

**The Role of Food Assistance Programs and Employment Circumstances
in Helping Households with Children Avoid Hunger**

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Abstract

Households with children in the United States are more likely to experience food insecurity than households with no children. However, households with children are *less likely* to experience hunger. This finding suggests that food insecure households with children may be drawing on personal and/or public resources to help them avoid hunger. In this paper, we use data from the April Food Security Supplements of the Current Population Survey to evaluate whether federal food assistance programs play a role in helping households with children avoid hunger. The problem of the endogeneity of a household's participation decision is addressed in two ways. First, for the Food Stamp Program, we use exogenous state-level policy variables that affect participation but not food security. Second, for households that experienced hunger during a given year, we study whether participation in any of the three largest federal food assistance programs was associated with lower levels of food insecurity during the last 30 days of that year. The paper also studies whether one personal resource, household employment circumstances, helps households with children avoid hunger. We find that by using better income data from the March Demographic Survey and by using a 10-item adult-referenced food security scale that excludes child-referenced items, we are able to control for the observed differences between households with and without children under 5 years old. For households with school-age children, only participation in the National School Lunch Program appears able to explain why they are able to avoid hunger.

The Role of Food Assistance Programs and Employment Circumstances in Helping Households with Children Avoid Hunger

1. INTRODUCTION

In 1995, the U.S. Department of Agriculture (USDA) began tracking the prevalence of food insecurity and hunger at the national level through an annual Food Security Supplement to the Current Population Survey, a monthly representative survey of around 50,000 U.S. households conducted by the Bureau of the Census for the Bureau of Labor Statistics. Eighteen questions from the supplement, known collectively as the U.S. Food Security Survey Module, form the basis of the U.S. Food Security Scale,¹ which is used to classify households into three levels of food security: food secure, food insecure without hunger, and food insecure with hunger.

The food security measure has been used by USDA to monitor the prevalence of food insecurity and hunger over time and across subgroups of the population at the national level (Hamilton et al., 1997a, b; Bickel, Carlson, and Nord, 1999; Andrews et al., 2000; Nord et al., 2002; Nord, Andrews, and Carlson, 2002, 2003). It has also been used to assess the prevalence of food insecurity by state (Nord, Jemison, and Bickel, 1999; Nord, Andrews, and Carlson, 2003) and in local areas (St. Peter and Bourdon, 1999; Seavey, 2001).

A second body of research places food insecurity and hunger in a broader evaluative framework, focusing on groups of interest to policymakers, such as mother-headed families (Polit, London, and Martinez, 2000) and food stamp leavers (Rangarajan and Gleason, 2001; Mills and Kornfeld, 2000). The measure has also been used to study a variety of issues, such as assessing whether it costs less to live in rural areas (Nord, 2000), whether food insecurity and food assistance affect child development (Dunifon

¹The module has since been included in other national surveys, including the National Health and Nutrition Examination Survey IV, the Survey of Program Dynamics, and the Early Childhood Longitudinal Study.

and Kowaleski-Jones, 2003; Stomer and Harrison, 2003), and whether public assistance helps alleviate food insecurity (Borjas, 2001; Nord, 2001).

Much of the literature combines food insecure households with and without hunger into a single category. This typically has been done to maintain sample size. Only around 3 percent of U.S. households are food insecure with hunger during a given year, and the prevalence of hunger is even lower for specific household types. Kabbani (2001) investigated the determinants of food insecurity and hunger separately and found a number of significant differences between them. Most notably, after controlling for other factors, households with children were more likely to be food insecure than households without children—a finding in line with annual prevalence estimates. However, after controlling for other factors, households with children were *less likely* to experience hunger than households without children.

In this paper, we investigate the reasons for this empirical observation, focusing on the potential role of federal food assistance programs and household employment circumstances in helping families with children avoid hunger. We primarily focus on the Food Stamp Program, but we also consider the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC) and the National School Lunch Program (NSLP).

The literature examining the effects of food assistance programs on food security is quite limited, for two reasons. First, data on household food security has only been available for a few years. Second, assessing the effects of participating in these programs is not a straightforward exercise. One cannot simply include participation in food assistance programs in a regression equation with food security as the dependent variable, because selection into these programs is an endogenous decision. The level of food insecurity affects a household's participation decision, resulting in a positive relationship that must be controlled for to assess the degree to which program participation reduces food insecurity and hunger.

Gundersen and Oliveira (2001) studied the effect of the Food Stamp Program on “food insufficiency,” a single-question measure of food deprivation that predates the food security measure.² They developed a model with simultaneous equations for Food Stamp participation and food insufficiency and used the odds of participating in the program, derived from the first equation, to control for the participation decision in the second equation. Borjas (2001) examined the extent to which welfare programs reduced food insecurity among immigrant households in the wake of welfare reform. He used changes in program eligibility rules over time and across states to estimate the effect of the decline in program participation among the immigrant community on food insecurity. Whereas Borjas found strong evidence of the link between public assistance and food security, he did not look at hunger separately. Nord (2001) studied trends in food security for low-income households that received food stamps and those that did not in order to assess the effects of the recent declines in Food Stamp participation rates on households. Nord did distinguish between food insecurity and hunger in his analysis and found that while food insecurity increased among low-income households not receiving food stamps, there was not a corresponding increase in hunger.

There is precious little completed research on the effects of other federal food assistance programs on hunger and food security. Dunifon and Kowaleski-Jones (2003) examined the influence of food insecurity and the National School Lunch Program on child development and well-being, but they did not examine how participation in NSLP affects food security. Nord and Romig (2003) examined seasonal differences in food security between spring and summer and found that they were significantly larger for households with school-age children, suggesting that the NSLP reduces the prevalence of hunger during the school year.

²USDA began including the food insufficiency question in its nationwide food consumption surveys in 1977. The question asked respondents to select one of four statements that best described the food eaten in their households: enough of the kinds of food we want to eat; enough but not always the kinds of food we want to eat; sometimes not enough to eat; often not enough to eat.

The research done on the relationship between employment and food security is also quite limited. Gundersen and Gruber (2001) included loss of earnings in their analysis of the determinants of food insufficiency. Kabbani (2001) found that food insecure households with an unemployed household head have higher odds of experiencing hunger than food insecure households with an employed head, suggesting that the latter might be using strategies to help them avoid hunger, for example by working longer hours when the need was greatest. Nord (2003) and Nord and Romig (2003) controlled for the labor force participation status of both primary and secondary earners in the household.

In this paper, we study the effect of both food assistance programs and household employment circumstances on household food security, focusing on the role these resources play in helping households with children avoid hunger. We address the problem of the endogeneity of a household's participation decision in two separate ways. First, for the Food Stamp Program, we use four exogenous state-specific policy variables that affect program participation but, we argue, not food security: the state's use of short recertification periods (of three months or less), a proxy variable indicating whether or not a state required monthly reporting, federal food stamp outreach spending by state, and the timing of a state's implementation of the electronic benefit transfer (EBT) system, a debit-type card that replaced traditional food stamp coupons in most states during the 1990s. All four policy variables are from Kabbani and Wilde (2003).

Second, for the three largest federal food assistance programs (in terms of government outlays)—the Food Stamp Program, NSLP, and WIC—we study whether participation in the program helped households that experienced some degree of hunger during the year prior to the interview escape food insecurity during the last 30 days of that year.

Section 2 describes the food security measure and reasons why an analysis of the determinants of food security might yield different parameter estimates at different levels of the scale. Section 3 describes the methodology we use to compare the determinants of hunger and food insecurity and to assess the effects of food assistance programs. Section 4 describes the data, including a detailed discussion of the

variables that we use to identify the program participation decision for the Food Stamp Program. Section 5 presents the results of our empirical analysis, and Section 6 contains our conclusions.

2. THE FOOD SECURITY MEASURE AND DIFFERENT HOUSEHOLD TYPES

The U.S. Food Security Survey Module includes a set of 18 questions that form the basis of the U.S. Food Security Scale. The 18 questions measure a common underlying construct and can be ordered in terms of degree of severity. Eight of the questions focus specifically on the food security of children in a household. Households with no children are only asked 10 questions. A type of nonlinear factor analysis, known as Rasch modeling, is used to generate a common food security scale.³ The Rasch model is meant to derive comparable values on a single scale for households with and without children (Hamilton, 2001).

The food security scale is used to create three official categories of household food security: (1) *food secure*: households show no or minimal evidence of food insecurity;⁴ (2) *food insecure without hunger*: food insecurity is evident in households' concerns and in adjustments to household food management, including reductions in diet quality, but with no or limited reductions in quantity of food intake; (3) *food insecure with hunger*: food intake of household members is reduced to an extent that implies that one or more household members are experiencing hunger due to lack of resources (Bickel et al., 2000).⁵

³The basic assumption of the scale is that the probability of affirming a question increases with the household's underlying level of food insecurity and falls as the severity of the condition measured by the particular question goes up (Hamilton et al., 1997b).

⁴USDA officially classifies households as being food secure if they give positive responses to two questions or less from the Food Security Survey Module. Several studies classify households that provide positive responses to one or two questions from the module as "marginally food secure," meaning that while they are officially classified as food secure, these households show some indication of food insecurity. In this study, we use the official definition.

⁵Food insecure with hunger was originally divided into two subcategories, food insecure with moderate hunger and food insecure with severe hunger. The latter category was used to identify households in which adults experienced extensive reductions in food intake and/or children experienced reductions in food intake to an extent

The food security scale represents a continuum that begins with households worrying about their food budget and food supply, then progresses to households reducing food quality, reducing the food intake of adults, and finally reducing the food intake of children. However, even though the order of positive responses to questions in the food security module is similar for different types of households, the rate at which positive responses declines with the severity of the questions may be quite different across household types. In other words, the distribution of responses may be quite different (Kabbani, 2001). This issue has little implication for the validity of the food security measure in terms of monitoring the prevalence of hunger and food security over time and across subgroups of the population. However, the issue is potentially quite important for researchers studying factors affecting food insecurity and hunger across household types.

Preferences and Social/Economic Incentives. Households may have different preferences or face different social/economic incentives, which may lead to differences in what they are willing to do to avoid hunger. For example, for single people, skipping a meal for lack of money may not be much different than cutting back on food or changing their diet. For families with children, however, providing food, even smaller quantities or less nutritious meals, may be more preferable than having a child go hungry. Different preferences and incentives can be expected to lead to different behaviors that increase or decrease the chances of experiencing hunger.

Person and Household-Level Resources. Households may have different resources that they can draw on when faced with food insecurity. Married couples with children and single parents both have an incentive to prevent the effects of food insecurity from reaching their children, but married couples have an additional resource. Two adults can more easily address immediate needs by keeping one person in the

that implies that they experienced hunger. Subsequent research demonstrated that the “severe hunger” category did not reliably identify households with hunger among children (Nord and Bickel, 2001). A separate scale comprising the eight child-referenced items is currently being used to describe the food security situation of children in a household.

labor force or by having both adults work. Employed heads of households facing food insecurity may be able to work additional hours when the need is high, whereas unemployed heads have fewer immediate options for avoiding hunger.

Public and Community-Level Resources. Different households have access to different levels of public resources. The federal government annually spends over \$30 billion on food assistance programs.⁶ Households with children are able to receive food stamps indefinitely as long as they meet program eligibility requirements. On the other hand, able-bodied adults without dependents (ABAWDs) are limited to 3 months of benefits in any 36-month period if they work less than 20 hours per week—unless they work in certain high-unemployment areas. WIC helps households with pregnant women and children under 5 years old. The School Breakfast and National School Lunch Programs are available to children in school, and by implication to families with school-age children. So, while households with children have higher odds of being food insecure, they have access to public resources that can help them avoid experiencing hunger.

Another possible explanation for the observed differences between households with and without children is that, as noted above, the food security scale for households with children is based on 18 survey items, whereas the food security scale for households without children is based on only 10 items—the difference being 8 items that pertain specifically to the food security of children in a household. Also as noted above, a Rasch model is used to combine these two sets of questions into a single scale. In Rasch modeling, if all respondents are given exactly the same set of questions, the food security scale value depends solely on the number of affirmative responses. However, if different respondents answer different sets of questions, the scale values depend on the severity of the questions answered (Frongillo, 2001; Wilde, 2004). Indeed, the questions asked only of households with children are disproportionately

⁶The federal government spent \$38.1 billion in 1996, \$32.6 billion in 2000, and \$37.8 billion in 2002 (Oliveira, 2002, 2003).

more severe, as a group, than the 10 questions common across all households (Hamilton et al., 1997b; Dutta, Gunderson, and Pattanaik, 2002). Recent studies have suggested that child hunger covers a separate *dimension* that is not adequately captured simply by looking at the standard 18-item measure (Nord and Bickel, 2002; Wilde, 2004), and a number of papers use a modified measure of food security, composed of only the 10 adult-referenced items common to households with and without children (Kabbani, 2001; Nord, 2003; Nord and Romig, 2003).

3. EMPIRICAL METHODOLOGY

We use regression analysis to identify the determinants of hunger and food insecurity, to study the differences between them, and to evaluate the potential role of food assistance programs and household employment circumstances in explaining observed differences with regard to households with and without children. In the course of our analysis, we will also shed new light on the role that food assistance programs play in alleviating hunger and food insecurity.

Identifying the Determinants of Hunger and Food Security

The USDA food security measure (S) classifies households into three mutually exclusive types: food secure (S=0), food insecure without hunger (S=1), and food insecure with hunger (S=2).

The first part of our empirical analysis uses multinomial logistic regression to compare the probability of two of the outcomes to the probability of the third (omitted) outcome.⁷ Using food secure (S=0) as the omitted category, the model estimates the following two equations:

⁷The food security measure is an ordering, with severity increasing from households that are food secure to those that are food insecure with hunger. Using an ordered logit, however, would have involved estimating specific cut points. Essentially, the estimated parameters from the “food secure / food insecure with hunger” comparison would have represented a markup of the estimated parameters from the “food secure / food insecure without hunger” comparison. Since we expect the determinants in our model to affect hunger and food insecurity status differently, we use the less restrictive multinomial logit model.

$$(1) \quad \ln [\text{Prob}(S_i=1) / \text{Prob}(S_i=0)] = \alpha_0 + \alpha_1 X_i$$

$$(2) \quad \ln [\text{Prob}(S_i=2) / \text{Prob}(S_i=0)] = \beta_0 + \beta_1 X_i$$

where equation (1) compares the probability of being food insecure without hunger to the probability of being food secure and equation (2) compares the probability of being food insecure with hunger to the probability of being food secure. X_i is a vector of household characteristics. To control for potential differences in scaling between households with and without children, we construct a 10-item adult-referenced scale for all households, applying the methodology outlined in Bickel et al. (2000). This construction makes the scale less sensitive overall, but it ensures that the same construct is being used for households with and without children. In the early stages of the analysis we use both constructs, but we later settle on using only the adult-referenced measure.

The Effect of the Food Stamp Program Using Two-Stage Regression Analysis

The second part of the empirical analysis seeks to control for participation in the Food Stamp Program, the nation's largest food assistance program. Our goal is to estimate the multinomial logistic model given by equations (3) and (4):

$$(3) \quad \ln [\text{Prob}(S_i=1) / \text{Prob}(S_i=0)] = \alpha_0 + \alpha_1 X_i + \alpha_2 \text{FSP}_i$$

$$(4) \quad \ln [\text{Prob}(S_i=2) / \text{Prob}(S_i=0)] = \beta_0 + \beta_1 X_i + \beta_2 \text{FSP}_i$$

where FSP indicates whether a particular household received food stamps during a given period. The problem with estimating equations (3) and (4) is that participating in the Food Stamp Program is endogenous in our model. Households that are food insecure are more likely to participate in the program, as given by equation (5), and therefore standard regression analysis may well find a positive association between program participation and food insecurity.

$$(5) \quad \ln [\text{Prob}(\text{FSP}_i=1) / \text{Prob}(\text{FSP}_i=0)] = \gamma_0 + \gamma_1 X_i + \gamma_2 S_i$$

Following Gundersen and Oliveira (2001), we address the problem of the endogeneity of the program participation decision by estimating equations (3) and (4) in two stages. The first stage involves estimating a reduced form of a household's Food Stamp Program participation decision. This is done by including all predetermined variables in the system of simultaneous equations in determining Food Stamp participation. To identify the food security model, however, we need to include at least one variable in the participation equation that (1) is correlated with the Food Stamp program participation decision and (2) is not correlated with the error term in the food security model. In other words, the variables' only association with food insecurity should be through their association with Food Stamp participation.

The reduced form Food Stamp participation equation can be estimated using standard logistic regression, and the parameters of the model can be used to *predict* program participation (Gundersen and Oliveira, 2001). However, Angrist and Krueger (2001) note that using a linear probability model in the first stage reduces the risk of generating inconsistent estimates in the second stage in the event that the first stage model is misspecified.⁸ In this paper, we use both methods to predict program participation and then test whether the logit model is misspecified.

The second stage involves including the predicted program participation values from the first stage into the food security equation, equations (3) and (4), and using multinomial logistic regression to estimate the model. The coefficient on Food Stamp participation is still biased, but it is now consistent, and the bias diminishes as the sample size increases. Using the Current Population Survey (CPS) provides us with fairly large sample sizes, but we note that even samples that appear to be large can suffer from finite sample bias (Bond, Jager, and Baker, 1995).

⁸When a logit model is used in the first stage, it must be exactly specified to yield consistent estimates.

The key to this estimation procedure is to find at least one exogenous variable that is highly correlated with the program participation decision, but not with the error term in the food security equation. Gundersen and Oliveira (2001) make use of a question that measures perceived stigma associated with the use of food stamps. They use data from the Survey of Income and Program Participation, which includes a question: “Do you/would you use food stamps at a store where you are not likely known?” Gundersen and Oliveira argue that there is no a priori reason to expect stigma to have a direct effect on food insufficiency. But stigma may have an effect on the decision to use food stamps. There is no comparable variable on stigma in the Food Security Supplement of the CPS. In fact, we have not been able to identify any variable in our data that could reasonably be correlated with Food Stamp participation but not directly correlated with food insecurity. Instead, we use four state-level policy variables that we believe are associated with Food Stamp participation, but not with the food security status of households living in the state: the use of short recertification periods (of 3 months or less), a proxy variable indicating that a state used monthly reporting, the timing of a state’s implementation of the EBT system, and federal food stamp outreach spending (see Kabbani and Wilde, 2003). We discuss these variables in the data section below.

The Effect of Food Assistance Programs on Changes in Food Security Status during the Year

In addition to the Food Stamp Program, we are interested in assessing whether other major food assistance programs targeting households with children, such as WIC and NSLP, can help explain why households with children are more likely to avoid hunger than households with no children. However, following the methodology outlined above would require us to identify instruments that affect

participation in these programs but do not otherwise affect food security. With no such instruments in hand, we need to identify an alternative estimation strategy.⁹

Considering the endogeneity of the program participation decision more closely, we notice that the problem arises because we are attempting to measure program effects at a single point in time. In reality, the relationship between food security and program participation is a dynamic one. A household at risk of hunger or food insecurity decides to participate in a food assistance program (positive relationship). Participation in the program then, presumably, reduces the household's risk of hunger and food insecurity (negative relationship). The CPS does have a limited longitudinal component that allows about half the interviewed households in a particular month to be matched to the same month a year later. However, the food security data in the CPS do not allow us to make use of this longitudinal component because the Food Security Surveys for which data are currently available were conducted in different months every year, in such a way that no overlap occurred.¹⁰

The CPS Food Security Supplement, however, does allow us to identify one longitudinal dimension of food security. The survey asks households a set of questions about their food security status during the previous 12 months, which are used to construct the USDA Food Security Scale, and a smaller set of questions about their food security status during the previous 30 days. Nord (2002) used the latter set of questions to construct a 30-day food security scale that is similar to the 12-month scale but measures more severe levels of food insecurity.

We use the 30-day food security scale to study factors associated with households that experienced hunger during the course of a year but escaped food insecurity during the last 30 days of that year. In other words, *for households that experienced hunger during the year*, we estimate equation (6):

⁹This is not to say that instruments cannot be found. For example, Chatterji et al. (2002) use a number of policy instruments to assess the relationship between WIC participation and the initiation and duration of breastfeeding, some of which appear to hold promise for studying the relationship between WIC and food security as well.

¹⁰Beginning in December 2001, the data are collected in December of every year.

$$(6) \quad \ln[\text{Prob}(S30_i=1)/\text{Prob}(S30_i=0)] = \alpha_0 + \alpha_1 X_i + \alpha_2 \text{FAP}_i$$

where $S30=1$ indicates that a household was food insecure during the 30 days leading up the interview and $S30=0$ indicates that the household was food secure during the 30 days before the interview. FAP refers to household participation in one of three federal food assistance programs during the 30 days before the interview: the Food Stamp Program, WIC, and the NSLP.¹¹

By focusing on whether households that experienced hunger during the year escape *food insecurity* (rather than hunger) during the last 30 days of the year, we raise the bar needed to “escape” hunger. This allows us to focus on households that really were able to achieve a significant improvement in their food security status during the course of the year. In addition, the questions used to construct the 30-day food security scale identify more severe conditions than the questions used to construct the 12-month scale. So escaping the 30-day food insecurity threshold is not as high a mark as escaping the 12-month threshold.

4. DATA

This paper uses data from the April 1995, April 1997, April 1999, and April 2001 Food Security Supplements of the Current Population Survey. The CPS is a monthly nationally representative survey of around 50,000 U.S. households conducted by the Bureau of the Census. Questions are asked at the household level, family level, and person level. For example, some variables, such as age, are obtained for

¹¹Participation in food assistance programs is undercounted in the CPS. This is especially the case for WIC, where underreporting in the Food Security Supplement has been estimated at 30 percent (Bitler, Currie, and Scholz, 2002). One reason for the underreporting is that households are asked only about program participation if their incomes fall below 185 percent of the poverty threshold or if they respond positively to specific screening questions. That said, there is evidence that the undercount may be mostly random (Bitler, Currie, and Scholz, 2002), which gives us some confidence in the validity of our analysis.

all persons living in a household. The questions in the Food Security Survey Module are asked at the household level.

The supplement was first administered in April 1995 and annually thereafter, in September 1996, April 1997, August 1998, April 1999, September 2000, April 2001, December 2001, and thereafter in December of every year.¹² The supplement contains the Food Security Survey Module, which is used to construct the Food Security Scale. The supplement also contains questions about food expenditures, strategies for coping with food insecurity (such as use of food pantries and soup kitchens), and participation in a number of national food assistance programs, including the Food Stamp Program, WIC, and NSLP.

Our research only uses data from the April supplements for two reasons. First, using the April supplements allows us to merge three-fourths of the households with data from the March Demographic Survey, providing us with a richer dataset that we can use to estimate household eligibility for, and participation in, food assistance programs. Second, food security prevalence estimates exhibit significant seasonal variation between the spring and fall/summer supplements, with higher food insecurity registered during the months of August and September.¹³ By limiting our analysis to the April supplements we avoid potential problems from this seasonal effect.¹⁴

¹²Households in the CPS are administered a questionnaire for four consecutive months one year and four consecutive months a year after their first interview. This construct (on 4 months, off 8 months, on 4 months) allows researchers to analyze changes in household circumstances between one year and the next. Unfortunately, because the food security supplement has alternated between spring and fall, none of the supplements with data currently available allow a comparison of household food security status over time. The situation will improve with the release of the December 2002 data.

¹³This seasonal variation may partly be due to the availability of two major food assistance programs during the school year, the effects of which may be better reflected in the April supplement: the National School Lunch Program and the School Breakfast Program. Nord and Romig (2003) make use of this seasonal variation to examine the effect of the National School Lunch Program on the prevalence of hunger among school-age children.

¹⁴We also exclude a number of survey rotations that include experimental questions: rotation groups 4 and 8 in 1997 and rotation group 8 in 1999 and 2001. We also exclude rotation 8 in 1995.

All the Food Security Supplements of the CPS contain constructed household food security scales for the 12-month period before the survey. Data for the 30-day scale for April 1999 are available from the Web site of USDA's Economic Research Service (ERS). Using the 1999 data as a guide, and following the methodology set forth in Nord (2002), we constructed 30-day food security scales for April 1995, 1997, and 2001. We also constructed a modified 12-month scale using only the 10 adult-referenced questions in the survey. This provided us with a food security measure that was developed from a common set of questions for households with and without children. Throughout the analysis we will use both the standard USDA 12-month food security measure and our modified 10-item adult-referenced measure as key dependent variables. The 30-day measure is used in the final set of regressions as discussed in section 3.¹⁵

The Basic Monthly CPS survey contains a good deal of information about the households surveyed, including demographic characteristics of household members, geographic information, and information on labor force participation. We use these data to control for a number of demographic characteristics of the household head, including age, race, gender, level of educational attainment, and employment. We also include variables indicating whether the household head was an immigrant, disabled, or over 65 years old. The household head used in our analysis differs from the "Reference Person" or "Householder" identified in the CPS. The Reference Person is the person identified by the survey Respondent as the one who owns or rents the house or apartment. In the case of a husband and wife jointly renting or owning a property, the CPS does not distinguish which of the two is actually the head of household. For married couple households, we identified the household head by first trying to identify which of the two was the owner or renter. If not determinable, we used labor force participation

¹⁵We could have used the 30-day Food Stamp Program participation variable available in the April supplement together with the 30-day food security measure in the multinomial logistic regression analysis, but it would have strained the focus of our current analysis. The distinction made between food insecurity and hunger in the 30-day food security measure is too weak to obtain significant differences between households with and without children.

and number of usual hours worked. If both spouses had the same labor force participation status, we considered the level of education. For the small number of remaining households, the Reference Person was selected as the household head. The household-level variables in our analysis include household composition, geographic region, homeownership, and income.

For much of our analysis, we use data that have been merged with the March supplement (the March Demographic Survey) for the same year. In such cases, we use income estimates from the March supplement because they are far more precise than the income ranges included in the April supplement. Food assistance program participation during the month prior to the interview (for the Food Stamp Program, WIC, and NSLP) comes from the April supplement. Food assistance program participation during the previous year (for the Food Stamp Program and NSLP) comes from the March supplement.

We include a number of employment characteristics of the household head and other members of the household. These employment variables merit further discussion.

Employment Status of Household Head. We include variables indicating whether the head of household was employed, unemployed, or not in the labor force at the time of the survey. We use these variables in most of the empirical specifications in our analysis, with “household head unemployed” as the omitted category.

Employment Status of Other Household Members. In some empirical specifications, we include variables indicating whether all, some, or no other adult household members were employed at the time of the survey. The adults included in constructing these variables were the spouse of the household head and relative adults and partners of the household head over age 18.

Household Averages for Selected Employment Variables. In some specifications, we also include variables indicating the average number of jobs held by adult household members, the average number of usual hours worked by adult household members, and the average unemployment duration of adult household members. We restrict the adults used in constructing these variables to the household head, the spouse, and other adult relatives or partners of the household head over age 18.

We also seek to control for the effects of participating in the Food Stamp Program. The methodology we use, described in Section 3, requires identifying at least one variable that is associated with program participation, but not (directly) with food security. We use four state-level policy variables in this context. The variables are from Kabbani and Wilde (2003).

Short (1–3 Month) Recertification Periods

Federal rules require participants in the Food Stamp Program to be recertified for the program *at least* once a year, or once every two years for households with an elderly or disabled person. Beginning in the early 1990s, many states began increasing their use of short recertification periods of three months or less, especially for households with working participants. States developed these policies (and others) in an effort to reduce their food stamp error rates.¹⁶ During the period of analysis (1995–2001), states with error rates higher than the national average faced financial penalties and those with low error rates received financial bonuses (Rosenbaum, 2000; Kabbani and Wilde, 2003).¹⁷

A growing body of evidence suggests that the use of short recertification periods places an added burden on participating households. The recertification process typically involves nearly 2.5 hours of client time, including at least one trip to the Food Stamp Program office (Ponza et al. 1999). Empirical studies have found that recertification policy is associated with lower program participation (Currie and Grogger, 2001; Kornfeld, 2002; Kabbani and Wilde, 2003).

We do not believe that there is a direct, systematic association between the food security status of households and a state's use of short recertification periods. The food security survey was initially developed because the federal government lacked basic information about the prevalence of hunger and food insecurity in the U.S. (President's Task Force on Food Assistance, 1984). The first USDA publication to provide food security and hunger prevalence estimates by state was released in September

¹⁶Error rates are determined through an annual review of approximately 50,000 food stamp cases. An error arises when an ineligible household is allowed to participate in the program, when a new participant household receives the wrong benefit amount, or when a continuing household receives the wrong benefit amount, either because the household failed to report a change in income or other circumstance that should have been reported or because the program agency failed to respond to the change within a given period of time. The dollar amounts of payments to ineligible households and overpayments and underpayments to eligible households are summed to arrive at the state's combined error amount, which is then divided by the state's total food stamp benefit issuance to arrive at the state's reported error rate.

¹⁷The 2001 Farm Bill made significant changes in the Food Stamp Program quality control system, including the way in which financial penalties and bonuses are determined.

1999 (Nord, Jemison, and Bickel, 1999), after three of the four years covered in our analysis. Thus, the overall prevalence of hunger and food insecurity in a state was, for the most part, not part of the information set of states making decisions about the use of short recertification periods.¹⁸ The states that were pursuing this policy were mostly those seeking to lower their error rates in order to receive financial bonuses or avoid financial penalties by the federal government.

The short recertification variable used in this analysis was constructed from public use Food Stamp Quality Control (QC) microdata from the Food and Nutrition Service (FNS), the USDA agency that administers the Food Stamp Program, for the 50 states and the District of Columbia for years 1995, 1997, 1999, and 2001. The data are by fiscal year, which accords well with our survey data. The months of March and April, for which we have data on Food Stamp Program participation, represent the two middle months of a fiscal year. The variable that we use in the analysis, the frequency of short recertification periods by state, indicates the share of a state's caseload that is assigned a recertification period of three months or less. The variable is constructed separately for households with and without an adult household member in the labor force at the time of the Quality Control survey. The frequency of short recertification periods by state, by year, and by workforce status of household members is then matched to households with corresponding characteristics in the April CPS.

Proxy Variable for Monthly Reporting

Food Stamp Program participants must report changes in their circumstances that could affect their eligibility for the program or their benefit levels. During most of the period of analysis, states could elect to use one of two reporting options: monthly reporting or change reporting. States with monthly reporting require participating households to submit monthly reports on their circumstances, even if no

¹⁸We also conducted the analysis omitting the 2001 data, thereby restricting our focus to years in which state officials did not have information about state levels of hunger and food security. We obtained similar results.

significant changes occurred that could affect their eligibility or benefit levels. States with change reporting require participant households to file reports only when specific changes in their circumstances occur, such as changes in the employment status of household members or changes in earnings above certain levels. States could obtain a waiver to implement other reporting systems. Other reporting options also became available by 2000, including quarterly reporting and semi-annual reporting (Rosenbaum, 2000). Having to report household circumstances on a monthly basis is considered more of a burden than other reporting options. We therefore expect this variable to have a negative association with Food Stamp Program participation. There is, however, no reason to expect this variable to be directly associated with household food security, for the same reasons as states' use of short recertification periods discussed above.

Information on state reporting policies is not readily available for most years in our study (with the exception of 2001). However, Parke Wilde (Kabbani and Wilde, 2003) found that states using monthly reporting typically assign long recertification periods to working households. This pattern suggested a proxy variable for monthly reporting policies: a binary indicator variable for states in which over 75 percent of working households receive recertification periods of 12 months or longer. The efficiency of this variable was verified for fiscal year 2001.

Federal Outreach Spending

The Food Stamp Act of 1977 provided an opportunity for state agencies that administer the Food Stamp Program to receive federal matching funds for outreach activities to inform low-income households about the program and its benefits, eligibility requirements, and application procedures. The outreach activities must be informational only. State agencies are not allowed to use the federal funds to recruit Food Stamp participants. State agencies are eligible to receive matching federal funds after submitting a proposal and obtaining approval from FNS. Federal outreach expenditures increased in the second half of the 1990s. Data on federal outreach expenditures were acquired directly from FNS. The outreach variable is defined as dollars of state outreach expenditures per person in the state population.

Receiving federal outreach spending requires the initiative of a state, and there is no indication that states applied for funding based on the food security status of their populations. Again, prevalence estimates of food insecurity and hunger by state were not available until late 1999.

Electronic Benefit Transfer (EBT) Implementation

Finally, we include a variable that reflects the timing of the implementation of the Electronic Benefit Transfer (EBT) system in a state, a debit-type card that replaced traditional food stamp coupons in most States during the 1990s. Data on EBT implementation were also obtained from FNS. The EBT system may help encourage program participation by reducing stigma in the use of food stamps, but it may also make it more difficult for persons unfamiliar with debit cards to access benefits (Figlio, Gundersen, and Ziliak, 2000; Currie and Grogger, 2001; Kornfeld, 2002). As Gundersen and Oliveira (2001) point out with respect to their stigma variable, there is no a priori reason to expect EBT implementation to affect food security except through its effect on Food Stamp Program participation.

Tables 1 and 2 present the means and standard deviations of the variables that we use in our analysis. Table 1 describes households from the April supplement only. Table 2 describes households that were successfully merged with observations from the March survey. Both tables are limited to households with incomes of less than 185 percent of the poverty threshold. We excluded households with primary adult members in the armed forces and households with complex living arrangements (less than 1 percent of the sample) in order to facilitate comparisons across household types. We also excluded households with household heads between the ages of 16 and 24 who were full-time students (1.1 percent of the sample). Full time students are not allowed to participate in the Food Stamp Program.

In our first set of regressions, which identify the determinants of hunger and food insecurity, we conduct the analysis for all households in the April CPS and for households with incomes less than 185 percent of the poverty threshold. When estimating the effect of the Food Stamp Program, we limit our analysis to households with incomes less than 185 percent of the poverty threshold. Food Stamp Program rules require that households without an elderly or disabled person have gross cash income from all

TABLE 1
Descriptive Statistics, Using April Data for Low-Income Households (Income < 185% Poverty)

<i>Observations</i> Variables	Year							
	1995		1997		1999		2001	
	n= 12,176		n= 9,371		n=9,341		n= 6,710	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Food Security (previous 12 months)	0.249	0.432	0.222	0.416	0.245	0.430	0.265	0.441
Hunger (previous 12 months)	0.097	0.296	0.080	0.271	0.080	0.271	0.093	0.290
Food Stamp Participation (past 30 days)	0.228	0.420	0.186	0.389	0.167	0.373	0.173	0.378
WIC Participation (past 30 days)	0.095	0.293	0.087	0.281	0.092	0.288	0.097	0.296
National School Lunch Program (30 days)	0.212	0.409	0.208	0.406	0.212	0.409	0.211	0.408
Age	48.10	19.43	49.35	19.70	49.68	19.79	49.01	19.69
White Non-Hispanic	0.635	0.481	0.606	0.489	0.595	0.491	0.589	0.492
Hispanic	0.139	0.346	0.152	0.359	0.165	0.371	0.164	0.370
Black Non-Hispanic	0.197	0.398	0.202	0.401	0.200	0.400	0.202	0.402
Other Non-Hispanic	0.028	0.166	0.041	0.198	0.040	0.196	0.045	0.207
No High School Degree	0.370	0.483	0.363	0.481	0.351	0.477	0.356	0.479
High School Degree	0.346	0.476	0.361	0.480	0.359	0.480	0.359	0.480
Some College	0.161	0.368	0.151	0.358	0.163	0.369	0.150	0.357
Associate Degree	0.049	0.216	0.048	0.214	0.048	0.214	0.059	0.236
College Degree	0.073	0.260	0.078	0.268	0.080	0.271	0.076	0.265
Children under 5 Years Old Present	0.233	0.423	0.208	0.406	0.198	0.399	0.210	0.407
Children 5–18 Years Old Present	0.373	0.484	0.357	0.479	0.353	0.478	0.374	0.484
Households with No Children	0.551	0.497	0.579	0.494	0.588	0.492	0.569	0.495
Married Head of Household	0.375	0.484	0.349	0.477	0.353	0.478	0.338	0.473
Single Head of HH - Multiple Adults	0.135	0.342	0.145	0.352	0.144	0.351	0.157	0.364
Single Head of HH - No Other Adults	0.490	0.500	0.506	0.500	0.503	0.500	0.505	0.500
Own Home	0.455	0.498	0.462	0.499	0.458	0.498	0.443	0.497
Northeast	0.167	0.373	0.171	0.377	0.171	0.376	0.168	0.374
Midwest	0.222	0.416	0.209	0.407	0.210	0.407	0.205	0.404
South	0.403	0.490	0.405	0.491	0.400	0.490	0.407	0.491
West	0.208	0.406	0.214	0.410	0.219	0.414	0.220	0.414

(table continues)

TABLE 1, continued

<i>Observations</i> Variables	Year							
	1995		1997		1999		2001	
	n= 12,176		n= 9,371		n=9,341		n= 6,710	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Central City	0.287	0.453	0.303	0.460	0.305	0.461	0.293	0.455
Non-metro	0.452	0.498	0.405	0.491	0.408	0.491	0.414	0.493
Metro - Not Central City	0.261	0.439	0.292	0.455	0.287	0.452	0.293	0.455
Income < 50% Poverty	0.186	0.389	0.186	0.389	0.158	0.365	0.145	0.352
50% <= Income <100%	0.288	0.453	0.255	0.436	0.247	0.431	0.298	0.458
100% <= Income <130%	0.185	0.389	0.193	0.394	0.222	0.415	0.219	0.413
130% <= Income <185%	0.341	0.474	0.366	0.482	0.373	0.484	0.338	0.473
Employed Head of HH	0.501	0.500	0.492	0.500	0.493	0.500	0.493	0.500
Unemployed Head of HH	0.054	0.227	0.048	0.215	0.043	0.203	0.044	0.206
Head of HH Not in Labor Force	0.444	0.497	0.460	0.498	0.464	0.499	0.462	0.499
All Other Relatives in HH Employed	0.200	0.400	0.180	0.384	0.187	0.390	0.192	0.394
Some Other Relatives in HH Employed	0.056	0.230	0.057	0.232	0.065	0.246	0.062	0.242
No Other Relatives in HH Employed	0.744	0.436	0.763	0.426	0.748	0.434	0.745	0.436
Average Number of Jobs	0.490	0.503	0.474	0.494	0.483	0.497	0.475	0.483
Average Usual Hours Worked	16.89	17.80	16.51	17.65	16.57	17.37	16.72	17.40
Average Unemployment Duration	1.205	6.536	1.067	6.128	0.748	5.106	0.871	5.317
Immigrant Head of HH	0.092	0.288	0.102	0.303	0.103	0.305	0.110	0.313
Female Head of HH	0.449	0.497	0.455	0.498	0.467	0.499	0.468	0.499
Disabled Head of HH	0.104	0.305	0.101	0.301	0.115	0.319	0.131	0.337
Elder Head of HH	0.255	0.436	0.290	0.454	0.286	0.452	0.265	0.441
Elder Present in Household	0.274	0.446	0.313	0.464	0.314	0.464	0.289	0.453
Fed Food Stamp Prog Outreach Spending	0.010	0.046	0.007	0.041	0.007	0.031	0.013	0.043
Use of Short Recertification Periods	0.103	0.159	0.183	0.244	0.257	0.282	0.251	0.274
Proxy for Monthly Reporting	0.370	0.483	0.366	0.482	0.288	0.453	0.314	0.464
EBT Implementation	0.013	0.110	0.137	0.337	0.518	0.479	0.732	0.420

TABLE 2
Descriptive Statistics, Using March/April Merged Data for Low-Income Households (Income < 185% Poverty)

<i>Observations</i> Variables	Year							
	1995		1997		1999		2001	
	n= 7,436		n=5,469		n=6,224		n=5,504	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
Food Security (previous 12 months)	0.229	0.420	0.208	0.406	0.225	0.418	0.225	0.417
Hunger (previous 12 months)	0.092	0.290	0.074	0.261	0.078	0.268	0.078	0.268
Adult Food Security (previous 12 months)	0.223	0.416	0.195	0.396	0.221	0.415	0.218	0.413
Adult Hunger (previous 12 months)	0.092	0.289	0.078	0.268	0.076	0.265	0.079	0.270
Food Stamp Participation (past year)	0.246	0.405	0.234	0.402	0.188	0.372	0.170	0.353
National School Lunch Program (past year)	0.253	0.435	0.254	0.435	0.244	0.429	0.217	0.413
Age	51.06	20.03	51.46	19.85	51.72	20.00	51.90	19.86
White Non-Hispanic	0.659	0.474	0.615	0.487	0.609	0.488	0.617	0.486
Hispanic	0.128	0.334	0.149	0.356	0.159	0.366	0.145	0.352
Black Non-Hispanic	0.189	0.391	0.199	0.400	0.197	0.398	0.200	0.400
Other Non-Hispanic	0.025	0.155	0.036	0.187	0.034	0.182	0.038	0.191
No High School Degree	0.376	0.484	0.373	0.484	0.358	0.480	0.340	0.474
High School Degree	0.350	0.477	0.356	0.479	0.355	0.479	0.360	0.480
Some College	0.150	0.357	0.141	0.348	0.153	0.360	0.157	0.364
Associate Degree	0.047	0.212	0.047	0.212	0.052	0.221	0.056	0.230
College Degree	0.077	0.266	0.083	0.276	0.082	0.275	0.087	0.282
Children under 5 Years Old Present	0.211	0.408	0.203	0.402	0.193	0.394	0.174	0.379
Children 5–18 Years Old Present	0.353	0.478	0.345	0.475	0.337	0.473	0.322	0.467
Households with No Children	0.586	0.493	0.598	0.490	0.609	0.488	0.633	0.482
Married Head of Household	0.359	0.480	0.328	0.470	0.328	0.470	0.319	0.466
Single Head of HH - Multiple Adults	0.114	0.318	0.123	0.329	0.115	0.319	0.131	0.338
Single Head of HH - No Other Adults	0.527	0.499	0.548	0.498	0.557	0.497	0.549	0.498
Own Home	0.490	0.500	0.478	0.500	0.477	0.500	0.495	0.500
Northeast	0.173	0.378	0.186	0.389	0.188	0.391	0.183	0.387
Midwest	0.225	0.418	0.204	0.403	0.210	0.407	0.197	0.398

(table continues)

TABLE 2, continued

<i>Observations</i> Variables	Year							
	1995 n= 7,436		1997 n=5,469		1999 n=6,224		2001 n=5,504	
	Mean	S.D.	Mean	S.D.	Mean	S.D.	Mean	S.D.
South	0.400	0.490	0.403	0.490	0.390	0.488	0.418	0.493
West	0.202	0.402	0.207	0.405	0.212	0.409	0.202	0.401
Central City	0.286	0.452	0.313	0.464	0.311	0.463	0.290	0.454
Non-metro	0.449	0.497	0.393	0.488	0.394	0.489	0.395	0.489
Metro - Not Central City	0.266	0.442	0.295	0.456	0.295	0.456	0.315	0.464
Income < 50% Poverty	0.147	0.355	0.137	0.344	0.136	0.343	0.127	0.333
50% <= Income <100%	0.285	0.451	0.279	0.449	0.277	0.448	0.268	0.443
100% <= Income <130%	0.194	0.396	0.206	0.404	0.200	0.400	0.219	0.414
130% <= Income <185%	0.373	0.484	0.378	0.485	0.386	0.487	0.386	0.487
Employed Head of HH	0.437	0.496	0.434	0.496	0.448	0.497	0.425	0.494
Unemployed Head of HH	0.050	0.217	0.044	0.206	0.036	0.187	0.034	0.181
Some Other Relatives in HH Employed	0.042	0.200	0.047	0.211	0.049	0.215	0.045	0.208
No Other Relatives in HH Employed	0.808	0.394	0.811	0.392	0.807	0.394	0.808	0.394
Average Number of Jobs	0.412	0.483	0.412	0.479	0.425	0.481	0.406	0.474
Average Usual Hours Worked	14.15	17.20	14.27	16.99	14.97	17.42	14.48	17.29
Average Unemployment Duration	1.109	6.258	0.892	5.176	0.670	4.803	0.713	5.030
Immigrant Head of HH	0.088	0.283	0.102	0.303	0.096	0.295	0.094	0.292
Female Head of HH	0.478	0.500	0.492	0.500	0.505	0.500	0.482	0.500
Disabled Head of HH	0.110	0.313	0.112	0.315	0.118	0.323	0.138	0.345
Elder Head of HH	0.311	0.463	0.322	0.467	0.320	0.466	0.316	0.465
Elder Present in Household	0.328	0.470	0.342	0.474	0.339	0.474	0.336	0.473
Fed Food Stamp Prog Outreach Spending	0.010	0.046	0.007	0.039	0.007	0.031	0.011	0.036
Use of Short Recertification Periods	0.096	0.151	0.169	0.233	0.240	0.272	0.231	0.262
Proxy for Monthly Reporting	0.364	0.481	0.364	0.481	0.281	0.450	0.302	0.459
EBT Implementation	0.015	0.117	0.132	0.332	0.500	0.478	0.737	0.413

sources under 130 percent of federal poverty guidelines, and all households must have net income, after certain allowable deductions, less than 100 percent of the poverty guidelines. By setting the income cutoff at 185 percent of the poverty threshold, we follow the lead of other studies that attempt to limit their analysis to income-eligible households without being too restrictive (McKernan and Ratcliffe, 2003). WIC eligibility rules require households to have incomes less than 185 percent of the poverty guidelines. NSLP rules require households to have incomes less than 185 percent of the poverty guidelines to qualify for reduced-price meals and to have incomes less than 130 percent of the poverty guidelines to qualify for free meals. Here again, to limit our analysis to income-eligible households without being too restrictive, the final set of regressions, which include WIC and NSLP participation, focus on households with incomes less than 250 percent of the poverty threshold. Although we also have data on the School Breakfast Program, practically all households that were enrolled in the program were also enrolled in the NSLP, making the variables highly collinear. We therefore limit our analysis to the NSLP, which has much wider coverage.

5. RESULTS

Differences between the Determinants of Food Insecurity and Hunger

We begin by using multinomial logistic regression analysis to estimate equations (1) and (2). Table 3 presents the results of the analysis for households in the April supplement only and compares the parameter estimates for food insecurity and hunger. The results in Table 3 are presented for two groups. The first three columns are results for all households in the CPS. The second three columns are results for households with incomes under 185 percent of the federal poverty threshold. The first column in each group presents the coefficients of comparing households that are food insecure without hunger to households that are food secure. The second column of each group presents the coefficients of comparing households that are food insecure *with* hunger to households that are food secure. The third column in each group uses a Wald test to test for the significance of the difference of the coefficients between the

TABLE 3
Multinomial Logistic Regression (Food Secure=0), Using CPS April Data (1995, 1997, 1999, 2001)

Variables	All Households (n= 121,703)			Low-Income Households (Income < 185% Poverty) (n= 37,798)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Characteristics of Household Head						
<i>White Non-Hispanic (omitted)</i>						
Age	0.0553** (0.0059)	0.0957** (0.0082)	0.04**	0.0612** (0.0066)	0.0987** (0.009)	0.04**
Age Squared	-0.0008** (0.0001)	-0.0012** (0.0001)	0.00**	-0.0008** (0.0001)	-0.0012** (0.0001)	0.00**
Hispanic	0.2258** (0.0435)	0.0502 (0.0586)	-0.18**	0.2412** (0.0499)	0.0388 (0.0659)	-0.20**
Black Non-Hispanic	0.3022** (0.0353)	0.1153* (0.0456)	-0.19**	0.2147** (0.0407)	0.0914 (0.0514)	-0.12*
Other Non-Hispanic	-0.1308 (0.076)	-0.2082* (0.0989)	-0.08	-0.1475 (0.088)	-0.1946 (0.1104)	-0.05
Educational Level of Household Head						
<i>High School Degree (omitted)</i>						
No High School Degree	0.1924** (0.0335)	0.3006** (0.0442)	0.11*	0.1521** (0.0374)	0.2885** (0.0487)	0.14*
Some College	0.0177 (0.0368)	0.1803** (0.0484)	0.16**	0.0083 (0.045)	0.2045** (0.0573)	0.20**
Associate Degree	-0.0629 (0.0567)	0.1878** (0.0721)	0.25**	-0.0720 (0.0735)	0.1537 (0.0915)	0.23*
College Degree	-0.6086** (0.051)	-0.5478** (0.0688)	0.06	-0.4027** (0.0691)	-0.2246** (0.0856)	0.18
Household Composition						
<i>Households with no Children (omitted)</i>						
Children under 5 Years Old Present	0.1882** (0.0331)	-0.2477** (0.0482)	-0.44**	0.2013** (0.0383)	-0.2012** (0.0533)	-0.40**
Children 5–18 Years Old Present	0.3536** (0.0296)	0.0586 (0.0399)	-0.29**	0.3556** (0.0351)	0.0810 (0.0457)	-0.27**
Married Head of Household	-0.0648 (0.0423)	-0.5148** (0.0541)	-0.45**	0.0149 (0.0508)	-0.3959** (0.0638)	-0.41**
Single Head - Multiple Adults	0.0339 (0.0381)	-0.1386** (0.0486)	-0.17**	0.0151 (0.0439)	-0.1362* (0.0554)	-0.15*

(table continues)

TABLE 3, continued

Variables	All Households (n= 121,703)			Low-Income Households (Income < 185% Poverty) (n= 37,798)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Geographic						
<i>West (omitted)</i>						
<i>Metro - Not Central City (omitted)</i>						
Northeast	-0.1974** (0.0421)	-0.3254** (0.0542)	-0.13*	-0.1817** (0.0508)	-0.2944** (0.063)	-0.11
Midwest	-0.1424** (0.0405)	-0.2393** (0.0522)	-0.10	-0.0439 (0.0487)	-0.1967** (0.061)	-0.15*
South	-0.0993** (0.0359)	-0.2109** (0.0464)	-0.11*	-0.0286 (0.0427)	-0.2166** (0.0539)	-0.19**
Central City	0.0037 (0.0338)	-0.0037 (0.0436)	-0.01	-0.0016 (0.0405)	-0.0308 (0.0512)	-0.03
Non-metro	-0.0895** (0.032)	-0.2156** (0.043)	-0.13*	-0.0929* (0.0384)	-0.1929** (0.05)	-0.10
Home Ownership and HH Income						
Own Home	-0.3873** (0.0306)	-0.6257** (0.0417)	-0.24**	-0.3597** (0.036)	-0.5603** (0.0484)	-0.20**
Income < 50% Poverty	2.4878** (0.0554)	** (0.0712)	0.09	0.6085** (0.047)	0.9027** (0.0618)	0.29**
50% ≤ Income <100%	2.4851** (0.0503)	2.5106** (0.0668)	0.03	0.5779** (0.0413)	0.8049** (0.0571)	0.23**
100% ≤ Income <130%	2.2050** (0.0528)	2.2684** (0.0695)	0.06	0.2742** (0.0461)	0.5392 (0.0628)**	0.27**
130% ≤ Income <185%	1.9513** (0.0475)	1.7572** (0.0668)	-0.19*			
185% ≤ Income <250%	1.0954** (0.0538)	0.9110** (0.0783)	-0.18*			
Workforce Status of Household Head						
<i>Head of HH Unemployed (omitted)</i>						
Employed Head of HH	-0.4019** (0.0563)	-0.8134** (0.0647)	-0.41**	-0.3726** (0.0627)	-0.7382** (0.0723)	-0.37**
Head of HH Not in Labor Force	-0.3098** (0.0629)	-0.5871** (0.073)	-0.28**	-0.2444** (0.0689)	-0.5020** (0.0798)	-0.26**

(table continues)

TABLE 3, continued

Variables	All Households (n= 121,703)			Low-Income Households (Income < 185% Poverty) (n= 37,798)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Other Characteristics						
Immigrant Head of HH	-0.1358** (0.0504)	-0.0901 (0.0673)	0.05	-0.1658** (0.0567)	-0.1241 (0.0747)	0.04
Female Head of HH	0.1863** (0.0378)	0.1087* (0.0445)	-0.08	0.1642** (0.0444)	0.0731 (0.0516)	-0.09
Disabled Head of HH	0.4952** (0.0511)	0.7666** (0.0596)	0.27**	0.4142** (0.0548)	0.7092** (0.0636)	0.29**
Elder Head of HH	0.3341** (0.1175)	0.7300** (0.1755)	0.40*	0.2949* (0.1328)	0.8909** (0.2048)	0.60*
Elder Present in Household	-0.3501** (0.0929)	-0.7405** (0.1463)	-0.39*	-0.2927** (0.1058)	-0.8611** (0.1748)	-0.57**

* significant at the 5% level; ** significant at the 1% level.

food insecure and hunger columns. Most independent variables in the model are dummy variables and should be interpreted in comparison to the omitted category.¹⁹

We begin by comparing households that are food insecure without hunger to households that are food secure (column 1). The results follow fairly expected lines. Controlling for other factors, both Hispanic and non-Hispanic blacks are more likely to be food insecure than non-Hispanic whites. Households in which the household head did not complete high school are more likely to be food insecure, compared to households whose head had a high school degree, and having a college degree is associated with lower odds of being food insecure.

Compared to households with no children, households with children under 5 years old and households with children between the ages of 5 and 18 are more likely to be food insecure. Households with a head who was employed at the time of the survey and households with a household head who was not in the labor force are both less likely to be food insecure than households with a head who was unemployed.

Column 2 compares food insecure households with hunger to food secure households. The results, for the most part, are similar to the results from column 1. This is not surprising because hunger represents a more severe form of food insecurity. Column 3, however, indicates that there are some significant differences between the coefficients in columns 1 and 2.

First, compared to households with no children, households with children under 5 years old are more likely to be food insecure, but are *less* likely to experience hunger. Compared to households with no children, households with children between 5 and 18 years old are significantly more likely to be food insecure but not significantly more likely to experience hunger. Compared to single adults (with no other

¹⁹The CPS uses a complex sample design, including stratification and over-sampling of some groups in the population. In this analysis, weights provided by the Census Bureau are used to help make the sample representative of the population. This adjustment still yields standard errors that are likely to be too small. To partially overcome this limitation, we only present results that are significant at the 5 percent level and higher, and we mostly focus our discussion on results that are significant at the 1 percent level.

adults in the household), married households are not significantly less likely to be food insecure, but are less likely to experience hunger.

Other differences emerge between columns 1 and 2. For example, compared to households with an unemployed household head, households with an employed head are less likely to experience food insecurity, and *even less* likely to experience hunger. The results suggest that unemployment significantly increases the risk of experiencing hunger for households facing food insecurity, while marriage and the presence of children significantly reduce the risk of hunger for households facing food insecurity. In the case of households with children under 5, the risk is reduced to such a degree that, controlling for other factors, they are *less* likely to experience hunger compared to households without children.

If we limit our analysis to households with incomes less than 185 percent of the poverty threshold, the regression results are nearly identical to those for all households. Households with children under 5 are still more likely to be food insecure compared to households with no children, and are less likely to experience hunger. In later sections, we limit our analysis to low-income households.

Table 4 conducts the same analysis as above, but uses the constructed 10-item adult-referenced food security measure to insure that the observed differences between households with children and households without children are not due to the construction of the 18-item scale. The results, for the most part, are almost identical to the results in Table 3, with one important exception: the differences between the coefficients on hunger and food insecurity for households with children under 5 are weaker for all households and no longer statistically significant for low-income households. However, households with children between the ages of 5 and 18 are now significantly more likely to be food insecure than households with no children, but significantly *less* likely to experience hunger.

Next, we merge the April data with data from the March supplements for the same year. Table 5 presents the results of the multinomial logistic regression analysis for households with incomes less than 185 percent of the poverty threshold using the more precise income information available in the March supplement. The first three columns use the standard 18-item measure. The second three columns use the

TABLE 4
Multinomial Logistic Regression (Food Secure=0), Using CPS April Data and the 10-Item Adult-Referenced Measure

Variables	All Households (n=121,703)			Low-Income Households (Income < 185% Poverty) (n=37,798)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Characteristics of Household Head						
<i>White Non-Hispanic (omitted)</i>						
Age	0.0508** (0.0057)	0.0915** (0.008)	0.04**	0.0586** (0.0065)	0.0937** (0.0088)	0.04**
Age Squared	-0.0007** (0.0001)	-0.0012** (0.0001)	0.00**	-0.0007** (0.0001)	-0.0012** (0.0001)	0.00**
Hispanic	0.2917** (0.043)	-0.0634 (0.059)	-0.36**	0.3017** (0.0509)	-0.1110 (0.0673)	-0.41**
Black Non-Hispanic	0.3788** (0.0348)	0.0747 (0.0449)	-0.30**	0.2972** (0.0414)	0.0049 (0.0515)	-0.29**
Other Non-Hispanic	-0.0562 (0.0741)	-0.1826 (0.0964)	-0.13	-0.1152 (0.09)	-0.1848 (0.1088)	-0.07
Education Level of Household Head						
<i>High School Degree (omitted)</i>						
No High School Degree	0.2123** (0.0333)	0.2873** (0.0435)	0.08	0.1489** (0.0381)	0.2652** (0.0486)	0.12*
Some College	0.0019 (0.0364)	0.1712** (0.0469)	0.17**	-0.0049 (0.0466)	0.2404** (0.0564)	0.25**
Associate Degree	-0.0258 (0.0549)	0.1593* (0.0701)	0.19*	-0.0175 (0.0749)	0.0829 (0.0934)	0.10
College Degree	-0.6286** (0.0488)	-0.5136** (0.0646)	0.11	-0.3809** (0.0706)	-0.1774* (0.0835)	0.20*

(table continues)

TABLE 4, continued

Variables	All Households (n=121,703)			Low-Income Households (Income < 185% Poverty) (n=37,798)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Household Composition						
<i>Households with no Children (omitted)</i>						
<i>Single Head of HH - No Other Adults (omitted)</i>						
Children under 5 Present	0.0448* (0.034)	-0.0850 (0.0462)	-0.13*	0.0556 (0.0403)	-0.0336 (0.0522)	-0.09
Children 5–18 Years Old Present	0.1169** (0.0295)	-0.1383** (0.0392)	-0.26**	0.1179** (0.036)	-0.1369** (0.0456)	-0.25**
Married Head of Household	-0.1382** (0.0408)	-0.5364** (0.0522)	-0.40**	-0.0260 (0.0513)	-0.3995** (0.0632)	-0.37**
Single Head - Multiple Adults	-0.0135 (0.0377)	-0.1366** (0.0477)	-0.12*	-0.0292 (0.045)	* (0.0551)	-0.09
Geographic						
<i>West (omitted)</i>						
<i>Metro - Not Central City (omitted)</i>						
Northeast	-0.2414** (0.0412)	-0.2937** (0.0528)	-0.05	-0.2109** (0.0518)	-0.2616** (0.0626)	-0.05
Midwest	-0.2000** (0.0398)	-0.2110** (0.0504)	-0.01	-0.1027* (0.05)	-0.1940** (0.0604)	-0.09
South	-0.1303** (0.0351)	-0.2213** (0.0456)	-0.09	-0.0463 (0.0434)	-0.2184** (0.054)	-0.17**
Central City	-0.0261 (0.0331)	0.0151 (0.0428)	0.04	-0.0517 (0.0412)	-0.0063 (0.0514)	0.05
Non-metro	-0.0967** (0.0316)	-0.1574** (0.0419)	-0.06	-0.1104** (0.0392)	-0.1435** (0.0497)	-0.03

(table continues)

TABLE 4, continued

Variables	All Households (n=121,703)			Low-Income Households (Income < 185% Poverty) (n=37,798)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Home Ownership and HH Income						
Own Home	-0.4135** (0.0302)	-0.6518** (0.0408)	-0.24**	-0.3388** (0.0368)	-0.5814** (0.0485)	-0.24**
Income < 50% Poverty	2.0550** (0.0526)	2.2831** (0.0682)	0.23**	0.6127** (0.048)	0.7737** (0.0612)	0.16*
50% ≤ Income <100%	2.0518** (0.0474)	2.2641** (0.0633)	0.21**	0.5696** (0.0425)	0.7166** (0.0561)	0.15*
100% ≤ Income <130%	1.8200** (0.0499)	2.0487** (0.0663)	0.23**	0.3056** (0.047)	0.4676** (0.0619)	0.16*
130% ≤ Income <185%	1.5411** (0.0448)	1.6090** (0.0627)	0.07			
185% ≤ Income <250%	0.9674** (0.0487)	0.9319** (0.0712)	-0.04			
Workforce Status of Household Head						
<i>Head of HH Unemployed (omitted)</i>						
Employed Head of HH	-0.4306** (0.0561)	-0.8307** (0.0638)	-0.40**	-0.3971** (0.0639)	-0.7383** (0.0725)	-0.34**
Head of HH Not in Labor Force	-0.3173** (0.0627)	-0.5423** (0.0718)	-0.22**	-0.2351 (0.0701)	-0.4350** (0.0796)	-0.20*
Other Characteristics						
Immigrant Head of HH	-0.0427 (0.0494)	-0.1891** (0.0692)	-0.15	-0.0199 (0.0568)	-0.1649* (0.0771)	-0.15
Female Head of HH	0.1838** (0.0364)	0.0791 (0.0431)	-0.10*	0.1522** (0.0446)	0.0519 (0.0511)	-0.10
Disabled Head of HH	0.4823** (0.0506)	0.8041** (0.0587)	0.32**	0.4052** (0.0547)	0.7379** (0.0631)	0.33**
Elder Head of HH	0.1717* (0.1108)	0.7011** (0.1711)	0.53**	0.1590 (0.1306)	0.8923** (0.206)	0.73**
Elder Present in Household	-0.2448** (0.0878)	-0.6789** (0.1423)	-0.43**	-0.2484* (0.1052)	-0.8534** (0.1768)	-0.61**

* significant at the 5% level; ** significant at the 1% level.

TABLE 5
Multinomial Logistic Regression (Food Secure=0), Using CPS March/April Merged Data for Low-Income Households (Income < 185% Poverty)

Variables	Using 18-Item Standard Measure (n=24,633)			Using 10-Item Adult-referenced Measure (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Characteristics of Household Head						
<i>White Non-Hispanic (omitted)</i>						
Age	0.0445** (0.0084)	0.0836** (0.0112)	0.04**	0.0419** (0.0083)	0.0816** (0.011)	0.04**
Age Squared	-0.0007** (0.0001)	-0.0012** (0.0001)	0.00**	-0.0006** (0.0001)	-0.0012** (0.0001)	0.00**
Hispanic	0.2838** (0.0644)	0.1474 (0.0824)	-0.14	0.3294** (0.0652)	-0.0165 (0.0842)	-0.35**
Black Non-Hispanic	0.3285** (0.0529)	0.1370* (0.066)	-0.19*	0.3513** (0.0539)	0.0915 (0.0655)	-0.26**
Other Non-Hispanic	0.0190 (0.1165)	0.0640 (0.1386)	0.05	0.1427 (0.1141)	0.0264 (0.1397)	-0.12
Educational Level of Household Head						
<i>High School Degree (omitted)</i>						
No High School Degree	0.2462** (0.0477)	0.3911** (0.0608)	0.14*	0.2582** (0.0482)	0.3594** (0.0605)	0.10
Some College	0.0623 (0.059)	0.2001** (0.0745)	0.14	0.0814 (0.0603)	0.2255** (0.0732)	0.14
Associate Degree	-0.0271 (0.0942)	0.2123 (0.1134)	0.24	-0.0109 (0.096)	0.1579 (0.1146)	0.17
College Degree	-0.5398** (0.0948)	-0.3431** (0.1161)	0.20	-0.5990** (0.0985)	-0.2517* (0.1107)	0.35*

(table continues)

TABLE 5, continued

Variables	Using 18-Item Standard Measure (n=24,633)			Using 10-Item Adult-referenced Measure (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Household Composition						
<i>Households with No Children (omitted)</i>						
<i>Single Head of HH- No Other Adults (omitted)</i>						
Children under 5 Years Old Present	0.1950** (0.0499)	-0.1665* (0.0677)	-0.36**	0.0229 (0.0522)	0.0233 (0.0664)	0.00
Children 5–18 Years Old Present	0.4108** (0.046)	0.2182** (0.0586)	-0.19**	0.1905** (0.0469)	-0.0699 (0.0582)	-0.26**
Married Head of Household	0.0708 (0.0675)	-0.3385** (0.0836)	-0.41**	0.0454 (0.0678)	-0.3498** (0.0826)	-0.40**
Single Head - Multiple Adults	0.1349* (0.059)	-0.0815 (0.0741)	-0.22*	0.1219* (0.0599)	-0.0101 (0.0728)	-0.13
Geographic						
<i>West (omitted)</i>						
<i>Metro - Not Central City (omitted)</i>						
Northeast	-0.1907** (0.065)	-0.3246** (0.0796)	-0.13	-0.2327** (0.0656)	-0.2834** (0.079)	-0.05
Midwest	-0.0431 (0.0636)	-0.1632* (0.0784)	-0.12	-0.0784 (0.0644)	-0.1805* (0.0777)	-0.10
South	-0.0451 (0.0561)	-0.1643* (0.0693)	-0.12	-0.0829 (0.0564)	-0.1808** (0.0695)	-0.10
Central City	0.0710 (0.0528)	0.0528 (0.0654)	-0.02	0.0035 (0.0532)	0.0874 (0.0658)	0.08
Non-metro	0.0417 (0.0503)	-0.0871 (0.064)	-0.13	0.0037 (0.0508)	-0.0282 (0.0639)	-0.03

(table continues)

TABLE 5, continued

Variables	Using 18-Item Standard Measure (n=24,633)			Using 10-Item Adult-referenced Measure (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Home Ownership and HH Income						
<i>130% ≤ Income <185% (omitted)</i>						
Own Home	-0.4445** (0.0468)	-0.6308** (0.061)	-0.19**	-0.3797** (0.0473)	-0.6393** (0.0611)	-0.26**
Income < 50% Poverty	0.2298** (0.0647)	0.3058** (0.0797)	0.08	0.2042** (0.0649)	0.2811** (0.0799)	0.08
50% ≤ Income <100%	0.4713** (0.0511)	0.3937** (0.0661)	-0.08	0.3722** (0.0515)	0.3673** (0.0664)	0.00
100% ≤ Income <130%	0.2662** (0.0575)	0.2816** (0.074)	0.02	0.1542** (0.0585)	0.3423** (0.0728)	0.19*
Workforce Status of Household Head						
<i>Head of HH Unemployed (omitted)</i>						
Employed Head of HH	-0.4503** (0.0829)	-0.8749** (0.0939)	-0.42**	-0.5292** (0.0834)	-0.8329** (0.095)	-0.30**
Head of HH Not in Labor Force	-0.2979** (0.0902)	-0.6202** (0.103)	-0.32**	-0.3392** (0.0907)	-0.4907** (0.1031)	-0.15
Other Characteristics						
Immigrant Head of HH	-0.1593* (0.0731)	-0.0589 (0.0928)	0.10	0.0487 (0.0723)	-0.1705 (0.0971)	-0.22*
Female Head of HH	0.1483* (0.0588)	0.1384* (0.0678)	-0.01	0.1650** (0.0589)	0.1052 (0.0665)	-0.06
Disabled Head of HH	0.5110** (0.0685)	0.9277** (0.0783)	0.42**	0.4923** (0.0681)	0.8787** (0.0775)	0.39**
Elder Head of HH	0.2152 (0.1788)	0.5897* (0.2376)	0.37	0.0734 (0.1745)	0.5725* (0.2384)	0.50
Elder Present in Household	-0.1288 (0.1483)	-0.3300 (0.2018)	0.05	-0.1385 (0.1462)	-0.3394 (0.2034)	-0.20

* significant at the 5% level; ** significant at the 1% level.

modified 10-item adult-referenced measure. The results, for the most part, are comparable to those in Tables 3 and 4, but the differences between the determinants of hunger and food insecurity have been moderated somewhat. Using better income data has moderated the observed differences between households with and without children. When we use *both* the adult-referenced measure and the more precise income estimates from March, the differences between households with and without children under 5 years old completely disappear. Only the differences between households with children between 5 and 18 remain.

These findings suggest that it is important to use the adult-referenced scale when studying child outcomes or focusing on households with children. For other variables in the model, the two measures yield very similar results. The findings also suggest that using more precise income data can better control for other exogenous determinants of hunger and food insecurity. Finally, the results suggest that, even after controlling for these factors, food insecurity and hunger, while representing different thresholds on the same scale, may also represent different states of well-being affected by different behaviors, incentives, and resources. Some factors that are associated with food insecurity may not play a role in determining whether the severity of the condition increases to the level of hunger, especially if some food insecure households are able to draw on personal and public resources to help them avoid hunger. Households with children between the ages of 5 and 18, for example, are more likely to be eligible for specific food assistance programs that may help them avoid hunger. The three programs that would benefit such households are the Food Stamp Program, the National School Lunch Program, and the School Breakfast Program. We begin by focusing on the Food Stamp Program.

The Effect of the Food Stamp Program on Hunger and Food Security

To control for the effects of food assistance programs, we would like to include program participation variables in our empirical model. The problem, as we discussed previously, is that these variables are endogenous. Food insecure households are more likely to participate in food assistance programs, and including them in the model may lead us to find positive associations between program

participation and food insecurity. Table 6 includes participation indicators for the two largest federal food assistance programs during the year prior to the survey. Participation in both programs is associated with higher levels of hunger and food insecurity. This positive relationship is most likely due to the endogeneity of the program participation decision.

To address this endogeneity problem, we first focus on the largest federal food assistance program, the Food Stamp Program. We estimate both a logistic regression and a linear probability model, with program participation as the dependent variable. We include in these regressions all predetermined variables in our model. In addition, we include the four state-level policy variables that we believe are associated with Food Stamp Program participation, but not with the food security status of households living in the state: the use of short recertification periods (of three months or less), a proxy variable for a state's use of monthly reporting, the timing of the implementation of the EBT system, and federal food stamp outreach spending. The results are presented in Table 7 for households with incomes less than 185 percent of the poverty threshold. We estimate the equation twice, once with state dummy variables and once without. These state dummies control for unobserved characteristics of each state that do not change over time (fixed effects). However, with only four years of data, including state fixed effects may severely reduce the explanatory power of our state policy variables.

The results in Table 7 show that more frequent application of short recertification periods is associated with significantly lower odds of participating in the program in all specifications. Monthly reporting, considered a burdensome requirement, is associated with lower odds of participating in the program when state fixed effects are not included. Federal Food Stamp outreach expenditures are also significant only when State fixed effects are not included. In this case, more outreach spending by a state is associated with higher odds of participating in the Food Stamp Program. EBT implementation is not significant in any of the specifications.

To check the performance of our instruments, we examine the F-statistics from the first stage regressions and find that the coefficients on the state policy variables are jointly significant in both

TABLE 6
Multinomial Logistic Regression (Food Secure=0) Including Food Assistance Program Participation,
Using CPS March/April Merged Data for Low-Income Households (Income < 185% Poverty)

Variables	Using 18-Item Standard Measure (n= 24,633)			Using 10-Item Adult-Referenced Measure (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Food Assistance Programs						
Food Stamp Participation	0.6481** (0.0533)	0.6832** (0.0656)	0.04	0.6301** (0.0543)	0.6524** (0.0656)	0.02
National School Lunch Program	0.4103** (0.0703)	0.4877** (0.0984)	0.08**	0.4062** (0.0747)	0.3571** (0.0995)	-0.05
Characteristics of Household Head						
<i>White Non-Hispanic (omitted)</i>						
Age	0.0418** (0.0085)	0.0799** (0.0113)	0.04**	0.0394** (0.0083)	0.0781** (0.0111)	0.04**
Age Squared	-0.0006** (0.0001)	-0.0011** (0.0001)	0.00**	-0.0006** (0.0001)	-0.0011** (0.0001)	0.00**
Hispanic	0.2282** (0.0649)	0.0898 (0.0829)	-0.14	0.2771** (0.0657)	-0.0632 (0.0846)	-0.34**
Black Non-Hispanic	0.2493** (0.0537)	0.0549 (0.0667)	-0.19*	0.2763** (0.0546)	0.0203 (0.0662)	-0.26**
Other Non-Hispanic	-0.0410 (0.1175)	0.0006 (0.1394)	0.04	0.0872 (0.1149)	-0.0276 (0.1403)	-0.11
Educational Level of Household Head						
<i>High School Degree (omitted)</i>						
No High School Degree	0.1990** (0.0481)	0.3436** (0.0612)	0.14*	0.2137** (0.0485)	0.3156** (0.0609)	0.10
Some College	0.0755 (0.0594)	0.2154** (0.0749)	0.14	0.0946 (0.0607)	0.2392** (0.0735)	0.14
Associate Degree	-0.0096 (0.0948)	0.2257* (0.1142)	0.24	0.0037 (0.0966)	0.1691 (0.1153)	0.17
College Degree	-0.4900** (0.0951)	-0.2949* (0.1165)	0.20	-0.5549** (0.0988)	-0.2078 (0.111)	0.35*

(table continues)

TABLE 6, continued

Variables	Using 18-Item Standard Measure (n= 24,633)			Using 10-Item Adult-Referenced Measure (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Household Composition						
<i>Households with No Children (omitted)</i>						
<i>Single Head of HH - No Other Adults (omitted)</i>						
Children under 5 Years Old Present	0.1225* (0.0507)	-0.2506** (0.0687)	-0.37**	-0.0497 (0.053)	-0.0619 (0.0674)	-0.01
Children 5–18 Years Old Present	0.0123 (0.0708)	-0.2616** (0.0978)	-0.27*	-0.2128** (0.0744)	-0.4433** (0.0975)	-0.23*
Married Head of Household	0.0647 (0.0676)	-0.3449** (0.0836)	-0.41**	0.0390 (0.0679)	-0.3541** (0.0826)	-0.39**
Single Head - Multiple Adults	0.1001 (0.0595)	-0.1186 (0.0746)	-0.22**	0.0888 (0.0603)	-0.0424 (0.0732)	-0.13
Geographic						
<i>West (omitted)</i>						
<i>Metro - Not Central City (omitted)</i>						
Northeast	-0.2179** (0.0655)	-0.3668** (0.0803)	-0.15	-0.2605** (0.0661)	-0.3226** (0.0795)	-0.06
Midwest	-0.0563 (0.064)	-0.1859* (0.0788)	-0.13	-0.0927 (0.0647)	-0.2017 (0.0781)	-0.11
South	-0.0571 (0.0564)	-0.1859** (0.0696)	-0.13	-0.0968 (0.0567)	-0.1982** (0.0697)	-0.10
Central City	0.0452 (0.0532)	0.0259 (0.0657)	-0.02	-0.0213 (0.0535)	0.0628 (0.0661)	0.08
Non-metro	0.0097 (0.0507)	-0.1225 (0.0644)	-0.13	-0.0267 (0.051)	-0.0594 (0.0642)	-0.03

(table continues)

TABLE 6, continued

Variables	Using 18-Item Standard Measure (n= 24,633)			Using 10-Item Adult-Referenced Measure (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Home Ownership and HH Income						
<i>130% ≤ Income <185% (omitted)</i>						
Own Home	-0.3601** (0.0475)	-0.5388** (0.0618)	-0.18*	-0.2971** (0.048)	-0.5551** (0.0618)	-0.26**
Income < 50% Poverty	0.0239 (0.0673)	0.0998 (0.0825)	0.08	0.0128 (0.0673)	0.0940 (0.0825)	0.08
50% ≤ Income <100%	0.2880** (0.0533)	0.2010** (0.0688)	-0.09	0.1995** (0.0537)	0.1901** (0.069)	-0.01
100% ≤ Income <130%	0.1995** (0.0579)	0.2154** (0.0745)	0.02	0.0940 (0.0589)	0.2837** (0.0732)	0.19*
Workforce Status of Household Head						
<i>Head of HH Not Unemployed (omitted)</i>						
Employed Head of HH	-0.3476** (0.0839)	-0.7654** (0.0951)	-0.42**	-0.4288** (0.0844)	-0.7338** (0.096)	-0.30**
Head of HH Not in Labor Force	-0.3149** (0.0911)	-0.6399** (0.1038)	-0.32**	-0.3537** (0.0915)	-0.5077** (0.1038)	-0.15
Other Characteristics						
Immigrant Head of HH	-0.1014 (0.0737)	-0.0055 (0.0932)	0.10	0.1043 (0.0728)	-0.1154 (0.0975)	-0.22*
Female Head of HH	0.0718 (0.0593)	0.0567 (0.0684)	-0.02	0.0923 (0.0593)	0.0315 (0.0671)	-0.06
Disabled Head of HH	0.4465** (0.0693)	0.8626** (0.0791)	0.42**	0.4279** (0.0688)	0.8139** (0.0782)	0.39**
Elder Head of HH	0.2051 (0.1797)	0.5822* (0.2387)	0.38	0.0626 (0.1752)	0.5671* (0.2394)	0.50
Elder Present in Household	-0.1472 (0.1491)	-0.3578 (0.2027)	-0.21	-0.1553 (0.1468)	-0.3677 (0.2043)	-0.21

* significant at the 5% level; ** significant at the 1% level.

TABLE 7
Logistic Regression on Food Stamp Program Participation Using CPS March/April Merged
Data for Low-Income Households (Income < 185% Poverty) and 10-Item Adult-Referenced Measure

Variables	Logit (n= 24,633)		Linear Probability Model (n= 24,633)	
	No State Fixed Effects	With State Fixed Effects	No State Fixed Effects	With State Fixed Effects
State Policy Variables				
Use of Short Recertification Periods	-0.2637* (0.1043)	-0.7167** (0.1275)	-0.0434** (0.0122)	-0.0891** (0.0148)
Proxy for Monthly Reporting	-0.1565** (0.0466)	0.0962 (0.1057)	-0.0167** (0.0054)	0.0143 (0.012)
Fed FSP Outreach Spending	1.3525** (0.4277)	-1.0545 (1.2915)	0.1502** (0.0554)	-0.0291 (0.1603)
EBT Implementation	-0.0333 (0.0564)	0.0310 (0.0743)	-0.0032 (0.0064)	0.0089 (0.0085)
Characteristics of Household Head				
<i>White Non-Hispanic (omitted)</i>				
Age	0.0216** (0.007)	0.0249** (0.007)	0.0025** (0.0008)	0.0027** (0.0008)
Age Squared	-0.0005** (0.0001)	-0.0005** (0.0001)	-0.0001** (0.00001)	-0.0001** (0.00001)
Hispanic	0.2253** (0.0615)	0.3066** (0.065)	0.0386** (0.0076)	0.0456** (0.008)
Black Non-Hispanic	0.5196** (0.0479)	0.6227** (0.0503)	0.0781** (0.0061)	0.0874** (0.0062)
Other Non-Hispanic	0.4758** (0.1015)	0.4868** (0.1058)	0.0575** (0.0126)	0.0552** (0.0129)
Education Level of Household Head				
<i>High School Degree (omitted)</i>				
No High School Degree	0.4156** (0.0438)	0.4087** (0.0443)	0.0578** (0.0052)	0.0570** (0.0052)
Some College	-0.1189* (0.0559)	-0.1217* (0.0565)	-0.0095 (0.0065)	-0.0099 (0.0065)
Associate Degree	-0.1857* (0.0891)	-0.1834* (0.0904)	-0.0108 (0.0101)	-0.0101 (0.0101)
College Degree	-0.4770** (0.0835)	-0.4515** (0.0842)	-0.0384** (0.0083)	-0.0351** (0.0083)
Household Composition				
<i>Households with no Children (omitted)</i>				
<i>Single Head of HH - No Other Adults (omitted)</i>				
Children under 5 Years Old Present	0.9155** (0.0488)	0.9301** (0.0492)	0.1158** (0.0062)	0.1160** (0.0062)
Children 5–18 Years Old Present	0.9162** (0.0435)	0.9202** (0.0439)	0.1420** (0.0053)	0.1418** (0.0053)
Married Head of Household	0.1024 (0.0633)	0.0966 (0.0639)	0.0039 (0.007)	0.0029 (0.007)
Single Head - Multiple Adults	0.3962** (0.0552)	0.4107** (0.0558)	0.0468** (0.0069)	0.0481** (0.0069)

(table continues)

TABLE 7, continued

Variables	Logit (n= 24,633)		Linear Probability Model (n= 24,633)	
	No State Fixed Effects	With State Fixed Effects	No State Fixed Effects	With State Fixed Effects
Geographic				
<i>West (omitted)</i>				
<i>Metro - Not Central City (omitted)</i>				
Northeast	0.1366* (0.062)		0.0282** (0.0072)	
Midwest	0.1129 (0.061)		0.0175* (0.007)	
South	0.1538** (0.0584)		0.0183** (0.0068)	
Central City	0.2021** (0.0492)	0.1619** (0.0508)	0.0266** (0.0057)	0.0223** (0.0058)
Non-metro	0.2801** (0.0465)	0.2136** (0.0497)	0.0287** (0.0052)	0.0234** (0.0055)
Home Ownership and HH Income				
<i>130% ≤ Income < 185% (omitted)</i>				
Own Home	-0.8435** (0.0419)	-0.8884** (0.0426)	-0.1025** (0.0049)	-0.1053** (0.0049)
Income < 50% Poverty	1.5940** (0.0593)	1.5788** (0.06)	0.2121** (0.007)	0.2096** (0.007)
50% ≤ Income < 100%	1.6470** (0.0487)	1.6470** (0.0491)	0.1985** (0.0055)	0.1972** (0.0054)
100% ≤ Income < 130%	0.8023** (0.0553)	0.8066** (0.0556)	0.0495** (0.0058)	0.0490** (0.0058)
Workforce Status of Household Head				
<i>Head of HH Not Unemployed (omitted)</i>				
Employed Head of HH	-0.9528** (0.0798)	-0.8995** (0.0809)	-0.1360** (0.0106)	-0.1286** (0.0106)
Head of HH Not in Labor Force	-0.0968 (0.0861)	-0.0739 (0.0869)	0.0140 (0.0113)	0.0160 (0.0113)
Other Characteristics				
Immigrant Head of HH	-0.7026** (0.0709)	-0.6133** (0.0721)	-0.0877** (0.0087)	-0.0805** (0.0087)
Female Head of HH	0.5649** (0.0531)	0.5642** (0.0536)	0.0749** (0.0061)	0.0736** (0.0061)
Disabled Head of HH	0.7723** (0.0591)	0.7262** (0.0597)	0.1153** (0.0077)	0.1088** (0.0078)
Elder Head of HH	0.0977 (0.1585)	0.0676 (0.1604)	0.0032 (0.0175)	0.0007 (0.0174)
Elder Present in Household	0.1660 (0.1375)	0.1921 (0.1395)	0.0156 (0.0156)	0.0185 (0.0156)

*significant at the 5% level; **significant at the 1% level.

specifications. However, the F-statistics are above 10, indicating that the policy variables are jointly good predictors of program participation, only when controlling for state fixed effects. An overidentification test for each specification finds that the instruments are valid and not directly associated to food insecurity or hunger, with the exception of the proxy variable for monthly reporting, which fails the overidentification test in most specifications. We therefore drop this variable in computing the probabilities of program participation.

The next step is to obtain predicted values for the participation decision in both empirical specifications in Table 7 and to use them as instruments for program participation in the food security equation. Table 8 presents the results of the multinomial logistic regression on food security, including the predicted values of Food Stamp Program participation from the logit and linear probability models. The first three columns do not control for state fixed effects, whereas the second three columns do. The first row presents the coefficients on the predicted participation values from the logit model. The results suggest that households that participate in the Food Stamp Program have significantly lower odds of being food insecure and experiencing hunger than households that do not participate. However, the results obtained using the predicted values from the linear probability model (row 2) suggest that there may be significant bias in the predicted values from the logit model due to misspecification. An overidentification test confirms this hypothesis. Table 8, therefore, presents only the results of the food security model that includes the predicted participation values from the linear probability model.

For households with children between the ages of 5 and 18, there remains a significant difference between the coefficients on hunger and food insecurity. However, the difference appears to be moderated somewhat compared to earlier specifications that do not control from Food Stamp Program participation, but not by enough to suggest a program effect.

The Effect of Household Employment Circumstances on Hunger and Food Security

So far, we have only included basic employment information in our model, by comparing household heads who are employed, or not in the labor force, to household heads who are unemployed. It

TABLE 8
Multinomial Logistic Regression (Food Secure=0) with Predicted Values for Food Stamp Program Participation,
Using CPS March/April Merged Data for Low-income Households (Income < 185% Poverty) and 10-Item Adult-Referenced Measure

Variables	No State Fixed Effects (n= 24,633)			With States Fixed Effects (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Predicted Food Stamp Program						
Using Linear Probability Model	-1.0839** (0.3199)	-1.3435** (0.4235)	-0.26	-1.0931** (0.3031)	-1.4506** (0.3972)	-0.36
Using Logit Model	-4.2404 (2.527)	1.7195 (2.7136)	5.96	-3.3846* (1.4286)	0.1774 (1.858)	3.56
Characteristic of Household Head						
<i>White Non-Hispanic (omitted)</i>						
Age	0.0528** (0.0105)	0.0772** (0.013)	0.02	0.0537** (0.0092)	0.0850** (0.0123)	0.03*
Age Squared	-0.0008** (0.0002)	-0.0011** (0.0002)	0.00	-0.0008** (0.0001)	-0.0012** (0.0002)	0.00
Hispanic	0.4864** (0.1142)	-0.0798 (0.1308)	-0.57**	0.4133** (0.095)	-0.0585 (0.1219)	-0.47**
Black Non-Hispanic	0.6779** (0.2021)	-0.0406 (0.2186)	-0.72**	0.6730** (0.1357)	0.1252 (0.1744)	-0.55**
Other Non-Hispanic	0.3750* (0.1795)	-0.0676 (0.2039)	-0.44	0.3154* (0.1412)	0.0540 (0.1757)	-0.26
Educational Level of Household Head						
<i>High School Degree (omitted)</i>						
No High School Degree	0.5026** (0.1534)	0.2603 (0.1676)	-0.24	0.4578** (0.0955)	0.3541** (0.123)	-0.10
Some College	0.0442 (0.0643)	0.2403** (0.0769)	0.20*	0.0193 (0.0624)	0.1965** (0.0761)	0.18*
Associate Degree	-0.0533 (0.0993)	0.1748 (0.1177)	0.23	-0.0407 (0.0971)	0.1383 (0.1163)	0.18
College Degree	-0.7591 (0.1372)**	-0.1868 (0.1509)	0.57**	-0.7307** (0.1107)	-0.2633* (0.1285)	0.47**

(table continues)

TABLE 8, continued

Variables	No State Fixed Effects (n= 24,633)			With States Fixed Effects (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Household Composition						
<i>Households with No Children (omitted)</i>						
<i>Single Head of HH - No Other Adults (omitted)</i>						
Children under 5 Years Old Present	0.5150 (0.2978)	-0.1761 (0.3218)	-0.69	0.4173* (0.1743)	0.0118 (0.2262)	-0.41
Children 5–18Years Old Present	0.7918* (0.3614)	-0.3139 (0.3892)	-1.11*	0.6624** (0.2077)	-0.0920 (0.2697)	-0.75*
Married Head of Household	0.0586 (0.0683)	-0.3557** (0.0831)	-0.41**	0.0457 (0.0682)	-0.3426** (0.0831)	-0.39**
Single Head - Multiple Adults	0.3133* (0.1289)	-0.0877 (0.1424)	-0.40*	0.2659** (0.0882)	-0.0165 (0.1115)	-0.28*
Geographic						
<i>West (omitted)</i>						
<i>Metro - Not Central City (omitted)</i>						
Northeast	-0.0803 (0.1118)	-0.3452** (0.1253)	-0.26			
Midwest	-0.0056 (0.0778)	-0.2091* (0.0898)	-0.20			
South	-0.0209 (0.0676)	-0.2060** (0.0796)	-0.19			
Central City	0.1195 (0.0872)	0.0397 (0.0998)	-0.08	0.0167 (0.0631)	0.0534 (0.0794)	0.04
Non-metro	0.1276 (0.0893)	-0.0797 (0.1034)	-0.21	0.0562 (0.0635)	-0.0311 (0.0805)	-0.09

(table continues)

TABLE 8, continued

Variables	No State Fixed Effects (n= 24,633)			With States Fixed Effects (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Home Ownership and HH Income						
<i>130% ≤ Income < 185% (omitted)</i>						
Own Home	-0.8212** (0.2673)	-0.4603 (0.2888)	0.36	-0.7455** (0.159)	-0.6177** (0.2065)	0.13
Income < 50% Poverty	1.1060* (0.5413)	-0.0846 (0.5827)	-1.19	0.9099** (0.3079)	0.2439 (0.3992)	-0.67
50% ≤ Income < 100%	1.2150* (0.5049)	0.0251 (0.5439)	-1.19	1.0320** (0.2871)	0.3329 (0.3731)	-0.70
100% ≤ Income < 130%	0.3638** (0.1379)	0.2573 (0.1527)	-0.11	0.3106** (0.0906)	0.3283** (0.1155)	0.02
Workforce Status of Household Head						
<i>Head of HH Unemployed (omitted)</i>						
Employed Head of HH	-1.1211** (0.3626)	-0.5927 (0.3902)	0.53	-1.0115** (0.2135)	-0.8163** (0.2727)	0.20
HH Not in Labor Force	-0.2762** (0.0982)	-0.5160** (0.1108)	-0.24	-0.2946** (0.094)	-0.4933** (0.1079)	-0.20
Other Characteristics						
Immigrant Head of HH	-0.3192 (0.2308)	-0.0206 (0.2554)	0.30	-0.1816 (0.1354)	-0.1125 (0.1776)	0.07
Female Head of HH	0.4816* (0.1976)	-0.0236 (0.2135)	-0.51	0.4184** (0.121)	0.1005 (0.1529)	-0.32
Disabled Head of HH	0.9840** (0.3009)	0.6797* (0.3236)	-0.30	0.8807** (0.1726)	0.8699** (0.22)	-0.01
Elder Head of HH	0.0915 (0.1748)	0.5653* (0.2386)	0.47	0.1075 (0.1753)	0.6245** (0.239)	0.52
Elder Present in Household	-0.0757 (0.151)	-0.3645 (0.2072)	-0.29	-0.0810 (0.1489)	-0.3545 (0.2066)	-0.27

* significant at the 5% level; ** significant at the 1% level.

is possible that a richer set of employment variables might provide insights into why households with children are more likely to experience food insecurity than households with no children, but are less likely to experience hunger. For example, adults in households with children facing the prospect of hunger might be more willing to work longer hours or hold more jobs than adults in households without children.

Table 9 considers the effects of a number of household-level employment variables. The top five rows of the table present the coefficients from including each of our constructed employment variables, one at a time, into our empirical model. The likelihood of a household experiencing food insecurity and hunger is lower when all adult members of the household are employed, compared to when no adults are employed. The likelihood of food insecurity and hunger is also lower the greater the average usual number of hours worked per adult household member. The likelihood of food insecurity and hunger is greater the higher the average unemployment duration of adult household members. Finally, the average number of jobs per adult is not significantly associated with lower levels of hunger and food insecurity.

The remainder of Table 9 includes all significant employment variables in one empirical model. The coefficients on the employment variables maintain their sign but most lose their significance. As to the question of whether household employment circumstances can explain the observed differences in the determinants of hunger and food insecurity between households with and without children, the answer is no. Including these household employment variables has little effect on the observed differences.

The Effect of Food Assistance Programs on Hunger and Food Security using Changes in Food Security Status during the Course of a Year

Participation in the Food Stamp Program does not appear to be able to explain the observed differences in the coefficients on hunger and food insecurity for households with children between the ages of 5 and 18. However, participation in the National School Lunch Program, which specifically targets school-age children, might. To examine this possibility, we follow a different estimation strategy than the one we have followed so far.

TABLE 9
Multinomial Logistic Regression (Food Secure=0) with Expanded Set of Employment Variables,
Using CPS March/April Merged Data for Low-Income Households (Income < 185% Poverty)

Variables	Using 18-Item Standard Measure (n= 24,633)			Using 10-Item Adult-referenced Measure (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
<u>Employment Variables Included One at a Time in Separate Regressions</u>						
<i>No Other Household Head Member Employed (omitted)</i>						
All Other Household Members Employed	-0.2634** (0.0619)	-0.3591** (0.0878)	-0.096	-0.2458** (0.0639)	-0.2035* (0.0863)	0.042
Some of Household Members Employed	-0.0169 (0.092)	-0.1415 (0.1326)	-0.125	-0.0581 (0.0944)	-0.0181 (0.1337)	0.040
Average Number of Jobs (head, spouse, or relative)	-0.0401 (0.0766)	-0.0872 (0.1025)	-0.047	-0.0510 (0.0791)	0.0439 (0.0993)	0.095
Usual Hours Worked (head, spouse, or relative)	-0.0115** (0.0021)	-0.0098** (0.0027)	0.002	-0.0098** (0.0021)	-0.0076** (0.0027)	0.002
Unemployment Duration (head, spouse, or relative)	0.0086* (0.0035)	0.0094* (0.0038)	0.001	0.0083* (0.0035)	0.0081* (0.0038)	0.000
<u>Employment Variables Included Jointly in Regression</u>						
Workforce Status of Household Head						
<i>Head of HH unemployed (omitted)</i>						
Employed Head of HH	-0.1113 (0.114)	-0.6153** (0.1378)	-0.504**	-0.2366* (0.1155)	-0.5713** (0.1384)	-0.335*
Head of HH Not in Labor Force	-0.1935 (0.1039)	-0.5010** (0.1195)	-0.307*	-0.2348* (0.1047)	-0.3821** (0.1197)	-0.147
All Other Household Members Employed	-0.1007 (0.0728)	-0.2589* (0.1002)	-0.158	-0.1146 (0.0747)	-0.0994 (0.0987)	0.015
Some of Household Members Employed	0.0528 (0.0934)	-0.0946 (0.1343)	-0.147	-0.0006 (0.0958)	0.0301 (0.1354)	0.031
Average Usual Hours Worked (head, spouse, or relative)	-0.0096** (0.0024)	-0.0056 (0.0031)	0.004	-0.0077** (0.0025)	-0.0059 (0.0031)	0.002
Average Unemployment Duration (head, spouse, relative)	0.0071* (0.0035)	0.0079* (0.0038)	0.001	0.0071* (0.0035)	0.0072 (0.0038)	0.000

(table continues)

TABLE 9, continued

Variables	Using 18-Item Standard Measure (n= 24,633)			Using 10-Item Adult-referenced Measure (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Characteristic of Household Head						
<i>White Non-Hispanic (omitted)</i>						
Hispanic	0.2823** (0.0645)	0.1507 (0.0825)	-0.132	0.3295** (0.0653)	-0.0160 (0.0843)	-0.345**
Black Non-Hispanic	0.3232** (0.0531)	0.1329* (0.0662)	-0.190*	0.3472** (0.0541)	0.0871 (0.0656)	-0.260**
Other Non-Hispanic	0.0013 (0.1168)	0.0463 (0.139)	0.045	0.1280 (0.1144)	0.0127 (0.14)	-0.115
<i>High School Degree (omitted)</i>						
No High School Degree	0.2427** (0.0478)	0.3900** (0.0608)	0.147*	0.2561** (0.0482)	0.3578** (0.0606)	0.102
Some College	0.0639 (0.0591)	0.1996** (0.0746)	0.136	0.0818 (0.0604)	0.2244** (0.0733)	0.143
Associate Degree	-0.0196 (0.0944)	0.2156 (0.1137)	0.235	-0.0061 (0.0962)	0.1589 (0.1148)	0.165
College Degree	-0.5366** (0.0949)	-0.3460** (0.1163)	0.191	-0.5978** (0.0986)	-0.2517* (0.1108)	0.346*
Household Composition						
<i>Households with No Children (omitted)</i>						
<i>Single Head of HH - No Other Adults (omitted)</i>						
Children under 5 Years Old Present	0.1760** (0.05)	-0.1830** (0.068)	-0.359**	0.0066 (0.0524)	0.0098 (0.0666)	0.003
Children 5–18 Years Old Present	0.4173** (0.0462)	0.2249** (0.0587)	-0.192**	0.1954** (0.047)	-0.0671 (0.0583)	-0.262**
Married Head of Household	0.0688 (0.0737)	-0.2705** (0.0913)	-0.339**	0.0567 (0.0738)	-0.3364** (0.0907)	-0.393**
Single Head - Multiple Adults	0.1544* (0.0663)	0.0065 (0.0833)	-0.148	0.1525* (0.0671)	0.0165 (0.0825)	-0.136

(table continues)

TABLE 9, continued

Variables	Using 18-Item Standard Measure (n= 24,633)			Using 10-Item Adult-referenced Measure (n= 24,633)		
	Food Insecure	Hunger	Dif	Food Insecure	Hunger	Dif
Home Ownership and HH Income						
<i>130% ≤ Income < 185% (omitted)</i>						
Own Home	-0.4376** (0.0469)	-0.6252** (0.0612)	-0.188**	-0.3733** (0.0474)	-0.6356** (0.0612)	-0.262**
Income < 50% Poverty	0.1718** (0.0658)	0.2498** (0.0809)	0.078	0.1537* (0.0659)	0.2427** (0.081)	0.089
50% ≤ Income < 100%	0.4293** (0.0517)	0.3541** (0.0669)	-0.075	0.3357** (0.0521)	0.3387** (0.0671)	0.003
100% ≤ Income < 130%	0.2454** (0.0577)	0.2613** (0.0742)	0.016	0.1365* (0.0587)	0.3278** (0.0729)	0.191*
Other Characteristics						
Immigrant Head of HH	-0.1608* (0.0732)	-0.0616 (0.0928)	0.099	0.0484 (0.0723)	-0.1737 (0.0972)	-0.222*
Female Head of HH	0.1439* (0.059)	0.1367* (0.068)	-0.007	0.1614** (0.059)	0.1040 (0.0666)	-0.057
Disabled Head of HH	0.4997** (0.0686)	0.9171** (0.0784)	0.417**	0.4820** (0.0682)	0.8722** (0.0776)	0.390**
Elder Head of HH	0.2612 (0.1793)	0.6226** (0.2379)	0.361	0.1066 (0.1748)	0.6008* (0.2388)	0.494
Elder Present in Household	-0.1988 (0.1488)	-0.3866 (0.2022)	-0.188	-0.1943 (0.1467)	-0.3831 (0.2038)	-0.189

Note: Age and geographic variables were included in the regression. They were omitted here to preserve space.

* significant at the 5% level; ** significant at the 1% level.

We consider the role of the three largest federal food assistance programs in helping households that experienced some degree of hunger during the course of a year to escape food insecurity during the last 30 days of that year. By limiting our analysis to households with incomes less than 250 percent of the poverty threshold and that experienced hunger during the year leading up to the survey, our sample size is reduced by over 90 percent to 2,302 observations. The dependent variable classifies households into those that were food secure during the 30 days prior to the survey and those that registered some degree of food insecurity.

The first column of Table 10 presents the results of the logistic regression analysis with no program participation variables included. A few variables in the model are associated with lower levels of food insecurity for households that experienced hunger during the year, including households with children and having multiple adults in the household (compared to households with a single adult).

Columns 2 – 4 of Table 10 present the results of including participation in federal food assistance programs during the 30 days prior to the survey into the model. To identify which of the food assistance programs might help explain our observations for households with children, we include the participation variables in our empirical model one at a time.

Participating in the Food Stamp Program, WIC, and the NSLP are all associated with lower levels of food insecurity during the 30 days before the survey among households that experienced hunger during the year, but the results are only significant for participation in the NSLP.

We next consider whether any of the three food assistance programs can explain why households with children are better able to escape hunger than households with no children. Controlling for the Food Stamp Program has little effect on the coefficients for households with children. This corresponds with our earlier results. Controlling for participation in WIC slightly weakens the coefficient on children under 5 years old, such that it is no longer significantly different from zero. However, the difference between the two coefficients is quite small, so we do not take this as strong evidence that WIC helped households with children escape hunger. Participation in the NSLP, however, substantially reduces the observed

TABLE 10
Logistic Regression Results on Food Insecurity during Past 30 Days (Food Secure=0; Food Insecure=1)
for Households that Experienced Hunger during the Previous Year,
Using the Adult-Referenced and CPS March/April Merged Data for Low-Income Households
(Income < 250% Poverty)

Variables	No Program (n=2,302)	Food Stamp Program (n=2,289)	WIC (n=2,252)	NLSP (n=2,295)
Food Assistance Program Participation		-0.0434 (0.1433)	-0.0800 (0.2113)	-0.3864* (0.1921)
Characteristic of Household Head				
<i>White Non-Hispanic (omitted)</i>				
Age	0.0049 (0.0266)	0.0062 (0.0266)	0.0068 (0.027)	0.0007 (0.0268)
Age Squared	-0.0003 (0.0003)	-0.0003 (0.0003)	-0.0003 (0.0003)	-0.0002 (0.0003)
Hispanic	0.0649 (0.2138)	0.0580 (0.2141)	0.0860 (0.2162)	0.0682 (0.2138)
Black Non-Hispanic	0.3758* (0.1558)	0.3770* (0.1561)	0.3851* (0.1589)	0.3720* (0.1562)
Other Non-Hispanic	1.1690* (0.4688)	1.1799* (0.4691)	1.2458* (0.4828)	1.1723* (0.469)
Educational Level of Household Head				
<i>High School Degree (omitted)</i>				
No High School Degree	0.2886* (0.1427)	0.3036* (0.1432)	0.2872* (0.1442)	0.3173* (0.1436)
Some College	0.0682 (0.1652)	0.0664 (0.1656)	0.0416 (0.1674)	0.0665 (0.1653)
Associate Degree	0.6305* (0.2994)	0.6372* (0.2998)	0.6917* (0.3128)	0.6229* (0.2994)
College Degree	0.3101 (0.2723)	0.3199 (0.2722)	0.2995 (0.2732)	0.3034 (0.2726)
Household Composition				
<i>Households with No Children (omitted)</i>				
<i>Single Head of HH - No Other Adults (omitted)</i>				
Children under 5 Years Old Present	-0.3367* (0.1476)	-0.3307* (0.1496)	-0.2858 (0.1713)	-0.3497* (0.1485)
Children 5–18 Years Old Present	-0.3815** (0.1334)	-0.3673** (0.1346)	-0.3854** (0.1353)	-0.1020 (0.1871)
Married Head of Household	0.4270* (0.1909)	0.4372* (0.1909)	0.4941* (0.1953)	0.4253* (0.1921)
Single Head - Multiple Adults	-0.5749** (0.1563)	-0.5728** (0.1568)	-0.5674** (0.1592)	-0.5734** (0.1576)

(table continues)

TABLE 10, continued

Variables	No Program (n=2,302)	Food Stamp Program (n=2,289)	WIC (n=2,252)	NLSP (n=2,295)
Geographic				
<i>West (omitted)</i>				
<i>Metro - Not Central City (omitted)</i>				
Central City	0.2009 (0.1582)	0.2091 (0.1584)	0.1631 (0.1603)	0.2022 (0.1584)
Non-metro	-0.0879 (0.1542)	-0.0825 (0.155)	-0.1225 (0.1569)	-0.0594 (0.155)
Home Ownership and HH Income				
<i>185% ≤ Income < 250% (omitted)</i>				
Own Home	0.1687 (0.1421)	0.1634 (0.1428)	0.1459 (0.1446)	0.1441 (0.1425)
Income < 50% Poverty	-0.7233** (0.2232)	-0.7177** (0.226)	-0.8208** (0.2287)	-0.6739** (0.2278)
50% ≤ Income < 100%	-0.1690 (0.1965)	-0.1624 (0.1994)	-0.2373 (0.2012)	-0.1500 (0.1995)
100% ≤ Income < 130%	-0.1864 (0.21)	-0.1743 (0.2104)	-0.1923 (0.2158)	-0.1581 (0.2131)
130% ≤ Income < 185%	0.2685 (0.2038)	0.2654 (0.204)	0.2241 (0.2088)	0.2845 (0.2066)
Workforce Status of Household Head				
<i>Head of HH unemployed (omitted)</i>				
Employed Head of HH	-0.3402 (0.3083)	-0.3311 (0.3085)	-0.3864 (0.308)	-0.3206 (0.3086)
Head of HH Not in Labor Force	-0.1781 (0.2842)	-0.1511 (0.2849)	-0.1267 (0.2849)	-0.1646 (0.2844)
Average Number of Jobs (head, spouse, or relative)	-0.4532* (0.1999)	-0.4486* (0.2007)	-0.4434* (0.2008)	-0.4699* (0.2002)
Unemployment Duration (head, spouse, or relative)	-0.0004 (0.0091)	-0.0001 (0.0091)	-0.0005 (0.0089)	-0.0001 (0.009)
Other Characteristics				
Immigrant Head of HH	-0.2599 (0.2432)	-0.2800 (0.2441)	-0.3287 (0.2449)	-0.2431 (0.2438)
Female Head of HH	0.6618** (0.1553)	0.6630** (0.1557)	0.6878** (0.1575)	0.6575** (0.1563)
Disabled Head of HH	0.2379 (0.1954)	0.2346 (0.1959)	0.2306 (0.1984)	0.2573 (0.1959)
Elder Head of HH	-0.2235 (0.627)	-0.2201 (0.6282)	-0.2662 (0.6333)	-0.2277 (0.6281)
Elder Present in Household	0.3660 (0.5309)	0.3773 (0.5316)	0.3543 (0.5344)	0.3578 (0.5326)

* significant at the 5% level; ** significant at the 1% level.

difference between households with and without children between the ages of 5 and 18. The results suggest that the NSLP plays a role in helping households with school-age children escape hunger.²⁰ This corresponds with recent findings from Nord and Romig (2003).

6. CONCLUSIONS

This paper identifies factors contributing to increased risk of food insecurity and hunger among U.S. households and resources that may help mitigate that risk. Unlike much of the literature, the analytical framework stresses the differences between the determinants of food insecurity and hunger and uses multinomial logistic regression to conduct the analysis. The results suggest that, compared to households with no children, households with children are more likely to experience food insecurity without hunger, but are less likely to experience food insecurity with hunger. This finding suggests that households with children may be drawing on personal and/or public resources to help them avoid hunger.

To investigate this possibility, we construct a modified measure of food security that only includes 10 of the 18 items that go into constructing USDA's standard 12-month food security measure. The 8 items that we omit apply only to households with children and might be responsible for the observed differences between households with and without children. We also merge the food security data (from the April supplements of the CPS) with data from the March supplements, because they contain program participation information over 12 months and because they contain more precise information on household income. As a result of these two steps, we are able to completely control for the observed differences for households with children less than 5 years old. However, households with children between 5 and 18 years old were still relatively more likely to experience food insecurity and relatively less likely to experience hunger.

²⁰Alternatively, the NSLP may be associated with other variables that help households with school-age children escape hunger. There remains the potential problem of selection bias, which needs to be addressed before firm conclusions can be reached about the effects of the NSLP.

To investigate this matter further, we control for household participation in the Food Stamp Program, the federal government's largest food assistance program. We address the problem of the endogeneity of the program participation decision by using a two-stage process in which we predict Food Stamp Program participation and include the predicted value as an instrument in the food security equation. To identify the model, we consider four state-level policy variables that we argue are correlated with the Food Stamp participation decision, but not with the error term of the food security equation. Our results suggest that participating in the Food Stamp Program appears to moderate the observed differences for households with children aged 5 to 18, but not significantly.

Next we address the possibility that household employment circumstances might explain why households with children are more likely to experience food insecurity, but less likely to experience hunger, compared to households without children. Although the household employment variables we include in our model provide us with a richer understanding of the determinants of hunger and food insecurity, they too do not explain the observed differences between households with and without children.

Finally, we consider whether participating in any of the three largest federal food assistance programs could explain the differences we observed between households with and without children. This is done by studying whether participating in each of the three food assistance programs within 30 days of the interview was associated with households that experienced hunger during the previous year escape food insecurity during the last 30 days of that year. We find that only participating in the National School Lunch Program was associated with lower levels of food insecurity in the 30 days prior to the survey interview for households that experienced hunger during the year. We also find that controlling for participation in the National School Lunch Program substantially reduced the observed differences between households with children between the ages of 5 and 18 and households without children. The results suggest that the NSLP might be playing an important role in helping households with school-age children escape hunger.

References

- Andrews, Margaret, Mark Nord, Gary Bickel, and Steven Carlson. 2000. *Household Food Security in the United States, 1999*. Food Assistance and Nutrition Research Report No. 8. U.S. Department of Agriculture, Economic Research Service, Washington, DC. Fall 2000.
- Angrist, Joshua, and Alan Krueger. 2001. "Instrumental Variables and the Search for Identification: From Supply and Demand to Natural Experiments." *Journal of Economic Perspectives* 15 (4): 69–85.
- Bickel, Gary, Steven Carlson, and Mark Nord. 1999. *Household Food Security in the United States 1995–1998: Advance Report*. U.S. Department of Agriculture, Food and Nutrition Service, Alexandria VA. July 1999.
- Bickel, Gary, Mark Nord, Cristofer Price, William Hamilton, and John Cook. 2000. *Guide to Measuring Household Food Insecurity, Revised 2000*. U.S. Department of Agriculture, Food and Nutrition Service, Alexandria VA. March 2000.
- Bitler, Marianne, Janet Currie, and John Karl Scholz. 2002. "WIC Eligibility and Participation." IRP Discussion Paper 1255-02, Institute for Research on Poverty, University of Wisconsin–Madison.
- Bond, John, David Jaeger, and Regina Baker. 1995. "Problems with Instrumental Variables Estimation when the Correlation between the Instruments and the Endogenous Explanatory Variables Is Weak." *Journal of the American Statistical Association* 90 (430): 443–450.
- Borjas, George. 2001. "Food Insecurity and Public Assistance." Presented at the Food Assistance and Nutrition Research Small Grants Conference, Economic Research Service, USDA, Washington DC, October 2001.
- Chatterji, Pinka, Karen Bonuck, Simi Dhawan, and Nandini Deb. 2002. "WIC Participation and the Initiation and Duration of Breastfeeding." IRP Discussion Paper 1246-02, Institute for Research on Poverty, University of Wisconsin–Madison.
- Currie, Janet, and Jeff Grogger. 2001. "Explaining Recent Declines in Food Stamp Program Participation." In *Brookings-Wharton Papers on Urban Affairs*, Vol. II, edited by William G. Gale and Janet Rothenberg Pack. Washington, DC: Brookings Institution.
- Dunifon, Rachel, and Lori Kowaleski-Jones. 2003. "The Influences of Participation in the National School Lunch Program and Food Insecurity on Child Well-Being." *Social Service Review* 77 (1): 72–92.
- Dutta, Indranil, Craig Gundersen, and Prasanta Pattanaik. 2002. *Measures of Food Insecurity at the Household Level*. Working Paper 02-03, Department of Economics, University of California, Riverside.
- Figlio, David, Craig Gundersen, and James Ziliak. 2000. "The Effects of the Macroeconomy and Welfare Reform on Food Stamp Caseloads." *American Journal of Agricultural Economics* 82(3): 635–641.

- Frongillo, Edward. 2001. "Testing the Robustness of the Food Security Scale with More Recent CPS Data: Discussion." In *Second Food Security Measurement and Research Conference. Volume I: Proceedings*, edited by Margaret Andrews and Mark Prell. Food Assistance and Nutrition Research Report No. 11-1. U.S. Department of Agriculture, Economic Research Service, Washington, DC. July 2001.
- Gundersen, Craig, and Joseph Gruber. 2001. "The Dynamic Determinants of Food Insufficiency." In *Second Food Security Measurement and Research Conference. Volume II: Papers*, edited by Margaret Andrews and Mark Prell. Food Assistance and Nutrition Research Report No. 11-2. U.S. Department of Agriculture, Economic Research Service, Washington, DC. July 2001.
- Gundersen, Craig, and Victor Oliveira. 2001. "The Food Stamp Program and Food Insufficiency." *American Journal of Agricultural Economics* 83 (4): 875–887.
- Hamilton, William L. 2001. "Developing National Prevalence Estimates From the 1995 Food Security Supplement to the Current Population Survey." In *Second Food Security Measurement and Research Conference. Volume I: Proceedings*, edited by Margaret Andrews and Mark Prell. Food Assistance and Nutrition Research Report No. 11-1, Economic Research Service, USDA, Washington, DC.
- Hamilton, William L., John T. Cook, William W. Thompson, Lawrence F. Buron, Edward A. Frongillo, Jr., Christine M. Olson, and Cheryl A. Wehler. 1997a. *Household Food Security in the United States in 1995: Summary Report of the Food Security Measurement Project*. Report prepared for the USDA, Food Consumer Service, Alexandria, VA.
- Hamilton, William L., John T. Cook, William W. Thompson, Lawrence F. Buron, Edward A. Frongillo, Jr., Christine M. Olson, and Cheryl A. Wehler. 1997b. *Household Food Security in the United States in 1995: Technical Report of the Food Security Measurement Project*. Report prepared for the USDA, Food Consumer Service, Alexandria, VA.
- Kabbani, Nader, and Parke Wilde. 2003. "Short Recertification Periods in the U.S. Food Stamp Program." *Journal of Human Resources* 38 (S): 1112–1138.
- Kabbani, Nader. 2001. *Avoiding Hunger: Factors Affecting the Likelihood that Food Insecure Households Will Be Hungry*. Presented at the Association for Public Policy Analysis and Management Annual Research Conference, Washington, DC, November 1–3, 2001.
- Kornfeld, Robert. 2002. *Explaining Recent Trends in Food Stamp Program Caseloads: Final Report*. Bethesda, MD: Abt Associates, Inc.
- McKernan, Signe-Mary, and Caroline Ratcliffe. 2003. *Employment Factors Influencing Food Stamp Program Participation*. Washington, DC: Urban Institute, June 2003.
- Mills, Gregory, and Robert Kornfeld. 2000. *Study of Arizona Adults Leaving the Food Stamp Program: Final Report*. Prepared by Abt Associates, Inc. for Economic Research Service, U.S. Department of Agriculture. Electronic Publication from the Food Assistance & Nutrition Research Program (e-FAN-01-001). December 2000.
- Nord, Mark. 2003. "Keeping Warm, Keeping Cool, Keeping Food on the Table: Seasonal Food Insecurity and Costs of Heating and Cooling." Presented at the Annual Meeting of the National Association for Welfare Research and Statistics, San Diego, CA, July 13–16, 2003.

- Nord, Mark. 2002. *A 30-Day Food Security Scale for Current Population Survey Food Security Supplement Data*. U.S. Department of Agriculture, Economic Research Service, Washington, DC. August 2002.
- Nord, Mark. 2001. "Food Stamp Participation and Food Security." *FoodReview* 24 (1): 13–19.
- Nord, Mark. 2000. "Does It Cost Less to Live in Rural Areas? Evidence from New Data on Food Security and Hunger." *Rural Sociology* 65 (1, March): 104–125.
- Nord, Mark, Margaret Andrews, and Steven Carlson. 2003. *Household Food Security in the United States, 2002*. Washington, DC: Economic Research Service, U.S. Department of Agriculture, Food Assistance and Nutrition Research Report No. 35, October 2003.
- Nord, Mark, Margaret Andrews, and Steven Carlson. 2002. *Household Food Security in the United States, 2001*. Washington, DC: Economic Research Service, U.S. Department of Agriculture, Food Assistance and Nutrition Research Report No. 29, October 2002.
- Nord, Mark, and Gary Bickel. 2002. *Measuring Children's Food Security in U.S. Households, 1995–99*. Washington, DC: Economic Research Service, U.S. Department of Agriculture, Food Assistance and Nutrition Research Report No. 25, April 2002.
- Nord, Mark, and Gary Bickel. 2001. "Estimating the Prevalence of Children's Hunger From the Current Population Survey Food Security Supplement." In *Second Food Security Measurement and Research Conference. Volume II: Papers*, edited by Margaret Andrews and Mark Prell. Food Assistance and Nutrition Research Report No. 11-2, Economic Research Service, USDA, Washington, DC.
- Nord, Mark, Kyle Jemison, and Gary Bickel. 1999. *Prevalence of Food Insecurity and Hunger, by State, 1996–1998*. U.S. Department of Agriculture, Economic Research Service, Washington, DC, September 1999.
- Nord, Mark, Nader Kabbani, Laura Tiehen, Margaret Andrews, Gary Bickel, and Steven Carlson. 2002. *Household Food Security in the United States, 2000*. Washington, DC: Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture, Food Assistance and Nutrition Research Report No. 21, February 2002.
- Nord, Mark, and Kathleen Romig. 2003. "Hunger in the Summer: Seasonal Food Insecurity and the National School Lunch and Summer Food Service Programs." Presented at the Association for Public Policy Analysis and Management Annual Research Conference, Washington, DC, November 2003.
- Ohls, James, Abhijay Prakash, Larry Radbill, and Allen Schirm. 2001. "Methodological Findings and Early Conclusions Based on the 1995, 1996, and 1997 Food Security Data." In *Second Food Security Measurement and Research Conference. Volume II: Papers*, edited by Margaret Andrews and Mark Prell. Food Assistance and Nutrition Research Report No. 11-2. U.S. Department of Agriculture, Economic Research Service, Washington, DC. July 2001.
- Oliveira, Victor. 2003. *The Food Assistance Landscape: March 2003*. Food Assistance and Nutrition Research Report No. 28-2. Washington, DC: Economic Research Service, USDA.
- Oliveira, Victor. 2002. *The Food Assistance Landscape*, Vol. 1(1). Food Assistance and Nutrition Research Report No. 28-2. Washington, DC: Economic Research Service, USDA, March 2002.

- Polit, Denise, Andrew London, and John Martinez. 2000. *Food Security and Hunger in Poor, Mother-Headed Families in Four U.S. Cities*. Prepared by MDRC, May 2000.
- Ponza, Michael, James C. Ohls, Lorenzo Moreno, Amy Zambrowski, and Rhoda Cohen. 1999. *Customer Service in the Food Stamp Program*. Princeton, NJ: Mathematica Policy Research, Inc.
- President's Task Force on Food Assistance. 1984. *Report of the President's Task Force on Food Assistance*. Washington, DC: U.S. Government Printing Office, January 1984.
- Rangarajan, Anu, and Philip Gleason. 2001. *Food Stamp Leavers in Illinois: How Are They Doing Two Years Later? Final Report*. An evaluation by Mathematica Policy Research, Inc. for the Economic Research Service, U.S. Department of Agriculture. Electronic Publication from the Food Assistance & Nutrition Research Program (e-FAN-01-002). January 2001.
- Rosenbaum, Dorothy. 2000. *Improving Access to Food Stamps*. Washington, DC: Center on Budget and Policy Priorities.
- Rose, Donald, Craig Gundersen, and Victor Oliveira. 1998. *Socio-Economic Determinants of Food Insecurity in the United States: Evidence from the SIPP and CSFII Datasets*. Technical Bulletin No. 1869. U.S. Department of Agriculture, Economic Research Service, Washington, DC. September 1998.
- Seavey, Dorie. 2001. *Food Insecurity and Hunger among Households Leaving Welfare in Massachusetts: A Review of Recent Findings from the MA Department of Transitional Assistance*. Report from the Food Security Institute, Center on Hunger and Poverty, Brandeis University, February 2001. Available at: www.centeronhunger.org.
- St. Peter, Robert, and David Bourdon. 1999. *Hunger in Kansas*. Topeka, Kansas: Kansas Health Institute, Pub. No. 99-100, August 1999.
- Stormer, Ame, and Gail G. Harrison. 2003. "Does Household Food Security Affect Cognitive and Social Development of Kindergartners?" IRP Discussion Paper No. 1276-03, Institute for Research on Poverty, University of Wisconsin-Madison.
- Wilde, Parke. 2004. "Food Security Response Patterns Differ for Households with and without Children." *Journal of Nutrition*, Forthcoming.