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Are Lower Income Households Willing and Able To Budget for Fruits and Vegetables?

Hayden Stewart and Noel Blisard

Abstract

Households have a number of needs and wants that all compete for scarce resources. Given this situation, are low-income households, in particular, generally willing and able to budget for healthful foods like fruits and vegetables, or are other goods and services, including other foods, more of a priority? For six out of seven selected types of food, we find that households with an income below 130 percent of the poverty line spend less money than higher income households. However, we also find that these households, when given a small increase in income, will allocate more money to only two out of the seven products, beef and frozen prepared foods. These foods may be priorities for reasons of taste and convenience. For additional money to be allocated to fruits and vegetables, a household's income needs to be slightly greater than 130 percent of the poverty line.

Keywords: food expenditures, fruits, vegetables, hierarchical demand, low-income households, food spending

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Summary

Though fruit and vegetable consumption is important to health, Americans do not eat enough of these foods. The problem is even worse among low-income households. Discrepancies between actual consumption and recommendations, as outlined in the *Dietary Guidelines for Americans*, are fueling interest in ways to promote fruits and vegetables, especially among low-income households. Could small adjustments to the buying power of low-income households increase their purchases of fruits and vegetables? The evidence to date is not encouraging.

What Is the Issue?

Past studies suggest that low-income households do not allocate additional dollars to fruit and vegetable purchases, given only a small increase in their buying power. Only at still higher levels of income are additional dollars budgeted for these foods. One explanation is that households have many competing needs and wants, some of which win out over fruits and vegetables when additional dollars become available. In this study, we expand on past analyses in order to explore this possibility. First, we ask, if a household earns less than 130 percent of the poverty line, on what types of foods might it allocate a portion of any small increase in income? Second, does a household's income need to rise much higher than 130 percent of the poverty line before increased expenditures are made for fruits and vegetables?

What Did the Study Find?

In 2003, households earning below 130 percent of the poverty line spent less than higher income households on six out of seven food types examined. However, a small increase in income will not likely induce them to spend more on fruits and vegetables. Beef expenditures and spending on frozen prepared foods do increase. Focus group analyses suggest that beef and frozen prepared foods may be priorities over fruits and vegetables for reasons of taste and convenience.

However, it appears that a household's income does not need to rise much higher than 130 percent of the poverty line—a cutoff for the Food Stamp Program—before the average household allocates additional resources to fruits and vegetables, given a small increase in income. A positive income effect is found among households earning between 130 and 185 percent of the poverty line. Among such households, a 10-percent increase in income prompts a 1.15-percent and 1.93-percent increase in fruit and vegetable expenditures, respectively.

How Was the Study Conducted?

Data on 5,275 households, who completed the Consumer Expenditure Survey published by the Bureau of Labor Statistics in 2003, were analyzed. We divided these households into three groups based on their reported incomes relative to the poverty line. The "low-income" group included households earning less than 130 percent of the poverty line. We then compared households' expenditures, by income group, on seven types of food: beef, milk and other dairy products, bread and other baked foods, frozen meals and other frozen prepared foods, eggs, fruits, and vegetables. These seven were chosen to include items from each of the major food groups, along with a popular type of convenience food—frozen entrees and other frozen foods. In total, these seven food types account for about half of what a typical low-income household spends on food for at-home consumption.

Statistical models of the relationship between a low-income household's income and its spending on each of the seven foods were then estimated. If a statistically significant relationship between spending and income were found, we concluded that households will allocate some portion of a small increase in income to the purchase of that food. Foods receiving a portion of any increase in income were considered spending priorities for low-income households.

Statistical models of food spending by higher income households were also estimated to determine whether households allocate more resources to foods, including fruits and vegetables, once their income reaches higher levels, and if these levels are much greater than 130 percent of the poverty line.

Finally, we reviewed focus group and food consumption studies to understand why certain foods may be priorities for low-income households, such as for reasons of taste or convenience, and to corroborate our findings.

Introduction

There is much interest in promoting fruit and vegetable consumption since, on average, Americans do not consume enough of these foods to satisfy the recommendations in the *Dietary Guidelines for Americans*.[1] For a 2,000-calorie reference diet, the Guidelines recommend that people consume 2 cups of fruit and 2.5 cups of vegetables daily. But, according to the most recent statistics, Americans eat only about 0.83 cups of fruit and 1.72 cups of vegetables, on average (U.S. Department of Agriculture, 2007).[2]

Lower income households are consuming even less fruits and vegetables than this national average. According to Stark Casagrande et al. (2007), an adult living in a household with income above 250 percent of the poverty line is more than twice as likely to meet fruit/vegetable guidelines as an adult of the same age, ethnicity, and educational attainment living in poverty.[3] Adults living in a household with income between 125 percent and 250 percent of the poverty line were 1.44 times more likely to meet guidelines. But adults living in households with an income between 100 percent and 125 percent of the poverty line were no more likely to meet guidelines than were those living in poverty.

It is natural to ask whether low-income households could be induced to purchase more fruits and vegetables through small adjustments to their buying power. However, the results of past studies are not encouraging. Wilde et al. (2000, 1999) examined the behavior of 3,642 individuals living in 1,901 low-income households (income below 130 percent of the poverty line, a cutoff for food stamp eligibility). Each individual had completed a pair of 1-day surveys, recalling all foods and beverages consumed in the previous 24 hours. Results indicated that participating in the Food Stamp Program (FSP) was not associated with consuming more fruits and vegetables than living in income-eligible households without participating. FSP participants tended to consume more meats, as well as more added sugars and total fats.

Studies investigating household food spending (e.g., Blisard et al., 2004; Stewart et al., 2003) have reached similar conclusions to those examining consumption patterns. Not only do households spend less on fruits and vegetables if their income is below 130 percent of the poverty line, but Blisard et al. (2004) found that low-income households are unlikely to increase fruit and vegetable spending given an extra dollar of income.

The findings of these past studies may be discouraging to policymakers and health policy advocates, but are not inconsistent with economic theories that describe the behavior of households. One possible explanation is provided by the theory of hierarchical demand. Low-income households purchase a restricted bundle of foods, typically containing less fruits and vegetables than in the mix of foods bought by higher income households. However, by a hierarchical view of behavior, low-income households may not be willing or able to allocate more money to every type of food, given only a small increase in buying power. These households have a number of other needs and wants, some of which may be other types of food that win out over fruits and vegetables when additional dollars first become available. Only at

[1] Published jointly by the U.S. Department of Agriculture and the Department of Health and Human Services, the *Dietary Guidelines for Americans* gives science-based advice on food and physical activity choices for health.

[2] These estimates are based on U.S. food availability data adjusted for spoilage and other waste.

[3] Stark Casagrande et al. (2007) find an association between income and fruit/vegetable consumption using data collected between 1999 and 2002. Other studies, using data collected between 1989 and 1991, also find that lower income households deviate further from guidelines than their higher income counterparts. These studies include Cleveland et al. (1997) and Krebs-Smith et al. (1995). All three of these studies examined consumption relative to Federal dietary guidelines for a 2,000-calorie reference at the time they were undertaken, when recommendations were stated in servings rather than cups.

still higher levels of income might additional money be budgeted for fruits and vegetables.

In this study, we further examine the relationship between a household's income and its budgeting for several types of foods, including fruits and vegetables. This approach expands on Blisard et al. (2004). First, we ask, if a household earns less than 130 percent of the poverty line, on what types of foods might it allocate a portion of any small increase in income? Second, does a household's income need to rise much higher than 130 percent of the poverty line before increased expenditures are made for fruits and vegetables?

Answering the above questions might help those promoting fruit and vegetable consumption. For one thing, it might be useful to know the approximate level of income at which households are likely to allocate additional resources to fruit and vegetable expenditures. Past studies have focused primarily on households that are income-eligible to participate in the Food Stamp Program. But obstacles to fruit and vegetable consumption apply to a much broader segment of the population.

We thus examine spending by both low-income and higher income households on seven types of foods: beef, milk and other dairy products, bread and other baked foods, frozen meals and other frozen prepared foods, eggs, fruits, and vegetables. We then estimate statistical models of the relationship between a household's income and its spending on each of the seven foods. A statistically significant relationship between spending and income suggests that households will allocate some portion of a small increase in income to the purchase of that food. Foods receiving a portion of any increase in income accrued to low-income households are considered priorities. Focus group and food consumption studies are reviewed to ascertain why certain foods may be priorities, such as for reasons of taste or convenience, and to corroborate our findings.

Food Spending Varies by Household Income

The Consumer Expenditure Survey (CE) can be used to compare household food spending by income level. The CE is published annually by the Bureau of Labor Statistics (BLS) and includes a diary survey. Data on 5,275 households who completed the CE diary in 2003 were used for this study. These households reported their expenditures on foods over a 2-week period. We averaged each household's expenditures over the 2 weeks to obtain an estimate of weekly average expenditures. Households reporting less than 2 weeks of expenditures were eliminated from the data, along with households providing incomplete income information.

We divided the 5,275 households in our CE sample into three groups according to income. To define a household's income, we first subtracted the value of any food stamps received by the households. We then determined the ratio of each household's adjusted income to the poverty line for that household. Defining level of income relative to the poverty line is consistent with how USDA determines whether a household is income eligible for several food assistance programs such as the Food Stamp Program and the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Households earning less than 130 percent of the poverty line were defined as "low-income" and included 1,073 households, or about 20 percent of all households in the sample. In fiscal year 2003, the poverty line was $18,660 per year for a family of 4 with 2 related children under age 18. So a household of this composition could earn up to $24,258 and be classified as "low-income" for this study.

We defined "middle-income" households as those earning between 130 percent and 500 percent of the poverty line. There were 2,964 CE households in this group, accounting for about 56 percent of our sample. The "upper income" group included 1,238 households earning more than 500 percent of the poverty line; they accounted for 23 percent of households.

Low-income households in the survey spent less than middle-income households on food in 2003: $33.90 per person per week versus $44.39 (table 1). For foods purchased for at-home consumption, low-income households spent $23.27, on average, versus $27.65 for middle-income households. We confirmed the statistical significance of these differences using tests of the difference between two population means (see footnote 1 of table 1).

Low-income households also tend to spend less for seven specific types of foods bought for at-home consumption (table 1). These seven represent items from each major food group, along with a popular type of convenience food, and account for about half of what low-income households spend on all foods for at-home consumption. In 2003, low-income households spent less than middle-income households on six of these seven foods, by a margin of as much as 23 percent (for fruits—$2.06 per capita versus $2.67). Only eggs showed no statistical difference in spending.

Low-income households were also less likely to have bought some quantity of each of the seven types of at-home foods over the 2-week survey period. For example, low-income households were less likely than middle-income households to have bought beef (55 percent of households versus 59 percent), milk and other dairy products (83 percent versus 90 percent), fruits (78 percent versus 85 percent), and vegetables (77 percent versus 83 percent). All estimated differences are statistically significant based on tests of the difference between two population proportions (see footnote 2 of table 1).

These differences in expenditures suggest that low-income households may consume less food, lower quality foods, or both. For example, a pound of asparagus likely costs more than a pound of carrots. If a low-income household eats more carrots and other households eat more asparagus, differences in vegetable expenditures may be greater than differences in consumption. Expenditures also depend upon where goods are purchased and whether they are bought on sale or with a coupon. By contrast, differences in the likelihood of purchasing some amount of each of the seven commodities suggest that low-income households may eat a less varied diet, on average, than higher income households.

Table 1

Weekly per capita food spending depends on a household's income level[1,2]

	Low-income (Sample = 1,073)		Middle-income (Sample = 2,964)		High-income) (Sample = 1,238)	
	Expenditures	% with positive exp.	Expenditures	% with positive exp.	Expenditures	% with positive exp.
Total food spending	$33.90	100%	$44.39	100%	$64.18	100%
All foods for at-home consumption	$23.27	95%	$27.65	96%	$33.62	97%
Bread and other baked foods	$2.22	84%	$2.67	88%	$3.07	89%
Milk and other dairy products	$2.42	83%	$3.03	90%	$3.62	92%
Eggs[3]	$0.33	55%	$0.35	58%	$0.33	57%
Fruits	$2.06	78%	$2.67	85%	$3.16	87%
Beef	$1.66	55%	$1.98	59%	$2.49	61%
Frozen entrees/foods	$0.90	34%	$1.03	41%	$1.17	43%
Vegetables	$1.99	77%	$2.39	83%	$2.92	86%

1 Differences in expenditures were tested for low-income versus middle-income households. The null hypothesis was that low-income households spend as much as or more than middle-income households. Our alternative hypothesis was that low-income households spend less. We rejected the null hypothesis for six of the seven types of food using a 1-tail t-test and a 10-percent level of significance.
2 Differences in proportions were tested for low-income versus middle-income households. The null hypothesis stated that the same or a larger proportion of low-income households bought at least some amount of the food type in question. Our alternative hypothesis stated that a smaller proportion of low-income households bought at least some amount of the food type. We rejected the null hypothesis for all seven food groups using a 1-tail t-test and a 10-percent level of significance.
3 Only for eggs is the difference in estimated expenditures between low-income and middle-income households not statistically different than zero.

Are Some Foods a Priority for Low-Income Households?

Though a household's total food expenditures tend to increase with its income, given only a very small increase in buying power, a low-income household may or may not spend more on every type of food. Furthermore, existing studies—including Blisard et al. (2004), Stewart et al. (2003), and Wilde et al. (2000, 1999)—suggest that additional dollars will not be allocated to fruits and vegetables. Such an outcome might be discouraging to policymakers and health policy advocates, but it would not be inconsistent with economic theories that describe the behavior of households. One possible explanation is provided by the theory of hierarchical demand.

Economists have long recognized that, when deciding how much to buy of a particular good or service, households may choose to spend nothing.[4] Jackson (1984) shows how households at lower income levels may choose to spend nothing more often than do their higher income counterparts. For example, "vegetables" is a commodity composed of many different foods. These foods may include different types of vegetables as well as vegetables consumed at different meal occasions.[5] Lower income households may buy a smaller subset of all the possibilities. By the arguments of Jackson (1984), they will gradually consume more of the other possibilities with sufficient increases in income. Total vegetable expenditures and the variety of vegetables bought will tend to increase as well.[6]

Given only a small increase in income, we may not observe an increase in expenditures on every type of commodity. For instance, a household may have to choose between allocating any additional resources to meats, fruits, vegetables, or a host of other food and nonfood commodities. A low-income household may be unable or unwilling to allocate additional dollars to more than one or two commodities. Additional purchases of other types of food might be postponed until a higher income level—say, between 130 percent and 185 percent of the poverty line—is reached. If so, spending on these nonpriority foods would be largely constant over the range of income from 0 to 130 percent of the poverty line, but increase with income thereafter.

The order (hierarchy) in which foods are added to a household's diet depends on the household's own unique preferences as well as on the prices of the various foods. In this way, argues Jackson (1984), the theory of hierarchical demand can be viewed as an extension of the classical definitions of goods and services as "luxuries" or "necessities." Necessities are goods on which lower income households concentrate their purchases. As a household's income increases, the share of the budget spent on necessities decreases and that devoted to luxuries increases.

A growing body of empirical studies supports Jackson's arguments and findings. For example, Shonkwiler et al. (1987) found that the number of individual foods purchased by a household increases with the household's total expenditure on all foods. It therefore follows that households with the lowest total expenditures will purchase the narrowest mix of foods.

[4] In this case, a "corner solution" is said to occur.

[5] For example, a green salad with dinner may be one vegetable and fried potatoes with lunch may be another.

[6] Of course, the household may purchase a smaller quantity of some of the foods it had already been buying and, perhaps, even stop purchasing some of these foods altogether.

Higher levels of income and food spending have also been linked to increased variety within food groups. Stewart and Harris (2005), for example, found the variety of a household's vegetable purchases to increase with income, implying that a low-income household is likely to be limited in its range of vegetable purchases.

Focus group analyses indicate why some foods may be more of a priority than others. In one study (Shankar and Klassen, 2001), low-income, Black women living in an urban public housing project stated that many fruits and vegetables were not as economical as other foods. Some respondents valued grapes and apples for their taste, but considered potatoes and other starches better for "filling up" the family.

However, cost is not the only obstacle to fruit and vegetable consumption identified by participants in focus groups (Shankar and Klassen, 2001). Women participating in focus groups did not want to serve vegetables disliked by children and believed that other foods could be more readily prepared.

Meats, by contrast, seem to enjoy a very different status. Bradbard et al. (1997) led a study of 28 focus groups in 6 States on the diverse attitudes, beliefs, and perceptions that shape participants' spending behaviors and food choices. Respondents emphasized the importance of serving meat as a part of dinner. It is a food that households "grew up with." Serving meat was also thought to convey status and success.

A Statistical Model of Demand

By estimating a model of food expenditures, we can assess the extent to which households will allocate a small increase in income to each of the types of foods shown in table 1. A model allows us to isolate the effects of income, level of education, age, and other characteristics of household members. This is necessary for properly testing whether a relationship exists between a household's food expenditures and any one of these characteristics. If a relationship is found for income, then we may conclude that a small change in income will induce a change in food spending. The particular type of model chosen for this analysis is the Engel model.

The Engel model posits a household's expenditures on a good, such as a type of food, to be determined by that household's income and demographic characteristics. Phlips (1974), for one, demonstrates how a simple Engel model can be derived from a more general representation of consumer behavior. However, that simple model also assumes a household's expenditures on a commodity to change at a constant rate with income. Observed patterns of food spending by households suggest that this assumption may be too restrictive. Many researchers have likewise allowed for greater flexibility in their Engel analyses so that a household's response to a change in income may differ at various levels of income. Among these studies, Holcomb et al. (1995) undertake an Engel analysis of spending on food at home and away from home. Wilde and Ranney (1996) estimate Engel models for low-income households that distinguish between the impact of food stamps and additional cash income. Lanfranco et al. (2002) examine the food spending patterns of Hispanic households.

The Engel model does not explicitly account for food prices. In lieu of prices, we include in our demand models each household's region of residence and the season when the survey was administered. For example, we expect that a Northeastern household faces a different set of prices for fruits and vegetables in the winter than a Western household in the summer. After accounting for regional and seasonal differences, we assume households to face similar prices.

Because many of the households in our sample did not buy any amount of each of the seven types of at-home foods shown in table 1 during their 2-week survey period, we express our Engel model for a typical household as:

$$Y_i = X_i\beta + \varepsilon_i \quad \text{if } X_i\beta + \varepsilon_i > 0;$$

$$Y_i = 0 \quad \text{if } X_i\beta + \varepsilon_i \leq 0.$$

where Y_i is the expenditures of a particular household on a particular type of food, X_i contains a number of independent variables that may explain those expenditures, β contains the parameters that relate X to the value of Y, and ε_i is an error term. A measure of household income is included among the variables in X. Unlike our definition of income in dividing households into groups (low, middle, and high), here we include the value of any food stamps received by households in our estimate of their income. Definitions of all X and Y variables are provided in appendix table 1.

The statistical model traditionally used for an Engel analysis, when many households have made zero purchases, is the tobit. However, the tobit model produces meaningful estimates of β, the relationship between the independent variables and food spending, only under a number of strong assumptions. Among these assumptions, the error term, ε_i, must be normally distributed and have constant variance. Any violation of these assumptions will lead to biased estimates of β. Unfortunately, these conditions are not commonly satisfied when working with household data, according to Deaton (1997).

The difference between tobit estimates of β and their true value can be large, argues Deaton, who simulates the performance of the tobit model when the variance of ε_i is not constant. He shows that the model produces poor estimates of β with simulated data that mimic the sort of household data generally analyzed by economists. Several solutions have been proposed. One approach is to also estimate a statistical model that provides unbiased estimates of β regardless of whether ε_i has a constant variance or is normally distributed. A researcher can then check that these results are not in conflict with his or her tobit parameter estimates.

Both Deaton (1997) and Greene (1997) recommend comparing the results from estimating a tobit model with those from estimating a censored least absolute deviations (clad) model, which are not affected by the properties of the error term ε_i. Thus, we use the traditional tobit model, but check whether our key results are in conflict with estimates of β produced by a clad model.[7]

[7] We estimate the clad model at several points on the distribution of Y conditional on X. Even households with the same characteristics, X, do not all have the same expenditures, Y. For example, a household at the distribution's median spends more than what is spent by half of all households with the same income and other characteristics as itself. The clad can produce an estimate of β at individual points on this distribution, such as the 30^{th}, 50^{th}, or 85^{th} percentile. A median (50^{th} percentile) regression, for instance, estimates β for households at the distribution's median. By contrast, the tobit provides a single estimate of β at the distribution's mean.

Where Might an Extra Dollar of Resources Be Allocated?

How much of any small increase in income will households allocate to each of the types of foods shown in table 1? Using the tobit and clad statistical models, we investigate this question for both low-income and middle-income households. For low-income households, which foods, if any, might be priorities? And, do households allocate more resources to other types of food upon reaching a higher income level, such as that achieved by middle-income households?

Because we are estimating Engel models for two income groups, we first determined whether it would be appropriate to pool our combined 4,037 observations or whether separate models should be estimated for our 1,073 low-income households and 2,964 middle-income households.[8] We found that pooling was not appropriate for six of the seven types of foods, with frozen foods the lone exception. Thus, we estimated a single Engel model for this one type of food, allowing only the income parameter to vary between the two groups. For the other six foods, we estimated entirely separate Engel models for each income group.

[8] Likelihood ratio tests were conducted.

Consistent with a hierarchical view of demand, we find a strong association between income and spending for some food groups, but not others. Our tobit estimates of β are shown in appendix tables 2 and 3. As is customary, the statistical significance of these estimates was judged using a t-test. This test starts by assuming no relationship between expenditures and an independent variable, such as income. This assumption is later rejected if the sample contains sufficient evidence that a relationship truly exists. For food types with sufficient statistical evidence of such a relationship, we present estimates of the elasticity of food expenditures with respect to income. These values predict how much expenditures are expected to increase in percentage terms, given a 10-percent increase in income.

Among low-income households, we find a statistically significant relationship between income and expenditures for beef and frozen foods. We expect a low-income household to spend 2.53 percent and 1.45 percent more on beef and frozen foods, respectively, given a 10-percent increase in income. Our finding of a positive income effect for beef agrees with past studies, including Wilde et al. (2000, 1999) and several of the focus group analyses, such as Bradbard et al. (1997), of low-income households.

We find no evidence of an income effect for fruits, vegetables, eggs, dairy products, or baked foods. The results on fruits and vegetables are not surprising given past studies, including Stark Casagrande et al. (2007), Blisard et al. (2004), Stewart et al. (2003), Shankar and Klassen (2001), and Wilde et al. (2000, 1999). These foods do not appear to be a priority for most low-income households.

Factors affecting the mix of foods bought by a low-income household include the household's level of education and age profile. In fact, these characteristics influence the household's spending on many types of food products, as witnessed by the statistical significance of the other variables in the estimated demand models (see appendix table 2). For example, better educated households may be more aware of the health benefits of vegetables and so choose behaviors (including spending/eating) that secure these benefits. Having a college education increases vegetable expenditures in a statistically significant way, even among low-income households.

By contrast, among middle-income households, we find positive income effects for six of the seven types of at-home foods, with eggs the only exception (table 2). Once a household has attained a certain income level (130-500 percent of the poverty line), it may be willing and able to allocate any additional money to many different types of food.

We checked the accuracy of our tobit results for low-income households by comparing these estimates against those of a clad model. The results from the two types of model are qualitatively consistent. Clad results for our income variable are presented in appendix table 4 for all food groups other than breads, for which we provide results in appendix table 4a.[9]

As an additional check, we also re-estimated our tobit models accounting differently for food stamp receipts. Specifically, we included the value of food stamps received by households as a separate independent variable, along with household income less the value of food stamp receipts. This change in approach did not qualitatively affect the results on our income variable for any of the seven types of food. However, food stamp receipts were positively associated with spending on beef, frozen foods, and breads. For vegetables, the estimated tobit parameter on food stamp receipts was positive but its statistical significance was questionable.[10] We therefore estimated a clad model for vegetables. While these results suggested a positive association between food stamps and vegetable spending, we do not consider them conclusive.[11] For fruit, the estimated coefficient on food stamp receipts was negative and statistically insignificant.

Table 2
Average increase in food expenditures given a 10-percent increase in income[1,2]

Expenditure	Low-income households	Middle-income households
	Percent	
Beef	2.53	1.27
Milk and other dairy products	--	0.92
Fruit	--	1.34
Vegetables	--	1.03
Bread and other baked goods	--	1.11
Frozen entrees and other frozen prepared foods	1.45	2.92
Eggs	--	--

-- A statistically significant relationship between income and food expenditures could not be identified.
1 See appendix for estimated demand model and auxiliary statistics.
2 The elasticity of expenditure with respect to income was estimated for all households using the estimated coefficients for their income group. We then averaged over the estimated elasticities for low-income and middle-income households separately.

9 We are able to identify an association between income and expenditures for only beef and frozen foods. For breads, our estimate of the income parameter is also positive and statistically significant at the median. However, when we estimated the value of the same parameter at other points on the conditional distribution of expenditures, including all those below the 45th percentile and above the 60th percentile, it was positive at some points but negative at others, and always insignificant. We do not believe this is inconsistent with the average response to a change in income being zero, as our tobit results suggest.

10 Our tobit estimate of the parameter on food stamp receipts had a P-value of 0.141. Thus, it is not significant at the 10-percent level at which we conduct our t-tests elsewhere in the study.

11 We estimated clad models at five selected points on the conditional distribution of expenditures. Our estimate of the parameter on food stamp receipts was always positive but statistically significant at only one of these points. We consider this result to be consistent with a positive association between vegetable expenditures and food stamp receipts, but not conclusive evidence of such a relationship.

Our failure to find an association between expenditures and income for some types of foods suggests that small changes in income will not generally lead to changes in spending on these same foods. However, when estimating any statistical model, there is the risk of committing an error. In this case, we are concerned about making a type 2 error, or failing to identify a relationship between expenditures and an independent variable, such as income, when in fact a relationship truly exists. In any given set of data, other factors may confound the relationship between income and food spending. One of these factors could be variation in how much money low-income households allocate to housing and other necessities. Another may be that data on the income of low-income households are often recorded with error (see Meyer and Sullivan, 2003, for more information). Such confounding factors can reduce our statistical model's power. As a general rule, the larger the relationship between a household's income and expenditures, the lower our probability of committing a type 2 error. Where there is a small, but still nonzero, income-expenditure relationship, the possibility of a type 2 error grows.

To minimize the likelihood of making a type 2 error, we judge our results in concert with the results of other studies, including past food consumption and focus group analyses. These studies use different data sources, and so the statistical tests conducted in them are independent. The probability of making the same error in independent tests is smaller than in any single test. For example, if the true relationship between income and food expenditures is large, our likelihood of failing to identify this relationship is lower, all else constant. However, the probability that we and many other researchers all make the same type 2 error is even lower. Since our findings are consistent with other studies, we can assert with more confidence that, even if it is not exactly zero, the relationship between a household's income and its spending on fruits and vegetables is likely small.[12]

[12] By contrast, our failures to identify an association between income and expenditures for baked foods and dairy foods, for example, might be considered somewhat preliminary, because we have not reviewed related studies.

At What Income Level Might Households Buy More Fruits and Vegetables?

Households appear not to allocate additional money to fruit and vegetable purchases as long as their incomes remain below 130 percent of the poverty line. So how much higher does a household's income need to rise before its fruit and vegetable spending increases?

Thus far, we have defined "low-income" households as earning up to 130 percent of the poverty line. We now expand this income range to include households earning between 0 and 260 percent of the poverty line, and re-estimate the demand models for fruits and vegetables using data on 2,445 households in our CE sample. Doing so, we find a statistically significant association between expenditures and income (estimation results shown in appendix table 5). Given a 10-percent increase in income, we expect households to spend 1.28 percent more on fruit and 0.9 percent more on vegetables.

This positive income effect is likely to reflect the behavior of households with an income between 130 and 260 percent of the poverty line (since no significant relationship was found among lower income households). To further explore this possibility, we modified how we account for income. We divided our 2,445 low-to-middle income households into three groups: group 1 (income between 0 and 130 percent of the poverty line) includes households that are income-eligible for the Food Stamp Program; group 2 (130-185 percent of the poverty line) includes households still eligible for the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC); and group 3 (185-260 percent of the poverty line).

To estimate an Engel model accounting for income as described above, we created a binary indicator variable for each of our three income groups. For example, the variable for group 2 equals 1 if a household's income is between 130 percent and 185 percent of the poverty line, and 0 otherwise. We then multiplied each of the three binary indicator variables by our income variable defined earlier for the purposes of model estimation. The products, known as interaction terms, can be included in our statistical model in lieu of the income variable itself. By replacing our income variable with the three interaction terms, we can obtain separate estimates of the relationship between income and expenditures for each of the three groups.

A positive association between income and expenditures is found for the second and third income groups (estimation results shown in appendix table 6).[13] Given a 10-percent increase in income, we expect households in group 2 (130 to 185 percent) to increase their fruit and vegetable expenditures by 1.15 percent and 1.93 percent, respectively. The same estimates for households in group 3 are 1.28 and 1.52 percent. We again find no evidence of an income effect for households in group 1, those earning below 130 percent of the poverty line.

As a final step, we compared our tobit results against clad parameter estimates, and found no conflict.[14] Clad estimates of the income parameter are provided in appendix 7.

[13] For the model of vegetable expenditures, our estimate of the parameter on income for households in group 2 is statistically significant at the 10-percent level. For the model of fruit expenditures, it has a P-value of 0.111. However, when we specified the model in a slightly different manner, we found that households in group 2 do spend more money on fruits than households in group 1 at the 10-percent level. Our clad estimates are also consistent with an income effect occurring as a household's income rises above 130 percent of the poverty line. See footnote 14.

[14] We estimated a clad model at several points on the distribution of expenditures, conditional on a household's income and other characteristics. For households in group 1, our estimated income parameter was positive at some points and negative at others, but always insignificant. For households in group 2 and group 3, the estimated parameter was always positive and, at some points, statistically significant. Though we generally conducted our tests of significance for clad parameter estimates at the 15-percent level, we investigated further the association between income and fruit expenditures for households in group 2, given our tobit results as discussed in footnote 13, and found this relationship to be significant at the 10-percent level for at least one point.

So, among households earning between 0 and 260 percent of the poverty line, an increase in fruit and vegetable expenditures is likely given a small increase in income. This positive income effect appears to be driven by the increase in spending that occurs as a household's income rises to between 130 percent and 185 percent of the poverty line. We conclude that households who are income-eligible for the Food Stamp Program do not appear to place a priority on fruits and vegetables. Meats and frozen prepared foods are a spending priority. However, a household's income does not need to rise much further before the household is also willing and able to allocate additional resources to fruits and vegetables, on average.

Do Low-Income Households Have the Financial Resources To Eat Healthfully?

Much of the debate about why obesity and overweight are on the rise in the United States has focused on the cost of healthful foods. Some have argued that low-income households cannot afford to eat healthfully due to the high cost of these foods. Income is one component of the cost equation. We find that low-income households spend less on fruits and vegetables, as well as on most other types of foods. However, a small increase in income will not likely induce them to spend more on fruits and vegetables. Spending on beef and frozen prepared foods does increase, and therefore may be a priority. Food consumption and focus group analyses corroborate these results.

Based on the findings of this study and other analyses, there is much evidence to support Jackson's (1984) theory of hierarchical demand. As their incomes increase, low-income households will add more foods to their diet. Foods providing greater satisfaction relative to their price will be added at lower levels of income than will other foods yielding less satisfaction relative to their price. As to fruits and vegetables, it appears that a household's income does not need to rise much higher than 130 percent of the poverty line, a cutoff point for the Food Stamp Program, before the household is willing to allocate additional resources to these foods, on average.

Our results might also help those promoting fruit and vegetable consumption. Past studies have focused largely on households who are income-eligible for the Food Stamp Program. However, there is interest in promoting fruits and vegetables among the population of the United States in general. WIC, for example, might soon provide fruits and vegetables to its participants. For people considering this program and other programs, it might be helpful to know that households earning above 130 percent of the poverty line appear to behave differently than households who are income-eligible for the Food Stamp Program. Among the former, we found a positive association between the receipt of additional income and fruit/vegetable demand; among the latter, we failed to find such an association.

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Appendix table 1

Definition and sample means of independent variables

Variable	Mean	Definition
Income	4.65	Annual pre-tax income, 100s of dollars per week per household member
Education:		
High School	0.276	Equals 1 if completed high school, no college, 0 otherwise
Some College	0.298	Equals 1 if completed some college, did not graduate, 0 otherwise
College	0.289	Equals 1 if completed college or higher level of education, 0 otherwise
Household age composition:		
Proportion under age 5	0.035	Proportion of household members under age 5
Proportion age 5-9 years	0.043	Proportion of household members age 5-9
Proportion age 10-14 years	0.046	Proportion of household members age 10-14
Proportion age 15-19 years	0.055	Proportion of household members age 15-19
Proportion age 20-29 years	0.125	Proportion of household members age 20-29
Proportion age 30-44 years	0.208	Proportion of household members age 30-44
Proportion age 65-74 years	0.103	Proportion of household members age 65-74
Proportion older than age 74	0.095	Proportion of household members older than age 74
Other demographic:		
Black	0.105	Equals 1 if household is Black, 0 otherwise
Household size (inverse)	0.551	Inverse of the number of household members
Season:		
Winter	0.249	Equals 1 if winter, 0 otherwise; includes January, February, and March
Spring	0.273	Equals 1 if spring, 0 otherwise; includes April, May, and June
Summer	0.250	Equals 1, if summer, 0 otherwise; includes July, August, and September
Region:		
Northeast	0.172	Equals 1 if household resides in Northeast, 0 otherwise
South	0.331	Equals 1 if household resides in South, 0 otherwise
West	0.234	Equals 1 if household resides in West, 0 otherwise

Appendix table 2

Estimation results, low-income, tobit model[1]

	Beef	Baked foods	Eggs	Dairy products	Frozen/ Prepared	Vegetables	Fruits
Intercept	2.413*	2.496*	0.496*	2.834*	-2.399*	2.942*	2.155*
	(0.67)	(0.436)	(0.126)	(0.438)	(0.449)	(0.492)	(0.47)
Income	0.774*	0.093	0.012	-0.103	0.414*	0.247	-0.118
	(0.296)	(0.187)	(0.055)	(0.187)	(0.237)	(0.213)	(0.202)
Household size	-3.68*	-0.837*	-0.394*	-0.425	-0.289	-1.928*	-1.085*
	(0.651)	(0.408)	(0.121)	(0.409)	(0.41)	(0.466)	(0.44)
High school	0.133	0.568*	-0.158*	0.445*	0.605*	-0.435*	0.389
	(0.34)	(0.224)	(0.064)	(0.225)	(0.265)	(0.253)	(0.241)
Some college	-0.463	0.43*	-0.174*	0.11	0.494*	-0.074	0.394
	(0.381)	(0.248)	(0.071)	(0.249)	(0.273)	(0.28)	(0.267)
College	-0.742	1.643*	-0.131	1.604*	0.6*	0.87*	2.075*
	(0.515)	(0.327)	(0.094)	(0.327)	(0.3)	(0.37)	(0.35)
North	0.287	0.783*	0.075	0.155	-0.894*	0.788*	0.753*
	(0.435)	(0.279)	(0.082)	(0.279)	(0.269)	(0.317)	(0.301)
South	0.27	0.065	0.111*	-0.163	-0.039	0.238	0.163
	(0.356)	(0.23)	(0.067)	(0.231)	(0.22)	(0.261)	(0.249)
West	0.071	0.412	0.215*	0.422	-0.649*	0.92*	0.97*
	(0.42)	(0.268)	(0.078)	(0.267)	(0.245)	(0.303)	(0.288)
Winter	0.33	0.035	-0.157*	0.051	0.206	0.334	0.344
	(0.384)	(0.249)	(0.072)	(0.25)	(0.247)	(0.282)	(0.271)
Spring	-0.247	-0.479*	-0.252*	-0.524*	-0.044	-0.213	0.08
	(0.391)	(0.254)	(0.073)	(0.255)	(0.243)	(0.288)	(0.275)
Summer	-0.382	-0.205	-0.12	0.215	0.141	0.032	0.485*
	(0.402)	(0.258)	(0.074)	(0.259)	(0.246)	(0.291)	(0.28)
Black	0.399	0.000	0.113*	-0.477*	-1.179*	0.579*	-0.021
	(0.359)	(0.236)	(0.067)	(0.238)	(0.283)	(0.266)	(0.255)
Proportion under age 5	-0.041	-0.874	-0.351	-0.937	0.799	-1.664*	-0.697
	(1.255)	(0.836)	(0.244)	(0.84)	(0.867)	(0.942)	(0.895)
Proportion age 5-9	-2.427*	-1.158	-0.265	-0.749	0.093	-2.801*	-1.209
	(1.118)	(0.744)	(0.21)	(0.743)	(0.781)	(0.839)	(0.8)
Proportion age 10-14	-1.554	-0.935	-0.249	-0.118	1.835*	-3.17*	-1.251
	(1.113)	(0.74)	(0.21)	(0.74)	(0.775)	(0.835)	(0.797)
Proportion age 15-19	-3.526*	-2.521*	-0.75*	-2.829*	-0.605	-3.521*	-2.945*
	(0.798)	(0.468)	(0.157)	(0.475)	(0.611)	(0.563)	(0.508)
Proportion age 20-29	-1.604*	-1.956*	-0.276*	-1.173*	0.085	-1.773*	-2.078*
	(0.57)	(0.356)	(0.106)	(0.355)	(0.355)	(0.404)	(0.387)
Proportion age 30-44	-0.342	-1.523*	0.037	-1.348*	-0.753*	-1.202*	-1.788*
	(0.642)	(0.422)	(0.12)	(0.419)	(0.346)	(0.472)	(0.453)
Proportion age 65-74	0.198	0.742*	0.292*	0.849*	-0.201	0.895*	0.91*
	(0.563)	(0.366)	(0.105)	(0.366)	(0.356)	(0.411)	(0.394)
Proportion age over 74	-0.292	1.064*	0.234*	0.421	0.459	0.256	0.777*
	(0.546)	(0.347)	(0.1)	(0.348)	(0.344)	(0.392)	(0.374)
σ, estimated value[2]	3.996	2.794	0.748	2.796	4.573	3.105	2.974

* = statistically significant at the 10-percent level. Standard errors are in parentheses.

[1] Based on 1,073 low-income households except for frozen prepared foods, which was analyzed using pooled data on low- and middle-income consumers, allowing only the effect of income to vary between the two populations.

[2] Sigma is the square root of σ^2. We do not test the statistical significance of this parameter.

Appendix table 3

Estimation results, middle-income, tobit[1]

	Beef	Baked foods	Eggs	Dairy products	Frozen/ Prepared	Vegetables	Fruits
Intercept	2.901*	2.162*	0.363*	2.561*	-2.399*	2.333*	1.136*
	(0.606)	(0.295)	(0.082)	(0.308)	(0.449)	(0.327)	(0.337)
Income	0.159*	0.11*	-0.01	0.1*	0.263*	0.102*	0.143*
	(0.091)	(0.044)	(0.012)	(0.046)	(0.065)	(0.049)	(0.05)
Household size	-3.519*	0.35	-0.057	0.578*	-0.289	0.147	0.898*
	(0.58)	(0.275)	(0.077)	(0.286)	(0.41)	(0.305)	(0.314)
High school	0.13	0.375*	-0.059	0.197	0.605*	0.028	0.084
	(0.373)	(0.182)	(0.05)	(0.19)	(0.265)	(0.202)	(0.209)
Some college	0.062	0.603*	-0.058	0.473*	0.494*	0.058	0.261
	(0.379)	(0.185)	(0.051)	(0.193)	(0.273)	(0.206)	(0.212)
College	-0.425	0.561*	-0.117*	0.907*	0.6*	0.562*	1.069*
	(0.404)	(0.197)	(0.054)	(0.205)	(0.3)	(0.218)	(0.225)
North	0.008	0.182	0.114*	0.28	-0.894*	0.268	0.374*
	(0.346)	(0.168)	(0.047)	(0.175)	(0.269)	(0.187)	(0.193)
South	-0.205	-0.141	0.03	-0.232	-0.039	0.05	-0.022
	(0.292)	(0.142)	(0.04)	(0.148)	(0.22)	(0.158)	(0.163)
West	-0.102	0.055	0.101*	0.046	-0.649*	0.445*	0.83*
	(0.313)	(0.152)	(0.043)	(0.158)	(0.2458)	(0.169)	(0.174)
Winter	-0.408	-0.129	-0.069	-0.157	0.206	-0.287	-0.021
	(0.325)	(0.158)	(0.044)	(0.165)	(0.247)	(0.175)	(0.181)
Spring	-0.386	-0.296*	-0.178*	-0.222	-0.044	-0.368*	0.1
	(0.313)	(0.152)	(0.042)	(0.159)	(0.243)	(0.169)	(0.174)
Summer	-0.37	-0.222	-0.123*	-0.191	0.141	-0.28	0.287
	(0.318)	(0.155)	(0.043)	(0.162)	(0.246)	(0.172)	(0.178)
Black	0.313	-0.695*	0.059	-1.228*	-1.179*	-0.268	-0.088
	(0.383)	(0.189)	(0.052)	(0.197)	(0.283)	(0.208)	(0.215)
Proportion under age 5	-2.996*	-1.041*	-0.368*	-0.142	0.799	-1.239*	-0.129
	(1.19)	(0.585)	(0.164)	(0.609)	(0.867)	(0.651)	(0.671)
Proportion age 5-9	-2.447*	-0.947*	-0.544*	-1.456*	0.093	-2.595*	-1.827*
	(1.057)	(0.523)	(0.146)	(0.546)	(0.781)	(0.585)	(0.604)
Proportion age 10-14	-1.482	-0.693	-0.334*	-0.9*	1.835*	-2.08*	-1.14*
	(1.051)	(0.523)	(0.144)	(0.546)	(0.775)	(0.582)	(0.602)
Proportion age 15-19	-1.797*	-0.956*	-0.335*	-0.817*	-0.605	-1.473*	-1.227*
	(0.969)	(0.473)	(0.132)	(0.4939)	(0.611)	(0.525)	(0.544)
Proportion age 20-29	-2.087*	-1.553*	-0.239*	-1.473*	0.085	-1.743*	-1.526*
	(0.489)	(0.232)	(0.066)	(0.241)	(0.355)	(0.258)	(0.264)
Proportion age 30-44	-1.26*	-0.977*	0.051	-1.09*	-0.753*	-1.169*	-1.045*
	(0.43)	(0.207)	(0.057)	(0.216)	(0.346)	(0.23)	(0.238)
Proportion age 65-74	0.215	0.141	0.065	0.393*	-0.201	0.09	0.397
	(0.457)	(0.223)	(0.062)	(0.232)	(0.356)	(0.246)	(0.255)
Proportion age over 74	-1.193*	0.607*	0.017	-0.068	0.459	0.01	0.798*
	(0.469)	(0.224)	(0.062)	(0.233)	(0.344)	(0.247)	(0.255)
σ, estimated value[2]	5.541	2.888	0.753	3.017	4.573	3.177	3.287

* = statistically significant at the 10-percent level. Standard errors are in parentheses.

[1] Based on 2,964 middle-income households except for frozen prepared foods, which was analyzed using pooled data on low- and middle-income consumers, allowing only the effect of income to vary between the two populations.

[2] Sigma is the square root of σ^2. We do not test the statistical significance of this parameter.

Appendix table 4

Estimation results on income variable, low-income, clad[1,2]

Food type	Estimate	85-percent confidence interval[2]	
		Lower limit	Upper limit
Beef	0.47*	0.031	1.439
Milk and other dairy products	-0.076	-0.401	0.206
Fruit	-0.102	-0.399	0.084
Vegetables	0.052	-0.13	0.296
Frozen entrees/other frozen foods	0.308*	0.08	0.558
Eggs	0.032	-0.026	0.135

* = Statistically different than zero based on confidence interval being entirely greater than zero.
[1] Estimated at the median of the conditional distribution of expenditures except for the results on frozen entrees and other frozen foods which are estimated at the 75th percentile of this distribution.
[2] Bias-corrected percentile confidence intervals calculated with the Stata software package using a bootstrap procedure.

Appendix table 4a

Estimation results on income variable, breads, clad, selected points on the conditional distribution of expenditures

Point on the distribution of expenditures conditional on the independent variables	Estimate	85-percent confidence interval[1]	
		Lower limit	Upper limit
25th percentile	0.009	-0.293	0.252
45th percentile	0.153	-0.035	0.347
50th percentile	0.231*	0.086	0.485
60th percentile	0.113	-0.189	0.311
75th percentile	-0.178	-0.672	0.19
85th percentile	-0.378	-1.071	0.005

* = Statistically different than zero based on confidence interval being entirely greater than zero.
[1] Bias-corrected percentile confidence intervals calculated with the Stata software package using a bootstrap procedure.

Appendix table 5

Estimation results, income under 260 percent of the poverty line, tobit[1]

	Vegetables	Fruits
Intercept	2.764*	1.535*
	(0.323)	(0.34)
Income	0.167*	0.247*
	(0.075)	(0.079)
Household size	-0.862*	-0.213
	(0.284)	(0.297)
High school	-0.255	0.169
	(0.174)	(0.183)
Some college	-0.131	0.285
	(0.186)	(0.197)
College	-0.679*	1.568*
	(0.223)	(0.234)
North	0.473*	0.622*
	(0.203)	(0.214)
South	0.066	0.178
	(0.171)	(0.18)
West	0.654*	0.967*
	(0.188)	(0.199)
Winter	0.171	0.215
	(0.187)	(0.198)
Spring	-0.087	0.143
	(0.184)	(0.195)
Summer	-0.039	0.436*
	(0.188)	(0.199)
Black	0.287	-0.058
	(0.193)	(0.205)
Proportion under age 5	-1.261	-0.039
	(0.65)	(0.682)
Proportion age 5-9	-2.532*	-1.4*
	(0.577)	(0.608)
Proportion age 10-14	-2.927*	-1.656*
	(0.58)	(0.612)
Proportion age 15-19	-3.325*	-3.039*
	(0.436)	(0.447)
Proportion age 20-29	-2.179*	-2.243*
	(0.274)	(0.288)
Proportion age 30-44	-1.342*	-1.623*
	(0.287)	(0.304)
Proportion age 65-74	0.166	0.2481
	(0.256)	(0.27)
Proportion age over 74	-0.185	0.306
	(0.242)	(0.255)
σ, estimated value[2]	3.083	3.254

* = statistically significant at the 10-percent level. Standard errors are in parentheses.

[1] Based on 2,445 low- to middle-income households.

[2] Sigma is the square root of σ^2. We do not test the statistical significance of this parameter.

Appendix table 6

Estimation results, three income groups, tobit[1]

	Vegetables	Fruits
Intercept	2.695*	1.635*
	(0.331)	(0.349)
Income group 1 (< 130% poverty)	0.282	-0.041
	(0.198)	(0.208)
Income group 2 (130% to 185% pov.)	0.325*	0.207**
	(0.125)	(0.13)
Income group 3 (>185% poverty)	0.18*	0.167*
	(0.088)	(0.092)
Household size	-1.002*	0.028
	(0.332)	(0.354)
High school	-0.25	0.159
	(0.174)	(0.183)
Some college	-0.125	0.266
	(0.187)	(0.197)
College	-0.704*	1.549*
	(0.223)	(0.235)
North	0.472*	0.619*
	(0.203)	(0.213)
South	0.063	0.175
	(0.171)	(0.180)
West	0.65*	0.96*
	(0.189)	(0.198)
Winter	0.163	0.213
	(0.187)	(0.197)
Spring	-0.085	0.135
	(0.184)	(0.195)
Summer	-0.042	0.429*
	(0.188)	(0.199)
Black	0.284*	-0.044
	(0.193)	(0.206)
Proportion under age 5	-1.271	0.01
	(0.650)	(0.682)
Proportion age 5-9	-2.531*	-1.381*
	(0.577)	(0.607)
Proportion age 10-14	-2.938*	-1.602*
	(0.581)	(0.613)
Proportion age 15-19	-3.294*	-3.058*
	(0.436)	(0.447)
Proportion age 20-29	-2.159*	-2.251*
	(0.275)	(0.288)
Proportion age 30-44	-1.323*	-1.626*
	(0.287)	(0.304)
Proportion age 65-74	0.153	0.229
	(0.256)	(0.270)
Proportion age over 74	-0.21	0.28
	(0.243)	(0.256)
σ, estimated value[2]	3.081	3.251

* = statistically significant at the 10-percent level, ** = statistically significant at the 12-percent level. Standard errors are in parentheses.

[1] Based on 2,445 low- to middle-income households.

[2] Sigma is the square root of σ^2. We do not test the statistical significance of this parameter.

Appendix table 7

Estimation results on income variable for three income groups , clad selected points on the conditional distribution of expenditures

Point on distribution	*Fruit* Estimate	*Fruit* 85-percent confidence interval[1] Low	High	*Vegetables* Estimate	*Vegetables* 85-percent confidence interval[1] Low	High
Group 1 (below 130 percent of poverty line):						
30th percentile	0.109	-0.131	0.319	0.156	-0.103	0.415
50th percentile	-0.121	-0.325	0.053	0.061	-0.116	0.251
70th percentile	-0.062	-0.32	0.272	0.008	-0.147	0.276
85th percentile	-0.163	-0.649	0.374	-0.041	-0.39	0.5
Group 2 (130 to 185 percent of poverty line):						
30th percentile	0.094	-0.072	0.184	0.161*	0.001	0.327
50th percentile	0.09	-0.039	0.221	0.109	-0.028	0.232
70th percentile	0.232* [2]	0.079	0.485	0.097	-0.046	0.28
85th percentile	0.315	-0.036	0.612	0.272*	0.078	0.732
Group 3 (185 to 260 percent of poverty line):						
30th percentile	0.033	-0.108	0.089	0.066	-0.06	0.163
50th percentile	0.015	-0.113	0.091	0.024	-0.05	0.129
70th percentile	0.159*	0.033	0.308	0.06	-0.035	0.217
85th percentile	0.273*	0.058	0.525	0.204*	0.079	0.517

* = Statistically different than zero based on confidence interval being entirely greater than zero.

[1] Bias-corrected percentile confidence intervals calculated with the Stata software package using a bootstrap procedure.

[2] A 95-percent confidence interval is (0.011, 0.591). Because it does not contain zero, we conclude that this estimate is also significant at the 5-percent level.