Do SNAP Recipients Get the Best Prices?

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Abstract

This paper examines the relationship between SNAP participation and prices paid for food items. To test this relationship, we develop an expensiveness index following the method of Aguiar and Hurst (2007) and use the FoodAPS data set. Using the ordinary least squares method and controlling for endogeneity using the Lewbel (2010) method, we found SNAP participation did not hold a statistically significant relationship with the prices paid for food items when we controlled for consumer behavior and food market variables. This indicates that SNAP participants are not systematically disadvantaged in their food purchases. Additional efforts to further educate SNAP participants of effective shopping and budgeting habits may be fruitful in helping households pay comparatively lower food prices.

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I Introduction

One of the key challenges when purchasing food is the ability to consider relative prices in a particular food environment.Within a food environment, a consumer can act to make "smart decisions"and purchase relatively less expensive items with the goal of obtaining desired food outcomes in a thrifty manner. Lower income households arguably have the strongest incentives to purchase food in the thriftiest way possible because the tradeoffs of not optimizing on price and nutritional value are comparatively higher than the tradeoffs faced by higher income households (Ghez and Becker 1975).

The Supplemental Nutrition Assistance Program (SNAP) is the US government's main effort towards improving food security of low income individuals in the United States. In the year 2015 the USgovernment spent approximately $74 billion on SNAP which contained nearly 46 million participants (USDA 2016)[a]. An important question for the efficiency of this program is whether participants pay prices that are consistent with non-recipients. Small improvements in the efficiency of participant usage could have large effects upon the impact of the program.In fact, educational efforts have also been provided to SNAP participants to improve their food purchasing decisions (USDA 2016)[b].

The main focus of this study is the analysis of factors affecting food prices paid by low income households. Of special interest, is the question of whether low income households whichparticipate in SNAP obtain lower food pricesrelative to nonparticipants.To answer our research questions, we make use of the FoodAps data set. The FoodAPS dataset is the first nationally representative survey of US household's food purchases including SNAP participants and non-participants. FoodAPS data contains information on prices paid for food items by 4046 families in conjunction with detailed information pertaining to household socio-demographic characteristics as well as information about the local food environment and competitive food market structure. Thus, the FoodAPS database provides a unique opportunity to consider the ability of low income to achieve improved purchasing decisions, while controlling for the number and quality of food providers as well as individual capability. The proposed analysis is not achievable with existing data sets such as the National Health and Nutrition Survey (NHANES) or the Behavioral Risk Factor Surveillance System (BRFSS). Specifically the NHANES and BRFSS do not contain information regarding local food market factors or variables measuring behaviors of consumers when making purchase decisions for food items.

Our analysisintends to generate valuable information for policy makers and those involved in SNAP-Ed efforts because it specifically examines the prices SNAP participants received when purchasing food items and will provide a more thorough and robust analysis than previously conducted by incorporating household, consumer, and market characteristics. By using the FoodAPS dataset, we will be better able to determine the effectiveness of the SNAP program to provide lower income households with the ability and knowledge to obtain nutritional food at comparatively lower costs. We will also provide a more robust analysis of the impact of food retailer market structure and socio-economic factors on the food prices a household faces.

II Literature Review

Food prices faced by households are the result of economic, demographic, and geographic factors. Household characteristics including size, makeup, race, income, and educational level may contribute to the prices paid by for food items by affecting the quantity or type of food purchased. Similarly, the specific consumer behaviors of the food purchasers in a household in conjunction with the food market they make purchases in can impact the ability achieve lower food prices.

Although a few studies have evaluated the effect of store type and socio-demographic characteristics on food prices in the United States, they have been limited to specific geographic areas (Aguiar and Hurst 2007; Musgrove and Galindo 1988; Rao 2000), specific food products (Bekesi, Loy, and Weiss 2013), or have used a limited set of explanatory variables (Stewart and Dong 2011). In this section, we summarize the main findings from this literature.

Several studies have explored the relationship between household income and food prices. A common finding among some of these studies is the inverse relationship betweenincome and prices paid and several explanations have been provided to explain this finding.Higher food prices for higher income consumers may be the result of food quality. Kyureghian, Nayga, and Bhattacharya (2013) found that income had a significantly positive relationship with the purchase of fruits and vegetables and that these items are a relatively more expensive purchase then many sugary and starchy products. Lower income consumers purchase food items with higher energy density and higher fat content (Drewnowski and Specter 2004; Morland et al 2001).

Alternatively, higher income households may pay higher prices for food itemsbecause higher incomes implies higher tradeoffs for time spent searching for lower prices (Becker 1965).For example, Cronovich, Daneshvary, and Schwer (1997) found that households earning over $75,000 were, *"significantly less likely to use coupons"* and "*households that feel their income is inadequate are more likely to use coupons*" (p. 1639)[1]. It is also possible higher

[1]Adequacy was determined by households who were asked, "How adequate do you consider your income?" (Cronovich, Daneshvary, and Schwer 1997, p. 1663). Responses were recorded as values between 1 (very adequate) to 5 (inadequate).

income households purchase higher quality, and potentially healthier, food items (Aguiar and Hurst 2007).

Lower income householdsmay face higher food costs because they are unable to afford larger quantities of food which can be purchased at lower per unit costs. This is referred to in the literature as the "size effect" (Mendoza 2011).In a case study of 3 villages in India, Rao (2000) found families from lower income villages frequently paid higher unit costs for food items because lower income families did not take advantage of bulk discount opportunities. Kunreuther (1973) found similar evidence from households in the United States where households did not purchase bundles of food products at the lowest per unit costs because some households faced lower storage capacity and tighter budgets.

It is important to distinguish the knowledge of how to take advantage of bulk discounts from the inability to take advantage of bulk discounts due to income constraints. Beatty (2010) found that lower income households in the United Kingdom were able to pay comparatively lower costs on average by spending a larger share of income on food items with quantity discounts. Varying consumer knowledge of lower prices in conjunction with effective educational policy could explain these findings.

The composition of a household has also been shown to affect buying patterns which affect food prices paid. Bekesi, Loy, and Weiss (2013) found that households with children are less likely to form specific buying habits than single adult households with no children due to the frequently changing tastes of children. Cronovich, Daneshvary, and Schwer(1997) found that family's with a child between 1 and 5 years old were less likelytoutilize coupons when purchasing food; however,the authors found that as the number of adults per household increased, households weremorelikely to use coupons. As food purchases become a larger portion of household expenses, it becomes more important for households to minimize costs. The literature has also found households with older adults were more likely to base their purchasing decision on past choices (Bekesi, Loy and Weiss 2013),more likely to use coupons (Cronovich, Daneshvary, and Schwer 1997), and were willing to go shopping more frequently to obtain lower prices (Anguiar and Hurst 2007). Households with older adults have also been associated with stronger preferences for nutritious foods than single person households and comparatively younger households (Blanciforti, Green, and Lane 1981),

Race has also been associated with variation in food prices paid by households. Black and Hispanic households are significantly less likely to use coupons than other racial groups (Cronovich, Daneshvary, and Schwer 1997).Geographical proximity to food providers, in many cases related to the racial makeup of neighborhoods, has also been shown to affectthe food prices households pay. Cummings and Mcintyre (2005) found that predominantly African-American neighborhoods are more likely to be located further to food access than neighborhoods of other racial composition. Zenk et al. (2005) also found that supermarkets were an average of 1.15 miles farther away from predominantly black neighborhoods than predominantly white neighborhoods.According to Kunreuther (1973), "*They [referring to lower income families] are thus more likely to patronize the neighborhood store than to travel some distance to chain store*" (p. 373-374). This limited travel choice could result in higher food costs. Hoch et al. (1995) found, "*isolated stores display less price sensitivity than stores close to their competitors*." (p.28). This lack of access to chain stores may lead to more income allocation to food (Chung and Myers 1999; Moreland et al. 2001).

In addition to distance from chain stores, households which do not own a means of transportation may also have limited ability to access stores with comparatively lower food prices. Andrews, Bhatta, and VerPloeg (2012) found that citizens of New Orleans who did not own their own mode of transportation paid additional travel costs of approximately $11 more per month than those with their own vehicle[2]. For low income families, these costs can be significant barriers to obtaining food items at lower prices.

Education level may also have an effect on purchasing decisions. In theory, individuals with more education may be more likely to understand and implement cost saving strategies, such as using coupons, to pay lower prices for food (Levedahl 1998; Narashman 1984). In contrast to this theory, Cronovich, Daneshvary, and Schwer (1997)did not find a statistically significant relationship between coupon usage and college education. However, the authors did find a statistically significant relationship between, households with at least one full time college student andcoupon usage. This is likely explained by the differences in incomes between college graduates and college students.

Employment status may also effect the purchasing decisions a household makes. Previous research has shown that adults who work full time and part time are less likelytopursue efforts which could food costs (Cronovich, Daneshvary, and Schwer 1997).Sheethan, Ainslie, and Chintagunta (1999) found no statistically significant relationship between previous buying patterns and purchases made by retired, unemployed, and single mother households. This is likely indicative of high price sensitivity due to income restraints.

Each of the factors or conditions examined in the previous literature can play important roles in householdfood purchase decisions and can impact prices paid. Our analysisbuilds on thisliterature incorporating all of the previously examined variables into a single analysis. We also incorporate The FoodAPS dataset which has not been used to assess the impact of SNAP on

[2]The cost was approximately 12 times more if the shopper used a taxi service.

price paid for food times[3]. Additionally, our analysis specifically examines the food prices paid by SNAP participants. This has not been examined in the previous literature.

III Data

The FoodAPS dataset is composed of a nationally representative survey of United States households food purchases collected from April 2012 to January 2013. The FoodAPS database contains 55307 observations of 4046 families selecting from 208 different food items. A complete list of the food items used in the FoodAPS dataset is provided in Table 1.

The FoodAPS dataset was collected using a multi-stage sampling design. The first stage selected a stratified sample of 50 primary sampling unites with each unit being a composite reflecting overall sample targets and estimated population of each primary sampling unit. The second stages consisted of data collection all food purchases made by members of each household.

Each household was asked to report all food purchases over a 7 day period. Households were also instructed to distinguish between food items purchased for the purpose of being consumed in the home and food items purchased to be consumed outside the home. The primary food shopper was identified as the primary respondent for each household. The primary food shopper was responsible for recording all food item purchases made, the weight of each item purchased, where the purchases were made, and if the household made use ofSNAP benefits when making these purchases. Adults and youths were also given food books and asked to record all purchases made following the same guidelines as the primary food buyer.Adults were defined as those 19 years old and older. Youths were defined as those 18 and under. Food purchases were recorded in food books which were collected after the sampling period.

[3]Taylor and Villas-Boas (2016) used the FoodAPS dataset to examine the effects of SNAP participation on store selection but do not extend their analysis to include prices.

Interviews were conducted before and after the food purchases were recorded with the primary food purchaser before and after the data collection period. The information collected during this interview was provided in the individual dataset and contains information on the primary food buyer's age, sex, race[4], marital status, and highest level of schooling completed. Information regarding household composition, income, reason for choosing primarily shopping location, if the household is located in a rural census tract, if the household has access to a vehicle and if they own or lease their vehicle(s), if the household rented or owned their place of occupancy, if the household held liquid assets of over $2,000 dollars, and total household income were also collected during the initial and final interviews.

Information on household participation in SNAP was also obtained during the interview process when then participating, including new parcitipants, were asked when they last received SNAP benefits and what amount they received. Households which reported receiving SNAP benefits were then matched by ERS staff the administrative records to verify both accuracy of their participation and the last date the household received SNAP benefits. Administrative confirmation the household received SNAP benefits were based on records obtained from the caseload and Anti-fraud Locator using EBT Retailer Transactions (ALERT) data.

Food access and food market information was compiled in the FoodAPS Retail Environment Study Data. The food access data is composed of 3 levels of food geographic aggregation: county-level, tract-level,and main block group-level. County-level aggregation includes information on the total population-normalized count of food retailers. Tract-level aggregation includes information of food retailers in and around each primary sampling unit. Main block group-level aggregation is the lowest level of aggregation and includes information

[4]Racial composition includes the categories: White, Black or African American, Hispanic or Spanish or Latino, American Indian or Alaskan Native, Asian, Hawaiian or Pacific Islander, and other.

on the availability of food retailers in and around block groups of each primary sample unit. Group blocks are distinguished by population count and socioeconomic indicators within a population sample unit. The FoodAPSRetail Environment Study Data also contains a block-group level restaurant file containing information on the availability of restaurants where FoodAPS households are located.

Information regarding the distances to nearest food retailers and the category of food retailer available are provided at the Main block group-level. The distances to food retailers are divided according to distances of less than or equal to 0.5 miles, between 0.5 and 1 mile, between 1 mile and 10 miles, and between 10 miles and 20 miles. Information regarding Food retailers are also broken into four categories: supermarket, nonsupermarket, farmers market, and farmers markets accepting SNAP. Supermarkets are categorized as food retailers with annual sales greater than $2 million. The nonsupermarket category includes smaller grocery stores with annual sales less than $2 million. The nonsupermarket category also includes convenience stores, pharmacies, gas stations, dollars stores, and specialties stores such as bakeries. Farmers markets are categorized as "*two or more farm vendors selling at a common direct retail outlet and the same physical location on a recurring basis*" (Wilde and Llobrera, 2014; p. 8).

Data on the local food environment for the market component of our empirical analysis is found in the geography component of the FoodAPS database. In the geography component retailers which are SNAP-authorized and not SNAP-authorized are categorized as either super store, supermarket, a combination of grocery/other store, convenience store, medium and large grocery store, or Wal-Mart. Each category of SNAP-approved retailer is further categorized on the number of each type of food retailer within 0.25, 0.5, 1, 2, 5, 10, 15, or 30 miles from the household.

IV Empirical Approach

Given that households buy a variety of different goods during each shopping trip, the first step of the analysis involved the calculation of a price index—also called expensiveness index (Beatty, 2010; Aguiar and Hurst, 2007)[5]. The second step of the analysis involved regressing the expensiveness index on a set of explanatory variables.

The Expensiveness Index

This index compares the cost of a household's food basket at average prices to the cost actually paid by the household. The price index construction follows the method used by Aguiar and Hurst (2007). First, we calculated Total expenditures for household *j* in month *m*are(X_m^j)

(1) $X_m^j = \sum_{i\in I,t\in m} p_{i,t}^j q_{i,t}^j, =\sum_{i\in I,t\in m} X_{i,t}^j$

where $p_{i,t}^j$denotes the price per ounce paid,$q_{i,t}^j$ denotes the quantity of ounces purchased, $X_{i,t}^j$denotes expenditures on good *i* and shopping trip (date) *t*. Another element needed for the calculation of the price index is the average price paid for product *i* by all households in month *m* ($\bar{p}_{\mathrm{i},m}$):

(2) $\bar{p}_{\mathrm{i},m} = \sum_{j\epsilon J,t\epsilon m}(\frac{X_{i,t}^j}{\bar{q}_{i,m}})$,

where$\bar{q}_{i,m} = \sum_{j\epsilon J,t\epsilon m} q_{i,t}^j$. is the total quantity of food item*i* purchased by all households during month *m*. Thus, the cost of household j food basket average prices is :

(3) $\tilde{X}_j = \sum_{i\epsilon I} \bar{p}_{\mathrm{i},m} q_{i,t}^j$.

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[5] We use the household as our unit of measurement for the food basket instead of family size because the primary food purchaser reports the items purchased for all household members including residents which are not related to the primary food purchaser.

Finally, the price (expensiveness) index, where I represents the set of all goods,for household*j* is(I^j):

$$(4)\ I^j = \frac{x_j}{\tilde{x}_j}.$$

We normalized the price index around one by dividing by dividing the average expensiveness index for each household by the average price index.An expensiveness index above 1 indicates that a household spent more than average in acquiring their food basket and a value below 1 indicates the household spent less than average on their food basket

Regression Analysis

The model we use is:

$$(5)\quad I^j = \alpha + + \beta\ \mathrm{SNAP}\ X^H_{i,t} + \beta' X^C_{i,t} + \beta' X^M_{i,t} + e_{i,t}$$

whereI^j representsourexpensiveness index developed above. The expensiveness index is regressed against the X^H, X^C, and X^M vectors which consist of our household, consumer behavior or buying habits, and market variables, respectively and $e_{i,t}$, is a random error.

SNAP, our primary interest, is a binary variable which indicates if the household received SNAP benefits. We only include households which have been confirmed by administrative match to be receiving SNAP benefits instead of measuring receiving SNAP benefits by households which indicated they have received SNAP benefits[6]. We use this approach to avoid misreporting participation which could bias our results (Almada, McCarthy, and Tchernis 2015).

[6]The difference between the reported and confirmed amount was 145 household or approximately 10% of all households who responded they were receiving SNAP benefits.

Our vector controlling for household related variables includes the logarithm of the yearly household income[7] and the logarithm of the household size. To determine the effects of the composition on prices paid for food items we also include variables of the percentage of household members over 60 years, between the ages of 5 and 17, and less than 5 years old[8]. We also use binary variables indicating the household is composed of a SinglePerson and if the primary food purchaser is male.Our Age variable represents the age of the primary food purchaser.

To account for education level, we use 5 binary variables which hold a value of 1 if the primary food purchaser has earned their GED or equivalence, received some college education but has not received a college degree received an associate's degree, received a bachelor's degreeor has received a master's degree or above.We also use binary variables to represent if the primary food purchaser is Black, Asian or Hispanic and if the household owns their place of residence or their car.

In the vector controlling for consumer behavior variables, we measure the household's financial capacityas a binary variable which holds a value of 1 if the household has $2,000 or more in liquid assets. Our numeracy variable is a binary and holds a value of 1 if the household reported previouslyskipped meals because of budgeting problems. The Grocery List variable is binary and holds a value of 1 if the respondent "almost always" or "most of the time" shops with a grocery store list according to their survey.Our HealthInterestis a binary variable and holds a value of 1 if the household tried to follow the recommendations of the MyPryamid plain.In our vector controlling for the food market,rural is a binary variable with a value of one if the household lives in a rural census tract according to the US Census

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[7]We calculate this by taking the logarithm of the reported monthly income of the household multiplied by 12 because yearly income was not recorded during the interview process.
[8]We use the same age distinctions as Beatty (2010).

Bureau.DistNearSNAPrepresents the closest distance to the nearest retailer accepting SNAP benefits. TotalSuperMarket represents the county total number of supermarkets, superstores, and large grocery stores. TotalNonSuperMarket represents the county total for nonsupermarkets. DensitySuperMarket represents the number of supermarkets per 1000 people at the county level. DensityNonSuperMarket represents the number of nonsupermarkets per 1000 people at the county level.

To account for different food prices in different geographical reasons, we also include binary variables indicating the household is located in either the South, West, or Midwest region of the US. We follow the US Census Bureau's regional distinctions. A complete list of all variables used and how they are measured is provided in Table 2. Summary Statistics of the variables used in our analysis are provided in Table 3.

For our regression analysis we first used the ordinary least squares approach (OLS) with different groups of control variables. We firstestimated a model including only SNAP participation (Model 1), followed by a model with SNAP participation and household socio-demographic control variables (Model 2), a model with the same variables as Model 2 and consumer behavior variables (Model 3), and finally a model with the same variable as Model 3 plus the food market variables (Model 4).To account for potential endogeneity of the SNAP variable, we then useda method developed by Lewbel (2010)[9] with the same models described above. In this methodidentification is achieved by having regressors that are uncorrelated with the product of heteroskedastic errors. This technique is especially helpful where instrumental variables are not easy to obtain (Lewbel 2010; Lewbel 2007; Gregory et al. 2013; Almada and Tchernis 2015; Baum 2011).

[9] Unfortunately, we are not able to test SNAP participation for endogeneity. However, given the theoretical reasons SNAP participation involves selectivity bias (Almada, McCarthy, and Tchernis 2015), it is highly probable SNAP participation is endogenous with our other regressors.

V Empirical Analysis

All the coefficient estimates in Tables 4 and 5 represent the effect of SNAP participation on the expenditure index. Using the OLS method, we received mixed results regarding the significance ofSNAP participation on the index representing theprices paid for food products by a household. Without controlling for household, consumer, or market variables, SNAPparticipants were found to have an expensiveness index that was 0.09 points lower than SNAP nonparticipants(approximately 1/5th of a standard deviation). When we controlled for household variables, the effect of SNAPparticipation was still statistically significant and negative but the magnitude (in absolute value) of the difference relative to SNAP nonparticipants was lower (0.05 points or approximately 1/7th of a standard deviation). When controlling for consumer and market variables, we found the effect SNAP participation was no longer statistically significantly. The magnitude of the change in the SNAP effect as more variables are added to the model is indicative of the relative importance of the control variables explaining the raw difference in expensiveness index values in Model 1 (Altonji et al., 2005). Thus, these results indicate consumer behavior factors and the local food market structure, but particularly consumer behavior factors, have a larger impact on the average prices a consumer pays for food products than the socio-demographic factors.

The regressions also showed a consistent negative statistically significant relationship between household size and our expensiveness index where each additional household decreases the expensiveness index between 0.02 and 0.03 points. Age was also consistently found to hold a negative statistically significant relationship to the average prices paid for food items however the quantitative effect was insignificant. Similar to findings in the previous literature, higher amounts of education were consistently associated with a higher expensiveness index where attainment of an associates, bachelors, and masters degree or above were found to have a positive effect to the expensiveness index.

The financial capability variable demonstrated a consistent positive statistically significant relationship with the expensiveness index where a household with $2000 or above in liquid assets was found to have anexpensiveness index a 0.07 (approximately 1/5th of a standard deviation)higher that households with less than $2,000 in liquid assets. In the regression including the market variables, we found a statistically significant negative effect of the number of non-supermarket stores per 1000 county citizens on the expensiveness index. We also founda negative statistically negative effect of distance to the nearest SNAP-authorized retailer and the expensiveness index. However, the both of these relationships were economically insignificant. We also found households located in the South, West, and MidWest regions of the US aid comparatively lower food prices. This indicates geographical location may have a significant impact on prices paid for food items[10].Detailed results of our findings using the OLS approach are reported in Table 4.

Our next of regressions,shown in Table 5, use the instrumental variable approach to account for endogeneity in the SNAP participation using Lewbel's (2010) method.Overidentification restrictions tests (HansenJ-statistic)fail to reject the null hypothesis that the moment conditions implied by the approach were valid, which provides some evidence about the validity of the approach used. Overall, we found little difference in the quantitative impacts and similar statistically significant relationships from our OLS estimations. We again found no statistically significant relationship between participation in SNAP and our

[10]We also tested for the effects of coupons on prices paid per household by using a binary variable given a value of 1 if the household used coupons while purchasing food items. Because of many missing observations (approximately 300) and no statistically significant relationship found between coupon usage and our expensiveness index, we do not include this variable in our analysis.

expensiveness index when we controlled for consumer and market variables. The similarity of our results indicates robustness of the effects of SNAP participation on the expensiveness index[11].

VI Implications

The main focus of the research was to estimate the effect of SNAP participation on the prices paid for food products. When we control for the local food market and specific consumer behaviors, participation in SNAP does not have a statistically significant impact on the prices households pay for food items. This likely indicates consumer behavior and the food environment play a comparatively more significant role in determining food prices paid for by families than participation in SNAP. This also yields the important conclusion that SNAP participants are not systematically disadvantaged in food purchases.

Financial capacity, which held a positive statistically significant relationship to our expensiveness index, indicates households who are able to attain savings are more likely to pay higher prices for food items.Our variables controlling for the local market for food items indicates both concentration of non-supermarket stores and closer proximity to SNAP authorized retailers were associated with comparatively lower prices paid for food items. Although smaller (non-supermarket) stores are typically associated comparatively higher prices than larger (supermarket) stores, it is possible higher competition for consumer patronage drives down prices. Both these findings demonstrate if the consumer is knowledgeable of potential bargains or saving opportunities in their local food market, they will be better able to attain comparatively lower food costs.

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[11]To account for price fluctuations for food items only available during certain seasons, we also binary variables to indicated households made purchases during summer, autumn, and winter. These variables did not add additional explanatory power to our analysis.

As the ability to effectively use SNAP to lower food costs is jointly related to the participating households'local food market and their specific consumer behaviors, it may be fruitful for researchers and policymakersto further examine these relationships specifically. It may be particularly fruitful to provide households participating in SNAP with additional information or educational materials on effective budgeting, financial planning, and shopping strategies for their local market environment. This would provide households with both the means and knowledge to pay comparatively lower food prices.

This analysis would be strengthened by including a measure of the effect of a disabled household member on the prices paid for food items by the household. Unfortunately, disability was not directly recorded with the survey data obtained by the FoodAPS database. The closest measurement of disability provided is the possible selection of "disabled" by the primary food purchaser to the question of the "main reason individual [referring to the primary food purchaser] did not work last week". The wording of this question could mean the respondent is temporarily unable to work from an injury or they are permanently disabled and unable to work. Given the potential role of disabilities in SNAP participation and the ability to purchase food, providing a direct measure of disability would be a useful addition to the FoodAPS database.

Table 1: Food Items Surveyed*

Aloe Vera and Juices	Coffee cappuccino drinks	Flour/ meal	Mexican food	Potatoes/ onions (FRZ)	Spreads (RFG)	UWF radish
Appetizers/ Snack rolls	Coffee creamer	Frankfurters	Mexican sauce	Poultry/ poultry substitutes	Steak/ Worcestershire sauce	UWF Spinach
Aseptic juices	Cold cereal	Fresh bread and rolls	Microwave package/ dinner entry	Poultry (FRZ/RFG)	Stuffing mixes	UWF Sprouts
Asian food	Cookies	Fresh eggs	Milk	Powdered Milk	Sugar	UWF Tomato
Baby food	Corn on the cob	Frosting	Milk flavoring/ cocoa mixes	Premixed cocktails/ coolers	Sugar substitutes	UWF Yams
Baby formula/ electrolytes	Cottage cheese	Frozen meat (not poultry)	Mustard and ketchup	Prepared deli/ gourmet food (RFG)	Syrup	UWF Tofu/ soybean
Baked beans/Canned bread	Crackers	Fruit and vegetable preservative	Natural cheese	Prepared vegetables (frozen)	Tea bags/ loose	UWF Vegetables
Baked goods	Cream cheese/ Cream cheese spread	Fruit	Noncarbonated water (including flavored)	Processed cheese	Tea instant mix	Vinegar
Bakery snacks	Creams/ creamers	Gelatin/pudding product/ mixes	Non fruit drinks	Processed poultry (FRZ/RFG)	Tea/ coffee ready to drink	Vitamins
Baking mixes	Dessert toppings	Glazed fruit	Non chocolate candy	Rice	Tea/ coffee refrigerated	Weight control/ nutritional liquid
Baking needs	Desserts	Grated cheese	Novelties	Rice/ popcorn	Tarts/ toaster pastries	Weight control/ protein supplement
Baking nuts	Desserts/ toppings	Gravy/ sauce mix	Other breakfast food	Salad dressing (RFG)	Tomato products	Whipped Toppings (RFG)
Baking syrup/ Molasses	Dinner sausage	Gum	Other condiments	Salad dressing	Tortillas/ eggrolls/ wanton wrap (refrigerated)	Wine
Barbeque sauce	Dinners	Ham	Other foods	Salad toppings	Uncooked meats (RFG)	Yogurt
Beer/Ale/Alcoholic cider	Dinners/ entrees	Hot cereal	Other salty snacks (not nuts)	Salad/ coleslaw (RFG)	UWF beans	
Bottled juices	Dip/dip mixes	Ice cream cones/ mixes	Other sauces	Salty snacks	UWF broccoli	
Bottled water	Dips	Ice cream/ sherbet	Other snacks	Seafood (FRZ)	UWF cabbage	
Bread/ dough	Dough/ biscuit dough	Instant potatoes	Pancake mixes	Seafood (RFG)	UWF carrots	
Bread crumbs/ Batter	Dried fruit	Jellies/ jam/ honey	Pasta	Seafood	UWF cauliflower	
Breakfast foods	Dried meat snacks	Juice/drink concentrate	Pasta (FRZ)	Shortening and oil	UWF Celery	
Breakfast meats	Drink mixes	Juices	Pasta (RFG)	Side dishes (RFG)	UWF cucumber	
Breath fresheners	Dry beans/ vegetables	Juices/ drinks	Pastry/ donuts	Snack bars/ granola bars	UWF grapefruit	
Butter	Dry dinner mix (add meat)	Lunch meat	Peanut butter	Snack nuts/ seeds /corn nuts	UWF lettuce	
Cake (not snack)/ Coffee cake	Dry fruit snacks	Luncheon meats	Pickles/ relish (RFG)	Soup	UWF mixed vegetables	

Canned juices	Dry packaged dinner mixes	Lunches	Pickles/ relish/ olives	Soup/sides/ other (FRZ)	UWF mushrooms
Canned/bottled fruit	Energy drinks	Margarine/ spreads/butters	Pies and cakes	Sour cream	UWF onions
Canned/prepared tea	English muffins	Marshmallows	Pies (FRZ)	Spaghetti/ Italian sauce	UWF oranges
Carbonated beverages	Entrees	Mutzod food	Pizza (FRZ)	Specialty nut butter	UWF other fruit
Cheesecakes	Evaporated/ condensed milk	Mayonnaise	Pizza (RFG)	Spices/ seasonings (not salt or pepper)	UWF other vegetables
Chocolate candy	Fish/ seafood FRZ	Meat (FRZ)	Pizza products	Spices/ seasonings	UWF peas
Cocktail mixes	Fish/seafood	Meat (RFG)	Plain vegetables	Spirits/ liquors	UWF peppers
Coffee	Eggnog/ buttermilk/ flavored milk	Meat	Popcorn/ popcorn oil	Sports drinks	UWF potato

*Where RFG refers to refrigerated items, FRZ to frozen items, and UWF represents uniform weight fresh items

Table 3 Summary Statistics

Variable	Obs	Mean	Std. Dev.
ExpensivenessIndex	3601	1.00	0.40
SNAP	3601	0.28	0.44
ln(Income)	3601	9.33	3.13
ln(HhSize)	3601	0.94	0.59
CompElder	3600	0.21	0.37
CompChild	3600	0.14	0.21
CompSmallChild	3600	0.08	0.15
SinglePerson	3600	0.19	0.39
Age	3597	46.05	16.07
Male	3601	0.25	0.43
GED	3601	0.29	0.45
SomeCollege	3601	0.27	0.45
AssociateDegree	3601	0.12	0.32
BachelorsDegree	3601	0.15	0.36
MastersorAbove	3601	0.07	0.26
AutoOwn	3601	0.83	0.37
HouseOwn	3601	0.50	0.50
Rural	3601	0.29	0.45
Black	3601	0.11	0.32
Asian	3601	0.04	0.20
Hispanic	3601	0.18	0.39
FinancialCapacity	3601	0.35	0.47
Numeracy	3601	0.08	0.27
List	2951	0.40	0.49
HealthInterest	3601	0.17	0.37
DistNearSNAP	3601	0.90	1.39
TotalSuperMarket	3601	130.73	235.70
TotalNonSuperMarket	3601	239.47	370.68
DensitySuperMarket	3601	0.12	0.04
DensityNonSuperMarket	3601	0.26	0.12
West	3601	0.22	0.42
South	3601	0.36	0.48
MidWest	3601	0.25	0.43

Table 3 Variable Categories and Explanations

Category	**Variable**	**Definition**
	Expensiveness Index (I^j)	Calculated as the sum of the cost of a household's food basket divided by the average cost of a food basket paid by other households
	SNAP	Binary variable indicating administrative match household received SNAP benefits
Household Vector (X^H)	ln(Income)	Represents the logarithm household's income per year
	Ln(HhSize)	Represents the logarithm of household size
	CompElder	Represents percentage of household size composed of members over 60 years old
	CompChild	Represents percentage of household size composed of members between the ages of 5 and 17
	CompSmallChild	Represents percentage of household size composed of members less than 5 years old
	SinglePerson	Binary variable indicating household is composed of one individual
	Male	Binary variable representing the primary food purchaser is male
	GED	Binary variable representing food purchaser has received a high school diploma or equivalence
	SomeCollege	Binary variable representing primary food purchaser has received some college education but has not received a college degree
	AssociatesDegree	Binary variable representingprimary food purchaser holds an associate's degree
	BachelorsDegree	Binary variable representing primary food purchaser holds a bachelors degree
	MastersorAbove	Binary variable representing primary food purchaser holds a masters degree or a higher degree
	AutoOwn	Binary variable representing the household owns a vehicle
	HouseOwn	Binary variable representing the household owns their place of residency
	Black	Binary variable representing the primary food purchaser is Black
	Asian	Binary variable representing the primary food purchaser is Asian
	Hispanic	binary variable which holds a value of 1 if the primary food purchaser is Hispanic

Consumer Behavior Vector (X^C)	FinancialCapacity	Binary variable representing the household has $2,000 or more in liquid assets
	Numeracy	Binary variable representing the household has ever skipped meals because of budgeting problems
	List	Binary variable representingprimary food purchaser “almost always” or “most of the time” shops with a grocery store list
	HealthInterest	Binary variable representing household tried to follow the recommendations of the MyPryamid plain
	Rural	Binary variable representing household lives in a rural census tract according to the US Census Bureau
Market Variables Vector (X^M)	DistNearSNAP	Represents distance to nearest retailer accepting SNAP benefits
	TotalSuperMarket	Represents county total number of supermarkets, superstores, and large grocery stores
	TotalNonSuperMarket	Represents the county total number of nonsupermarkets
	DensitySuperMarket	Represents the number of supermarkets per 1000 people at the county level
	DensityNonSuperMarket	Represents the number of nonsupermarkets per 1000 people at the county level
	West	Binary variable representing household is located in the West region of the United States
	South	Binary variable representing household is located in the South region of the United States
	MidWest	Binary variable representing household is located in the Mid-West region of the United States

Table 4 OLS Results

Model 1 regresses our expensiveness index on our SNAP variable. Model 2 includes SNAP and our household variables. Model 3 includes SNAP, household, and consumer behavior variables. Model 4 includes our SNAP, household, consumer behavior, and market variables

	Model 1	Model 2	Model 3	Model 4
SNAP	-0.09 (-6.73)***	-0.05(-3.36)***	-0.02 (-1.35)	-0.02 (-1.27)
Log Annual Income		0.002 (1.22)	0.001(0.54)	0.001 (0.59)
Log Household Size		-0.08 (-5.21)***	-0.06 (-3.73)***	-0.06 (-3.68)***
Percent Elderly Members		0.03 (0.77)	-0.01 (-0.67)	-0.02 (-0.76)
Percent Children		0.001 (0.06)	-0.01 (-0.31)	-0.01 (-0.42)
Percent Small Children		0.02 (0.90)	0.01 (0.54)	0.008 (0.34)
Single Person		-0.06 (-2.40)**	-0.04 (-1.47)	-0.03 (-1.32)
Age		-0.002 (-3.81)***	-0.002 (-3.10)***	-0.002 (-3.26)***
Male		-0.03 (-2.15)**	-0.03 (-2.03)**	-0.03 (-1.84)*
GED		0.007 (0.47)	-0.002 (-0.12)	-0.007 (-0.41)
Some College		0.03 (1.90)*	0.002 (1.19)	0.02 (1.15)
Associate Degree		0.08 (3.08)***	0.06 (2.42)**	0.06 (2.26)**
Bachelors Degree		0.11 (5.09)***	0.09 (3.98)***	0.07 (3.68)***
Masters or Above		0.20 (6.64)***	0.20 (5.57)***	0.19 (5.26)***
Owns Car		-0.04 (-1.70)**	-0.03 (-1.42)	-0.03 (-1.28)
Owns House		0.03 (1.89)*	0.006 (0.41)	0.08 (0.54)
Rural Location		-0.05 (-3.77)***	-0.05 (-3.02)***	-0.03 (-1.60)
Black		-0.05 (-2.15) **	-0.03 (-1.32)	-0.02 (-0.98)
Asian		-0.09 (-2.23)**	-0.09 (-1.85)*	-0.07 (-1.73)*
Hispanic		-0.04 (-2.54)**	-0.04 (-1.92)*	-0.03 (-1.73)*
Financial Capacity			0.07 (4.68)***	0.07 (4.60)***
Numeracy			-0.05 (-1.94)*	-0.05 (-1.92)*
Uses Grocery List			0.002 (0.13)	0.002 (0.13)
Health Interest			0.01 (0.61)	0.01 (0.64)
Distance Nearest SNAP retailer				-0.01 (-1.83)*
Total Supermarkets				0.00008 (0.71)
Total NonSupermarkets				-0.00008(-1.24)
Density of Supermarket				-0.03 (-0.19)
Density of NonSupermarkets				-0.15 (-2.69)**
West				-0.07 (-2.57)**
South				-0.05 (-2.23)*
MidWest				-0.09 (-4.17)***
Constant	1.02 (124.58)***	1.18 (23.88)***	1.13 (28.38)***	1.23 (27.22)***
N	3601	3597	2949	2949
F-stat	45.26	7.60	8.34	7.35

R^2	0.01	0.05	0.07	0.08

t statistics in parentheses
* p<0.1 ** p<0.05 *** p<0.01, Regressions reported with robust standard errors

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Table 5 IV Using Lewbel Method

Model 1 includes SNAP and our household variables. Model 2 includes SNAP, household, and consumer behavior variables. Model 3 includes our SNAP, household, consumer behavior, and market variables. We do not include a regression of our expensiveness index and our SNAP variable only because the method cannot be used with a single regressor.

	Model 1	Model 2	Model 3
SNAP	-0.003 (-0.10)	0.03 (1.15)	0.03 (1.21)
Log Annual Income	0.003 (1.52)	0.001 (0.63)	0.001 (0.64)
Log Household Size	-0.08 (-5.68)***	-0.07 (-5.22)***	-0.07 (-5.23)***
Percent Elderly Members	0.03 (1.10)	-0.006 (-0.28)	-0.006 (-0.29)
Percent Children	-0.001 (-0.08)	-0.002 (-0.01)	-0.01 (-0.48)
Percent Small Children	0.02 (1.02)	0.02 (1.26)	0.02 (1.15)
Single Person	-0.07 (-3.36)***	-0.05 (-0.20)	-0.04 (-0.18)
Age	-0.002 (-3.76)***	-0.002 (-3.41)***	-0.002 (-3.84)***
Male	-0.02 (-1.53)	-0.03 (-1.80)*	-0.02 (1.65)*
GED	0.002 (0.15)	0.02 (1.13)	0.0003 (0.03)
Some College	0.03 (1.96)*	0.01 (0.55)	0.02 (1.22)
Associate Degree	0.06 (2.55)***	0.05 (2.33)**	0.05 (2.41)**
Bachelors Degree	0.11 (5.49)***	0.11 (4.92)***	0.10 (4.77)***
Masters or Above	0.21 (6.89)***	0.21 (5.95)***	0.20 (5.75)***
Owns Car	-0.01 (-0.63)*	-0.01 (-0.61)	-0.01 (-0.54)
Owns House	0.03 (2.68)**	0.02 (1.64)	0.02 (1.72)*
Rural Location	-0.06 (-4.38)***	-0.05 (-3.53)***	-0.04 (-2.54)**
Black	-0.05 (-2.57)***	-0.04 (-2.09)**	-0.04 (-1.85)*
Asian	-0.08 (-2.07)**	-0.08 (-1.92)*	-0.08 (-2.03)**
Hispanic	-0.05 (-2.84)**	-0.04 (-1.90)**	-0.04 (-1.73)*
Financial Capacity		0.08 (5.32)***	0.08 (5.31)***
Numeracy		-0.07 (-2.87)***	-0.08 (-3.53)***
Uses Grocery List		-0.003 (-0.28)	0.001 (0.11)
Health Interest		0.00003 (0.00)	0.001 (0.09)
Distance Nearest SNAP retailer			-0.006 (-1.44)
Total Supermarkets			0.000003 (0.33)
Total NonSupermarkets			-0.00005 (-0.88)
Density of Supermarket			0.01 (0.68)
Density of NonSupermarkets			-0.17 (-3.05)***
West			-0.07 (-2.84)***
South			-0.04 (-2.26)**
MidWest			-0.09 (-4.13)***
Constant	1.11 (28.67)***	1.14 (28.44)***	1.18 (27.39)***
N	3597	2949	2949
F-stat	8.67	9.18	8.35

Centered R^2	0.05	0.06	0.07
Hansen J-Stat	25.34	24.32	36.65

Z score in parentheses

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