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# Dynamics of Poverty and Food Sufficiency

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## Abstract

This study examines dynamics in poverty and food insufficiency using newly available longitudinal data from the 1993 panel of the Survey of Income and Program Participation (SIPP) and the follow-on Survey of Program Dynamics (SPD). The study uses these data to characterize the incidence and dynamics of poverty and food problems for the entire U.S. population and for different subgroups. It also estimates multivariate, discrete-choice regression models to examine the factors associated with transitions into and out of poverty and food insufficiency, and it analyzes the empirical results in the context of a life-cycle model of income and food consumption. Results indicate that the incidence of food insufficiency in the United States is low—less than 3 percent in 1997. There also appears to be little persistence in food problems; 79 percent of people in households with food problems at the start of the study period were in households without problems 2 years later. The multivariate results indicate that female-headed households face an especially high risk of being food insufficient. Low levels of asset income, an indicator of a household's ability to spread out consumption costs over time, are also associated with food sufficiency problems.

**Keywords:** food sufficiency, food insufficiency, food security, food insecurity, poverty, well-being, hunger.

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## Summary

The incidence of food insufficiency in the United States is low: Less than 3 percent of the population lived in food-insufficient households in 1997. Persistence in food insufficiency appears to be low as well: 79 percent of people living in households with food problems in 1994-95 were in households without problems 2 years later. A household is considered food insufficient if household members either sometimes or often do not have enough to eat. This study examines dynamics in poverty and food insufficiency for the entire U.S. population and for different subgroups—that is, the movement of individuals, families, and households into and out of deprivation.

Policymakers and researchers are interested in the processes that underlie economic hardship in the United States. Considerable research has been done on the incidence and dynamics of income-based measures of poverty and on alternative, consumption-based measures of hardship, such as food insufficiency. However, because data collection has focused on poverty, we know relatively little about the dynamics of food insufficiency.

Understanding the dynamics of food insufficiency has implications for the design and implementation of welfare programs. Identifying conditions associated with long-term food insufficiency would improve targeting and efficiency in assistance programs.

In this study, we use newly available longitudinal data from the 1993 panel of the Survey of Income and Program Participation (SIPP) and the follow-on Survey of Program Dynamics (SPD). We link the data from the two surveys to compare the change in food sufficiency over time within households. We also determine whether changes in poverty and food insufficiency are the same or different processes, what factors contribute to entry into and exit from poverty and food insufficiency, and whether households that are deprived today run a greater risk of future deprivation.

Other study results indicate that:

- Changes in income poverty and food insufficiency are related, but have distinct processes. Poverty and food insufficiency are both indicators of economic hardship, but food insufficiency depends on more than just poverty status, indicating that measures of poverty and food insufficiency capture different dimensions of economic hardship.
- Female-headed households are significantly more likely to enter into food insufficiency and less likely to exit from it than other households. In addition, disability status and changes in household composition both appear to be associated with entry into food insufficiency. On the other hand, completing high school is consistently found to increase the chances of leaving food insufficiency.
- Although the incidence and persistence of food sufficiency problems are low, people who were in food-insufficient households in 1994-95 were 10 times more likely than others to be in food-insufficient households in 1997.

These findings support the design of the Food Stamp Program and other food assistance programs as a safety net for low-income people, particularly those with unexpected income difficulties. However, for persistently food-insufficient households, more targeted assistance programs may be necessary. The evidence that food insufficiency is related to, yet distinct from, poverty indicates the importance of ongoing efforts by USDA to collect and analyze data on food sufficiency to further understand economic hardship.

# Dynamics of Poverty and Food Sufficiency

David C. Ribar and Karen S. Hamrick\*

## Introduction

Policymakers and social scientists are keenly interested in understanding the processes that underlie economic hardship in U.S. households. Researchers have devoted a vast amount of effort to examining the incidence, correlates, and dynamics of income-based measures of poverty and have developed a considerable body of knowledge. They have also looked at alternative, consumption-based measures of hardship, such as food insufficiency. However, because fewer data have been collected on these outcomes, we know relatively little about important characteristics of food sufficiency problems and other measures of material hardship, including their dynamic properties.

The dynamics of economic hardship involve the movement of individuals, families, and households into and out of deprivation. Analyses of these movements consider whether hardship is a brief or long-lasting condition. They also consider whether households that are deprived today are at greater risk of deprivation in the future—that is, whether deprivation is characterized by state dependence. In the case of income poverty, studies have established that most spells of poverty in the United States are short; only a small percentage last more than a few years. Studies have also found that poverty exhibits state dependence—families that have been poor in the past are more likely to be poor in the future. It is important to know whether food problems have similar dynamic properties.

These dynamic properties have implications for the design of welfare programs, especially for food assistance. The U.S. Department of Agriculture (USDA) currently administers 15 domestic food assistance programs that work individually and in concert to provide a nutrition safety net for children and low-income adults. The programs are a major component of the

Federal safety net, and in fiscal 2002, USDA spent \$37.9 billion on its domestic food assistance programs, an increase of almost 11 percent over fiscal 2001. Identifying the conditions associated with persistent food insufficiency would allow for more targeted and efficient assistance programs for households that experience it.

Understanding the dynamics of both poverty and food sufficiency states may also help us to better define the general concept of economic well-being. The standard (Orshansky) income-poverty measure, which compares a family's annual income with three times the national average food expenditure for families of its size, has serious limitations. Several approaches have been proposed for addressing these limitations. The National Research Council (Citro and Michael, 1995) has recommended that programs continue to compare families' incomes and needs, but refine the definition and improve the measurement of each element. At the same time, USDA, the Census Bureau, and other agencies have begun to collect information on particular hardships experienced by households. In particular, USDA has spearheaded the effort to document food insecurity and hunger through its collection of data on food security and the development of the food security scale (Bickel et al., 2000). Data on other measures of well-being, such as the ability to meet medical expenses, housing costs, and other specific household needs, have been collected and examined periodically by the Census Bureau.

This study examines dynamics in poverty and in food insufficiency using newly available longitudinal data. Specifically, the study links data from the 1993 panel of the Survey of Income and Program Participation (SIPP) with information from the follow-on Survey of Program Dynamics (SPD). The two surveys asked households comparable questions about food sufficiency; the resulting data reveal how food sufficiency has changed over time within households. In addition, the SIPP and SPD collected a wealth of other economic and demographic data that allowed us to construct longitudinal

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measures of poverty, program participation, and other factors. The study uses these data to characterize the incidence and dynamics of poverty and food problems for the entire U.S. population and for different subgroups. It also estimates multivariate, discrete-choice regression models to examine the factors associated with transitions into and out of poverty and food insufficiency. The empirical data are analyzed in the context of a life-cycle model of income and food consumption.

We address three research questions: (1) Are movements into and out of poverty and food insufficiency the same or different processes? (2) What factors contribute to poverty and food insufficiency entry and exit? (3) Is there state dependence—that is, does the past matter in poverty and food insufficiency?

The primary contribution of this study is its analysis of food insufficiency dynamics. Several earlier studies have documented the *incidence* of food sufficiency problems and examined the factors associated with those problems at a particular point in time. However, the lack of longitudinal data has prevented researchers from studying dynamic issues. Data from the SIPP and the SPD allowed us to assess whether food problems are relatively transient or long-lasting, whether people who have had food problems are more likely to experience them in the future, and whether food security mobility differs across groups with different economic and demographic characteristics.

A second contribution of the study is that it investigates whether the outcomes of longitudinal poverty and of food sufficiency are fundamentally distinct processes or manifestations of the same underlying process. While poverty and food sufficiency are obviously related, the study's life-cycle model suggests that they will differ depending on a household's ability to borrow and save—that is, to smooth out consumption costs over time. The study formally tests for differences in poverty and food sufficiency outcomes and examines whether the differences are consistent with life-cycle theory.

Finally, because the SPD contains numerous alternative food problem measures, including measures necessary to construct the food security scale and index, we were able to examine whether our results are comparable to previous findings. The scale is also useful for sensitivity analyses. Research by Ziliak (1998) shows that longitudinal analyses of household well-being may be sensitive to the type of measure used, so we explored that possibility as well.

## Previous Studies

A large body of empirical research exists that can help inform an analysis of poverty and food sufficiency dynamics. For brevity, this review focuses on studies that have examined food sufficiency problems, food consumption, or poverty as outcome variables.

### Determinants of Food Insecurity and Insufficiency

Several studies have examined factors associated with the incidence of food insecurity, food insufficiency, and other extended measures of household well-being at a single point in time. Although a few researchers have motivated their empirical analyses using dynamic conceptual models (e.g., Gundersen and Gruber, 2001), none has directly examined changes in food sufficiency problems.

Cross-sectional studies have generated a variety of results, sometimes conflicting. For instance, Rose, Gundersen, and Oliveira (1998) estimated the effects of different economic and demographic variables on food insufficiency using national sample data. They found that food insufficiency fell with rising income, food stamp benefits, and education, and with home ownership; they also found that household structure and race and ethnicity were important factors. Daponte, Haviland, and Kadane (2002) used a survey of poor families from Allegheny County, Pennsylvania, to examine the effects that food stamp and food pantry use had on the ability to make minimally adequate food expenditures. They found that families with higher incomes and higher food stamp benefit levels fared better than families with lower incomes and benefits.

In contrast, Cohen et al. (1999) found that food outcomes were worse among food stamp recipients than among eligible nonparticipants and near-eligible individuals. They estimated that half of all food stamp recipients experience some type of food insecurity. Gundersen and Oliveira (2001) similarly found that food stamp use was positively correlated with food insufficiency when program participation was treated as an exogenous variable. However, once they controlled for the endogeneity of food stamp use, the statistical significance of the relationship disappeared. Winship and Jencks (2002) found that single mothers had higher rates of food insufficiency problems than married mothers but that both groups experienced a similar decline in problems over the late 1990s. Because single mothers are more likely to need and receive public assistance, the results suggest that welfare

reform had little effect on food outcomes. Bauman (2000) examined an aggregate index of economic deprivation, which included food insufficiency as one of the arguments, and found that families with heads that worked part of the year experienced higher rates of hardship than those with nonworking heads.

Gundersen and Gruber (2001) developed a detailed dynamic theoretical model of food problems and used descriptive statistics from the 1991 and 1992 panels of the SIPP to test its implications. They found that food-insufficient households were more likely to suffer unexpected income losses and had less stable incomes than other households. In addition, these households appeared to have less ability to smooth changes in income because of low savings and liquidity constraints.

### **Food Consumption in Low-Income Families**

There is an extensive body of related literature on food consumption and nutrition outcomes for low-income households. Fraker (1990) summarized more than 30 studies that used microdata to look at how household food consumption, nutrient availability, and individual nutrient intakes varied with income, food stamp receipt, household composition, and other characteristics. The studies consistently found that the marginal propensity to consume food out of income for low-income households was very small: Estimates indicated that low-income households spend 5-10 cents on food for each additional dollar of income they receive.

The marginal propensity to consume food out of food stamp benefits was much higher—17-47 cents out of each additional dollar. These results are somewhat puzzling because economic theory predicts that the marginal propensities to consume out of each type of income would be much closer. Although food stamps can be used only for food purchases (which would seem to imply a marginal propensity of one), households can presumably shift their remaining resources away from food and toward other goods. One explanation for the findings is selectivity: Households that place a high value on food consumption may be more likely to participate in the Food Stamp Program. However, substantial differences in the marginal propensities remained even after researchers incorporated statistical controls for selectivity. Researchers have also examined whether differences in the number of adults in the household (Breunig et al., 2001) can account for the difference in propensities. Using electronic benefit transfer data to analyze the timing of food expenditures, Wilde and Andrews (2000) found

that food stamp recipients may be extramarginal during one part of the month and inframarginal during another part, if they have liquidity constraints or spend their entire benefit early in the month.

### **Dynamics of Food Consumption**

While no food insufficiency studies have used longitudinal data, a number of studies on the dynamics of overall food consumption have done so. These studies have used the annual, longitudinal food consumption measures from Panel Study of Income Dynamics (PSID) and have been framed as tests of consumption smoothing and the permanent income hypothesis, rather than of food sufficiency problems specifically.<sup>1</sup> Some researchers, such as Zeldes (1989), concluded that food consumption patterns were consistent with liquidity constraints, while others, like Mariger and Shaw (1993), rejected this finding. Several researchers have examined the additional implications for food consumption of habit formation (Dyanan, 2000), unemployment spells (Dynarski and Sheffrin, 1987), and different rate of time preferences (Lawrence, 1991). Ziliak (1998) has examined whether tests of the permanent income hypothesis are sensitive to alternative measures of consumption other than food consumption. He found that food consumption was less likely than other measures to lead to a rejection of the permanent income hypothesis.

### **Dynamics of Poverty Spells**

In contrast to the dearth of longitudinal research on food problems, the literature on the dynamics of poverty spells is extensive. Summaries of this literature can be found in Jäntti and Danziger (2000), Burgess and Propper (1998), and McKernan and Ratcliffe (2002b). Most of this research on poverty spell dynamics has been descriptive. For instance, the Census Bureau produces regular tabulations using the SIPP (e.g., Eller, 1996, and Naifeh, 1998). These reports indicate that most poverty spells are brief but that a non-negligible fraction of them are long lasting. In the most recent report, Naifeh calculates that three-quarters of poverty spells in the early 1990s ended within a year but that an eighth lasted more than 2 years.

The pathbreaking research on poverty dynamics by Bane and Ellwood (1986) was also largely descriptive.

<sup>1</sup>The permanent income hypothesis is that anticipated changes in an individual's economic situation over his/her lifetime have already been factored into economic decisions. The individual will only react to unanticipated changes in income. Consequently, only unanticipated changes in income will alter consumption.

Bane and Ellwood employed multivariate hazard models; however, they used these mostly to characterize spells and decompose the sources of transitions into those associated with the earnings of different household members and the structure of the household. Their research indicated that there was a great deal of mobility in poverty transitions, but also a fair degree of state dependence. Their results also revealed that changes in the household head's earnings accounted for only a portion of the transitions into and out of poverty, while earnings of secondary workers and household changes accounted for much of the remainder. Stevens (1994) updated this research and examined changes over time. Besides confirming Bane's and Ellwood's findings, she found that mobility into and out of poverty decreased in the 1980s, especially for female-headed households. In a subsequent study, Stevens (1999) highlighted the importance of multiple spells of poverty. She estimated reduced-form hazard models of poverty exits and reentry and found that more than half of all those who left poverty returned within 4 years. Rodgers and Rodgers (1993) applied an alternative depth-of-poverty index to longitudinal data, which also accounted for reentry into poverty. Like Stevens, they found that the incidence of chronic poverty was high. More recently, Rank and Hirschl (2001) used life-table methods to describe poverty patterns at all ages and found that, while many people experience poverty at some point during adulthood, few are persistently poor.

Only a few behavioral studies have been done on poverty dynamics. Rather than relying on simple decompositions or reduced-form associations, Burgess and Propper (1998) estimated a detailed model that treated employment, marriage, fertility, and earnings changes as endogenous processes. They found that each of these processes affected poverty, although changes in marital status appeared to be the most significant factor. McKernan and Ratcliffe (2002a) also conducted a behavioral study to identify trigger events in poverty transitions; they found that a variety of household and earnings events contributed to poverty dynamics.

In addition to the studies that have explicitly examined poverty transitions, many have analyzed the determinants of various components of the poverty measure. Lillard and Willis (1978) focused on men's earnings mobility; using variance component techniques in earnings regressions, they found that much of the variation in earnings across workers reflects permanent differences. Lichter, Landry, and Clogg (1991) looked at transitions between discrete labor force outcomes, including

movements among unemployment, involuntary part-time employment, low-wage (below poverty) full-time employment, and high-wage full-time employment. More recently, Pavetti and Acs (2001) used a similar classification to examine the implications of young women's employment mobility for welfare reform. Blank and Ruggles (1996) estimated dynamic models of food stamp and cash assistance eligibility and participation. Moffitt and Rendall (1995) and Fitzgerald and Ribar (2001) examined spells of female heads of household.

### Contribution of This Study

This study ties together the literature reviewed and extends it in several respects. First and most important, it documents and examines the dynamics associated with food insufficiency. All the previous research on food sufficiency problems has been conducted using static methods. The availability of the SIPP and SPD longitudinal data means that this study can consider new issues, such as whether food problems are transient or long-lasting and whether people are more likely to have food problems in the future if they have experienced them in the past. The study also extends the research on the dynamics of poverty and overall food expenditures by considering an alternative measure of hardship that relies on direct reports of household ability to meet basic needs. Although the measure is subjective (each household uses its own criteria in determining food sufficiency) and only captures one dimension of household functioning, it avoids some of the problems associated with the standard poverty measure (see Citro and Michael, 1995).

Second, unlike all but a handful of the studies on poverty dynamics (such as Burgess and Propper, 1998, and McKernan and Ratcliffe, 2002), this study estimates multivariate transition models that account for a large number of personal and household characteristics. These models allowed us to identify economic, demographic, and program factors associated with changes in food sufficiency problems, holding other factors constant. Third, because the analysis dataset also contains standard poverty measures, the study can compare findings for poverty and food insufficiency dynamics using the same sample and empirical methodology and examine whether alternative measures lead to different conclusions.<sup>2</sup> Finally, the study relies on data from the mid- to late 1990s. Thus, it not only provides a more up-to-date picture,

<sup>2</sup>For instance, research by Bhattacharya, Currie, and Haider (2002) suggests that poverty and food insecurity measures are not equivalent predictors of children's dietary outcomes.

but also considers a period of tremendous economic growth and the profound social and program changes associated with the Personal Responsibility and Work Opportunity Reconciliation Act (PRWORA) of 1996.

## Theory: Poverty and Food Insufficiency

Poverty and food insufficiency are two ways to describe economic hardship. A brief theoretical analysis helps to illustrate the ways in which these outcomes are related but also different. To keep the focus on poverty and food insufficiency, the model takes the household's income and needs as given. Sawhill (1988) and others have discussed how income and needs are affected by short-term economic factors such as employment availability and wage levels, long-term economic factors such as education and training, demographic factors such as marriage, fertility, and migration, and programmatic factors such as tax rates and public assistance benefit levels. These are important determinants, and the study examines them in the subsequent empirical analysis. However, for simplicity, the theoretical analysis abstracts from them.

### The Model

The theoretical analysis is based on a simplified, two-period version of a household life-cycle model, similar to the model considered by Gundersen and Gruber (2001). In our model, the household has time-separable preferences defined over its consumption of food,  $F_t$ , and all other goods,  $C_t$ , in each period ( $t = 1, 2$ ) so that:

$$U = U_1(F_1, C_1) + \beta U_2(F_2, C_2)$$

where  $\beta$  ( $0 < \beta < 1$ ) is a discount rate (rate of time preference) and  $U_t(\cdot, \cdot)$  is the preference function (sub-utility) for period  $t$ . The needs of the household over time are assumed to be captured by the preference function.

To characterize the resources available to the household, the model assumes that the household begins period 1 with assets  $A$  and receives income in each period,  $Y_t$ , resulting in a budget constraint (without discounting) of  $A + Y_1 + Y_2$ . It also assumes that the household must pay a price of  $p_F$  for each unit of food. For convenience, food is priced relative to units of other consumption and assumed not to change over time. Unlike the Gundersen and Gruber model, there is no uncertainty—the household knows its income, the price of food, and all other relevant variables for both periods in period 1. The household chooses levels of food and

other consumption in each period to maximize utility subject to its budget constraint.

### The Household Is Able To Borrow and Save

We first consider the implications of this model if the household is free to borrow and save in the first period. Specifically, assume that the household can do so at an interest rate  $r$ , and that any loans must be paid off in period 2. With these assumptions, the household has a two-period budget constraint, expressed as:

$$p_F F_1 + C_1 + (p_F F_2 + C_2)/(1+r) \leq A + Y_1 + Y_2/(1+r).$$

The ability to borrow and save means that the household can smooth consumption. Consumption in each period depends on the total amount of income available in both periods, not just the income in that period; a low level of income in one period can be offset by a high level of assets or income in the other period. This implies that an isolated instance of poor income (that is, very low income in one period) will reduce food consumption but need not lead to an acute reduction, other things held equal.

Food insufficiency can nonetheless occur in this model. For instance, a household with few assets and low levels of income in both periods would experience correspondingly low levels of consumption.

### The Household Has Constraints on Borrowing and Saving

If the household is constrained in its ability to borrow and save, the implications are different. In the extreme case where borrowing or saving are not possible, consumption in each period depends on that period's resources. A drop in income will lead to a relatively large contemporaneous reduction in consumption—that is, poverty and food insufficiency will be tied more closely together. In the more realistic case where households are not restricted in their ability to save but are somewhat restricted in their ability to borrow (e.g., constrained by the ability to obtain credit or by the credit limit on a charge card), the timing pattern of income changes becomes important. The household can smooth consumption if it starts with a high level of assets or receives a large income in the first period, but is less able to do so if it does not receive a large income until the second period.

### Implications of the Model

Clearly, this model abstracts from many crucial features other than the determinants of income and needs,



such as unexpected price and income changes, multiple periods, actual production of meals, household composition, and time dependencies.<sup>3</sup> Still, it provides a useful framework for motivating the empirical models and interpreting patterns in the data. In particular, it shows that a household's food consumption is not only related to its current income but also to its past and future income, its ability to borrow and save, and its needs and preferences. For instance, a household experiencing a temporary spell of poverty may be able to smooth food consumption over time and maintain food sufficiency, if it is not liquidity constrained. Thus, we might observe households that are poor but food sufficient. Alternatively, a household with exceptionally high food needs might report being food insufficient, even if its income is above the poverty threshold.

## Data

The study draws its data for the empirical analyses from the 1993 panel of the Survey of Income and Program Participation and the follow-on Survey of Program Dynamics. The SIPP is a large, national longitudinal survey conducted by the Census Bureau. The 1993 panel interviewed individuals every 4 months over nine waves from Winter 1993 until Fall 1995. In each wave, the SIPP asked people about their work behavior, income receipt, program participation, and family structure. In the final wave, the survey also collected information about basic needs, including food sufficiency.

The SPD is a follow-on to the 1992 and 1993 panels of the SIPP and consists of people who were either original respondents in those surveys or who were living with original respondents. The SPD is an annual longitudinal survey that is designed to capture the changes in income, labor supply, household composition, and program participation that are necessary for evaluating the impacts of PRWORA. The annual interview in 1998 asked questions about food sufficiency and food security in addition to the regular core questions about economic and demographic status. (See appendix A for more information on the SIPP and SPD.)

The linked data from the SIPP and SPD are useful because they permit us to examine food sufficiency and poverty for individuals at two different points in time. For poverty status, longitudinal data are available from

several other surveys; for overall food consumption, they are available from the Panel Study of Income Dynamics (PSID). Although the PSID included food sufficiency questions in the 1999 and 2001 waves, the data have just recently become available. The SIPP and SPD also have other useful features, such as detailed information on different sources of income.

The advantages of using the SIPP and SPD need to be balanced against several difficulties, however. The main difficulty in working with these data is the complex structure of the underlying files. The present analysis required us to link together data from two large files from the SIPP (the Longitudinal file and the Wave 9 Topical Module file) and three files from the SPD (the Longitudinal File, the 1998 Experimental File, and the 1998 Food Security Status File). Another difficulty is that the data from the SPD 1998 Experimental File are unedited. The two SIPP Files and the Longitudinal SPD File were edited by the Census Bureau for consistency; however, the 1998 Experimental SPD File was not. The lack of editing means that it is not possible to link some people from the Experimental File to their records in the other files. It also means that some individual responses are either missing or inconsistent.

A final difficulty is the unusual sampling pattern for the SPD. Like all longitudinal surveys, the SIPP and the SPD suffer from sample attrition. However, the attrition problems in the SPD are especially severe because the survey did not immediately reinterview respondents from the SIPP (the first SPD "bridge" interview took place in March 1997); this large time gap meant that some participants could not be located. Also, the SIPP purposely dropped a large number of respondents in 1998 for budgetary reasons. The SPD does, however, include sample weights, which account for the representation problems associated with attrition and the cut in the sample. All of the empirical analyses in this study make use of these weights. Unfortunately, the weights do not account for observations that are dropped because of item nonresponse and linking problems in the experimental SPD file. Because of these various problems, estimates in the study may not be nationally representative. Also, there is no easy way to aggregate the study's statistical results up to population levels (for example, to estimate the number of people in the United States experiencing poverty or food insufficiency).<sup>4</sup>

<sup>3</sup>Gundersen and Gruber (2001) considered some of these issues. In addition, Mariger and Shaw (1993) considered uncertainty and multiple time periods in their analysis of food consumption; Dynan (2000) considered habit formation, and Rose et al. (1998) considered a household production model of nutritional intake.

<sup>4</sup>For estimates of the levels of food security of different demographic groups, see Nord et al. (2002).

Despite these drawbacks, the study's linked SIPP and SPD dataset remains a unique analytical resource. Subsequent analyses to be discussed indicate that descriptive statistics from the dataset match up well with published statistics and give us confidence that the study's results are sound.

### Measuring Food Sufficiency and Security

The principal outcome variables for the longitudinal analyses are measures of household food sufficiency and family poverty.<sup>5</sup> Questions regarding food sufficiency were asked in Wave 9 of the SIPP (1995-96) and in the 1998 annual interview of the SPD. In each instance, household heads were asked whether the household had:

1. Enough to eat and the kinds of food wanted.
2. Enough to eat but not always the kinds of food wanted.
3. Sometimes not enough to eat.
4. Often not enough to eat.

The SIPP and the SPD both framed the questions in terms of the preceding 12 months.<sup>6,7</sup> In the empirical analysis, a household is identified as being food insufficient if the head reports that the unit either sometimes or often did not have enough to eat.

Both surveys also asked household heads who reported being food insufficient about the reasons for their food problems. For example, households were asked if the problems stemmed from a lack of money, proper kitchen facilities, or health complications. These questions are potentially useful for distinguishing between households that lack resources for enough food and for other reasons (such as preferences or dieting). However, almost all of the food-insufficient households reported

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<sup>5</sup>Note that poverty measures look at family income, whereas survey questions of food sufficiency ask about the household situation. In the vast majority of cases, the family and the household are the same. Cases where they were not the same include households containing unrelated persons. Here we are precise in our usage of "family" and "household."

<sup>6</sup>The framing was implicit in the SIPP; the food sufficiency questions followed several other basic needs that were framed in terms of the preceding 12 months. The framing was explicit in the SPD.

<sup>7</sup>One other difference was that a single question with the four categories just listed was asked in the SPD, while two questions were asked in the SIPP. First, the household was asked whether they always had enough to eat, sometimes did not have enough to eat, or often did not have enough to eat. Only if they responded that they always had enough to eat were they asked whether or not they had the kinds of food they wanted to eat. In a split-panel experiment in the CPS, the two-part question resulted in a substantially higher reported prevalence of food insufficiency than the single question (Nord, 1998).

resource constraints. The study experimented with a more restrictive food-insufficient-for-resource-reasons variable, but found that it had no discernable effect on the results.

An alternative way of measuring food problems in households is the food security scale developed by USDA (Bickel et al., 2000). The food security scale is derived from a long series of questions (18 items) and has been extensively researched. It is intended to measure the existence and severity of food insecurity and hunger and can be used to distinguish between households that are "food secure," "food insecure without hunger," and "food insecure with hunger." Food security questions were asked as part of the SPD but were not included in the SIPP; thus, they can be used to examine hunger at a point in time but not longitudinally. Food sufficiency and food security are clearly related to one another. The analysis focuses on food sufficiency because repeated measures are available over time; where possible, it also considers measures of food security. (See appendix B for more information on food sufficiency and food security measures.)

While the food sufficiency and food security measures are useful for providing direct information about food problems and the ability to meet basic needs, we need to be concerned about how to interpret these self-reported data. One issue is the benchmarks that the household head uses in answering the questions.<sup>8</sup> Where does the head draw the line between having "enough" and "not enough" to eat? It is possible that two respondents who come from households with identical resources and demographic compositions could give opposite, yet logically consistent, answers if they value food consumption differently. The fact that the data are longitudinal allows us to control for persistent, idiosyncratic differences in valuations and helps address this problem (that is, each household would be expected to apply the same standard for food sufficiency in each time period). Another issue is applying this household measure to individual members. The head reports the condition for the household as a whole, not for specific members. But the household may act to shield children and other vulnerable members from food problems (Bickel et al., 2000), which would mean that some individuals in the dataset had adequate food but are reported as being food insufficient. We do not think that these measurement issues, although they are present, significantly bias the results.

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<sup>8</sup>In most, but not all cases, the household head was the same person in the two time periods.

## Measuring Poverty

The other principal outcome that the study examines is family poverty. The analysis uses the standard (Orshansky) poverty measure. From the SIPP, an income-to-needs ratio is formed by summing the monthly reports of family income and measures of family needs over the 12 months preceding the Wave 9 interview (that is, the data are taken from Waves 7-9 and include months from 1994 and 1995). The SPD data come from annual measures describing calendar year 1997. Although the definitions of the measures are similar, there are some differences. In particular, the SIPP measure accounts for month-to-month variation in family composition, while the SPD measure does not. Also, the SIPP measure is based on a shorter recall period.

The analysis includes an indicator for whether anyone in the household received food stamps in the preceding year. As with the income measures, the food stamp participation measure from the 1993 panel of the SIPP is constructed from the 12 months preceding the Wave 9 interview; the measure from the SPD is taken directly from an annual question describing calendar year 1997. We also experimented with other program participation measures, including an indicator for whether anyone in the household received any type of public assistance payment (Temporary Assistance for Needy Families, Aid to Families with Dependent Children, general assistance, foster child payments, or other welfare). These other measures of assistance generally were not significant predictors of food sufficiency once the income-to-needs ratio, food stamp measure, and other controls were included. We also considered alternative measures of food stamp participation, such as number of months of participation, but found that these measures did not perform as well as the annual indicator for any receipt of food stamps.

The theoretical analysis and previous permanent income studies point to the importance of liquidity constraints and the household's net financial position. Eligibility for food stamps also depends on the household's net assets. The analysis relies on two measures to capture net worth: an indicator for whether the household's total payments from interest, dividends, and property rentals in the preceding year were less than \$500, and an indicator for whether the living quarters were owned by someone in the household.

Other demographic characteristics of individuals, their families, and households are also included in the analysis dataset. Standard demographic characteristics for individuals include sex, age, race, ethnicity, education

level, and marital status. Some additional characteristics that are especially relevant for the TANF and Food Stamp Programs are the number of children in the household, the person's employment status, and whether the person is disabled, is a citizen, or lives in a household headed by an unmarried female. For some analyses, the study uses data on age, disability status, and family structure to identify able-bodied adults without dependents (ABAWDs). Note that here ABAWDs are all able-bodied adults without dependents, not just those who are food stamp recipients.

## Characteristics of Food-Insufficient Households

Descriptive statistics for the analysis dataset are reported in tables 1 and 2 and appendix C.<sup>9</sup> Table 1 lists food sufficiency and income-to-needs outcomes for 1994-95 and 1997 and food security outcomes from 1997. The tables indicate that, in each year, most of the population (approximately five out of six people) lived in households with enough food and the kinds of food they wanted. Only 4.3 percent of the population in 1994-95 lived in households in which there was sometimes or often not enough food; by 1997, this figure had fallen by a third to 2.7 percent.<sup>10</sup> The figures similarly indicate that food insecurity and hunger only affect a small percentage of people in the United States—an estimated 9 out of 10 people were in food secure households. Only 3.8 percent of people (about 1 out of 26) were in households classified as food insecure with hunger. These figures can be compared with the standard poverty figures. The 1994-95 data indicate that 12.1 percent of the population was in

<sup>9</sup>Despite the concerns about the representativeness of the linked SIPP and SPD because of sample attrition, item nonresponse, and other issues, the descriptive statistics from tables 1 and 2 match up well with published estimates. The annual poverty rate from the analysis sample for 1994-95 is close to Naifeh's (1998) estimate of 12.6 percent for 1994 based on SIPP data and slightly below Dalaker's (2001) estimates of 14.5 percent for 1994 and 13.8 percent for 1995 based on CPS data. The 1997 estimate is also close to the figure that Naifeh's data would predict and just below Dalaker's CPS estimate. The poverty rates for different demographic subgroups in 1994-95 and 1997 follow the same patterns as Dalaker's CPS estimates; the only exception is the slightly elevated poverty rate for elderly individuals in 1997. The food sufficiency and security measures are also close to previous estimates. The study's estimate of 2.7 to 4.3 percent of the population living in food insufficient households is near the household percentage estimates for 1989-92 reported by Rose et al. (1998). Similarly, its estimate of 10.9 percent of the population living in food-insecure households in 1997 matches well with the CPS-based estimate of 9.8 percent, and the estimated decrease in food insufficiency from 1994-95 to 1997 tracks a similar fall in food insecurity (Andrews et al., 2000). Additional calculations reveal that the relationships between key variables are stable over time; for instance, the correlation between the food insufficiency measure and the income-to-needs ratio is -0.28 in 1994-95 and -0.29 in 1997.

<sup>10</sup>Part of this apparent decline may be an artifact of measurement differences described in footnote 7.

poverty (lived in a family with an income-to-needs ratio less than one); by 1997, the estimated poverty in the data had fallen to 11.6 percent.

Poverty and food insufficiency were positively related, as expected (table 1). People who lived in families with incomes below the poverty line were several times more likely to face food insufficiency than those in families with higher incomes. For instance, the food insufficiency rate for people in poor families in 1994-95 was 16.2 percent vs. a general rate of 4.3 percent

**Table 1—Food sufficiency, food insecurity, and income-to-needs, 1994-95 and 1997**

| Item   | 1994-95        | 1997 |
|--|----------------|------|
|  | <i>Percent</i> |      |
| Family income-to-needs ratio:  |                |      |
| In poverty, people in families with an income-to-needs ratio—                  |                |      |
| Under 0.5  | 3.4            | 4.3  |
| Between 0.5 and 1.0  | 8.6            | 7.3  |
| Above the poverty threshold, people in families with an income-to-needs ratio— |                |      |
| Between 1.0 and 2.0  | 19.5           | 17.4 |
| 2.0 or greater   | 68.5           | 70.9 |
| Food sufficiency:  |                |      |
| People in households—  |                |      |
| With enough food and of the kinds wanted                                       | 82.1           | 83.2 |
| With enough food but not the kinds wanted                                      | 13.6           | 14.1 |
| That sometimes do not have enough food   | 3.8            | 2.3  |
| That often do not have enough food   | 0.5            | 0.4  |
| Food security:   |                |      |
| People in households that are—   |                |      |
| Food secure  | —              | 89.1 |
| Food insecure without hunger   | —              | 7.2  |
| Food insecure with hunger  | —              | 3.8  |
| Food insufficiency and poverty:  |                |      |
| Food insufficiency among people who were in poverty                            | 16.2           | 11.0 |
| Poverty among people in food-insufficient households                           | 45.8           | 47.1 |

Notes: — = Not available. The family income-to-needs ratio, food sufficiency, and food security statistics are all distributions; sums may not add to 100 due to rounding. The food security series of questions was not asked in the 1994-95 SIPP, so estimates cannot be calculated.

Source: Figures calculated using weighted data from the 1993 SIPP and 1998 SPD.

(3.8 percent in households that sometimes do not have enough food and 0.5 percent in households that often do not have enough food). In both 1994-95 and 1997, roughly half of the people in food-insufficient households were also in poor families.<sup>11</sup>

Table 2 and figure 1 report static and dynamic measures of poverty and food insufficiency for the entire sample and for demographic subgroups. The dynamic measures include indicators for whether people were in poor families or food-insufficient households in either 1994-95 or 1997 or in both years along with transition rates into and out of each state. The figures in table 2 confirm previous findings that poverty is relatively transient. While 16.6 percent of the population were poor in either 1994-95 or 1997, only 7.1 percent were poor in both years. Of those people who were not poor in 1994-95, 5.1 percent entered poverty by 1997. The corresponding exit rate from poverty was 41.3 percent over this period.<sup>12</sup> Although the figures provide evidence of mobility, they also give evidence of state dependence: A person who was poor in 1994-95 was 10 times more likely to be poor in 1997 than a person who was not poor in the earlier period. (See box, “Persistence and State Dependence,” and appendix D, “Persistence and State Dependence Examples.”)

Food insufficiency was both rarer and more transient than poverty (table 2). Only 6.1 percent of the population lived in a food-insufficient household in either 1994-95 or 1997, and less than 1 percent lived in such households in both years. Only about 1 person out of 50 who were initially food sufficient lost sufficiency status, while roughly 4 out of 5 people who were initially food insufficient attained sufficiency. At the same time, as with the poverty figures, these rates indicate that there was a great deal of state dependence: A person who was initially in a food-insufficient household was 10 times more likely to be food insufficient in 1997 than a person who was initially in a food-sufficient household.

Estimates for different demographic groups reveal that women were more likely to live in poor families and

<sup>11</sup>Almost all of the people who were food insecure but not in poverty were near-poor—two-thirds of those above the poverty threshold had an income-to-needs ratio between 1.0 and 2.0.

<sup>12</sup>Because the exit and entry rates in table 2 are calculated over a period of just over 2 years, they are not directly comparable to the annual rates reported in other studies. Rough comparisons can be made, however, by projecting the annual rates from previous studies out to 2 years. For instance, if we take Naifeh’s (1998) 1993-94 entry and exit rates of 3.2 and 23.8 percent and project forward an additional year, we obtain 2-year rates of 5.5 and 41.2 percent, respectively.

food-insufficient households than men. The higher poverty and food insufficiency rates for women reflected higher rates of entry for each condition and lower rates of exit. Children were more likely to live in poor families or food-insufficient households than adults and less likely to exit from either of these conditions. The elderly had higher rates of poverty than working-age adults, but lower rates of food insufficiency. The elderly also had lower exit rates from poverty and food insufficiency.

Rates varied across racial and ethnic groups and with citizenship status. Poverty rates and food insufficiency rates for Blacks and African Americans and Hispanics were roughly three times higher than for Whites. Blacks and Hispanics had very high rates of entry for poverty and food insufficiency and low rates of exit. Noncitizens had poverty and food insufficiency rates that were comparable to those of Blacks and Hispanics.

Poverty and food insufficiency declined with increased education. The rates for people who did not complete high school were 2 to 3 times higher than for people who did and 6 to 10 times higher than for people who completed college.

Rates also varied with family structure. Female-headed households with children had the highest rates of poverty and food insufficiency of any demographic group examined. They also had the highest entry rates for each outcome and the lowest exit rates. Married couple households with children had lower than average rates of poverty and food insufficiency. Rates for ABAWDs were lower still.

### Multivariate Analysis

The foregoing analysis provides a useful description of those who have experienced poverty and food insufficiency. However, to better study the factors associated with the dynamics of these conditions, one must

**Table 2—Poverty and food insufficiency rates and dynamics for selected demographic groups**

| Characteristics               | Families in poverty |      |            |             |            |           | Households with insufficient food |      |            |             |            |           |
|-------------------------------|---------------------|------|------------|-------------|------------|-----------|-----------------------------------|------|------------|-------------|------------|-----------|
|                               | 1994-95             | 1997 | Both years | Either year | Entry rate | Exit rate | 1994-95                           | 1997 | Both years | Either year | Entry rate | Exit rate |
| <i>Percent</i>                |                     |      |            |             |            |           |                                   |      |            |             |            |           |
| All people                    | 12.1                | 11.6 | 7.1        | 16.6        | 5.1        | 41.3      | 4.3                               | 2.7  | 0.9        | 6.1         | 1.9        | 79.1      |
| Male                          | 10.0                | 9.4  | 5.5        | 14.0        | 4.3        | 45.0      | 3.8                               | 2.4  | 0.7        | 5.6         | 1.8        | 81.6      |
| Female                        | 14.0                | 13.8 | 8.7        | 19.1        | 5.9        | 37.9      | 4.7                               | 3.0  | 1.1        | 6.6         | 2.0        | 76.6      |
| Age in 1995:                  |                     |      |            |             |            |           |                                   |      |            |             |            |           |
| 0-16 years                    | 19.8                | 17.3 | 12.3       | 24.8        | 6.2        | 37.9      | 6.4                               | 4.1  | 1.5        | 9.0         | 2.8        | 76.6      |
| 17-60 years                   | 9.5                 | 9.2  | 5.2        | 13.5        | 4.4        | 45.3      | 4.1                               | 2.5  | 0.8        | 5.8         | 1.8        | 80.5      |
| 61+ years                     | 9.4                 | 11.5 | 6.1        | 14.9        | 6.0        | 35.1      | 1.8                               | 1.3  | 0.4        | 2.8         | 0.9        | 77.8      |
| White                         | 9.2                 | 9.2  | 5.1        | 13.3        | 4.5        | 44.6      | 3.7                               | 2.2  | 0.7        | 5.1         | 1.6        | 81.1      |
| Black or African American     | 31.0                | 27.3 | 20.4       | 37.9        | 10.0       | 34.2      | 8.2                               | 6.5  | 2.1        | 12.6        | 4.8        | 74.4      |
| Hispanic                      | 29.3                | 25.4 | 18.5       | 36.3        | 9.8        | 36.9      | 12.2                              | 7.7  | 2.9        | 17.0        | 5.5        | 76.2      |
| Noncitizen                    | 32.5                | 27.2 | 20.8       | 38.8        | 9.5        | 36.0      | 11.8                              | 6.6  | 2.8        | 15.5        | 4.3        | 76.3      |
| Education level:              |                     |      |            |             |            |           |                                   |      |            |             |            |           |
| Less than high school diploma | 20.9                | 19.3 | 13.3       | 26.9        | 7.6        | 36.4      | 6.5                               | 4.6  | 1.7        | 9.4         | 3.1        | 73.8      |
| High school diploma           | 7.8                 | 7.8  | 3.9        | 11.8        | 4.2        | 50.0      | 3.5                               | 1.9  | 0.4        | 4.9         | 1.6        | 88.6      |
| College degree                | 2.1                 | 3.3  | 0.8        | 4.5         | 2.6        | 61.9      | 0.9                               | 0.5  | 0.2        | 1.2         | 0.3        | 77.8      |
| Household type:               |                     |      |            |             |            |           |                                   |      |            |             |            |           |
| Married-couple with children  | 7.5                 | 6.0  | 3.4        | 10.2        | 2.8        | 54.7      | 3.3                               | 1.6  | 0.4        | 4.4         | 1.2        | 87.9      |
| Female head with children     | 45.7                | 41.8 | 33.3       | 54.3        | 15.7       | 27.1      | 13.6                              | 12.7 | 4.3        | 22.0        | 9.7        | 68.4      |
| ABAWD                         | 4.2                 | 4.4  | 1.2        | 7.4         | 3.3        | 71.4      | 3.1                               | 1.5  | 0.3        | 4.2         | 1.2        | 90.3      |

Notes: Hispanics may be of any race. ABAWD is all able-bodied adults without dependents (whether or not food stamp recipient).

Source: Figures calculated using weighted data from the 1993 SIPP and 1998 SPD.

control for the influence of multiple variables. For instance, family structure varies with the household head's level of education, and some of the differences in poverty and food insufficiency between married-couple and single-parent households may be attributable to differences in education.

The study estimates multivariate discrete logistic models of the transitions between the two measures of economic hardship in 1995—poverty or food insufficiency status—and the corresponding measures in 1997. Two transition models are estimated for each outcome: a logit model for transitions (entries) into poverty or food insufficiency and a logit model for transitions (exits) out of each category. For the poverty entry model (the model for the top two solid arrows in figure 1a), the dependent variable is poverty status in 1997, and the model is estimated using the sample of individuals

who were not poor in 1995. For the poverty exit model (the model for the top two dashed arrows in figure 1a), the dependent variable is an indicator for *not being* in poverty in 1997 (the converse of poverty status), and the model is estimated using the sample of individuals who were initially poor in 1995. Similar specifications are used to examine transitions into and out of food insufficiency (that is, to model the solid and dashed arrows for figure 1b). Discrete logistic models of this kind have been employed by Stevens (1994, 1999) and others. The models are summarized below.

**Poverty entry:**

model: probability(in poverty in 1997 | not in poverty in 1994-95)  
 =  $f_{\text{povexit}}$ (personal and household characteristics)

population: individuals who were not in poverty in 1994-95

**Poverty exit:**

model: probability(not in poverty in 1997 | in poverty in 1994-95)  
 =  $f_{\text{poventry}}$ (personal and household characteristics)

population: individuals who were in poverty in 1994-95

**Food insufficiency entry:**

model: probability(food insufficient in 1997 | food sufficient in 1994-95)  
 =  $f_{\text{insuffentry}}$ (personal and household characteristics)

population: individuals who were food sufficient in 1994-95

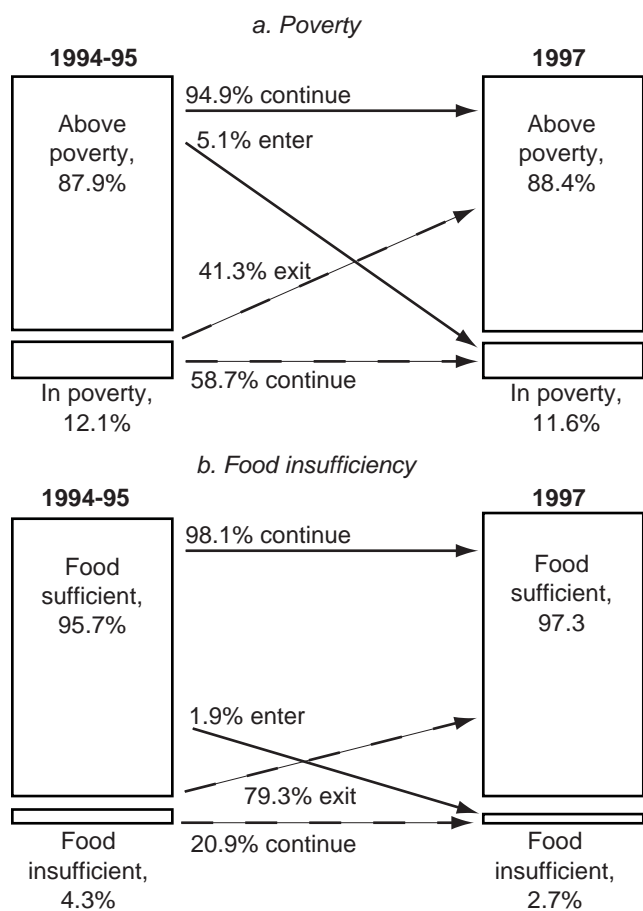
**Food insufficiency exit:**

model: probability(food sufficient in 1997 | food insufficient in 1994-95)  
 =  $f_{\text{insuffexit}}$ (personal and household characteristics)

population: individuals who were food insufficient in 1994-95

Figure 1

**Levels of and transitions in poverty and food insufficiency: 1994-95 to 1997**



Note: Sums may not add to 100 due to rounding.  
 Source: Authors' estimates using data from the Survey of Income and Program Participation and the Survey of Program Dynamics.

Table 3 lists results from three pairs of entry and exit specifications. The models were estimated on a sample of individuals who were at least 18 years old in 1995

and not enrolled in school in 1995 or 1997. This group was chosen to limit the analysis to people who were potential decisionmakers in the household and who were not voluntarily poor because of schooling—that is, who were not individuals with low or no earnings as a result of being enrolled in school or a training program.

The first two columns of table 3—models (1) and (2)—report coefficient estimates and standard errors from models of poverty transitions. The standard errors in these and subsequent columns have been corrected for clustering within households (i.e., for correlations in the unobserved determinants of transitions among individuals from the same household). The models include a number of variables that have either been included in previous analyses of poverty or that seem relevant for poverty dynamics. Specifically, the models incorporate personal characteristics, including age (and age squared), gender, race, ethnicity, citizenship, employment, and disability status. They also incorporate measures of

family and household characteristics, including an indicator for whether the household was headed by a female, the number of children in the household, and the ratio of income to needs (the poverty standard) for the family. With the exception of citizenship status (which is only available for 1997), all of the variables are measured at the start of the transition period in 1995. Means and standard deviations for the explanatory variables are reported in appendix C.

Care should be taken in interpreting the coefficients from table 3. The coefficients in the logit specifications do not have the same interpretation as regression coefficients and thus do not represent the direct association between the listed variables and the actual transition outcomes. Instead, the coefficients represent the association between the independent variables and  $F^{-1}$  (probability of making a transition), where  $F^{-1}(\bullet)$  is the inverse function of the logistic cumulative distribution function. The reported coefficients are useful in determining the direction and

### Persistence and State Dependence

The concepts of persistence and state dependence are related in that they both describe conditions over time. However, persistence indicates the length of time in a condition, whereas state dependence indicates that the past matters in determining current or future conditions.

In explaining the concept of persistence, it is useful to look at ERS's definition of persistent poverty counties. The current definition (prior to the release of the 2000 census) is high poverty—poverty rates greater than or equal to 20 percent—over the last four decades (the 1960, 1970, 1980, and 1990 censuses). Persistence describes the overall condition of the counties at various points in time; it does not imply that these counties or these poor families have greater or smaller probabilities of being in poverty, say, in the 1980 census than in the 1990 census.

State dependence, however, means that the chances of experiencing a condition depend on whether that same condition was experienced in the past. For example, someone currently in a state has a higher probability of being in that state in a later time period than someone who is not now in that state.

Because we are using household survey data measuring complex conditions, it is important to remember that there is the possibility of measurement error and of unobserved characteristics. Consequently, there is a risk that the finding of state dependence in poverty or in food insufficiency may actually be due to unobserved characteristics that we could not control for, rather than to true state dependence. True state dependence may then be due to unobserved underlying characteristics.

See appendix D for a more detailed explanation.

A definition of persistent poverty can be found at:  
[www.ers.usda.gov/Briefing/Rurality/Typology/](http://www.ers.usda.gov/Briefing/Rurality/Typology/)

A map of the persistent poverty counties can be found at:  
[www.ers.usda.gov/Briefing/Rurality/Typology/Poverty.htm](http://www.ers.usda.gov/Briefing/Rurality/Typology/Poverty.htm)

**Table 3—Results for poverty and food insufficiency transition models**

| Variable                           | Poverty              |                      | Food insufficiency   |                     | Food insufficiency with income-to-needs ratio |                     |
|------------------------------------|----------------------|----------------------|----------------------|---------------------|---|---------------------|
|                                    | Entry (1)            | Exit (2)             | Entry (3)            | Exit (4)            | Entry (5)                                     | Exit (6)            |
| Age                                | -0.047**<br>(0.023)  | -0.0005<br>(0.026)   | 0.030<br>(0.035)     | -0.069<br>(0.051)   | 0.037<br>(0.035)                              | -0.069<br>(0.051)   |
| Age <sup>2</sup> (/100)            | 0.039*<br>(0.023)    | -0.013<br>(0.026)    | -0.061<br>(0.037)    | 0.068<br>(0.052)    | -0.069*<br>(0.037)                            | 0.067<br>(0.052)    |
| Female                             | 0.337***<br>(0.126)  | -0.305*<br>(0.162)   | -0.264<br>(0.231)    | 0.267<br>(0.278)    | -0.299<br>(0.229)                             | 0.265<br>(0.279)    |
| Black or African American          | 0.542***<br>(0.178)  | -0.120<br>(0.242)    | 0.454*<br>(0.257)    | -0.477<br>(0.399)   | 0.472*<br>(0.251)                             | -0.483<br>(0.398)   |
| Hispanic                           | 0.367*<br>(0.221)    | -0.176<br>(0.228)    | 0.423<br>(0.280)     | 0.368<br>(0.458)    | 0.362<br>(0.284)                              | 0.330<br>(0.439)    |
| U.S. citizen                       | -0.286<br>(0.306)    | 0.045<br>(0.302)     | -0.449<br>(0.483)    | 0.075<br>(0.508)    | -0.433<br>(0.478)                             | 0.034<br>(0.497)    |
| Completed high school              | -0.410***<br>(0.143) | 0.436**<br>(0.171)   | -0.461*<br>(0.244)   | 1.014***<br>(0.343) | -0.401*<br>(0.239)                            | 1.013***<br>(0.341) |
| Completed college                  | -0.218<br>(0.268)    | 0.112<br>(0.395)     | -0.994*<br>(0.527)   | 0.040<br>(0.821)    | -0.759<br>(0.524)                             | 0.022<br>(0.825)    |
| Female-headed household            | 0.311*<br>(0.171)    | -0.450*<br>(0.232)   | 0.762***<br>(0.273)  | -0.777**<br>(0.389) | 0.650**<br>(0.287)                            | -0.759**<br>(0.386) |
| Number of children under age 18    | -0.005<br>(0.072)    | -0.224***<br>(0.074) | -0.065<br>(0.115)    | -0.203*<br>(0.119)  | -0.102<br>(0.118)                             | -0.206*<br>(0.119)  |
| Disabled                           | 0.684***<br>(0.146)  | -0.740***<br>(0.163) | 0.691**<br>(0.291)   | 0.272<br>(0.309)    | 0.587**<br>(0.287)                            | 0.262<br>(0.308)    |
| Annual hours of work 1995 (/1,000) | -0.122<br>(0.092)    | 0.230*<br>(0.122)    | 0.103<br>(0.133)     | 0.073<br>(0.173)    | 0.116<br>(0.134)                              | 0.080<br>(0.174)    |
| Income-to-needs, 1995              | -0.471***<br>(0.104) | 1.277***<br>(0.405)  | -0.597***<br>(0.145) | 0.473**<br>(0.193)  | -0.321*<br>(0.169)                            | 0.545*<br>(0.283)   |
| Income-to-needs, 1997              |                      |                      |                      |                     | -0.415*<br>(0.219)                            | -0.076<br>(0.159)   |
| Constant                           | -0.254<br>(0.653)    | -0.106<br>(0.813)    | -2.303**<br>(0.942)  | 2.078<br>(1.385)    | -1.989**<br>(0.989)                           | 2.185*<br>(1.319)   |
| Log likelihood                     | -1,379.28            | -712.67              | -637.82              | -186.72             | -623.65                                       | -186.47             |
| Observations                       | 8,358                | 1,156                | 9,098                | 416                 | 9,098   | 416                 |

\*Significant at 0.10 level; \*\*Significant at 0.05 level; \*\*\*Significant at 0.01 level.

Notes: Blank spaces in data field indicate that the variable was not included. Hispanics may be of any race. Logistic transition models estimated using weighted data from the 1993 SIPP and 1998 SPD. Estimated standard errors in parentheses account for repeated observations in households.



statistical significance of associations; however, unless they are transformed, they do not tell us the magnitudes of the direct associations.

The coefficient estimates in table 3 in the poverty entry specification (model (1)) are generally consistent with expectations and previous research; most of the estimates are significantly different from zero, indicating that these factors explain some of the variation in poverty. The coefficient estimates on age and age squared indicate that the probability of entering poverty declines with age through about age 60, then increases thereafter. The probability of entering poverty is estimated to be higher for women, Blacks, Hispanics, people in female-headed households, and the disabled. The probability is lower for people with a high school diploma or those whose initial incomes were far above the poverty line.

The poverty exit specification (2) in table 3 has fewer statistically significant coefficients. The coefficients for age, race, and ethnicity, which were significant in the entry model, are all insignificant in the exit model. However, the coefficient for the number of children, which was small and insignificant in the entry model, is significantly negative for exits, indicating that large households are less likely to leave poverty than small households. Among the other significant coefficients, the signs are all consistent with the implied associations with poverty in the entry model. The high rates of poverty for women, people living in female-headed households, people who did not complete high school, and the disabled reflect high rates of both entry and exit.

To a rough approximation, the coefficient estimates from the poverty entry and exit models in table 3 seem to have the same implications for the overall incidence of poverty. That is, variables that are associated with high probabilities of entry are also associated with low probabilities of exit, and vice versa. This suggests that a single process might describe poverty outcomes independent of previous poverty status—i.e., that there might not be state dependence once observable characteristics are taken into account. However, when we tested formally for this, we found that a single specification did not fit the data as well as separate entry and exit specifications.<sup>13</sup> Thus, although the entry and exit coefficients are broadly similar, the statistical evidence is consistent with poverty outcomes exhibiting state dependence.

<sup>13</sup>The test is a variant of the well-known Chow test of structural shift. Specifically, a likelihood ratio test was performed that compared the sum of the log likelihoods from the separate entry and exit models with the log likelihood from a single, restricted specification for the overall incidence of poverty.

While the results are consistent with the existence of state dependence, there may be other explanations. For instance, if person- or household-specific variables affect the probability of being in poverty in each period but are not captured in the statistical model, the estimation results would indicate that present and past poverty status are related. In this case, the observed relationship would arise through the mutual correlation with the omitted variables rather than through a direct correlation. In general, it is difficult to distinguish between the effects of unobserved heterogeneity and genuine state dependence.

Columns (3) and (4) of table 3 report results from logit models of transitions into and out of food insufficiency. Because the food insufficiency specifications include the same explanatory variables as the poverty models, the results for each outcome can be readily compared. Many of the results are similar to those in the first two columns. Blacks are more likely to transition into food insufficiency, as are people who are disabled and those in female-headed households. Education and the initial income-to-needs ratio are negatively associated with entry into food insufficiency. The most notable difference between the results for the food insufficiency and poverty entry models is that the age profile for food insufficiency has an inverted U-shape (increases and then decreases with age). When we look at the results for the food insufficiency exit models, we see that only a few of the estimates are significant but that all of the significant coefficients have the same signs as the poverty exit models—education and the initial income-to-needs ratio are positively associated with exits, while female head-of-household status and number of children are negatively associated. As with the poverty results, a formal comparison of the separate entry and exit specifications indicates that the estimates are consistent with food insufficiency exhibiting state dependence.

The last two columns in table 3, columns (5) and (6), list results from food insufficiency transition models that include the income-to-needs ratio in 1997 as an explanatory variable. From the theoretical model, we expect that food insufficiency and income will be negatively related. Indeed, for the entry model, the coefficient for income-to-needs is significantly negative; however, for the exit model, the coefficient is small and insignificant.

Once the income-to-needs ratio is taken into account, do any of the other variables matter? The respecifications adding the 1997 income-to-needs ratio are useful for addressing this question: The answer is clearly yes.

Most of the coefficients that are statistically significant in the initial food insufficiency models remain significant after the income-to-needs ratio is added. If poverty were the only determinant of food insufficiency, then adding the 1997 ratio would render the other explanatory variable coefficients statistically insignificant. This finding indicates that while the dynamics of poverty and food insufficiency are related, they are each determined by distinct processes.

### Models With Additional Control Variables

In addition to the explanatory variables used above, we added further controls to see if they yield further or confirming information on poverty and food sufficiency dynamics. Table 4 lists results from poverty and food insufficiency transition models that add several variables from (a) the start of the transition period that are especially relevant for food problems and (b) the end of the transition period that may be endogenous.

Among the first set of variables added in the table are controls for food stamp receipt, home ownership, and low levels of interest, dividend, or rental income in 1994-95. Food stamps do not enter into the calculation of the standard poverty measure; however, they do affect a household's ability to purchase food. Home ownership should not have a direct effect on the income-based poverty measure, but should be related to the household's net financial position and ability to smooth consumption. The indicator for asset income is a little different from the other two measures because asset income does directly affect poverty. However, if the returns from assets provide only a small portion of the typical household's income, the measured effect on poverty may be negligible, while the returns may still indicate an ability to smooth consumption.<sup>14</sup> Home ownership and asset income affect the household's ability to smooth consumption, and so are only included for the first time period, 1995.

Among the second set of variables added in table 4 are controls for female-headed households, number of children, disability status, changes in household composition, employment, and food stamp receipt by the end of the transition period in 1997.<sup>15</sup> The head-of-

<sup>14</sup>Consider a family with exactly \$500 in asset income, the threshold for the asset indicator variable. This small amount of income might not have much effect on poverty status. However, the assets that generate this income would be available to help smooth consumption. If the annual rate of return were 5 percent, the corresponding value of the assets would be \$10,000.

<sup>15</sup>Changes in household composition include households that moved, dissolved, or re-formed.

household, number of children, and household composition variables capture demographic changes that may affect needs, while the employment and food stamp variables are economic measures that capture changes in resources. Because of the large number of potentially endogenous variables, the study does not attempt to correct for the possible biases. The coefficients, therefore, need to be interpreted as partial (conditional) associations rather than partial effects.

In the poverty entry model in table 4, column (1), the coefficients for gender and age lose their significance compared with the model in table 3, and the coefficients on female-headed households and work hours in 1995 switch signs and become significantly negative. The coefficients on Black, Hispanic, high school completion, disability status, and the income-to-needs ratio in 1995 keep their signs and significance from table 3. Among the added variables from the start of the transition period, the coefficients on the home ownership and low-asset income measures are insignificant and close to zero, while the coefficient on food stamp receipt in 1995 is significantly positive. The positive coefficient on food stamp use in 1995 may reflect households that are especially close to the poverty threshold; it could also reflect households that had high levels of income early in 1994-95 but were just entering a period of poverty at the end of 1995.

Except for disability status in 1997, all of the added variables from the end of the transition period are significant in the poverty entry equation. Female-headed household and number of children have the anticipated positive coefficients; the indicator for other changes in household composition also has a positive coefficient. The coefficient on labor supply in 1997 is negative, while the coefficient on food stamp use is positive.

In the poverty exit model of table 4, column (2), only three of the variables that had been significant in table 3—disability status, initial work hours, and the initial income-to-needs ratio—keep their signs and significance. Of the added variables, household changes and food stamp receipt at the end of the transition period have significant negative coefficients, while annual work hours in 1997 has a significant positive coefficient. Each of the significant coefficients is opposite in sign to its counterpart in the entry equation, indicating that these variables contribute to poverty in similar ways through entries and exits.

In the table 4 food insufficiency entry model column (3), the addition of the new variables also leads to some

**Table 4—Results for poverty and food insufficiency transition models with additional controls**

| Variable                              | Poverty              |                      | Food insufficiency   |                     | Food insufficiency with income-to-needs ratio |                     |
|---------------------------------------|----------------------|----------------------|----------------------|---------------------|---|---------------------|
|                                       | Entry (1)            | Exit (2)             | Entry (3)            | Exit (4)            | Entry (5)                                     | Exit (6)            |
| Age                                   | -0.032<br>(0.025)    | -0.002<br>(0.028)    | 0.043<br>(0.035)     | -0.066<br>(0.052)   | 0.049<br>(0.035)                              | -0.070<br>(0.052)   |
| Age <sup>2</sup> (/100)               | 0.024<br>(0.025)     | -0.011<br>(0.028)    | -0.064*<br>(0.037)   | 0.060<br>(0.053)    | -0.070*<br>(0.037)                            | 0.063<br>(0.054)    |
| Female                                | 0.021<br>(0.130)     | 0.022<br>(0.171)     | -0.501**<br>(0.256)  | 0.366<br>(0.291)    | -0.510**<br>(0.257)                           | 0.401<br>(0.287)    |
| Black or African American             | 0.444**<br>(0.194)   | -0.122<br>(0.224)    | 0.262<br>(0.255)     | -0.385<br>(0.406)   | 0.300<br>(0.255)                              | -0.390<br>(0.405)   |
| Hispanic                              | 0.426*<br>(0.232)    | -0.235<br>(0.243)    | 0.335<br>(0.281)     | 0.306<br>(0.444)    | 0.285<br>(0.282)                              | 0.261<br>(0.427)    |
| U.S. citizen                          | -0.341<br>(0.333)    | 0.086<br>(0.338)     | -0.478<br>(0.488)    | 0.095<br>(0.532)    | -0.474<br>(0.484)                             | 0.042<br>(0.523)    |
| Completed high school                 | -0.297**<br>(0.145)  | 0.264<br>(0.174)     | -0.352<br>(0.254)    | 0.936***<br>(0.351) | -0.321<br>(0.244)                             | 0.941***<br>(0.348) |
| Completed college                     | 0.010<br>(0.277)     | -0.202<br>(0.397)    | -0.787<br>(0.515)    | -0.384<br>(0.947)   | -0.614<br>(0.508)                             | -0.407<br>(0.981)   |
| Female-headed household, 1995         | -0.754***<br>(0.257) | -0.368<br>(0.477)    | 0.266<br>(0.379)     | 0.063<br>(0.631)    | 0.283<br>(0.366)                              | 0.137<br>(0.568)    |
| Number of children under age 18, 1995 | -0.128<br>(0.112)    | -0.078<br>(0.108)    | 0.025<br>(0.182)     | -0.256<br>(0.191)   | 0.034<br>(0.178)                              | -0.245<br>(0.194)   |
| Disabled, 1995                        | 0.462***<br>(0.153)  | -0.392**<br>(0.169)  | 0.464<br>(0.286)     | 0.199<br>(0.334)    | 0.422<br>(0.279)                              | 0.202<br>(0.336)    |
| Low-asset income, 1995                | -0.097<br>(0.174)    | 0.056<br>(0.387)     | 1.829***<br>(0.581)  | -0.976<br>(1.181)   | 1.799***<br>(0.582)                           | -1.112<br>(1.250)   |
| Own home, 1995                        | -0.001<br>(0.160)    | -0.034<br>(0.193)    | -0.178<br>(0.287)    | 0.558<br>(0.370)    | -0.181<br>(0.277)                             | 0.536<br>(0.369)    |
| Annual hours of work (/1,000), 1995   | 0.502***<br>(0.113)  | -0.317**<br>(0.147)  | 0.289*<br>(0.173)    | -0.091<br>(0.200)   | 0.224<br>(0.165)                              | -0.110<br>(0.200)   |
| Received food stamps, 1995            | 0.488**<br>(0.226)   | -0.058<br>(0.216)    | 0.567<br>(0.349)     | -0.805*<br>(0.416)  | 0.527<br>(0.345)                              | -0.804*<br>(0.415)  |
| Income-to-needs, 1995                 | -0.432***<br>(0.107) | 1.592***<br>(0.438)  | -0.405***<br>(0.133) | 0.199<br>(0.192)    | -0.203<br>(0.155)                             | 0.294<br>(0.255)    |
| Female-headed household, 1997         | 1.447***<br>(0.231)  | -0.169<br>(0.470)    | 0.645**<br>(0.321)   | -1.002*<br>(0.601)  | 0.514*<br>(0.306)                             | -1.099**<br>(0.535) |
| Number of children under age 18, 1997 | 0.202*<br>(0.104)    | -0.129<br>(0.114)    | -0.139<br>(0.165)    | 0.107<br>(0.217)    | -0.184<br>(0.158)                             | 0.078<br>(0.215)    |
| Disabled, 1997                        | -0.183<br>(0.219)    | -0.149<br>(0.284)    | -0.111<br>(0.351)    | 0.026<br>(0.674)    | -0.109<br>(0.346)                             | 0.036<br>(0.668)    |
| Changed households, 1997              | 0.456***<br>(0.162)  | -0.429*<br>(0.233)   | 0.808***<br>(0.260)  | -0.187<br>(0.338)   | 0.756***<br>(0.267)                           | -0.153<br>(0.344)   |
| Annual hours of work (/1,000), 1997   | -0.917***<br>(0.119) | 0.782***<br>(0.136)  | -0.328<br>(0.202)    | 0.074<br>(0.204)    | -0.214<br>(0.199)                             | 0.118<br>(0.207)    |
| Received food stamps, 1997            | 0.991***<br>(0.249)  | -0.925***<br>(0.209) | 0.130<br>(0.367)     | 0.222<br>(0.419)    | 0.049<br>(0.357)                              | 0.198<br>(0.423)    |
| Income-to-needs, 1997                 |                      |                      |                      |                     | -0.333<br>(0.214)                             | -0.110<br>(0.148)   |
| Constant                              | -0.622<br>(0.746)    | -0.418<br>(0.979)    | -4.801***<br>(1.182) | 3.714*<br>(1.772)   | -4.494***<br>(1.232)                          | 4.081**<br>(1.794)  |
| Log likelihood                        | -1,261.75            | -648.32              | -605.55              | -178.97             | -596.75                                       | -178.54             |
| Observations                          | 8,358                | 1,156                | 9,098                | 416                 | 9,098   | 416                 |

\*Significant at 0.10 level; \*\*Significant at 0.05 level; \*\*\*Significant at 0.01 level.

Notes: Blank spaces in data field indicate that the variable was not included. Hispanics may be of any race. Logistic transition models estimated using weighted data from the 1993 SIPP and 1998 SPD. Estimated standard errors in parentheses account for repeated observations in households.

changes in the coefficients from table 3. The coefficients on Black and female-headed household in 1995 lose their significance, while the coefficient on the gender variable becomes significantly negative. Among the added variables, low levels of asset income are significantly positively associated with transitions into food insufficiency, which is consistent with the theoretical model. The coefficient for the other net worth variable, home ownership, is insignificant. As in the poverty model, female-headed household and changes in household composition in 1997 have significant positive associations with food insufficiency. The coefficients on food stamp use in 1994-95 and 1997 are not significant.

The food insufficiency exit model in column (4) of table 4 has few significant coefficients. High school completion has a significant positive coefficient, and food stamp receipt at the start of the transition period and female-headed household at the end of the period have significant negative coefficients. All the other coefficients are insignificant. Indeed, a likelihood ratio test indicates that the added variables are not jointly significant.

Columns (5) and (6) of table 4 list results from food insufficiency models that also include the income-to-needs ratio at the end of the transition period as an explanatory variable. As with the results from table 3, the coefficient on the income-to-needs ratio is negative in the entry model but falls just short of being statistically significant. The coefficient is small and insignificant in the exit model. The inclusion of this variable leads to relatively minor changes in the other coefficients. We found that adding the additional controls does not change our general conclusions from the original models. Most important, the results of the models with additional controls are consistent with poverty and food sufficiency existing as different processes.

### **Additional Sensitivity Analyses**

Further analyses were done to evaluate the robustness of the results above and also to extract additional insight from the data. First, we looked at food insufficiency entry and exit for various subgroups. Next, we compared the food insufficiency results with food-insecurity results. Finally, we tested to see if the models above were sensitive to the specification of poverty or to measurement error in reporting household food insufficiency.

### **Analysis of Selected Groups**

Table 5 lists results from logistic food insufficiency entry and exit models estimated with different subsets of the

analysis data. The first two columns list results from models estimated using a sample of working-age adults (age 18-60 years or younger in 1995); this subsample drops elderly people, who rely more on asset and retirement income, have smaller households, and have more health problems than younger adults. The next two columns list results from models estimated on a sample of people living in households with children in both 1995 and 1997. Households with children are more likely to be poor and experience food insufficiency problems than other households. Having a female head of household is also likely to have different implications in households with children. Indeed, the coefficients on entry (1.014) and exit (-1.541) for 1997 indicate that female-headed households with children are both more likely to enter and less likely to exit food insufficiency. The final two columns of table 5 list results from models estimated on a sample of people living in food stamp-eligible households in either 1995 or 1997. Eligibility was crudely imputed: A household was treated as “eligible” if it actually received food stamps or if its annual income was less than 1.3 times the poverty standard and it had low levels of asset income.<sup>16</sup> Thus, it might be more appropriate to view these households just as a low-income sample.

As with the other sensitivity analyses, the results differ across the three subsamples, but on the whole, the differences are minor. There are no significant sign reversals; most of the differences reflect changes in significance. Among the robust results, female-headed households at the end of the transition period and changes in household composition have consistent positive associations with entry into food insufficiency, while the income-to-needs ratio at the end of the transition period generally has a negative association. High school completion has a consistent positive association, and female-headed household at the end of the transition period has a consistent negative association, with exits from food insufficiency.

### **Analysis of Food Insecurity**

As discussed in the previous section, the food insecurity scale may be a better indicator of food problems than the food insufficiency measure. Unfortunately, the

<sup>16</sup>This is a very crude imputation procedure that uses monthly rather than annual criteria and mostly ignores the relevant asset and disability tests. An alternative method is to use the 7th Wave of the 1993 SIPP, which contains information for determining food stamp eligibility. However, that method involves linking an additional wave of data, which is for a different time period than the data for the food security/food sufficiency questions. Thus, either method will contain some misidentification of food stamp-eligible households.

**Table 5—Results for food insufficiency transition models for selected groups**

| Variable                              | Working-age adults   |                     | Households with children |                     | Food stamp eligible  |                      |
|---------------------------------------|----------------------|---------------------|--------------------------|---------------------|----------------------|----------------------|
|                                       | Entry<br>(1)         | Exit<br>(2)         | Entry<br>(3)             | Exit<br>(4)         | Entry<br>(5)         | Exit<br>(6)          |
| Age                                   | 0.199**<br>(0.088)   | -0.139<br>(0.111)   | -0.014<br>(0.056)        | 0.066<br>(0.116)    | 0.066*<br>(0.037)    | -0.038<br>(0.058)    |
| Age <sup>2</sup> (/100)               | -0.271**<br>(0.111)  | 0.159<br>(0.141)    | 0.030<br>(0.063)         | -0.073<br>(0.145)   | -0.095**<br>(0.040)  | 0.038<br>(0.061)     |
| Female                                | -0.430<br>(0.278)    | 0.228<br>(0.331)    | -0.462<br>(0.318)        | 0.469<br>(0.357)    | -0.380<br>(0.330)    | 0.798**<br>(0.333)   |
| Black or African American             | 0.262<br>(0.289)     | -0.394<br>(0.439)   | 0.017<br>(0.283)         | -1.415**<br>(0.634) | 0.386<br>(0.263)     | -0.478<br>(0.428)    |
| Hispanic                              | 0.361<br>(0.308)     | 0.300<br>(0.447)    | 0.316<br>(0.373)         | -0.195<br>(0.570)   | 0.372<br>(0.309)     | 0.015<br>(0.482)     |
| U.S. citizen                          | -0.300<br>(0.554)    | 0.023<br>(0.593)    | 0.045<br>(0.461)         | 0.277<br>(0.704)    | -0.433<br>(0.424)    | 0.022<br>(0.555)     |
| Completed high school                 | -0.341<br>(0.270)    | 0.934**<br>(0.376)  | 0.184<br>(0.277)         | 0.834*<br>(0.499)   | -0.118<br>(0.224)    | 1.104***<br>(0.371)  |
| Completed college                     | -0.579<br>(0.532)    | -0.416<br>(1.045)   | 0.182<br>(0.518)         | -1.391<br>(1.828)   | -0.019<br>(0.529)    | 0.092<br>(0.961)     |
| Female-headed household, 1995         | 0.311<br>(0.378)     | 0.167<br>(0.584)    | 0.131<br>(0.414)         | 0.064<br>(0.692)    | -0.123<br>(0.322)    | -0.037<br>(0.525)    |
| Number of children under age 18, 1995 | -0.127<br>(0.155)    | -0.287<br>(0.204)   | 0.087<br>(0.256)         | -0.235<br>(0.285)   | 0.008<br>(0.187)     | -0.245<br>(0.218)    |
| Disabled, 1995                        | 0.437<br>(0.321)     | 0.289<br>(0.403)    | 0.511*<br>(0.281)        | -0.354<br>(0.534)   | 0.309<br>(0.298)     | 0.199<br>(0.359)     |
| Low-asset income, 1995                | 2.353***<br>(0.744)  | -0.602<br>(1.414)   | 0.604<br>(0.710)         | -0.205<br>(1.153)   |                      |                      |
| Own home, 1995                        | -0.074<br>(0.304)    | 0.678<br>(0.420)    | -0.080<br>(0.361)        | 0.255<br>(0.517)    | -0.315<br>(0.292)    | 0.665<br>(0.409)     |
| Annual hours of work (/1,000), 1995   | 0.245<br>(0.175)     | -0.103<br>(0.231)   | -0.107<br>(0.197)        | 0.036<br>(0.280)    | 0.275<br>(0.168)     | -0.071<br>(0.224)    |
| Received food stamps, 1995            | 0.727**<br>(0.368)   | -0.621<br>(0.452)   | 0.625<br>(0.437)         | -0.133<br>(0.734)   | 0.368<br>(0.313)     | -0.544<br>(0.446)    |
| Income-to-needs, 1995                 | -0.241<br>(0.170)    | 0.288<br>(0.252)    | -0.028<br>(0.182)        | 0.049<br>(0.311)    | 0.009<br>(0.128)     | -0.117<br>(0.287)    |
| Female-headed household, 1997         | 0.529*<br>(0.293)    | -1.158**<br>(0.541) | 1.014***<br>(0.360)      | -1.541**<br>(0.667) | 0.691**<br>(0.320)   | -1.407***<br>(0.537) |
| Number of children under age 18, 1997 | -0.142<br>(0.144)    | 0.113<br>(0.224)    | -0.185<br>(0.222)        | -0.217<br>(0.369)   | -0.130<br>(0.167)    | 0.029<br>(0.249)     |
| Disabled, 1997                        | -0.368<br>(0.391)    | -0.219<br>(0.712)   | 0.147<br>(0.485)         | 1.924**<br>(0.861)  | 0.072<br>(0.388)     | 0.115<br>(0.757)     |
| Changed household, 1997               | 0.777***<br>(0.286)  | -0.197<br>(0.381)   | 0.637*<br>(0.367)        | -0.153<br>(0.590)   | 0.646**<br>(0.284)   | -0.201<br>(0.390)    |
| Annual hours of work (/1,000), 1997   | -0.228<br>(0.216)    | 0.122<br>(0.225)    | -0.001<br>(0.192)        | 0.160<br>(0.282)    | -0.351**<br>(0.172)  | 0.312<br>(0.221)     |
| Received food stamps, 1997            | -0.044<br>(0.348)    | 0.057<br>(0.454)    | -0.427<br>(0.460)        | -0.661<br>(0.668)   | 0.003<br>(0.325)     | 0.221<br>(0.432)     |
| Income-to-needs, 1997                 | -0.291<br>(0.217)    | -0.110<br>(0.146)   | -0.772***<br>(0.201)     | -0.388<br>(0.238)   | -0.234*<br>(0.131)   | -0.313**<br>(0.138)  |
| Constant                              | -7.813***<br>(2.152) | 4.786**<br>(2.434)  | -2.975*<br>(1.696)       | 2.053<br>(2.839)    | -3.116***<br>(1.180) | 2.401<br>(1.554)     |
| Log likelihood                        | -506.13              | -149.91             | -341.48                  | -96.11              | -490.30              | -148.64              |
| Observations                          | 7,000                | 358                 | 4,507                    | 226                 | 2290                 | 293                  |

\*Significant at 0.10 level; \*\*Significant at 0.05 level; \*\*\*Significant at 0.01 level.

Notes: Blank spaces in data field indicate that the variable was not included. Hispanics may be of any race. Logistic transition models estimated using weighted data from the 1993 SIPP and 1998 SPD. Estimated standard errors in parentheses account for repeated observations in households.

questions necessary to construct the food insecurity scale were not asked in 1995 as part of the SIPP. They were, however, asked as part of the SPD, and the study uses these data in some sensitivity analyses. In particular, we respecify the conditional food insufficiency models, using the food insecurity indicator (columns (1) and (2) of table 6) and food insecurity numerical scale (columns (3) and (4) of table 6) as the dependent variables. The binary food insecurity indicators—food secure or food insecure (with or without hunger)—are modeled using logit specifications, while the food insecurity scale variables are estimated using tobit specifications. A tobit model is necessary because households that are completely food secure—that is, who answered no to each of the 18 questions—are not assigned a value on the food insecurity scale. The models are estimated using essentially the same subsamples as the food insufficiency entry and exit models—that is, the estimates are conditional on living in a food-sufficient or food-insufficient household in 1995.<sup>17</sup> Because of differences in the definitions of the initial and terminal conditions, the specifications are not transition models as such. Nevertheless, they help show whether the use of the food insecurity measures leads to dramatic changes in the results.

The results differ somewhat between the food insufficiency and food insecurity models in table 6. Most of the differences, however, are changes in significance rather than changes in estimated directions of associations. There are no instances of significant sign reversals. Robust results for the models estimated on the subset of people who were initially food sufficient (the entry subsample) include the negative coefficients for age squared, the indicator for women, the income-to-needs ratio in 1997, and the positive coefficient for disability status. However, none of the significant results from the food insufficiency exit models was consistently replicated in the food insecurity models. Consequently, it appears that some of the study's findings are sensitive to the way that food problems are measured.

#### ***Relationship Between Food Insufficiency and the Income-to-Needs Ratio***

Our conclusions that food insufficiency and poverty capture different dimensions of economic hardship are based on models that make a strong assumption about the relationship between these two variables. In particular, our models include the income-to-needs ratio as a linear determinant of the propensity to enter or exit

<sup>17</sup>The samples used in the models for table 6 are slightly smaller because of a small amount of item nonresponse in the food insecurity measure.

food insufficiency. If this assumption is incorrect, our findings might simply represent a rejection of this specification. To determine whether our results were sensitive to the specification of poverty, we reestimated our models using a flexible, nonlinear function of the income-to-needs ratio (not shown). Our results did not change qualitatively when we did this, which supports our conclusion that food insufficiency and poverty are distinct processes.

#### ***Household Heads***

The foregoing analyses were conducted using all of the adults who were not enrolled in school in each household. However, as we noted, food insufficiency and insecurity information was reported only by the household head. The information on food problems and the other explanatory variables might not be well matched for people who move in and out of households. Similarly, if individual characteristics affect the way an individual perceives or reports food insufficiency or insecurity, there may be a problem with including household members other than the head. To see if these types of reporting issues might have affected the results, we reestimated our models on a restricted sample of household heads. The results from these models (which are not shown) were qualitatively similar to the results for all individuals.

## **Conclusions**

This research uses data from the 1993 panel of the SIPP and the SPD to examine both the incidence of household food insufficiency and family poverty and transitions between these outcomes. The study considers these outcomes in the context of a theoretical economic model in which households smooth consumption to buffer negative income shocks and avoid food sufficiency problems. It provides descriptive statistics and cross-tabulations of food insufficiency and poverty outcomes. It also estimates multivariate logit models of the transitions between different food insufficiency and poverty states.

The empirical analyses revealed that the incidence of food problems in the United States is low. In 1997, less than 3 percent of people were estimated to live in households that were food insufficient (households in which there sometimes or often was not enough to eat), and less than 4 percent were in households that were food insecure with hunger. Persistence in food problems appears to be low as well. Four-fifths of the people who were in households that were food insufficient in 1994-95 were in food-sufficient households 2 years later.

**Table 6—Results for conditional food insecurity models**

|  | Food insecurity: Logit            |                                     | Food insecurity scale: Tobit      |                                     |
|--|-----------------------------------|-------------------------------------|-----------------------------------|-------------------------------------|
|  | Food sufficient<br>in 1995<br>(1) | Food insufficient<br>in 1995<br>(2) | Food sufficient<br>in 1995<br>(3) | Food insufficient<br>in 1995<br>(4) |
| Age                                    | 0.020<br>(0.020)                  | 0.054<br>(0.049)                    | 0.068<br>(0.045)                  | 0.187*<br>(0.107)                   |
| Age <sup>2</sup> (/100)                | -0.046**<br>(0.019)               | -0.044<br>(0.050)                   | -0.152***<br>(0.044)              | -0.163<br>(0.109)                   |
| Female                                 | -0.364***<br>(0.116)              | -0.121<br>(0.222)                   | -0.872***<br>(0.280)              | 0.319<br>(0.501)                    |
| Black or African American              | 0.464***<br>(0.163)               | -0.198<br>(0.353)                   | 1.110**<br>(0.441)                | -0.011<br>(0.782)                   |
| Hispanic                               | 0.131<br>(0.177)                  | -0.156<br>(0.406)                   | 0.642<br>(0.445)                  | -0.204<br>(0.714)                   |
| U.S. citizen                           | -0.305<br>(0.237)                 | -0.579<br>(0.600)                   | -0.658<br>(0.654)                 | -1.175<br>(0.973)                   |
| Completed high school                  | -0.200<br>(0.128)                 | -0.196<br>(0.299)                   | -1.156***<br>(0.311)              | 0.165<br>(0.612)                    |
| Completed college                      | -0.303<br>(0.230)                 | 0.580<br>(0.687)                    | -1.361**<br>(0.544)               | 1.849<br>(1.560)                    |
| Female-headed household, 1995          | 0.494**<br>(0.231)                | -0.331<br>(0.661)                   | 1.196**<br>(0.598)                | -0.923<br>(1.329)                   |
| Number of children under age 18, 1995  | 0.118<br>(0.081)                  | 0.021<br>(0.163)                    | 0.252<br>(0.190)                  | 0.282<br>(0.316)                    |
| Disabled, 1995                         | 0.509***<br>(0.131)               | -0.273<br>(0.276)                   | 1.636***<br>(0.331)               | -0.288<br>(0.602)                   |
| Low-asset income, 1995                 | 1.042***<br>(0.259)               | 0.300<br>(0.822)                    | 2.634***<br>(0.460)               | 0.132<br>(2.301)                    |
| Own home, 1995                         | -0.099<br>(0.142)                 | -0.251<br>(0.320)                   | -0.298<br>(0.345)                 | -0.761<br>(0.627)                   |
| Annual hours of work (/1,000), 1995    | 0.109<br>(0.080)                  | 0.349*<br>(0.190)                   | 0.054<br>(0.200)                  | 0.375<br>(0.390)                    |
| Received food stamps, 1995             | 0.403**<br>(0.192)                | -0.163<br>(0.401)                   | 1.514***<br>(0.461)               | 0.237<br>(0.709)                    |
| Income-to-needs, 1995                  | -0.222***<br>(0.069)              | -0.452**<br>(0.216)                 | -0.319*<br>(0.167)                | -0.869*<br>(0.516)                  |
| Female-headed household, 1995          | 0.123<br>(0.224)                  | 0.535<br>(0.648)                    | 0.191<br>(0.548)                  | 0.674<br>(1.296)                    |
| Number of children, under age 18, 1997 | -0.078<br>(0.079)                 | 0.070<br>(0.181)                    | -0.267<br>(0.194)                 | -0.158<br>(0.377)                   |
| Disabled, 1997                         | 0.040<br>(0.227)                  | 0.190<br>(0.529)                    | 0.400<br>(0.585)                  | 0.416<br>(0.924)                    |
| Changed household, 1997                | 0.139<br>(0.151)                  | 0.275<br>(0.315)                    | 0.594<br>(0.375)                  | 0.298<br>(0.616)                    |
| Annual hours of work (/1,000), 1997    | -0.127<br>(0.083)                 | -0.224<br>(0.178)                   | -0.309<br>(0.198)                 | -0.333<br>(0.372)                   |
| Received food stamps, 1997             | 0.549***<br>(0.196)               | 0.288<br>(0.413)                    | 1.847***<br>(0.481)               | 1.086<br>(0.787)                    |
| Income-to-needs, 1997                  | -0.363***<br>(0.076)              | -0.305*<br>(0.183)                  | -1.169***<br>(0.165)              | -0.844**<br>(0.408)                 |
| Constant                               | -1.579***<br>(0.645)              | 0.286<br>(1.551)                    | -2.400<br>(1.469)                 | 1.560<br>(3.637)                    |
| Log likelihood                         | -1,733.25                         | -243.94                             | -5,398.79                         | -900.30                             |
| Observations                           | 9,092                             | 416                                 | 9,092                             | 416                                 |

\*Significant at 0.10 level; \*\*Significant at 0.05 level; \*\*\*Significant at 0.01 level.

Notes: Hispanics may be of any race. Conditional logit and tobit models estimated using weighted data from the 1993 SIPP and 1998 SPD. Estimated standard errors in parentheses account for repeated observations in households.

However, while the incidence and persistence of food problems are low, the study's descriptive analysis showed that state dependence is still strongly evident; that is, the past matters in determining food sufficiency status. People who were in food-insufficient households in 1994-95 were 10 times more likely than others to be in food-insufficient households in 1997.

The study's theoretical analysis demonstrates how income poverty and food insufficiency are related, yet distinct, processes. Poverty and food insufficiency are both indicators of economic hardship. However, if a household is able to borrow and save, bouts of poverty need not result in food problems. The multivariate empirical analysis confirms that food insufficiency depends on more than just poverty status, a result that indicates that poverty and food insufficiency capture fundamentally different dimensions of economic hardship. A low level of asset income (an indicator of the household's ability to smooth consumption) has a consistent positive association with food problems. In some specifications, home ownership (another indicator of net financial worth) is negatively related to food problems.

The multivariate analyses of transitions in food insufficiency generate other consistent findings. Female-headed households are significantly more likely to transition into food insufficiency and significantly less likely to exit from it than other households. Disability status at the start of the transition period and changes in household composition also appear to be associated with entry into food insufficiency. High school completion is consistently found to increase the chances of leaving food insufficiency.

The study also examined the relationship between food stamp use and food sufficiency problems. It found that food stamp use in 1994-95 had a significant positive association with food problems in 1997—that is, led to

lower rates of exit from food insecurity, but that food stamp use in 1997 was generally not significantly associated with concurrent food problems. As Gundersen and Oliveira (2001) have shown, endogeneity may be affecting the results. In particular, the food stamp variable may be picking up unmeasured aspects of the household's resources or possibly differential concerns regarding food consumption. Either of these effects could bias the associations downward. In any event, the study provides no evidence that food stamps alleviate food problems.

The research results are relevant to several other aspects of food assistance policy. First, the finding that the incidence of food insufficiency is low and transient supports the general design of the Food Stamp Program and other food assistance programs as a safety net for low-income people and, in particular, for those who have unexpected income difficulties. However, our finding that food problems might exhibit state dependence suggests that more targeted efforts would be beneficial for some households. Second, like the analysis by Winship and Jencks (2002), the finding that food insufficiency trends have followed trends in poverty suggests that welfare reform has not led to increases in food sufficiency problems. Third, the findings that assets and home ownership are important factors reinforce Gundersen's and Gruber's (2001) findings that improved access to credit for low-income persons might help households maintain food sufficiency. At the same time, these results indicate why asset tests continue to be used to determine food stamp eligibility—households with assets are less likely to experience food insufficiency. Finally, our finding that food insufficiency is related to, yet distinct from, poverty supports ongoing efforts by USDA to collect and analyze data on food sufficiency in order to further understand economic hardship.



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## Appendix A. Data

### Survey of Income and Program Participation (SIPP)

FIRST WAVE—over 2/93-5/93 all households surveyed once

|               |  |
|---------------|--|
| February 1993 | FIRST WAVE, First Rotation Group, surveyed regarding 10/92-1/93  |
| March 1993    | FIRST WAVE, Second Rotation Group, surveyed regarding 11/92-2/93 |
| April 1993    | FIRST WAVE, Third Rotation Group, surveyed regarding 12/92-3/93  |
| May 1993      | FIRST WAVE, Fourth Rotation Group, surveyed regarding 1/93-4/93  |

SECOND WAVE—6/93-9/93 all households surveyed a second time

|                |  |
|----------------|--|
| June 1993      | SECOND WAVE, First Rotation Group, (same households that were in FIRST WAVE, First Rotation Group), surveyed regarding 2/93-5/93   |
| July 1993      | SECOND WAVE, Second Rotation Group, (same households that were in FIRST WAVE, Second Rotation Group), surveyed regarding 3/93-6/93 |
| August 1993    | SECOND WAVE, Third Rotation Group, (same households that were in FIRST WAVE, Third Rotation Group), surveyed regarding 4/93-7/93   |
| September 1993 | SECOND WAVE, Fourth Rotation Group, (same households that were in FIRST WAVE, Fourth Rotation Group), surveyed regarding 5/93-8/93 |

THIRD WAVE—10/93-1/94, all households surveyed a third time

FOURTH WAVE—2/94-5/94, all households surveyed a fourth time

FIFTH WAVE—6/94-9/94, all households surveyed a fifth time

SIXTH WAVE—10/94-1/95, all households surveyed a sixth time

SEVENTH WAVE—2/95-5/95, all households surveyed a seventh time

EIGHTH WAVE—6/95-9/95, all household surveyed an eighth time

NINTH WAVE—10/95-1/96, all households surveyed a ninth and final time for the SIPP; survey included food sufficiency questions that covered previous 12 months' experience

### Survey of Program Dynamics (SPD)

|            |   |
|------------|---|
| March 1997 | SPD Bridge Survey, covering previous 12 months' experience; all households surveyed in March  |
| March 1998 | SPD Annual Survey, covering previous 12 months' experience, all households surveyed in March; food sufficiency and food security questions included |

### Data Files Used

1. 1993 SIPP longitudinal file—for core information such as income, demographic characteristics, program participation
2. Topical module file from Wave 9 of 1993 SIPP—for food sufficiency questions
3. Longitudinal SPD file—for linking the SIPP and SPD files
4. Unedited 1998 SPD file—or food security and food sufficiency information
5. Food Security Supplement of the SPD—for the food security status variables

### Creating the Dataset

The topical module file from Wave 9 of the 1993 SIPP was linked with the 1993 SIPP longitudinal file so that the food sufficiency information would be added to the core information. Then, the longitudinal SPD file was used to provide the link between the SIPP and the SPD. Next, the unedited 1998 SPD file was linked in order to add the food sufficiency information for the respondents. Finally, the ERS Food Security Supplement file of the SPD was linked to obtain the food security measure.

## **Population Studied**

Individuals who appeared in both the SIPP and the SPD and who were at least 18 years old in 1995 and not enrolled in school in 1995 or 1997.

Note: The 1992 SIPP data were not used. This group of respondents was not asked the food sufficiency questions that were included in Wave 9 of the 1993 SIPP. Consequently, that data cannot be used for food insufficiency analysis.

For more information on the SIPP, see [www.sipp.census.gov/sipp/](http://www.sipp.census.gov/sipp/)

For more information on the SPD, see [www.sipp.census.gov/spd/](http://www.sipp.census.gov/spd/)

For more information on the ERS Food Security Supplement of the SPD, see [www.ers.usda.gov/data/foodsecurity/SPD/](http://www.ers.usda.gov/data/foodsecurity/SPD/)

## Appendix B. Food Sufficiency and Food Security

### Food Sufficiency

Measures of food sufficiency are based on the following series of questions developed by the Census Bureau. In each instance, household heads were asked whether the household had:

1. Enough to eat and the kinds of food wanted,
2. Enough to eat but not always the kinds of food wanted,
3. Sometimes not enough to eat, or
4. Often not enough to eat.

The SIPP and the SPD both framed the questions in terms of the preceding 12 months.

This series of questions were included in the Ninth Wave of the 1993 SIPP and in the 1998 SPD.

In this paper, households are identified as being food insufficient if the head reports that they either sometimes or often did not have enough to eat.

For more information, see [www.sipp.census.gov/sipp/](http://www.sipp.census.gov/sipp/) or [www.sipp.census.gov/spd/](http://www.sipp.census.gov/spd/)

### Food Security

Measures of food security are based on a series of 18 questions developed by USDA. The definition of food security is access by all people at all times to enough food for an active, healthy life. This is considered a condition necessary for the U.S. population to be healthy and well nourished, and so the concept of food security is used in administering food assistance programs. The complete list of the 18 questions is available at:

[www.ers.usda.gov/Briefing/FoodSecurity/](http://www.ers.usda.gov/Briefing/FoodSecurity/)

This module of questions is used as a supplement to the Current Population Survey. In addition, the module was also used in the 1998 SPD.

From these questions, one can distinguish whether the individual or household is food secure, food insecure without hunger, or food insecure with hunger. In addition, a food security scale can be created to measure the severity of food insecurity and hunger. The scale ranges from 0 to 13; however, values of 0 (all questions answered “no”) are coded as -6 in the SPD. For more information, see the ERS food security website above, or Bickel, et al. (2000) or Nord, et al. (2002).

In this paper, food insecurity is defined in terms of households that are food insecure without hunger or food insecure with hunger.

## Appendix C. Descriptive Statistics for Subsamples Used in Multivariate Analyses

| Variable  | Not poor<br>in 1994-95 |                       | Poor in<br>1994-95 |                       | Food sufficient<br>in 1994-95 |                       | Food insufficient<br>in 1994-95 |                       |
|---|------------------------|-----------------------|--------------------|-----------------------|-------------------------------|-----------------------|---------------------------------|-----------------------|
|   | Mean                   | Standard<br>deviation | Mean               | Standard<br>deviation | Mean                          | Standard<br>deviation | Mean                            | Standard<br>deviation |
|   | <i>Years</i>           |                       | <i>Years</i>       |                       | <i>Years</i>                  |                       | <i>Years</i>                    |                       |
| Mean age  | 47.51                  | (17.20)               | 46.80              | (18.66)               | 47.66                         | (17.40)               | 41.50                           | (14.57)               |
|   | <i>Proportion</i>      |                       | <i>Proportion</i>  |                       | <i>Proportion</i>             |                       | <i>Proportion</i>               |                       |
| Female  | 0.50                   | (0.50)                | 0.66               | (0.47)                | 0.51                          | (0.50)                | 0.58                            | (0.49)                |
| Black or African American                           | 0.09                   | (0.29)                | 0.29               | (0.45)                | 0.11                          | (0.31)                | 0.24                            | (0.43)                |
| Hispanic  | 0.08                   | (0.27)                | 0.22               | (0.41)                | 0.08                          | (0.28)                | 0.25                            | (0.43)                |
| U.S. citizen  | 0.97                   | (0.18)                | 0.88               | (0.33)                | 0.96                          | (0.19)                | 0.87                            | (0.34)                |
| Completed high school                               | 0.58                   | (0.49)                | 0.45               | (0.50)                | 0.57                          | (0.50)                | 0.54                            | (0.50)                |
| Completed college                                   | 0.24                   | (0.43)                | 0.04               | (0.20)                | 0.23                          | (0.42)                | 0.05                            | (0.21)                |
| 1995:   |                        |                       |                    |                       |                               |                       |                                 |                       |
| Female-headed household                             | 0.19                   | (0.39)                | 0.49               | (0.50)                | 0.21                          | (0.41)                | 0.39                            | (0.49)                |
|   | <i>Level</i>           |                       | <i>Level</i>       |                       | <i>Level</i>                  |                       | <i>Level</i>                    |                       |
| Average number of<br>children under age 18          | 0.73                   | (1.10)                | 1.39               | (1.65)                | 0.77                          | (1.16)                | 1.43                            | (1.58)                |
|   | <i>Proportion</i>      |                       | <i>Proportion</i>  |                       | <i>Proportion</i>             |                       | <i>Proportion</i>               |                       |
| Disabled  | 0.17                   | (0.38)                | 0.45               | (0.50)                | 0.19                          | (0.39)                | 0.40                            | (0.49)                |
| Low-asset income                                    | 0.64                   | (0.48)                | 0.95               | (0.23)                | 0.65                          | (0.48)                | 0.95                            | (0.22)                |
| Own home  | 0.79                   | (0.40)                | 0.40               | (0.49)                | 0.77                          | (0.42)                | 0.46                            | (0.50)                |
|   | <i>Thousands</i>       |                       | <i>Thousands</i>   |                       | <i>Thousands</i>              |                       | <i>Thousands</i>                |                       |
| Annual hours of work                                | 1.45                   | (1.08)                | 0.40               | (0.75)                | 1.37                          | (1.10)                | 0.92                            | (0.97)                |
|   | <i>Proportion</i>      |                       | <i>Proportion</i>  |                       | <i>Proportion</i>             |                       | <i>Proportion</i>               |                       |
| Received food stamps                                | 0.04                   | (0.19)                | 0.58               | (0.49)                | 0.08                          | (0.27)                | 0.47                            | (0.50)                |
| Income-to-needs                                     | 3.91                   | (2.47)                | 0.66               | (0.25)                | 3.69                          | (2.54)                | 1.55                            | (1.29)                |
| 1997:   |                        |                       |                    |                       |                               |                       |                                 |                       |
| Female-headed household                             | 0.19                   | (0.39)                | 0.50               | (0.50)                | 0.21                          | (0.41)                | 0.38                            | (0.49)                |
|   | <i>Level</i>           |                       | <i>Level</i>       |                       | <i>Level</i>                  |                       | <i>Level</i>                    |                       |
| Average number of children<br>children under age 18 | 0.70                   | (1.08)                | 1.27               | (1.61)                | 0.74                          | (1.13)                | 1.21                            | (1.40)                |
|   | <i>Proportion</i>      |                       | <i>Proportion</i>  |                       | <i>Proportion</i>             |                       | <i>Proportion</i>               |                       |
| Disabled  | 0.08                   | (0.27)                | 0.10               | (0.30)                | 0.08                          | (0.28)                | 0.07                            | (0.26)                |
| Changed households                                  | 0.19                   | (0.39)                | 0.25               | (0.43)                | 0.19                          | (0.39)                | 0.31                            | (0.46)                |
|   | <i>Thousands</i>       |                       | <i>Thousands</i>   |                       | <i>Thousands</i>              |                       | <i>Thousands</i>                |                       |
| Annual hours of work                                | 1.40                   | (1.10)                | 0.63               | (0.97)                | 1.34                          | (1.11)                | 1.10                            | (1.08)                |
|   | <i>Proportion</i>      |                       | <i>Proportion</i>  |                       | <i>Proportion</i>             |                       | <i>Proportion</i>               |                       |
| Received food stamps                                | 0.02                   | (0.15)                | 0.40               | (0.49)                | 0.05                          | (0.22)                | 0.29                            | (0.45)                |
| Income-to-needs                                     | 4.25                   | (2.83)                | 1.27               | (1.34)                | 4.05                          | (2.86)                | 1.99                            | (1.91)                |
| Number of observations                              | 8,358                  |                       | 1,156              |                       | 9,098                         |                       | 416                             |                       |

Notes: Hispanics may be of any race. Statistics were estimated using weighted data from the 1993 SIPP and 1998 SPD.

## Appendix D. Persistence and State Dependence Examples

The concepts of *persistence and state dependence* are important in the analysis of outcomes over time. The term persistence describes whether a particular condition, like poverty or food insecurity, is brief or long-lasting. *State dependence* indicates whether the chances of experiencing a condition depend on having experienced the same condition in the past. Some hypothetical examples of a society's experiences with poverty show the distinctions between these two measures.

Consider a society in which half the people are poor in any given year and half are not. This tells us the *level* of poverty in the society but not its *dynamics*. We could imagine several types of dynamic patterns.

### **Example #1: Some persistence, no state dependence.**

This level of poverty could occur if everyone in the society had an equal (50 percent) chance of being poor or affluent in any given year. In this situation, one-half of the people who are poor this year (25 percent of the total population) would be poor next year—that is, would have poverty spells that continued for at least 2 years. One-half of those people (12.5 percent of the total population) would have spells that continued for 3 years, and so on. Thus, the society would be composed of some people (50 percent) who are not currently experiencing poverty, some people (25 percent) who are currently in the first year of their spell of poverty, and other people (25 percent) who are currently in their second or later spell of poverty.

### **Example #2: Complete persistence and state dependence.**

The levels of poverty for this society could also arise with an initial 50-50 distribution of outcomes and no one ever subsequently entered or left poverty. In this case, the chances of leaving poverty would be zero, as would the chances of falling into poverty. Here, the past clearly matters, as a person in poverty never escapes.

### **Example #3: No persistence, complete state dependence.**

At the other extreme, everyone in this society could change places each year. The poor would face a 100-percent chance of leaving poverty, and the affluent would face a 100-percent chance of entering poverty. Each person would cycle from being poor one year to being affluent the next. Once again, the past matters; however, the past contributes to all spells lasting only a single year.

**Example #4: Spurious state dependence.** Statisticians recognize that unmeasured differences in people's underlying probabilities of entering or exiting conditions may lead to wrong conclusions about state dependence.

Consider our earlier example of a society in which half the people are poor and half are not. Suppose that the population in this society is made up of two types of people: one group that has a high probability of being poor and another that has a low probability. Assume that the people with high probabilities (we can call them H types) have a 90-percent chance of being poor in each year and that this probability does not depend on their prior poverty status. Thus, these people experience very persistent poverty but do not experience state dependence. Assume that the people with low probabilities (L types) have a 10-percent chance of being poor in each year, but again do not experience state dependence. Finally, assume that the two types are equally represented in the total population. The following table summarizes these assumptions:

| Type | Proportion of population | Probability of being poor this year if poor last year | Probability of being poor this year if not poor last year |
|------|--------------------------|---|---|
|      |                          | Percent   |   |
| H    | 50                       | 90  | 90  |
| L    | 50                       | 10  | 10  |

As we go from one year to the next, 81 percent of the H types will continue their poverty spells, 9 percent will end their spells, 9 percent will begin new spells, and 1 percent will remain out of poverty. We can repeat these calculations to determine the transition probabilities for the L types and the population as a whole. The transition probabilities are as follows:

| Type | Remain poor | Exit poverty | Enter poverty | Remain affluent |
|------|-------------|--------------|---------------|-----------------|
|      | Percent     |              |               |                 |
| H    | 81          | 9            | 9             | 1               |
| L    | 1           | 9            | 9             | 81              |
| All  | 41          | 9            | 9             | 41              |



Now suppose that we do not know people's types; we observe only their poverty histories. That is, we only observe the bottom row of the table. We would observe that 82 percent of the total population who are poor in a given year remain poor the next year, while 18 percent exit poverty. We would also observe that 18 percent of the total population who are not poor in a given year enter poverty, while 82 percent remain affluent.

In this case, the transition probabilities for the total population suggest that there is state dependence (people who are poor are more likely be poor in the next period). However, this arises spuriously from a failure to account for underlying differences in people's probabilities of being poor.