

The Thrifty Food Plan and low-income households in the United States: What food groups are being neglected?

Hayden Stewart ^{a,*}, Noel Blisard ^b

^a *Economic Research Service, US Department of Agriculture, 1800 M Street, NW,
Room N2134 Washington, DC 20036-5831, USA*

^b *Economic Research Service, US Department of Agriculture, 1800 M Street, NW,
Room N4086 Washington, DC 20036-5831, USA*

Accepted 6 December 2005

Abstract

Food assistance programs in the United States provide low-income households with the resources to purchase a healthy, nutritious, and palatable diet, if they buy the market baskets of food outlined in the Thrifty Food Plan. This study compares the cost of these baskets with actual spending on food at home by low-income households. Simulations reveal at-home food spending by low-income households to represent only 86% of what is needed to follow the Thrifty Food Plan. Married couples with children and female-headed households with children spend only 73% and 82%, respectively, and just 43% and 50% for at-home fruits and vegetables.

© 2005 Elsevier Ltd. All rights reserved.

Keywords: Thrifty Food Plan; Food stamps; Food spending; Poverty; Low-income households

Introduction

The Food Nutrition Service (FNS), an agency of the US Department of Agriculture (USDA) and administrator of the Food Stamp Program (FSP) in the United States, has

* Corresponding author. Tel.: +1 202 694 5394; fax: +1 202 694 5662.

E-mail addresses: hstewart@ers.usda.gov (H. Stewart), nblisard@ers.usda.gov (N. Blisard).

announced its intention to place more emphasis on teaching program beneficiaries about choosing a healthful diet with a balanced mix of breads, cereals, rice, pasta, fruits, vegetables, dairy items, and proteins (FNS, 2004). To successfully influence the diets of FSP recipients, nutrition educators will need to know whether households are devoting enough resources to acquiring food in the aggregate as well as how they are allocating their food dollars to key food groups.

The Center for Nutrition Policy and Promotion (CNPP) of USDA has developed the Thrifty Food Plan (TFP) to serve as a national standard for a market basket of foods affordable to low-income households, especially those participating in the FSP. The plan contains expenditure levels for 25 food categories for individuals of different ages and gender. The cost of these foods has been calculated using national-average prices for foods sold for at-home consumption. Food plan costs for each member of a household are estimated based on these assumed prices and quantities. Assumed food prices are adjusted annually for inflation.¹ Furthermore, the TFP is based on a family of four. Due to economies of size associated with the number of people in a household, per capita costs are scaled up for households smaller than four persons, and scaled down for larger households (see CNPP, 1999). To examine how low-income households tend to allocate their food dollars, a household's actual expenditures can be compared to the costs of its TFP basket of foods.

The affordability of the TFP has received much attention in the literature, including several studies demonstrating that the median low-income household spends about enough on all food to purchase their TFP basket of foods (e.g., Daponte and Stephens, 2004; Nord et al., 2004). However, these expenditures also include money spent for away-from-home foods, which not only tend to be more expensive, but less nutritious than food at home (Lin et al., 1999).

In this study, we expand on the existing literature by investigating how closely low-income households match their food-at-home budget with the cost of the TFP. This is important because low-income households participating in the FSP have enough resources to purchase foods in the TFP. Also, by selecting foods in accordance with the TFP, these households have the potential to achieve a healthy, nutritious, and palatable diet.

Furthermore, in this study, we compare the cost of the TFP to actual household spending by major food group. These groups include: (1) cereal and bakery, (2) meat, poultry, fish, and eggs, (3) dairy, and (4) fruits and vegetables. In this way, we can ascertain whether or not low-income households are allocating their food dollars in a manner consistent with a nutritious and palatable diet at a minimal cost as outlined in the TFP, and, in addition, where low-income households may be over or under allocating their food-at-home dollars relative to the TFP benchmark.

Finally, we conduct our analysis over a sample of all US households, but focus on the implications for low-income households. By including all households, we can see how increases in income influence food budget allocation, both for all at-home foods and by food group for households below and above the food stamp income-eligibility line. We can thereby gain some insight into how low-income households might adjust their budget with increases in income.

¹ Costs are adjusted for inflation based on food components of the Consumer Price Index.

The Thrifty Food Plan

For over 100 years, the USDA has prepared guides for selecting nutritious diets at different cost levels. By the 1930's, the USDA published diets at four levels: (1) the Restricted Food Plan diet for Emergency Use, (2) the Minimum-Cost Food Plan, (3) the Moderate-Cost Food Plan, and (4) the Liberal Food Plan. These plans suggested the amounts of foods that households could buy at four cost levels to meet the nutritional needs of men, women, and children of different ages. This information helped people to shop for food with the Restricted and Minimum-Cost Food Plans being intended for low-income families affected by the Depression (Welsh et al., 1992; Davis and Saltos, 1999). In the early 1940s, the Restricted and Minimum-Cost Food Plans were replaced by the Low-Cost Food Plan. In 1961, the Economy Food Plan was developed as a nutritionally adequate diet for use when the cost of food must be lower than the average food expenditures of low-income households. In 1975, this food plan was replaced by the TFP, which represented a completely new set of market baskets but at the same "minimal cost" as the market baskets of the Economy Food Plan (CNPP, 2003, p. 2).

The foods in the TFP market basket support a palatable and nutritious diet at a minimal cost. Items representing 92% of the cost of the TFP can be divided into four groups including: (1) cereal and bakery, (2) meat, poultry, fish, and eggs, (3) dairy products, and (4) fruits and vegetables. The remaining 8% of food expenditures are for fats and oils, sugar and sweets, non-alcoholic beverages, and seasonings. The TFP includes neither away-from-home nor prepared foods, such as frozen dinners.

Food assistance programs in the United States provide low-income households with the resources to purchase their TFP basket. Most importantly, the value of food stamps received by participants approximates the difference between the household's TFP cost of food and 30% of its net monthly income. Households may also receive free foods through the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC), school meals, or food pantries.

Overview and previous literature

The issue of whether households feel food secure has received much attention in the existing literature. One topic of research has been the relationship between a household's feeling of security and its desired diet. Work by Jensen (2002) suggests that some low-income households are subjectively insecure with hunger because they cannot afford the diet of their choice. These households reported needing \$44.79 per capita per week to purchase enough food whereas food secure households require only \$34.05, a level more in alignment with the cost of the TFP.

Other studies focus on the implications of using national average prices to calculate the TFP. While prices can vary from region-to-region, one study, Andrews et al. (2001), investigated the cost of TFP foods in Washington, DC, and finds that items were available at, or even, below the assumed TFP prices. However, households in other places could face higher prices, and these prices could affect their perceived food security.

Other research suggests that low-income households may identify themselves as food insecure because they allocate resources elsewhere in the household budget. Cash and food stamps are imperfect substitutes; in fact, the marginal propensity to consume food given an extra dollar of food stamps is less than \$0.50 (e.g., Breunig et al., 2001). However, this

issue becomes one of household budgeting, and ignores the fact that the FSP provides the household with enough resources to achieve a nutritious and palatable diet.

Given the above arguments, some researchers have analyzed households' total food spending (food at home and food away from home) relative to the TFP. [Daponte and Stephens \(2004\)](#), for one, identify some of the demographic characteristics associated with spending at least as much on food as a household's TFP cost of food. For instance, those researchers find that the effect of being a household with an elderly member is an increased probability of spending too little on food whereas the effect of being a household with a child is a decreased probability of spending too little.

Some other studies have tried to further incorporate the value of some free foods obtained by households, such as [Daponte et al. \(2001\)](#). That study finds the value of food acquired by low-income households to increase by \$0.28 with an additional dollar in food stamps, by \$0.69 for every dollar worth of free food received from a food pantry, and by \$0.73 for every dollar worth of food received through WIC. That study was not able to quantify the value of foods received by households' through school meal programs.

Given these other findings, perhaps, it is not surprising that [Gundersen and Oliveira \(2001\)](#) do not find a statistically significant relationship between the receipt of food stamps and the members of a household feeling that, at least sometimes, they do not have enough to eat.

Unlike the above cited studies, other analyses examine how low-income households allocate their food budget by food group. A study by [Wilde et al. \(1999\)](#) investigates the consumption of meats, fruits, vegetables, grains, dairy, sugars, and fats. That study does not find food stamps to be associated with large increases in the consumption of fruits and vegetables, but rather with an increased consumption of meats, added sugars, and total fats.

In another study of budget allocation, [Stewart et al. \(2003\)](#) confirm that low-income households spend less than their higher income counterparts on fruits and vegetables. In addition, these households are unlikely to increase such spending given an extra dollar in income or food stamps. An extra dollar would more likely be allocated to what low-income households perceive to be more basic, and thus desirable, food groups, such as meats and bakery products.

Improving diet quality, along with adequacy, is a goal of FNS. In 2004, FNS announced a plan to overhaul its nutrition education efforts to "better address the health concerns and food budget constraints faced by low-income people" ([FNS, 2004, p. 3](#)). FNS stated that they will focus on health promotion and the prevention of diseases by establishing more active lifestyles and healthier eating habits. To most effectively allocate resources, FNS also proposed targeting women with children. Women in the program will learn about the importance of being active, maintaining a healthy weight, and following dietary guidelines, such as consuming enough fruits and vegetables. For FSP households, the TFP provides such a diet.

However, existing studies have not demonstrated whether enough resources are being spent on food at home or on each of the four food groups to potentially achieve a nutritious and palatable diet at a minimal cost as outlined in the TFP. This study seeks to do so. Since the TFP represents a minimal cost food plan that is nutritious and palatable, we seek to determine which, if any, households allocate their food budgets in this manner, and which specific types of low-income households deviate from it.

Limitations of the study should be kept in mind. First, our findings represent the minimal intakes that low-income households may experience, since households may also acquire free foods (e.g., from pantries or through school meal programs). Second, a budget allocation corresponding to the TFP does not ensure a healthy diet. For example, spending TFP levels on cereal and bakery products does not ensure that any whole grains are purchased and, in fact, much of these expenditures could be for cookies and donuts. Third, prices faced by households may vary (e.g., [Andrews et al., 2001](#)) and low-income households may also adopt economizing practices, such as buying items on sale (e.g., [Leibtag and Kaufman, 2003](#)).

Data and methodology

As noted above, we interpret the TFP cost of food as a proxy or target for whether a low-income household is allocating its food budget to potentially achieve a nutritious and palatable diet at a minimal cost. As for away-from-home foods, we note that they tend to account for a smaller share of a low-income household's budget as compared with a higher income household's. For example, in the data set under study, the median low-income household spends about 20% of its food dollars away from home, whereas the mean low-income household spends 27%. By contrast, higher income households typically spend 50% or more of their total food budget away-from-home. Additionally, for low-income households, we speculate that away-from-home foods represent potential deviations from a minimal cost, nutritious, and palatable diet, especially since these households tend to have total food expenditures approximately equal to the cost of the TFP.

The current study combines data on the cost of the TFP adjusted for age, gender and household size, supplied by the CNPP, and the [Consumer Expenditure Survey \(CE\), 2002](#). The CE is administered annually by the Bureau of Labor Statistics to measure household expenditures for the total non-institutionalized US population. In the diary section of the survey, households report their expenditures on food items for two weeks. We matched records of spending on at-home foods to other information on a household's characteristics, such as annual income, level of education, age of household members, and the size of the household. The definition of at-home versus away-from-home foods is based primarily on where the food is bought. At-home foods include foods bought at grocery stores (or other food stores) as well as foods prepared by consumers while on trips. By contrast, away-from-home foods include meals and snacks (other than alcoholic beverages) acquired at full-service restaurants, fast food outlets, take-out places, delivery, concession stands, buffets and cafeterias, vending machines, and mobile vendors. Also taken into account are board (including at school), meals as pay, special catered affairs, school lunches, and meals eaten away from home by consumers while on trips.

Data from the CNPP allowed us to estimate the 2002 TFP cost of food for 3235 households in the CE,² including the cost of foods in the four food groups noted earlier.³ We then took the ratio the household's actual spending, as reported in the CE, to the cost

² We removed households providing incomplete data on characteristics of interest, such as income and members' ages, households not providing data for both weeks of the diary, and single-male households. Also, among households included in the sample, data for older children, aged 12–19, were averaged since we could not identify whether these children were male or female in the CE.

³ We include dry beans in the fruit and vegetable group.

of the household's TFP market baskets. Thus, we obtained five dependent variables, including ratios for all at-home foods and each of the four groups (sample means shown in Table 1).

Our modeling efforts focused on estimating the relationship between each of the five ratios, income, and selected household demographics – the so-called Engel Curve. While some studies fit these models using data on only low-income households, we include households of all income levels in our analysis, and focus our discussion on those households with incomes at or below 130% of the poverty line. These households are income-eligible for food stamps and are thus the target group for nutritional education. We created six income brackets based on multiplies of the poverty line – adjusted for household size. Hence, the first bracket ranged from zero to 130% of the poverty line. The second ranged from 131% to 260% of the poverty line. For estimation purposes, we created a binary indicator variable to place each household within its appropriate income bracket.

Table 1
Definitions and means of variables in study

Variables	Definition	Mean
<i>Independent variables</i>		
Northeast = 1	If household resides in the Northeast, 0 otherwise	0.17
South = 1	If household resides in the South, 0 otherwise	0.32
West = 1	If household resides in the West, 0 otherwise	0.24
Black = 1	If household is Black, 0 otherwise	0.10
Winter = 1	If household was surveyed in Winter, 0 otherwise	0.26
Spring = 1	If household was surveyed in Spring, 0 otherwise	0.26
Summer = 1	If household was surveyed in Summer, 0 otherwise	0.25
Female head = 1	If household is headed by female, 0 otherwise	0.09
Income level 1 (PL1) = 1	If household income was between 0 and 130% of the poverty line	0.18
Income level 2 (PL2) = 1	If household income was between 131% and 260% of the poverty line	0.25
Income level 3 (PL3) = 1	If household income was between 261% and 390% of the poverty line	0.19
Income level 4 (PL4) = 1	If household income was between 391% and 520% of the poverty line	0.13
Income level 5 (PL5) = 1	If household income was between 521% and 650% of the poverty line	0.10
Household size	Inverse of number of people residing in household	0.55
High school = 1	If 12 years of schooling or GED, 0 otherwise	0.28
Some college = 1	If 1–3 years of college completed, 0 otherwise	0.29
College = 1	If 4 years or more of college completed, 0 otherwise	0.31
Proportion 75	Proportion of household members age 75 or older	0.11
Proportion 65–74	Proportion of household members age 65–74	0.12
Proportion 30–44	Proportion of household members age 30–44	0.20
Proportion 20–29	Proportion of household members age 20–29	0.09
Proportion 15–19	Proportion of household members age 15–19	0.05
Proportion 10–14	Proportion of household members age 10–14	0.06
Proportion 5–9	Proportion of household members age 5–9	0.06
Proportion 5	Proportion of household members under age 5	0.05
<i>Dependent variables</i>		
Ratio	Ratio of food at home expenditures to TFP cost	0.97
Ratiocb	Ratio of cereal and bakery product expenditures to TFP cost	1.08
Ratiod	Ratio of meat, poultry, fish, and egg expenditure to TFP cost	0.70
Ratiod	Ratio of dairy product expenditures to TFP cost	0.86
Ratiodf	Ratio of fruit and vegetable expenditures to TFP cost	0.58
Sample size		3235

For example, PL1 equals one if a household's income is less than or equal to 130% of the poverty line, and zero otherwise.⁴

While the TFP was created for low-income households, including households of all income levels is consistent with research on food demand, and improves statistical results. An implicit assumption of cross-sectional analysis is that a lower income household would behave the same way as a higher income household – holding all other variables constant – given an increase in income. For instance, Banks et al. (1997) fit models using data on households of all incomes levels, and argue that their results explain the behavior of households at every level of income. In addition, by including all households we obtain more accurate statistical estimation given the larger variation in the data.

Another advantage of including higher-income households is to ascertain how budgeting changes, relative to the TFP, with discreet changes in household income. For example, if spending for only one or two food groups changes as we move from the lowest income level to the next level, this might suggest that low-income households concentrate their initial income on preferred foods, perhaps meats and eggs, and then allocate substantially more to other groups only after obtaining incomes above 130% of the poverty line. Such a hierarchical allocation would be consistent with past studies (Stewart et al., 2003; Wilde et al., 1999).⁵

Besides income, we also include the inverse of household size to capture the effects of “conflicts of interest.” We hypothesize that households with one or two people can more easily make expenditures in accordance with the TFP. As household size increases, the wants and desires of one family member may compete with the preferences of other family members and, if so, compromises must be made. Preliminary statistical analysis of our five ratios of expenditures to the TFP showed declines as household size increased.

Eight explanatory variables control for the proportion of a household's members belonging to each of eight age groups. A household's age profile is important, since teenagers and young adults tend to spend a larger proportion of food dollars away from home. On average, 20% of the members of a household in our sample are in the 30–44 age bracket, whereas only 5% are in the bracket comprised of children under 5 years of age (Table 1).

Another binary variable captures the effect of being a female-headed household with one or more children. Not only are many low-income households headed by females, but FNS has proposed targeting women with children. In our sample, 9% of all households are female-headed (Table 1), compared with 23% of low-income households.

Three binary variables capture the level of education of the person who filled out the diary of the CE survey. Thirty-one percent of our sample has a four-year degree or higher, whereas 28% has a high school education (Table 1). Past research shows that better educated households may spend more money on particular food groups, including fruits and vegetables (e.g., Stewart et al., 2003).

⁴ Separate categories were considered for households below 65% of the poverty line and those households with more than this amount of income, but less than 130%. However, according to a likelihood ratio test, the estimated coefficients on these two variables were not statistically different.

⁵ Unlike a neo-classical view of demand, a hierarchic view emphasizes that the variety of products purchased may increase with total expenditures (e.g., Jackson, 1984). That is, when their total expenditures are constrained, households may first add to their consumption set goods which yield the greatest marginal benefit relative to their price. Goods of a lesser priority only enter the consumption set at higher levels of total expenditure.

A binary race variable also enters the model, classifying households as either Black or non-Black. About 10% of our sample is Black households.

Finally, region of residence and season enter the model to capture geographic and seasonal variation in prices. Among households in our sample, 32% reside in the South, and 17% in the Northeast (Table 1). Finally, about 25% of the surveys were completed during winter spring, summer, and fall.

Our choice of econometric model was complicated by the fact some households did not spend any money on some of the food groups during the two-week survey period. These data are censored at zero, and the appropriate economic model for any one of our five dependent variables can be described as

$$\begin{aligned} y_i &= \mathbf{x}_i\boldsymbol{\beta} + \varepsilon_i & \text{if } \mathbf{x}_i\boldsymbol{\beta} + \varepsilon_i > 0, \\ &= 0 & \text{if } \mathbf{x}_i\boldsymbol{\beta} + \varepsilon_i \leq 0, \end{aligned} \quad (1)$$

where y_i is the ratio of actual expenditure to the TFP for household i , $\mathbf{x}_i$ contains the explanatory variables listed in Table 1, and ε_i is an error term.

The challenge in estimating (1) is that, due to censoring, an ordinary least squares (OLS) regression of $\mathbf{Y}$ on $\mathbf{X}$ can result in biased parameter estimates. Instead of OLS, a standard approach to correct for zero censoring is to use the Tobit procedure. However, there are a few limitations of this approach too. For the purpose of our study, we examined each of the major limitations to determine whether the Tobit procedure, or another method, was best suited for our data and intended model.

Our CE data do not reveal whether a household with zero expenditures never consumes the item, does not consume the item given current prices and income, or consumes the item infrequently. Only by assuming that all households would use the product, under the right set of prices and income, and that no infrequency-of-purchase or non-use problems exist, can we use the Tobit model. Researchers have developed models to relax this strong assumption, including the double-hurdle of Cragg (1971). We fit our data to a variant of the double-hurdle model which allows the Tobit to be estimated with separate Probit and censored regressions. However, the model did not explain the data better than did the traditional Tobit.⁶

The Tobit is also not robust to any misspecification of the error term (Deaton, 1997). By contrast, the censored least absolute deviations (CLAD) estimator of Powell (1984) requires no parametric assumptions about the error term. We therefore compared coefficients estimated using a traditional Tobit to those estimated using the method of Powell (1984), but obtained similar results.⁷

Estimation results

Estimation results reported in Table 2 indicate that many variables are statistically significant at the 10% level or better, especially those accounting for income and age composition. Table 2 contains the marginal effects of all explanatory variables in the model. To calculate marginal effects, estimated Tobit coefficients are adjusted by the probability of

⁶ As estimated by the Probit component of our infrequency of purchase model, the probability of purchase was near one for most households. In this situation, the infrequency of purchase model converges to the Tobit.

⁷ A 95% confidence interval about the estimated median regression coefficients contained the Tobit coefficient estimates.

Table 2
Tobit model for ratio of Thrifty Food Plan to actual expenditures

Independent variables	Food at home	Cereals and bakery	Meat, poultry, fish and eggs	Dairy products	Fruits and vegetables
<i>Adjusted marginal beta coefficients^a</i>					
Constant	1.11***	1.12***	0.90***	0.91***	0.41***
Northeast	0.13***	0.15***	0.15***	0.09**	0.12***
South	0.05*	0.01	0.09***	0.03	0.04**
West	0.12***	0.07	0.07**	0.12***	0.13***
Black	−0.07**	−0.15***	0.10**	−0.25***	−0.03
Winter	−0.04	0.02	−0.02	−0.07**	−0.03
Spring	−0.04	−0.04	0.02	−0.03	−0.01
Summer	−0.06*	−0.06	−0.02	−0.04	−0.01
Female head	0.16***	0.15**	0.13***	0.09*	0.10***
Income level 1 (PL1)	−0.27***	−0.21***	−0.13***	−0.15***	−0.14***
Income level 2 (PL2)	−0.20***	−0.15***	−0.13***	−0.09**	−0.09***
Income level 3 (PL3)	−0.16***	−0.14**	−0.12***	−0.08*	−0.08**
Income level 4 (PL4)	−0.08*	−0.10*	−0.03	−0.02	−0.07**
Income level 5 (PL5)	−0.05	−0.06	−0.06	−0.01	0.02
Household size	0.12**	0.07	−0.24***	−0.02	0.19***
High school	−0.05	−0.02	−0.08**	0.02	−0.04
Some college	−0.07	−0.03	−0.13***	−0.01	−0.03
College	0.01	0.05	−0.13***	0.09**	0.09***
Proportion 75	−0.15***	0.09	−0.17***	−0.07	−0.01
Proportion 65–74	0.01	0.13**	−0.01	0.03	0.03
Proportion 30–44	−0.20***	−0.32***	−0.13***	−0.21***	−0.14***
Proportion 20–29	−0.34***	−0.43***	−0.34***	−0.30***	−0.18***
Proportion 15–19	−0.49***	−0.69***	−0.50***	−0.63***	−0.29***
Proportion 10–14	−0.28***	−0.41***	−0.32***	−0.39***	−0.04
Proportion 5–9	−0.31***	−0.43***	−0.46***	−0.39***	−0.10
Proportion 5	−0.07	−0.40	−0.20	−0.14	0.20***
Sigma	0.66	0.99	0.79	0.78	0.55
Probability of purchase	0.93	0.85	0.79	0.85	0.84

^a Estimated coefficients scaled by the probability of purchase.

* Estimated coefficient significant at the 10% level or better.

** Estimated significant at the 5% level or better.

*** Estimated significant at the 1% level or better.

purchase (e.g., Greene, 1997). The figures in the table therefore represent the change in the ratio of actual at-home food spending to the TFP. For example, in the all food-at-home equation, the marginal effect of being a black household is to decrease the ratio by 7 percentage points, whereas this same variable's effect on meat, poultry, fish, and eggs is to increase the ratio by 10 percentage points.

The ratio of actual at-home food spending to the TFP is smaller for the four lowest income groups than for the highest. The coefficients on PL1 through PL4 are each negative and statistically significant at the 10% level. Since the indicator variable for the highest income group (incomes greater than 650% of the poverty line) is omitted from the regression model, each of the included variables is a contrast to that upper-income group. Most notable, the ratio of at-home spending to the TFP is 27% lower for the lowest income group (zero to 130% of the poverty line) relative to the omitted high income group. Not shown in Table 2, but easily calculated from our estimates in Table 2, are the differences between the lowest income group, and the other income categories. For income levels PL2 through PL6, these differences, significant at the 5% level or better, are 7 percentage points, 11 percentage points, 20 percentage points, 22 percentage points, and 27 percentage points.⁸ In words, the net effect of moving from the lowest income group to the next group is to increase the ratio by 7 percentage points.

Further revealed by the estimated coefficients on PL1 and PL2 are that, if a low-income household receives enough additional income to move into income group 2, we would expect an almost 7% increase in the ratio for at-home dairy expenditures and an almost 6% increase in the ratio for at-home fruit and vegetable expenditures, but no increase in at-home expenditures on cereals, bakery, meat, poultry, fish, and eggs.⁹ This might indicate that cereals, bakery, and proteins are, in general, preferred by low-income households, and that significant increases in dairy, fruits, and vegetables occur only after higher levels of income are obtained. This would be consistent with a hierarchical demand, whereby low-income households first purchase food groups most preferred with their limited income. Whether this is due to preferences, affordability, or both cannot be determined from this data.

Younger people also reduce their household's ratio of actual at-home spending to the TFP. Like income, age variables are interpreted relative to the omitted group – in this case, 45–64-year olds. These effects are mostly negative and highly statistically significant. Most notably, having a member aged between 15 and 19 decreases the ratio by 49 percentage points (actually 0.49 multiplied by the proportion of the household in this age group) relative to a member aged 45–64 years. This large negative effect further holds across the food groups.

Marginal net effects are interesting, but simulations can better reveal how closely typical households match their actual spending to the TFP. Marginal effects are viewed in isolation from the effects of the other variables in the model. For example, the positive effect of having a female head (16 percentage points for food at home) can be overwhelmed by having children in the same household. Thus, to understand how closely a representative household follows the TFP at different income levels, we substituted the values of the

⁸ Statistical significance was confirmed through likelihood ratio tests.

⁹ Estimated changes are based on the difference in the estimated coefficients on PL1 and PL2. Statistical significance was confirmed through likelihood ratio tests. Notably, statistically significant increases in the latter two food categories do not occur until a household reaches income group 4 (391–520% of the poverty line).

independent variables into the estimated model, obtaining fitted values for each household. We then calculated the average fitted value. We next repeated this exercise, but restricted our sample to low-income households, and then to the highest income households. Results are contained in Table 3.

Looking at all income levels, American households spend enough on food at home to buy the TFP basket. The ratio of actual food-at-home spending to the TFP is 0.99 (Table 3). Of course, this statistic does not indicate how these dollars are allocated over the four food groups. Table 3 further indicates that, on average, all households spend about 12% more than the TFP on at-home cereals and bakery goods, but only about 60% on at-home fruits and vegetables.

In contrast to the average, food at-home spending by low-income households averages about 86% of the TFP cost of foods versus 118% for the highest income households (Table 3). While low-income (highest income) households spend about (more than) the TFP amount on at-home cereal and bakery goods, they spend just 53% (71%) on at-home fruits and vegetables, 70% (86%) on at-home meat, poultry, fish, and eggs, and 74% (103%) on at-home dairy products.

We now turn our attention to simulating ratios for specific types of low-income households. This exercise has several merits. First, it demonstrates the extensive variation among low-income households. And second, it identifies particular types of low-income household least likely to allocate their food budgets in accordance with the TFP. For this exercise, we created four mutually exclusive household types. These households included female-headed (with children), married couples with children, single females, and elderly couples. All together, these four household types represent about 90% of our sample of low-income households. Simulations for these household types over our five equations were conducted using only low-income households of the type in question, and averaging fitted ratios over the same.

Fitted ratios tend to be lower among households with children (Table 4). Married couples with children spend about 73% of the TFP on food at home, while female-headed households spend about 82%. This trend continued over the four food groups. While

Table 3
Expected value of the ratio of the TFP to actual expenditures

Food category	All households	Lowest-income	Highest-income
Food at home	0.99	0.86	1.18
Cereals and bakery	1.12	1.02	1.29
Meat, poultry, fish, and eggs	0.74	0.70	0.86
Dairy products	0.88	0.74	1.03
Fruits and vegetables	0.60	0.53	0.71

Table 4
Expected value of the ratio of the TFP to actual expenditures for low-income household types

Food category	Female-headed	Married couple with children	Single females	Elderly couple
Food at home	0.82	0.73	0.90	0.96
Cereals and bakery	0.86	0.79	1.13	1.30
Meat, poultry, fish, and eggs	0.77	0.71	0.61	0.82
Dairy products	0.61	0.67	0.79	0.95
Fruits and vegetables	0.50	0.43	0.59	0.58

single females and elderly couples spent more than the TFP for at-home cereal and bakery products, female-headed households and couples with children spent 86% and 79%, respectively. For all household types, fitted ratios were lowest for at-home fruits and vegetables, but, again, female-headed households and couples with children had the lowest, 50% and 43%, respectively. Only in one instance did another type of household have a lower fitted ratio, and that was the ratio for single females for spending on at-home meat, poultry, fish, and eggs.

Implications and conclusions

Before discussing our conclusions, we briefly address the issue of food security. Our analysis above is concerned with the issue of budget allocation. A gap between what is actually spent by a household and the TFP does not indicate lacking enough food. It merely indicates that the household allocates its food-at-home budget differently than envisioned by designers of the TFP. As a check, we calculated the ratio of total food spending (food at home as well as food away from home) relative to the TFP for all low-income households in our sample. The average was 1.28. However, the median low-income household just about matches the TFP with a ratio of 0.99. Taking the mean and median statistics together, the typical low-income household devotes just enough resources to potentially purchase the nutritious and palatable diet behind the TFP.

Returning to the budgeting issue, as noted earlier in our discussion of the data, low-income households in our sample spent about 27% of their total food dollars away from home, on average. We believe these purchases to represent potential deviations from a low-cost, nutritious, and palatable diet, especially if these households have total food expenditures approximately equal to the cost of the TFP. For example, a single mother may take her child to a fast-food restaurant because she lacks the time to cook and her child can be entertained. However, ignoring possible time constraints and, perhaps, a lack of cooking skills, she could reallocate that money back to food at home, and potentially achieve a more healthful diet at a lower cost. Typically, food away from home is more expensive than food at home, because of the additional marketing services it embodies, and less healthful than what households consume at home (Lin et al., 1999).

Net their away-from-home expenditures, typical low-income households are likely to spend only 86% of the TFP on food at home (Table 3). In particular, there is reason to be concerned about households with children. Couples with children spend 73% of the TFP on food at home whereas female-headed households spend 82% (Table 4), although this may be somewhat offset by free food from pantries or school lunches.

The typical low-income household may also need to reallocate dollars across food groups. While the four groups account for 92% of the cost of the TFP, low-income households spend only 71% of their at-home budget on them (Table 5). The implication is that low-income households are allocating a much greater share of their at-home budget to miscellaneous prepared foods, non-alcoholic beverages, sugar and sweets, and fats and oils. Examination of our data indicates that these households spend about 12% of their at-home budget on miscellaneous foods, and about 9% on non-alcoholic beverages. The remaining 8% is spent on fats, oils, sugars, and sweeteners. In this behavior, low-income households may mirror higher-income Americans who also value convenience and tastes. Like food away from home, miscellaneous foods contain marketing services that may save the household time, but are not factored into the TFP.

Table 5

Cost of TFP as a percentage of the food-at-home expenditures of low-income households

Household type	Percentage of the TFP ^a	Actual percentage ^b
All low-income households	0.92	0.71
Female head	0.93	0.72
Married couple with children	0.93	0.73
Single female	0.90	0.69
Elderly couple	0.94	0.75

^a Sum of cereals, bakery, meat, poultry, fish, eggs, dairy, fruits, and vegetables divided by TFP.^b Sum of the four food groups divided by food-at-home expenditures.

The most under allocated food group is fruits and vegetables. Given the importance of these foods in a healthful diet and the degree of under allocation, special emphasis could be placed here by nutritional educators followed by dairy, and then meat, poultry, fish, and eggs. One might “color-code” food stamps instead, so that a fixed proportion of benefits would have to be spent on fruits and vegetables.

Alternatively, the problem of budget allocation might be viewed as one of time allocation and cooking skills. As noted earlier, low-income households allocate 12% of their food-at-home budget to miscellaneous prepared foods and about 27% of their total food budget to food away from home. Perhaps, low-income meal preparers lack the time and/or cooking skills to prepare the meals in the TFP. If so, these households cannot be expected to purchase the TFP basket. In this case, a different TFP, including prepared foods, would be required. In all likelihood, the food stamp allotment would have to be increased to make such a plan affordable.

In summary, although a typical low-income household spends about the same amount on total food (at home and away) as the TFP costs, this household does not tend to allocate these dollars in accordance with the TFP. We have further found evidence that households containing women with children tend to deviate most from the TFP. This finding is consistent with the FNS proposal to target households with children for special nutritional education on how to obtain healthy diets at a minimal cost. Of course, any definitive conclusions would require further research into exactly what foods these households tend to acquire, including free foods.

Acknowledgments

The authors thank two anonymous reviewers for their thoughtful comments. All remaining errors and omissions are the responsibility of the authors. The views and opinions expressed in this paper do not necessarily reflect those of the Economic Research Service, US Department of Agriculture.

References

- Andrews, M., Kantor, L.-S., Lino, M., Ripplinger, D., 2001. Using USDA's Thrifty Food Plan to assess food availability and affordability. *FoodReview* 24 (2), 45–53.
- Banks, J., Blundell, R., Lewbel, A., 1997. Quadratic Engel curves and consumer demand. *The Review of Economics and Statistics* 79, 527–539.
- Breunig, R., Dasgupta, I., Gundersen, C., Pattanaik, P., 2001. Explaining the food stamp cash-out puzzle. Food Assistance and Nutrition Research Report No. 12, Economic Research Service, US Department of Agriculture, Washington, DC.

- Bureau of Labor Statistics. Consumer Expenditure Survey, 2002. US Department of Commerce, Washington, DC.
- Center for Nutrition Policy and Promotion, 1999. Thrifty Food Plan, 1999. Administrative Report. US Department of Agriculture, Washington, DC.
- Center for Nutrition Policy and Promotion, 2003. The low-cost, moderate-cost, and liberal food plans. Administrative Report. US Department of Agriculture, Washington, DC.
- Cragg, J.G., 1971. Some statistical models for limited dependent variables with applications to the demand for durable goods. *Econometrica* 39, 829–844.
- Daponte, B.O., Stephens, M., 2004. The relationship between food assistance, the value of food acquired, and household food security. The University of Chicago. Irving B. Harris Graduate School of Public Policy, Working Paper #04.08.
- Daponte, B.O., Haviland, A., Kandane, J.B., 2001. To what degree does food assistance help poor households acquire enough food? Northwestern University/University of Chicago Joint Center for Poverty Research, Working Paper #236.
- Davis, C., Saltos, E., 1999. Dietary recommendations and how they have changed over time. In: Frazao, E. (Eds.), *America's Eating Habits: Changes and Consequences*, Agriculture Information Bulletin No. 750, US Department of Agriculture, Washington, DC, pp. 33–50.
- Deaton, A., 1997. *The Analysis of Household Surveys: A Microeconometric Approach to Development Policy*. Johns Hopkins University Press for the World Bank, Baltimore and London.
- Food Nutrition Service, 2004. Food Stamp Nutrition Education Framework. Draft proposal issued for public comment. US Department of Agriculture, Washington, DC. Available from [online]: <<http://www.fns.usda.gov/oane/MENU/FSNE/FSNE.pdf>> (accessed 10.01.2004.).
- Greene, W.H., 1997. *Econometric Analysis*, third ed. Prentice-Hall, New Jersey.
- Gundersen, C., Oliveira, V., 2001. The Food Stamp Program and food insufficiency. *American Journal of Agricultural Economics* 83, 875–887.
- Jackson, L.F., 1984. Hierarchic demand and the Engel curve for variety. *Review of Economic and Statistics* 66, 8–15.
- Jensen, H., 2002. Food insecurity and the Food Stamp Program. *American Journal of Agricultural Economics* 84, 1215–1228.
- Leibtag, E., Kaufman, P., 2003. Exploring food purchase behavior of low-income households: how do they economize, Agriculture Information Bulletin No. 747–07, Economic Research Service, US Department of Agriculture, Washington, DC.
- Lin, B., Frazao, E., Guthrie, J., 1999. Away-from-home foods increasingly important to quality of american diet, Agriculture Information Bulletin No. 749, Economic Research Service, US Department of Agriculture, Washington, DC.
- Nord, M., Andrews, M., Carlson, S., 2004. Household food security in the United States, 2003, Food Assistance and Nutrition Research Report No. 42, Economic Research Service, US Department of Agriculture, Washington, DC.
- Powell, J., 1984. Least absolute deviations estimation for the censored regression model. *Journal of Econometrics* 25, 303–325.
- Stewart, H., Blisard, N., Jolliffe, D., 2003. Do income constraints inhibit spending on fruits and vegetables among low-income households? *Journal of Agricultural and Resource Economics* 28, 465–480.
- Welsh, S., Davis, C., Shaw, A., 1992. A brief history of food guides in the United States. *Nutrition Today* 27, 6–11.
- Wilde, P., McNamara, P., Ranney, C., 1999. The effect of income and food programs on dietary quality: a seemingly unrelated regression analysis with error components. *American Journal of Agricultural Economics* 81, 959–971.