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. 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 (Dynan, 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>&</sup>lt;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 parttime employment, low-wage (below poverty) fulltime 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. Finally, the study relies on data from the mid- to late 1990s. Thus, it not only provides a more up-to-date picture,

<sup>&</sup>lt;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, twoperiod 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,  $C_n$  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  $U_t(\bullet, \bullet)$  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,  $Y_p$  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:

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

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,