Socio-Economic Determinants of Food Insecurity in the United States: Evidence from the SIPP and CSFII Datasets. By Donald Rose, Craig Gundersen, and Victor Oliveira, Food and Rural Economics Division, Economic Research Service, U.S. Department of Agriculture. Technical Bulletin No. 1869.

Abstract

This bulletin reports empirical findings on the determinants of food insecurity in the United States using data from the 1989-91 Continuing Survey of Food Intake by Individuals and the 1992 Survey of Income and Program Participation. Descriptive statistics on food insufficiency status (a proxy measure for the most food-insecure households) are presented from both surveys. Multivariate logit models are used to study the effects of socio-economic characteristics on food insufficiency. Households with higher incomes, homeowners, households headed by a high school graduate, and elderly households were less likely to be food insufficient. Holding other factors constant, those in poverty were over 3.5 times more likely to be food insufficient. However, there was not a one-to-one correspondence between poverty and food insufficiency, since over 40 percent of food-insufficient households were not poor and about 10 percent of poor households were food insufficient. Food stamp benefit levels were inversely associated with food insufficiency.

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Summary

One way to study food insecurity is through the use of indirect measures, such as the number of people in poverty. However, income-based poverty measures may not give an accurate picture of food security, or living standards in general, because they do not take into account assets, in-kind benefits, taxes, price differences, or the special needs of some households, such as those headed by single parents or those containing individuals with disabilities. Increasingly, economists are using direct measures of well-being to gain a better understanding of deprivation and improve policy analysis.

This report reviews the concept of household food insecurity as one such measure and presents empirical findings on the characteristics of the food insecure in the United States. Data were analyzed from the 1989-91 Continuing Survey of Food Intake by Individuals (CSFII) and the 1992 Survey of Income and Program Participation (SIPP). As a proxy measure for the most food-insecure households, we used food insufficiency status, a previously validated dichotomous indicator based on the respondents' report of household food intake. Households reporting that they sometimes or often do not get enough to eat were considered food insufficient.

In the 1989-91 CSFII and 1992 SIPP surveys, 2.5 and 2.3 percent of the U.S. population were food insufficient. Bivariate analysis, however, indicated that food insufficiency was not evenly distributed throughout the population. Food insufficiency rates were inversely related to household income. Food insufficiency was lower for households headed by a high school graduate than for those headed by a non-high school graduate. Homeowners were less likely than renters to be food insufficient. For households with two or more people, food insufficiency rates generally increased with size. White households in both surveys had the lowest rates of food insufficiency. In the SIPP, non-Hispanic blacks had lower food insufficiency rates than Hispanics, while in the CSFII, the reverse was true. Households headed by someone over the age of 60 had lower rates of food insufficiency than households headed by younger persons.

Multivariate logit models were used to study the effects of socio-economic characteristics, including poverty status and food stamp benefits, on food insufficiency. Both income and home ownership were strong inverse predictors of food insufficiency. Households headed by those who were high school graduates or who were elderly were also less likely to be food insufficient, whereas those headed by single parents were more likely to be food insufficient. Holding other factors constant, those in poverty were over 3.5 times more likely to be food insufficient. Despite the strong relationship of poverty to food insufficiency, there was not a one-to-one correspondence. Over 40 percent of food-insufficient households were above the poverty line and about 10 percent of households in poverty were food insufficient. This affirms the need for direct indicators of food insecurity, since the use of an indirect measure, like poverty status, would overlook a large percentage of households who were food insufficient and would incorrectly identify many households who were not. For food stamp participants, food stamp benefit levels were inversely associated with food insufficiency rates and the magnitude of this association was greater than that between cash income and food insufficiency.

Socio-Economic Determinants of Food Insecurity in the United States

Evidence from the SIPP and CSFII Datasets

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Introduction

Many Americans strongly believe that hunger in a Nation as wealthy as the United States is not acceptable for moral reasons. This belief has been reflected in presidential reports, congressional hearings, and opinion polls (White House Conference on Food, Nutrition, and Health, 1969; President's Task Force on Food Assistance, 1984; U.S. House of Representatives, 1992; and Breglio, 1992). The Nation's investment in food assistance efforts to reduce hunger and undernutrition, $38 billion in fiscal year 1996, is a testament to this concern. In addition to the moral imperative, society has a practical interest in this issue. Food insufficiency may increase the risk of undernutrition, and result in conditions such as iron-deficiency anemia or growth stunting. Iron deficiency has been shown to cause functional impairments in work performance, behavior and intellectual development, and resistance to infections (Viteri and Torun, 1974; Walter *et al.*, 1989; and Dallman, 1987). Moreover, hunger can have an effect long before the symptoms of undernutrition occur. For example, the skipping of meals, even when it does not result in undernutrition, can affect the way children function in school (Meyers *et al.*, 1989) and thus affect their future productivity.

An understanding of the nature and determinants of food insecurity is an important part of improving policies that seek to reduce the problem of domestic hunger. Unlike the situation in some low-income countries, food supply problems generally do not contribute to food insecurity in the United States, because of the effective U.S. food production, marketing, and distribution infrastructure. In this report, we analyze recent micro-level data to better understand the socio-economic determinants of food insecurity at the household level.

One way to study food insecurity is through the use of indirect measures, such as the number of people in poverty. Research during the 1950's found that, on average, U.S. households spent about one-third of their income on food (USDA, 1957). So, poverty thresholds were set at three times the cost of the economy food plan, a low-cost nutritionally adequate food plan designed by U.S. Department of Agriculture. Early estimates of the number of hungry people in the United States were based on income in relation to the poverty thresholds (U.S. Senate Select Committee on Nutrition and Human Needs, 1969). However, income-based poverty measures may not give an accurate picture of food security, or living standards in general, because they do not take into account assets, in-kind benefits, taxes, price differences, or the special needs of some households, such as those headed by single parents or those containing individuals with disabilities.

In part due to these drawbacks of income-poverty measures, economists are increasingly using direct measures of well-being in the measurement and analysis of living standards. For example, the United Nations Development Program (UNDP) uses literacy and life expectancy at birth, as well as an adjusted real Gross Domestic Product per capita index as the three indicators in its human development index (UNDP, 1990). This approach is consistent with the work of Amartya

Sen (1985), who has argued that assessment of human functionings, such as having a nourishing diet or being adequately housed, makes more sense in developing living standards than do the income or the commodities needed to obtain such functionings. Empirical work in the United States has also studied direct measures of well-being. For example, Mayer and Jencks (1989) looked at a variety of direct measures in a sample of low-income households from Chicago, Mauldon (1996) studied the effects of income on measures of food and shelter inadequacy in California, and Gundersen (1996) compared measures of housing poverty with income-poverty in a representative sample of the United States.

There are other reasons for studying direct measures of well-being. Because the object of concern is more directly measured, this type of information can be useful in prescribing policy and designing and evaluating programs. For example, legislation authorizing the Food Stamp Program (FSP) calls for the program to reduce hunger and improve nutrition. Direct measures are useful in evaluating whether the program's intent is met. Direct measures of well-being also are useful in informing the public about issues of concern, since the meaning of these measures can be understood more easily than the somewhat abstract definitions of living standards used in measuring poverty.

Substantial work on the measurement of hunger and food insecurity has been done in the nutrition discipline. Researchers at health departments, universities, and public advocacy groups have undertaken various studies to define and measure hunger in the United States (Briefel and Woteki, 1992; Radimer *et al.*, 1992; and Wehler *et al.*, 1992). This work was motivated, in part, by a presidential task force that found evidence of hunger, but was unable to estimate the extent of the problem or how it had changed in recent years due to a lack of adequate indicators (President's Task Force on Food Assistance, 1984). Since that time, consensus has formed on conceptual definitions of food insecurity and hunger expressed in a report prepared for the American Institute of Nutrition on nutritional status indicators of low-income populations (FASEB/LSRO, 1990). Food security was defined in this report as: "access by all people at all times to enough food for an active, healthy life and includes at a minimum: (a) the ready availability of nutritionally adequate and safe foods, and (b) the assured ability to acquire acceptable foods in socially acceptable ways (e.g. without resorting to emergency food supplies, scavenging, stealing, and other coping strategies)."

Transforming this conceptual definition into an operational definition that can yield survey-based measures of food insecurity and hunger is the subject of current research supported by the Food and Nutrition Service (FNS) of the U.S. Department of Agriculture (USDA) in collaboration with the National Center for Health Statistics of the U.S. Department of Health and Human Services.[1] This effort to define and measure food insecurity and hunger is a task outlined in the *10-Year Comprehensive Plan for the National Nutrition Monitoring and Related Research* (U.S. Department of Health and Human Services and U.S. Department of Agriculture, 1993), a plan mandated by Federal legislation enacted in 1990. A main goal of the legislation is to provide a manner in which the food needs and nutritional health of the Nation can be monitored over time and thus provide the information base needed for improvements in this area.

Consistent with goals of the 10-Year Plan, we pursue three primary objectives in this report. The first is to analyze the overall socio-economic determinants of food insecurity. A second objective is to provide a quantitative estimate of the relationship between income-poverty and food insecurity and thus advance our understanding of the connection between indirect and direct measures of well-being. As a third objective, we explore the relationship of income and food stamp benefits to food insecurity among food stamp households.[2] Here we extend previous work on the food stamp population that has considered the effects of cash versus in-kind benefits on food spending. In pursuing these objectives we use both bivariate descriptive statistics and multivariate logit models.

[1]As part of this research, FNS has designed a food security survey implemented as a supplement to many surveys (Hamilton *et al.*, 1997a, 1997b). The survey was first conducted in the April 1995 monthly Current Population Survey (CPS).

[2]The FSP is the largest Federal food-assistance program. It served an average of 25.5 million people per month, while providing more than $22 billion in benefits in fiscal year 1996. The program provides low-income households with monthly allotments of coupons that can be used at authorized retail food stores. Households can use these coupons to buy most foods, but they cannot be exchanged for cash, nor can they be used to buy alcohol, tobacco, or nonfood items. Eligibility for the program is based on need; households must meet income guidelines, asset limitations, and certain work requirements.

Data for these analyses come from two recent national household-based surveys that contain information about food insecurity, the 1989-91 Continuing Survey of Food Intake by Individuals (CSFII) and the 1992 Survey of Income and Program Participation (SIPP).[3] These surveys differ in several aspects, including the sample design and the timing of their implementation. The latter is important, since the FSP experienced a dramatic increase in caseload from 1989 to 1992 (Oliveira, 1996), an increase that might have implications for our analyses of food insecurity. To the extent that we see similarities in the determinants of food insecurity across surveys that differ in both sample design and timeframe, we can be more confident of the robustness of our results.

Theoretical Framework

We model food insecurity within the framework of consumer demand theory and begin by incorporating the demand for characteristics (Gorman, 1956; and Lancaster, 1966) with household production theory (Becker, 1965).[4] Households produce meals by combining market-purchased foods and time spent shopping and cooking with the use of durable goods, such as refrigerators and stoves, and human capital, such as the nutrition knowledge and cooking skills it takes to make these meals. Households derive utility from these meals through the satisfaction found in a set of taste characteristics as well as through the health effects of the nutrients consumed. Thus, consider a utility function that has vectors of taste components, **S**, and nutrients, **N**, found in these meals,

$$U=U(\boldsymbol{S}, \boldsymbol{N}, \boldsymbol{X_o}, l), \qquad (1)$$

as well as a vector of other goods, $\mathbf{X_O}$, and leisure, represented by l. Households are assumed to maximize this utility subject to a home production function and constraints on their income and time. The amount of nutrients consumed is a function of home production, as represented by,

$$\boldsymbol{N}=n,(\boldsymbol{X_F}, L_F, \boldsymbol{K}, \boldsymbol{D}), \qquad (2)$$

where $\mathbf{X_F}$ is a vector of market-purchased foods, L_F is the labor time spent in food shopping and meal preparation, **K** is a vector of capital goods, including human capital as indicated earlier, and **D** is a vector of demographic characteristics, such as household size and composition. Production functions for other characteristics of meals, such as taste, can be similarly depicted. The budget constraint for this problem is given by,

$$\boldsymbol{P_F X_F}+\boldsymbol{P_o X_o}=V+w(T-L_F-l), \qquad (3)$$

where $\mathbf{P_F}$ is a vector of food prices, $\mathbf{P_O}$ is a vector of prices for other goods, w is the wage rate, V represents non-wage income, and T is total time available to the household members. We have incorporated the total time constraint into this budget constraint; time spent in the labor market is equal to $T - L_F - l$. Reduced-form nutrient demand equations for this optimization problem are of the form:

$$\boldsymbol{N}=n^*(\boldsymbol{P_F}, \boldsymbol{P_o}, V, w, \boldsymbol{K}, \boldsymbol{D}). \qquad (4)$$

Demand functions for other characteristics of meals as well as other goods and leisure could be similarly depicted.

For purposes of exposition, we consider the case of one nutrient, food energy, E.[5] Our indicator I_i of food insecurity is defined by,

$$I_i=l, \text{ if } E_i<E_{min}$$

$$I_i=0, \text{ otherwise}, \qquad (5)$$

where food insecurity occurs when the household falls below some minimum level of energy consumption, E_{min}. Thus, our indicator of food insecurity is based on nutrient intake below a minimum level, a nutrient intake that is a function of prices, wages, nonlabor income, capital, and household characteristics.

Our theoretical framework has been static in nature and this is reflective of our datasets, which limit our empirical work to cross-sectional modeling. Food insecurity,

[3]The Third National Health and Nutrition Examination Survey (1988-94) also collected information on food insecurity, but the unit of analysis for the survey was the individual, not the household.

[4] For examples of models used to examine food insecurity in a developing world context, see Barrett, 1998; Dasgupta, 1993; and Glomm and Palumbo, 1993.

[5]Energy intake is perhaps the most relevant characteristic for assessment of food insufficiency, which is what we model empirically. Food security, of course, is a broader concept than just food sufficiency. It includes other characteristics of foods, such as micronutrients and flavor components, that make up a nutritionally adequate and socially acceptable diet. Our treatment could be easily generalized to reflect these additional characteristics of foods, by using vectors of nutrients and/or food components. Other aspects of food security, such as concern about having enough food or the use of socially acceptable food procurement methods, go beyond specific characteristics inherent in foods, and would require a different treatment. See the section on "Measuring Food Insecurity" for additional details related to this.

of course, is a condition based on previous and current experiences as well as expectations about the future. Implicit in the terminology of food insecurity is an uncertainty about future consumption levels. Although a full treatment of the household's attitude about risk and its effect on food security is beyond the scope of this report, we acknowledge that wealth has an effect on a household's abilities to adapt to uncertainty. Accordingly, one could consider the vector of capital goods in our reduced-form model (equation 4) to include other assets available to the household that do not directly relate to food production.

Empirical Models

In this section, we describe three empirical models that we use to answer questions about food insecurity. The three models share much of the same structure, so we begin with a complete description of Model I, and subsequently examine distinguishing features of Models II and III.

In Model I, as in all three models, we use a categorical dependent variable model, the logit model (Cramer, 1991), to predict the probability of food insecurity, q_i, for household i,

$$q_i = \frac{1}{1+e^{-z_i}}$$
$$z_i = \alpha + \beta Y_i + \boldsymbol{\gamma K_i} + \boldsymbol{\delta D_i} + \varepsilon_i, \qquad (6)$$

where Y is income, α and β are coefficients, $\boldsymbol{\gamma}$ and $\boldsymbol{\delta}$ are vectors of coefficients, and ε_i is an error term.

The following paragraphs describe the variables used in this model, and our prior expectations about their relationship to food insecurity. Unlike equation (4), this empirical specification omits the price vectors, $\mathbf{P_O}$ and $\mathbf{P_F}$, because we use cross-sectional data. In the $\mathbf{D_i}$ vector, we include dummy variables for geographic regions to incorporate part of the spatial variation in prices that may exist.[6] Total household income, Y, includes income from wage labor as well as nonlabor income, V.[7]

Household income has a direct effect on food security, since a lack of money prevents a household from purchasing enough food. There is also an indirect effect if a household cannot afford the transportation to a food store.[8] We assume that food expenditures are a function of pooled household income, the sum of income from all household members. Previous research indicates that households reporting zero or negative income are behaviorally distinct from other low-income households (Wemmerus and Porter, 1996). Accordingly, we dropped these households (27 in the CSFII and 201 in the SIPP, about 0.50 percent of each survey) from our analytic samples.

The extent of a household's human capital, such as educational level, affects both present and future income. Education also portrays another important dimension of human capital: the purchasing efficiency, food knowledge, and meal preparation skills of the main food purchaser and preparer in the household. The person responsible for these tasks is generally the female head and so it is her educational level, rather than the male head's, that we use here. In households with no female head present, the education of the male head is used.

A household's level of total assets can be expected to affect its ability to withstand abrupt changes in prices, income, or unforeseen events that create need for additional expenditures. We use homeownership as a proxy measure for a household's wealth, both because it is the single largest asset for many households and because it is highly correlated with more liquid assets, such as increased savings. Homeownership may be expected to affect food insecurity in other specific ways. A subset of homeowners, those with paid-off mortgages, have more disposable income available for food expenditures. Also, because foreclosures take a longer time than evictions, homeowners unable to afford both adequate quantities of food and housing may be food secure, at least in the short run. Finally, homeownership may proxy for greater efficiency in the allocation of household resources (Mayer and Jencks, 1989) and in this sense can be seen as a product of higher levels of human capital.

Household size and composition can also be expected to affect the probability of food insecurity. Minimum

[6]Price differences among central cities, suburbs, and rural areas may also be important to food insecurity, but confidentiality restrictions in the SIPP preclude accurate identification of this distinction.

[7]Transfer income, such as AFDC, is included in total household income, but gifts, in-kind benefits, such as food stamps, and goods produced for own consumption are not. In rural areas where homegrown food is consumed in significant quantities our income measure may be understated.

[8]In a pilot test of the food sufficiency question on the Third National Health and Nutrition Examination Survey, 87 percent of the food insufficient reported that a lack of resources for food purchases was the reason for food insufficiency and 22 percent reported a lack of transportation (Briefel and Woteki, 1992), which may be due to income constraints.

quantities of food needed increase with the number of persons in a household. As the number increases, however, economies of size may play a role and the proportionate increase in food costs may decline. We use household size in a quadratic form to capture these effects. With respect to household composition, single-parent households (the overwhelming majority are women) are of particular interest. These families do not have the benefit of a spouse's non-market labor (for example, dishwashing, cooking) that would allow for more time in shopping and preparing food. This time constraint may lead to a substitution of more expensive already-prepared foods for cheaper basic foods and thus more likely lead to food insecurity.

Race-ethnicity is expected to have indirect and direct influences upon food insecurity rates. One example of an indirect influence is due to the differences in incomes. On average, Latinos and African-Americans have lower incomes than whites, and this will restrict the amount of money available for food consumption. Directly, race-ethnicity may be influential due to differences in ethnic food consumption patterns or due to language barriers to food shopping that limit choices and increase food costs. We use three dichotomous variables to indicate whether households were headed by a non-Hispanic black, a Hispanic, or another non-Hispanic racial group. Non-Hispanic whites were the reference group.

We use a dichotomous variable to indicate that the household head is older than 60 years of age. Age may inversely influence food insecurity for several reasons. Many elderly people are depleting a stock of savings not reflected in their income levels. Also, unlike other homeowners, many seniors have paid off mortgages. Both of these factors free up money for food consumption. Food energy needs are lower among the elderly and physical sensations, such as hunger, may be less strong among seniors, which may lead to lower rates of self-assessed food insecurity (Rolls, 1993). Other characteristics of the elderly increase the likelihood of food insecurity. The elderly are less mobile, which might prevent access to low-cost foodstores. Many recently widowed elderly men lack knowledge about food preparation and tend to be more food insecure. Also, many qualified elderly households are reluctant to get food stamps, which may increase their chances of food insecurity.

In Model II, we further our understanding of direct and indirect measures of well-being by examining the relationship between food insufficiency (a direct measure) and falling below the poverty threshold (an indirect measure). In part, indirect measures are used in other research and policy analyses because of their presumed ability to accurately reflect more direct indicators of well-being. In Model II, we examine this presumption by looking at the influence of being below the poverty threshold on the probability of food insufficiency. This is done with a logit model similar to that in Model I, but rather than using a continuous measure of household income, we use a categorical variable indicating poverty status (that is coded as 1 if a given household's income falls below the Bureau of Census poverty threshold for that household size, and zero otherwise).[9] All other independent variables are the same as in Model I, except for the household size variables, which are excluded, since the poverty threshold is a function of household size.

To explore the relationship of food stamps to food insecurity, Model III treats the incomes of food stamp participants and non-participants separately, and is given by,

$$\ln\left(\frac{q_i}{1-q_i}\right) = \alpha + \beta_{FSY} FSY_i + \beta_{NPY}(1-FS)Y_i + \beta_B B_i + \gamma K_i + \delta D_i + \varepsilon_i, \qquad (7)$$

where FS is a variable indicating household participation in the FSP, B_i is the annual value of food stamps received by household i, and β_{FSY}, β_{NPY}, and β_B are coefficients representing the effects on food insecurity of income for food stamp participants, of income for non-participants, and the dollar value of food stamps. Note that for food stamp households, FS equals 1 and the second income term in this equation equals zero, whereas for non-participating households, FS equals zero and the first income term drops out. The added flexibility of this model recognizes that food stamp participants have resources available for food purchases not available to non-participants and, as a consequence, the influence of income may differ. The dollar value of the food stamps received by the household is included as a separate variable (rather than combined with participants' income), because food stamp recipients do not

[9]For the CSFII, we use annual income to establish whether a household is below the poverty threshold. For the SIPP, we multiplied income from the previous 4 months by 3 to get an annual estimate of income before comparing with the poverty thresholds. In the official poverty measure, a household is considered poor if its annual income is below the poverty threshold.

treat income and food stamps as equivalent in the purchase of food. Previous research has shown that an additional dollar of income increases food spending of an average low-income household by 5 to 11 cents, whereas the increase is in the range of 23 to 29 cents if the additional dollar is in the form of food stamps (Fraker, 1990).[10] Food stamps also have a greater positive effect on household nutrient availability (Devaney and Moffitt, 1991; and Allen and Gadson, 1983) and preschooler nutrient intake (Rose *et al.*, 1998) than does cash income. Since eligible households self-select into participant and non-participant groups, the above model is predictive for households already on the FSP and cannot be used to assess the overall effect of the program.

Measuring Food Insecurity

In this report, we model household food insufficiency, a state that applies to the most food-insecure households. The Federal Government's efforts to measure household food security began in 1977, when a question on food sufficiency was used in USDA's Nationwide Food Consumption Survey. Since that time, the question has been included in various national surveys; the CSFII and SIPP were two of the most recent to collect household-level data.[11] The USDA food sufficiency question asked respondents which of the following statements best describes the food eaten in their household: 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; or often not enough to eat.

This question asks directly about the respondents' assessments of the adequacy of their household food.[12] It allows respondents to choose among the various descriptions of their food situations and does not lead respondents to over-report hunger (Basiotis, 1992). By design, the question requires respondents to consider both the quality and quantity of the household food supply. Those households reporting that they sometimes or often do not get enough to eat are considered food insufficient. Here we focus exclusively on this quantity dimension of food insecurity. Food-insufficient households are food insecure, but the converse does not necessarily hold.

Several studies have confirmed the validity of the USDA food sufficiency question as a measure of food insecurity, despite some limitations.[13] Basiotis (1992) used national-level data to show that classification of respondents using this question was consistent with consumer theory regarding the demand for calories and food. A study using data from the 1985-86 CSFII found that weekly income and usual food expenditures were lower in households reporting food insufficiency (Cristofar and Basiotis, 1992). The same study found that the mean food intake of women from food-insufficient households was lower than for food-sufficient women for 13 food groups, while the mean food intake of children from food-insufficient households was lower than for food-sufficient children for five food groups. A more recent study using the 1989-91 CSFII found that, after controlling for other factors that affect diet, food insufficiency was significantly related to decreases in nutrient intake at the household level. Calorie intake was 13 percent lower for food-insufficient households and the decrease in intake of 13 other nutrients ranged from 8 to 18 percent of consumption levels in food-sufficient households (Rose and Oliveira, 1997).

Data Sources

We use two recent national-level datasets with information on household food sufficiency: the 1989-91 Continuing Survey of Food Intake by Individuals (CSFII) and the 1992 Survey of Income and Program Participation (SIPP). These data sets had a common

[10]The food stamp effect implied by these estimates is 2.1 to 5.8 times the effect of cash. Using a flexible functional form, Levedahl (1991) found the ratio of marginal propensities to spend (MPS) on at-home food from the two sources (i.e., $MPS_{Food\ Stamps}/MPS_{cash}$) to be 2.7.

[11]The National Health and Nutrition Examination Survey is another recent national survey with the USDA food sufficiency question, but it is asked at the individual rather than the household level.

[12]Although this question is asked at the household level, it does not imply that all persons in the household experience food insufficiency to the same degree. A typical pattern in a household with parents and children is for the parents to first reduce food intake, and only as the extent of food insufficiency worsens will the food intake of children be affected (Wehler *et al.*, 1992).

[13]The food sufficiency question addresses just one aspect of the broader definition of food insecurity, which also incorporates the manner of food procurement as well as the safety and nutritional quality of the food consumed (*see the quoted text in the Introduction*). Also, the food sufficiency question is based on the respondents' perception of their food situation and is therefore subjective. People with the same food consumption levels may have different impressions of their situation. For example, an elderly person who has the Great Depression as a reference point may be less likely to report not getting enough to eat than someone who did not experience the depression. Although the timeframe for this question is specified in the SIPP (i.e., with reference to the previous 4 months), the lack of a clearly defined time reference in the CSFII may increase the number of respondents reporting food insufficiency. However, some respondents may be embarrassed to admit that they sometimes or often do not get enough to eat, leading to the under-reporting of food insufficiency (Briefel, 1993).

measure of food sufficiency and included similarly detailed socio-demographic variables.

The CSFII is conducted by the USDA's Agricultural Research Service and forms an integral part of the National Nutrition Monitoring and Related Research Program (FASEB/LSRO, 1990). The CSFII was based on two independent stratified clustered samples of housing units (a basic, or all-income sample, and a low-income sample) drawn from the 48 coterminous States and Washington, DC (USDA, 1992). Additional details regarding sampling procedures and response rates have previously been published (Tippett *et al.*, 1995). The modeling results presented in this report are based on a sample of 6,620 households.

The SIPP is a multipanel longitudinal survey of the non-institutional population of the United States administered by the Department of Commerce, Census Bureau. Its goal is to collect information on income, program participation, labor force activity, and household composition. Questions concerning these issues form the core module of SIPP. There are also topical modules covering the same time period. In this report, we use food sufficiency data obtained from the Well-Being Topical Module, administered in the last trimester of 1992, as well as socio-economic data obtained from the core module of the same time period. Because of the panel nature of SIPP (households are typically interviewed over a 2½-year period), the Well-Being Module was administered to two independent samples, those from the 1991 panel and those from the 1992 panel. We report on a combined sample from these two panels of 30,303 households.

Descriptive Results

In the 1989-91 CSFII and 1992 SIPP surveys, 2.5 and 2.3 percent of the U.S. population were food insufficient. The prevalence of food insufficiency, however, was not evenly distributed throughout the population. This section reviews our findings on the prevalence of food insufficiency among various socio-economic groups of the population.

Food insufficiency rates by socio-economic characteristics were calculated at the household level into two broad categories: the entire population and the population with incomes below 185 percent of the poverty line, which we refer to as "the low-income population." The latter is a convenient cut-off since it is the income limit for eligibility in several federally sponsored food assistance programs, such as the Special Supplemental Nutrition Program for Women, Infants, and Children (WIC).

Food insufficiency rates for selected variables are presented in table 1. Income clearly mattered in predicting who was food insufficient. In both surveys, the food insufficiency rates were very low for households above 185 percent of the poverty line (0.7 percent), but food insufficiency rates did differ for those below this level. In the CSFII, as income increased, there was a sharp decrease in the percentage of food-insufficient households, from 16.0 percent for households less than 50 percent of the poverty line to 2.4 percent for households between 130 and 185 percent of the poverty line. In the SIPP, as income increased, there was also a drop, but not as pronounced (10.0 to 3.7 percent). The percentage of all low-income households that were food insufficient was relatively similar in the two surveys: 6.7 percent in the CSFII and 6.1 percent in the SIPP.

Food insufficiency was lower for households headed by a high school graduate than for those headed by someone without a high school diploma, 1.7 versus 5.6 percent in the CSFII and 1.9 versus 4.1 percent in the SIPP.[14] Homeownership is divided into two categories: homeowners and renters.[15] The difference in food insufficiency between homeowners and renters was rather large. In the SIPP, 4.8 percent of renters were food insufficient while only 1.0 percent of owners were. Two-person households had the lowest food insufficiency rates (1.6 percent in the SIPP). For households with two or more persons, food insufficiency rates generally increased with size. Among low-income households, one-person households had the lowest food insufficiency rates.

Household composition is broken into four categories: wife and husband with children, wife and husband without children, single person with children, and single person without children.[16] The sharpest distinction was between households with a wife and husband and

[14]Variables relating to education, race, and age refer to the female head of household in dual-headed households, for reasons discussed above.

[15]Households paying no cash rent, a very small percentage of the population, are counted as renters.

[16]In this breakdown of categories, unmarried partners who live together are counted as single. Also, all households may contain non-nuclear family members and/or boarders. Therefore, a "single-person household without children" does not imply that there is only one person in the household.

Table 1—Food insufficiency rates by selected variables: All households and households with income at or below 185 percent of the poverty line

Variable	All households		Income ≤185 percent of poverty	
	1989-91 CSFII	1992 SIPP	1989-91 CSFII	1992 SIPP
	Percent food insufficient, weighted			
All households	2.5	2.3	6.7	6.1
Income of household, percent of poverty line:				
≤ 50 percent	16.0	10.0	16.0	10.0
> 50 and ≤ 100 percent	10.2	8.6	10.2	8.6
> 100 and ≤ 130 percent	4.3	5.1	4.3	5.1
> 130 and ≤ 185 percent	2.4	3.7	2.4	3.7
> 185 percent	.7	.7	NA	NA
Income of household, percent of poverty line (cumulative rates):				
≤ 50 percent	16.0	10.0	16.0	10.0
≤ 100 percent	11.8	9.0	11.8	9.0
≤ 130 percent	9.4	7.7	9.4	7.7
≤ 185 percent	6.7	6.1	6.7	6.1
Education of household head:				
Did not complete high school	5.6	4.1	8.2	6.3
High school graduate	1.7	1.9	5.4	6.0
Homeownership status:				
Owners	1.0	1.0	3.4	3.1
Renters	5.2	4.8	9.6	8.8
Age of household head (years):				
< 40	3.2	3.4	8.4	8.4
≥ 40 and < 60	2.2	2.3	9.7	8.0
≥ 60	1.6	.8	3.2	1.7
Household size:				
1 person	2.8	2.4	5.3	4.4
2 persons	1.7	1.6	5.9	5.4
3 persons	2.0	2.5	6.1	8.5
4 persons	2.2	2.4	6.8	7.1
5 persons	4.3	3.6	11.1	8.4
6 or more persons	6.6	4.7	11.2	8.3
Household composition:				
Wife and husband with child(ren)	2.2	2.1	7.1	6.1
Wife and husband without children	.8	.7	4.3	3.0
Single person with child(ren)	6.6	7.2	10.6	10.6
Single person without children	3.1	2.5	5.5	4.9
Race-ethnicity of the household head:				
Non-Hispanic white	1.6	1.8	4.4	5.4
Non-Hispanic black	6.5	3.8	11.3	6.0
Hispanic	5.5	5.3	11.0	9.6
Non-Hispanic other	3.8	3.5	12.2	8.8
Census region:				
Northeast	2.6	2.3	6.8	6.6
South	2.6	2.2	6.3	5.2
Midwest	2.2	2.0	6.5	5.5
West	2.6	2.9	7.5	8.2

Notes: For this analysis, the unweighted sample size of the CSFII is 6,620 households and the unweighted sample size of the SIPP is 30,303 households. Weighted the sample sizes are 91,731,880 households and 90,610,818 households.

NA = Not applicable.

no children (0.7 percent in the SIPP) and households with a single parent (7.2 percent).

Households are classified into four race-ethnicity categories: non-Hispanic white, non-Hispanic black, Hispanic, and non-Hispanic other. White households in both surveys had by far the lowest rates of food insufficiency: 1.8 percent in the SIPP and 1.6 percent in the CSFII. In the SIPP, non-Hispanic blacks had lower food insufficiency rates than Hispanics, 3.8 versus 5.3 percent, while in the CSFII the reverse was true, 6.5 versus 5.5 percent. Non-Hispanic others had lower rates than non-Hispanic blacks and Hispanics in both surveys.

Age of the household head is divided into three categories: less than 40 years, 40 or more years but less than 60 years, and 60 or more years. Households headed by someone over the age of 60 had the lowest percentage of food-insufficient households (0.8 percent in the SIPP), while those under the age of 40 had the highest (3.4 percent). Variation across major geographical areas was minimal for both the entire population and the low-income population.

These bivariate results give us a useful description of the relation between various variables and the extent of food insufficiency. While illustrative, these do not give us information about the relative influence of the variables. For example, homeowners have a lower incidence of food insufficiency than renters and higher income households have a lower probability of food insufficiency than lower income households. However, homeowners, on average, have higher incomes than renters. As a consequence, without controlling for these two factors, it is not clear to what extent homeownership versus higher incomes matters for food insufficiency. In the next section, using multivariate logit models, we control for the influence of other variables to examine more precisely the effect of many of the variables in this section on food insufficiency.

Logit Model Results

In the following sections, we describe the results of logit models employed to address three main issues: the socio-economic determinants of food insufficiency, the relationship between poverty status and food insufficiency, and the relationship between income, food stamps and food insufficiency. Explanations of these models are presented in the Empirical Models section. Table 2 provides definitions and sample means for the variables used in these models.

Socio-Economic Determinants of Food Insufficiency

As expected, household income was negatively and significantly related to the probability of food insufficiency in both the CSFII and SIPP samples (table 3).[17] There were five non-income characteristics of the food insufficient that were quite similar across the two surveys. First, economies of size were present. For the SIPP sample, the coefficient on household size was positive, while for the squared term of household size, the coefficient was negative. Thus, as household size increases, the probability of being food insufficient also increases but the relative increase decreases as more people are added. The same pattern was observed in the CSFII, although it was not significant. Second, homeownership was negatively and significantly related to food insufficiency in both samples. Third, in both surveys, high school graduates were less likely to be food insufficient then non-high-school graduates. Fourth, seniors had lower probabilities of food insufficiency. Finally, regional indicators appeared to have little influence on food insufficiency; they were generally insignificant, except for those residing in the West in the SIPP sample.

One major difference between the surveys was that non-Hispanic blacks had a higher probability of food insufficiency than non-Hispanic whites in the CSFII, but a lower probability in the SIPP.[18] Cristofar and Basiotis (1992), using a low-income sample of adult women from the 1985-86 CSFII, also found that elderly blacks had a higher probability of food insufficiency. Conversely, one possible reason for the negative coefficient is that the elderly black men have been more efficient food shoppers than whites; given the same amount of income, they may be less likely to be food insufficient. Some evidence of this comes from Basiotis *et al*. (1983) where, holding income constant, black households had lower food costs but no difference in nutrient intake levels. In light of the discrepancies between these surveys, further research into the influence of race-ethnicity on the probability of food insufficiency is needed.

[17]Discussion of significant outcomes in the text refers to those at a 95-percent confidence level.

[18]A similar pattern was observed across the two surveys with respect to comparison between Hispanic and non-Hispanic whites, although coefficients on the Hispanic variable were not statistically significant in the SIPP.

Table 2—Variable definitions and sample means[1]

Variable	Definition	Mean, unweighted (standard deviation)	
		CSFII	SIPP
INCOME	Annual household income ($)	22,788 (22,748)	37,271 (28,446)
POVERTY	Equals 1 if household income is below poverty line; else 0	0.299	0.114
INCFS[2]	Annual household income of food stamp participants ($)	7,586 (5,301)	13,642 (13,570)
VAFS[2]	Annual dollar value of food stamp benefits	1,873 (1,298)	1,936 (1,458)
FDSTAMPS	Equals 1 if household participates in FSP	.149	.084
INCNP[2]	Household income of non-participants	25,459 (23,573)	39,449 (28,471)
HHSZ	Number of persons in household	2.64 (1.58)	2.65 (1.49)
HHSZSQ	Number of persons in household squared	9.49 (12.72)	9.25 (10.98)
DUNOKID	Equals 1 if household heads are husband and wife with no children present; else 0	.243	.292
SINOKID	Equals 1 if household head is a single person with no children present; else 0	.348	.327
SIKID	Equals 1 if household head is a single person with child(ren); else 0	.139	.098
DUKID	Omitted base group — household heads are husband and wife, child(ren) present	.270	.283
SENIOR	Equals 1 if household head is more than 60 years of age; else 0	.306	.253
BLACK	Equals 1 if household head is a non-Hispanic black; else 0	.140	.088
HISP	Equals 1 if household head is Hispanic; else 0	.082	.070
OTHER	Equals 1 if household head is a non-Hispanic other; else 0	.024	.031
WHITE	Omitted base group — household head is a non-Hispanic white	.754	.811
NOREST	Equals 1 if household is in the Northeast; else 0	.208	.203
SOUTH	Equals 1 if household is in the South; else 0	.373	.335
WEST	Equals 1 if household is in the West; else 0	.194	.204
MIDWST	Omitted base group — household is in the Midwest	.215	.258
HIGHSCH	Equals 1 if household head graduated from high school; else 0	.665	.798
OWNER	Equals 1 if household head owns home; else 0	.577	.658

[1]The analytic samples include all households with non-missing data on food insufficiency and the variables listed in this table. Also, only households with positive incomes were included in the analyses.

[2]Mean values for income and benefit levels of food stamp participants were calculated separately for this group as was income for non-participants. In Model III, however, the values of INCFS and VAFS were set to zero for non-participants, as was INCNP for participants.

Table 3—Determinants of food insufficiency: Parameter estimates from logit models[1]

Variable	Model I		Model II		Model III	
	1989–91 (CSFII)	1992 (SIPP)	1989–91 (CSFII)	1992 (SIPP)	1989–91 (CSFII)	1992 (SIPP)
	Coefficient (standard error)					
INCOME	–0.00008 ($9.4x10^{-6}$)**	–0.00006 ($3.7x10^{-6}$)**				
POVERTY			1.286 (.141)**	1.309 (.091)**		
INCFS					–0.00002 (.00002)	–0.00004 ($7x10^{-6}$)**
VAFS					–.00022 (.00007)**	–.00008 (.00004)
INCNP					–.0001 (.00001)**	–.00007 ($4x10^{-6}$)**
HHSZ	.225 (.112)*	.510 (.111)**			.281 (.113)*	.500 (.111)**
HHSZSQ	–.004 (.009)	–.033 (.012)**			–.007 (.009)	–.033 (.012)**
DUNOKID	–.421 (.269)	–.039 (.179)	–.661 (.239)**	–.526 (.155)**	–.347 (.270)	–.030 (.179)
SINOKID	.175 (.256)	.682 (.179)**	.043 (.168)	.299 (.110)**	.236 (.256)	.665 (.180)**
SIKID	–.046 (.174)	.493 (.119)**	.005 (.165)	.614 (.115)**	–.089 (.178)	.464 (.123)**
SENIOR	–.745 (.180)**	–1.532 (.152)**	–.645 (.179)**	–1.296 (.152)**	–.809 (.179)**	–1.552 (.152)**
BLACK	.451 (.150)**	–.280 (.125)*	.552 (.149)**	–.283 (.125)	.436 (.149)**	–.280 (.125)*
HISP	.372 (.177)*	–.048 (.123)	.504 (.176)**	.106 (.123)	.359 (.177)*	–.009 (.123)
OTHER	.642 (.295)*	.133 (.198)	.709 (.291)*	.190 (.195)	.605 (.297)*	.131 (.198)
NOREST	–.005 (.185)	.051 (.124)	–.074 (.185)	–.043 (.123)	–.037 (.186)	.060 (.124)
SOUTH	–.067 (.160)	–.060 (.111)	–.059 (.159)	–.037 (.110)	–.051 (.160)	–.054 (.111)
WEST	.075 (.188)	.255 (.119)*	.073 (.187)	.179 (.118)	.062 (.188)	.239 (.119)*
HIGHSCH	–.358 (.125)**	–.355(.091)**	–.471 (.127)**	–.556(.093)**	–.335 (.125)**	–.334 (.092)**
OWNER	–.385 (.143)**	–.673 (.094)**	–.533 (.142)**	–.931 (.095)**	–.363 (.144)*	–.658 (.095)**
CONSTANT	–1.765 (.399)**	–2.805 (.300)**	–3.055 (.219)**	–3.170 (.146)**	–2.003 (.373)**	–2.773 (.299)**

[1]The dependent variable in all of these models, household food insufficiency, takes on the value of 1 if the household is food insufficient and zero, otherwise. Thus, variables with negative parameter estimates are inversely related to the probability of food insufficiency.

*Variable is statistically significant at the 95-percent confidence level.

**Variable is statistically significant at the 99-percent confidence level.

Relationship of Food Insufficiency to Poverty

In Model II, we replaced the household income variable from Model I with an indicator for poverty status. This model allows us to assess the relationship of our direct measure of well-being, food insufficiency, with an indirect measure, poverty status. Households in poverty were more likely to be food insufficient in both samples as evidenced by the positive coefficient estimates (table 3). Odds ratios calculated from these coefficients for those CSFII households in poverty show that the odds of being food insufficient are 3.6 times larger than for those not in poverty.[19] The corresponding odds ratio for the SIPP sample was 3.7.

Despite the strong relationship of poverty to food insufficiency, there is not a one-to-one correspondence. Only about 12 percent of income-poor households were food insufficient in the CSFII and about 9 percent were food insufficient in the SIPP (table 1). Model II allows us to observe the poverty-food sufficiency relationship, net of other factors that might affect food insufficiency status, such as education or race-ethnicity.[20] Simulations of the probability of food insufficiency were performed using the parameter estimates from Model II and the average values for each of the variables. In the CSFII sample, the predicted probability of being food insufficient was 6.7 percent for those with incomes below the poverty level and in the SIPP sample, the predicted probability was 3.8 percent. These results are lower than our descriptive statistics in table 1 (which were 11.8 and 9.0 percent, respectively) and indicate that factors associated with poverty, such as a lower level of schooling and lower homeownership rates, tend to increase the likelihood of food insufficiency.

There was also a substantial percentage of food-insufficient households not in poverty. In the CSFII, 41.3 percent of food-insufficient households were above the poverty line and in the SIPP, 53.3 percent of food-insufficient households were above the poverty line. Even if a higher cutoff is chosen, 185 percent of the poverty line, there were still 20.4 and 21.9 percent of the food-insufficient households that were not low-income. This provides further evidence of the need to rely on more than income-based poverty measures in our understanding of deprivations such as food insufficiency.

Exploratory Work on the Food Stamp Population

We explored the relationship of food stamps to food insufficiency, using the more flexible Model III. In both surveys, income for either participants or non-participants as well as food stamp benefit levels were negatively associated with the probability of food insufficiency (table 3). Of particular interest here is the relative effect of changes in income and food stamps for food stamp recipients. The coefficient on the value of food stamps was twice the magnitude of the coefficient on participant income in the SIPP sample, and over 10 times in the CSFII. The signs and significance levels for the other variables in Model III were similar to those in Model I.

We further explored the effects that changes in food stamp allotments might have on current participants, by calculating the increase in the probability of food insufficiency for a 1-percent decrease in food stamp benefits, about $1.56 per household per month in the CSFII and about $1.61 in the SIPP. These quasi-elasticities are presented for different groups of participants in table 4.[21]

[19]The odds ratio is given by,

$$OR = \frac{\frac{q_1}{1 - q_1}}{\frac{q_o}{1 - q_o}},$$

where q_1 is the probability of food insufficiency for those with a given characteristic (e.g., in poverty), *ceteris paribus,* and q_0 is the probability of food insufficiency for those without the characteristic (e.g., not in poverty).

[20]The signs and significance of these other factors are similar to Model 1.

[21]For the logit model, the dependent variable is a probability and ranges from 0 to 1. Quasi-elasticities are a convenient way of expressing the change in this probability in percentage points for a 1-percent change in the variable of interest, holding all other variables constant. In this case, for the probability of food insufficiency q and the food stamp benefit level B, the quasi-elasticity, ηB, is given by:

$$\eta_B = \frac{d\, q,}{d \ln B}$$

which, for each household i, is equivalent to

$$\eta_{Bi} = q_i (1 - q_i)\, \beta_B\, B_i,$$

where β_B is the parameter estimate on the food stamp bonus from Model III (see equation (7) in the "Empirical Models" section).

We expect that a decline in benefits would have the greatest effect for those with the lowest incomes, and these simulations bear this out. Reviewing the CSFII data, for those with incomes below 50 percent of the poverty level, a 1-percent decrease in food stamp benefits would increase the food insufficiency rate by about 0.08 percentage point (e.g., from 16.00 to 16.08 percent). For those with incomes between 100 and 130 percent of the poverty level, the food insufficiency rate would increase by 0.03 percentage point. Overall for food stamp households, a 1-percent decrease in benefits, holding all else constant, would raise the food insufficiency rate by about 0.01 to 0.05 percentage points; that means an additional 4,000 to 13,000 households would be food insufficient.

The findings from Model III are broadly consistent with previous work that has found increased marginal propensities to consume out of food stamps relative to cash income (Levedahl, 1991). However, it should be emphasized that the results presented here are descriptive of food stamp

Table 4—Change in the food-insufficiency rate for a 1-percent decrease in food stamp benefits: Simulations for selected characteristics[1]

	Change in the food insufficiency rate (in percentage points)	
Characteristics	1989-91 CSFII	1992 SIPP
All food stamp households	0.052	0.014
Income (percent of poverty level):		
< 50 percent	.082	.027
Between 50 and 75 percent	.048	.019
Between 75 and 100 percent	.032	.009
Between 100 and 130 percent	.030	.008
Household structure:		
Married, with child(ren)	.070	.015
Married, no children	.020	.004
Single, with child(ren)	.068	.022
Single, no children	.016	.004
Age of household head:		
< 60 years	.063	.017
> 60 years	.010	.002
Race-ethnicity:		
White	.037	.012
Black	.065	.014
Hispanic	.063	.021
Other	.082	.019
Region:		
Northeast	.050	.015
Midwest	.058	.013
South	.051	.014
West	.051	.016

[1]Figures in this table are based on quasi-elasticities calculated for each household, using parameters estimated in Model III, and averaged for the groups listed above. See footnote 21 for the quasi-elasticity formula used here.

households as represented in these samples and should not be taken to imply a program effect.[22] Also, the simulations presented here are based on static modeling that do not consider other possible changes for participant households (for example, increased employment earnings), either due to recent changes in food stamp legislation or other broad changes related to the economy.

Conclusions

Our first objective was to determine the socio-economic predictors of food insufficiency in the United States. Not surprisingly, income was one of the strongest predictors of food insufficiency, and this inverse relationship is consistent across survey and functional form. We also found an inverse relationship between schooling and food insufficiency; high school graduates were less likely to be food insufficient, even when the effects of income were controlled. Consistent with expectations, homeownership was inversely related to food insufficiency. Households headed by those over 60 years of age also were less likely to be food insufficient. Household size increased the probability of food insufficiency, but the negative coefficient on the squared term may indicate economies of size in food purchases. These results were consistent across survey and model. Our results on the effects of race-ethnicity, however, were ambiguous; signs differed across the two data sets for non-Hispanic blacks.

Our second concern was to further assess the relationship between a commonly used indirect measure of well-being, poverty status as determined by Census Bureau thresholds, and a direct measure of well-being, food insufficiency status. As expected, poor households were much more likely to be food insufficient, a result that we found in both bivariate and multivariate analyses. In our bivariate models, approximately 10 percent of poor households were food insufficient, while only about 1.5 percent of non-poor households were food insufficient. In our multivariate analyses (Model II), we found poverty status to be positively and significantly related to food insufficiency for both data sets.

One important result from this analysis is that food insufficiency affects nonpoor as well as poor households. Over 40 percent of food-insufficient households had incomes above the poverty thresholds and would be overlooked if poverty status was the only indicator of food insufficiency. These findings further support the need to use direct indicators of well-being in the evaluation of policies intended to improve specified social outcomes, such as the alleviation of hunger and food insecurity.

Finally, we ran an exploratory model of the relative importance of food stamps and income among food stamp participants. Our empirical results on food insufficiency and food stamp use among participants are consistent with work finding a higher marginal propensity to spend on food out of food stamps than out of cash and indicate that holding all other factors constant, a decrease in food stamp benefits would increase the percentage of food-insufficient households.

This report raises three important issues for future research. First, does the FSP help alleviate food insufficiency? Because not all eligible households receive food stamps, the self-selection of some but not all households into the program may bias results on the influence of food stamp benefits. For example, if, *a priori*, food stamp recipients are more likely to be food insecure in comparison with identical households who do not receive food stamps, single-equation models (such as those used in this report) may understate the influence of food stamps on the probability of food insufficiency. Second, what is the economic status of food-insufficient households in periods before and after they are food insufficient? While work here has given us a useful snapshot of food insecurity in the United States at a moment in time, further research is needed into the characteristics of the food insecure over time. Finally, new measures of resource-constrained hunger and food insecurity have been developed recently for the United States with data from the Food Security Supplement to the Current Population Survey (Hamilton *et al.*, 1997a and 1997b). Do the socio-economic determinants of food insecurity differ from these other measures of food insecurity? Our research lays the groundwork for exploring this important question.

[22]When unobserved differences between participants and eligible non-participants affect not only the decision to participate but also outcomes of interest, a self-selection bias can be introduced. For example, those on the FSP may be less likely to be food insufficient, even in the absence of food stamps, because they are more informed about ways to economize in feeding their family. In this case, a comparison of FSP participants with eligible non-participants, even with multivariate controls, will overstate the true food stamp effect. Previous research on the effects of the FSP on food expenditures, on nutrient availability at the household level, and on nutrient intake by individuals has not found evidence of selection bias (Ranney and Kushman, 1987; Devaney and Moffitt, 1991; and Rose *et al.*, 1998).

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