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

	Families in poverty						Households with insufficient food					
Characteristics	1994-95	1997	Both years	Either year	Entry rate	Exit rate	1994-95	1997	Both years	Either year	Entry rate	Exit rate
					Percent							
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

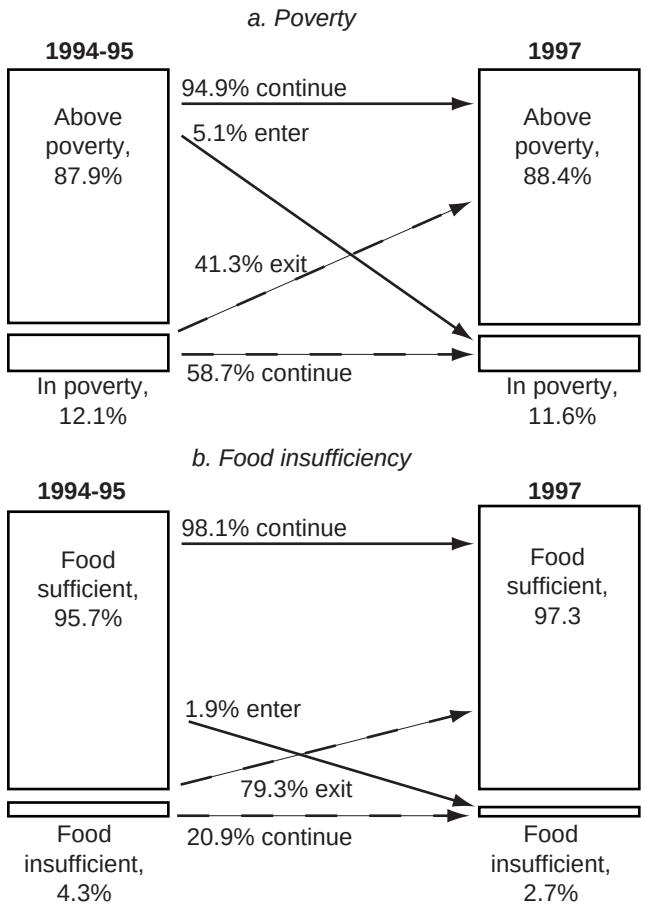
Notes: Hispanics may be of any race. ABAWD is all able-bodied adults without dependents (whether or not food stamp recipient).
Source: Figures calculated using weighted data from the 1993 SIPP and 1998 SPD.

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.

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.

Poverty entry:

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

population: individuals who were food insufficient in 1994-95

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/

A map of the persistent poverty counties can be found at:
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**	-0.0005	0.030	-0.069	0.037	-0.069
	(0.023)	(0.026)	(0.035)	(0.051)	(0.035)	(0.051)
Age^2 (/100)	0.039*	-0.013	-0.061	0.068	-0.069*	0.067
	(0.023)	(0.026)	(0.037)	(0.052)	(0.037)	(0.052)
Female	0.337***	-0.305*	-0.264	0.267	-0.299	0.265
	(0.126)	(0.162)	(0.231)	(0.278)	(0.229)	(0.279)
Black or African American	0.542***	-0.120	0.454*	-0.477	0.472*	-0.483
	(0.178)	(0.242)	(0.257)	(0.399)	(0.251)	(0.398)
Hispanic	0.367*	-0.176	0.423	0.368	0.362	0.330
	(0.221)	(0.228)	(0.280)	(0.458)	(0.284)	(0.439)
U.S. citizen	-0.286	0.045	-0.449	0.075	-0.433	0.034
	(0.306)	(0.302)	(0.483)	(0.508)	(0.478)	(0.497)
Completed high school	-0.410***	0.436**	-0.461*	1.014***	-0.401*	1.013***
	(0.143)	(0.171)	(0.244)	(0.343)	(0.239)	(0.341)
Completed college	-0.218	0.112	-0.994*	0.040	-0.759	0.022
	(0.268)	(0.395)	(0.527)	(0.821)	(0.524)	(0.825)
Female-headed household	0.311*	-0.450*	0.762***	-0.777**	0.650**	-0.759**
	(0.171)	(0.232)	(0.273)	(0.389)	(0.287)	(0.386)
Number of children under age 18	-0.005	-0.224***	-0.065	-0.203*	-0.102	-0.206*
	(0.072)	(0.074)	(0.115)	(0.119)	(0.118)	(0.119)
Disabled	0.684***	-0.740***	0.691**	0.272	0.587**	0.262
	(0.146)	(0.163)	(0.291)	(0.309)	(0.287)	(0.308)
Annual hours of work 1995 (/1,000)	-0.122	0.230*	0.103	0.073	0.116	0.080
	(0.092)	(0.122)	(0.133)	(0.173)	(0.134)	(0.174)
Income-to-needs, 1995	-0.471***	1.277***	-0.597***	0.473**	-0.321*	0.545*
	(0.104)	(0.405)	(0.145)	(0.193)	(0.169)	(0.283)
Income-to-needs, 1997					-0.415*	-0.076
					(0.219)	(0.159)
Constant	-0.254	-0.106	-2.303**	2.078	-1.989**	2.185*
	(0.653)	(0.813)	(0.942)	(1.385)	(0.989)	(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.[13] Thus, although the entry and exit coefficients are broadly similar, the statistical evidence is consistent with poverty outcomes exhibiting state dependence.

[13]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.[14] 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.[15] The head-of-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

[14]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.

[15]Changes in household composition include households that moved, dissolved, or re-formed.

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

	Poverty		Food insufficiency		Food insufficiency with income-to-needs ratio	
Variable	Entry (1)	Exit (2)	Entry (3)	Exit (4)	Entry (5)	Exit (6)
Age	-0.032	-0.002	0.043	-0.066	0.049	-0.070
	(0.025)	(0.028)	(0.035)	(0.052)	(0.035)	(0.052)
Age^2 (/100)	0.024	-0.011	-0.064*	0.060	-0.070*	0.063
	(0.025)	(0.028)	(0.037)	(0.053)	(0.037)	(0.054)
Female	0.021	0.022	-0.501**	0.366	-0.510**	0.401
	(0.130)	(0.171)	(0.256)	(0.291)	(0.257)	(0.287)
Black or African American	0.444**	-0.122	0.262	-0.385	0.300	-0.390
	(0.194)	(0.224)	(0.255)	(0.406)	(0.255)	(0.405)
Hispanic	0.426*	-0.235	0.335	0.306	0.285	0.261
	(0.232)	(0.243)	(0.281)	(0.444)	(0.282)	(0.427)
U.S. citizen	-0.341	0.086	-0.478	0.095	-0.474	0.042
	(0.333)	(0.338)	(0.488)	(0.532)	(0.484)	(0.523)
Completed high school	-0.297**	0.264	-0.352	0.936***	-0.321	0.941***
	(0.145)	(0.174)	(0.254)	(0.351)	(0.244)	(0.348)
Completed college	0.010	-0.202	-0.787	-0.384	-0.614	-0.407
	(0.277)	(0.397)	(0.515)	(0.947)	(0.508)	(0.981)
Female-headed household, 1995	-0.754***	-0.368	0.266	0.063	0.283	0.137
	(0.257)	(0.477)	(0.379)	(0.631)	(0.366)	(0.568)
Number of children under age 18, 1995	-0.128	-0.078	0.025	-0.256	0.034	-0.245
	(0.112)	(0.108)	(0.182)	(0.191)	(0.178)	(0.194)
Disabled, 1995	0.462***	-0.392**	0.464	0.199	0.422	0.202
	(0.153)	(0.169)	(0.286)	(0.334)	(0.279)	(0.336)
Low-asset income, 1995	-0.097	0.056	1.829***	-0.976	1.799***	-1.112
	(0.174)	(0.387)	(0.581)	(1.181)	(0.582)	(1.250)
Own home, 1995	-0.001	-0.034	-0.178	0.558	-0.181	0.536
	(0.160)	(0.193)	(0.287)	(0.370)	(0.277)	(0.369)
Annual hours of work (/1,000), 1995	0.502***	-0.317**	0.289*	-0.091	0.224	-0.110
	(0.113)	(0.147)	(0.173)	(0.200)	(0.165)	(0.200)
Received food stamps, 1995	0.488**	-0.058	0.567	-0.805*	0.527	-0.804*
	(0.226)	(0.216)	(0.349)	(0.416)	(0.345)	(0.415)
Income-to-needs, 1995	-0.432***	1.592***	-0.405***	0.199	-0.203	0.294
	(0.107)	(0.438)	(0.133)	(0.192)	(0.155)	(0.255)
Female-headed household, 1997	1.447***	-0.169	0.645**	-1.002*	0.514*	-1.099**
	(0.231)	(0.470)	(0.321)	(0.601)	(0.306)	(0.535)
Number of children under age 18, 1997	0.202*	-0.129	-0.139	0.107	-0.184	0.078
	(0.104)	(0.114)	(0.165)	(0.217)	(0.158)	(0.215)
Disabled, 1997	-0.183	-0.149	-0.111	0.026	-0.109	0.036
	(0.219)	(0.284)	(0.351)	(0.674)	(0.346)	(0.668)
Changed households, 1997	0.456***	-0.429*	0.808***	-0.187	0.756***	-0.153
	(0.162)	(0.233)	(0.260)	(0.338)	(0.267)	(0.344)
Annual hours of work (/1,000), 1997	-0.917***	0.782***	-0.328	0.074	-0.214	0.118
	(0.119)	(0.136)	(0.202)	(0.204)	(0.199)	(0.207)
Received food stamps, 1997	0.991***	-0.925***	0.130	0.222	0.049	0.198
	(0.249)	(0.209)	(0.367)	(0.419)	(0.357)	(0.423)
Income-to-needs, 1997					-0.333	-0.110
					(0.214)	(0.148)
Constant	-0.622	-0.418	-4.801***	3.714*	-4.494***	4.081**
	(0.746)	(0.979)	(1.182)	(1.772)	(1.232)	(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.[16] 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

[16]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

	Working-age adults		Households with children		Food stamp eligible	
	Entry	Exit	Entry	Exit	Entry	Exit
Variable	(1)	(2)	(3)	(4)	(5)	(6)
Age	0.199**	-0.139	-0.014	0.066	0.066*	-0.038
	(0.088)	(0.111)	(0.056)	(0.116)	(0.037)	(0.058)
Age^2 (/100)	-0.271**	0.159	0.030	-0.073	-0.095**	0.038
	(0.111)	(0.141)	(0.063)	(0.145)	(0.040)	(0.061)
Female	-0.430	0.228	-0.462	0.469	-0.380	0.798**
	(0.278)	(0.331)	(0.318)	(0.357)	(0.330)	(0.333)
Black or African American	0.262	-0.394	0.017	-1.415**	0.386	-0.478
	(0.289)	(0.439)	(0.283)	(0.634)	(0.263)	(0.428)
Hispanic	0.361	0.300	0.316	-0.195	0.372	0.015
	(0.308)	(0.447)	(0.373)	(0.570)	(0.309)	(0.482)
U.S. citizen	-0.300	0.023	0.045	0.277	-0.433	0.022
	(0.554)	(0.593)	(0.461)	(0.704)	(0.424)	(0.555)
Completed high school	-0.341	0.934**	0.184	0.834*	-0.118	1.104***
	(0.270)	(0.376)	(0.277)	(0.499)	(0.224)	(0.371)
Completed college	-0.579	-0.416	0.182	-1.391	-0.019	0.092
	(0.532)	(1.045)	(0.518)	(1.828)	(0.529)	(0.961)
Female-headed household, 1995	0.311	0.167	0.131	0.064	-0.123	-0.037
	(0.378)	(0.584)	(0.414)	(0.692)	(0.322)	(0.525)
Number of children under age 18, 1995	-0.127	-0.287	0.087	-0.235	0.008	-0.245
	(0.155)	(0.204)	(0.256)	(0.285)	(0.187)	(0.218)
Disabled, 1995	0.437	0.289	0.511*	-0.354	0.309	0.199
	(0.321)	(0.403)	(0.281)	(0.534)	(0.298)	(0.359)
Low-asset income, 1995	2.353***	-0.602	0.604	-0.205		
	(0.744)	(1.414)	(0.710)	(1.153)		
Own home, 1995	-0.074	0.678	-0.080	0.255	-0.315	0.665
	(0.304)	(0.420)	(0.361)	(0.517)	(0.292)	(0.409)
Annual hours of work (/1,000), 1995	0.245	-0.103	-0.107	0.036	0.275	-0.071
	(0.175)	(0.231)	(0.197)	(0.280)	(0.168)	(0.224)
Received food stamps, 1995	0.727**	-0.621	0.625	-0.133	0.368	-0.544
	(0.368)	(0.452)	(0.437)	(0.734)	(0.313)	(0.446)
Income-to-needs, 1995	-0.241	0.288	-0.028	0.049	0.009	-0.117
	(0.170)	(0.252)	(0.182)	(0.311)	(0.128)	(0.287)
Female-headed household, 1997	0.529*	-1.158**	1.014***	-1.541**	0.691**	-1.407***
	(0.293)	(0.541)	(0.360)	(0.667)	(0.320)	(0.537)
Number of children under age 18, 1997	-0.142	0.113	-0.185	-0.217	-0.130	0.029
	(0.144)	(0.224)	(0.222)	(0.369)	(0.167)	(0.249)
Disabled, 1997	-0.368	-0.219	0.147	1.924**	0.072	0.115
	(0.391)	(0.712)	(0.485)	(0.861)	(0.388)	(0.757)
Changed household, 1997	0.777***	-0.197	0.637*	-0.153	0.646**	-0.201
	(0.286)	(0.381)	(0.367)	(0.590)	(0.284)	(0.390)
Annual hours of work (/1,000), 1997	-0.228	0.122	-0.001	0.160	-0.351**	0.312
	(0.216)	(0.225)	(0.192)	(0.282)	(0.172)	(0.221)
Received food stamps, 1997	-0.044	0.057	-0.427	-0.661	0.003	0.221
	(0.348)	(0.454)	(0.460)	(0.668)	(0.325)	(0.432)
Income-to-needs, 1997	-0.291	-0.110	-0.772***	-0.388	-0.234*	-0.313**
	(0.217)	(0.146)	(0.201)	(0.238)	(0.131)	(0.138)
Constant	-7.813***	4.786**	-2.975*	2.053	-3.116***	2.401
	(2.152)	(2.434)	(1.696)	(2.839)	(1.180)	(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.[17] 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 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.

[17]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.