Household Food Security and Tradeoffs in the Food Budget of Food Stamp Program Participants

An Engel Function Approach

Contractor and Cooperator Report No. 38
March 2008

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Abstract

This study develops a framework for differentiating true Food Stamp Program (FSP) impacts on food security from those that arise because households with the most severe food-related hardships are more likely to participate in the program. The framework hypothesizes that food spending improvements are the likely causal link between FSP participation and enhanced food security. Since food stamp benefits diminish with income, the incremental effect of FSP participation is also expected to diminish. Using data from the Current Population Survey Food Security Supplements in a statistical framework that controls for household income, the study finds that FSP participants have consistently higher at-home food spending and lower away-from-home-spending than comparable nonparticipants. For both groups, food security rises with income, but food security remains lower for program participants. Because differences in food spending and food security do not disappear as income rises, the study concludes that observed disparities are not likely to be true program impacts.

This study was conducted by Tufts University under a cooperative research contract with USDA's Economic Research Service (ERS) Food and Nutrition Assistance Research Program (FANRP): contract number 43-3AEM-5-80088 (ERS project representative: Margaret Andrews). The views expressed are those of the authors and not necessarily those of ERS or USDA.

Acknowledgments

This report benefited from excellent research assistance by Nyssa Schloyer Ackerley, project management by Anne Marie Golla and Margaret Andrews at USDA's Economic Research Service (ERS), and comments and suggestions from Ted Macaluso at USDA's Food and Nutrition Service (FNS) and from colleagues who attended presentations at ERS, the annual meeting of the American Agricultural Economics Association, and the Experimental Biology conference. The research was supported by the Food Assistance and Nutrition Research Program (FANRP) at ERS (Agreement Number 43-3AEM-5-80088). All errors are the responsibility of the authors.

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Report Summary

Using data from the federal government's household food security survey, this study charted how increased income and FSP participation are associated with changes in food spending and food security outcomes. The analysis distinguished two possible contributions of food stamp benefits: increasing the household's total resources and influencing the allocation of those limited resources in the direction of food goods.

What Is the Issue?

Household food insecurity and hunger are important social concerns in the United States. The Economic Research Service reported that 10.9% of U.S. households had "low food security" status in 2006, based on self-reports of food-related hardship at some point during the year. This estimate included 4.0% that experienced "very low food security," a more serious condition that is commonly accompanied by self-reports of hunger for some household members.

In response to these social concerns, the U.S. Department of Agriculture (USDA) seeks to reduce and prevent food insecurity through improved access to federal nutrition-assistance programs. The Food Stamp Program (FSP), the largest nutrition-assistance program, served 26 million people on average each month in 2005, providing $29 billion in targeted food benefits.

Analysts have tried a wide variety of research designs to measure the effects of the FSP, but such research faces serious challenges. The difficulty is that households with more severe food-related hardships are more likely to participate in the program, so one cannot easily use participant / nonparticipant differences to identify true program effects.

This study introduces two features that hold some promise for improving our ability to measure program effects: (a) it offers a modification to the traditional theory of consumer choice subject to a targeted benefit such as food stamps, highlighting differences in the empirical implications of true program effects and self-selection patterns, and (b) it estimates Engel functions separately for food that can be purchased with FSP benefits (at-home food) and restaurant food that cannot be purchased with FSP benefits (away-from-home food).

What Did the Study Find?

At-home food spending (such as grocery spending) in a recent week was higher for FSP participants than for nonparticipants, even after controlling for total income. By contrast, away-from-home food spending (such as restaurant spending) in a recent week was lower for FSP participants than for nonparticipants. These results are what one would expect if food stamps enhanced households' at-home food spending, making it less necessary for them to purchase food from restaurants.

Despite the raised at-home food spending in a recent week, participants perceived a modestly greater shortfall in their food budget than did nonparticipants, even after controlling for total income. Participants generally perceived slightly higher food needs on average, while they had little increase in "usual" food spending, perhaps because the increased spending for at-home food and the decreased spending for away-from-home food nearly cancelled each other out. This result suggests that, even after receiving FSP benefits, participants continue to perceive difficulty acquiring sufficient food resources.

FSP participants had much higher rates of food insecurity compared with nonparticipants at the same levels of total income, presumably due to a self-selection pattern in which those households with greater hardship were more likely to seek program benefits for which they were eligible. While the national rate of "low or very low food security" among all U.S. households was about 11% in 2005, the comparable rates for FSP participants with the lowest levels of total income reached higher than 55% for all three household types in this study.

A key hypothesis motivating this study was that the very poorest FSP participants, in terms of total income, would be most constrained in their household budget, and hence they would benefit from raised levels of at-home food spending supported by the maximum food stamp benefit, perhaps leading to lower rates of household food insecurity. This hypothesis could not be confirmed in this analysis. Instead, rates of food insecurity for low-income FSP participants are very high, reflecting serious hardship for the participant group. This self-selection pattern, in which households that experience hardship are more likely to participate in the Food Stamp Program, made it difficult to determine true program effects from the data and research design used in this analysis.

High rates of food insecurity for low-income participant households were noted regardless of whether these households had above-average or below-average at-home food spending. Holding constant total resources, having above-average at-home food spending might nevertheless contribute to other food-related goals, such as improved diet quality, that were beyond the scope of this study. For most household types and total income levels, having above-median at-home food spending did not appear to suffice on its own to produce improved household food security.

In conclusion, FSP participation is associated with suppressed away-from-home food spending and with enhanced at-home food spending. Yet, these higher at-home food spending levels do not automatically imply improved food security outcomes. Cross-sectional comparisons of food security outcomes for participants and nonparticipants are dominated by self-selection effects. Holding constant total income, rates of food insecurity remain higher for program participants than for nonparticipants.

How Was the Study Conducted?

This study treated food spending as the main vehicle by which food stamp benefits influence household food security. It resuscitated, with modifications, the traditional economic theory of consumer choice between food and nonfood goods subject to a

targeted food benefit such as food stamps. This traditional theory relies on a distinction between unconstrained (or inframarginal) households and constrained (or extramarginal) households. According to the theory, additional food stamp benefits should have a modest effect in raising food spending for unconstrained households and a large effect in raising food spending for constrained households.

This theory, which dates to the 1940s, has in recent years not been accepted as the basis for research about the Food Stamp Program, because empirical evidence appeared to contradict one of its predictions (Fraker, 1990; Wilde and Andrews, 2000). Specifically, the evidence suggested that additional food stamp benefits had a comparatively large effect on food spending even for households that appeared to be unconstrained. This study therefore pursued a modified version of the traditional theory, in which the difference between constrained and unconstrained households is not a sharp binary distinction but rather a matter of degree.

The study addressed two food spending outcomes and two food security outcomes. The food spending outcomes were:

A. At-home food spending. Food spending in supermarkets, grocery stores, and convenience stores.

B. Away-from-home food spending. Food spending in restaurants and cafeterias.

The food security outcomes were:

C. The self-perceived food spending gap. The difference between usual food spending and self-reported food spending needs. A positive gap indicates adequate food spending, while a negative gap indicates a self-perceived shortfall in food spending.

D. Household food security. Based on responses to multiple food security survey items, USDA classifies households as being "food secure" or "food insecure." Within the food insecure category, there are sub-categories for "low food security" and "very low food security." The food security outcomes studied here include these food security status indicators and also the response frequencies for selected individual food security survey items.

For each of these outcomes, there were three types of research questions:

1. Response to total income. In an analysis conducted separately for FSP participants and nonparticipants, how does the outcome respond to increasing levels of total income (cash income plus any food stamp benefits)?

2. Response to program participation status. In comparisons of households at the same level of total income, how does the outcome differ for FSP participants and nonparticipants?

3. Distinguishing the program effect. In light of the (modified) theory of economic choice between food and nonfood goods, do the results appear more consistent with self-selection patterns, more consistent with true program effects, or does the direction of causation remain indeterminate?

Data analyzed for this report come from the food security supplement to the Current Population Survey (CPS). The food security supplements contain approximately 55,000 household observations per year. The U.S. Census Bureau collects labor market information on behalf of the Bureau of Labor Statistics (BLS) each month through the CPS. The Census Bureau also collects food spending and food security data on behalf of USDA in December only through the food security supplement. In this study, food security supplement data for December of 2001 to 2005 were combined.

I. Introduction

Household food insecurity and hunger are important social concerns in the United States. The Economic Research Service reported that 10.9% of U.S. households had "low food security" status in 2006, based on self-reports of food-related hardship at some point during the year (Nord, Andrews, and Carlson, 2007). This estimate included 4.0% that experienced "very low food security," a more serious condition that is commonly accompanied by self-reports of hunger for some household members.[1]

In response to these social concerns, the U.S. Department of Agriculture (USDA) seeks to reduce and prevent food insecurity through improved access to federal nutrition-assistance programs (USDA, 2006). The Food Stamp Program (FSP), the largest nutrition-assistance program, served 26 million people on average each month in 2005, providing $29 billion in targeted food benefits (USDA, Food and Nutrition Service, 2006).

Measuring the effect of FSP participation. This study is one part of a broader research agenda to understand the impact of the Food Stamp Program on food security. Analysts have tried a wide variety of research designs to measure program effects (Wilde, 2007), but such research faces serious challenges. The difficulty is that households with more severe food-related hardships are more likely to participate in the program, so one cannot easily use participant / nonparticipant differences to identify true program effects. There has been some discussion of ethical random assignment research designs for measuring program effects, but these are some years away from development (Burstein et al., 2005; Wilde, 2007).

The present study investigated the cross-sectional associations between cash income, FSP participation status, food stamp benefit amounts, and several household food spending and food security outcomes. Using data from USDA's flagship food security survey, a supplement to the Current Population Survey (CPS), the study estimated and charted "Engel functions" for FSP participants and nonparticipants, which show how each outcome responds to total income (cash income plus food stamp benefits). The study charted how increased income and FSP participation are associated with changes in food spending and food security outcomes. The analysis distinguished two possible contributions of food stamp benefits: increasing the household's total resources and influencing the allocation of those limited resources in the direction of food goods.

Theoretical approach. This study treated food spending as the main vehicle by which food stamp benefits influence household food security. It resuscitated, with modifications, the traditional economic theory of consumer choice between food and nonfood goods subject to a targeted food benefit such as food stamps. This traditional theory relies on a distinction between unconstrained (or inframarginal) households and

[1] Previously, USDA used the terms "food insecurity without hunger" and "food insecurity with hunger," respectively, to describe the classifications for "low food security" and "very low food security." USDA changed the terminology in the most recent annual food security report to be more precise and limited in using the word "hunger" (Nord, Andrews, and Carlson, 2006).

constrained (or extramarginal) households. According to the theory, additional food stamp benefits should have a modest effect in raising food spending for unconstrained households and a large effect in raising food spending for constrained households.

This theory, which dates to the 1940s, has in recent years not been accepted as the basis for research about the Food Stamp Program, because empirical evidence appeared to contradict one of its predictions (Fraker, 1990; Wilde and Andrews, 2000). Specifically, the evidence suggested that additional food stamp benefits had a comparatively large effect on food spending even for households that appeared to be unconstrained. This study therefore pursued a modified version of the traditional theory, in which the difference between constrained and unconstrained households is not a sharp binary distinction but rather a matter of degree.

Our main study of food spending and food security outcomes was preceded by an investigation into the degree of constraint or extramarginality that is found in the household budgets of FSP participants with varying levels of total income. Our hope was that better understanding these features of the household budget might permit the analysis to distinguish self-selection patterns from true program effects. However, to foreshadow the results in later sections, the degree of constraint or extramarginality did not fall as total income rose to the extent one might expect. Similarly, participant / nonparticipant differences for several key outcomes did not diminish steadily as total income rose, as one might expect from our theory.

As a consequence, like the non-experimental literature that preceded it, the results of the present non-experimental study testify to the strength of self-selection patterns. The most interesting results show strong positive associations between FSP participation and at-home food spending, and yet negative associations between FSP participation and food security status, where all of these associations are measured holding constant real total income.

Outcomes. The study addresses two food spending outcomes and two food security outcomes. The labels for these outcomes, A through D, are retained throughout this report.

The food spending outcomes are:

A. At-home food spending. Food stamp benefits may by law be spent only on food and beverages from authorized food retailers, such as grocery stores and supermarkets. While the nutrition education component of the Food Stamp Program has been growing in recent years, it is still dwarfed by the value of the food stamp benefits themselves, so at-home food spending remains the leading path by which the program is expected to influence other outcomes such as reducing food insecurity and hunger.

B. Away-from-home food spending. Although food stamps in most cases may not be spent in restaurants and cafeterias, the program could still in principle

affect away-from-home food spending by encouraging low-income households to acquire a higher fraction of their food in grocery stores. This possible substitution effect has been little studied. Yet, in light of contemporary nutrition concerns, encouraging less reliance on restaurant food could be an important benefit of the Food Stamp Program.

The food security outcomes are:

C. The self-perceived food spending gap. One way of evaluating the adequacy of household food spending is to ask the household respondent to report what level of food spending he or she perceives as sufficient. The food spending gap is the difference between usual food spending and this self-reported food spending need. A positive gap indicates adequate food spending, while a negative gap indicates a self-perceived shortfall in food spending.

D. Household food security. The most important policy motivation for the federal government's investment in the Food Stamp Program is to improve household food security. Based on responses to multiple food security survey items, USDA classifies households as being "food secure" or "food insecure." Within the food insecure category, there are sub-categories for "low food security" and "very low food security." The food security outcomes studied here include these food security status indicators and also the response frequencies for selected individual food security survey items.

Research questions. For each of these outcomes, there are three types of research questions. The labels for these questions, 1 through 3, are retained throughout this report. The questions are:

1. Response to total income. In a cross-sectional Engel-function analysis conducted separately for FSP participants and nonparticipants, how does the outcome respond to increasing levels of total income (cash income plus any food stamp benefits)?

2. Response to program participation status. In cross-sectional comparisons of households at the same level of total income, how does the outcome differ for FSP participants and nonparticipants?

3. Distinguishing the program effect. The challenge is that a positive association between FSP participation and an outcome such as at-home food spending could be due to the program's beneficial effect, or it could be due to the self-selection pattern in which households with greater food needs are more likely to take the trouble to participate. In light of the (modified) theory of economic choice between food and nonfood goods, do the Engel-function estimates and participant-nonparticipant differences appear more consistent with self-selection patterns, more consistent with true program effects, or does the direction of causation remain indeterminate?

II. Background

Household food security measurement. The federal government has estimated the prevalence of household food insecurity since 1995 (Eisinger, 1998; National Research Council, 2006). "Food security" is defined as "access by all people at all times to enough food for an active, healthy life." "Food insecurity" is defined as the absence of food security at the household level. Hunger is defined as "the uneasy or painful sensation caused by a lack of food" (Nord, Andrews, and Carlson, 2005).

USDA measures the prevalence of these conditions each year using an 18-item battery of questions on a supplement to the Current Population Survey (CPS) and other nationally representative household surveys. The questions refer to problems of food insecurity and hunger that are attributable to resource constraints, not hunger due to weight-loss dieting or voluntary fasting. Ten of the items refer to conditions in all households, and 8 more items are asked only of households with children.

Examples of comparatively mild symptoms of hardship in these questions include:

> "We worried whether our food would run out before we got money to buy more." Was that often, sometimes, or never true for you in the last 12 months?
>
> "The food that we bought just didn't last and we didn't have money to get more." Was that often, sometimes, or never true for you in the last 12 months?

Examples of comparatively severe symptoms of hardship in these questions include:

> In the last 12 months, were you ever hungry, but didn't eat, because you couldn't afford enough food? (Yes/No)
>
> In the last 12 months, did you or other adults in your household ever not eat for a whole day because there wasn't enough money for food? (Yes/No)

USDA converts these questions into binary items, showing whether or not a household affirms the presence of a particular symptom of hardship, and sums the number of affirmative responses (0 to 10 for households without children; 0 to 18 for households with children). In the official terminology, households are classified as having "high food security" if they have fewer than 3 affirmative responses. They are classified as having "low or very low food security" if they have 3 or more affirmative responses. They are classified as having "very low food security" if they have 6 or more affirmative responses in households without children or 10 or more affirmative responses in households with children.

Food Stamp Program (FSP). The Food Stamp Program is the nation's largest federal nutrition assistance program and a centerpiece of the social safety net. It provides a

targeted food benefit through an electronic card much like a bank debit card, which may be used to purchase foods and non-alcoholic beverages from authorized food retailers. In fiscal year 2005, the program served a monthly average of 25.7 million people, of whom half were children and 8 percent were elderly (Barrett, 2006).

To be eligible for food stamp benefits, most households must have monthly gross income less than 130 percent of the federal poverty line ($2097 for a family of four in 2005), monthly net income after certain deductions less than the poverty line ($1613 for a family of four), and countable assets below a specified value. If the household is very poor, having a net cash income of zero, it receives the maximum benefit amount approximately equal to the monthly cost of the Thrifty Food Plan ($506 for a family of four in 2005). The maximum benefit for a family of four equals the Thrifty Food Plan for a family of four, and the maximum benefit for other household sizes is adjusted to account for household size and economy of scale in food purchases and preparation. For households with positive net cash income, the household's food stamp benefit is reduced by 30 cents for each dollar of net cash income. This benefit formula generates an inverse relationship between a household's cash income and its food stamp benefit amount.

III. Literature

Program effects on food spending. A thorough 2004 USDA literature review summarized the large body of research showing that food stamp benefits substantially raise food spending (Fox, Hamilton, and Lin, 2004). Two studies in the early 1990s used random-assignment research designs to compare food stamps with equivalent cash benefits, while two others used quasi-experimental designs (Fraker, Martini, and Ohls, 1995), and dozens of earlier studies used nonexperimental regression approaches to estimate the marginal propensity to spend on food out of food stamps and cash (Levedahl, 1995; Fraker, 1990).

Past research on food stamps and food spending faced several hurdles. The random-assignment experiments were compelling, in the sense of providing scientifically sound evidence about whether food stamps have distinct effects on food spending, but these studies were expensive. By contrast, the self-selection models required strong and not entirely plausible parametric distributional assumptions, and did not always in practice appear robust (Devaney and Fraker, 1989).

The regression analyses frequently estimated the marginal effect of food stamps to be two or more times larger than the corresponding marginal effect of cash income on food spending (Fraker, 1990; Levedahl, 1995). This distinct food stamp effect seemed too high to be consistent with the traditional theory of consumer choice subject to in-kind government benefits, for reasons that are discussed below in section IV. Moreover, researchers became suspicious of the source of independent variation in food stamp benefits and cash income, given that the food stamp benefit formula seems at first to be a linear function of cash income (Wilde, 2001; Nord and Newman, 2004).

Program effects on food security.[2] USDA's 2004 literature review found some evidence that food stamps raise nutrient availability in household food supplies, while it found less consistent evidence that food stamps improve individual nutrient intake (Fox, Hamilton, and Lin, 2004). At the time that review was written, the literature measuring the effect of food stamps on food insecurity and hunger was sparse, but this literature has expanded more recently.

There is a strong *prima facie* case that food stamps may alleviate hunger by providing valuable resources to very poor households. However, the main food security survey items ask about the occurrence of hardship at any time in the preceding 12 months, while food stamp benefits vary widely in amount, are posted only once monthly, and are largely spent during the first several days after acquisition each month (Wilde and Ranney, 2000; Shapiro, 2005). Hence, the magnitude of the food stamp effect is an important open empirical question.

Only 65% of eligible people choose to participate (Cunnyngham, Castner, and Schirm, 2007), and those who suffer from hunger are more likely to take the trouble to participate. As a consequence, even if one restricts attention to the population of households with income below 130 percent of the poverty line, the prevalence of very low food security is about twice as high among food stamp participants as among nonparticipant households (Figure 1). This self-selection or self-targeting pattern has been noted many times in the recent literature (Fox, Hamilton, and Lin, 2004; Nord, Andrews, and Carlson, 2005; Holben, 2006; Burstein et al., 2005).

Efforts to address this problem with more complex statistical approaches have generated a series of interesting papers and articles that shed light on the self-selection pattern but do not in the end succeed in quantifying the effect of food stamps on food insecurity and hunger. This section reviews seven such research approaches.

The first approach is to control for other observable variables while seeking to measure the effect of FSP participation in a regression model. However, several studies have found that prevalence of food insecurity or hunger remain much higher for participants than for nonparticipants even after including control variables in this fashion (Gundersen and Oliveira, 2001; Gibson-Davis and Foster, 2006).

A second approach is jointly to model the effect of food stamps on food insecurity and vice versa using a system of simultaneous equations. This statistical methodology requires either a strong assumption about the distribution of the error terms or the presence of instrumental variables that strongly affect FSP participation but do not otherwise affect food insecurity. Using cross-sectional data from the Survey of Income and Program Participation (SIPP), Gundersen and Oliveira sought to measure the effect of food stamp participation on "food insufficiency," a measure of food-related hardship based on a single survey question that predated USDA's official food security measurement methods. Gundersen and Oliveira reported that the more complex statistical models removed the evidence of a statistically significant positive association

[2] This literature review draws on Wilde (2007), with permission from the *Journal of Nutrition.*

between food stamp participation and food insufficiency (Gundersen and Oliveira, 2001). More precisely, their simultaneous equations models found as large a positive association between program participation and food insufficiency as simpler models did, but the standard error was larger in the more complex models and hence the statistical significance disappeared (Gundersen and Oliveira, 2001, Table 3). Also using simultaneous equations, Jensen found that the random disturbances for equations describing program participation and food security status were correlated, such that a higher tendency toward FSP participation was associated with lower risk of food insecurity (Jensen, 2002). Using data from the Survey of Program Dynamics (SPD), Huffman and Jensen found that being food insecure with hunger strongly increased the likelihood of FSP participation, but "no evidence that the food assistance reduces food insecurity" (Huffman and Jensen, 2006).

A third approach is to use longitudinal or panel data. Hofferth used data from the Panel Study of Income Dynamics (PSID) to measure the association between transitions in FSP participation status and food insecurity, but she concluded that most of the observed associations reflected variation in families' unmet needs for food rather than a true effect of program participation (Hofferth, 2004). Using data from the SIPP and SPD, Ribar and Hamrick found that food stamp use in 1994-95 was associated with lower rates of exit from food insecurity by 1997, and hence their study "provides no evidence that food stamps alleviate food problems," but they also noted the continued presence of unobservable factors and did not claim to have measured the causal impact of FSP participation (Ribar and Hamrick, 2003). With longitudinal data from the same CPS survey that provides federal statistics on food insecurity and hunger, Wilde and Nord found that using a fixed effects panel data model to control for time-invariant unobservable factors reduced but did not eliminate the appearance that FSP participation was associated with poorer food security status (Wilde and Nord, 2005).

A fourth approach, pursued by Gibson-Davis and Foster (2006) using data from the Early Childhood Longitudinal Survey, is propensity score matching. This statistical technique estimates a model for the probability of program participation, then predicts the probability of participation for each person in the sample, and finally compares the food security status of matched participants and nonparticipants with similar predicted probabilities. The authors' most reliable models indicated that food stamps did not affect the probability of being classified as food insecure, although they offered "tentative evidence" that food stamps reduced the level of food insecurity among those who are categorized as food insecure. The authors warned that establishing cause and effect with propensity score matching "might not be possible in some instances, given the magnitude of the selection effects."

A fifth approach, the dose-response approach, employs variation across participant households in the food stamp benefit amount to measure the response of food security status to an increasing dose of food stamps (Fox, Hamilton, and Lin, 2004). Some early research using this approach found a small but statistically significant association between higher benefit amounts and lower risk of food insecurity (Rose, Gundersen, and Oliveira, 1998). Other work using a dose-response approach is ongoing (Daponte and

Stephens, 2004; Nord and Newman, 2004). Kabbani and Kmeid used a dose-response approach to study whether a household that experienced hunger in the previous year nevertheless reported food secure status in the most recent month (Kabbani and Kmeid, 2005). Interpreting results from the dose-response approach requires careful attention to the nature of the program's benefit formula, which implies that the poorest households generally receive the highest food stamp benefits. The source of variation in food stamp benefits conditional on cash income is not random, but rather it depends systematically on the household's deductions (Wilde, 2001). As a consequence, it is difficult to distinguish the effect of a higher food stamp dose from the effect of lower cash income and differences in the household characteristics that influence deductions.

A sixth approach exploits "natural experiments," such as changes in program rules for some populations but not others, for use in a quasi-experimental research design. In the only such study we could find that directly addresses food stamps and food security, Bartfeld and Dunifon (2006) used hierarchical linear modeling to investigate the effect of multiple variables including the fraction of the state-level low-income population that participates in the Food Stamp Program. A model including interaction terms between this measure of participation and household-level income status found small but statistically significant beneficial effects of higher FSP participation for near-poor and low-income households, but not for poor households or higher-income households. In a study of a related "natural experiment," Borjas found that immigrant populations whose program eligibility was restricted in the 1996 welfare reforms experienced a significant relative deterioration in food security status (Borjas, 2004). Two studies have used variation in weather -- a truly "natural" independent variable if ever there was one -- to assess the effect of heating and cooling costs on food security status (Nord and Kantor, 2006; Bhattacharya et al., 2002), but it is difficult to conceive of natural events that would influence FSP participation in the same fashion that weather influences heating and cooling costs.

The seventh and final approach would use a random-assignment research design to measure the effect of FSP participation on food security status. Influential studies in San Diego and Alabama in the early 1990s used a random-assignment design to measure the effect of "cashing out" food stamps on food spending (Fox, Hamilton, and Lin, 2004). Random-assignment research designs have been much discussed in the recent literature on food insecurity and hunger, but never implemented. Several authors use identical language to hold up random-assignment designs as the "gold standard" but then go on to describe them as unethical or infeasible for the current research question (Fox, Hamilton, and Lin, 2004; Burstein et al., 2005; Gibson-Davis and Foster, 2006). Burstein et al. (2005) do propose a random-assignment component as one part of a larger project on measuring FSP effects, and Wilde (2007) discusses some possible designs that would meet the ethical requirement of providing at least the current federal entitlement to all eligible study participants.

In addition to the literature relating food stamps directly to food security, reviewed here, there is also a growing body of research relating food security status to weight status (Townsend et al., 2001; Wilde and Peterman, 2006; Sarlio-Lahteenkorva and Lahelma,

2001) and relating FSP participation to weight status (Gibson, 2003; Jones and Frongillo, 2006; Chen, Yen, and Eastwood, 2005). These studies do not seek to measure the effect of food stamps on food security status.

Research on food spending and food security jointly. There is a smaller body of work that, like this study, emphasizes food spending as the leading vehicle by which food stamps influence household food security. Jensen (2002) observed, "Dating as far back as Engel's work, poverty has been closely tied to food expenditures." The original Federal poverty line was established as a multiple of the estimated minimal food spending requirement. In addition to survey questions about actual and usual food spending, the food security supplement to the CPS asks respondents for their own estimate of their household's minimal food spending needs. Such self-reported spending requirements can be used to assess poverty thresholds (Blaylock and Smallwood, 1986; Andrews, Nord, and Kabbani, 2001; Jensen, 2002).

Using data from the food security supplement to the CPS, Nord and Newman (2004) estimated the cross-sectional relationships between the food stamp benefit level, usual food spending from all sources, and the risk of having very low food security. The authors noted that that participant / nonparticipant comparisons without dose-response analysis have trouble accounting for self-selection issues, while dose-response analysis that includes both cash income and FSP benefits on the right-hand side raises a concern about the source of independent variation in these two variables (a concern that is discussed in Wilde, 2001). Faced with this challenge, Nord and Newman retained the FSP benefit variable and omitted the cash income variable in key models of food spending and food security outcomes.

USDA's annual report on household food security in 2003 noted a strong positive relationship between food spending and food security: the median food insecure household spent 4 percent less than the value of the Thrifty Food Plan on food, while the median food secure household spent 26 percent more than the value of the Thrifty Food Plan on food (Nord, Andrews, and Carlson, 2004).

The combination of known findings about food stamps, food spending, and food security leaves a mystery. If food stamps raise food spending, and higher food spending is associated with improved food security, why is FSP participation associated with lower food security? This paradox could be reconciled if FSP participants have both higher food spending and higher self-perceived food needs, leading to lower food security status. This possibility is investigated empirically in this study.

IV. Theory

Overview. The traditional economic theory of consumer choice with a food stamp benefit dates to Southworth (1945). In this theory, a consumer's total income is composed of cash income and food stamp benefits if she is a FSP participant. Her total income is just cash income if she is a FSP nonparticipant. Subject to the constraints on her resources,

she makes her best possible choices about spending levels for a food good and a nonfood good, where the nonfood good represents a composite of all the other things a person could buy.

The theory draws an important distinction between constrained or extramarginal FSP participants and unconstrained or inframarginal participants. Constrained participants receive more in food stamps than they would otherwise spend on food if their total income were all cash, so they choose to spend all their stamps on the food good and all their cash on the nonfood good. Unconstrained participants contribute some of their cash income to their food budget in addition to using food stamps for food.

In the Southworth theory, food spending for constrained participants responds very sharply to a marginal increase in food stamp benefits. Every additional dollar of food stamps leads to an additional dollar of food spending. By contrast, food spending for unconstrained participants responds to increased food stamp benefits just as slowly as it would respond to an increase in cash income. Past research has estimated that low-income Americans spend about 5 to 15 cents of each additional dollar of cash income on food.

As noted previously in section III, many regression analyses of food spending have estimated the marginal effect of food stamp benefits to be two or more times larger than the marginal effect of cash income (Fraker, 1990; Levedahl, 1995; Wilde and Ranney, 1996). This food stamp effect seemed too high to be consistent with the comparatively large number of participants who appeared unconstrained or inframarginal, in the sense of spending some of their own cash income on food.

If the empirical observation is correct, there are several plausible explanations for this paradox:

- Households may spend some of their own cash income on food late in the month, after their food stamps have run out, even if they were effectively extramarginal (constrained) earlier in the food stamp month. In past research, food spending was typically measured on a 7-day or 14-day basis, food stamp benefits were typically measured on a 1-month basis, and household income was commonly measured for a 1-month or 12-month period. Because food spending by food stamp recipients is sharply cyclical, these measurement differences made it hard to identify extramarginal households properly (Wilde and Ranney, 2000; Wilde and Andrews, 2000).
- Households may spend some of their own cash income on food away-from-home, in cafeterias and restaurants, even if their at-home food budget is essentially extramarginal. Program rules prevent food stamp spending in restaurants. For example, as welfare reforms of the 1990s have increased the labor market orientation of the Food Stamp Program, larger numbers of participants may occasionally purchase food away-from-home for work-related reasons.
- One household member may spend some cash income on food, while another household member who controls food stamp benefits makes household budgeting decisions on an extramarginal basis. Breunig et al. (2001) argued that the "cashout

paradox" -- the finding that even inframarginal households appear to spend food stamps differently from cash income -- may be explained by intra-household bargaining behavior in households with more than one adult.

These explanations share a common feature. In each case, there may be cash spending on food in households that nevertheless behave in some respects extramarginally. Rather than try to model in detail all features of these three explanations, we suppose more simply that there is some minimum level of necessary cash spending on food, even in extramarginal households. For example, a household may have to spend cash on food late in the food stamp month, when benefits have run out. As another example, one household member may spend cash on food while another member carries the food stamp benefit card. In this modification of the traditional theory, we can be quite sure a household is constrained if its food spending falls equal to or below its benefit level, and we can be quite sure a household is unconstrained if its food spending exceeds its benefit level by a large margin, but we may think of the household as "partly" constrained to an unknown extent in intermediate cases.

An Example. The traditional theory and the modified theory are presented formally in the next subsection, but for intuition, it may help to give an example.

Suppose Household A has $400 in monthly cash income and $200 in monthly food stamp benefits. If the household had more simply owned $600 in cash, it would have spent $150 monthly on food, but it honors the FSP regulations and instead spends all of its FSP benefits on food. In the traditional theory, the analyst who observed the household's monthly food spending ($200) and monthly food stamp benefit ($200) would immediately recognize the household as constrained or extramarginal.

Now, suppose Household B also has $400 in monthly cash income and $200 in monthly food stamp benefits. Household B also would have spent $150 monthly on food, but it too honors the FSP regulations and instead spends all of its FSP benefits on food. Moreover, since the FSP benefits come in one lump each month, it economizes shopping time and transportation costs by spending these benefits in one large supermarket trip at the start of the month. Toward the end of the month, the household relies on nonperishable staples that were stored from the original shopping trip plus about $30 of cash spending on additional milk and vegetables from a smaller nearby grocery. In the traditional theory, the analyst who observed the household's monthly food spending ($230) and monthly food stamp benefit ($200) might incorrectly classify the household as unconstrained, even though the household is better described as constrained for most of the month.

The traditional model of consumer choice. In the Southworth theory, consumer preferences over a food good (F) and a non-food good (X) are described by a utility function (U). Program participants have two kinds of resources, cash income (C) and food stamp benefits (B). Nonparticipants have only cash income. The sum of cash income and food stamp benefits is called total income (Y).

Participants make rational choices subject to two resource constraints:

- total spending cannot exceed total income, and
- non-food spending cannot exceed cash income, because of rules forbidding food stamp spending on non-food goods.

Mathematically, the function U is a utility function, quasi-concave and increasing in both arguments. The participant's consumer choice problem is:

(1)	Maximize	$U(F,X)$,	
	subject to	$F+X \leq Y = C+B$,	(total income constraint)
		$X \leq C$,	(cash income constraint)
		$F \geq 0$, and $X \geq 0$	(non-negativity constraints).

The participant consumer is constrained or extramarginal if the cash income constraint is binding. For such a consumer, $X = C$, $F = B$, and no cash income is spent on food. If B increases by some marginal amount, F will increase by the same amount. In this sense, for extramarginal households, the "food stamp effect" on food spending is very large.

By contrast, the participant consumer is unconstrained or inframarginal if the cash income constraint is non-binding. For such a consumer, $X < C$, $F > B$, and the consumer contributes some of her own cash income to her food budget. F will increase by an identical amount in response to a marginal increase either in B or C. In this sense, for inframarginal households, the "food stamp effect" on food spending is comparatively small and it exactly equals the corresponding "cash income effect" on food spending.

For participants, let $f(Y)$ be the unconstrained Engel function, showing food spending as an increasing function of total income for an inframarginal consumer. The solution to the consumer problem (1) is a kinked food demand function, which may be expressed:

(2) $F = \max[B,f(Y)]$ (for participants).

This equation means that food spending equals B if the consumer is extramarginal, and food spending equals $f(Y)$ if the consumer is inframarginal.

Nonparticipants also make rational choices, but their food stamp benefit equals zero, so they face only the total income constraint and the non-negativity constraints. The cash income constraint is redundant. For nonparticipants, it is not possible to be extramarginal, so more simply:

(3) $F = f(Y)$ (for nonparticipants).

The food stamp benefit formula. The last piece of information we need to illustrate the shape of the Engel function under the traditional theory is the structure of the food stamp benefit formula. The cash income amount (C in the preceding discussion) is called "gross income" in food stamp parlance. The food stamp benefit is based on "net

income," which equals gross income minus certain deductions. The deduction amount (D) equals the sum of a standard deduction, an earned income deduction, an excess shelter cost deduction and several smaller deductions. If these deductions exceed C, then net income equals zero, and the participant receives the maximum benefit (M). Otherwise, the participant receives the maximum benefit minus 30 percent of her net income.

More formally, the benefit formula can be stated as a function of cash income:

(4) $B = \min[M, M - 0.3\ (C - D)]$.

In order to use this benefit formula in connection with Engel functions such as equations (2) and (3), we need to restate equation (4) as a function of total income (Y). Recalling that $C = Y - B$ and substituting into equation (4), we get:

(5) $B = \min[M, 1.4\ M - 0.43\ (Y - D)]$.

This equation is easier to understand when illustrated (Figure 2). For consistency with later figures, the horizontal access is total income (cash plus food stamp benefits) rather than cash income alone. At the left side of the figure, participants with the lowest level of total income receive the maximum food stamp benefit (M). Moving rightward as total income increases due to increases in cash income, the participant at first continues to receive the maximum benefit but then the benefit begins to fall.

By looking at equation (2) and equation (5) together, we get a picture of the shape of the Engel function under the assumptions of the traditional theory (Figure 3). At the left side of the figure, representing the lowest level of total income, the household receives the maximum benefit and is constrained such that food spending equals this maximum benefit. Moving rightward as total income increases, the benefit decreases but the household is still constrained such that food spending equals the benefit. As total income increases yet further, the household becomes unconstrained as food spending begins to exceed the benefit amount. Finally, at the highest level of total income, the household is not eligible to participate in the Food Stamp Program.

This Engel function for participants may be contrasted with the corresponding Engel function for nonparticipants (Figure 3). The nonparticipant household is never constrained by any food stamp benefit, so food spending simply increases steadily at all levels of total income.

A modified theory. In the modified theory, there may be cash spending on food in households that nevertheless behave in some respects extramarginally. Suppose the minimum level of necessary cash spending on food is denoted α. We have described α as representing cash spending on food late in the food stamp month when benefits have run out or cash spending on food by one member while another member carries the food stamp benefit card. The level of α would not be directly observable, but we presume the analyst has some general knowledge of its maximum possible value.

The new cash income constraint in the participant's consumer choice problem is:

(6) $X \leq C\text{-}\alpha$.

The revised solution to the consumer choice problem (1) is:

(7) $F = \max[B+\alpha, f(Y)]$.

In this revised theory, the analyst cannot tell whether the household is unconstrained just by checking whether the household contributed any cash income at all to the food budget. A small amount of cash spending on food could be consistent with either constrained or unconstrained status. It is only when the amount of cash spending on food exceeds what one might think is a reasonable value for α that the analyst can feel confident that the household is unconstrained.

Just as in Figure 3 from the preceding subsection, it is possible to illustrate the Engel function under this modified version of the traditional theory (Figure 4). At the left side of the figure, representing the lowest level of total income, the household receives the maximum benefit and is constrained such that food spending equals this maximum benefit plus the additional amount α. Moving rightward as total income increases, the benefit decreases but the household is still constrained such that food spending equals the benefit plus α. As total income increases yet further, the household becomes unconstrained as food spending begins to exceed the benefit amount. Finally, at the highest level of total income, the household is not eligible to participate in the Food Stamp Program.

Self-selection patterns. The preceding analysis applies to a particular household with fixed preferences for food and non-food goods. If participants and nonparticipants were selected randomly from the same general population, the model's implications would only be a little more complicated when we allow for more realistic variation across households in food needs, preferences, deductions, and values for α.

For example, if the line graphs in Figures 3 and 4 represented mean food spending levels at each level of total income -- rather than the food spending level for a single household -- the kinks in the Engel functions would not be quite as pronounced, but other features of the illustration would remain the same. In particular, the distinct effect of food stamp benefits on food spending would continue to appear pronounced at low levels of total income (toward the left of the figures), while spending levels would be the same for participants and nonparticipants at higher levels of total income (toward the right of the figures).

The real problem arises in the very plausible case where program participation status is not random, but instead it depends on a household's variable food needs or preferences. In particular, it seems likely that households with greater preferences for food or a higher

degree of food-related hardship are more likely to take the trouble to participate in the Food Stamp Program.

Figure 5 is a variant of Figure 3, with the new feature that participants are assumed to be self-selected from a subpopulation with a higher tendency to spend limited total income on food. Participants generally have higher food spending levels in Figure 5 than in Figure 3. Hence, participants are more commonly unconstrained in Figure 5 than in Figure 3. Only the participants with the very lowest levels of total income, at the left side of Figure 5, are so short of cash that they reserve their cash for non-food spending alone.

Using theory for causal inference. The modified theory and the self-selection story offer two competing explanations for the paradoxical empirical finding that food stamps appear to have a distinctive large effect on food spending even for households that appear to be unconstrained or inframarginal under the assumptions of the traditional theory. Both of these competing explanations suggest that mean food spending may be higher for participants than for nonparticipants with comparable total income.

Fortunately, the explanations differ sharply in their implications for the shape of the Engel functions for participants and the nature of participant / nonparticipant spending differences holding constant total income. Specifically, the modified theory predicts that beneficial participant / nonparticipant differences will narrow and even disappear as total income rises to the level where benefits become small and most households become inframarginal. By contrast, the self-selection story is consistent with participant / nonparticipant differences at all levels of total income, at least under the assumption that self-selection does not vary systematically with total income.

The distinct implications of these competing explanations could in principle help the analyst to determine whether observed cross-sectional results are due to self-selection patterns or true program effects. In Section I of this report, we listed "distinguishing the program effect" as the third of three research questions to investigate for each of the outcomes studied. Such a determination is precisely what has proven difficult the recent empirical research on food stamps and food security.

V. Data and Methods

Data analyzed for this report come from the food security supplement to the Current Population Survey (CPS). The U.S. Census Bureau collects labor market information on behalf of the Bureau of Labor Statistics (BLS) each month through the CPS. The Census Bureau also collects food spending and food security data on behalf of USDA in December only through the food security supplement. In this study, food security supplement data for December of 2001 to 2005 were combined.

The food security supplements contain approximately 55,000 household observations per year (56,443 in December 2001, 56,967 in December 2002, 55,411 in December 2003, 55,307 in December 2004, and 54,556 in December 2005). The supplements contained

226,305 households with 1 to 6 household members and annual household income less than $75,000. Of these, we could determine FSP participation status for 223,452 households. We excluded 49,586 households with missing values for the "control card" cash income variable (see subsection on cash income below) and also excluded households with high total income on an adult equivalent basis (see subsection on total income below). The final sample size with nonmissing values for FSP participation and all the required income variables was 173,146 household observations.

FSP participation status. Households that reported receiving food stamp benefits in approximately the preceding month (November or December) were classified as participants. There is underreporting of FSP participation in the CPS, due partly to error and misreporting by respondents and partly to insufficient coverage in the CPS of some population groups that may have high rates of FSP participation. For example, in December 2005 the participants in the weighted CPS sample represented 6.3 million participant households, while program data from the Food and Nutrition Service report 11.8 million participant households for that month.

Households that did not receive food stamp benefits during the year were classified as nonparticipants. Just over 2,000 households that received food stamp benefits during the year, but not during the preceding month, were excluded. For purposes of this study, these latter households could not be classified as participants (because their food spending data applied to a recent week in which they did not have food stamp benefits), nor could they be classified as nonparticipants (because their food security data applied to the past year, in which they did have food stamp benefits).

For FSP participant households, the food stamp benefit variable reported the household benefit amount for the most recent month in dollars.

Cash income. The cash income variable in the CPS, known colloquially as the "control card income" variable, asked households to report their annual income in one of 14 categories. Cash income was based on the combined income of all family members over the age of 15 years, including money earned from jobs, business, pensions, dividends, interest, social security payments, and any other income over the past 12 months. To convert the annual control card cash income to a continuous monthly cash income variable, the midpoint of the control card income categories was divided by 12. The control card cash income variable suffered from high rates of nonresponse: 18.4 percent refused the question and another 3.6 percent responded "don't know."

Total income. Total income equaled the sum of monthly cash income plus monthly food stamp benefits. Because the research design sought to measure the association between total income and outcomes of interest without imposing a linear functional form or other parametric functional form by assumption, the main results use categories of real monthly total income per adult male equivalent (AME) as a key explanatory variable (the adult equivalent scale is discussed below). The categories were $0-249, $250-$499, ..., $2,250-$2,499. Large samples of nonparticipants were available in each category of real total income. For participants, naturally, there were few or no observations in categories of

real total income that much exceeded the gross income cutoff for food stamp eligibility. Using a standard of requiring at least 200 observations in each real total income category, the analysis retained participant households for the four poorest categories with income per AME less than $1000 in household types (a) single adults with children and (b) two adults with children, and for the six poorest categories with income per AME less than $1500 in household type (c) adults with no children.

Household structure. Analyses were conducted separately for three household types: a) a single adult with one or more children (*n*=12,498 or 7.8 percent of weighted sample), b) two adults with one or more children (*n*=35,755 or 20.9 percent of weighted sample), and c) one or more adults with no children (*n*=116,978 or 66.5 percent of weighted sample). All other household compositions were excluded (*n*=7,915 or 4.8 percent of weighted sample).

Inflation and adult male equivalent (AME) adjustments. Wherever economic variables in the analysis were reported in terms of "adult male equivalents" (AME), the variable was scaled on the basis of average daily energy needs for particular age and gender groups, as found in the *2005 Dietary Guidelines for Americans*. This adjustment for energy needs does not account for variation in energy needs due to differences in physical activity or weight status. For example, the daily energy needs are 2200 calories for a male aged 31 to 50 years, 1800 calories for a female aged 31 to 50 years, and 1200 calories for a child aged 4 to 8 years. A household with an adult male, and adult female, and a young child would have 1.00 + 0.82 + 0.55 = 2.37 AMEs.

Monthly cash income, monthly food stamp benefit amount, and total income were deflated using the CPI for urban consumers to December 2003 dollars, to account for inflation. They were divided by the number of adult male equivalents (defined above) to put these household-level variables on a per-AME basis. Similar inflation and AME adjustments were made to the food spending variables discussed below.

Food spending outcomes.
The outcomes are described here using labels A through D that correspond to the discussion in Secton I (p. 4).

A. At-home-food spending. Total expenditures minus non-food item expenditures for purchases at supermarkets and specialty shops such as, meat markets, produce stands, bakeries, warehouse clubs, and convenience stores, including any purchases made with food stamps in the previous week.

B. Away-from-home food spending. Total expenditures on food purchased at a restaurant, fast food place, or cafeteria, including children who may have bought food at the school cafeteria or vending machines in the previous week.

Food Security outcomes.
C. The self-perceived food spending gap. The food security supplement asked whether the household needed more or less than its current usual food spending to buy just

enough food to meet household needs. The household could respond "no" to both questions if its current usual food spending exactly met its needs. If the household needed either more or less, a follow-up question asked the amount. We defined "minimum needed food spending" as usual weekly food spending plus or minus any such amount.

The self-perceived food spending gap was defined as usual weekly food spending minus the minimum needed food spending. Hence, a positive self-perceived food spending gap indicated that usual food spending was more than adequate, and a negative self-perceived food spending gap indicated that food spending was less than adequate.

D. Household food security measures:
Food security status was reported in the CPS as a categorical variable, representing respectively the conditions of "high food security," "low food security," and "very low food security" on the basis of responses to 10 survey items (in households with children) or 18 survey items (in households without children) about symptoms of food-related hardship in the past 12 months.

In addition to the main results for the 12-month food security measure, we analyzed a comparable 30-day measure that reflects responses to survey items about hardship in the most recent month. The 30-day food security status variable in the CPS for 2001-2004 used three categories describing the conditions of "high food security or mild low food security," "low food security," and "very low food security." The reason for the slight difference in terminology for the most secure category is that the survey items with 30-day reference periods tended to address comparatively serious symptoms of hardship. In 2005, USDA improved its method for reporting food security status on a 30-day basis, using a wider range of survey items with a 30-day reference period, but for this analysis we necessarily used the 2001-2004 data instead of just the 2005 data, due to sample size considerations.

Thus, in this report, the 30-day category "very low food security" is a good 30-day analogue to the 12-month category with the same name. The 30-day category "low or very low food security" is slightly less inclusive than the 12-month category with the same name, necessarily omitting some households with marginally high levels of food security.

Survey weights. All analyses used the CPS household weights for the food security supplement, which adjust for the complex sampling design to make the point estimates representative of the population of U.S. households.

The CPS does not provide the stratum and cluster identifiers one would need to adjust standard errors for the complex sampling design. For most reported results, unadjusted and unweighted standard errors are reported in appendix tables. In USDA's annual food security report for 2004, based on information from a jacknife replication method, the authors used a design effect of 1.6 as a rule of thumb, which implies that the real sampling variance of reported parameters would be 1.6 times as large as the reported

unadjusted sampling variance, due to the complex survey design of the CPS (Nord et al., 2005). This rule of thumb in turn implies that adjusted standard errors would be 26% higher than the unadjusted standard errors reported in the appendix to this report. Due to the large sample sizes available from the CPS for the five years from 2001 to 2005, we believe that, while having access to adjusted standard errors would be ideal, it makes little difference for the statistical inferences reported in this report.

Analyses. First, in Section VI, a preliminary analysis of household budgets investigated the distribution of food stamp benefits at each level of total income, for participants. The purpose was to understand the empirical food stamp benefit formula as it worked in practice in this data set. The relationship between food stamp and cash income in this data set could differ from what one would expect based on the official benefit formula for several reasons, including the time mismatch between the underlying annual cash income data and the monthly food stamp benefit data, the lumpiness introduced by the categories of control card cash income, rounding error in reporting program benefits, and more fundamental misreporting of either cash income or benefit information. The preliminary analysis helped to understand the role and scope of food stamp and cash income within the household's total income.

In addition to the results reported in Section VI, we made several efforts to reconcile participants' self-reported benefit amounts with the amounts that one would predict based on the benefit formula. Because one source of possible discrepancy was that cash income was reported for a 12 month period while FSP benefits were reported for a recent month, we replicated the analysis of the FSP benefit amount and the principal food spending outcomes while breaking out separately households that were participants for the full year or for just part of the year. However, the results were closely similar for these two groups of participants, so this did not reconcile the self-reported benefit and cash income amounts.

Similarly, because one source of possible discrepancy was that our household types combine heterogeneous demographic structures, we attempted to create alternative household type categories that were more homogeneous (for example, a two-parent household type with exactly two adults and two children instead of the current category for two adults and one or more children; or, a household type with exactly two elderly adults living alone instead of the current category more generally for adults without children). Again, the results were closely similar to those reported in our main analysis in this report.

Second, in Section VII, the project's main analyses estimated Engel responses for the four types of outcomes (labeled A through D as on p. 4). For each outcome type, the analysis addressed the three research questions about Engel responses, participant / nonparticipant differences, and the possibility of discerning cause and effect. These research questions were described previously in Section I (labeled 1 through 3 as on pp. 4-5). Each analysis was conducted separately for the three household types (labeled a through c as on p. 16).

Third, in Section VIII, we investigated the role of food spending as the principal vehicle by which food stamps influence food spending. If at-home food spending serves as intended as a vehicle by which food stamp participation can improve household food security status, one might expect to find the highest food security status for households whose at-home food spending appeared to be raised. Whereas the preceding analyses treated food spending and food security as separate outcomes that respond to total income and program participation, this third section of results addressed food spending as both an outcome influenced by FSP participation and a contributor to food security status. We divided participant and nonparticipant households into two groups, based on whether their weekly food spending at-home was greater than or less than the median food spending level for all households. Then, we estimated Engel responses for low food security status separately for the "high food spenders" and "low food spenders" in each participation category.

The resulting Engel functions show, while holding constant total income and program participation status, whether higher food spending contributes to higher food security. This analysis helps to distinguish whether food insecurity is fundamentally a problem of low food spending or whether it reflects a broader set of hardships.

VI. Results: Preliminary Analysis of Household Budgets.

Descriptive statistics for participants and nonparticipants in the three household types are reported in Table 1. Because the nonparticipant sample includes households that were not nearly income-eligible for FSP participation, it is not surprising that the nonparticipant households were much better off in terms of both income and education.

Among participants, household types (a) single adults with children and (b) two adults with children were poorer on average than household type (c) adults without children. The fraction of households with an elderly member was low for household types (a) and (b), but about half of households with type (c).

Food stamps provided 24.1 percent of all income received by households in type (a) and 16.0 percent of all income received by households in type (b), but only 10.4 percent of all income received by households in type (c). The average monthly benefit amount per AME fell from a high of $113.17 in the poorest type (a) to about $80 in household types (b) and (c).

Within household types, mean benefits did not fall sharply as total income rose to the extent that one might expect. In Figure 6, the line graphs without diamonds show how the mean benefit amount varied with total income (see also Table 2). For comparison, the line graphs with diamonds illustrate the corresponding pattern estimated for 2001 to 2004 from Quality Control (QC) data from the Food and Nutrition Service for the same years. The QC data are a more authoritative source of information about program benefits, but they could not be used for the main analyses in this study, which require survey questions about food spending or food security outcomes that are only available in

the CPS. The mean benefit amount in the CPS data did not trend downward as total income increased. By contrast, the comparison mean benefit amount in QC data generally fell as total income rose.

There are several reasons why the relationship between program benefits and total income in the CPS data might not precisely follow what one would expect from reading the official benefit formula or from comparable analyses with QC data. As noted in the methods section (Section V), these reasons include time mismatch between the underlying annual cash income data and the monthly food stamp benefit data, the lumpiness introduced by the categories of control card cash income, rounding error in reporting program benefits, and misreporting of either cash income or benefit information. As described in the methods section, we made several attempts to reconcile the self-reported benefit amounts with the self-reported cash income values, but all of these attempts yielded results that were substantially the same as those reported here, suggesting that the problem cannot be remedied with the current data source.

Matters appeared somewhat better in the CPS data when we investigated the percentage of total income from FSP benefits, as total income rose (Figure 7 and Table 2). Food stamp benefits contributed a comparatively large fraction of total income for the poorest participants, and a smaller fraction of total income for near-poor participants who have income approaching the boundary for eligibility. Hence, one still finds that the relative role of the food stamp benefit becomes smaller in household budgets with more total resources.

VII. Results: Main Engel Responses for Four Categories of Outcomes.

A. At-home food spending.

A1. Response to total resources. For nonparticipant households, in all three household types, actual weekly at-home food spending per adult equivalent ("at-home food spending," for short) appeared to respond positively and steadily to increased total income (Figure 8 and Table 3).

For participant households, at-home food spending appeared to respond positively and steadily to increased total income for two of the household types: (a) single adults with children and (c) adults without children. For the third household type, (b) multiple adults with children, at-home food spending first fell and then rose as total income increased.

With that single exception, the Engel functions for at-home food spending were positively sloped as one would expect. To give a sense of the magnitude of the spending increase, for nonparticipants in household type (a) single adults with children, at-home food spending rose from about $32 per adult equivalent per week for the poorest group (with monthly total income per adult equivalent $0-250) to about $37 for a near-poor group (with total income $750-1000) to about $49 for a middle-income group (with total income $2250-2500).

A2. Response to program participation status. In all three household types, holding constant total income, at-home food spending was higher for the participant group than for the comparable nonparticipant group (Figure 8 and Table 3). Without exception, the association between FSP participation and at-home food spending was positive.

To give a sense of the large magnitude of the FSP participation association, for household type (a) single adults with children, at-home food spending ranged from $6 to $12 higher for the participant group. Taking the middle of that range as an example, a weekly $9 per AME increase in at-home food spending was as great as the increase one saw as a nonparticipant household's income rises from deep poverty (with monthly total income per adult equivalent $0-250) to an income level above the boundary for food stamp eligibility (with total income per adult equivalent of around $1500). In other words, the participant/nonparticipant difference has as big an association with food spending as a large increase in income would have.

A3. Distinguishing the program effect. For household types (a) single adults with children and (c) adults without children, the results failed to show the pattern that we hypothesized in the theory section would constitute evidence of a true program effect on food spending (Figure 8 and Table 3). The participant / nonparticipant differential was at least as great for those participants who were expected to be unconstrained (with comparatively high total income) as for those participants who were expected to be constrained (with comparatively low total income). In the framework of the theory section, these patterns were what one would expect if self-selection patterns were responsible for the participant / nonparticipant differences.

For household type (b) multiple adults with children, the Engel function for participants first descended and then ascended as total income increases. Consequently, the participant / nonparticipant difference was greater for those participants who were expected to be constrained than for those participants who were expected to be unconstrained. In the framework of the theory section above, this pattern for household type (b) was what one would expect if true program effects were responsible for the participant / nonparticipant difference in at-home food spending. However, because this pattern is not corroborated by the other two household types, this does not provide very strong evidence of the direct effect of food stamps on food spending.

One reason why the hypothesized causal relationship did not show up very strongly may be that the near-poor participant households were not as clearly unconstrained, and the poorest participant households were not as clearly constrained, as we hypothesized they might be. Using the measure of at-home food spending in a recent week, we can finally estimate the degree of constraint empirically. Figure 9 estimates the fraction of the sample that is extramarginal, using three increasingly permissive definitions of extramarginality: having weekly food spending below weekly benefits (where weekly benefits equal monthly benefits / 4.2), having weekly food spending below 1.2 times weekly benefits, and having weekly food spending below 1.4 times weekly benefits. As

a function of total income, the fraction of the sample that was estimated to be constrained appeared fairly constant, instead of declining as total income increased.

B. Away-from-home food spending.

B1. Response to total resources. For both nonparticipant and participant households, in all three household types, actual weekly away-from-home food spending per adult equivalent ("away-from-home food spending," for short) was much lower than the at-home food spending levels reported in results section A above (Figure 8 and Table 4).

For non-participant households, away-from-home food spending appeared in most cases to respond positively and steadily to increased total income. The single minor exception is that away-from-home food spending descended as total income increased for just the very poorest nonparticipants in household type (c) adults without children.

For participant households, away-from-home food spending appeared to respond positively and steadily to increased total income for all three household types.

In general, the Engel functions for away-from-home food spending were positively sloped as one would expect. To give a sense of the magnitude of the spending increase, for nonparticipants in household type (a) single adults with children, away-from-home food spending rose from about $5 for the poorest group (with monthly total income per adult equivalent $0-250) to almost $10 for a near-poor group (with total income $750-1000) to about $17 for a middle-income group (with total income $2250-2500).

B2. Response to program participation status. In all three household types, holding constant total income, away-from-home food spending was lower for the participant group than for the comparable nonparticipant group (Figure 8 and Table 4). For household type (c) adults without children, away-from-home food spending appeared to be greatly suppressed in the participant group, whereas the participant / nonparticipant difference was smaller but still noticeable for the other two household types. Without exception, the association between FSP participation and away-from-home food spending was negative.

To give a sense of the modest magnitude of the FSP participation association, for household type (a) single adults with children, away-from-home food spending ranged from $1.90 to $3.60 lower for the participant group than for the nonparticipant group. A weekly $2.25 decrease in away-from-home food spending, for example, was equivalent to the decrease in food spending one saw as a nonparticipant household's income fell modestly from poverty (with monthly total income per adult equivalent $500-750) to deep poverty (with total income $0-250).

B3. Distinguishing the program effect. For all three household types, the appearance of suppressed away-from-home food spending in the participant group could indicate that FSP benefits encouraged at-home food spending at the expense of restaurant food spending (Figure 8 and Table 4). However, this suppression of away-from-home food

spending was not systematically greater among participant households that one would expect to be constrained (with comparatively low total income), compared with participant households that one would expect to be unconstrained (with comparatively high total income in the near-poor range).

C. The self-perceived food spending gap.

The self-perceived food spending gap is the difference between the household's usual food spending level and the spending level that the household reports would be adequate to meet its needs.

The variable for weekly usual food spending per adult equivalent ("usual food spending," for short) differs in a couple of respects from the at-home and away-from-home food spending variables discussed in the preceding subsections. First, usual food spending includes the sum of both at-home and away-from-home spending. Second, usual food spending reflects a typical weekly spending amount, whereas the results reported in the preceding subsections reflect actual food spending in the most recent week.

The previous subsections noted that the association between FSP participation and food spending was very different for at-home and away-from-home food spending. In particular, FSP participation appeared to be associated with elevated at-home food spending and suppressed away-from-home food spending in the most recent week. Because usual food spending reflects the sum of these offsetting associations, the overall participant / nonparticipant differences in usual food spending are negligible and not directly helpful for understanding program effects (Figure 10 and Table 5). The usual food spending variable is addressed in this subsection only because of its role in the computation of the self-perceived food spending gap discussed below.

Following the question about usual food spending, the household reported whether a minimum adequate level of food spending was lower or higher than usual food spending, and, if so, by what amount. These responses were used to construct a variable for self-perceived minimum required weekly food spending per adult equivalent ("minimum required food spending," for short). While minimum required food spending for nonparticipants did rise as total income rose, the increase was not large (Figure 11 and Table 6). In general, nonparticipant households across a wide range of total income had fairly similar ideas on average about what amount of food spending was required.

By contrast, for all three household types, minimum required food spending was higher for the participant group than for the nonparticipant group at the same level of total income. For household types (a) single adults with children and (b) multiple adults with children, this participant / nonparticipant difference was fairly small. For household type (c) adults without children, this participant / nonparticipant difference was larger. This pattern is consistent with the self-selection account of elevated food spending for program participants. The participant group appeared to have somewhat higher food spending needs.

Results for the self-perceived food spending gap -- the difference between usual food spending and minimum required food spending -- is discussed in the remainder of this subsection (Figure 12 and Table 7). A negative value for the gap variable indicates self-perceived unmet needs. A positive value for the gap variable indicates usual food spending that exceeds self-perceived requirements.

C1. Response to total resources. For nonparticipant households, in all three household types, the self-perceived food spending gap appeared to respond positively and steadily to increased total income (Figure 12). The minor exception is that, for household type (c) adults without children, the food spending gap was flat at low levels of total income. The general pattern of a rising food spending gap reflects the fact that the slope of the usual food spending function was steeper than the slope of the minimum required food spending function. In other words, even though minimum required food spending rose slightly as total income rose, usual food spending rose even faster, so higher income households were better able to exceed their food spending needs.

Still focusing on nonparticipant households, it is interesting to note the total income level at which the food spending gap turned positive. Figure 12 illustrates this total income level as the horizontal value at which the food spending gap first crossed the horizontal axis. This total income threshold, which ranges from about $800 to $1400 per month per adult equivalent across the three household types, has been suggested by some as a type of poverty standard (Jensen, 2002; Andrews, Nord, and Kabbani, 2001). This total income threshold is the one at which nonparticipant households become able on average to meet their self-perceived requirement for food spending.

For participant households, the food spending gap also appears to respond positively and steadily to increased total income.

C2. Response to program participation status. In all three household types, holding constant total income, the food spending gap was lower (more negative) for the participant group than for the comparable nonparticipant group. For household types (a) single adults with children and (b) multiple adults with children, this participant / nonparticipant difference was comparatively small. For household type (c) adults without children, this participant / nonparticipant difference was larger. Without exception, the association between FSP participation and the ability to meet self-perceived food spending needs was negative.

To give a sense of the large magnitude of the FSP participation association, for household type (a) single adults with children, the food spending gap ranged from $2.90 to $4.00 lower for the participant group (which can be compared to usual food spending in the neighborhood of $40). For household type (c) adults without children, the participant/nonparticipant difference in the self-perceived food spending gap was even larger.

As a consequence of the lower (more negative) food spending gap, the participant group in all three household types was on average unable to meets its self-perceived food

spending even at the highest level of total income that participants achieved. In terms of the graphical illustration in Figure 12, the food spending gap function for participants never crossed the horizontal axis. In summary, holding constant total income, the participant group appeared less able than the nonparticipant group to meet its self-perceived food spending needs.

C3. Distinguishing the program effect. The lower (more negative) food spending gap offered clear evidence of the self-selection pattern, in which households with greater food needs were more likely to participate in the program. Little hope of identifying the causal impact of FSP benefits on the food spending gap was provided by comparison of the participant/non-participant difference for participant households that one would expect to be constrained (with comparatively low total income) and those participant households that one would expect to be unconstrained (with comparatively high total income in the near-poor range).

D. Household food security.

D1. Response to total resources. As one would expect, for both nonparticipant and participant households, in all three household types, the 12-month prevalence for the "low or very low food security" and "very low food security" classifications appeared to fall as total income increased (Figure 13, Table 8, and Table 9).

To give a sense of the large magnitude of the improvement in food security status, for nonparticipants in household type (a) single adults with children, the prevalence of "low or very low food security" status fell from about 40% for the poorest households (with total income $0-500) to 11% for a middle-income group (with total income $2250-2500).

Similar results were seen when household food security status was defined based on survey questions with a reference period of the most recent 30 days (Figure 14, Table 10, and Table 11). Recall in these results that the 30-day category "very low food security" is a good analogue to the 12-month category with the same name, while the 30-day category "low or very low food security" is slightly less inclusive than the 12-month category by the same name, omitting some less-than-perfectly secure households with mild evidence of hardship. The 30-day food security status improved steadily as total income increased.

D2. Response to program participation status. In all three household types, holding constant total income, the 12-month prevalence of "low or very low food security" status and "very low food security" status was dramatically higher for FSP participants (Figure 13, Table 8, and Table 9).

To give a sense of the large magnitude of the FSP participation association, for household type (a) single adults with children, the 12-month prevalence of "low or very low food security" status for near-poor participants (with monthly total income per adult equivalent $750-1000) was greater than the corresponding prevalence for any group of nonparticipants, even if they were in deep poverty (with total income $0-250).

Likewise, using the 30-day measure, the prevalence of "low or very low food security" and the prevalence of "very low food security" were consistently higher for participants than for nonparticipants (Figure 14). In the case of household type (a) single adults with children, food security status was slightly worse for participants. In the case of household types (b) and (c), food security status was much worse for participants.

D3. Distinguishing the program effect. The higher rates of food insecurity for program participants offered clear evidence of the self-selection pattern, in which households experiencing greater hardship were more likely to participate in the program (Figure 13, Table 8, and Table 9). Little hope of identifying the causal impact of FSP benefits on the food insecurity prevalence was provided by comparison of the participant/non-participant difference for participant households that one would expect to be constrained (with comparatively low total income) and those participant households that one would expect to be unconstrained (with comparatively high total income in the near-poor range).

VIII. Results: Food Stamps, Food Spending, and Food Security Jointly

The preceding section treated FSP participation and total income as explanatory variables, and it treated at-home food spending and household food security status separately as outcomes of interest. This section more explicitly treats at-home food spending as a vehicle by which resources and program participation might influence household food security status.

As described in the methods section (Section V), we divided the participant and nonparticipant groups according to whether their at-home food spending was above or below the median value for all households. Thus, Figure 15 shows the cross-sectional relationship between rates of food insecurity and total income separately for "high food spenders" and "low food spenders" in the participant and nonparticipant categories.

As in Section VII (D) previously, rates of food insecurity fell as total income rose. A single exception is just the highest part of the total income range for program participants in the household type (a) single adults with children. In general, greater total resources were strongly associated with improved household food security status. Likewise, as in Section VII (D) previously, FSP participation was associated with higher rates of having "low or very low food security."

However, for most household types and total income levels, food security status was not notably different for households with above-median and below-median at-home food spending (Figure 15). The similarity in food security status for high (above-median) and low (below-median) at-home food spenders was a consistent pattern for participant and nonparticipant groups in household types (b) and (c). The strong finding from this figure is that total income and program participation status appeared to matter much more than food spending level. In most cases, the rate of food insecurity differed only slightly for

high food spenders and low food spenders, but was in all cases much higher for program participants than for nonparticipants.

IX. Discussion

Implications for future research. Plotting Engel functions with total income (cash income plus food stamp benefits) as the key explanatory variable proved to be a fruitful way of comparing outcomes for participants and nonparticipants. In a sense, this approach combines appealing features of two approaches that have been most common in preceding research, participant/nonparticipant comparisons and regression analysis with cash income and FSP benefits as separate arguments.

This Engel function approach can be closely tied to an economic model of household decision-making subject to a budget constraint with both cash income and a targeted food benefit. This theoretical model is an adaptation of the traditional neoclassical or Southworth approach (Section IV). Even though one cannot always classify a household deterministically as constrained (extramarginal) or unconstrained (inframarginal), one would still expect in general that the fraction of households who are constrained will be higher among those participants with the very lowest total income.

In this study, as one would expect, FSP benefits represented a higher portion of the total budget for the poorest program participants. However, in the CPS data used here, the mean benefit amount did not fall with rising total income as one would expect based both on reading the official benefit formula and on separate estimates from Quality Control data (Section VI). Possible reasons include time mismatch between the underlying annual cash income data and the monthly food stamp benefit data, the lumpiness introduced by the categories of control card cash income, rounding error in reporting program benefits, and misreporting of either cash income or benefit information. This data limitation somewhat hindered this investigation's hopes of using the modified theoretical model of household decision-making to generate new insight into the real effect of FSP participation, as distinguished from self-selection patterns.

It remains an open question whether a similar analysis could achieve that hope using improved data. Because mismatch of reference periods is a leading candidate explanation for the difficulties encountered here, one recommendation is to collect survey data with the same monthly reference period for variables describing cash income, FSP benefits, food spending, minimum required food spending, and household food security status. Similarly, because respondent error in self-reporting cash income and FSP benefits is another candidate explanation for the difficulties encountered here, another recommendation for future research is to draw samples from a sampling frame of participants for whom the income variables can be corroborated from program records.

The analysis supports a couple of other observations for future research. Because we found such divergent responses of at-home and away-from-home food spending to FSP participation, it seems advisable to continue to ask spending questions about these two

resources separately. Indeed, an improvement in the CPS supplement instrument would retain the division between at-home and away-from-home food sources in the survey questions about usual food spending and minimum required food spending, making these questions more similar to the current questions about at-home and away-from-home food spending in the past week. This research confirms that the "food spending gap" between minimum required food spending and usual food spending may offer insight into the relationship between FSP participation, food spending, and food security. However, this insight was blurred in the present study by the fact that "usual" food spending from all sources appeared to have little association with FSP participation. That lack of association is not because food stamps have little relationship to food spending; rather, it appears to be because the positive association between FSP participation and at-home food spending was partially canceled by the negative association between FSP participation and away-from-home food spending. Because food stamps may only be used for at-home food spending, and had only a small association with combined food spending from all sources, a "food spending gap" based on the difference between minimum required at-home food spending and usual at-home food spending might have offered more clear information about program effects.

Principal conclusions. This research permits us to draw several conclusions.

First, at-home food spending in a recent week increased with total income (cash income plus food stamp benefits). This pattern was found for all three household types and for both participant and nonparticipant groups. See results section VII.A1.

Second, at-home food spending in a recent week was higher for FSP participants than for nonparticipants, even after controlling for total income. This finding is consistent with a beneficial impact of food stamp participation on at-home food spending, related to the targeted nature of food stamp benefits and exceeding the effect that one would attribute simply to the increased total resources provided by food stamp benefits. See results section VII.A2.

Third, away-from-home food spending in a recent week was lower for FSP participants than for nonparticipants. This finding is consistent with a potentially healthful impact of food stamps in promoting at-home food spending in place of away-from-home food spending. This result is notable, given that the program increases total household resources, and hence one could easily imagine the FSP would have tended to raise spending on any normal good. See results section VII.B2.

Fourth, despite the raised at-home food spending in a recent week, FSP participants had little increase in usual food spending from all sources combined. Furthermore, the "food spending gap" between usual food weekly spending and self-perceived minimum required weekly food spending suggests that participants perceived a greater shortfall in their food budget than did nonparticipants even at the same low levels of total income. This observation of food budget shortfalls for FSP participants is corroborated by the food security outcomes discussed below. See results section VII.C2.

Fifth, rates of food insecurity fell with increased total resources, as one would expect. This pattern was observed whether one looked at the rates of "low or very low food security" or just "very low food security," and whether one used the 12-month or 30-day food security measures. It was observed for all three household types and for both the participant and nonparticipant groups. See results section VII.D1.

Sixth, FSP participants had much higher rates of food insecurity compared with nonparticipants at the same levels of total income, presumably due to a self-selection pattern in which those households with greater hardship were more likely to seek program benefits for which they were eligible. While the national rate of "low or very low food security" among all U.S. households was about 11% in 2005, the comparable rates for FSP participants with the lowest levels of total income reached higher than 55% for all three household types. See results section VII.D2.

A key hypothesis motivating this study was that the very poorest FSP participants, in terms of total income, would be most constrained (or extramarginal) in their household budget, and hence they would benefit from raised levels of at-home food spending supported by the maximum food stamp benefit, perhaps leading to lower rates of household food insecurity. This hypothesis could not be confirmed in this analysis. Instead, rates of food insecurity for low-income FSP participants are very high, reflecting serious hardship for the participant group. This self-selection pattern, in which households that experience hardship are more likely to participate in the Food Stamp Program, made it difficult to determine true program effects using cross-sectional data in this analysis.

Seventh, the high rates of food insecurity for low-income participant households were noted regardless of whether these households had above-median or below-median at-home food spending. Holding constant total resources, having above-median at-home food spending might nevertheless contribute to other food-related goals that were beyond the scope of this study, such as improved diet quality. However, for most household types and total income levels, having above-median at-home food spending did not appear to suffice on its own to produce improved household food security. See results section VIII.

In conclusion, FSP participation is associated with suppressed away-from-home food spending and with an increase in at-home food spending beyond what can be attributed to the cash value of the program benefits. Yet, these higher at-home food spending levels do not automatically imply improved food security outcomes. Cross-sectional comparisons of food security outcomes for participants and nonparticipants are dominated by self-selection effects. Holding constant total income, rates of food insecurity remain higher for program participants than for nonparticipants.

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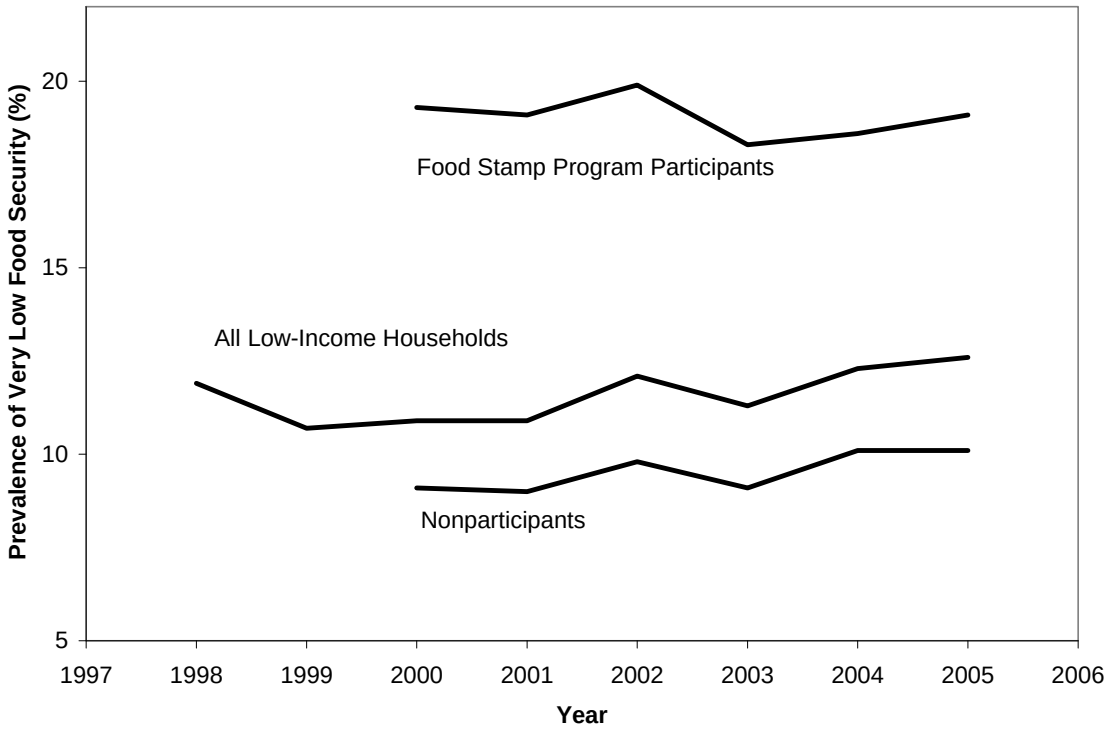


Figure 1. Changes over time in the prevalence of very low household food security for FSP participant households, low-income nonparticipant households, and all low-income households (below 130 percent of the poverty line).

Source: Annual USDA food security reports (Nord, Andrews and Carlson, 2006).

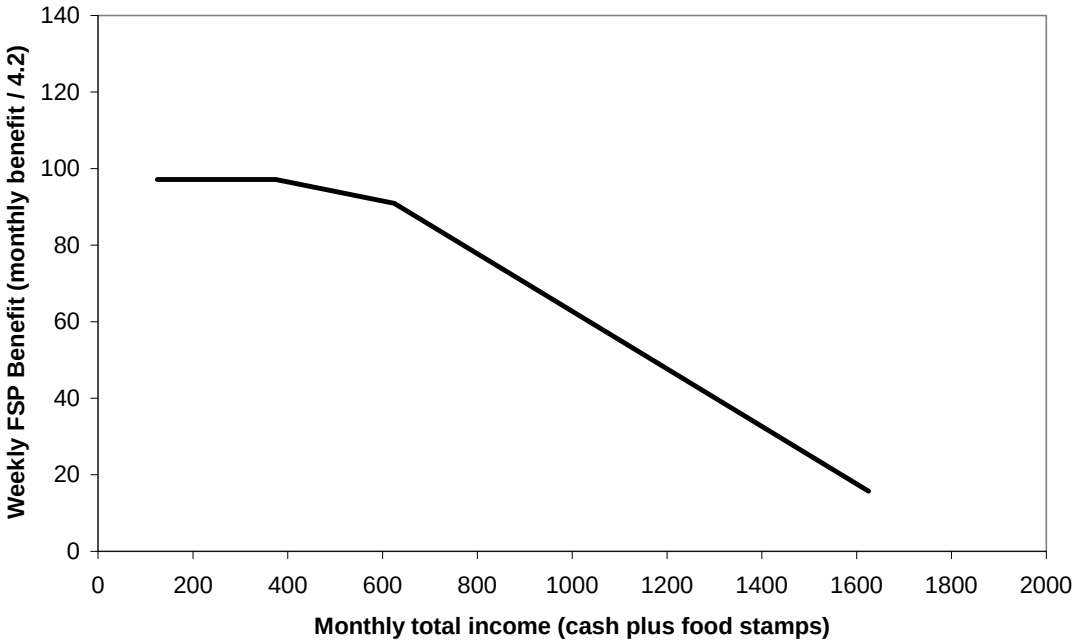


Figure 2. The food stamp benefit formula, showing average weekly food stamp benefits (monthly benefits / 4.2) at each level of total income (cash plus food stamps).

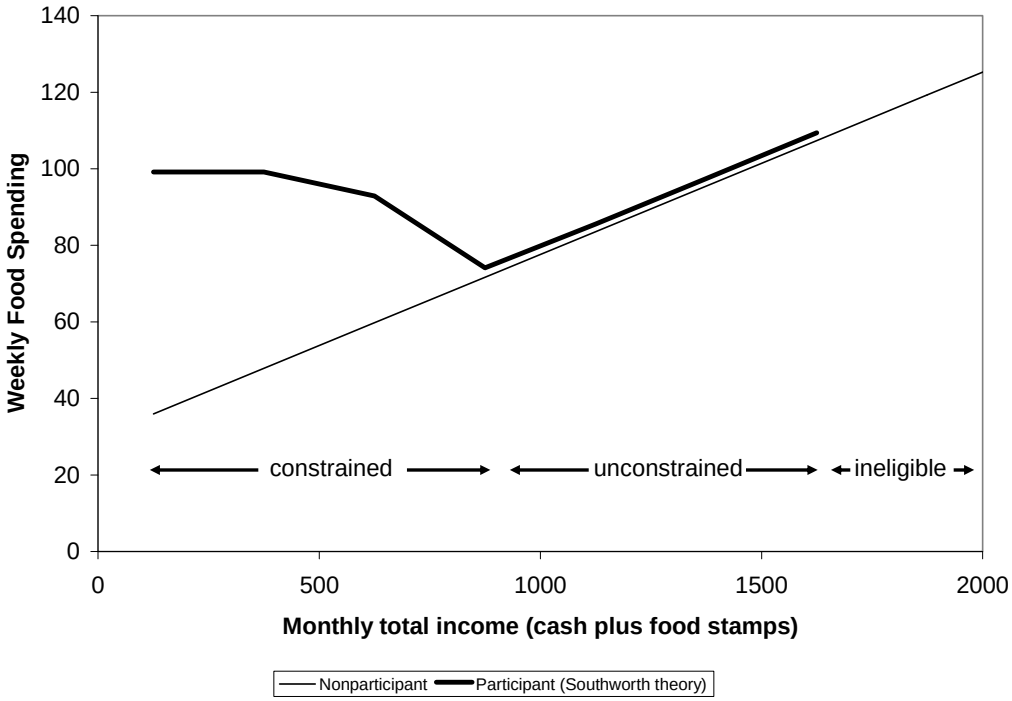


Figure 3. Engel functions for FSP participants and nonparticipants under the traditional Southworth theory, which stipulates distinct food spending behavior for constrained and unconstrained participants.

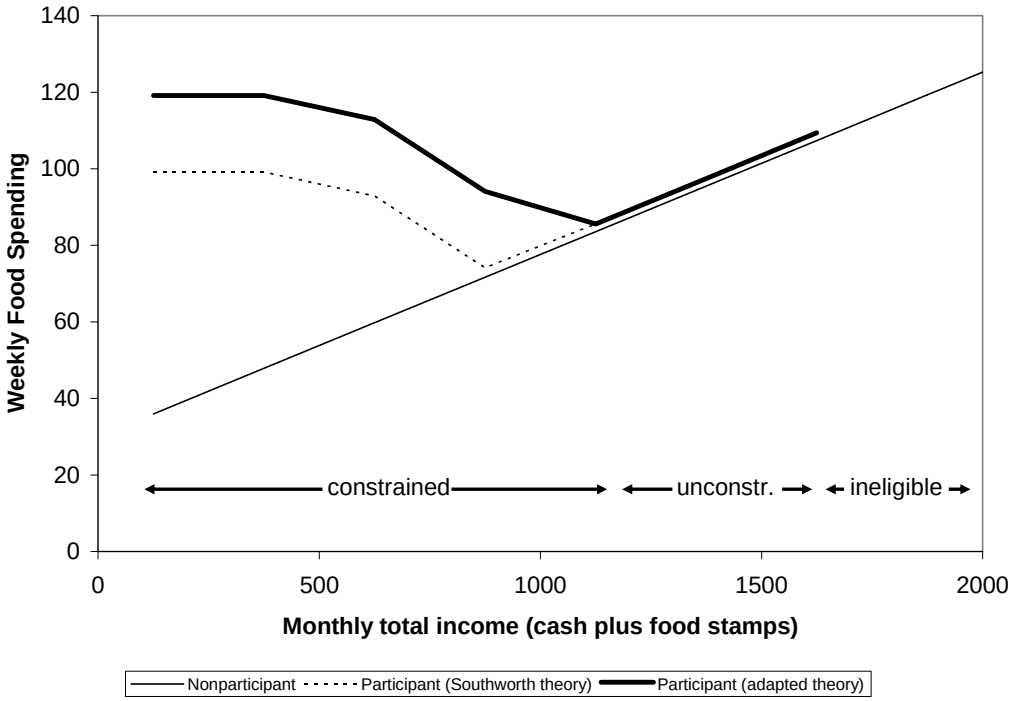


Figure 4. Engel functions for FSP participants and nonparticipants under the adapted theory, which is similar to the Southworth theory but allows for some cash spending on food even in constrained households.

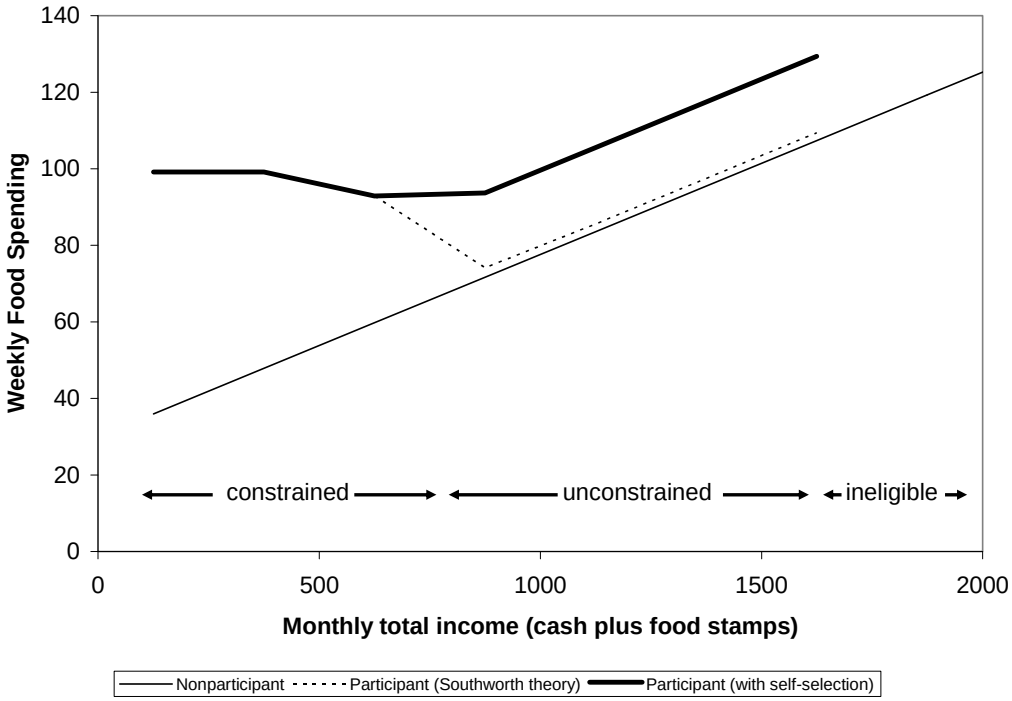
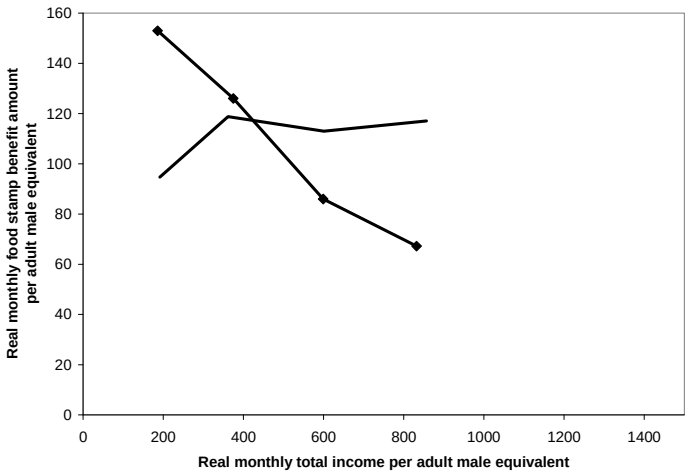
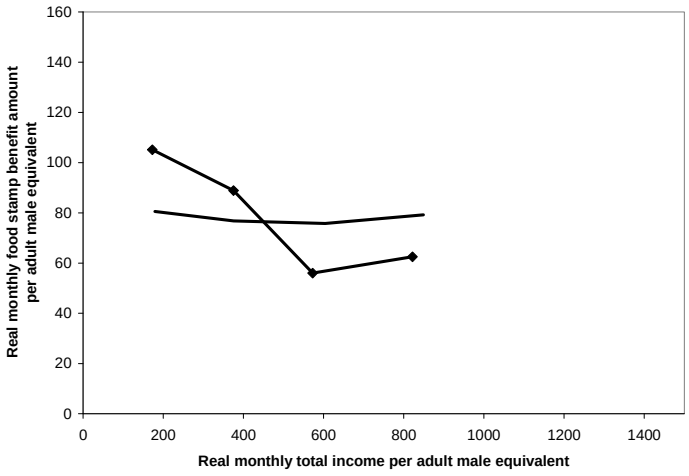


Figure 5. Engel functions for FSP participants and nonparticipants under a model of self-selection, which is similar to the Southworth theory but allows participants to have higher preferences for food than nonparticipants have.

(a) One adult with children



(b) Two adults with children



(c) No children

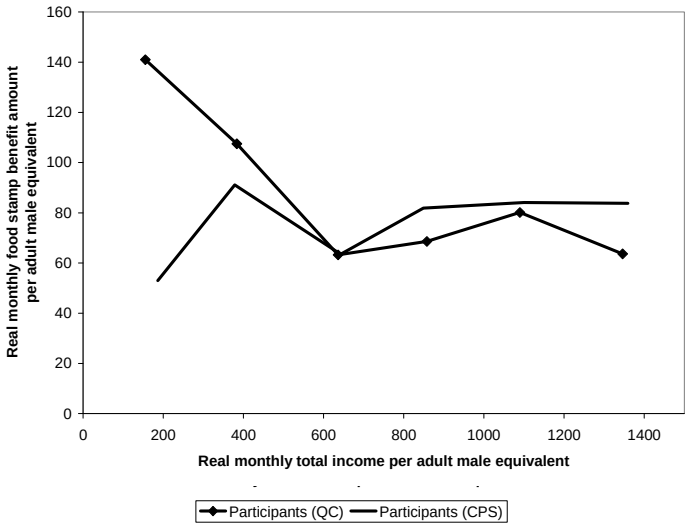
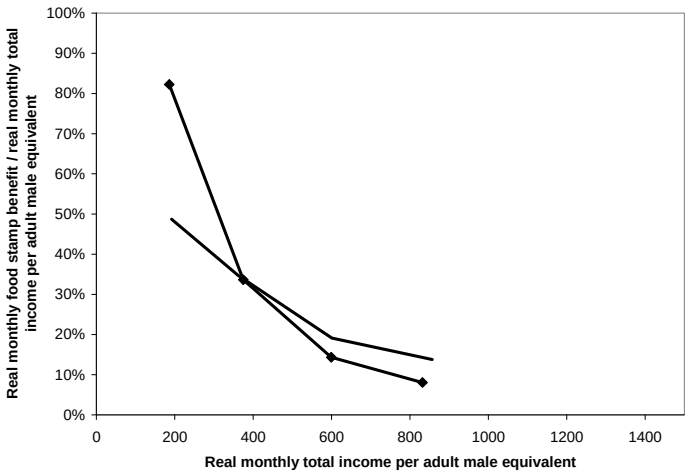
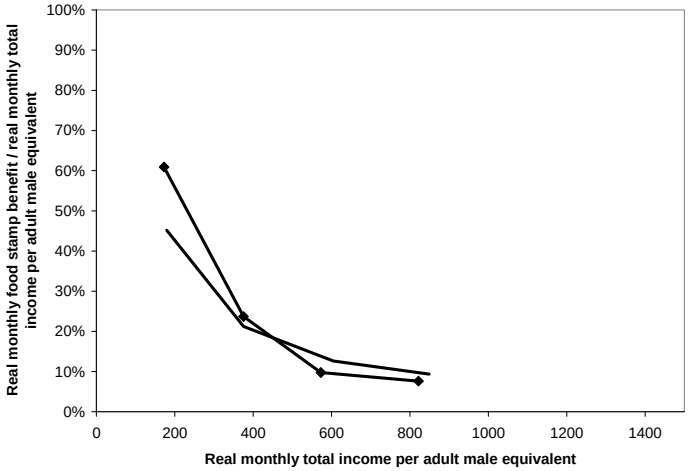


Figure 6. Monthly food stamp benefits as a function of monthly total income (cash plus food stamps), in Quality Control data (QC) and the Current Population Survey (CPS)

(a) One adult with children



(b) Two adults with children



(c) No children

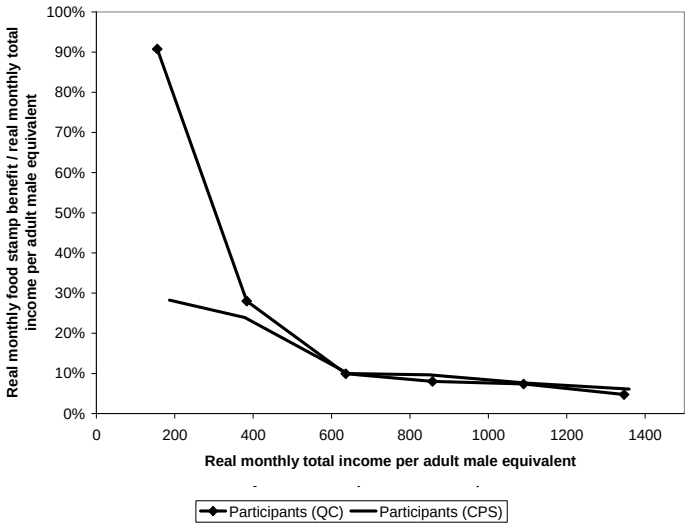
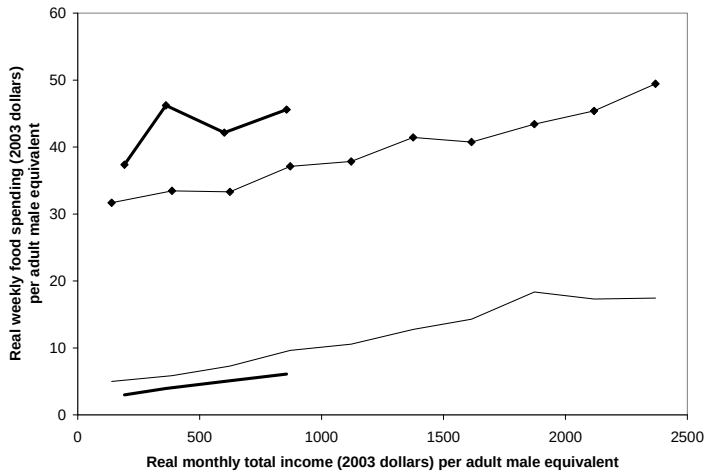
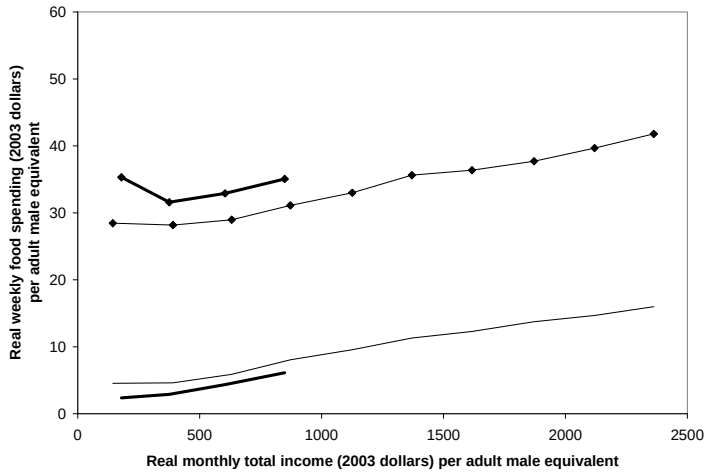


Figure 7. Monthly food stamp benefits as a percentage of monthly total income (cash plus food stamps), in the Current Population Survey (CPS) and Quality Control data (QC).

(a) One adult with children



(b) Two adults with children



(c) No children

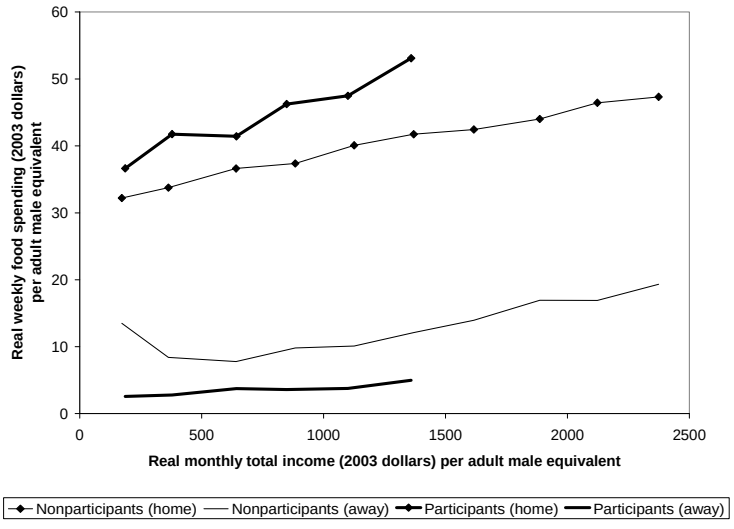
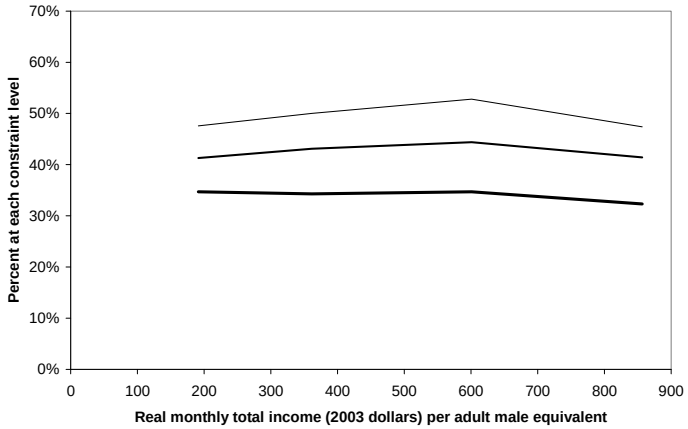
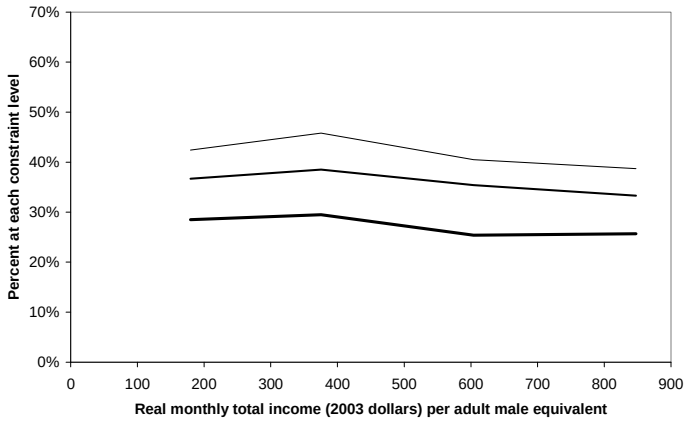


Figure 8. Weekly food spending at-home and away-from-home as a function of monthly total income (cash plus food stamps), by FSP participation status.

(a) One adult with children



(b) Two adults with children



(c) No children

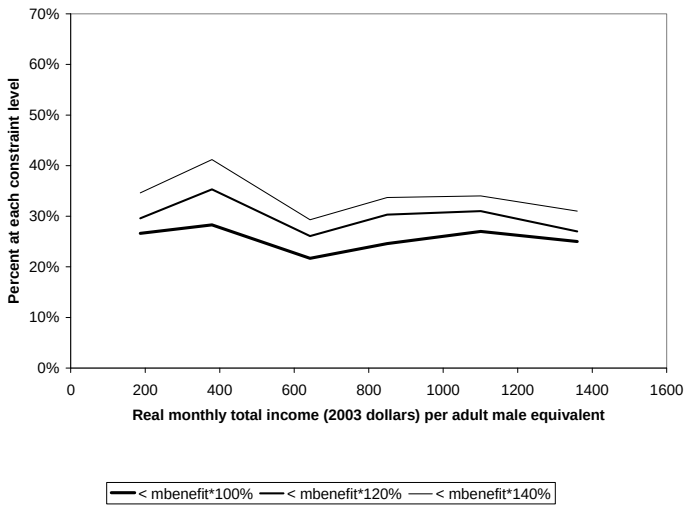
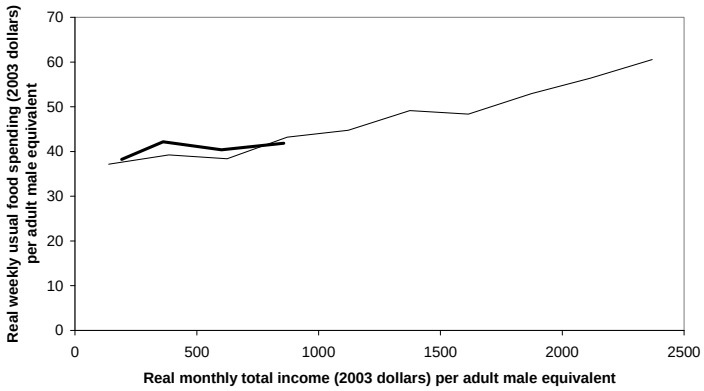
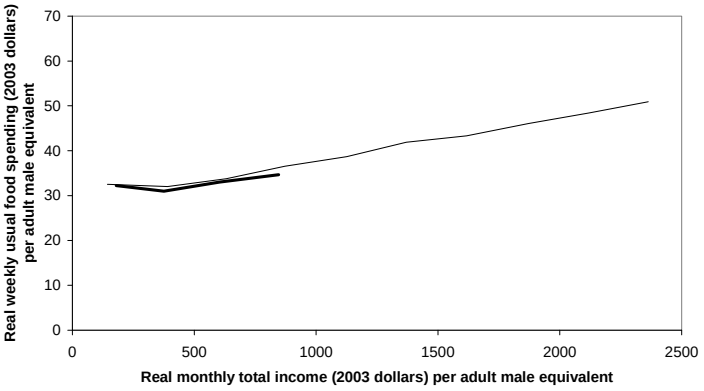


Figure 9. Percentage of participant households that appears to be extramarginal, using 3 definitions of extramarginal: (i) food spending less than 100% of benefits, (ii) food spending less than 120% of benefits, and (iii) food spending less than 140% of benefits.

(a) One adult with children



(b) Two adults with children



(c) No children

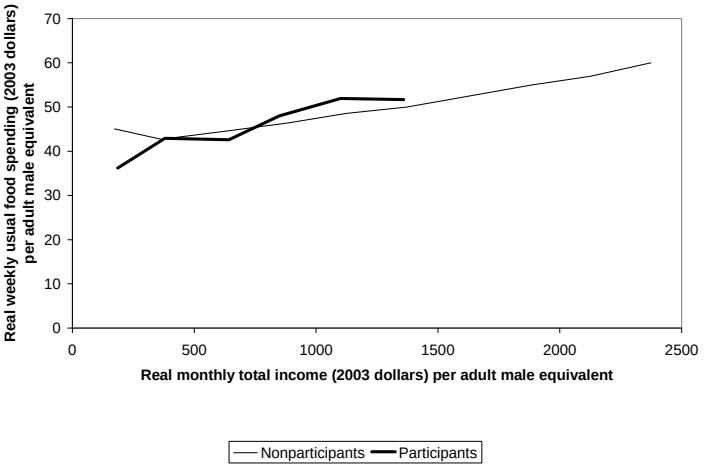
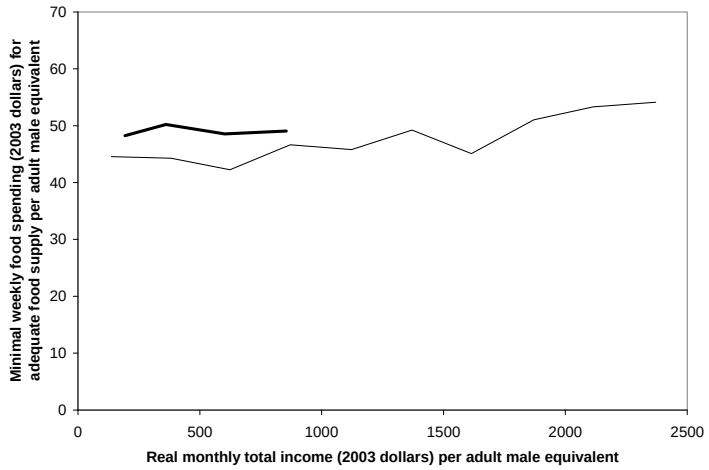
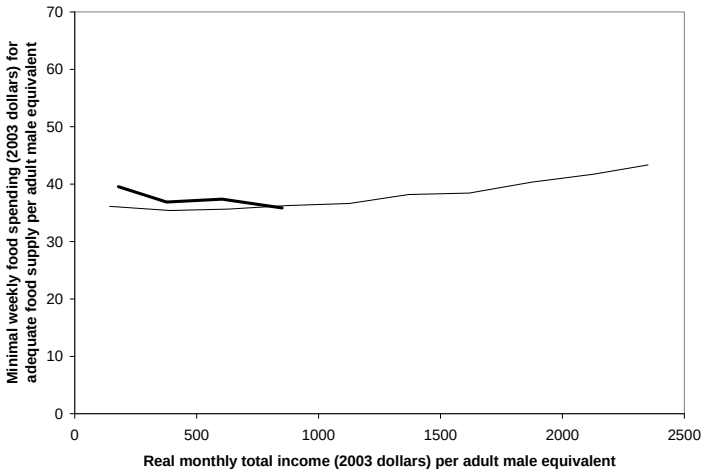


Figure 10. Weekly usual food spending as a function of monthly total income (cash plus food stamps), by FSP participation status.

(a) One adult with children



(b) Two adults with children



(c) No children

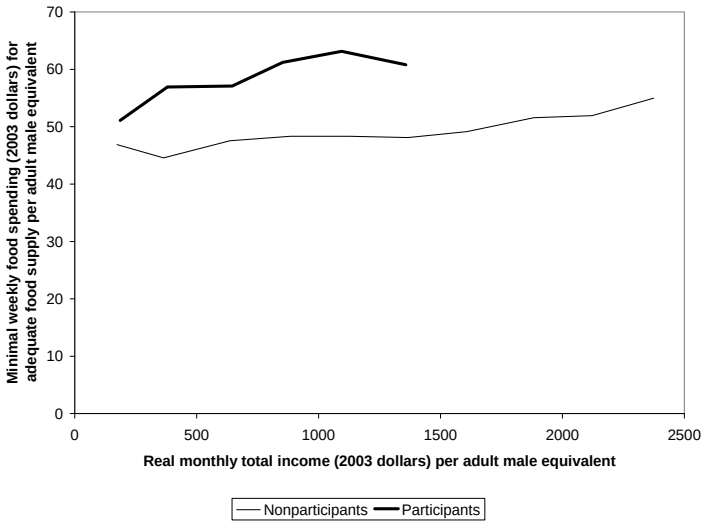
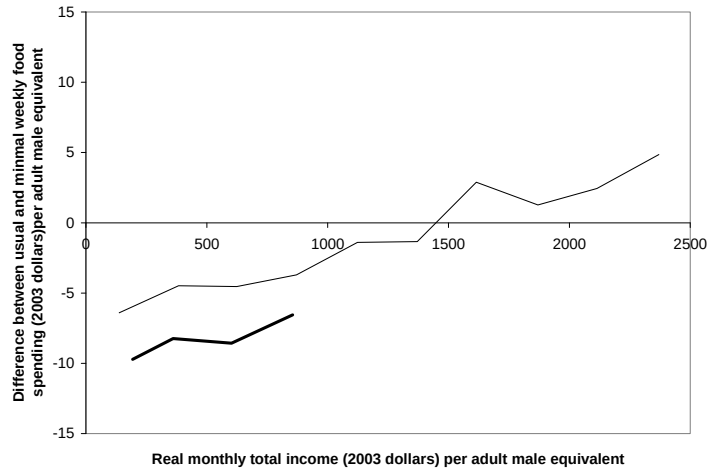
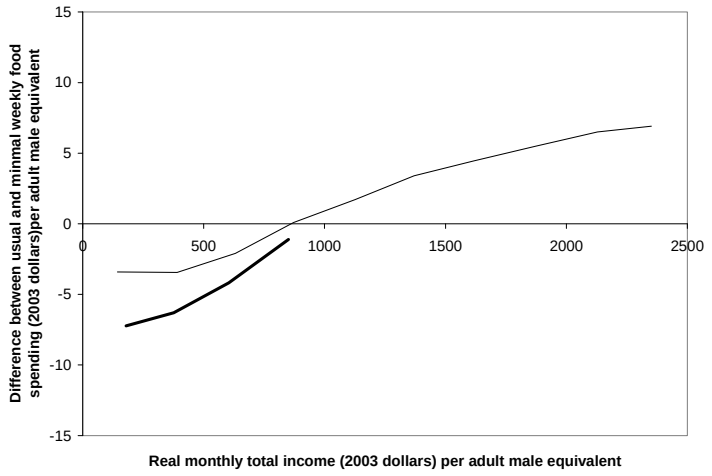


Figure 11. Weekly self-perceived minimum needed food spending as a function of monthly total income (cash plus food stamps), by FSP participation status.

(a) One adult with children



(b) Two adults with children



(c) No children

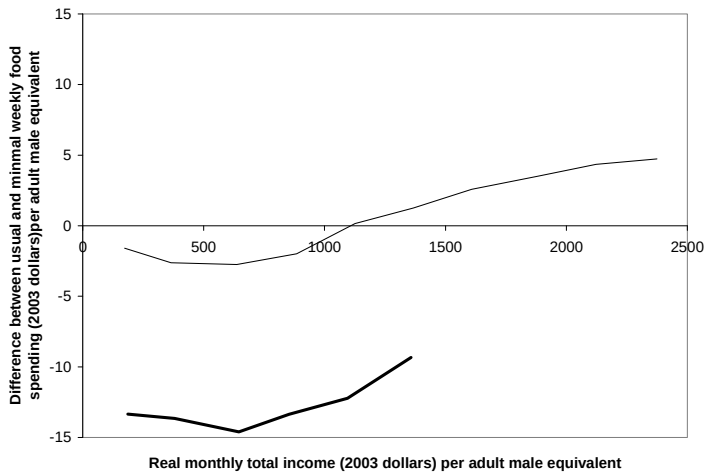
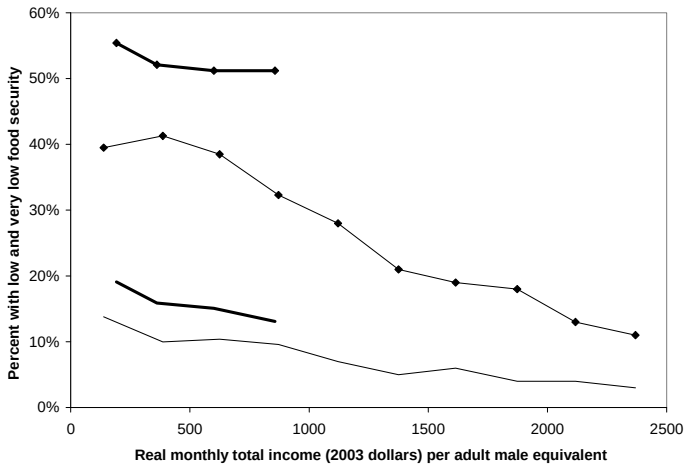
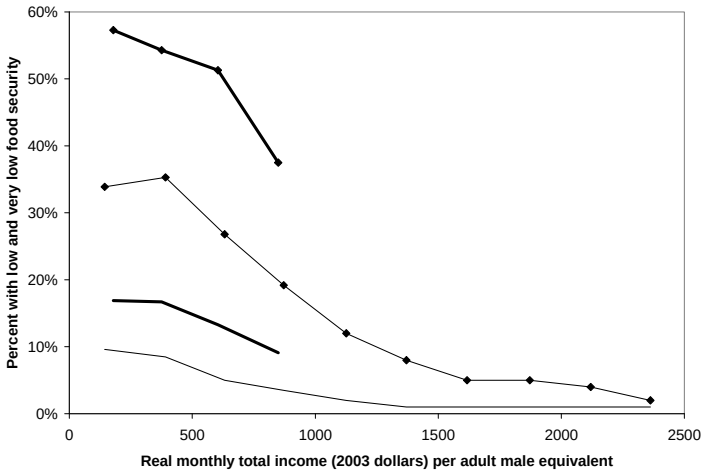


Figure 12. Difference between mean usual and self-perceived minimal weekly food spending **(**2003 dollars per week) necessary to meet food needs, as a function of total income (cash plus food stamps), by FSP participation status.

(a) One adult with children



(b) Two adults with children



(c) No children

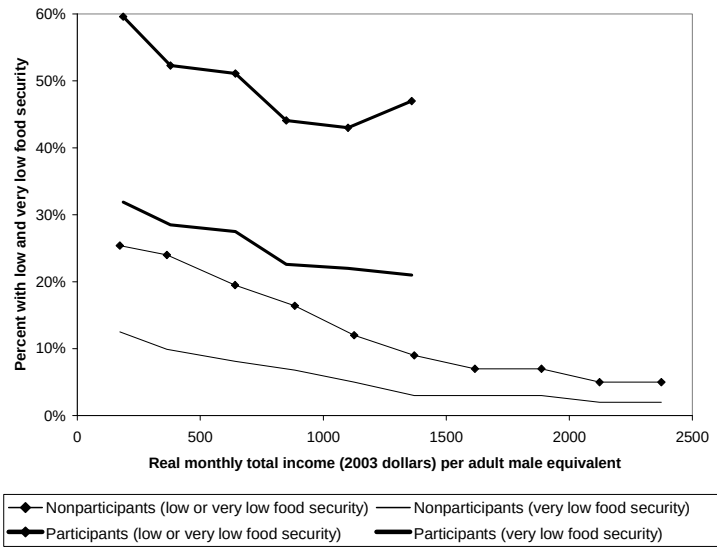
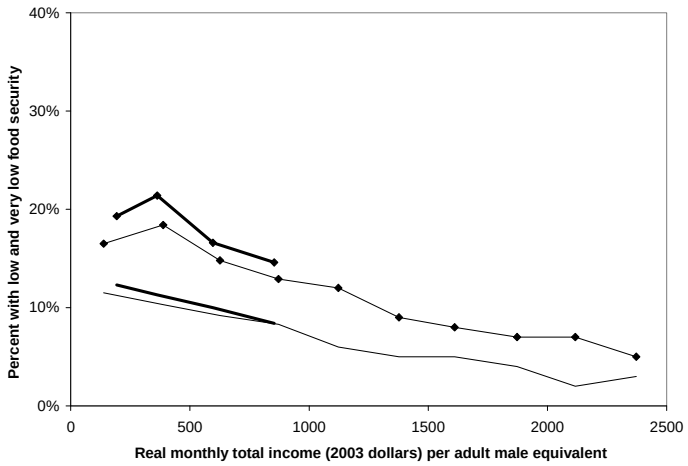
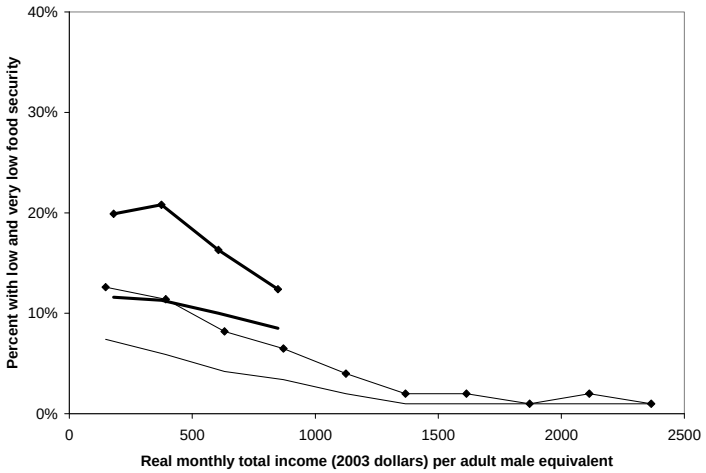


Figure 13. Percent classified as having "low or very low food security" and having "very low food security" in the past 12 months, as a function of total income (cash plus food stamps), by FSP participation status.

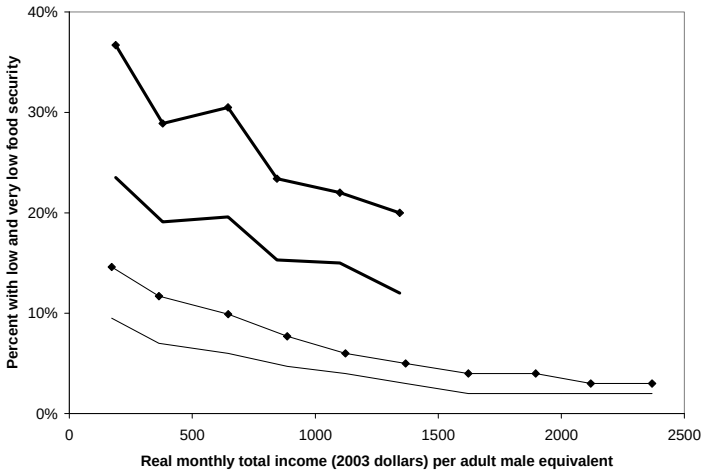
(a) One adult with children



(b) Two adults with children



(c) No children



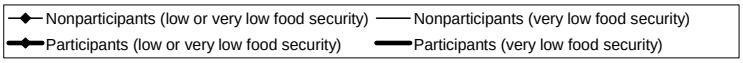
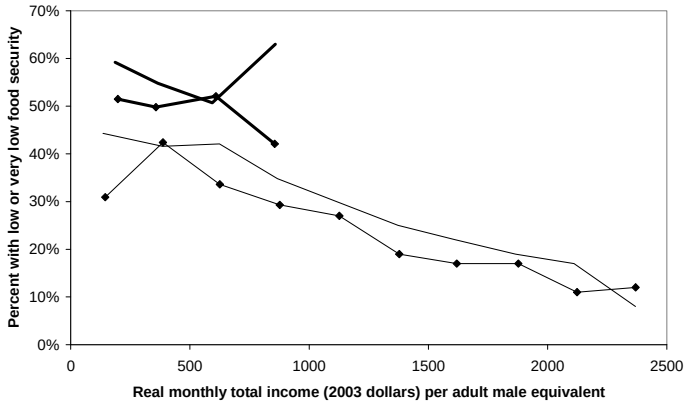
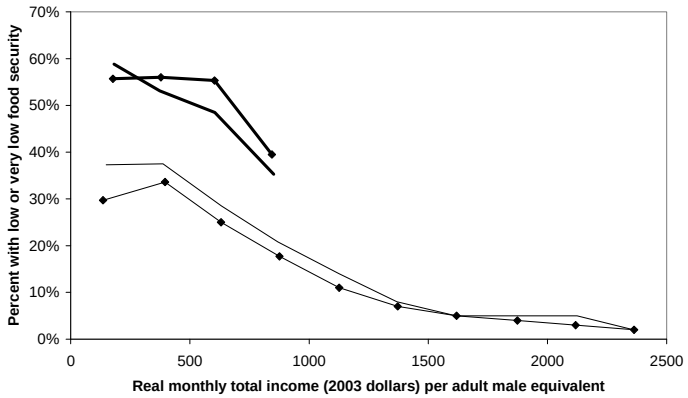


Figure 14. Percent classified as having "low or very low food security" and having "very low food security" in the past 30 days, as a function of total income (cash plus food stamps), by FSP participation status.

(a) One adult with children



(b) Two adults with children



(c) No children

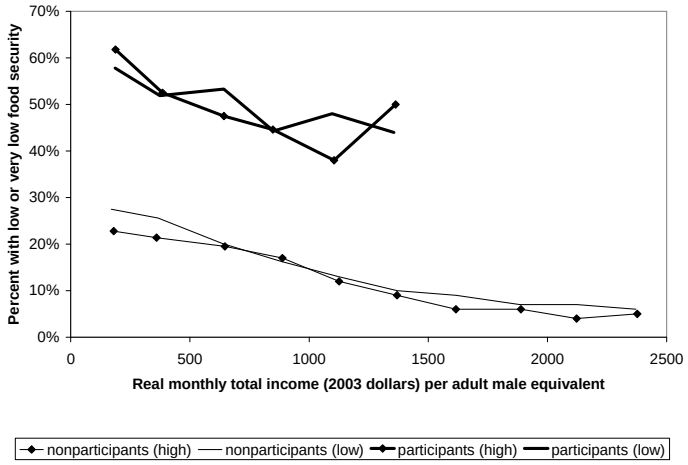


Figure 15. Percent classified as having low or very low food security, as a function of total income (cash plus food stamps), by both food spending status (higher or lower than median food spending) and FSP participation status.

Table 1: Characteristics[1] for Food Stamp Program participants and nonparticipants

Household type	Single adult with children		Two adults with children		Adult(s) no children	
	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
Number of households	2842	9656	2292	33463	4185	112793
Real total monthly income per AME (mean)	468.75	1265.40	492.46	1177.54	768.80	2114.84
Real monthly cash income per AME (mean)	355.58	1265.40	413.81	1177.54	688.52	2114.84
Real monthly food stamp benefit per AME (mean)	113.17	0	78.65	0	80.28	0
Number of household members (mean)	3.1	2.6	4.2	3.9	1.5	1.7
% households with one or more members elderly (age $\geq$ 60 years)	1.8	2.4	7.1	4.1	51.7	60.2
% interviewees at least High School graduate or GED	68.4	86.9	60.7	85.8	54.4	83.8

1 Mean and percent using survey weights. Analysis restricted to household observations where real total income was not missing.

Table 2: Mean food stamp benefit as a function of mean total income according to self reports in the Current Population Survey

Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Mean benefit[1]	% of total income	Mean benefit[1]	% of total income	Mean benefit[1]	% of total income
< 250	94.7	48.7%	80.5	45.2%	53.0	28.2%
250 - < 500	118.8	34.7%	76.8	21.2%	91.1	23.9%
500 - < 750	113.0	19.1%	75.8	12.7%	63.5	10.0%
750 - <1,000	117.1	13.8%	79.2	9.4%	81.9	9.7%
1,000 - <1,250	--	--	--	--	84.1	7.6%
1,250 - <1,500	--	--	--	--	83.8	6.1%

1 Mean food stamp benefit amount **(**2003 dollars per month) per adult male equivalent, weighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 200. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A1.

Table 3: At-home food spending in previous week for Food Stamp Program participants and nonparticipants

	At-home food spending in previous week [1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	37.37	31.69	35.31	28.46	36.64	32.20
250 - < 500	46.22	33.46	31.59	28.18	41.74	33.76
500 - < 750	42.16	33.32	32.91	28.98	41.43	36.61
750 - <1,000	45.60	37.12	35.07	31.10	46.25	37.37
1,000 - <1,250	--	37.85	--	33.01	47.47	40.08
1,250 - <1,500	--	41.44	--	35.61	53.08	41.73
1,500 - <1,750	--	40.74	--	36.37	--	42.44
1,750 - <2,000	--	43.42	--	37.71	--	44.01
2,000 - <2,250	--	45.40	--	39.68	--	46.43
2,250 - <2,500	--	49.46	--	41.78	--	47.32

1 Mean at-home food spending **(**2003 dollars per week) per adult male equivalent, using survey weights.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 200. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A2.

Table 4: Away-from-home food spending in previous week for Food Stamp Program participants and nonparticipants

	Away-from-home food spending in previous week[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	3.00	5.00	2.37	4.55	2.56	13.49
250 - < 500	3.96	5.86	2.91	4.62	2.78	8.39
500 - < 750	5.00	7.28	4.37	5.88	3.73	7.78
750 - <1,000	6.09	9.64	6.13	8.06	3.60	9.82
1,000 - <1,250	--	10.56	--	9.56	3.77	10.11
1,250 - <1,500	--	12.76	--	11.30	4.98	12.11
1,500 - <1,750	--	14.29	--	12.30	--	13.95
1,750 - <2,000	--	18.34	--	13.75	--	16.92
2,000 - <2,250	--	17.31	--	14.67	--	16.90
2,250 - <2,500	--	17.44	--	15.98	--	19.32

1 Mean away-from-home food spending **(**2003 dollars per week) per adult male equivalent, using survey weights.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 200. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A3.

Table 5: Usual food spending for Food Stamp Program participants and nonparticipants

	Usual food spending [1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	38.21	37.16	32.22	32.51	36.20	45.06
250 - < 500	42.17	39.22	30.97	32.03	42.91	42.71
500 - < 750	40.39	38.38	33.00	33.79	42.60	44.63
750 - <1,000	41.85	43.19	34.67	36.53	48.01	46.41
1,000 - <1,250	--	44.76	--	38.69	51.94	48.55
1,250 - <1,500	--	49.16	--	41.89	51.71	49.98
1,500 - <1,750	--	48.38	--	43.33	--	52.36
1,750 - <2,000	--	52.95	--	46.09	--	55.02
2,000 - <2,250	--	56.41	--	48.44	--	56.94
2,250 - <2,500	--	60.58	--	50.93	--	60.02

1 Mean usual food spending food spending **(**2003 dollars per week) per adult male equivalent, using survey weights.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 200. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A4.

Table 6: Self-perceived minimum required food spending for Food Stamp Program participants and nonparticipants

	Minimal weekly food spending for adequate food supply[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	48.24	44.58	39.56	36.13	51.10	46.90
250 - < 500	50.22	44.28	36.90	35.41	56.94	44.55
500 - < 750	48.55	42.26	37.39	35.67	57.08	47.55
750 - <1,000	49.06	46.66	35.87	36.27	61.21	48.33
1,000 - <1,250	--	45.80	--	36.63	63.15	48.35
1,250 - <1,500	--	49.23	--	38.20	60.79	48.13
1,500 - <1,750	--	45.10	--	38.44	--	49.15
1,750 - <2,000	--	51.05	--	40.35	--	51.58
2,000 - <2,250	--	53.31	--	41.74	--	51.93
2,250 - <2,500	--	54.15	--	43.36	--	54.95

1 Mean self-perceived minimum required food spending food spending **(**2003 dollars per week) per adult male equivalent, weighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 160. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A5.

Table 7: The food spending gap, usual minus minimum required food spending for FSP participants and nonparticipants

	Usual minus minimum required weekly food spending [1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	-9.72	-6.40	-7.23	-3.41	-13.34	-1.59
250 - < 500	-8.24	-4.48	-6.30	-3.44	-13.65	-2.62
500 - < 750	-8.56	-4.54	-4.19	-2.10	-14.60	-2.75
750 - <1,000	-6.55	-3.70	-1.11	0.10	-13.35	-1.99
1,000 - <1,250	--	-1.40	--	1.71	-12.22	0.15
1,250 - <1,500	--	-1.34	--	3.40	-9.33	1.25
1,500 - <1,750	--	2.89	--	4.45	--	2.58
1,750 - <2,000	--	1.27	--	5.50	--	3.51
2,000 - <2,250	--	2.44	--	6.50	--	4.35
2,250 - <2,500	--	4.86	--	6.91	--	4.73

1 Usual minus minimum required food spending food spending **(**2003 dollars per week) per adult male equivalent, weighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 160. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A6.

Table 8: Percent with low or very low food security in the past 12 months, for Food Stamp Program participants and nonparticipants

	Percent with low or very low food security in the past 12 months[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	55.4	39.5	57.3	33.9	59.6	25.4
250 - < 500	52.1	41.3	54.3	35.3	52.3	24.0
500 - < 750	51.2	38.5	51.3	26.8	51.1	19.5
750 - <1,000	51.2	32.3	37.5	19.2	44.1	16.4
1,000 - <1,250	--	28.0	--	12.0	43.0	12.0
1,250 - <1,500	--	21.0	--	8.0	47.0	9.0
1,500 - <1,750	--	19.0	--	5.0	--	7.0
1,750 - <2,000	--	18.0	--	5.0	--	7.0
2,000 - <2,250	--	13.0	--	4.0	--	5.0
2,250 - <2,500	--	11.0	--	2.0	--	5.0

1 Using survey weights.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 200. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A7.

Table 9: Percent with very low food security in the past 12 months, for Food Stamp Program participants and nonparticipants

	Percent with very low food security in the past 12 months[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	19.1	13.8	16.9	9.6	31.9	12.5
250 - < 500	15.9	10.0	16.7	8.5	28.5	9.9
500 - < 750	15.1	10.4	13.3	5.0	27.5	8.1
750 - <1,000	13.1	9.6	9.1	3.5	22.6	6.8
1,000 - <1,250	--	7.0	--	2.0	22.0	5.0
1,250 - <1,500	--	5.0	--	1.0	21.0	3.0
1,500 - <1,750	--	6.0	--	1.0	--	3.0
1,750 - <2,000	--	4.0	--	1.0	--	3.0
2,000 - <2,250	--	4.0	--	1.0	--	2.0
2,250 - <2,500	--	3.0	--	1.0	--	2.0

1 Using survey weights.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 200. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A8.

Table 10: Percent with low or very low food security in the past 30 days, for Food Stamp Program participants and nonparticipants

	Percent with low or very low food security in the past 30 days[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	19.3	16.5	19.9	12.6	36.7	14.6
250 - < 500	21.4	18.4	20.8	11.4	28.9	11.7
500 - < 750	16.6	14.8	16.3	8.2	30.5	9.9
750 - <1,000	14.6	12.9	12.4	6.5	23.4	7.7
1,000 - <1,250	--	12.0	--	4.0	22.0	6.0
1,250 - <1,500	--	9.0	--	2.0	20.0	5.0
1,500 - <1,750	--	8.0	--	2.0	--	4.0
1,750 - <2,000	--	7.0	--	1.0	--	4.0
2,000 - <2,250	--	7.0	--	2.0	--	3.0
2,250 - <2,500	--	5.0	--	1.0	--	3.0

1 Using survey weights. This 30-day measure may undercount households with mild levels of food insecurity.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 160. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A9.

Table 11: Percent with very low food security in the past 30 days, for Food Stamp Program participants and nonparticipants

	Percent with very low food security in the past 30 days[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	12.3	11.5	11.6	7.4	23.5	9.5
250 - < 500	11.3	10.3	11.3	5.9	19.1	7.0
500 - < 750	10.0	9.2	10.0	4.2	19.6	6.0
750 - <1,000	8.4	8.3	8.5	3.4	15.3	4.7
1,000 - <1,250	--	6.0	--	2.0	15.0	4.0
1,250 - <1,500	--	5.0	--	1.0	12.0	3.0
1,500 - <1,750	--	5.0	--	1.0	--	2.0
1,750 - <2,000	--	4.0	--	1.0	--	2.0
2,000 - <2,250	--	2.0	--	1.0	--	2.0
2,250 - <2,500	--	3.0	--	1.0	--	2.0

1 Using survey weights.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 160. Standard errors for this table, without correction for complex survey design, are available in Appendix Table A10.

Table A1: Unadjusted standard errors for Table 2, mean food stamp benefit as a function of total income, Current Population Survey

Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	SE of mean benefit[1]	SE of benefits as % of total income	SE of mean benefit[1]	SE of benefits as % of total income	SE of mean benefit[1]	SE of benefits as % of total income
< 250	1.74	0.725	1.76	0.858	2.46	1.186
250 - < 500	1.44	0.487	1.14	0.344	1.85	0.459
500 - < 750	2.07	0.363	1.64	0.281	1.59	0.253
750 - <1,000	3.96	0.476	2.46	0.294	1.83	0.213
1,000 - <1,250	--	--	--	--	2.93	0.262
1,250 - <1,500	--	--	--	--	5.25	0.379

1 Mean food stamp benefit amount **(**2003 dollars per month) per adult male equivalent. Standard errors are unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Table A2: Unadjusted standard errors for Table 3, at-home food spending for FSP participants and nonparticipants

	Standard error of at-home food spending in previous week [1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	1.43	1.59	1.34	0.77	2.02	0.69
250 - < 500	1.07	0.95	0.86	0.42	1.29	0.54
500 - < 750	1.39	0.72	1.14	0.30	1.21	0.40
750 - <1,000	2.48	0.86	1.75	0.30	1.31	0.37
1,000 - <1,250	--	0.90	--	0.32	1.92	0.36
1,250 - <1,500	--	0.93	--	0.34	3.49	0.36
1,500 - <1,750	--	0.98	--	0.34	--	0.36
1,750 - <2,000	--	1.22	--	0.49	--	0.39
2,000 - <2,250	--	1.53	--	0.57	--	0.45
2,250 - <2,500	--	1.70	--	0.87	--	0.47

1 Standard error of at-home food spending **(**2003 dollars per week) per adult male equivalent, unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 200.

Table A3: Unadjusted standard errors for Table 4, away-from-home food spending for FSP participants and nonparticipants

	Standard error of away-from-home food spending in previous week[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	0.26	0.41	0.22	0.30	0.42	0.50
250 - < 500	0.18	0.29	0.15	0.17	0.22	0.26
500 - < 750	0.28	0.28	0.30	0.13	0.33	0.18
750 - <1,000	0.67	0.37	0.53	0.14	0.25	0.22
1,000 - <1,250	--	0.33	--	0.15	0.37	0.19
1,250 - <1,500	--	0.43	--	0.17	1.28	0.19
1,500 - <1,750	--	0.53	--	0.19	--	0.22
1,750 - <2,000	--	0.93	--	0.27	--	0.27
2,000 - <2,250	--	0.74	--	0.38	--	0.29
2,250 - <2,500	--	0.98	--	0.52	--	0.31

1 Standard error of away-from-home food spending (2003 dollars per week) per adult male equivalent, unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Note: Table cells are excluded where sample size < 200.

Table A4: Unadjusted standard errors for Table 5, usual food spending for FSP participants and nonparticipants

	Standard error of usual food spending [1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	1.13	1.49	0.97	0.73	1.54	0.78
250 - < 500	0.79	0.83	0.61	0.36	1.01	0.52
500 - < 750	1.05	0.60	0.90	0.28	1.09	0.38
750 - <1,000	1.92	0.71	1.10	0.26	1.19	0.36
1,000 - <1,250	--	0.74	--	0.26	1.55	0.32
1,250 - <1,500	--	0.85	--	0.29	2.77	0.31
1,500 - <1,750	--	0.92	--	0.33	--	0.34
1,750 - <2,000	--	1.10	--	0.44	--	0.36
2,000 - <2,250	--	1.26	--	0.59	--	0.39
2,250 - <2,500	--	1.67	--	0.76	--	0.44

1 Standard error of usual food spending food spending **(**2003 dollars per week) per adult male equivalent, unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Table A5: Unadj. standard errors for Table 6, self-perceived minimum required food spending for FSP participants and nonparticipants

	Standard error of self-perceived minimum required weekly food spending[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	1.92	1.78	1.32	0.94	2.63	0.90
250 - < 500	1.05	1.08	1.02	0.47	1.58	0.66
500 - < 750	1.37	0.82	1.11	0.35	1.44	0.50
750 - <1,000	2.82	0.93	1.30	0.32	1.69	0.47
1,000 - <1,250	--	0.96	--	0.31	2.55	0.38
1,250 - <1,500	--	1.11	--	0.33	3.65	0.39
1,500 - <1,750	--	1.03	--	0.39	--	0.40
1,750 - <2,000	--	1.38	--	0.49	--	0.41
2,000 - <2,250	--	1.42	--	0.68	--	0.44
2,250 - <2,500	--	1.72	--	0.94	--	0.54

1 Standard error of self-perceived minimum required weekly food spending **(**2003 dollars per week) per adult male equivalent, unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Table A6: Standard errors for Table 7, the food spending gap for Food Stamp Program participants and nonparticipants

	Standard error of minimal weekly food spending for adequate food supply[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	1.25	1.02	0.75	0.62	1.76	0.66
250 - < 500	0.65	0.62	0.66	0.31	1.03	0.40
500 - < 750	0.81	0.54	0.67	0.21	0.93	0.27
750 - <1,000	1.57	0.60	0.79	0.18	0.98	0.27
1,000 - <1,250	--	0.56	--	0.18	1.53	0.19
1,250 - <1,500	--	0.68	--	0.20	1.96	0.22
1,500 - <1,750	--	0.60	--	0.22	--	0.21
1,750 - <2,000	--	0.93	--	0.30	--	0.22
2,000 - <2,250	--	0.81	--	0.42	--	0.24
2,250 - <2,500	--	0.92	--	0.57	--	0.31

1 Standard error of mean self-perceived minimum required food spending food spending **(**2003 dollars per week) per adult male equivalent, unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Table A7: Standard errors for Table 8, percent with low or very low food security in the past 12 months

	Standard error of percent with low or very low food security in the past 12 months[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	2.3	2.4	2.4	1.7	3.4	0.8
250 - < 500	1.4	1.7	1.6	1.0	1.6	0.7
500 - < 750	1.9	1.4	2.3	0.7	1.6	0.5
750 - <1,000	3.5	1.4	3.0	0.6	1.6	0.4
1,000 - <1,250	--	1.3	--	0.5	2.2	0.3
1,250 - <1,500	--	1.4	--	0.4	3.4	0.3
1,500 - <1,750	--	1.5	--	0.4	--	0.3
1,750 - <2,000	--	1.5	--	0.4	--	0.3
2,000 - <2,250	--	1.5	--	0.5	--	0.3
2,250 - <2,500	--	1.6	--	0.5	--	0.3

1 Unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Table A8: Standard errors for Table 9, percent with very low food security in the past 12 months

	Standard error of percent with very low food security in the past 12 months[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	1.8	1.7	1.9	1.1	3.2	0.6
250 - < 500	1.0	1.0	1.2	0.6	1.5	0.5
500 - < 750	1.4	0.9	1.5	0.4	1.4	0.3
750 - <1,000	2.4	0.8	1.8	0.3	1.3	0.3
1,000 - <1,250	--	0.8	--	0.2	1.8	0.2
1,250 - <1,500	--	0.7	--	0.2	2.9	0.2
1,500 - <1,750	--	0.9	--	0.1	--	0.2
1,750 - <2,000	--	0.9	--	0.1	--	0.2
2,000 - <2,250	--	0.8	--	0.2	--	0.2
2,250 - <2,500	--	0.8	--	0.2	--	0.2

1 Unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Table A9: Standard errors for Table 10, percent with low or very low food security in the past 30 days

	Standard error of percent with low or very low food security in the past 30 days[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	2.1	2.1	2.3	1.3	3.7	0.8
250 - < 500	1.3	1.5	1.5	0.8	1.7	0.6
500 - < 750	1.7	1.2	1.8	0.5	1.7	0.4
750 - <1,000	2.9	1.1	2.4	0.4	1.5	0.4
1,000 - <1,250	--	1.1	--	0.3	2.0	0.3
1,250 - <1,500	--	1.1	--	0.2	3.3	0.2
1,500 - <1,750	--	1.2	--	0.2	--	0.2
1,750 - <2,000	--	1.2	--	0.2	--	0.2
2,000 - <2,250	--	1.1	--	0.3	--	0.2
2,250 - <2,500	--	1.2	--	0.4	--	0.2

1 Unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.

Table A10: Standard errors for Table 11, percent with very low food security in the past 30 days

	Standard error of percent with very low food security in the past 30 days[1]					
Household type	Single adult with children		Two adults with children		Adult(s) no children	
Total Income Category[2]	Participants	Non-participants	Participants	Non-participants	Participants	Non-participants
< 250	1.7	1.8	1.9	1.0	3.2	0.6
250 - < 500	1.0	1.2	1.2	0.6	1.5	0.5
500 - < 750	1.4	1.0	1.4	0.4	1.5	0.3
750 - <1,000	2.2	0.9	2.1	0.3	1.3	0.3
1,000 - <1,250	--	0.8	--	0.2	1.7	0.2
1,250 - <1,500	--	0.9	--	0.2	2.8	0.2
1,500 - <1,750	--	0.9	--	0.2	--	0.2
1,750 - <2,000	--	0.9	--	0.2	--	0.2
2,000 - <2,250	--	0.7	--	0.3	--	0.2
2,250 - <2,500	--	0.9	--	0.3	--	0.2

1 Unweighted.

2 Total income (2003 dollars per month) = (cash income per year/12 + food stamp benefits per month) per adult male equivalent.