% of organic spinach buyers have purchased PL organic spinach with a 32% PL expenditure share of total organic spinach. However, only 9% of conventional buyers have made a PL purchase. with 6% PL expenditure share of total conventional purchase amount. As obtained from the IRI data set, spinach consumers in the Western U.S. spend an average of $8.24 on organic spinach, and $6.40 on conventional spinach. The average household purchases of organic and conventional spinach are 1.39 and 2.14 pounds, respectively.

In the full sample, of all male household heads that purchased spinach at least once during 2007, 30% could be classified as mid-aged. A mid-aged female resides in 47% of the households and only 15% of the household heads have a post-graduate degree. The majority, 66%, of the household heads is married. In addition, 15% of the households have one child, 7% have two children, and 78% have no children. In the organic (conventional) sample, among all male household heads that purchased organic (conventional) spinach, 32% (29%) belong to the mid-age group, 43% (49%) of the households have female heads that are mid-aged. With regard to education, 17% and 14% of the household heads have a post-graduate degree in the organic and

conventional samples, respectively. Among the organic (conventional) consumers, 18% (14%) have one child, 6% (7%) have two children, and 76% (79%) have no kids.

On average, the price of dark green vegetables is 37% higher than the regional price of starchy vegetables. The starchy vegetables include plain and frozen potatoes, corn, lima beans, and green peas. The average price of fruits is about 36.1% of the average packaged savory snacks, which include potato chips, pretzels and crackers. All the regional average prices are measured in $ per gram.

We included two variables that measure consumers' food accessibility. The variable 'HH no car' indicates the percentage of households in a county that live more than 10 miles from the nearest supermarket or large grocery store but have no car. According to the USDA-ERS Food Atlas (2010), specialized food stores include outlets mainly engaged in retailing specialized foods such as retail bakeries, meat and seafood markets, dairy stores, and produce markets. Variables as fruit and vegetable consumption per capita and sweet snack consumption per capita are indicators of regional food-at-home consumption levels. The per-resident fruit and vegetable information is based on fresh, frozen and canned produce purchased, excluding juices. A representation of the regional per-residents is provided with the packaged sweet snacks, which include cookies and candy bars.

Regarding consumer health, we utilized the adult obesity rate from the USDA-ERS Food Atlas, which is an estimate of age-adjusted percentages of residents older than 20 with obesity defined as a BMI $\geq$ 30 kg/m^2. These obesity estimates are based on data from the Behavioral Risk Factor Surveillance System (BRFSS) for 2007 and the U.S. Census Bureau (USDA-ERS 2010). This variable models the regional relationship between a household's food choices, given the surrounding average adult obesity rates. Frequently termed "built environment", previous

research has led to mixed findings regarding the impact of the external environment on individual food consumption (Hill et al. 2003). Christakis and Fowler (2007) suggested that obesity does not spread among neighbors in the immediate geographic location. However Papas et al. (2007) report a statistically positive association between the food environment and obesity. We expect that in given food environment, we may observe a "peer effect" with regard to produce consumption since consumers may behave similarly. Thus, consumers in an area with a lower average adult obesity rate may exhibit healthier behavior such as purchasing more spinach.

Estimation Approach

Following Dettman and Dimitri (2007) and Zhuang et al. (2009), we are using the Heckman two-step selection model because it generates consistent and asymptotically efficient parameter estimates compared to the standard least squares regression methods (Heckman 1990). In the first stage, a household's PL spinach purchase decision is estimated using a binary logistic regression to understand how the individual household's demographic, spinach purchase quantity and dollar amount, and food environmental impact the PL vs. NB choice. In the second stage, the PL spinach expenditure share is explained by a group of household demographic, spinach purchase and food environmental variables using a least squares estimation. The inverse Mills Ratio λ estimated from the first stage is also included in the second stage to control for the selection bias.

Given the mixed findings of previous studies, there is a need for defining a profile of the PL food consumer. For instance, while some findings (e.g. Richardson, Jain and Dick 1996) suggest that low-income households purchase more PL products than higher income households, other studies show the opposite (e.g., Zhuang, Dimitri, and Jaenicke 2009). An increased educational

level will increase the chance of purchasing vegetables including PLs (e.g. Stevens-Garmon, Huang, and Lin 2007; Zhuang, Dimitri, and Jaenicke 2009). Furthermore, Lin, Reed, and Lucier (2004) determined that women older than 40 eat the most spinach out of all female age groups.

However, an important factor that is usually not taken into account in the literature is the intricacy of food environment, peer effect and health factors that affect consumer food choices. Food choices reflect the complex way in which individuals select, consume, and utilize the available food supply based on factors such as cultural background, food environment, food accessibility, and economic status (Schroeter and House 2007). Regarding the food environmental variables, we include the number of specialty food stores and the percentage of households in the county that do not have cars and live over 10 miles away from the closest super center or major grocery store to measure household access to produce including organic produce. Kamphuis et al. (2006) gave an excellent summary of the environmental influences on fruit and vegetable consumption. We expanded their findings by including the regional per-capita consumptions of fruit and vegetables and sweet snacks, and the local adult obesity rate to indicate the influence of peers' eating habit and food choices on individual household's produce purchase decision.

In regression equation (5), the probability of household's selecting PL spinach over NB is a function of information regarding household spinach purchases represented by the average total spinach expenditures and purchase quantity; household demographic variables, such as education, age, gender, and marital status are included as independent variables; and food environmental variables such as the number of specialized food stores, regional per-capita fruit and vegetable consumption, and per-capita sweet snack consumption, and the percentage of households in the county that do not have cars and live over 10 miles away from the closest

super center or major grocery store are also included. Moreover, the relationship between produce selection behavior and a given health condition is represented by the regional adult obesity rate.

$$\begin{aligned}\text{Prob}(PL_i) = {} & \gamma_0 + \gamma_1 \text{ Total purchase value}_i + \gamma_2 \text{ Total purchase volume}_i \\ & + \gamma_3 \text{ Male mid-aged}_i + \gamma_4 \text{ Female mid-aged}_i + \gamma_5 \text{ Married}_i \\ & + \gamma_6 \text{ Post-graduate}_i + \gamma_7 \text{ Specialized stores}_i + \gamma_8 \text{ Fruit and veg/capita}_i \\ & + \gamma_9 \text{ Sweet snack/capita}_i + \gamma_{10} \text{ HH no car}_i + \gamma_{11} \text{ Adult obesity rate}_i + \varepsilon_{1i} \quad (5)\end{aligned}$$

The share of each household's PL spinach expenditure is determined by various demographic, spinach purchase and food environmental variables and is given by:

$$\begin{aligned}\text{PL share}_i = {} & \beta_0 + \beta_1 \text{ Total purchase value}_i + \beta_2 \text{ Total purchase volume}_i \\ & + \beta_3 \text{ HH income}_i + \beta_4 \text{ Children}_i + \beta_5 \text{ Married}_i + \beta_6 \text{ Specialized stores}_i \\ & + \beta_7 \text{ Price ratio Green leafy/Starchy}_i + \beta_8 \text{ Price ratio Fruit/Savory}_i + \varepsilon_{2i} \quad (6)\end{aligned}$$

Equation (6) includes some of the variables from the logistic estimation. However, it expands the analysis by focusing on impacts that might directly influence PL spinach expenditures, such as the household per-member income and whether the household has children under age of 18. In addition, we include two different local price indices of substitute or complement goods, such as price ratio of green leafy vs. starchy goods, and ratio of the regional average price of fruit to the regional average prices of savory snacks.

Results

We estimated equations (5) and (6) with Stata 12.0 for three samples: the general spinach consumer sample (full sample), organic consumer sample and conventional consumer sample. The statistically significant Mills Ratio λ is the correlation coefficient between the two error

terms from the two equations. The Wald statistics is calculated to test whether the coefficients in equation (6) jointly explain consumers' expenditure share in PL purchase, i.e., H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = 0$. The null hypothesis is rejected at 1% significance level for all three consumer groups, which suggests the model variables perform well in jointly explain household PL spinach expenditure share.

Table 2 here

Table 2 shows the Heckman two-step estimation results. Increasing total spinach purchases by 1 pound would increase private expenditure shares by 0.8% point, 2.3% point and 7.4% point for general spinach consumers, organic spinach consumers and conventional spinach consumers, respectively. Moreover, 1 pound of total spinach purchase volume decreases the share of the PL spending by 6.7% point, 8.8% point and 30% point for the three consumer groups respectively. We find that a $1,000 increase in household per-member income decreases the PL spinach expenditure share by 0.5% point for conventional spinach consumers. However, the family income has no impact on PL expenditure share for organic consumers. Compared with households with no children, families with children tend to increase their organic PL expenditure share by 7.8% point. A married household head would spend 17.4% point and 11.8% point less on PL spinach.

The food environmental factors all have a significant influence on the PL spinach expenditure share for the organic consumer group. Increasing the price ratio between green leafy and starchy vegetables and the price ratio between fruit and savory snacks would significantly decrease the PL spinach expenditure share by 105.7% and 154.2% point, respectively. Therefore, as the price of dark green vegetables decreases by 1% relative to the price of starchy vegetables, the household's spending on organic PL spinach would increase by 54.2% point. In addition, one

more specialized food store in the neighborhood could significantly increase the household organic PL purchase share by 171.3% point, which is almost twice as much as the impact on the general PL spinach purchase. This suggests that the specialized store is a traditional channel for purchasing organic produce. For conventional spinach consumers, increasing the price ratio between green leafy and starchy vegetables would decrease the conventional PL spinach expenditure share by a smaller amount of 78.7% point.

Table 3 here

Table 3 presents the marginal effect of PL choice probability after Heckman estimation. We find that with regard to spinach purchase information, a household that purchases one more dollar of spinach is 1.72% point more likely to purchase PL spinach. The likelihood of organic private PL spinach consumption is more than three times higher than that of conventional consumers purchasing PL spinach when one more dollar of conventional spinach is purchased. One more pound of spinach purchase would decrease organic consumer's probability of choosing PL by 13.18% point, and conventional consumer's probability by 3.16% point.

Regarding demographics, a household with mid-aged female head tends to purchase less conventional PL spinach, while a mid-aged male household head tends to purchase more of the organic PL spinach. Married households would purchase less of the organic PL spinach. Moreover, household heads with a post-graduate degree would purchase more of conventional PL spinach.

In addition, the food environmental factors significantly influence household PL spinach purchasing behavior. One more specialty store per 1,000 people would increase the household's probability of purchasing PL spinach by 2.87% point, and particularly organic PL by a larger increase of 4.35% point. Interestingly, the existence of a higher regional adult obesity rate

decreases the chance of conventional PL spinach purchases by 0.28% point and organic PL spinach purchases by 1.14% point. Increasing per-capita fruit and vegetable consumptions would increase consumer's likelihood of selecting organic PL spinach and conventional PL spinach by 0.1% and 0.06% point respectively. However, decreasing the per-capita sweet snack consumptions would increase consumer's selection of organic PL spinach and conventional PL spinach by 0.75% and 0.2% point respectively. The existence of a high percentages of households with no cars that live more than 10 miles from the closest major grocery store would increase consumer's selection of organic PL spinach and conventional PL spinach by 7.2% and 2.29% point respectively.

Conclusions

The present research provides a unique contribution to literature by expanding the understanding of the PL produce consumer. Specifically, we examine how individual household demographic, spinach purchase, and more interestingly, food environmental factors influence the selection of PL spinach and its purchase share for general spinach consumers, organic spinach consumers and conventional spinach consumers, respectively.

Through the empirical analyses of PL spinach purchasing behavior for various spinach consumers, we find that some of the key determinants influence the organic and conventional spinach consumers' PL choice and expenditure in a slightly different manner. Specifically, we find that mid-aged male household heads tend to choose organic PL spinach over NB equivalent, while mid-aged female household heads tend to choose conventional NB spinach over PL. Married household head would purchase less of organic PL spinach. Household heads with a post graduate degree have a higher chance of selecting conventional PL spinach. For both

organic and conventional consumer groups, household that purchased less quantity of spinach or spent more dollars on spinach purchase prefer PL product over NB.

The food environmental impacts present interesting empirical results with respect to individual household PL spinach selection and they have important policy implications. Our study suggests that higher prices of green leafy relative to starchy vegetables could lead to an expenditure shift from PL spinach to NB. For organic spinach consumers, higher prices of fruits relative to starchy snacks could lead to an expenditure shift from PL to NB. Hence, we find a large substitution effect between PL and NB produce given consumers' budget constraints. We also find that increased organic spinach availability through specialized food stores is the largest contributor towards PL spinach purchase decision, which increases the organic PL expenditure share by nearly twice as much as the general PL expenditure share. This finding has been confirmed by the trend that more retailers have moved from selling only organic NB products to developing organic PL products, and the share of organic PL products share increased from 8% in 2003 to 17.4% in 2008 (Dimitri and Oberholtzer 2009).

Most importantly, our findings suggest that consumers' purchasing decisions are influenced by their peers and by their respective residential areas. A household living in a region with high per-capita fruit and vegetable consumption would have a larger chance of purchasing spinach. By contrast, a household residing in a high per-capita sweet snack consumption region would have a lower chance of purchasing spinach. Furthermore, consumers in a region with a higher average adult obesity rate tend to purchase less spinach, especially organic PL spinach.

Food environment is playing an increasingly important role in affecting a household's food choice, along with more traditional measures of household demographic and food purchase impacts, especially given that PL produce has increased its market share significantly in recent

years. An understanding of what factors might encourage increased consumption of healthful foods is important to producers and marketers for developing more effective marketing strategies beyond their traditional consumer base. Previous studies in low-income communities suggest that quality, selection and purchasing convenience promote the intake of fresh fruit and vegetables more than the actual cost of food (Biltstein, Snider, and Evans 2012). Government policy makers could build on this information to increase produce availability for low-income consumers, provide nutritional guidelines to encourage consumption of healthy foods.

References

Anders, S. and W. Ahmad. 2011. Private Label and National Brand Pricing and Promotional Strategies in Health Differentiated Product Categories: A Canadian Evidence. Selected Paper, prepared for the 2011 EAAE Annual Meeting, August 30 to September 2.

Biltstein, J.L., Snider, J., and W.D. Evans. 2012. Perceptions of the Food Shopping Environment are associated with greater Consumption of Fruits and Vegetables. Public Health Nutrition, forthcoming.

Christakis, N.A. and J.H. Fowler. 2007. The Spread of Obesity in a Large Social Network over 32 Years. The New England Journal of Medicine 357(4): 370-379.

Connor, J.M. and E.B. Peterson. 1992. Market Structure Determinants of National Brand – Private Label Price Differences on Manufactured Food Products. *Journal of Industrial Economics.* 40(June): 157-171.

Dettmann, R., and C. Dimitri. 2007. Organic Consumers: A Demographic Portrayal of Organic Vegetable Consumption within the United States. Contributed paper at the 105th EAAE Seminar, March 8-10, Bologna, Italy.

Dimitri, C., and C. Greene. 2002. Recent Growth Patterns in the U.S. Organic Food Market. Washington, DC: U.S. Department of Agriculture, Economic Research Service. Agricultural Information Bulletin No. AIB777.

Dimitri, C., and L. Oberholtzer. 2009. Marketing U.S. Organic Foods: Recent Trends from Farms to Consumers. Washington, DC: U.S. Department of Agriculture, Economic Research Service. Economic Information Bulletin No. 58.

Dodds, W.B., Monroe, K.B., and D. Grewal. 1991. Effects of Price, Brand, and Store Information on Buyer's Product Evaluations. *Journal of Marketing Research* 23(3): 301-319.

Grunert, K.G. 1995. Food Quality: A Means-End Perspective. Food Quality and Preference 6: 171-176.

Heckman, J. 1990. Varieties of Selection Bias. *The American Economic Review* 80(2): 313-318.

Hill, J.O., Wyatt, H.R., Reed, G.W., and J.C. Peters. 2003. Obesity and the Environment: where do we go from here? Science 299: 853-855.

Information Resources, Inc. (IRI). 2011. National Consumer Panel. Chicago, IL: Symphony IRI Group.

Karp, H. 2012. Store Brands Step Up Their Game, and Prices. Wall Street Journal, January 31.

Kamphuis, C.B., Giskes K., De Brujin, G.J., Wendel-Vos, W, and F. J. Van Lenthe. 2006. Environmental Determinants of Fruit and Vegetable Consumption Among Adults: A Systematic Review *British Journal of Nutrition* 96(4): 620-635.

Lin, B.-H., Reed, J., and G. Lucier. 2004. U.S. Fruit and Vegetable Consumption: Who, What, Where, and How Much. U.S. Department of Agriculture-Economic Research Service (USDA-ERS). Agricultural Information Bulletin 792-2.

Lusk, J.L. and K. Brooks. 2011. Who Participates in Household Scanning Panels? *American Journal of Agricultural Economics* 93(1): 226-240

McFadden, Daniel. 1974. Conditional Logit Analysis of Qualitative Choice Behavior *Frontiers in Econometrics* New York, Academic Press.

Organic Trade Association (OTA). 2011. Industry Statistics and Projected Growth, based on the Organic Industry Survey. Retrieved from the WWW on October 12, 2011: http://www.ota.com/organic/mt/business.html

Papas, M.A., Alberg, A.J., Ewing, R., Helzlsouer, K.J., Gary, T.L., and A.C. Klassen. 2007. The Built Environment and Obesity. Epidemiologic Reviews 29: 129-143.

Rao, A.R., and K.B. Monroe. 1989. The Effect of Price, Brand Name, and Store Name on Buyer's Perceptions of Product Quality: An Integrative Review. *Journal of Marketing Research* 26(3): 351-357.

Richardson, P.S., Jain A.K., and A. Dick 1996. Household Store Brand Proneness: A Framework. *Journal of Retailing* 72(2): 225-237.

Schroeter, C. House, L., and A. Lorence. 2007. Fruit and Vegetable Consumption Among College Students in Arkansas and Florida: Food Culture vs. Health Knowledge. International Food and Agribusiness Management Review 10(3): 63-89.

Stevens-Garmon, J., Huang, C., and B.-H. Lin. 2007. Organic Demand: A Profile of Consumers in the Fresh Produce Market. *Choices* 22(2): 109-115.

Sturm, R., and A. Datar. 2005. Body Mass Index in Elementary School Children, Metropolitan Area Food Prices and Food Outlet Density. Public Health 119: 1059-1068.

Ubilava, D., Foster, K.A., Lusk, J.L., and T. Nilsson. 2011. Differences in Consumer Preferences when Facing Branded versus Non-Branded Choices. Journal of Consumer Behavior 10: 61-70.

U.S. Census Bureau. 2011. "State and County Quick Facts." Retrieved from the WWW on October 21, 2011: http://quickfacts.census.gov/qfd/meta/long_fips.htm

U.S. Department of Agriculture-Economic Research Service (USDA-ERS). 2007. Fresh-Market Spinach: Background Information and Statistics. Retrieved from the WWW on October 14, 2011: http://www.ers.usda.gov/News/spinachcoverage.htm

U.S. Department of Agriculture-Economic Research Service (USDA-ERS). 2010. Food Environment Atlas. Retrieved from the WWW on August 12, 2011: http://www.ers.usda.gov/foodatlas/

Volpe, R. 2011. The Relationship between National Brand and Private Label Food Products. USDA-ERS Economic Research Report Number 129, December.

Zhuang, Y., Dimitri, C. and E. C. Jaenicke. 2009. Consumer Choice of Private Label or National Brand: The Case of Organic and Non-Organic Milk. Contributed paper at the AAEA meeting, July 26-28, Milwaukee, WI.

Figures and Tables

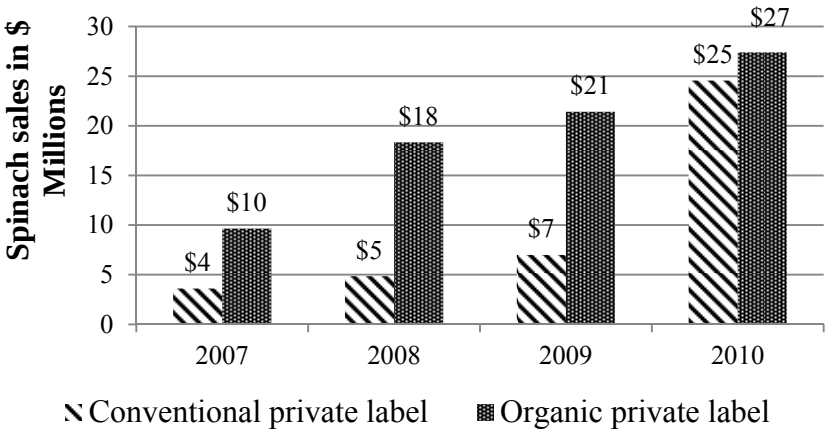

Figure 1: Bagged Conventional and Organic Private Label Spinach Sales in the Western U.S., 2007-2010 (Information Resources, Inc. (IRI) 2011).

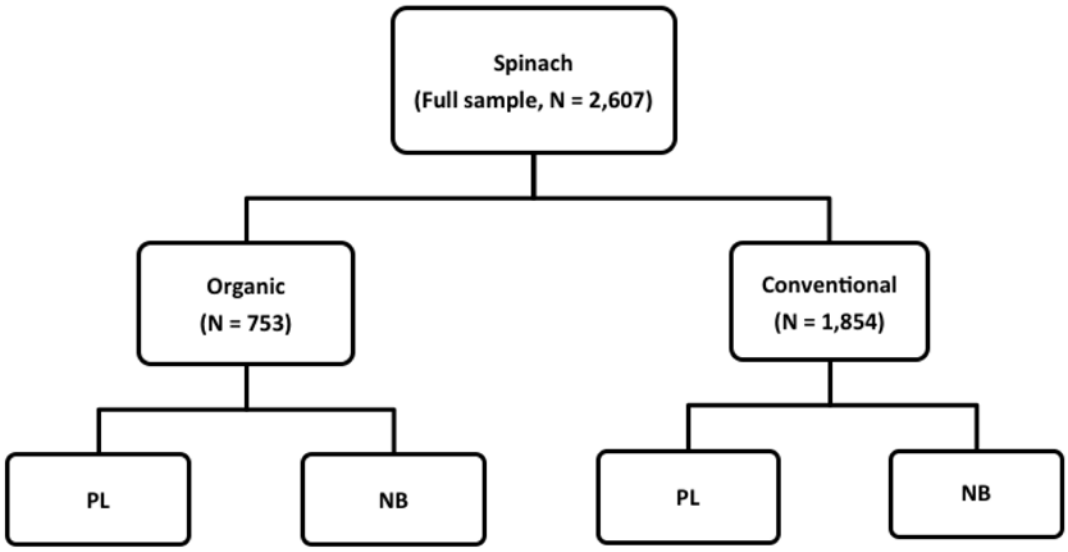

Figure 2: Structural Overview of Estimated Models

Table 1: Descriptive Statistics for the Three Samples

Variable	Definition	Full sample (N = 2,607)		Organic sample (N =753)		Conventional sample (N = 1,854)	
		Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Dependent variables							
Private label	1 = if Household has purchased private label spinach in 2007	0.179	0.383	0.398	0.490	0.090	0.286
Private label share	Private label spinach expenditure/total or organic/conventional spinach expenditure	0.111	0.275	0.319	0.441	0.060	0.215
Spinach purchase information							
Total expenditure	Average household total expenditures in $ for spinach	8.207	10.823				
Organic expenditure	Average household total expenditures in $ for organic spinach			8.240	11.442		
Conventional expenditure	Average household total expenditures in $ for conventional spinach					6.395	8.053
Spinach purchase	Average 2007 household total spinach purchase volume, lbs	1.830	2.493				
Organic purchase	Average 2007 household total organic spinach purchase volume, lbs			1.391	2..227		
Conventional purchase	Average 2007 household total conventional spinach purchase volume, lbs					1.599	2.143
Demographics							
Male mid-aged	1 = male and 35 ≤ age ≤ 54	0.295	0.456	0.317	0.466	0.285	0.452
Female mid-aged	1 = female and 35 ≤ age ≤ 54	0.470	0.499	0.429	0.495	0.487	0.500
Married	1 = if Household head is married	0.658	0.474	0.684	0.465	0.648	0.478
Post-graduate	1 = if Household head has a post-graduate degree	0.145	0.353	0.165	0.371	0.138	0.345
Children	Child/children status in the household 1= if Household has at least one child	0.219	0.414	0.239	0.427	0.211	0.408

Table 1: Continued

HH Income	Mean of each annual household income category per household member in $1,000s. $4.999 if x<$10; $17.499 if x<$20; $22.499 if x<$25; $42.499 if x<$50; $62.499 if x<$75; $87.499 if x ≥$75	28.514	15.601	30.074	15.324	27.880	15.672
Food environment							
HH no car	% of housing units in a county that are more than ten miles from a supermarket or large grocery store and have no car	0.111	0.524	0.090	0.563	0.119	0.508
Fruit and veg/capita	Pounds of fresh, frozen and canned fruit and vegetables purchased per resident of the region during the year. Juices are not included.	180.687	28.747	179.716	28.159	181.081	28.980
Sweet snack/capita	Pounds of packaged sweet snacks purchased per resident of the region during the year. Packaged sweet snacks include, for example, cookies and candy bars.	109.343	8.359	110.203	8.310	108.994	8.356
Price ratio Green leafy/starchy	Ratio of the regional average price ($/gram) of dark green vegetables to the regional average price ($/gram) of starchy vegetables	1.374	0.099	1.383	0.097	1.371	0.099
Price ratio Fruit/savory	Ratio of the regional average price of fruit to the regional average price of packaged savory snacks	0.361	0.029	0.361	0.028	0.360	0.029
Specialized stores	Number of specialized food stores in the county per 1,000 people	0.099	0.038	0.103	0.038	0.097	0.038
Adult obesity rate	Estimates of age-adjusted percentages of persons age ≥ 20 with obesity, where obesity exists when BMI ≥ 30 kg/m^2.	23.117	3.936	22.601	4.220	23.326	3.796

Table 2: Heckman Two-step Estimation Results

	General spinach consumer		Organic consumer		Conventional consumer	
First stage: PL selection	Coefficient	Std. err.	Coefficient	Std. err.	Coefficient	Std. err.
Total expenditure	0.071***	0.006	0.077***	0.014	0.067***	0.010
Total purchase volume	-0.214***	0.028	-0.343***	0.070	-0.221***	0.045
Male mid-aged	0.124*	0.069	0.299***	0.110	-0.039	0.099
Female mid-aged	-0.108*	0.068	0.008	0.108	-0.158*	0.096
Married	-0.051	0.067	-0.206*	0.111	0.025	0.094
Post-graduate	0.139*	0.089	0.056	0.143	0.200*	0.122
Specialized stores	2.874***	0.861	4.345***	1.496	0.781	1.272
Fruit and veg/capita	0.002*	0.001	0.003*	0.002	0.004***	0.002
Sweet snack/capita	-0.009**	0.004	-0.019***	0.007	-0.014**	0.006
HH no car	0.147***	0.051	0.187*	0.104	0.161***	0.065
Adult obesity rate	-0.028***	0.008	-0.030**	0.013	-0.020*	0.013
Constant	-1.162	0.488	1.453*	0.786	-0.349	0.704
Second stage: PL expenditure share						
Total expenditure	0.008**	0.004	0.022***	0.008	0.075***	0.022
Total purchase volume	-0.067***	0.013	-0.087**	0.045	-0.308*	0.162
HH income	-0.002*	0.001	-0.001	0.001	-0.005**	0.002
Children	-0.005	0.036	0.078*	0.048	-0.021	0.067
Married	-0.064**	0.031	-0.174***	0.049	-0.118**	0.063
Specialized stores	0.918**	0.391	1.713***	0.632	0.981	0.788
Price ratio green leafy/starchy veg.	-0.351**	0.178	-1.057***	0.273	-0.787**	0.345
Price ratio fruit/savory snacks	0.168	0.476	-1.542**	0.665	0.705	0.922
Constant	0.903***	0.320	2.290***	0.469	0.710	0.618
Mills Ratio	0.155**	0.079	0.437***	0.113	0.462***	0.113

***p < 0.01. **p < 0.05, *p < 0.1.

Table 3: Marginal Effects From Heckman Estimation

	General spinach consumer		Organic consumer		Conventional consumer	
Probability (PL= 1)	Marginal (% point change)	Std. err.	Marginal (% point change)	Std. err.	Marginal (% point change)	Std. err.
Spinach purchase information						
Total expenditure	1.717***	0.157	2.958***	0.539	0.964***	0.143
Total purchase volume	-5.182***	0.687	-13.181***	2.702	-3.160***	0.642
Demographics						
Male mid-aged	3.092*	1.756	11.616***	4.293	-0.551	1.387
Female mid-aged	-2.621*	1.625	0.310	4.166	-2.251*	1.367
Married	-1.242	1.654	-7.963**	4.306	0.356	1.322
Post-graduate	3.531*	2.359	2.176	5.530	3.159*	2.121
Food environment						
Specialized stores	69.689***	20.886	166.931***	57.517	11.153	18.176
Fruit and veg/capita	0.049*	0.026	0.106*	0.072	0.059***	0.021
Sweet snack/capita	-0.226**	0.099	-0.747***	0.255	-0.196**	0.084
HH no car	3.557***	1.235	7.195*	3.982	2.294***	0.929
Adult obesity rate	-0.674***	0.002	-1.138***	0.483	-0.284*	0.183

***p < 0.01. **p < 0.05, *p < 0.1.