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Socio-Economic Characteristics, Shopping Incidences, and Healthful Food Choices: an Analysis by Income Status

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Socio-Economic Characteristics, Shopping Incidences, and Healthful Food Choices: an Analysis by Income Status

Abstract

Objective: This study examines differences in the role of prices paid, socio-economic-characteristics, and number of visits to specific store formats on purchases of products recommended for increased and limited consumption by the *Dietary Guidelines for Americans* among low-income and non-low-income individuals.

Design: Aggregate annual purchases of skim/low-fat and whole milk, lean and regular ground beef, and whole wheat and white bread for a nationally representative sample of U.S. households (N=65,503) are analyzed. We run a bivariate tobit model to examine how various demographic characteristics are associated with the quantity purchased for each product, focusing on prices, income, race and ethnicity, and education; the estimation is run for both low-income and non-low-income households and allows for correlation of the unobservables associated with purchase choice.

Setting: Food-at-home purchases at different retail stores across the U.S. from January 2012 to December 2012.

Subjects: Households using scanner devices to record their purchases from food retailers during the study period.

Results: Our results suggest that low-income households are more price sensitive than non-low-income households for products recommended for increased consumption (RIC), but the results are mixed for products recommended for limited consumption (RLC). In addition, a higher price of RLC items were associated with greater purchases of RIC items in its place. Finally, a higher education level was associated with lower quantities of RLC items purchased, with a greater effect on low-income households.

Conclusions: Our results suggest that policies targeting a reduction of RLC food products may be more effective than trying to increase consumption of RIC items. Increasing the prices of RLC products could lead to an increase in consumption of RIC ones in its place for all households, regardless of income. In addition, higher education had a greater effect on low-income households, which may suggest targeted educational campaigns may be more effective.

Some diet-related diseases, such as obesity and type II diabetes, are disproportionately distributed among lower income households (U.S. Dept. of Health and Human Services, 2010). Studies have shown that, on average, low-income individuals' diets do not meet the *Dietary Guidelines for Americans* (DGA) (e.g., Leung et al. 2012; Drewnowski and Specter 2004; Kennedy et al. 1995). These studies find that low-income consumers tend not to meet the recommended amounts of whole grains, fruits, and vegetables, and exceed the recommended limits for processed meats, sweets, and sugar-sweetened beverages.

In response to these findings, some researchers have examined methods of improving diet quality among low-income individuals by focusing on the affordability of a healthy diet. Although the less healthy food choices of lower-income households are often attributed to the higher cost of healthy diets (e.g. Drewnowski and Specter 2004; Darmon and Drewnowski, 2015), some researchers have suggested that a healthy diet can be more affordable than an unhealthy one for certain products (e.g. Todd et al. (2011); Carlson and Frazão 2014); others found the switch to a healthy diet to be cost neutral (Nansel et al., 2016; Raynor et al., 2002). Research has shown that policies focused on financial targets may not lead to significant dietary changes. For example, Dong and Lin (2009) found that even though a price reduction may increase low-income Americans' consumption of fruits and vegetables, most of them still would not meet the dietary guidelines. Other studies have examined whether changes in SNAP benefit allocations, such as adding a bonus or voucher for fruits and vegetables, could promote a healthier diet (Guthrie et al. 2007; Shenkin and Jacobson 2010). In spite of the heavy focus on examining how price affects diets in the economics literature, a systematic literature review of food demand elasticities reveals that the emphasis on understanding disparities in the demand for food products is limited: only nine out of one hundred sixty studies reviewed by Andreyeva et al. (2010) presented estimates of food price elasticities for low-income groups, in some cases presenting values only for aggregate food products. These studies find that demand for food is relatively inelastic, and that price changes alone may not be enough to have a considerable effect on consumers adopting healthier dietary habits (in their example, increasing consumption of fruits and vegetables). Nevertheless, it is important for public health researchers to examine elasticities to fully assess the impact of price interventions designed to protect public health, as discussed by Nghiem et al. (2013).

In addition to examining the affordability of healthy diets, numerous studies have investigated

the role of socio-economic-characteristics (SECs) on diet quality (e.g. Turrell et al. 2003; Darmon and Drewnowski 2008), including race and poverty (e.g. Baker et al. 2006). Although this line of literature has expanded considerably in the last few decades, actual purchase data have been used only recently to analyze the association between SECs and diets (e.g. Ng et al. 2016; Stern et al. 2016b). Most of these studies look across product categories rather than focusing on whether the healthier option was chosen within a specific product category. By comparing the share of expenditures spent to those recommended by the DGA, Chen et al. (2016) show that higher compliance with the DGA is associated with a lower risk of being obese, illustrating the importance of focusing on whether the healthy option has been chosen *within* product categories. This literature further suggests that the type of store where the food is purchased is linked to the consumption of food associated with unhealthy diets (e.g., Stern et al. 2016a).

Our study uses actual consumer purchase data to examine which characteristics are associated with purchases of healthy (i.e. suggested by the DGA) and less-healthy (i.e. discouraged) alternatives within a product category, assessing differences in the relative importance of each characteristic by examining its marginal effect. Specifically, we estimate the association between quantity purchased and prices paid, SECs variables, and shopping incidences at different store types for Low-Income (LI) and Non-Low-Income (NLI) households. We focus on store bought foods because the majority of the dietary intake and expenditures of US consumers comes from food retailers, despite the increasing spending on food-away-from-home (FAFH) (Drewnowski and Rehm 2013). We focus our analysis on three different food items: ground beef, non-flavored dairy milk, and sandwich bread. For each of these food items, we identify the version that is recommended by the DGA and compare it to the discouraged option (e.g. regular ground beef vs. lean ground beef).

Data and Methods

We use the IRI Consumer Network Panel™ (IRI-CNP) database courtesy of the Economic Research Service (ERS) of the USDA, which records all food-at-home (FAH) purchases for a nationally representative sample of U.S. households.¹ Household income and number of individuals in each

¹Food bought to prepare or consume at home is included; however the database does not record purchases of food-away-from-home (FAFH), for example, fast food chain, restaurant, or school lunch purchases.

household are used to determine whether a household is above or below the poverty line. We opted for using the 2012 data, because at the moment when the analysis started precise information on households SEC was only available for that year, as described in Sweitzer et al. (2016). Of the households included in the database, we selected the 62,503 belonging to the “Static Panel,” a panel of households meeting specific criteria for purchase recordings and which have assigned sample weights to result in nationally representative purchases. For additional information regarding how sampling weights are constructed and the complete documentation of the database, please see Sweitzer et al. (2016).

We segmented the data into two groups, Low-Income (LI) and Non-Low-Income (NLI) households using the 12 income brackets reported in the IRI-CNP database and the U.S. Census Bureau Poverty Thresholds (U.S. Census Bureau, 2015) for that year. Households are determined to be LI if the midpoint of their income bracket is at or below 200% of the official poverty threshold for their reported household size, otherwise they are defined as NLI. In the household panel, there are 13,647 households (21.8% of the sample), classified as LI and 48,856 (78.2%) as NLI.

The IRI-CNP database provides household-level information on each purchase occasion (i.e., shopping trip): total ounces purchased, dollars paid, store type where the purchase took place (i.e., grocery store, drug store, mass merchandiser, superstore, convenience store, dollar store, club store, or all other stores), and if a coupon or promotion was used. We convert ounces to pounds for non-liquid products (e.g., ground beef and sandwich bread), fluid ounces to gallons for milk, and aggregate the purchase occasions of each household to the annual level, to mitigate the effects of stockpiling (i.e., for ground beef and sandwich bread which are easily frozen). We include both purchasing and non-purchasing households in our analysis; a purchasing household has aggregate annual quantity purchased (total ounces) of an item greater than zero. Average price paid is calculated by dividing total expenditures (obtained by aggregating dollars paid to an annual level) by total quantity (pounds or gallons).

The product versions included in this analysis are: Skim/Lowfat Milk, Whole Milk, Lean Ground Beef, Regular Ground Beef, White Sandwich Bread, Wheat Sandwich Bread. Summary statistics are presented in Table 1.

The dependent variables are total quantity purchased of the three products considered (in pounds for bread and ground beef, gallons for milk). For household i , and for each product, we indicate

with $Q_{R,i}$ the purchased quantity of the recommended for increased consumption version (RIC), and with $Q_{D,i}$ that of the item recommended for limited consumption (RLC). We generate two indicator variables d_i^{LI} and d_i^{NLI} ; the first takes the value of 1 for all the household classified as LI, and zero otherwise. Similarly, the second takes the values of 1 for all the household classified as NLI, and zero otherwise. The covariates used in the model (indicated as “ x ” below) are on per-unit price, race, household size, metro status, marital status, education, homeowner status, employment status, ethnicity, household composition type, and number of purchase occasions at each store type.² We interact each of these independent variables with the indicators d_i^{LI} and d_i^{NLI} to capture the different effects of each characteristic for LI and NLI purchases.

$$Q_{RIC,i} = d_i^{LI} \sum \beta_{RIC,i}^{LI} x_i + d_i^{NLI} \sum \beta_{RIC,i}^{NLI} x_i + \varepsilon_{R,i}$$

$$Q_{RLC,i} = d_i^{LI} \sum \beta_{RLC,i}^{LI} x_i + d_i^{NLI} \sum \beta_{RLC,i}^{NLI} x_i + \varepsilon_{D,i}$$

To account for the censored nature of the dependent variable, and the fact that the purchase of recommended for increased and limited consumption versions are correlated, we estimate each pair of equations (for each food item) allowing for the errors to be correlated (that is $Corr(\varepsilon_R, \varepsilon_D) = \rho$). Thus, we use a seemingly unrelated regression (bivariate) tobit, using the bitobit routine in STATA Lawson (2007). We use the regression coefficients to estimate three marginal effects for each regressor to determine their effects on quantity purchased –conditional and unconditional on whether it was purchased– and on the probability of purchasing a positive quantity of product, for both LI and NLI households.

We will perform statistical tests to assess the statistical difference of the estimated coefficients. The estimated equations are given by

$$\Delta\beta_x^{LI} = \beta_{x,RIC}^{LI} - \beta_{x,RLC}^{LI}; \Delta\beta_x^{NLI} = \beta_{x,RIC}^{NLI} - \beta_{x,RLC}^{NLI}$$

²Prices faced by non-purchasing households are imputed using the procedure by Cox and Wohlgenant (1986).

$$\Delta\beta_{x,RIC} = \beta_{x,RIC}^{NLI} - \beta_{x,RIC}^{LI}; \Delta\beta_{x,RLC} = \beta_{x,RLC}^{NLI} - \beta_{x,RLC}^{LI}$$

where $\Delta\beta_x^{LI}$ and $\Delta\beta_x^{NLI}$ represent the differences in coefficients (for the x variable) for the recommended and discouraged consumption items, for LI and NLI households, respectively; whereas $\Delta\beta_{x,RIC}$ and $\Delta\beta_{x,RLC}$ represent the difference in estimated coefficients for the x variable for the recommended and limited consumption items, respectively, across LI and NLI households. While the first pair illustrates whether the relationship between x and purchasing the recommended, and discouraged items are statistically different in LI and NLI (respectively), the second pair shifts the focus on how those relationships differ, for LI and NLI households, across RIC and RLC products.

Results

The results of the estimation are presented for each product, in the order illustrated above. The focus will be on the coefficients for price, income, ethnicity, and education levels of the household head.

Table 2 includes the results for milk. The “own-price” coefficients (Skim Milk’s price in the RIC purchase equation, and Whole Milk’s in the RLC’s) show the expected negative and statistically significant coefficients in both equations. Interestingly, even though LI households seem more price sensitive than NLI for both products based on the magnitude of the coefficients, the only statistically significant difference is for the whole milk (RLC), suggesting that LI households are more price sensitive than NLI for the RLC item, but not the RIC. The cross-price coefficients for both products are positive and statistically significant, suggesting the products are used as substitutes, but there is no statistical differences between NLI and LI households. These results suggest that prices have the same effect on household purchases of milk, regardless of income level.

Household income is negatively associated with purchases of both types of milk for NLI households, while for LI ones, the association is positive for Skim Milk and negative for Whole Milk. As a result, the responsiveness of milk purchases to income is statistically different across NLI and LI household for both RLC and RIC milk, and in both cases, they indicate a higher effect among NLI compared to LI households, i.e. $\Delta\beta_x^{RLC}$ and $\Delta\beta_x^{RIC}$ are both positive and statistically significant.

For NLI households, higher income has a statistically larger association with lower purchases of RLC than RIC, and the gap between RIC and RLC becomes larger for LI households ($\Delta\beta_x^{LI} > 0$).

Considering race and ethnicity, being Black, Hispanic, Asian, or other race (non-white) is associated with lower purchases of RIC (Skim) milk for households at both income levels, with coefficients that are not statistically different from one another. Furthermore, we find that LI households purchases of RLC milk is not affected by race and ethnicity in a statistically significant way, whereas NLI households' purchases is affected positively. Even so, there is no statistically significant difference between coefficients of LI and NLI households (that is, $\Delta\beta_{x,RIC}$ and $\Delta\beta_{x,RLC}$ for these variables are not statistically different than 0). However, the difference in RIC and RLC race and ethnicity coefficients for NLI and LI households shows that being black, Asian, or of other race is associated to relatively higher purchases of the RLC product (Whole Milk).

Finally, we find that the higher the education level of the household head, the stronger the positive association with the purchases of Skim Milk across both NLI and LI households, and the stronger the negative association with Whole Milk purchases. However, the difference in the magnitude of the estimated coefficients across income levels show little evidence of education having different effects on purchases of RLC or RIC items across household income levels (the only exception being college degrees, showing a statistically significant $\Delta\beta_{x,RLC}$). Given the differing sign of the education coefficients for RLC and RIC milk purchase equations, we observe the expected result that higher education levels are associated with higher purchases of Skim Milk than Whole Milk ($\Delta\beta_x^{LI}$ and $\Delta\beta_x^{NLI}$ are positive and statistically significant for all education levels, except "some college" for NLI households).

Table 3 includes the results for Ground Beef. The "own-price" coefficients (Lean Beef's price in the RIC purchase equation, Regular Beef's in the RLC's) show the expected negative and statistically significant coefficients in both equations. Based on the coefficients, LI households appear to be more price sensitive than NLI for both products, but while $\Delta\beta_{x,RIC}$ (Lean Beef) is positive and statistically significant, $\Delta\beta_{x,RLC}$ is not statistically different than 0. Interestingly, we find statistically significant differences in cross-price coefficients across NLI and LI household for both products; it should be mentioned, however, that the price of Regular Beef is associated with higher purchases of Lean Beef, whereas the Lean Beef price is associated with lower purchases of Regular Beef.

The effect of income on the purchases of Ground Beef suggests that higher income levels are associated with larger purchases of the RIC product (Lean Beef), and negatively to that of RLC (Regular Beef) for both income groups; furthermore, for both RLC and RIC beef, the coefficients for LI households are larger than NLI ones. However, the responsiveness of ground beef purchases to income is statistically different across NLI and LI households only for RLC ground beef. Also, we find that higher income households in both the NLI and LI groups may tend to purchase more of the RIC than RLC products, as the estimated $\Delta\beta_x^{LI}$ and $\Delta\beta_x^{NLI}$ are both positive and statistically significant.

Considering race and ethnicity, a Hispanic household head and a household head belonging to other races (non-white) do not seem to have a large effect on beef purchases. Household with a black household head purchase lower amounts of lean ground beef, whereas being black is not associated with the purchase of regular beef. As a result, both $\Delta\beta_x^{LI}$ and $\Delta\beta_x^{NLI}$ are negative and statistically different than zero, indicating that, overall, being black is associated with lower purchased levels of RIC beef. Households with an Asian household head purchased less ground beef (both RIC and RLC) across income groups. Most differences in coefficients for this variable are not statistically different than 0.

The education level of the household head seems to have a very limited effect on the purchased amounts of RIC ground beef for both NLI and LI households. Similarly, the estimate $\Delta\beta_{x,RIC}$ is not statistically different than 0 for this variable. In contrast, we find that higher levels of education of the household head are associated with statistically significant lower purchases of RLC beef, with larger coefficients for LI households. However, the estimated $\Delta\beta_{x,RLC}$ are positive and statistically significant only for “Some College” and “Post Graduate” education, providing some evidence that the association of higher levels of education with lower purchases of RLC may be stronger for LI households than NLI ones. The estimated $\Delta\beta_x^{LI}$ and $\Delta\beta_x^{NLI}$ are positive and statistically significant for all education levels (except “some college”).

Table 4 reports the results for Sandwich Bread. Again, own-price coefficients show the expected negative and statistically significant coefficients. The coefficients suggest that LI households are more price sensitive than NLI for both products; the positive and statistically significant $\Delta\beta_{x,RIC}$ and $\Delta\beta_{x,RLC}$ further support this conclusion. Interestingly, all of the estimated cross-price coefficients are negative and statistically significant, suggesting a certain level of complementarity

between the two types of sandwich bread.

The estimated coefficients of income are all negative and statistically significant, with the exception of LI, RIC bread, which is not statistically different than 0. Thus, the results suggest that higher income levels are associated with lower purchases of sandwich bread across all households. Higher income levels are associated with lower purchases of RIC bread for NLI more than LI ones ($\Delta\beta_{x,RIC}$ is negative and statistical significant), whereas no difference is found for RLC bread ($\Delta\beta_{x,RLC}$ is not statistically different than 0). Also, we find that higher income households in both the NLI and LI groups may purchase relatively more RIC bread compared to RLCs, as both estimated $\Delta\beta_x^{LI}$ and $\Delta\beta_x^{NLI}$ are positive and statistically significant.

Considering race and ethnicity, we find more heterogeneous patterns compared to those of the other two food products considered. For example, we find a positive and significant relationship between Hispanic household heads and RIC purchases for LI households, and a negative one with RLC purchases for NLI households. Overall, these result in positive and statistically significant $\Delta\beta_x^{LI}$ and $\Delta\beta_x^{NLI}$ and a negative $\Delta\beta_{x,RIC}$. Households with Black household heads purchase lower amounts of RLC and higher amounts of RIC breads, although we find no statistical difference in the coefficients for NLI and LI households in both equations; however, estimates of $\Delta\beta_x^{LI}$ and $\Delta\beta_x^{NLI}$ for this variable are both positive and statistically significant, indicating a higher overall purchase of RIC than RLC bread across both income groups. Having an Asian household head seems to be related to lower overall purchases of sandwich breads across product types and income levels. However, for RLC bread, the effect is more marked for LI than NLI households ($\Delta\beta_{x,RLC}$ is positive and statistically significant); for LI households, the effect is larger for RLC than RIC bread ($\Delta\beta_x^{LI}$ is positive and statistically significant).

The education level of the household head has no statistically significant effect on the purchases of RIC bread in LI households, whereas for NLI households, higher education levels (college or post graduate) are negatively related to its purchases. Interestingly, higher education levels discourage purchases of white bread for both NLI and LI household. Therefore, as education level increases, households seem to move away from sandwich bread altogether; as the estimated $\Delta\beta_{x,RIC}$ and $\Delta\beta_{x,RLC}$ are all statistically significant, and, respectively, negative and positive in sign, we find some evidence that higher levels of education can be associated with lower purchases of RLC and higher RIC (relatively speaking) more for LI than NLI households. The estimated $\Delta\beta_x^{LI}$ and $\Delta\beta_x^{NLI}$

are all positive and statistically significant.

Discussion

Our results present a detailed examination of how price and several socio-economic factors are associated with the purchased amount of food items recommended for increased and limited consumption (RIC and RLC, respectively) for low-income (LI) and non-low-income (NLI) households. We focus on three products that have a version that is RIC and RLC by the DGA: bread, ground beef, and sandwich bread. Our results highlight the differing effect of these factors on LI and NLI households for each product.

Consistent with our expectations, we find that as the price increases, the quantity purchased decreases for both RIC and RLC across all household types. We find that LI households are more price sensitive than NLI households for all three RLC items, whereas for the RIC ones, this only applied to ground beef and sandwich bread. Furthermore, while we find that higher prices of the RLC may lead to the increase in purchases of RIC (for milk and ground beef), a similar substitution effect does not occur when prices of RIC items increase (only for milk). This result lends some support to policies increasing the price of less healthy food items (i.e. “fat-tax”), which may have some effect in encouraging the purchase of RIC items, while providing little support for policies aiming to subsidize the purchases of healthier items.

Households with a higher income purchased a lower quantity of all three RLC items while the results for the RIC items were mixed. NLI households with a higher income purchased a lower quantity of RIC sandwich bread and milk, but purchased a higher quantity of RIC ground beef. However, LI households with higher incomes were associated with a higher quantity of RIC purchased, although the result was statistically insignificant for sandwich bread. These results suggest that supplementing LI households’ income could lead to healthier purchases within a food group. In addition, the income effect on RIC purchases was greater for LI households, although the difference was statistically insignificant for beef.

Most of the results for the ethnicity and race of the household head were mixed. Asian household heads bought less of all three RIC items for both LI and NLI households. Similarly, Blacks and Hispanics also bought less RIC ground beef and milk, but purchased more sandwich bread, although some of the results were statistically insignificant. Among RLCs, most of the results were insignif-

icant, particularly for LI households. The exception was Bread RLC, which had fewer purchases among Hispanics and all three race categories for both LI and NLI households.

A higher education level of the household head was associated with lower quantities of RLC items purchased, although some of the results for those with some college education were statistically insignificant. However, for RIC items, only milk had a higher quantity of purchases associated with having at least a college degree for both LI and NLI households. The results for bread and beef were mostly statistically insignificant; household heads with higher education levels purchased less RIC bread among NLI households. These suggest that having a higher education level reduces purchases of RLC items, with a greater effect on LI households, but does not necessarily lead to greater purchases of RIC products.

Conclusion

The results from our study suggest that prices and other socio-economic characteristics have a significant effect on the purchased quantity of food products for which the *Dietary Guidelines for Americans* recommends limited consumption, but have mixed effects on those recommended for increased consumption. Our results suggest that increasing prices of food products recommended for limited consumption or increasing household income could result in lower purchases of these items, and may also increase purchases of those recommended for consumption in its place. They also suggest improving education may lead to fewer purchases of less healthy products, particularly for low-income households.

Understanding the extent of these associations is important for public policy, especially to design the appropriate policy intervention for the target population. It has been highlighted that using separate indicators for SECs –such as education, occupation, and household income– affect diets differently (e.g. Turrell et al. 2003). The findings of our study suggest that policies aimed at increasing the prices of less healthy products would have a greater effect on households across income levels. In addition, given that higher education levels have a stronger effect on low-income households, our results suggest that educational campaigns targeted specifically at these households may be more effective.

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Table 1. Means and Differences of Means between NLI and LI

Variable	Milk			Beef			Bread		
	NLI Mean	LI Mean	Difference	NLI Mean	LI Mean	Difference	NLI Mean	LI Mean	Difference
rinc_totlb_imp	18.45	17.50	0.95 ***	0.89	0.72	0.17 ***	5.89	7.47	-1.58 ***
rlim_totlb_imp	3.42	5.67	-2.24 ***	1.95	3.69	-1.73 ***	6.75	10.80	-4.05 ***
rinc_price_imp	3.91	3.75	0.16 ***	4.40	4.27	0.13 ***	1.57	1.43	0.14 ***
rlim_price_imp	4.59	4.13	0.45 ***	2.96	2.86	0.10 ***	1.38	1.23	0.15 ***
medinc	80.14	21.77	58.37 ***	80.14	21.77	58.37 ***	80.14	21.77	58.37 ***
race2	0.10	0.10	-0.01 **	0.10	0.10	-0.01 **	0.10	0.10	-0.01 **
race3	0.04	0.02	0.02 ***	0.04	0.02	0.02 ***	0.04	0.02	0.02 ***
race4	0.04	0.05	-0.01 ***	0.04	0.05	-0.01 ***	0.04	0.05	-0.01 ***
hhsz	2.32	2.48	-0.15 ***	2.32	2.48	-0.15 ***	2.32	2.48	-0.15 ***
marital1	0.70	0.44	0.26 ***	0.70	0.44	0.26 ***	0.70	0.44	0.26 ***
edu_somcol	0.42	0.42	-0.01	0.42	0.42	-0.01	0.42	0.42	-0.01
edu_college	0.46	0.29	0.16 ***	0.46	0.29	0.16 ***	0.46	0.29	0.16 ***
edu_postgrad	0.21	0.06	0.15 ***	0.21	0.06	0.15 ***	0.21	0.06	0.15 ***
own	0.87	0.66	0.21 ***	0.87	0.66	0.21 ***	0.87	0.66	0.21 ***
emp_parttime	0.22	0.24	-0.02 ***	0.22	0.24	-0.02 ***	0.22	0.24	-0.02 ***
emp_fulltime	0.66	0.33	0.34 ***	0.66	0.33	0.34 ***	0.66	0.33	0.34 ***
hisp1	0.05	0.05	0.00	0.05	0.05	0.00	0.05	0.05	0.00
type_yngchild	0.08	0.11	-0.03 ***	0.08	0.11	-0.03 ***	0.08	0.11	-0.03 ***
type_oldchild	0.11	0.17	-0.06 ***	0.11	0.17	-0.06 ***	0.11	0.17	-0.06 ***
type_couple	0.18	0.37	-0.19 ***	0.18	0.37	-0.19 ***	0.18	0.37	-0.19 ***
metro	0.87	0.78	0.08 ***	0.87	0.78	0.08 ***	0.87	0.78	0.08 ***
region1	0.18	0.16	0.02 ***	0.18	0.16	0.02 ***	0.18	0.16	0.02 ***
region2	0.26	0.28	-0.02 ***	0.26	0.28	-0.02 ***	0.26	0.28	-0.02 ***
region3	0.36	0.37	-0.01 ***	0.36	0.37	-0.01 ***	0.36	0.37	-0.01 ***

Table 2. Parameter estimates, standard errors, and differences in value for skim/lowfat (RIC) and whole (RLC) milk

Variable	RIC		RLC		Differences			
	NLI (S.E.)	LI (S.E.)	NLI (S.E.)	LI (S.E.)	RIC (S.E.)	RLC (S.E.)	NLI (S.E.)	LI (S.E.)
<i>Prices</i>								
Price for RIC item	-4.047 *** (0.089)	-4.390 *** (0.197)	1.702 *** (0.085)	1.637 *** (0.183)	0.343 (0.216)	0.065 (0.202)	-5.749 *** (0.137)	-6.027 *** (0.299)
Price for RLC item	1.200 *** (0.100)	1.211 *** (0.211)	-2.244 *** (0.081)	-2.976 *** (0.166)	-0.010 (0.233)	0.732 *** (0.184)	3.445 *** (0.144)	4.187 *** (0.300)
<i>Characteristics of the household</i>								
Income	-0.006 ** (0.003)	0.151 *** (0.027)	-0.026 *** (0.003)	-0.087 *** (0.024)	-0.157 *** (0.028)	0.060 ** (0.024)	0.020 *** (0.005)	0.237 *** (0.041)
Household size	4.289 *** (0.184)	2.311 *** (0.299)	1.855 *** (0.170)	2.377 *** (0.260)	1.978 *** (0.352)	-0.521 * (0.311)	2.434 *** (0.278)	-0.066 (0.442)
Married	4.206 *** (0.402)	4.129 *** (0.669)	1.104 *** (0.373)	1.247 ** (0.586)	0.077 (0.780)	-0.143 (0.695)	3.103 *** (0.607)	2.882 *** (0.989)
Owns rather than rents	2.463 *** (0.376)	2.517 *** (0.509)	-1.959 *** (0.344)	-0.885 ** (0.450)	-0.053 (0.633)	-1.075 * (0.566)	4.423 *** (0.564)	3.401 *** (0.753)
<i>Household race and ethnicity</i>								
Hispanic	-2.438 *** (0.587)	0.535 (1.137)	0.034 (0.541)	-0.717 (0.996)	-2.973 ** (1.280)	0.750 (1.133)	-2.472 *** (0.885)	1.251 (1.681)
Black	-12.363 *** (0.432)	-12.154 *** (0.810)	2.517 *** (0.382)	-0.236 (0.686)	-0.210 (0.918)	2.753 *** (0.785)	-14.881 *** (0.638)	-11.918 *** (1.176)
Asian	-8.450 *** (0.677)	-9.546 *** (1.810)	2.215 *** (0.628)	2.476 (1.558)	1.096 (1.933)	-0.261 (1.680)	-10.665 *** (1.022)	-12.022 *** (2.655)
Other race, not white	-5.046 *** (0.673)	-5.282 *** (1.169)	1.817 *** (0.611)	0.360 (1.018)	0.236 (1.348)	1.457 (1.187)	-6.863 *** (1.007)	-5.642 *** (1.721)
<i>Household type</i>								
Households with younger children	-0.303 (0.531)	1.015 (0.932)	4.199 *** (0.485)	0.515 (0.815)	-1.318 (1.073)	3.684 *** (0.948)	-4.502 *** (0.799)	0.499 (1.380)
Households with older children	4.714 *** (0.514)	4.456 *** (0.878)	-2.134 *** (0.486)	-0.943 (0.775)	0.258 (1.017)	-1.191 (0.915)	6.848 *** (0.784)	5.399 *** (1.303)
Couples	-0.122 (0.482)	-2.068 *** (0.756)	-1.313 *** (0.454)	-1.467 ** (0.670)	1.946 ** (0.896)	0.153 (0.810)	1.191 (0.730)	-0.601 (1.120)
<i>Education of household head</i>								
Some college	-0.463 * (0.279)	0.831 (0.505)	-0.482 * (0.261)	-0.414 (0.447)	-1.294 ** (0.577)	-0.068 (0.518)	0.019 (0.423)	1.245 * (0.749)
College graduate	1.203 *** (0.275)	1.718 *** (0.548)	-2.915 *** (0.259)	-1.976 *** (0.491)	-0.515 (0.613)	-0.939 * (0.555)	4.118 *** (0.418)	3.694 *** (0.816)
Post graduate	1.646 *** (0.333)	2.661 *** (0.982)	-3.007 *** (0.321)	-2.708 *** (0.895)	-1.015 (1.037)	-0.300 (0.950)	4.653 *** (0.511)	5.369 *** (1.472)
Part-time	-0.464 (0.299)	-0.191 (0.560)	-0.822 *** (0.284)	-0.458 (0.499)	-0.273 (0.634)	-0.364 (0.575)	0.358 (0.456)	0.267 (0.832)
Full-time	-2.047 *** (0.280)	-0.027 (0.601)	0.057 (0.265)	-0.788 (0.532)	-2.020 *** (0.663)	0.845 (0.594)	-2.104 *** (0.427)	0.761 (0.891)
<i>Household location</i>								
Lives in urban county	-0.614 * (0.367)	-0.373 (0.581)	-1.212 *** (0.344)	-0.821 (0.516)	-0.240 (0.687)	-0.391 (0.620)	0.598 (0.557)	0.448 (0.862)
Midwest	0.549 (0.399)	1.878 ** (0.797)	2.418 *** (0.375)	1.072 (0.711)	-1.329 (0.891)	1.346 * (0.804)	-1.869 *** (0.606)	0.806 (1.185)
Northeast	4.605 *** (0.369)	4.400 *** (0.702)	-2.020 *** (0.360)	-2.558 *** (0.640)	0.205 (0.793)	0.538 (0.734)	6.625 *** (0.569)	6.959 *** (1.053)
South	-0.169 (0.349)	-2.137 *** (0.676)	2.927 *** (0.328)	3.289 *** (0.598)	1.968 *** (0.761)	-0.362 (0.682)	-3.096 *** (0.530)	-5.426 *** (1.001)
<i>Type of store</i>								
Dollar store purchases	-0.127 *** (0.023)	-0.062 ** (0.027)	0.150 *** (0.019)	0.146 *** (0.022)	-0.064 * (0.035)	0.004 (0.029)	-0.276 *** (0.033)	-0.208 *** (0.038)
Superstore purchases	0.024 *** (0.005)	0.042 *** (0.008)	0.014 *** (0.004)	0.031 *** (0.007)	-0.018 * (0.010)	-0.017 * (0.009)	0.009 (0.007)	0.011 (0.012)
Mass-merchandise purchases	0.160 *** (0.006)	0.120 *** (0.015)	0.001 (0.006)	-0.002 (0.013)	0.039 ** (0.016)	0.003 (0.015)	0.159 *** (0.009)	0.122 *** (0.022)
Convenience, drug store, or other	0.068 *** (0.007)	0.096 *** (0.012)	0.041 *** (0.006)	0.040 *** (0.011)	-0.028 ** (0.014)	0.000 (0.013)	0.028 *** (0.010)	0.056 *** (0.018)
<i>Constants</i>								
Low-income indicator		-0.165 (1.733)		4.230 *** (1.522)				
Constant	10.641 *** (0.888)		-6.056 *** (0.812)					

Table 3. Parameter estimates, standard errors, and differences in value for lean (RIC) and regular fat (RLC) ground beef

Variable	RIC		RLC		Differences			
	NLI (S.E.)	LI (S.E.)	NLI (S.E.)	LI (S.E.)	RIC (S.E.)	RLC (S.E.)	NLI (S.E.)	LI (S.E.)
<i>Prices</i>								
Price for RIC item	-0.569 *** (0.118)	-1.413 *** (0.263)	-3.854 *** (0.265)	-4.717 *** (0.560)	0.844 *** (0.289)	0.862 (0.618)	3.286 *** (0.281)	3.304 *** (0.599)
Price for RLC item	0.845 *** (0.203)	2.440 *** (0.443)	-5.139 *** (0.262)	-9.486 *** (0.531)	-1.594 *** (0.486)	4.347 *** (0.592)	5.985 *** (0.316)	11.926 *** (0.663)
<i>Characteristics of the household</i>								
Income	0.014 *** (0.002)	0.040 ** (0.020)	-0.027 *** (0.003)	-0.100 *** (0.026)	-0.026 (0.020)	0.073 *** (0.026)	0.041 *** (0.004)	0.140 *** (0.031)
Household size	0.136 (0.127)	-0.015 (0.214)	1.891 *** (0.187)	2.355 *** (0.271)	0.151 (0.249)	-0.464 (0.329)	-1.755 *** (0.218)	-2.370 *** (0.333)
Married	0.751 *** (0.288)	-0.223 (0.481)	1.518 *** (0.428)	0.863 (0.631)	0.974 * (0.561)	0.655 (0.763)	-0.768 (0.500)	-1.086 (0.766)
Owns rather than rents	0.024 (0.267)	0.646 * (0.374)	-1.496 *** (0.394)	-2.549 *** (0.494)	-0.622 (0.459)	1.054 * (0.631)	1.520 *** (0.461)	3.195 *** (0.598)
<i>Household race and ethnicity</i>								
Hispanic	0.688 * (0.399)	-0.226 (0.839)	-0.880 (0.624)	-0.947 (1.108)	0.914 (0.929)	0.066 (1.272)	1.569 ** (0.717)	0.721 (1.344)
Black	-3.878 *** (0.332)	-3.453 *** (0.651)	0.336 (0.442)	0.800 (0.748)	-0.425 (0.730)	-0.463 (0.868)	-4.214 *** (0.535)	-4.253 *** (0.960)
Asian	-3.424 *** (0.530)	-4.362 *** (1.498)	-5.032 *** (0.842)	-7.781 *** (2.047)	0.938 (1.588)	2.749 (2.213)	1.608 * (0.970)	3.419 (2.464)
Other race, not white	-0.819 * (0.469)	-0.502 (0.851)	-0.005 (0.712)	-1.704 (1.153)	-0.317 (0.972)	1.699 (1.355)	-0.814 (0.826)	1.202 (1.386)
<i>Household type</i>								
Households with younger children	-0.302 (0.366)	-0.031 (0.650)	-1.878 *** (0.551)	-1.300 (0.862)	-0.271 (0.747)	-0.578 (1.023)	1.576 ** (0.640)	1.269 (1.041)
Households with older children	0.114 (0.355)	-0.150 (0.623)	-0.119 (0.527)	0.992 (0.804)	0.265 (0.717)	-1.111 (0.961)	0.233 (0.614)	-1.142 (0.981)
Couples	-1.236 *** (0.358)	-1.593 *** (0.555)	-1.860 *** (0.538)	-2.013 *** (0.744)	0.357 (0.660)	0.154 (0.918)	0.624 (0.627)	0.420 (0.898)
<i>Education of household head</i>								
Some college	0.292 (0.195)	0.475 (0.368)	0.161 (0.292)	-1.311 *** (0.488)	-0.183 (0.416)	1.472 *** (0.568)	0.131 (0.339)	1.786 *** (0.590)
College graduate	0.258 (0.192)	0.765 * (0.397)	-1.920 *** (0.292)	-2.019 *** (0.536)	-0.507 (0.441)	0.098 (0.610)	2.179 *** (0.338)	2.784 *** (0.645)
Post graduate	0.020 (0.238)	0.480 (0.719)	-2.919 *** (0.375)	-5.392 *** (1.040)	-0.460 (0.757)	2.474 ** (1.105)	2.939 *** (0.431)	5.873 *** (1.225)
Part-time	0.038 (0.210)	-0.013 (0.408)	-0.202 (0.322)	-0.673 (0.547)	0.051 (0.459)	0.472 (0.635)	0.240 (0.373)	0.660 (0.659)
Full-time	0.052 (0.200)	-0.054 (0.433)	1.993 *** (0.305)	0.569 (0.576)	0.106 (0.477)	1.424 ** (0.651)	-1.941 *** (0.354)	-0.624 (0.696)
<i>Household location</i>								
Lives in urban county	0.968 *** (0.252)	1.737 *** (0.424)	-1.014 *** (0.369)	-0.132 (0.552)	-0.769 (0.493)	-0.882 (0.664)	1.982 *** (0.431)	1.870 *** (0.672)
Midwest	-7.148 *** (0.336)	-7.765 *** (0.686)	-10.062 *** (0.539)	-9.987 *** (0.964)	0.617 (0.760)	-0.075 (1.102)	2.914 *** (0.619)	2.222 * (1.149)
Northeast	-1.320 *** (0.249)	-2.708 *** (0.478)	-1.813 *** (0.389)	-1.272 * (0.675)	1.388 *** (0.538)	-0.541 (0.779)	0.493 (0.447)	-1.436 * (0.799)
South	-2.979 *** (0.236)	-5.012 *** (0.465)	-0.012 (0.363)	-0.327 (0.647)	2.032 *** (0.520)	0.316 (0.742)	-2.968 *** (0.420)	-4.684 *** (0.770)
<i>Type of store</i>								
Dollar store purchases	0.021 (0.030)	-0.020 (0.045)	0.311 *** (0.031)	0.327 *** (0.034)	0.041 (0.054)	-0.016 (0.046)	-0.290 *** (0.042)	-0.347 *** (0.055)
Superstore purchases	0.166 *** (0.002)	0.147 *** (0.004)	0.256 *** (0.003)	0.297 *** (0.006)	0.019 *** (0.004)	-0.041 *** (0.006)	-0.090 *** (0.004)	-0.150 *** (0.007)
Mass-merchandise purchases	0.171 *** (0.004)	0.148 *** (0.009)	0.199 *** (0.007)	0.190 *** (0.014)	0.023 ** (0.010)	0.008 (0.016)	-0.027 *** (0.008)	-0.042 *** (0.016)
Convenience, drug store, or other	0.158 *** (0.008)	0.129 *** (0.014)	0.243 *** (0.013)	0.253 *** (0.020)	0.028 * (0.017)	-0.010 (0.024)	-0.085 *** (0.015)	-0.124 *** (0.023)
<i>Constants</i>								
Low-income indicator		-0.757 (2.050)		18.755 *** (3.245)				
Constant	-16.970 *** (0.927)		9.760 *** (1.494)					

Table 4. Parameter estimates, standard errors, and differences in value for whole wheat (RIC) and white (RLC) sandwich bread

Variable	RIC		RLC		Differences			
	NLI (S.E.)	LI (S.E.)	NLI (S.E.)	LI (S.E.)	RIC (S.E.)	RLC (S.E.)	NLI (S.E.)	LI (S.E.)
<i>Prices</i>								
Price for RIC item	-2.998 *** (0.185)	-4.864 *** (0.376)	-3.177 *** (0.245)	-3.463 *** (0.483)	1.865 *** (0.419)	0.286 (0.541)	0.178 (0.319)	-1.401 ** (0.636)
Price for RLC item	-1.819 *** (0.187)	-1.921 *** (0.403)	-1.616 *** (0.189)	-4.053 *** (0.416)	0.102 (0.445)	2.437 *** (0.457)	-0.203 (0.276)	2.132 *** (0.603)
<i>Characteristics of the household</i>								
Income	-0.028 *** (0.003)	0.036 (0.023)	-0.048 *** (0.003)	-0.054 ** (0.026)	-0.064 *** (0.023)	0.005 (0.026)	0.020 *** (0.004)	0.089 ** (0.036)
Household size	2.079 *** (0.152)	1.590 *** (0.244)	4.055 *** (0.177)	4.413 *** (0.278)	0.488 * (0.288)	-0.358 (0.330)	-1.976 *** (0.243)	-2.823 *** (0.384)
Married	2.959 *** (0.340)	3.436 *** (0.550)	3.315 *** (0.397)	2.570 *** (0.625)	-0.477 (0.647)	0.745 (0.740)	-0.357 (0.541)	0.866 (0.864)
Owns rather than rents	0.553 * (0.317)	0.025 (0.420)	-0.671 * (0.373)	-1.022 ** (0.484)	0.528 (0.527)	0.351 (0.611)	1.224 ** (0.507)	1.047 (0.665)
<i>Household race and ethnicity</i>								
Hispanic	0.780 (0.492)	3.131 *** (0.928)	-1.393 ** (0.592)	-0.554 (1.091)	-2.351 ** (1.050)	-0.839 (1.241)	2.173 *** (0.797)	3.685 ** (1.486)
Black	4.570 *** (0.345)	4.378 *** (0.635)	-5.230 *** (0.433)	-3.811 *** (0.751)	0.192 (0.722)	-1.420 (0.867)	9.801 *** (0.573)	8.189 *** (1.020)
Asian	-3.291 *** (0.585)	-2.716 * (1.503)	-4.709 *** (0.708)	-8.897 *** (1.815)	-0.574 (1.612)	4.188 ** (1.948)	1.418 (0.948)	6.181 ** (2.438)
Other race, not white	0.409 (0.564)	-0.467 (0.959)	-2.457 *** (0.679)	-4.627 *** (1.128)	0.876 (1.113)	2.170 (1.317)	2.866 *** (0.914)	4.160 *** (1.536)
<i>Household type</i>								
Households with younger children	0.121 (0.443)	-0.474 (0.766)	-2.467 *** (0.522)	-4.587 *** (0.880)	0.595 (0.885)	2.120 ** (1.023)	2.589 *** (0.710)	4.113 *** (1.212)
Households with older children	-0.178 (0.429)	-1.547 ** (0.721)	0.899 * (0.497)	0.515 (0.816)	1.369 (0.839)	0.384 (0.955)	-1.077 (0.681)	-2.062 * (1.132)
Couples	-1.262 *** (0.411)	-0.322 (0.624)	-3.673 *** (0.489)	-5.343 *** (0.717)	-0.940 (0.747)	1.670 * (0.867)	2.411 *** (0.660)	5.021 *** (0.985)
<i>Education of household head</i>								
Some college	-0.327 (0.235)	0.525 (0.417)	-1.556 *** (0.273)	-4.066 *** (0.477)	-0.852 * (0.479)	2.510 *** (0.550)	1.229 *** (0.373)	4.591 *** (0.658)
College graduate	-0.686 *** (0.231)	0.241 (0.453)	-5.086 *** (0.272)	-7.201 *** (0.526)	-0.927 * (0.508)	2.115 *** (0.591)	4.400 *** (0.370)	7.441 *** (0.720)
Post graduate	-0.942 *** (0.284)	0.946 (0.810)	-7.019 *** (0.341)	-10.640 *** (0.986)	-1.888 ** (0.858)	3.621 *** (1.043)	6.077 *** (0.459)	11.586 *** (1.322)
Part-time	0.276 (0.252)	-0.424 (0.461)	-1.081 *** (0.297)	-1.531 *** (0.535)	0.700 (0.526)	0.451 (0.612)	1.357 *** (0.404)	1.107 (0.733)
Full-time	-0.364 (0.238)	-0.805 (0.495)	-0.319 (0.280)	-0.882 (0.568)	0.441 (0.549)	0.563 (0.633)	-0.045 (0.380)	0.077 (0.782)
<i>Household location</i>								
Lives in urban county	-0.937 *** (0.306)	-1.491 *** (0.478)	-2.285 *** (0.354)	-2.043 *** (0.545)	0.554 (0.567)	-0.242 (0.650)	1.348 *** (0.485)	0.552 (0.752)
Midwest	1.810 *** (0.350)	0.382 (0.675)	12.293 *** (0.416)	13.633 *** (0.786)	1.428 * (0.760)	-1.340 (0.888)	-10.483 *** (0.562)	-13.251 *** (1.073)
Northeast	4.988 *** (0.315)	2.541 *** (0.581)	8.033 *** (0.381)	8.296 *** (0.692)	2.447 *** (0.660)	-0.263 (0.789)	-3.045 *** (0.511)	-5.755 *** (0.936)
South	1.338 *** (0.299)	-1.343 ** (0.557)	7.356 *** (0.362)	9.109 *** (0.661)	2.681 *** (0.632)	-1.753 ** (0.753)	-6.019 *** (0.485)	-10.452 *** (0.896)
<i>Type of store</i>								
Dollar store purchases	0.033 ** (0.014)	-0.019 (0.019)	0.158 *** (0.017)	0.129 *** (0.020)	0.052 ** (0.023)	0.028 (0.026)	-0.125 *** (0.023)	-0.148 *** (0.029)
Superstore purchases	0.054 *** (0.004)	0.074 *** (0.007)	0.082 *** (0.004)	0.059 *** (0.008)	-0.019 ** (0.008)	0.023 *** (0.009)	-0.028 *** (0.006)	0.014 (0.010)
Mass-merchandise purchases	0.083 *** (0.005)	0.059 *** (0.012)	-0.025 *** (0.006)	-0.051 *** (0.014)	0.025 * (0.013)	0.025 (0.016)	0.109 *** (0.008)	0.110 *** (0.019)
Convenience, drug store, or other	0.049 *** (0.006)	0.044 *** (0.011)	0.027 *** (0.007)	0.019 (0.012)	0.004 (0.012)	0.007 (0.014)	0.022 ** (0.010)	0.025 (0.017)
<i>Constants</i>								
Low-income indicator		4.480 *** (1.337)		6.838 *** (1.555)				
Constant	-2.356 *** (0.704)		-3.556 *** (0.828)					