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Abstract

Over the past two decades, retailers are providing more Private label foods (PL), which are directly competing with the National brand (NB) products. For years, PLs competed as generic and cheaper versions with their high-priced NB substitute. However, modern PLs have improved in product quality relative to NBs and are available in the premium, organic, and even produce sections with the goal to distinguish themselves from their competitors' product lines. One of the fastest growing segments in the produce industry consists of triple-washed cello-packed spinach. Using a two-step Heckman model, we determine the impact of household purchase information, demographics, and food environment on PL spinach purchasing behavior. Given its regional dominance with regard to spinach production and fresh spinach consumption, we focus on households residing in the U.S. West. Results show that food environment is the main driver for PL spinach purchases. We determine that specialty stores might be traditional channels for purchasing organic PL spinach, while supercenters might take the role of the main outlet for conventional NBs. An understanding of what factors might encourage increased consumption of healthful foods is important to producers and marketers for developing effective strategies in order to reach beyond the traditional consumer base.

KEYWORDS: private label, food environment, specialty stores, supercenters, organic, conventional

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1. Introduction

Over the past two decades, U.S. food retailers are providing more Private Label foods (PL) 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. As shown in previous economic studies, NBs increase consumer awareness and loyalty by convincing consumers that the brand should be associated with quality (e.g. Rao and Monroe, 1989; Dodds et al., 1991; Ubilava et al., 2011). In comparison, PLs were originally perceived to be of lower quality and limited to product categories such as staple foods. For years, PLs competed as generic and cheaper versions with their high-priced NB substitute (Anders and Ahmad, 2011; Connor and Peterson, 1992).

However, modern PLs have improved in product quality relative to NB and are available in the premium, organic, and even produce sections with the goal to distinguish themselves from their competitors' product lines (Volpe, 2011; Jonas and Roosen, 2008). 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). Consumers are starting to develop loyalty towards these goods and specific retailers that offer their own line of PLs (Karp, 2012). 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). Organic produce can be considered a "gateway product", given that these products frequently form the first organic purchasing experience, which is then widened to other product categories (Hartman Group, 2000 and 2002). Moreover, there is a trend that more retailers have moved away from selling only organic NBs, as evident from the 9.4% increase in organic PLs share between 2003 and 2008 (Dimitri and Oberholtzer, 2009).

This success can be attributed to the rising demands for convenience foods and declining food preparation skills (Biltstein, Snider, and Evans 2012). One of the fastest growing segments in the produce industry consists of triple-washed cello-packed spinach (U.S. Department of Agriculture-Economic Research Service (USDA-ERS), 2007). California and Arizona produce 85% of the U.S. supply of spinach, and California accounts for about three-fourths of the value of both the fresh and processing spinach crops. Furthermore, households in the Western U.S. purchase more fresh spinach than those residing in other regions (Lucier, Allshouse, and Lin, 2004). Figure 1 shows the trend in household purchase volumes 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 from 2007 to 2010, with a growth rate of 170% (Figure 1). During the

same time frame, conventional PL spinach sales increased by over five times from $4 million to $25 million (Information Resources Inc. (IRI), 2011). Given this increased sales trend, policy makers and agribusiness companies have become interested in determining the drivers of spinach purchasing behavior in the Western U.S.

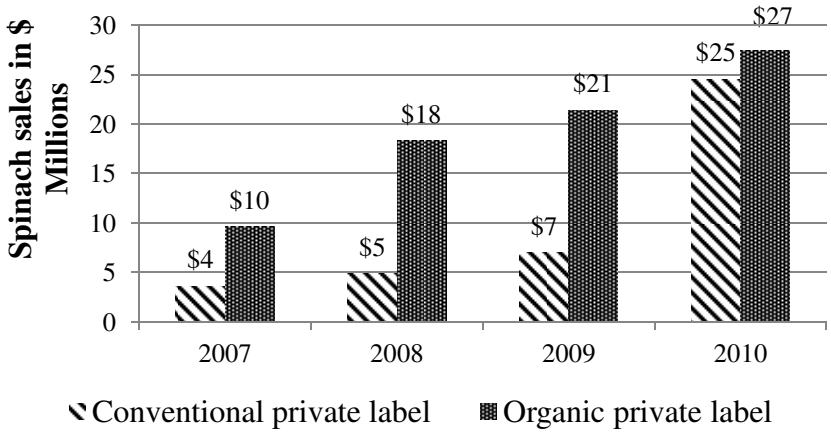

Figure 1: Conventional and Organic Private Label Packaged Spinach Sales in the Western U.S., 2007-2010 (Information Resources, Inc. (IRI), 2011).

One important factor that is usually not taken into account in the literature is the intricacy of the food environment, peer effects, and health factors that affect consumer food choices. Food choices reflect the complex way in which individuals select and consume the available food supply based on factors such as cultural background, food environment, food accessibility, and economic status (Schroeter, House, and Lorence, 2007). In particular, food environmental factors such as the number of grocery stores may have an increasingly important effect on a household's produce choice (Sturm and Datar, 2005). However, a PL from an upscale, specialty retailer, such as a natural food retailer, will appeal to a different consumer than a similar product from a supercenter or club store (Packaged Facts, 2007). Furthermore, given the increasing density of specialty food 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. As such, it is important to investigate a broad spectrum of food retail outlets in order to assess a more complete PL consumer profile.

Past empirical studies have found mixed results regarding which individual customer characteristics could lead to PL purchases. For instance, while some findings (e.g. Richardson, Jain and Dick, 1996; Dhar and Hoch, 1997) suggest that low-income and senior households purchase more PLs than higher

income households, other studies show the opposite (e.g. Zhuang, Dimitri, and Jaenicke, 2009). Hoch (1996) reports that consumers that display higher overall price sensitivity are more likely to penetrate PLs. Bellizzi et al. (1981) could not discern any difference between several consumer behavioral variables and PL purchases. Thus, there is need for research that estimates a profile of PL consumers, together with information about food environmental factors. Furthermore, it is important to single out the impact of environmental influences on specific vegetable purchasing patterns and separate it from other produce categories in order to obtain a clear profile of consumer behavior (Kamphuis et al., 2006).

The objective of this study is to identify the profile of the PL spinach consumer. Specifically, we estimate the impact of spinach purchase information, demographics, and food environment information on the purchasing behavior of PL spinach. In order to investigate differences between organic and conventional consumers, we differentiate these two sub-groups from the full sample of all spinach consumers.

Developing a better understanding of factors that impact consumer purchasing behavior of PL vs. NB spinach 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 and marketers will benefit by developing more effective marketing strategies in a 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.

2. Conceptual Model

As frequently used in previous literature on food consumption decisions, Heckman's theoretical framework models the two stages of the purchasing behavior (e.g. Dettmann and Dimitri, 2007; Zhuang, Dimitri, and Jaenicke, 2009). Consumers make the sequential decision of (1) what type of spinach to choose (PL vs. NB spinach) and, conditional on this choice (2) how much to spend on it.

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

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

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:

$$p_{ij} \quad \frac{e^{X_{ij}\gamma}}{\sum_j e^{X_{ij}\gamma}} \tag{2}$$

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

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., $PL_i \quad 1$, for household i if and only if this household's latent utility $PL_i^* \quad U_{iPL} - U_{iNB} \geq 0$. Therefore, household $i's$ observed PL purchase choice is given by:

$$PL_i \quad X_i\gamma \quad \mu_i \tag{3}$$

where $PL_i \quad 1$ when $PL_i^* \geq 0$ and $PL_i \quad 0$ 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., $E_i^{PL} \quad argmax_E(U_i|PL_i \quad 1)$. Because E_i^{PL} only occurs when the household purchased a PL product, household i's PL expenditure in each category (organic or conventional) is then determined by:

$$E_i^{PL} \quad Z_i\beta \quad \theta\lambda_i \quad \varepsilon_i \tag{4}$$

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 equation (3).

3. Data

We use the 2007 Symphony IRI Group of Information Resources Inc. (IRI) National Consumer Network Panel (NCP). The IRI NCP panel is based on a demographically representative sample of 52,000 households nationwide. Panel members could either be volunteers or recruited by IRI. After their purchase, participating households use hand-held scanners to record the dates of their product 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 NCP also provides associated household demographic information (IRI, 2011).

To become part of our full sample, NCP households had to have purchased packaged spinach at least once during 2007. This spinach purchase could have been either organic or conventional, and within these categories either PL or NB spinach. Given its regional dominance with regard to spinach production and fresh spinach consumption, we focus on households residing in the U.S. West (Lucier, Allshouse, and Lin, 2004 and 2007).

The food environmental variables are merged 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, per-capita at-home food consumption, two different related price ratios, food availability, and adult obesity rate.

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 serve as our dependent variables, the remaining three variable categories are used as independent variables in our analyses.

In order to investigate differences between organic and conventional PL spinach consumers, we analyze two sub-samples in addition to the full sample. The full sample contains 2,607 households who purchased any spinach during 2007, the organic consumer sample consists of 753 households who purchased organic spinach at least once, and the conventional consumer sample is composed of 1,854 households who purchased only conventional spinach (Table 1).

Of all spinach buyers, 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 24% 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. Averaging across all purchase occasions, Western U.S spinach consumers spend $8.24 per pound of organic spinach and $6.40 per pound of conventional spinach. In addition, the average household purchase volumes of organic and conventional spinach are 1.39 and 1.60 pounds per purchase occasion, respectively.

Table 1. Descriptive Statistics

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	0.239	0.354	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
Total purchase volume	Average 2007 household total spinach purchase volume, lbs	1.830	2.493				
Organic purchase volume	Average 2007 household total organic spinach purchase volume, lbs			1.391	2.227		
Conventional purchase volume	Average 2007 household total conventional spinach purchase volume, lbs					1.599	2.143
Demographics							
Female	1 = if Household main shopper is female	0.934	0.249	0.936	0.244	0.933	0.251
Senior	1 = if the age of Household main shopper is over 55	0.580	0.494	0.547	0.498	0.593	0.491

Married	1 = if Household main shopper is married	0.658	0.474	0.684	0.465	0.648	0.478
College	1 = if Household main shopper has a college or post-college degree	0.488	0.499	0.541	0.500	0.467	0.499
Young children	1= if Household has ≥ one young child (younger than 12)	0.140	0.347	0.149	0.356	0.137	0.344
Hh income	Mean of each annual household income category per household member in $1,000s. $4.999 if x<$10; $14.999 if x<$20; $22.499 if x<$25; $37.499 if x<$50; $62.499 if x<$75; $87.499 if x ≥ $75	27.977	15.670	29.630	15.391	27.305	15.737
Food environment							
Hh no car	% of housing units in a county that are more than ten miles from a supermarket or large grocery store and have no car	0.111	0.524	0.090	0.563	0.119	0.508
Fruit and veg/capita	Pounds of fresh, frozen and canned fruit and vegetables purchased per resident of the region during the year. Juices are not included.	180.687	28.747	179.716	28.159	181.081	28.980
Sweet snack/capita	Pounds of packaged sweet snacks purchased per resident of the region during the year. Packaged sweet snacks include, for example, cookies and candy bars.	109.343	8.359	110.203	8.310	108.994	8.356
Price ratio green leafy/starchy	Ratio of the regional average price ($/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
Specialty stores	Number of specialty food stores in the county per 1,000 people	0.099	0.038	0.103	0.038	0.097	0.038
Grocery stores	Number of grocery stores in the county per 1,000 people	0.186	0.070	0.188	0.069	0.186	0.071
Supercenters/club stores	Number of supercenters and club stores in the county per 1,000 people	0.011	0.009	0.012	0.009	0.011	0.009
Adult obesity rate	Estimates of age-adjusted percentages of persons age $\geq$ 20 with obesity, where obesity exists when BMI $\geq$ 30 kg/m^2.	23.117	3.936	22.601	4.220	23.326	3.796

In the full sample, 93% of the main household grocery buyers that purchased any spinach during 2007 are female. More than half, 58%, of the main grocery shoppers is senior. About 49% of the main household grocery buyers have a college or post-college degree. The majority, 66%, of the household heads is married. In addition, 14% of the households have at least one young child. In the organic (conventional) sample, among all main household grocery buyers that purchased organic (conventional) spinach, 94% (93%) are female, and 55% (59%) are senior. In the organic and conventional sub-samples, respectively, 54% and 47% of the main household grocery buyers have at least a college degree. Among the organic (conventional) consumers, 15% (14%) have at least one child that is younger than 12 years.

On average, the regional 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 regional price of fruits is 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.

Food accessibility is measured by the variable "Hh no car", which indicates the percentage of households per county that live more than 10 miles from the nearest supermarket or large grocery store but have no car. In our data set, this variable ranges from 0.01% to 8.17%.

We use three different variables to measure food availability. According to the USDA-ERS Food Atlas (2010), grocery stores include establishments generally known as supermarkets and smaller grocery stores primarily engaged in retailing a general line of food, such as canned and frozen foods; fresh fruits and vegetables; and fresh and prepared meats, fish, and poultry. Supercenters and club stores are primarily engaged in retailing a general line of groceries in combination with general lines of new merchandise, such as apparel, furniture, and appliances. Specialty food stores include outlets mainly engaged in retailing specialty foods such as retail bakeries, meat and seafood markets, dairy stores, and produce markets.

We included two indicators of regional food-at-home consumption levels. The per-capita fruit and vegetable information is based on fresh, frozen and canned produce purchased, excluding juices. A representation of the regional per-capita packaged sweet snack consumption includes cookies and candy bars.

To further characterize the food environment, we utilize 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). These variables model the regional relationship between a household's

food choices, given the surrounding food environmental factors. 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 a given food environment, we may observe a "peer effect" with regard to produce consumption since consumers may behave similarly.

4. Estimation Approach

This study employs the Heckman two-step selection model, which generates consistent and asymptotically efficient parameter estimates compared to the standard least squares regression methods (Heckman 1990). Moreover, Heckman's sample selection method also addresses the potential endogeneity problem.

In our model, consumers make the sequential decisions of (1) whether to choose PL or NB spinach, and (2) how much to spend on each spinach purchase. Empirically, a household's PL spinach purchase decision is first estimated using a binary logistic regression and then using a least-squares regression to understand how the individual household's spinach purchase information, demographics, and food environmental variables impact the PL vs. NB purchasing behavior. The inverse Mills Ratio λ estimated from the first stage is also included in the second stage to control for the selection bias. Furthermore, separability of one type of good from other products in the same category is assumed, based on the fact that an optimizing consumer with a budget constraint will only choose one variety but not a combination (Schroeter, Ritchie, and Rickard 2011). For example, if leafy greens are weakly separable from all other products according to consumer demand, then an increase in PL spinach purchase might reduce the purchase of all other PL and NB leafy greens.

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. The demographic variables consist of gender, age level, marital status, and education level of the main grocery shopper in the household. Additionally, we include information about the family income per household member and residence of children younger than 12 years. These demographic variables are included in the analysis to derive a more clear profile of target consumers.

Food environmental variables are the numbers of specialty food stores, grocery stores, and supercenters/club stores, the per-capita regional fruit and

vegetable consumption, and 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 supercenter or major grocery store. Moreover, the relationship between spinach selection behavior and the regional health status is represented by the percent of adult obesity, where obesity exists when BMI $\geq$30.

$$\begin{aligned}\text{Prob}(PL_i) = {} & \gamma_0 + \gamma_1 \text{ Total expenditure}_i + \gamma_2 \text{ Total purchase volume}_i \\ & + \gamma_3 \text{ Female}_i + \gamma_4 \text{ Senior}_i + \gamma_5 \text{ Married}_i \\ & + \gamma_6 \text{ College}_i + \gamma_7 \text{ Specialty stores}_i + \gamma_8 \text{ Grocery stores}_i \\ & + \gamma_9 \text{ Supercenters/club stores} + \gamma_{10} \text{ Fruit and veg/capita}_i \\ & + \gamma_{11} \text{ Sweet snack/capita}_i + \gamma_{12} \text{ Hh no car}_i + \gamma_{13} \text{ Adult obesity} \\ & \text{rate}_i + \varepsilon_{1i} \end{aligned} \quad (5)$$

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

$$\begin{aligned}\text{PL share}_i = {} & \beta_0 + \beta_1 \text{ Total expenditure}_i + \beta_2 \text{ Total purchase volume}_i \\ & + \beta_3 \text{ Hh income}_i + \beta_4 \text{ Young children}_i + \beta_5 \text{ Married}_i \\ & + \beta_6 \text{ Specialty stores}_i \\ & + \beta_7 \text{ Grocery stores}_i + \beta_8 \text{ Supercenters/club stores}_i \\ & + \beta_9 \text{ Price ratio green leafy/starchy}_i \\ & + \beta_{10} \text{Price ratio fruit/savory}_i + \varepsilon_{2i} \end{aligned} \quad (6)$$

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 12. 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.

5. Results

We estimated equations (5) and (6) with Stata 12.0 for the three samples of PL consumers. The statistically significant Mills Ratio λ is the correlation coefficient between the two error terms from the two equations. The Wald statistic is calculated to test whether the coefficients in equation (6) jointly explain consumers' expenditure share in PL purchase, i.e., H_0: $\beta_1 = \beta_2 = \beta_3 = \beta_4 = \beta_5 = \beta_6 = \beta_7 = \beta_8 = \beta_9 = \beta_{10} = 0$. The null hypothesis is rejected at 1% significance level for

all three consumer groups, which suggests the model variables perform well in jointly explaining household PL spinach expenditure share.

Table 2 shows the Heckman two-step estimation results. Within the organic sub-sample, a higher PL spinach purchasing likelihood is observed by households in which the major grocery shopper is younger than 55 years, who live in a region with a high per-capita fruit and vegetable consumption, a low per-capita sweet snack consumption, a high density of specialty stores and supercenters/club stores, and a low rate of adult obesity. Conventional PL spinach is more likely to be purchased by households with a main grocery shopper who holds at least a college degree. This is consistent with previous studies that determine an increased educational level raises the chance of purchasing conventional vegetables including PLs (e.g. Stevens-Garmon, Huang, and Lin, 2007; Zhuang, Dimitri, and Jaenicke, 2009). Additional food environmental information suggests that households that reside in regions with a higher density of supercenters/club stores are more likely to purchase conventional PL spinach.

It is important to note that an increased PL spinach purchase is observed by households in all three samples that reside in a region with a larger percentage of households without cars that live more than 10 miles from the nearest grocery store. To further classify this finding, we found a strong positive correlation between the regional percentage of low-income households that live more than 10 miles from the closest major grocery store and the regional percentage of households without cars that live more than 10 miles from the closest major grocery store. Thus, our data shows that households without cars that do not live in close proximity to a grocery store tend to belong to the lower-income group. Our finding suggests that consumers on a tight budget may be more likely to purchase PL spinach given their price-sensitive behavior.

Our second-stage results show that increasing total spinach expenditure by 1 dollar would increase PL expenditure shares by 0.8%, 2.2% and 7.8% for total spinach consumers, organic spinach consumers and conventional spinach consumers, respectively. Moreover, 1 additional pound of total spinach purchase volume decreases the share of the PL spending by 6.8%, 9.6% and 32.5% for the three consumer groups respectively.

A $1,000 increase in household per-member income decreases the total (conventional) PL spinach expenditure share by 2% (0.5%). Surprisingly, a household with young children does not have a higher expenditure share on PL spinach. A married household grocery shopper would spend 6.7%, 9.1% and 11.3% less on total, organic, and conventional PL spinach.

Table 2. Heckman Two-Step Estimation Results

	Total PL		Organic PL		Conventional PL	
First stage: PL selection	Coefficient	Std. err.	Coefficient	Std. err.	Coefficient	Std. err.
Total expenditure	0.070***	0.006	0.081***	0.014	0.066***	0.010
Total purchase volume	-0.213***	0.028	-0.363***	0.073	-0.217***	0.046
Female	0.058	0.130	-0.133	0.212	0.267	0.197
Senior	-0.131**	0.063	-0.196**	0.100	-0.028	0.090
Married	-0.603	0.069	-0.122	0.113	-0.061	0.097
College	0.147**	0.062	-0.034	0.099	0.266***	0.088
Specialty stores	2.388***	0.967	4.558***	1.847	0.199	1.340
Grocery stores	0.609	0.519	-0.211	1.007	0.830	0.663
Supercenters and club stores	1.439	4.144	11.692*	7.197	-16.672**	7.119
Fruit and veg/capita	0.002*	0.001	0.004**	0.002	0.002	0.002
Sweet snack/capita	-0.010**	0.004	-0.023***	0.007	-0.007	0.006
Hh no car	0.134***	0.051	0.212*	0.112	0.109*	0.067
Adult obesity rate	-0.030***	0.009	-0.034***	0.014	-0.018	0.013
Constant	-0.130	0.505	1.850**	0.809	-0.996	0.727
Second stage: PL expenditure share						
Total expenditure	0.008**	0.004	0.022***	0.007	0.078***	0.023
Total purchase volume	-0.068***	0.014	-0.096***	0.038	-0.325**	0.163
Hh income	-0.016*	0.001	-0.0003	0.001	-0.005***	0.002
Young children	0.027	0.042	0.048	0.054	0.028	0.076
Married	-0.067**	0.032	-0.091**	0.043	-0.1131*	0.066
Specialty stores	0.816*	0.432	1.255*	0.667	0.927	0.866
Grocery stores	0.205	0.230	-0.054	0.411	0.376	0.469
Supercenters and club stores	-1.945	1.970	-0.438	2.349	-11.332**	5.905
Price ratio green leafy/starchy veg.	-0.388*	0.215	-0.242	0.271	-0.416	0.384
Price ratio fruit/savory snacks	0.624	0.462	-0.112	0.698	1.126	0.971
Constant	0.748***	0.283	0.684	0.449	-0.072	0.695
Mills Ratio	0.190**	0.083	0.189**	0.095	0.541***	0.129

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

The food environmental factors significantly influence the PL spinach expenditure share. In general, increasing the price ratio between green leafy and starchy vegetables would significantly decrease the PL spinach expenditure share by 38.8%. In addition, one more specialty food store in the neighborhood could significantly increase the household organic PL purchase share by 125.5%, which is almost 1.5 times as much as the impact on the total PL spinach purchase. Interestingly, one more supercenter and club store in the neighborhood could significantly decrease the household conventional PL purchase share by over 11 times.

Table 3 presents the marginal probabilities of PL choice after the Heckman estimation. We find that with regard to spinach purchase information, a household purchasing one more dollar of spinach is 1.7%, 3.1%, and 0.9% more likely to purchase PL spinach, organic PL spinach, and conventional PL spinach, respectively. Increasing the purchase volume of organic spinach by one pound would decrease the probability of choosing PL spinach by 5.2%, organic PL spinach by about 14.0%, and conventional PL spinach by 3.0%.

Our demographic variables show the difference between the PL spinach consumer profiles. Female shoppers have a 3.1% higher chance of purchasing conventional spinach. Senior shoppers tend to purchase less PL spinach and organic PL spinach by 3.2% and 7.5%, respectively. Consumers with college/post-college degrees are more likely to purchase PL spinach and conventional PL spinach by 3.6% and 3.8%.

With regards to the food environmental variables, one more specialty store per 1,000 people would increase the household's probability of purchasing PL spinach by 57.9%, and organic PL spinach by 175.1%. Moreover, one more supercenter/club store per 1,000 people would decrease the household's probability of purchasing conventional PL spinach by 231.8%. Interestingly, adding one more supercenter/club store would increase the likelihood of purchasing organic PL spinach by 449.2%. A one-pound increase in the regional per-capita fruit and vegetable consumption would raise a household's likelihood of selecting organic PL spinach by 0.1%. Increasing the regional per-capita sweet snack consumption by one pound would decrease the household choice of total PL spinach and organic PL spinach by 0.2% and 0.7%, respectively. A one-point increase in the percentage of households with no cars that live more than 10 miles from the closest major grocery store would increase household's purchase of organic PL spinach and conventional PL spinach by 7.2% and 1.5%, respectively. Interestingly, a one-percent increase in the regional adult obesity rate decreases the chance of total PL spinach purchases by 0.7% and organic PL spinach purchases by 1.1%.

Table 3. Marginal Effects From Heckman Estimation

	Total PL		Organic PL		Conventional PL	
Probability (PL= 1)	Marginal (% change)	Std. err.	Marginal (% change)	Std. err.	Marginal (% change)	Std. err.
Spinach purchase information						
Total expenditure	1.708***	0.157	3.116***	0.555	0.919***	0.140
Total purchase volume	-5.158***	0.688	-13.958***	2.788	-3.014***	0.629
Demographics						
Female	1.377	2.983	5.192	8.350	3.131*	1.909
Senior	-3.209**	1.553	-7.546**	3.856	-0.394	1.262
Married	-1.475	1.708	-4.693	4.398	-0.856	1.380
College	3.565**	1.504	1.296	3.822	3.763***	1.265
Food environment						
Specialty stores	57.900***	23.430	175.097***	70.970	2.768	18.630
Grocery stores	14.775	12.572	-8.087	38.693	11.547	9.250
Supercenters and club stores	34.887	100.447	449.163*	276.457	-231.831**	97.463
Fruit and veg/capita	0.044	0.029	0.106*	0.072	0.025	0.023
Sweet snack/capita	-0.238**	0.106	-0.747***	0.255	-0.098	0.089
Hh no car	3.259***	1.250	7.195*	3.982	1.512*	0.934
Adult obesity rate	-0.733***	0.212	-1.138***	0.483	-0.246	0.180

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

6. Conclusions and Outlook

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.

The present research provides a unique contribution to the literature by expanding the understanding of the PL purchase decision (e.g. Kamphuis et al., 2006). Specifically, we included various food environmental factors to determine the influence of peers' eating habit and food choices on individual household's produce purchase decision. Moreover, our study identifies different profiles of PL purchasing behavior by performing a sub-category analysis of packaged spinach, i.e., organic vs. conventional.

Our findings show that consumers' purchasing decisions are influenced by food access and food availability in their respective residential areas. Regarding food access, households that do not have a car and live more than 10 miles from a grocery store are more likely to purchase PL spinach. Our correlation analysis shows that the majority of these households belong to the lower-income bracket in our study, which might suggest that price consciousness may lead to their PL purchasing behavior. This finding confirms the study by Inagami et al. (2009), Bonfrer and Chintagunta (2004), and Hoch (1996), who determined that price-sensitive consumers tend to show a higher penetration of store brands. Previous studies in low-income communities found that quality, selection and purchasing convenience promote the intake of fresh fruit and vegetables (Biltstein, Snider, and Evans, 2012). Government policy makers could build on this information to ensure produce availability and access for low-income consumers in order to encourage consumption of healthy foods.

We determine that increased organic spinach availability through specialty food stores is the largest contributor towards PL spinach purchase decision. Supercenters/club stores have a large negative effect on the purchasing likelihood of conventional PL spinach. Thus, specialty stores might be traditional channels for purchasing organic PL spinach, while supercenters might take the role of the main outlet for conventional NBs. Interestingly, grocery stores do not impact PL spinach-purchasing behavior. Our data does not contain any information regarding promotional pricing strategies such as coupons or club-cards, which could additionally classifies PL purchasing behavior with regard to the different food retail outlets and their respective promotional tactics.

Our study shows that health behavioral outcomes are a direct consequence resulting from the local food context, such as purchasing patterns and pricing mechanisms. Consumers in a region with a lower average adult obesity rate, high per-capita fruit and vegetable consumption, and low per-capita sweet snack consumption tend to purchase more PL spinach. Previous studies labeled these neighborhoods as "advantaged", given the good local availability and increased access to fruit and vegetables (Kamphuis et al., 2006).

Interestingly, a number of studies show increased PL sales penetration or increased competition between PL and NB may actually result in higher prices for NB (Ward et al., 2002; Bonanno and Lopez, 2005; Bontemps et al., 2005; Bontemps et al., 2008). Given this seemingly counterintuitive phenomenon, policy makers and agribusiness companies will remain interested in determining the relationship between the prices of PL and NB products resulting from changes in supply and demand.

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