

Food Access and Its Relationship To Food Choice

Policymakers are concerned about people with limited access to healthy food because they believe it may influence food shopping and spending behavior, the prices of food faced by people in areas with limited access, and the types of foods purchased and consumed. This chapter examines these economic consequences of limited access. Food shopping behaviors for participants of the Supplemental Nutrition Assistance Program are summarized.³⁵ The chapter also considers food spending behavior for SNAP participants with different levels of access to supermarkets, examining the types of foods that SNAP participants purchase based on their access to supermarkets. Finally, the chapter analyzes data on the price of selected similar foods across different food retail outlet types.

Food Shopping Behavior for Participants of SNAP

SNAP serves as the foundation of America's national nutrition safety net for low-income families. In November 2008, more than 31 million persons participated in the program and received an average benefit of \$115. Benefits are targeted to the purchase of food for home use and are redeemed through more than 175,000 authorized stores.

Access to a variety of high quality and affordable foods is essential to meet the program's mission of improving food security, reducing hunger, and providing access to a healthful diet and nutrition education. Of particular concern are households who live in rural areas or low-income urban neighborhoods where access to stores that offer such quality and variety at reasonable cost may be limited. During the mid-1990s, USDA's Food and Nutrition Service implemented a research agenda to address questions about food access among SNAP and other low-income households. While these data are from the 1990s, they provide a foundation for exploring store access. At the same time, care should be taken to view these findings in the historical context in which they were generated. Several relevant changes have occurred during the last 15 years. For example, both the number and profile of authorized stores have changed. At the same time, there has been an increase in the percentage of SNAP benefits used in superstores and supermarkets. SNAP eligibility rules with respect to vehicle ownership are now less restrictive, which may expand store access.

In order to participate in SNAP, stores must apply for authorization and demonstrate that they meet established eligibility criteria. These criteria address the nature and extent of food business conducted; the volume of SNAP sales that can be reasonably expected; as well as the business integrity of the store applicant (7 CFR 278.1 (b)). The first criterion is operationally defined in terms of 1) a store's food sales volume in relation to overall sales and/or 2) inventory of staple foods and the variety of products available within specified staple food categories.

³⁵On October 1, 2008, the Food Stamp Program changed its name to the Supplemental Nutrition Assistance Program (SNAP). Because all of the research discussed in this section was conducted prior to the name change, most program references are to the Food Stamp Program.

These broad criteria enable FNS to authorize a wide variety of store types and sizes in many locations so that participants have a range of food shopping options. Table 5.1 compares the percentage of authorized retailers and benefits redeemed by store type in Fiscal Years (FY) 1994 and 2008.

Store types are defined in terms of the dollar value of annual gross sales and product lines offered. Supermarkets are defined as foodstores that provide a full range of foods and have \$2 million or more in annual gross sales. Large groceries have annual sales between \$500,000 and \$2 million, while small grocery stores have annual sales of less than \$500,000.³⁶ Convenience stores provide a more limited range of foods, usually excluding fresh produce. Specialty stores primarily sell one or two product lines, such as produce, meats, or baked goods. Examples of other store types include nonprofit food buying co-op stores and combination grocery/other stores.

The largest category of stores in both FY 1994 and FY 2008 is convenience stores; they accounted for 27 and 35 percent of all authorized stores, respectively. In contrast, the majority of program benefits are spent in supermarkets or other large stores³⁷ – 77 percent in FY 1994 and 87 percent in FY 2008. These data exemplify the rise in the use of superstores for SNAP participants. On the other hand, redemptions at medium-sized grocery stores have decreased since 1994.

SNAP benefit redemptions in relation to where participants live

Historically, much of the research on food deserts has focused on geographic proximity to food retailers. While this work offers one perspective on store access, another is to examine where low-income families actually shop. Mantovani and Welsh (1996) report that food stamp shoppers tended to use their benefits outside of the ZIP Code in which they live. This pattern was

³⁶The 2008 data include a category for medium sized stores. For this classification, stores with sales of \$1 million to \$2 million are large, \$250,000 to \$1 million are medium, and less than \$250,000 are small.

³⁷In FY 1994, this category included supermarkets and large grocery stores. In FY 2008, the category includes supermarkets, superstores, and large grocery stores.

Table 5.1
Percentage of Authorized Retailers and SNAP Redemptions by Category FY 1994 Versus FY 2008

Store type	Authorized retailers		Benefits redeemed	
	FY 1994	FY 2008	FY 1994	FY 2008
			<i>Percent</i>	
Supermarkets	15	12	77	47
Superstores	na	8		37
Large grocery stores ¹		2		2
Medium grocery stores	25	6	11	2
Small grocery stores ²		9		2
Convenience stores	27	35	4	4
Combination stores ³	16	17	3	2
Farmers' markets	<1	<1	<1	<1
All other	17	9	5	2
Total	100	98	100	98

¹In FY 1994, data for large grocery stores and supermarkets was combined.

²In FY 1994, data for small and medium grocery stores was combined.

³This category includes stores such as independent drug stores, dollar stores, and general stores.

na =not applicable.

Source: USDA, FNS calculations based on 1994 and 2008 administrative data on SNAP redemptions.

more noticeable in rural areas, where recipients shopped in relatively larger population centers. Even in urban areas, however, households traveled beyond their neighborhood supermarkets to more affluent areas and/or to other low-income ZIP Codes to access stores offering items of particular interest, such as fresh fruits and vegetables or ethnic products.

FNS also surveyed nationally representative samples of participants, eligible nonparticipants, and near-eligible nonparticipants with questions about shopping patterns and access to stores in the National Food Stamp Program Survey (Ohls et al., 1999). Like other surveys of this kind, a disproportionate number of long-term participants were included, and determinations of eligibility could only approximate the criteria applied by the program.

Ohls et al. (1999) reported that nearly 90 percent of each low-income group used supermarkets as their main foodstore. Even among participants who reported that they usually did not shop at supermarkets, all but 2 percent reported that they sometimes used such stores.

Among program participants, the average distance to the nearest supermarket was 1.8 miles. In contrast, the average number of miles to the store used most often by participants and eligible nonparticipants was 4.9 miles. A similar study that used electronic benefits transfer (EBT) redemption data in the State of Maryland also found that SNAP participants redeemed benefits at stores farther than the nearest SNAP food retailer (Cole, 1997). This study found that in Maryland, the average distance traveled to redeem SNAP benefits was 2.7 miles, but the average distance to the nearest store was 0.3 miles. These data suggest low-income households typically bypassed nearby supermarkets to use stores farther from home.

Thirty-eight percent of participants and 34 percent of eligible nonparticipants reported that they did not shop in their neighborhoods. About half of each group said this was because there was no store nearby. Average distance to the most frequently used store among those reporting no neighborhood retailers was higher than the average distances reported by the overall participant and eligible nonparticipant samples. The average reported distance to the most frequently used store was 9.2 miles for participants with no neighborhood stores, compared to an average of 4.9 miles for the overall sample of food stamp households.

EBT transaction patterns

FNS has continuously tracked benefit redemption by store in the aggregate. With the introduction of EBT systems, it became feasible to examine shopping patterns at the household level. Maryland was the first State to operate EBT Statewide and provided FNS an opportunity to track the frequency, location, dollar value, and timing of household food purchases (Cole, 1997). Supermarkets comprised just 17 percent of authorized food stamp stores in Maryland at the time of the study. However, 44 percent of Statewide food stamp purchases occurred in supermarkets, and 72 percent of benefits were used in supermarkets. On any given day in the month, the supermarket percentage of total daily redemptions throughout the State was roughly constant. The same pattern occurred for other store types. This conflicts with the expectation that recipients make their large purchases in

supermarkets early in the month and fill in with smaller buys at other store types during the rest of the month.

More recently, FNS analyzed a national sample of EBT transaction data that was linked to store and household characteristics (Cole, 2005). Participants spent most of their food stamp benefits in supermarkets. Supermarkets accounted for 64 percent of all EBT purchases and 83 percent of the dollar value of food stamp benefits redeemed. Over 46 percent of food stamp households shopped exclusively at supermarkets, while less than 6 percent never shopped in supermarkets. The latter families were concentrated among households receiving the minimum monthly benefit, \$10 or less.

Shopping patterns did not vary substantially across community characteristics. The average number and dollar amount of purchases among households in counties with persistent poverty mirrored the national averages. The percentage of households with no supermarket purchases was almost the same in areas with persistent poverty (6 percent) as in areas without (5 percent). Similarly, the data show little difference across urban, suburban, and rural households. The percent of food stamp benefits redeemed in supermarkets ranged from 80 percent among rural families to 85 percent among households in suburban areas.

The aggregated redemption data for FY 2008 show that a majority of benefits are spent in large stores: 87 percent of food stamp benefits were redeemed in superstores, supermarkets, or large grocery stores. Only 4 percent of benefits were redeemed in convenience stores, and another 4 percent were redeemed in small to medium grocery stores.

Spending on Different Food Groups and Access to Supermarkets

The analysis now addresses the questions of what foods people buy and how access may influence purchase behavior. Using national data from the NFSPS, Rose and Richards (2004) examined the effects of limited access to supermarkets on the amount of fruit and vegetable purchases. Access to a supermarket was defined by three variables—distance to store, travel time to store, and car ownership. The study found that limited access to a supermarket was negatively related to the purchase of fruits and vegetables, but only the effect on fruits was statistically significant.

This analysis uses the same data used by Rose and Richards (2004) to examine the amount of food from different food groups purchased per week by SNAP participants. The study by Rose and Richards (2004) is extended in three ways. First, fruits and vegetables are separated into canned and noncanned forms. Limited access to a supermarket is hypothesized to exert greater effects on the purchase of noncanned produce than canned produce since many smaller grocery stores and convenience stores sell mostly canned, but not necessarily fresh fruits and vegetables. Additionally, potatoes and dried beans are treated as a separate vegetable category. The analysis also examines purchases of milk and other dairy products. Like fresh produce, milk and dairy products are perishable, so that milk purchases are hypothesized to be negatively affected by limited access to a supermarket.

Second, survey respondents were also asked whether they did their major food shopping at a supermarket as well as the frequency at which they shopped for food. The analysis combines these two variables to develop three mutually exclusive categories of access to a supermarket: major food shopping was not at a supermarket, no matter how frequently shopping was done; major food shopping was at a supermarket but shopping was infrequent (less than once in 2 weeks); and major food shopping was at a supermarket and was conducted at least once every 2 weeks. The measure of shopping frequency is intended to capture difficulty in getting to a store—if stores are relatively close and the costs (both time and travel costs) are low, then it is expected that respondents will shop more frequently. But if costs to getting to a supermarket are high, we would expect respondents to make less frequent trips to the supermarket.

Third, the extension to the Rose and Richards study accounts for the censored nature of food expenditures. In a given week, some households may not make any purchase of the food groups in question. To accommodate this data issue, the analysis employs the Tobit censored regression model, as discussed later.

Data

Data for examining supermarket access on food purchases are drawn from the NFSPS, conducted by Mathematica Policy Research, Inc. for USDA's FNS. The NFSPS employed computer-assisted personal interview (CAPI) methods to collect data on household food purchases among food stamp recipients between June 1996 and January 1997. Respondents reported their 7-day food use (some households were asked to provide four-day records), which included data on both the quantities and prices of food used as well as expenditures on food at home and away from home. This is the only USDA survey in which household food use (quantity and expenditure) data were collected since the 1987-88 Nationwide Food Consumption Survey. Social, demographic, and economic characteristics of households were also collected.

Data such as the National Health and Nutrition Examination Survey (NHANES) could be used to model food consumption, but the NHANES data do not include measures of food retail access. Further, it is not feasible to link NHANES data with geographically identifying data that could be used with more direct measures of access to food retailers (e.g. distance to supermarkets, number of supermarkets in the area, and the variety of food markets in the area).

In total, 1,109 in-person interviews were completed from the SNAP list frame, and 1,069 households provided complete information on quantity and expenditure data. After excluding households with missing information, the final sample totals 860 households.

There are more than 2,000 foods recorded in NFSPS, and they are aggregated according to the research focus of the project. Insufficient intake of foods rich in fiber and calcium (such as fruits, vegetables, and dairy products) is a major dietary deficiency facing Americans, especially the low-income subpopulation (Lin, 2005). The analysis hypothesizes that households with

limited access to supermarkets tend to spend proportionally less of their food budget on perishable foods, such as fresh fruits, fresh vegetables, and dairy products, than households that shop mainly at supermarkets. This study focuses on household purchases of five food groups—dairy products, noncanned fruits, noncanned vegetables, canned fruits, and canned vegetables.

The NFSPS collected data on access to and shopping at supermarkets. NFSPS respondents were asked if they did their food shopping at supermarkets, whether they had private vehicles or public transportation for food shopping, the distance and travel time to the stores in which they shopped, and the frequency of food shopping. Most of these variables are highly correlated. Only 7 percent of the sample households (64 out of 860) indicated that they did not shop mainly at supermarkets (table 5.2). Among those who shopped mainly at supermarkets, 27 percent (218 out of 796) shopped less than once in 2 weeks. In this study, three mutually exclusive categories are specified to signify limited access to a supermarket: major food shopping was not at a supermarket, no matter how frequently shopping was done; major food shopping was at a supermarket but shopping was infrequent (less than once in 2 weeks); and major food shopping was at a supermarket and was conducted at least once every 2 weeks. This three-part measure of access is an individual measure of access and not an area-based measure of access like those used in the previous chapter.

Tobit censored regression model

On any given week, some food stamp households did not purchase a particular food group. Therefore, a cluster of zero consumption values for a particular food group is observed in the data—making it necessary to estimate a censored regression model. Any statistical procedure that does not account for zero observations produces inconsistent parameter estimates. Tobin (1958) was the first to propose a censored normal regression model (Tobit model) to deal with censored data in regression, which can be expressed as below

$$(1) \quad \begin{aligned} q_i &= x'\beta_i + \varepsilon_i && \text{if } x'\beta_i + \varepsilon_i > 0 \\ &= 0 && \text{if } x'\beta_i + \varepsilon_i \leq 0, \quad i = 1, 2, \dots, n, \end{aligned}$$

where q_i denotes the endogenous variable, x is the vector of exogenous variables, and ε_i is the error term. The Tobit procedure was used to estimate 6 censored purchase equations.

Results

Six separate Tobit equations are estimated to examine the relationship between limited access to a supermarket on household purchases of fruits, vegetables, and milk. Fruits are disaggregated into canned and non-canned forms; vegetables are disaggregated into canned, potatoes and beans, and noncanned vegetables. Supermarket access is represented by a set of categorical variables: major food shopping was not at a supermarket, no

Table 5.2

Descriptive statistics of the NFSPS respondents

	Supermarket shopping			
	Total	Frequent shopper	Infrequent shopper	Not shop at
Sample	860	578	218	64
Average purchase	<i>Pounds per week</i>			
Noncanned vegetables	3.73	3.93	3.32	3.30
Canned vegetables	2.06	2.05	2.14	1.79
Potatoes and beans	2.95	3.05	2.92	2.10
Noncanned fruits	5.92	6.23	5.38	4.94
Canned fruits	1.59	1.66	1.51	1.19
Milk and dairy products	12.29	12.71	12.31	8.52
Proportion consuming	<i>Percent</i>			
Noncanned vegetables	85	86	83	78
Canned vegetables	69	67	73	70
Potatoes and beans	82	83	81	81
Noncanned fruits	83	85	80	78
Canned fruits	42	42	43	36
Milk and dairy products	97	97	98	94
Mean values of explanatory variables:				
Per capita income (\$/month)	305			
Meal number (# meals prepared from food purchase)	48			
	<i>Percent</i>			
Four day (sample report only 4-day purchase)	8			
Asian (sample)	1			
Black (sample)	39			
Native American (sample)	1			
Hispanic (sample)	13			
White (sample)	46			
Single-headed (sample with one head)	34			
Child (sample with children under 18)	56			
Elderly (sample with senior > 60)	27			
Less than high school (head without HS diploma)	46			
High school (head with HS diploma)	38			
College (head attended college)	16			
Rural (living in rural area)	15			
West	38			
South	20			
Midwest	24			
Northeast	18			
Spring	24			
Summer	24			
Fall	29			
Winter	23			

Source: USDA, ERS calculations based on 1996-97 National Food Stamp Program Survey data.

matter how frequently shopping was done; major food shopping was at a supermarket but shopping was infrequent (less than once in 2 weeks); and major food shopping was at a supermarket and was conducted at least once every 2 weeks (the reference group). The results are shown in table 5.3.

As expected, households that did not shop mainly at a supermarket tended to purchase significantly smaller amounts of noncanned vegetables, noncanned fruits, and milk than households that shopped frequently at a supermarket. Households that did not shop at a supermarket also purchased less canned fruits and vegetables as well as potatoes and beans, but the differences are not statistically significant at the 10-percent level. Compared to households that shopped frequently at a supermarket, infrequent supermarket shoppers purchased less of the six food categories in question, but the differences are not significant.

As indicated earlier, underconsumption of fruits, vegetables, and milk is a major dietary deficiency facing Americans, especially low-income Americans. The results suggest that food stamp recipients who did not shop at a supermarket purchased less of these already under-consumed foods than recipients who shopped frequently at a supermarket.

The Tobit results also point to other important determinants of food purchases. The number of meals (number of people and number of occasions) prepared from the weekly food purchases, as expected, positively affects the purchased amounts of the six food groups. Household purchases of these six food groups appear to vary by race and ethnicity. Compared with Whites, Asian and Hispanic households tend to buy more noncanned vegetables and noncanned fruits but less of canned vegetables and potatoes and beans. Black households tend to purchase less milk and potatoes and beans than Whites. Households with children purchase less noncanned vegetables but more canned fruits and milk than households without children. Households with elderly individuals buy more noncanned vegetables than households without elderly members. Sample members are grouped into three education categories—less than high school, high school graduate, and attended college. No differences are found across these education levels. Per capita income (within the low-income sample of SNAP participants) is not associated with differences in the purchases of any of the six food categories.

Price Differentials and Store Format

Another important consequence of limited access to foodstores is that consumers may face higher prices for food at the retail outlets that are available. As Chapter 5 noted, higher prices in some stores or areas may be due to lower volume of sales, higher fixed costs, or other reasons. This section compares prices of three selected goods—milk, ready-to-eat cereal, and bread—which are sold in almost all types of food retail outlets. There is not enough detailed information to compare prices in areas with limited access with those with better access. Instead, price variation is examined across store type—grocery, convenient, discount, and other stores.

Table 5.3
Tobit results

	Vegetables			Fruits		Milk
	Non canned	Canned	Potatoes Beans	Non canned	Canned	
Intercept	0.76	0.38	1.52 **	0.79	-5.95 ***	7.05 ***
Meal number	0.06 ***	0.02 ***	0.04 ***	0.07 ***	0.04 ***	0.13 ***
Four day	0.55	-0.97 **	0.27	-0.38	-0.97	-0.84
Income per capita	0.00	0.00	0.00	0.00	0.00	0.00
Asian	3.43 **	-2.91 **	-3.37 ***	6.76 ***	-1.00	-5.50 *
Black	0.25	0.27	-1.07 ***	0.12	-0.60	-5.60 ***
Native American	-0.01	-0.04	-0.60	0.13	-0.17	-3.61
Hispanics	1.09 *	-1.90 ***	-1.15 **	4.03 ***	0.24	-1.78
Single-headed	-0.23	0.41	0.34	0.17	-0.20	1.48 **
Child	-1.20 **	0.35	0.14	0.42	1.98 ***	4.33 ***
Elderly	0.98 **	-0.31	-0.36	0.84	-0.57	0.07
High school	-0.26	0.24	-0.21	0.17	0.52	-0.02
College	0.68	-0.12	-0.22	1.30 *	0.71	-0.79
Rural	-0.43	0.04	0.14	0.18	-0.33	-1.25
West	0.31	1.08 ***	1.09 ***	-0.79	0.91	0.90
South	0.06	-0.18	-0.94 **	-0.12	0.44	-0.47
Midwest	-1.00 *	0.16	-0.51	-1.27	0.35	-0.26
Spring	0.42	-0.46	-1.12 **	0.67	1.20	-1.92 *
Summer	1.07 *	-0.10	-0.33	2.08 ***	0.19	-1.29
Fall	-0.44	-0.06	-0.18	-0.98	0.29	-1.27
Did not shop at a supermarket	-1.32 **	-0.07	-0.28	-1.88 **	-0.47	-2.54 **
Shopped infrequently at a supermarket	-0.60	-0.08	-0.28	-0.86	-0.13	-0.07
Scale	4.72	3.13	3.78	7.12	5.97	9.59

Significance levels: ***, **, and * denote 1, 5, and 10 percent, respectively.

Source: USDA, ERS Tobit model estimations based on 1996-97 National Food Stamp Program Survey data.

Literature review

Many studies have examined price disparities across income class, store format, and accessibility (Andreyeva et al., 2008; Block and Kouba, 2006; Broda et al., 2009; Chung and Myers, 1999; Hayes, 2000; Hendrickson et al., 2006; Latham and Moffat, 2007; Talukdar, 2008). A limitation of these studies is their use of observed prices in a regional setting rather than actual prices paid on a national level. Kaufman et al. (1997) provides a review of literature on food price disparity dating back to the 1960s and identifies the complexities of undertaking such research.

Andreyeva et al. (2008) replicated a 1971 study of food availability and price in New Haven, Connecticut. Their findings show improvement in availability and price since 1971. Findings indicate differences across store types—grocery stores were approximately 4 percent cheaper than convenience stores for a basket of goods. The study also found that high-income areas faced higher prices than low-income areas.

Block and Kuoba (2006) compared prices for a market basket of goods in different types of stores in the Austin and Oak Park sections of Chicago. Austin is a lower-middle-class African-American community that borders Oak Park, an upper-middle-income suburb. They find mixed results. Discount supermarkets showed the lowest prices. Independent grocery stores had higher prices for packaged goods than chain supermarkets, but lower prices for fresh items.

Broda et. al (2009) analyzed actual consumer purchases and found that poor households pay less for food items they purchase than households with higher incomes—a 10-percent increase in income roughly induces a modest 0.1-percent increase in prices paid per food item. They also found that poor households tend to shop more frequently at discount stores and supercenters. Even after controlling for household characteristics and product fixed effects, the study found that poorer households pay a lower price even in stores of the same retail chain.

Chung and Myers (1999) conducted a survey in the Twin Cities metropolitan area to determine how store type (nonchain/convenience store versus chain/supermarket) and neighborhood quality (measured by percent of households under the poverty level within a zip code) affects price of a food market basket. They conclude that store type is more important in driving price disparities than the geographic location of a household—the premium for shopping at a convenience and/or nonchain store outweighs the premium for shopping in a poor neighborhood. Limitations to their methodology include the way missing price values were treated. When price for a selected item is missing, the least expensive brand/size product (e.g., an in-store brand in its largest package size) was used. When a selected item was not available in the store, the sample mean price was used. Additionally, the use of regional data based on “sticker prices” (those listed on the shelf) as opposed to actual transaction prices at the national level do not control for promotional purchases (e.g., on-sale and coupon use).

Hayes (2000) analyzed prices in New York City to establish if prices in low-income neighborhoods were indeed higher than those in more affluent neighborhoods. The study concludes that the mean price for a market food basket is 2 percent higher in more affluent neighborhoods although the means are not significantly different. Even after controlling for the price of on-sale items and generic branding, the prices in low-income neighborhoods were not significantly different than in more affluent neighborhoods. The author does acknowledge that it is possible that the quality of food items purchased by the poor is below that of the items purchased by the more affluent.

Hendrickson et al. (2006) studied prices of selected Thrifty Food Plan foods in four Minnesota communities with higher than average poverty (two rural and two urban). The study examined prices offered in grocery stores in

these communities for the TFP foods and compared their prices with those of the TFP Market Basket Price (MBP). If a food was found in the grocery store, the price of the lowest price version of the food (price per pound) was recorded. The study found that in the two urban areas, 6 and 9 out of the 19 foods studied were more expensive than the TFP MBP. In the two rural areas, 2 and 4 of the 19 foods studied were more expensive than the TFP MBP. Over all of these communities, the prices per pound of fresh produce were equal or less expensive than the TFP MBP price. Although this study uses the lowest price per pound product in the store for a selected food, it still only uses the available price instead of the actual paid price. Further, the TFP MBP is a national price average so it is not clear if the prices in the Minnesota communities studied are different from the TFP MBP because prices in the neighborhoods are different or because the State or region has different prices.

Mantovani et al. (1997) examined information on MBP for each store in a national sample of stores authorized to redeem SNAP benefits. Market basket quality was measured in terms of the availability of acceptable items as guided by a USDA publication on buying quality food (1975). This analysis focused on product availability and cost in areas with different concentrations of poverty. In urban areas, market basket costs in supermarkets and large grocers were nearly equivalent across levels of poverty. Prices were less at “other” stores located in high-poverty areas than those in lower poverty areas. In rural areas, market basket costs were consistently similar in higher and lower poverty areas.

Latham and Moffat (2007) study prices of a market basket of goods across store types in low and higher income neighborhoods of Hamilton, Ontario, Canada. They find that prices at supermarkets in low income areas were similar to prices at areas that were not low income. Prices were higher, however, at variety stores, which offer fewer groceries but more nonprescription drugs, tobacco products, and other products, operating in low-income areas.

Talukdar (2008) investigated prices faced by the poor for both food and nonfood items in Buffalo, New York, and surrounding suburban neighborhoods. The study found that the inner-city neighborhoods experience a weakened competitive market leading to cost-inefficient “corner stores” which have a 6-7 percent premium over regional or national chain grocery stores. Even after controlling for economies of scale and competitive environments, prices were 2 to 5 percent higher in the poorest neighborhoods.

This study extends the literature by analyzing actual consumer purchases at a national level, rather than observed “sticker prices” in certain localities. Furthermore, the study will focus on particular food items rather than representative “food baskets,” enabling the pricing models to control for specific product attributes such as milk fat and whole grain, as well as for market factors such as promotional on-sale prices and coupon use. The study also borrows from a recent analysis conducted in conjunction with ERS, which explores actual prices paid by consumers across different income levels (Broda et al., 2009).

Table 5.4

Descriptive statistics of variables used in price analysis

Variables	Definition	Fluid milk		RTE cereal		Bread	
		Convenience store	All other	Convenience store	All other	Convenience store	All other
Price	Unit value (expenditure net of any promotions divided by the corresponding quantity), cents per ounce	2.47	2.59	16.17	16.71	8.67	9.03
Income	The ratio of household income over the federal poverty level; where income is the midpoint of the income class	3.57	3.83	3.59	3.73	3.18	3.73

Market shares (percent of purchase occasions)

Grocery store	Purchase occasion at grocery store	73		67		72	
Convenience store	Purchase occasion at convenience or drug store	5		2		1	
Discount store	Purchase occasion at supercenter or club warehouse	17		20		17	
Other stores	Purchase occasion at other store	5		10		9	
Promotional sale	Purchase made on-sale or with a coupon	27	18	69	36	19	23
Spring	Purchase in spring (Jan-Mar)	27	26	27	26	26	25
Summer	Purchase in summer (Apr-Jun)	24	25	23	25	24	25
Fall	Purchase in fall (Jul-Sept)	25	25	28	26	26	25
Winter	Purchase in winter (Oct-Dec)	25	24	22	23	24	24
East	Northeastern census region	28	20	26	18	22	20%
Central	Midwestern census region	33	24	29	26	35	24
West	Western census region	11	20	19	22	13	20
South	Southern census region	29	35	26	35	29	36
Urban	Purchase in urban area	81	77	85	77	78	77
Pint	16 oz. used as midpoint (0 - 24 oz.)	2	1	--	--	--	--
Quart	32 oz. used as midpoint (25 - 48 oz.)	4	6	--	--	--	--
Half gallon	64 oz. used as midpoint (49 - 96 oz.)	26	33	--	--	--	--
Gallon	128 oz. used as midpoint (> 97 oz.)	68	60	--	--	--	--
Skim	Less than 0.5g of fat*	18	24	--	--	--	--
Low-fat	Less than 4.7g of fat (includes 0.5%, 1%, 1.5%, 2%)*	58	54	--	--	--	--
Whole	8g of fat*	24	22	--	--	--	--
Size	Continuous quantity (1 oz. - 81 oz.)	--	--	15.18	17.58	--	--
Whole-grain	Identified as a whole-grain product	--	--	60	52	13	21
Small size	16 oz. used as midpoint (0 - 18 oz.)	--	--	--	--	25	27
Medium size	20 oz. used as midpoint (19 - 22 oz.)	--	--	--	--	44	33
Large size	24 oz. used as midpoint (> 22 oz.)	--	--	--	--	31	40
No. observations		55,000	978,414	14,759	660,650	9,873	876,944
		1,033,414		675,409		886,817	

Source: USDA, ERS calculations based on 2006 Nielsen Homescan Panel data.

Data

The data source for investigating price differentials by store type is the 2006 Nielsen Homescan panel data. The panelists constitute a random sample that is representative of the U.S. population and provides purchase information of food items for at-home consumption. Each household is supplied with a scanner device that the panelist uses at home to record grocery items purchased at all retail outlets. The household either scans the Uniform Product Code (UPC) or a designated code for random-weight purchases for each food item. Each purchase records the date, the quantity purchased, expenditures for that quantity, promotional information including whether or not the item is on sale, and detailed product characteristics.

Total enrollment in the Homescan panel for 2006 was over 37,000 households, but to avoid would-be data problems resulting from incomplete reporting, only those households that reported purchases for at least 10 months were included. Panelists report total expenditures and the quantity of food purchased. Prices are derived as unit values – the ratio of reported expenditures, net of any promotional and sale discounts, to the reported quantities for each purchase record.

Each purchase record is identified by store type (grocery, convenience, discount, and others),³⁸ day of purchase, whether the purchase was made with a discount, and an array of product attributes. Each panelist also provided data on his or her social, economic, and demographic characteristics, including income, household size, and place of residence.

This study examines the prices of the three most popular healthy food items purchased by Homescan panelists at convenience stores and also at grocery stores—fluid milk, ready-to-eat cereals (RTE cereals hereafter), and bread.³⁹ For milk, attributes include fat content (nonfat/skim, low-fat, or whole) and container size (pint, quart, half gallon, or gallon). Buttermilk, soy, and flavored milk are not included in the analysis. For cereals and bread, attribute data include container size and whether it is a whole grain bread or cereal. Rolls, buns, muffins, and other sweetened breads, such as cakes and donuts, are excluded from the data set. Although the three aforementioned foods examined in this study could be considered loss leader products,⁴⁰ the model controls for in-store promotions and coupon use. Table 5.4 provides a list of variables constructed from the data to be used in the empirical estimation with descriptive statistics.

Hedonic pricing model

The analysis of price differences at grocery stores and convenience stores is carried out using the hedonic model, which is based on Lancaster's (1966) characteristics demand theory that consumers derive utility from the characteristics or attributes inherent in a good or service. The price consumers pay for a good is the sum of the values consumers assign to the good's attributes, as shown below.

$$(2) \quad P_i = \alpha_0 + \sum_{r=1} \alpha_r MKT_{rit} + \sum_{s=1} \beta_s PRO_{sit} + e_i$$

³⁸Homescan does not differentiate between the sizes of grocery stores (i.e., large specialty grocers, such as Whole Foods, and large grocers, such as Publix, Giant, and Safeway, are all considered grocery stores). Discount stores include large supercenters such as Super Wal-Mart and Super Target and warehouse stores.

³⁹These are the most frequently purchased goods at convenience stores for all consumers, not just low-income consumers. We considered studying prices of fruits and vegetables and other "healthy" food options across store outlet type, but the sample of purchases was too small (i.e., not enough of these types of goods were purchased from convenience stores to study their prices).

⁴⁰Loss leader pricing of products is a marketing strategy in which retailers set low prices for particular "loss leader" products, typically below or at cost, to attract customers into the store to buy other products.

Table 5.5

Hedonic results

Variable	Fluid milk		RTE cereal		Bread	
	Coefficient	Standard error	Coefficient	Standard error	Coefficient	Standard error
Constant	2.419***	0.025	22.879***	0.220	6.338***	0.137
Income	0.024***	0.002	0.334***	0.016	0.317***	0.008
Convenience	0.129***	0.031	5.839***	0.775	0.620***	0.200
Discount	-0.202***	0.016	-0.720***	0.114	-0.351***	0.063
Other	-0.188***	0.030	-2.351***	0.150	-1.334***	0.061
On sale	-0.508***	0.016	-3.695***	0.106	-1.669***	0.065
Spring	0.026***	0.005	-0.310***	0.036	-0.314***	0.017
Summer	-0.035***	0.005	-0.035	0.040	-0.262***	0.016
Fall	-0.034***	0.004	-0.128***	0.032	-0.190***	0.016
East	-0.417***	0.044	0.297	0.210	0.640***	0.120
Central	-0.437***	0.027	-0.226	0.171	-0.067	0.121
West	-0.210***	0.035	1.110***	0.168	1.254***	0.193
Urban	0.019***	0.019	0.644***	0.113	0.323***	0.100
Income*conv	-0.008	0.005	-0.289***	0.043	-0.153***	0.045
Pint	4.213***	0.173	--	--	--	--
Quart	1.988***	0.042	--	--	--	--
Half gallon	0.983***	0.026	--	--	--	--
Skim	-0.087***	0.015	--	--	--	--
Low-fat	-0.062***	0.013	--	--	--	--
Pint*conv	0.896***	0.181	--	--	--	--
Quart*conv	0.072	0.069	--	--	--	--
Halfgal*conv	-0.429***	0.056	--	--	--	--
Skim*conv	-0.095**	0.045	--	--	--	--
Low-fat*conv	-0.053**	0.027	--	--	--	--
Whole-grain	--	--	0.068	0.046	1.592***	0.042
Size	--	--	-0.366***	0.009	--	--
Size*conv	--	--	-0.373***	0.045	--	--
Small	--	--	--	--	4.986***	0.091
Medium	--	--	--	--	0.478***	0.100
Small*conv	--	--	--	--	-2.181***	0.387
Medium*conv	--	--	--	--	0.404**	0.199
No. of obs.	1,033,414		675,409		886,817	
R-squared	0.511		0.159		0.268	

Source: USDA, ERS hedonic regression model estimations based on 2006 Nielsen Homescan Panel data.

where P_{it} is the price paid by the i -th household in time t ; MKT_{it} represents a set of market factors such as income (a measure of neighborhood store and product quality), type of store, promotional offering, season, region, and urbanicity of purchase; PRO_{it} represents product attributes; and e_{it} is the error term. Interaction terms between convenience store purchases and product attributes, as well as income, allow for the testing of additional price differentiations observed in convenience stores.

Results

Milk, RTE cereals, and bread are three of the most frequently purchased items at both convenience stores and grocery stores by Homescan panelists. The hedonic model is specified in linear functional form so that estimated coefficients represent price premiums or discounts. The hedonic results are summarized in table 5.5. The R-squared is 51 percent for milk, 16 percent for RTE cereals, and 27 percent for breads. These goodness-of-fit measures are quite high for cross-sectional studies, implying that the data fit the model reasonably well. “Grocery” is treated as the reference store in the model so that the estimated coefficient for “Convenience” measures the price difference between the two types of stores. Specifically, a positive (negative) coefficient for “Convenience” store indicates that consumers pay a higher (lower) price at a convenience store than at a grocery store. Income is included to capture store, product, and neighborhood quality attributes unobserved in the data. In particular, a household’s income is expected to be associated with the quality of shopping venue and product offering, which, in turn, would be reflected in the price paid.

Fluid milk

The price of milk is expressed as cents per fluid ounce (128 ounces in a gallon). The estimated constant term suggests an average price of 2.42 cents per ounce (or \$3.10 per gallon) for whole milk in a gallon container sold in a grocery store in the Southern United States in the winter. The results suggest that the same milk is sold at a price 0.13 cents per ounce higher at a convenience store, or about 5 percent above the grocery store price. As expected, consumers pay a lower price at discount stores, such as Wal-Mart, at an average of 0.2 cents per ounce below the grocery store price. The estimated coefficient for “Income” (a measure of store and product quality) is significant but small, indicating that the price of milk in a grocery store increases only slightly with income. Additional variation in price associated with income in a convenience store (measured by the interaction between “Income” and “Convenience”) is found to be insignificant.

Differences in milk prices between convenience and grocery stores vary by container size and fat content, as indicated by some significant coefficients for the interaction terms between convenience store and milk type. Adding the estimated coefficient for the container size “Pint” (i.e., 4.21 cents) to the constant term of 2.42 cents helps determine the average price (cents/oz) of a pint of whole milk sold in a grocery store in the Southern United States in the winter (6.63 cents/oz or \$1.06/pint). The same pint of milk is sold for 1.03 cents more (0.13 + 0.90) at convenience stores, or about 16 percent more than in a grocery store. A half gallon of whole milk was priced at 3.40 cents/

oz (2.42 + 0.98) at grocery stores, but there was actually a price discount (0.3 cents/oz) for such milk sold at convenience stores.

More than a quarter (27 percent) of milk purchases at convenience stores was associated with a promotion (i.e., sale or coupon use), compared with 18 percent of all purchases recorded elsewhere (table 5.4). When milk was purchased under a promotion with a discount, the discount averaged about 20 percent below the regular price. This price discount of 20 percent is quite large, compared with the 5-percent price premium for convenience store milk over grocery store milk, suggesting that the use of a coupon or promotional shopping habits could effectively lower the price of milk purchased at a convenience store or grocery

RTE cereals

RTE cereals were priced at an average of 22.87 cents/oz in a grocery store (in the Southern United States and in the winter), or about \$4 per box in its average container size reported in table 5.4. Consumers paid 5.84 cents/oz (25 percent) more at convenience stores. As expected, a lower unit price is associated with larger packaging. The interaction between the packaging size and a convenience store purchase modeled by the variable “Size*conv” (-0.37) in combination with “Size” (-0.37) indicates that price of cereal relative to packaging size falls twice as fast in a convenience store (-0.74) as in a grocery store (-0.37), signifying that size has more influence on price in a convenience store.

Like milk, RTE cereal in a grocery store increases in price with the affluence of the neighborhood, as measured by household income. However, the interaction term between income and convenience store is negative and significant (-0.29) and must be interpreted in conjunction with the income variable (0.33). This suggests less price variation in convenience stores relative to store and product quality, as measured by income.

In general, whole-grain cereals command a higher price, although the price differential is quite small. A surprisingly large proportion (69 percent) of convenience store RTE cereals were purchased under a promotional discounted price, compared with the share reported for those purchased elsewhere (table 5.4). The average discount is 3.69 cents/oz, which is 16 percent of the regular price. Clearly, purchasing items on sale or using a coupon can effectively offset the higher price that consumers face at convenience stores.

Bread

Bread in its largest 24-ounce size was priced at an average of 6.34 cents/oz at grocery stores and about 0.62 cents (about 10 percent) more at convenience stores. When bread was purchased on sale or with a coupon, the average price dropped to 4.67 cents/oz (26 percent of the regular price). Prices of bread also varied greatly by package size, and unlike whole-grain RTE cereals, whole-grain bread commanded a large and significant price premium, averaging 1.59 cents/oz (or 25 percent of the price of non-whole-grain breads). Like the case of milk, price differentials between convenience store bread and grocery store bread varied by package size. The estimated

coefficients indicate that medium- and large-sized bread (constituting 76 percent of convenience store purchases) was priced higher in a convenience store than in a grocery store. Yet, bread sold in a small package size was priced lower in a convenience store.

As with RTE cereal, the variable “Income” was used as a measure of neighborhood store and product quality. The results indicate that the effect of income on grocery store prices (0.32) is about twice that of the effect on convenience store prices (0.32 – 0.15). This again points to less price variation across neighborhood store and product quality (income) for convenience store purchases relative to grocery store purchases. Higher household income increases the probability that a household will choose to shop at a specialty foodstore, which tend to maintain higher prices on average.

Discussion

Grocery stores generally stock a multitude of product offerings that present consumers with choices of brand, size, quality, and other product attributes. This results in greater price disparity for particular food items. Convenience stores have more limited intra-product choices. Therefore, consumers face a relatively constricted price range in convenience stores as compared with grocery stores. Access to a grocery store allows consumers to choose from a wider array of products, thereby allowing consumers to choose items whose prices fall within their budgets.

The analysis of price variation for similar goods across different store types shows that prices are higher, on average, at convenience stores than they are at grocery stores, and this finding is confirmed in the literature (Broda et al., 2009). Relatively easy access to convenience stores and smaller food retailers in some neighborhoods may lead to higher prices for food for people who live in those neighborhoods. But this argument assumes that people who live in these neighborhoods do not shop at large stores or search for sale items. Broda et al. (2009) use 2005 Nielsen Homescan data to address the effects of access to different types of stores on overall shopping expenditures and prices paid by lower income consumers. The analysis does not directly consider access to stores or shopping patterns but instead focuses on differences across household income levels.

Broda et al. (2009) show that across all income levels, 52-57 percent of all food purchases are made at grocery stores. Spending on food at convenience stores is a very small portion of shoppers’ food budgets, even for those at the lowest income levels. Those with the lowest incomes (from \$5,000 to \$11,999) spend 2 to 3 percent of their total food expenditures in convenience stores, while the highest income consumers (annual income over \$100,000) spend only 0.7 percent of their total food expenditures at convenience stores. Low-and middle-income households (incomes between \$5,000 and \$49,999) spend 20-22 percent of their food dollars at supercenters, where prices are lower. Households with incomes over \$70,000 spend 13-17 percent of their food dollars at these types of stores. Clearly, lower income consumers shop at outlets offering lower prices.

Examining prices paid for specific goods (through the Universal Product Code of the good purchased) across household income level, Broda et al. (2009) find that while households with incomes below \$8,000 per year may pay 0.5 to 1.3 percent more for their groceries than households earning slightly more, those earning between \$8,000 and \$30,000 pay the lowest prices for groceries. Households with the highest incomes, with earnings over \$100,000, pay the greatest amount for groceries, between 2-3 percent higher than poorer households. These results suggest that the poor do not pay higher prices for food.

One caveat to these results is that the Broda et al. (2009) study does not directly address access issues as it is only approximated by household income level. The study does not have information about the costs consumers face to get to food retail outlets, which could be greater for those who live in areas with limited access.

Summary

For SNAP to meet its mission, it is essential that participants have access to foodstores offering good quality, variety, and reasonable prices without the participants encountering undue burden. As a whole, participants live close to an authorized retailer, which is often a supermarket or large grocery store. More than 90 percent of participating households spend at least some of their benefits in a supermarket, and close to 90 percent of all benefits are redeemed in supermarkets or large grocery stores. Food stamp recipients reported being largely satisfied with the stores in which they shop most frequently. Studies of SNAP participant access and shopping patterns reviewed here indicate that most SNAP participants have access to supermarkets and large grocery stores. These findings, however, do not eliminate the possibility that access may be challenging for some participants and nonparticipants in some places.

The analysis of food purchases suggests that SNAP participants who did not shop mainly at a supermarket purchased less noncanned fruit, noncanned vegetables, and milk than SNAP participants who shopped frequently at a supermarket. SNAP participants who did not shop at a supermarket also purchased less canned fruits and vegetables than others, but the differences are not statistically significant. Overall, the results suggest that lack of access to a supermarket is associated with lower levels of expenditures on some foods that are important for healthy diets.

This analysis of food purchasing behavior, like the majority of studies on the topic, only shows associations between access and food purchases, not whether access differences actually cause differences in food purchasing. It is possible that those who do not have access to supermarkets or other sources of healthy foods would not buy these foods if their access was better. To determine a causal impact, longitudinal data or information that is related to access but not to food purchasing behavior would be needed.

It appears that only two studies have used longitudinal data to try to determine differences in purchasing behavior over time as the degree of access changed (Wrigley et al., 2003; Cummins et al., 2005). These studies were conducted in the UK, and both considered changes in shopping

behavior and food intake when a new supermarket was opened in an underserved area.⁴¹ Results from Wrigley et al. (2003) showed that a sizable number of residents in both studies switched their main shopping source to the new store, more walked to and from the store than before, and fewer took buses, taxis, or someone else's car due to the change in access. Cummins et al. (2005) also found that when access improved, many shoppers switched to a new store, more walked to the new store, and fewer traveled to the store using someone else's car.

This study's demand analysis does not consider the relative food prices of these groups of foods that survey participants face. Those with limited access could face higher prices of noncanned fruits and vegetables, which could impact their purchase behavior. The analysis attempted to incorporate prices and estimate a demand system, but the results were not reasonable, possibly due to the rather limited size of the sample.

Another limitation of the analysis of food purchasing behavior is that the sample includes only participants of SNAP. Not all those who are eligible for the program choose to apply and receive benefits. Those who do, tend to be poorer and have lower incomes than those who do not. But it is possible that some poor people choose not to participate because they do not have good access to stores where they can redeem benefits or to stores where they want to buy foods. Thus, the analysis could underestimate the differences in access on food purchasing behavior by not including those who do not participate in SNAP because of access limitations.

Households with limited access to supermarkets may rely more on fast food or carryout restaurants to satisfy their needs for foods. It has been documented that foods from fast food restaurants are generally lower in nutritional quality (Lin et al., 1999). Therefore, a greater reliance on fast food could adversely affect the diet and health of those who have limited access to supermarkets. Future research should be conducted to study the effect of limited access to supermarkets on food purchases at commercial foodservice outlets.

The results for estimating price differentials between grocery stores and convenience stores are consistent with a priori expectations that consumers pay more for food at a convenience store than at a grocery store. Likewise, neighborhood quality, as measured by household income, affects prices positively, but to a lesser magnitude for those purchases at a convenience store. An important finding, however, is that on-sale purchases and coupon use are frequently reported at convenience stores. The price discount afforded by on-sale purchases or coupon use is quite large and can compensate for the higher price registered at convenience stores. Frugal shopping habits can effectively overcome the price disadvantage at convenience stores. Of course, frugal shopping habits can also be effective when shopping at grocery stores.

Analysis by Broda et al. (2009) is consistent with the idea that frugal shopping habits can overcome high prices. This study finds small differences in expenditures at different food retailers across income levels. It also finds that, in general, the poor do not pay more for food. The study finds that households earning between \$8,000 and \$30,000 per year pay the least

⁴¹Findings on food intake changes from these studies are summarized in Chapter 4.

for groceries, while the poorest consumers, those with household incomes below \$8,000, pay between 0.5 to 1.3 percent more for their groceries than households earning slightly more.

With respect to price analyses, Homescan panelists may under-report some items purchased at a convenience store due to on-the-go consumption (e.g., fresh produce and ready-to-eat snacks). Prices reported by Homescan panelists are nationally representative, but the results may not apply to local areas with specific characteristics, such as areas affected by Hurricane Katrina.

References

Andreyeva, T., D.M. Blumenthal, M.B. Schwartz, M.W. Long, and K.D. Brownell (2008). "Availability and Prices of Foods Across Stores and Neighborhoods: The Case of New Haven, Connecticut," *Health Affairs*, September/October, 27(5): 1381-1388.

Block, D., and J. Kouba (2008). "A Comparison of the Availability and Affordability of a Market Basket in Two Communities in the Chicago Area," *Public Health Nutrition*, 9(7): 837-845.

Broda, C.E. Leibtag, and D.E. Weinstein (2009). "The Role of Prices in Measuring the Poor's Living Standard," *Journal of Economic Perspectives*, 23 (2): Spring, 000-000.

Chung, C., and S.L. Myers (1999). "Do the Poor Pay More for Food? An Analysis of Grocery Store Availability and Food Price Disparities," *Journal of Political Economy*, 91 (3): 480-93.

Code of Federal Regulations. Title 7 - Agriculture, Chapter 2: Subchapter C. Part 278.

Cohen, B., J. Ohls, M. Andrews, M. Ponza, L. Moreno, A. Zambrowski, and R. Cohen (1999). "Food Stamp Participants' Food Security and Nutrient Availability," *Final Report to the Food and Nutrition Service*, U.S. Department of Agriculture, Mathematica Policy Research.

Cole, N. (1997) *Evaluation of the Expanded EBT Demonstration in Maryland: Patterns of Food Stamp and Cash Welfare Benefit Redemption*, Report submitted to U.S. Department of Agriculture, Food and Nutrition Service, by Abt Associates, Inc., February.

Cole, N., and Lee, E. (2005) *Analysis of EBT Redemption Patterns: Methods and Detailed Tables*, Report submitted to U.S. Department of Agriculture, Food and Nutrition Service, by Abt Associates, Inc., November.

Cole, N., D. Hoaglin, and J. Kirlin, J. (2001). *National Survey of WIC Participants*, Report submitted to U.S. Department of Agriculture, Food and Nutrition Service, by Abt Associates, Inc., June.

Cummins, S., A. Findlay, M. Petticrew, and L. Sparks (2005). "Healthy Cities: The Impact of Food Retail-Led Regeneration on Food Access, Choice and Retail Structure," *Built Environment*, Vol. 31(4): 288-301.

Hayes, L.R. (2000). "Are Prices Higher for the Poor in New York City?" *Journal of Consumer Policy*, 23 (2): 127-52.

Hendrickson, D., C. Smith, and N. Eikenberry (2006). "Fruit and Vegetable Access in Four Low-Income Food Desert Communities in Minnesota," *Agriculture and Human Values*, 23:371-383.

Kaufman, P.R., J.M. MacDonald, S.M. Lutz, and D.M. Smallwood (1997). *Do the Poor Pay More for Food? Item Selection and Price Differences Affect Low-Income Household Food Costs*, Agricultural Economic Report No. 759, U.S. Department of Agriculture, Economic Research Service.

Koralek, R.D. (1996). Conference on Access to Food September 18 and 19, 1995: Report of the Proceedings, U.S. Department of Agriculture, Food and Nutrition Service, February.

Lancaster, K. (1966). "A New Approach to Consumer Demand Theory," *Journal of Political Science* 74 (April): 132-157.

Latham, J., and T. Moffat (2007). "Determinants of Variation in Food Dost and Availability in Two Socioeconomically Contrasting Neighbourhoods of Hamilton, Ontario, CA," *Health and Place*, 13: 273-287.

Lin, B. (2005). "Diet Quality Usually Varies by Income Status," *Amber Waves*, Vol. 3, Issue 4, September.

Mantovani, R.E., L. Daft, T.F. Macaluso, J. Welsh, and K. Hoffman (1997). *Authorized Food Retailer Characteristics Study (Technical Report IV): Authorized Food Retailers' Characteristics and Access Study*, Report submitted to U.S. Department of Agriculture, Food and Nutrition Service, by Macro International, Inc.

Mantovani, R.E., and J. Welsh (1996). *Authorized Food Retailer Characteristics Study (Technical Report III): Geographic Analysis of Retailer Access*, report submitted to U.S. Department of Agriculture, Food and Nutrition Service, by Macro International, Inc.

Martinez, Steve, and Phil Kaufman (2008). "Twenty Years of Competition Reshape the U.S. Marketing System," *Amber Waves*, Vol. 6, Issue 2, April.

Ohls, J.C., M. Ponza, L. Moreno, A. Zambrowski, A., and R. Cohen (1999). *Food Stamp Participants' Access to Food Retailers*, Report submitted to U.S. Department of Agriculture, Food and Nutrition Service, by Mathematica Policy Research, Inc.

Olander, C., E. Jones, and S. Carlson (2006). *An Analysis of Food Stamp Redemption Patterns*, U.S. Department of Agriculture, Food and Nutrition Service.

Pearson T, J. Russell, M.J. Campbell, and M.E. Barker (2005). "Do "Food Deserts" Influence Fruit and Vegetable Consumption?--A Cross-Sectional Study," *Appetite* 45(2): 195-7.

Rose, Donald and Rickelle Richards (2004). "Food Store Access and Household Fruit and Vegetable Use Among Participants in the US Food Stamp Program," *Public Health Nutrition* 7(8): 1081-1088.

Talukdar, D. (2008). "Cost of Being Poor: Retail Price and Consumer Price Search Differences Across Inner-City and Suburban Neighborhoods," *Journal of Consumer Research*, 35 (3): 457-71.

Tobin J. (1958). "Estimation of Relationships for Limited Dependent Variables," *Econometrica* 26(1): 24-36.

U.S. Department of Agriculture (1975). *How to Buy Food for Economy and Quality: Recommendations from the United States Department of Agriculture*. New York: Courier Dover Publications.

Wrigley, N., D. Warm, and B. Margetts (2003). "Deprivation, Diet and Food-Retail Access: Findings From the Leeds 'Food Deserts' Study," *Environment and Planning A*, 35: 151-188.

Zenk, Shannon N. et al. (2005). "Fruit and Vegetable Intake in African Americans: Income and Store Characteristics," *American Journal of Preventive Medicine* 29(1): 1-9.