

Household Assets and Food Security: Evidence from the Survey of Program Dynamics

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Abstract This study uses the Survey of Program Dynamics data to examine the independent role of household assets in food security. It further examines whether assets provide a buffer for low-income households to food insecurity in the face of income losses. Results of the Two-Part Model analyses show that household assets have a significant association with food security in both the full sample and the low-income sample. In the presence of household assets, income's effect on food security decreases. In addition, the significant interaction terms of income loss and household assets indicate that assets provide resources to smooth food consumption. The findings of this study suggest a consideration of asset building strategies in asset related provisions of current food assistance policy.

Keywords Food security · Food stamp program · Household assets · Income

Introduction

Each year considerable amounts of public funds are spent on food and nutrition programs in the US. For instance, federal expenditures for food assistance programs mounted to nearly \$51 billion in 2006 (USDA 2007)—the third consecutive year that food assistance expenditures exceeded the previous historical record. In particular, the Food Stamp Program (FSP) participation rate had increased

between 2001 and 2005 (Wolkwitz 2007), resulting in record high of FSP expenditures of nearly \$33 billion in 2006 (Nord et al. 2007). Despite massive public and private efforts to help poor households meet their food needs, still nearly one out of 10 households is not able to secure its food consumption at some time during a year. The beginning years of the 21st century even witnessed a noticeable increase in the nation's food insecurity rate. About 4.6 million households (4%) experienced very low food security in 2006 (Nord et al. 2007). More than three million children live in households classified as “very low food security” (Nord et al. 2007).

The problem of food insecurity, although affected by a number of factors (Heflin et al. 2007), is largely attributed to insufficient household resources (Nord et al. 2007). Among others, income and homeownership have been well recognized as important determinants of food security. For instance, food insecurity rates for low-income households are substantially higher than the national average (Nord et al. 2007). Studies also show that homeowners are less likely to experience food insecurity than non-homeowners (e.g., Rose et al. 1998). Other than income, however, other household economic resources, such as household assets (except homeownership), have not been adequately studied with respect to how they affect food security. In particular, the question arises as to whether household assets have any effect on food security, net of income. Research in this regard will be useful for public food assistance programs, given the growing awareness that asset accumulation may provide an effective approach for the poor to achieve self-sufficiency and food security (Mills et al. 2000; Ribar and Hamrick 2003).

The potential of asset accumulation in addressing poverty is in part reflected in policy changes in recent years (Grinstein-Weiss et al. 2010). For instance, AFDC/TANF

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programs revised asset-related provisions and allowed states to use TANF funds to support Individual Development Accounts (IDAs)¹ so that welfare recipients could build household assets (DHHS 1999). As TANF recipients are automatically eligible for FSP, these changes in AFDC/TANF undoubtedly affect food assistance policies and their target populations. As early as the 1990s, legislative efforts attempted to seek modifications in the food stamp policy to allow more generous asset holding for participants (PL 103-66). Also, given the crucial role of car ownership in searching for and securing jobs (Fletcher et al. 2005; Ong 2002; Raphael and Rice 2002), many states have expanded flexibility in the vehicle asset test (Rosenbaum 2002).

Although household assets have been regarded as an important protecting factor for food security and other forms of material hardship (Beverly et al. 2003; Carroll 1997; Ribar and Hamrick 2003; Rose et al. 1998), few studies have empirically examined the independent role of household assets in food security (Huang et al. 2010). Two reasons perhaps account for this. First, from a consumption perspective, income and assets are both economic resources and are different only in terms of their form. For a long time, income has been considered the most important economic factor in well-being. Household income, therefore, is often used as a proxy for consumption, and the independent role of household assets to promote well-being is largely unnoticed. Some studies, however, have shown that household income and household assets differ in many ways (Cramer 2003; Ruggles and Williams 1989; Sherraden 1991). Compared with household income, household assets provide a unique and perhaps more consistent measure of well-being (Haveman and Wolff 2000; Sherraden 1991). Second, it is generally considered that low-income households barely have any assets for backup when facing food insecurity and have to turn to public food assistance programs. But what complicates this argument is that some low-income households may not have incentives to accumulate assets due to the current asset tests for eligibility in the FSP and other means test programs. Studies have shown that poor people can engage in saving if appropriate incentives are provided (Beverly 1997; Schreiner and Sherraden 2007).

This study will address the gap in the research by investigating the association between household economic

resources and food security. In particular, it is intended to explore whether various forms of household assets play an independent role in protecting households from food insecurity when income is taken into account. Further, it examines if assets have any cushioning effects on smoothing consumption and reducing food insecurity.

Literature Review

A number of socio-economic determinants of food security have been studied. This review focuses on household economic resources, namely household income and assets. The positive effect of income on food security has been consistently documented in the current literature. Using the 1989–1991 continuing survey of food intake by individuals and the 1992 Survey of Income and Program Participation (SIPP), Rose et al. (1998) find that household income is significantly and negatively related to the probability of food insufficiency in both samples. When household income is replaced with poverty status, it shows that households in poverty are more likely to be food insufficient. Mimura (2008) also finds poverty status a good explaining factor of economic hardship of low-income families. Regardless of the strong relationship between income and food sufficiency, only about 10% of income-poor households are food insufficient and a large proportion of food insufficient households are not in poverty (Rose et al. 1998). Ribar and Hamrick's (2003) study also demonstrates that the income-to-needs ratio is significantly associated with transitions into and out of food sufficiency, but they also firmly state that the income-to-needs ratio is not the only determinant of food insufficiency. Iceland and Bauman (2007) particularly point out that food insecurity is more affected by short-term income than long-term income, which resonates the discussions on the effects of income volatility on the predicted probability of food insufficiency (Bania and Leete 2007; Gundersen and Gruber 2001). Negative income shocks increase the possibility that a household faces food insufficiency. This is especially true for poor households as they experience the greatest increases in income volatility (Bania and Leete 2007; Hernandez and Ziol-Guest 2009).

Researchers agree that household assets may be an important factor in food security, given their virtue of improving household ability to withstand abrupt changes in income or unforeseen events (Rose et al. 1998). West and Price (1976) claim that assets have a significant effect on food consumption and that this effect appears stronger among Anglo households. Gundersen and Gruber (2001) offer two reasons for household food insecurity, both related to the household asset status: low average income and initial assets, and negative income shocks, lack of

¹ Individual Development Accounts (IDAs) are special savings accounts that are designed to help poor people build assets for increased self-sufficiency and long-term economic security (Sherraden 1991). Account holders receive matching funds as they save for purposes such as buying a first home, job training, going to a college, or starting or expanding a small business. Welfare recipients are allowed to have IDA accounts in TANF programs in many states (Edwards and Bailey 2006). Generally, savings in IDAs are excluded from asset tests of social assistance programs.

savings, and liquidity constraints. Based on the 1991–1992 SIPP panel data, they find that only a small proportion of food-insufficient households (3.6%) have savings, while over 25% of food-sufficient households have savings. When examining multiple factors contributing to household food security in a rural county, Olson et al. (1997) find that households with savings are more likely than those without to be food secure. Another study, using asset income as a proxy for household assets, finds that households with low levels of asset income are more likely to enter into food insufficiency, but assets do not seem to have a significant effect on food insufficiency (Ribar and Hamrick 2003). Besides financial assets, home ownership and vehicle ownership show positive associations with household food security (Olson et al. 1997; Rose et al. 1998). Possibly, home owners with mortgages paid off may have more disposable financial resources for purchasing food, and individuals with a car may be more likely to find and maintain a job that supplies income for food purchases.

These studies, perhaps the best available for us to understand household assets and food security, are limited in several aspects. First, except homeownership (e.g., Gundersen and Gruber 2001; Ribar and Hamrick 2003; Rose et al. 1998), other forms of household assets are barely studied. In these few studies, measures of savings that have been used, such as “lack of savings” and “asset income,” are not direct measures of household savings and do not allow an assessment of how different levels of savings can affect food security. This problem is mostly due to data constraints. For instance, asset measures in the SIPP core questionnaire only included asset ownership (home, vehicle, and bank account) and the income generated from asset holdings. To obtain a comprehensive understanding of the effect of household assets on food security, it is important to closely examine different forms and levels of household assets.

Further, as is assumed by most of the studies in this area, assets play an important role in cushioning uncertain income shocks due to circumstances such as unemployment, illness, or marriage dissolution. Assets provide resources to fill the income shortage and smooth consumption (Carroll 1997; Hubbard et al. 1994; Ribar and Hamrick 2003). Improved access to credit might help households maintain food sufficiency (Gundersen and Gruber 2001; Ribar and Hamrick 2003). While the buffering effect of assets is clearly noted, it needs to be closely tested in the model. In addition, different forms of assets may have distinct buffering effects. For instance, savings is perhaps more directly related to food security than homeownership because once being withdrawn from the savings account it can be directly used to purchase food, while owning a vehicle can give a household some

flexibility to shop around and purchase less expensive but sufficient amount of food within the budget limit.

Third, measures of food security status in the above studies mostly use the USDA food sufficiency question, which addresses only one aspect of the broader definition of food security. As a single question, the standard food sufficiency question asks: “Which best describes the food eaten in your household? (1) enough of the kinds of food we want to eat; (2) enough but not always the kinds of food we want to eat; (3) sometimes not enough to eat; (4) often not enough to eat.” The food sufficiency question, although reliable, is not able to capture various conditions or behaviors in households, such as food procurement, food safety, nutritional quality, and anxiety about food supply (Rose et al. 1998). Compared with the USDA 18-item food security scale developed later, the traditional food sufficiency question, despite a long history in the USDA national food surveys and a high correlation with the food security scale, is a “substantially weaker measure” of food security (Bickel et al. 2000). In contrast, the 18-item food security scale is able to measure the full range of food insecurity (Rose et al. 1998). This food security scale has been included in several specialized national surveys since 1995, but to date, the data have not been adequately analyzed, especially in terms of the relationship between household assets and food security.

Using the data from the Survey of Program Dynamics (SPD), this study extends the existing studies by explicitly examining the independent role of household assets in food security and the buffering effects of household assets on food consumption.

Data, Sample, and Methodology

Data

This study uses the SPD (the US Census Bureau 2002) data to examine the relationship between household economic resources and food security. Under the Personal Responsibility and Work Opportunity Reconciliation Act (PRW-ORA) of 1996, the US Census Bureau is required to collect data to evaluate the effects of welfare reform on program participation, income, employment, marital relationship, and out-of-wedlock births. Following the 1992 and 1993 SIPP panels, the SPD consists of people who were either original respondents in the SIPP surveys or who were living with those respondents. The SPD data were collected annually between 1997 and 2002 (each wave provides respondents’ information for last year). From 1999 onwards, the SPD expanded core questions on asset ownership (home and bank accounts) to include new questions

asked about the amounts of different types of household assets.

While sample attrition oftentimes brings about concerns about the representation of the SPD data, sample weights included in the SPD can be used to partly address this issue (Ribar and Hamrick 2003). Despite severe sample attrition, the SPD data are still considered representative when compared with the Current Population Survey (CPS), and the other two major longitudinal household surveys—the Panel Study of Income Dynamics (PSID) and the National Longitudinal Survey of Youth (NLSY) (Weinberg and Shipp 2000).

Several practical considerations also led to the choice of the SPD over the other national surveys which also include the 18-item food security scale. First, although the PSID includes the food security scale in 1999 and 2001, its sample is rather small compared with the SPD. In addition, the PSID has been collecting data biennially since 1997, which could result in extraneous factors that cannot be controlled for in this study. Second, the CPS, the first to include the 18-item food security core module, does not provide much information on household assets.

To closely examine household assets and their relationships with household food security status, the 2002 SPD data are selected. Using the measures collected in the same year however may cause a problem of endogeneity. For example, divorce, unemployment, medical emergencies and other expected events may affect both household assets and household food security status. To avoid this problem, this study examines how household assets in the previous year affect household food status in the current year. That is, asset measures in the 2001 SPD data are selected. The current study uses the food security status files created by the USDA Economic Research Service based on the Household Food Security Survey Module included in the SPD core instrument in 1998 and the following 4 years. The 2002 food security status file is incorporated in the 2002 SPD main data set.

Sample

This study uses the following criteria to guide sample selection: (1) In the SPD, each household member is an observation from which the data are collected. As the characteristics of a household are shared by each household member, the current study keeps only observations of household heads. Households with more than one person identifying themselves as household heads ($n = 412$, 3.7%) are omitted to avoid complication in analysis. (2) Household heads under 65 years old are selected. According to Nord et al. (2007), households with elders are least likely to experience food insecurity among all types of households. Therefore, those aged 65 or over are not

included as their food security pattern is suspected to be different from that of the working age population. To apply these two sample selection criteria results in a total of 8,534 households as the full sample. As the current study is intended to examine household assets and food security not only in the general population but also in low-income households, households with an income below the 200% poverty line are selected from the full sample to form the low-income sample ($n = 1,585$). Analyses are conducted on both the full sample and the low-income sample.

Measurement

The dependent variable, *food security*, measured in 2002, is indicated by the USDA 18-item food security scale.² This scale asks about food related experiences and behaviors, such as “We worried whether our food would run out before we got money to buy more,” “The food that we bought just did not last and we did not have money to get more,” and “We could not afford to eat balanced meals” (Bickel et al. 2000; Nord et al. 2007). A continuous food security scale score (0–13.0)³ is computed for each household. Higher scores suggest higher levels of food insecurity. Over 10% of households in the full sample ($n = 1,212$, 14.62%) have a food security score greater than zero, which indicates either “food insecurity” or “at risk of food insecurity.” A more detailed discussion of the food security measure follows in the discussion of analytical strategy as it is closely related to data analysis per se.

Household economic resources are measured by both income and assets. To be consistent with the current literature (Iceland and Bauman 2007), this study uses the short-term income measure, the total annual household income. Household asset variables include homeownership, vehicle ownership, savings, and mutual fund/stock holdings. A positive response to homeownership indicates that the home was owned/bought by the respondent or someone in the household. Similarly, a positive response to vehicle ownership indicates that someone in the household owned a car, van, or truck. Savings is the sum of the amounts in solely owned and jointly owned interest-earning accounts, such as a savings or checking account, money market funds, bonds, treasury notes or certificates of deposit or other investments that pay interest. Mutual funds/stocks is the sum of the amounts in solely owned and jointly owned mutual funds or stocks. Given that the majority of the sample (nearly 70%) does not have any

² There are 18 items for households with children and 10 items for households without children (Bickel et al. 2000).

³ In the food security files created by the USDA, households that affirmed no items are in fact coded as missing to avoid a food security score of zero being considered part of this interval scale.

mutual funds/stocks, a dichotomous variable is created to indicate the presence/absence of this type of asset. Both the income and savings measures are logarithmic transformed.

There are three categories of control variables: (1) household head's characteristics, including age, gender, race (1 = black, 0 = other), education (1 = high school diploma or above, 0 = less than high school) and employment status (1 = employed; 0 = unemployed); (2) household characteristics, including household size, number of children under 18 years, and family structure indicated by three dummy variables for single parents with children, married couple with children, and households without children (the reference group in multivariate analysis), respectively, and (3) food stamp participation.

Analytical Strategy

The analysis focuses on the effect of household assets in the previous year on household food security status in the current year. Given the distribution of the dependent variable—that is, the food security score has a corner solution at zero—a Two-Part Model is used for data analysis (Cameron and Trivedi 2005; Dow and Norton 2003). The Two-Part Model is considered appropriate because the sample is highly skewed with most households receiving a food security scale score of zero, indicating food security while only a small proportion of households reported one or more conditions indicative of food insecurity. Food security is modeled using separate processes: The first process uses logit model to explain the probability of (presumed) food security—that is, having a food security score of zero against non-zero. The second process uses OLS model to explain the variation in non-zero food security sale scores, namely, the degree of severity of food insecurity. In both processes, household economic resources variables are included in the model along with control variables. The base model includes income alone, followed by the four asset measures, homeownership, vehicle ownership, savings, and mutual funds/stocks being added in the model, respectively. Then a closer look is given to the low-income sample because the problem of food insecurity is more likely to occur in households with limited incomes (Rose et al. 1998).

Finally, the buffering effect of assets is tested on the low-income sample given that low-income households are especially vulnerable to negative income shocks. There is evidence to show that the problem of food insecurity is transient and does not last long (Ribar and Hamrick 2003). If households have some savings, it will be of vital importance for smoothing food consumption. The buffering effect of assets will be tested using the interaction terms of income loss and assets. All multivariate estimates reported in the tables are weighted.

Results

Descriptive Statistics

Table 1 summarizes and compares the characteristics of the full sample and the low-income sample. To be consistent with the analytical strategy described above, the full sample is divided into two groups: households that are presumed food secure ($n = 7,080$, 85.38%) and households that reported food insecurity or at risk of food insecurity ($n = 1,212$, 14.62%). This percentage is higher than the 2002 food insecurity rate (11.1%) reported by the USDA in that the former also includes those households (3.05%) that confirmed 1–2 items on the food security scale and therefore are considered the at risk population. The low-income sample consists of food secure households ($n = 892$, 57.33%) and food insecure households ($n = 664$, 42.67%). Quite expectedly, the low income sample has a much larger proportion of households that are defined food insecure. However, still more than half of the low-income households are able to secure their food consumption, indicating that constrained income may not necessarily lead to food insecurity.

In the full sample, 72.2% of the food secure group are home owners, 89.34% have a vehicle, 60.08% have savings, and 30.95% have mutual funds/stocks, all significantly higher than those in the food insecure/at risk group. The mean income of the food secure group is \$64,775, almost 2.5 times that of the food insecure group. However, the average amount of savings and mutual funds/stocks owned by the food secure group is about 10 times those of the food insecure group. A similar pattern is found in the low-income sample. What is also noted is that low-income households with certain levels of savings and mutual funds are able to secure their food needs regardless of income constraints.

The two groups in the full sample and the low-income sample, respectively, significantly differ from each other in age, gender, race, education, number of children under 18 years, food stamp participation, region, employment and family structure. The food stamp participation rate is 7.2% in the full sample and nearly 30.5% in the low-income sample. Single mothers headed households account for a large proportion of households having food insecurity problems (27% in the full sample and 34% in the low-income sample).

Multivariate Statistics

Full Sample

Multivariate analysis of food security includes income, an asset variable and a set of control variables to see if assets

Table 1 Characteristics of the sample

Variable	Full sample		Low-income sample			
	Total	Group A: presumed food secure (food security score = 0)	Group B: at-risk or food insecure (food security score > 0)	Total	Group C: total presumed food secure (food security score = 0)	Group D: At-risk or food insecure (food security score > 0)
Food security score > 0						
Mean (sd)	0.65 (1.85)	–	4.46 (2.54)	1.98 (2.85)	–	4.65 (2.59)
Median	0	–	4.14	0	–	4.23
Economic resources variables						
Household income (\$)*** †††	59,439 (41,749)	64,775 (41,649)	26,893 (23,322)	16,223 (10,377)	17,689 (10,661)	14,281 (9,617)
Mean (sd)	51,771	57,498	20,781	14,950	16,288	12,745
Median	67.86	72.20	41.25	40.19	44.84	33.28
Homeownership (%)*** †††	86.21	89.34	68.98	67.19	74.10	57.68
Vehicle ownership (%)*** †††						
Savings ownership (%)*** †††						
Zero	45.68	39.92	78.63	77.16	72.31	84.04
Above zero	54.32	60.08	21.37	22.84	27.69	15.96
Savings (continuous) (\$)*** †††						
Mean (sd)	4,753 (14,048)	5,457 (14,950)	555 (4,171)	813 (5,344)	1,306 (6,987)	164 (1,294)
Median	51.4	257	0	0	0	0
Mutual fund/stocks (%)*** †††						
Zero	72.49	69.05	92.08	93.38	90.36	97.29
Above zero	27.51	30.95	7.92	6.62	9.64	2.71
Mutual fund/stocks (continuous)	9,797 (33,454)	11,441 (36,095)	892 (6,900)	1,396 (12,215)	2,346 (16,149)	131 (1,267)
Mean (sd) (\$)*** †††						
Demographic and household characteristics						
Age (mean, sd) (years)**	41.7 (11.25)	41.9 (11.16)	40.8 (11.86)	40.2 (12.76)	39.8 (12.90)	40.81 (12.57)
Female (%)*** †††	41.13	37.87	60.48	60.57	54.04	69.28
Black (%)*** †††	11.4	9.56	22.85	22.71	18.61	28.01
High school or above (%)*** †††	86.5	89.32	69.14	66.12	69.62	60.99
Household size (mean, sd)	3.03 (1.49)	3.02 (1.45)	3.01 (1.71)	2.94 (1.76)	2.95 (1.75)	2.91 (1.75)
Number of children (mean, sd)***	1.02 (1.19)	0.98 (1.14)	1.20 (1.39)	1.30 (1.43)	1.28 (1.40)	1.32 (1.45)
Poverty (%)*** ††† a	9.75	6.02	31.85	43.91	37.67	51.66
Food stamp participation (%)*** †††	7.20	3.55	29.21	30.54	20.96	43.83
Region (%)***						
Northeast	19.37	20.04	15.43	16.34	16.70	16.11
South	36.23	35.49	42.33	45.87	46.52	45.63
West	20.37	19.84	22.94	18.36	16.82	20.48

Table 1 continued

Variable	Full sample		Low-income sample			
	Total	Group A: presumed food secure (food security score = 0)	Group B: at-risk or food insecure (food security score > 0)	Total	Group C: total presumed food secure (food security score = 0)	Group D: At-risk or food insecure (food security score > 0)
Midwest	20.03	24.62	19.31	19.43	19.96	17.77
Employment (%)*** †††	85.30	88.70	64.44	62.84	70.07	53.16
Family structure (%)**** †						
Single parent with children	13.93	11.26	29.54	30.16	25.56	36.30
Female-headed	11.60	9.01	26.65	27.51	22.31	34.34
Male-headed	2.33	2.25	2.89	2.65	3.25	1.96
Married couple with children	39.59	41.43	26.83	28.90	33.52	22.89
Households without children	46.47	47.31	43.65	40.95	40.92	40.81
N (%)	8,292	7,080 (85.38)	1,212 (14.62)	1,556 (18.76)	892 (57.33)	664 (42.67)

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ (difference between the two groups in the full sample)

† $p < 0.05$, †† $p < 0.01$, ††† $p < 0.001$ (difference between the two groups in the low-income sample)

^a This variable indicates whether households were income-poor in both 2001 and 2002

have any effect on food security in addition to that of income (see Table 2). Results of the logit models using the full sample show that income plays an important role in protecting households from food insecurity. In the base model, the odds of having a value of zero on the food security scale (presumed food secure) increases by 58% when household income is doubled. However, in the presence of household asset variables, there is a decrease in the effect of income on food security as suggested by the logit regression coefficient of the income variable. The decrease is especially pronounced when the savings variable is added in the model.

All four asset variables in the logit models demonstrate an association with food security status when income is controlled for. Specifically, homeowners are less likely than non-homeowners to experience food insecurity. The odds of being food insecure or at risk of food insecurity for homeowners (food insecurity or at risk of food insecurity) is twice that for non-homeowners. This finding concurs with the previous studies regarding the relationship between homeownership and food insecurity/insufficiency. What is more, the other three asset measures, vehicle ownership, savings, and mutual funds/stocks are all statistically associated with the food security status net of the effect of income. Both savings and mutual funds/stocks are significantly associated with household food security status at the 0.001 level. The odds ratio is 1.48 for households with and without car ownership, and is 2.35 for those with and without mutual fund/stocks. A 100% increase in savings raises the odds of having a food security scale value of zero by 23%. These findings support the hypothesis regarding the protective effects of household assets on food security status.

The findings also suggest that the effects of education, food stamp participation, employment, family structure, and region are consistent across the five models. These findings are consistent with previous studies (e.g., Garasky and Stewart 2007; Rose et al. 1998). Regarding family structure, households of married couples with children do not differ from households without children in food security status, but households of single parents with children are more likely to experience food insecurity. The direction of the coefficient of education also shows consistency with previous studies. That is, households headed by an individual with a high school diploma or above are less likely to experience food insecurity. Interpretation of the effect of food stamp participation on food security is somewhat difficult. While it is speculated that food stamp participation can help reduce food insecurity, this study, together with several previous studies, shows a contradiction: food stamp participants have a higher probability of food insecurity, which is mostly due to the self-selection bias. The lack of experimental design makes it difficult to examine

the causal relationship between food stamp participation and food security. Nonetheless, this is beyond the scope of the current study.

As mentioned in the above, OLS models focus on households in or at risk of food insecurity to see whether family economic resources have an association with the severity of food insecurity. OLS analyses yield results different from the logit models. First, while the OLS models are overall significant, most of the factors showing significance in the logit models turn out statistically non-significant in the OLS models. Only food stamp participation is significantly related to the severity of food insecurity across the five models specified with different measures of household economic resources. It is noted that, for those in or at risk of food insecurity, income is not related to the severity of food insecurity nor are household assets indicated by homeownership, vehicle ownership, and mutual funds/stocks. However, savings is associated with the severity of food insecurity at the 0.05 level. A 100% increase in household savings reduces the food security scale value by 0.07 unit. This is to say, regardless of income, households with more savings are better off than those with no or little savings in that they have lower food security scale scores.

Low-income Sample

In order to closely examine how household economic resources are related to the severity of food insecurity in low-income households, the two-stage analysis is run on households living under the 200% poverty line (see Table 3). Given the little variation of the income measure in this low-income sample, it is not surprising that household income is not significantly associated with household food security status in both statistical processes. Surprisingly, however, all measures of household assets except homeownership are significantly related to food security status and the directions of the coefficients of the asset variables are consistent with expectations. The mean marginal effect of (logged) savings is 0.023, which suggests that on average, every unit increase in (logged) savings leads to a 2% point increase in the probability of food security when holding other variables constant. For instance, for a low-income household without any savings, to save \$160 can result in a 10% point increase in the probability of food security. The OLS models to explain the severity of food insecurity in the low-income sample have no significant variables.

Interaction Effects

As discussed above, to examine if assets have any buffering effects on food consumption when a household faces

income losses, interaction terms are created for the income loss variable and each of the asset measures (see Table 4). An income loss variable indicating the difference in the total household income between 2001 and 2002 is created. A dichotomous income shock variable can be created alternatively, but selecting a level of income loss to indicate negative income shocks can be rather arbitrary. Therefore, income loss is used as a continuous variable: a positive value indicates an income loss and a negative value indicates an income increase. On average, each low-income household in the sample had a \$729 increase in income in 2002 (median = \$203). Nearly half of low-income households ($n = 732$, 46.2%) experienced income losses (median = \$3,420). Then four interaction terms are created using this income loss variable and homeownership, vehicle ownership, savings, and mutual fund/stocks, respectively.

Results of the multivariate results from the logit models indicate that the main effect of savings and the interaction term of savings and income loss are both significant. The sign of the coefficient of the interaction term is consistent with the expectation. That is, the effect of savings on food security is larger in the presence of income losses, indicating that savings has important buffering effects on smoothing consumption and preventing low-income households from food insecurity. However, the regression coefficient of the interaction term is small in magnitude, suggesting that the buffering effect of savings in the presence of income loss is not strong as expected. All the other three interaction terms are not statistically significant in the logit model. This again reinforces the findings in the above that savings is an important protector of food security. Spending from accumulated savings allows low-income households to escape from the adverse impacts of income losses and secure their food consumption. The only significant interaction term in the OLS regression model is that of home and income loss. This indicates that homeowners experience less harm caused by income loss than nonhomeowners and their degree of food insecurity is less severe when holding the other factors constant.

Discussion

In summary, family economic resources in the form of income and assets are significantly related to household food security status (security or insecurity). Noticeably, household assets have additional effects on food security status when income is controlled for. For low-income households, income is not a determinant of food security status, but household assets (vehicle ownership, savings and mutual fund/stocks) are still significant determinants. Savings turns out to be the most stable determinant of food

Table 2 Two-stage analysis of household economic resources and food security (full sample)

Variable	Stage 1: logit models (probability of food security)				Stage 2: OLS models (severity of food insecurity)					
	Income only	Home-ownership	Vehicle ownership	Savings	Mutual fund/stock	Income only	Home-ownership	Vehicle ownership	Savings	Mutual fund/stock
Age	0.005	-0.004	0.005	0.001	0.002	0.004	0.004	0.004	0.003	0.003
Gender (male = 1; female = 0)	0.441**	0.403**	0.427**	0.417**	0.423**	0.154	0.154	0.165	0.153	0.134
Race (black = 1; white = 0)	-0.387	-0.290	-0.317	-0.261	-0.340*	-0.108	-0.109	-0.139	-0.117	-0.087
Education (high school and above = 1; else = 0)	0.997***	0.914***	0.955***	0.699***	0.892***	-0.155	-0.154	-0.135	-0.104	-0.194
Household size	-0.087	-0.122	-0.102	-0.030	-0.061	0.019	0.020	0.026	0.009	0.032
Number of children under 18 years	-0.170	-0.136	-0.149	-0.228*	-0.184	-0.126	-0.126	-0.133	-0.106	-0.128
Food stamp participation (yes = 1; no = 0)	-0.972***	-0.890***	-0.926***	-0.772***	-0.923***	0.783***	0.782***	0.757***	0.738***	0.810***
Region										
Northeast	0.059	0.139	0.096	0.093	0.053	-0.202	-0.202	-0.235	-0.231	-0.186
South	-0.186	-0.225	-0.204	-0.083	-0.183	-0.187	-0.187	-0.188	-0.200	-0.152
West	-0.453*	-0.384*	-0.456*	-0.388*	-0.433*	-0.102	-0.103	-0.112	-0.075	-0.098
Midwest (reference group)										
Employment (employed = 1; unemployed = 0)	0.609***	0.616***	0.578***	0.603***	0.529***	0.017	0.017	0.033	0.000	-0.026
Family structure										
Single parent with children	-0.570*	-0.599**	-0.578*	-0.510*	-0.558*	0.006	0.006	0.019	-0.015	0.010
Married with children	0.278	0.136	0.243	0.261	0.225	-0.357	-0.355	-0.335	-0.378	-0.393
Households w/o children (reference group)										
Household income (logged)	0.380**	0.343**	0.361*	0.274*	0.349**	-0.012	-0.012	0.005	-0.070	-0.019
Homeownership (yes = 1; no = 0)		0.703***				-0.007	-0.007	-0.161		
Vehicle ownership (yes = 1; no = 0)			0.396*							
Savings (logged)				0.190***					-0.070*	
Mutual fund/stocks (yes = 1; no = 0)					0.855***					0.560
Constant	-2.855*	-2.382	-2.888*	-2.013	-2.482	4.339***	4.337***	4.345***	4.305***	4.383***
X ²	361.18***	375.08***	361.16***	447.13***	364.64***					
F						1.72*	1.60†	1.64*	1.80*	1.70*
R ²						0.039	0.039	0.040	0.046	0.044
N	4,548	4,548	4,548	4,548	4,548	575	575	575	575	575

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Notes: 1. All estimates are weighted

2. To follow Bickel et al. (2000) suggestion regarding associative analysis using the food security scale score, extreme households in the sample were omitted. That is, households affirmed all items on the food security scale (i.e., food security raw score of 18 for households with children and 10 for households without children) are omitted

Table 3 Two-stage analysis of household economic resources and food security (low-income sample)

Variable	Stage 1: logit models (probability of food security)				Stage 2: OLS models (severity of food insecurity)					
	Income only	Home-ownership	Vehicle ownership	Savings	Mutual fund/stock	Income only	Home-ownership	Vehicle ownership	Savings	Mutual fund/stock
Age	-0.005	-0.008	-0.006	-0.006	-0.008	-0.000	-0.004	-0.000	-0.000	0.000
Gender (male = 1; female = 0)	0.408*	0.396	0.394	0.469*	0.415*	-0.008	-0.013	0.004	-0.010	-0.046
Race (black = 1; white = 0)	-0.117	-0.093	-0.026	-0.072	-0.073	-0.079	-0.050	-0.116	-0.075	-0.112
Education (high school and above = 1; else = 0)	0.322*	0.319*	0.267	0.257	0.252	0.086	0.083	0.102	0.108	0.115
Household size	-0.129	-0.144	-0.146	-0.089	-0.115	-0.051	-0.075	-0.046	-0.081	-0.042
Number of children under 18 years	0.063	0.076	0.090	0.021	0.054	-0.257	-0.240	-0.264	-0.210	-0.271
Food stamp participation (yes = 1; no = 0)	-0.686***	-0.666***	-0.642**	-0.569**	-0.639**	0.455	0.487	0.428	0.403	0.437
Region										
Northeast	-0.321	-0.300	-0.261	-0.268	-0.337	0.199	0.261	0.151	0.0947	0.191
South	-0.460	-0.487*	-0.476*	-0.329	-0.420	0.316	0.273	0.320	0.227	0.310
West	-0.587*	-0.553*	-0.561*	-0.467	-0.550*	0.731	0.794	0.709	0.677	0.714
Midwest (reference group)										
Employment (employed = 1; unemployed = 0)	0.363	0.351	0.294	0.379*	0.282	-0.093	-0.090	-0.070	-0.128	-0.070
Family structure										
Single parent with children	-0.272	-0.287	-0.281	-0.211	-0.281	-0.233	-0.261	-0.214	-0.235	-0.226
Married couple with children	0.439	0.397	0.353	0.408	0.362	-0.372	-0.456	-0.322	-0.394	-0.352
Households w/o children (reference group)										
Household income (logged)	-0.040	-0.039	-0.058	-0.050	-0.036	0.014	0.023	0.021	0.026	0.007
Homeownership (yes = 1; no = 0)		0.246					0.352			
Vehicle ownership (yes = 1; no = 0)			0.467*					-0.189		
Savings (logged)				0.110***					-0.0791	
Mutual fund/stocks (yes = 1; no = 0)					1.244***					-0.914
Constant	1.296*	1.349*	1.260*	1.064	1.333*	4.364***	4.366***	4.404***	4.482***	4.444***
X ²	52.57***	54.55***	54.31***	67.10***	66.83***					
F						2.11*	2.13**	2.02*	2.04*	2.16**
R ²						0.076	0.081	0.077	0.081	0.080
N	829	829	829	829	829	334	334	334	334	334

* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$
 Note: The same as those for Table 2

Table 4 Interaction of income loss and household assets in the low-income sample

Variable	Stage 1: logit models (probability of food security)				Stage 2: OLS models (severity of food insecurity)			
	Home-ownership	Vehicle ownership	Savings	Mutual fund/stock	Home-ownership	Vehicle ownership	Savings	Mutual fund/stock
<i>Main effect</i>								
Income	-0.031	-0.055	-0.059	-0.039	-0.015	0.045	0.028	0.040
Income loss (thousand dollars)	0.01	0.002	-0.01	0.002	0.4	0.03	-0.01	0.02
Homeownership (yes = 1; no = 0)	0.239				0.303			
Vehicle ownership (yes = 1; no = 0)		0.472*				-0.193		
Savings (logged)			0.124***				-0.045	
Mutual fund/stocks (yes = 1; no = 0)				1.662**				-1.073
<i>Interaction effect</i>								
Income loss × homeownership	-0.01				-0.1**			
Income loss × vehicle ownership		0.006				-0.02		
Income loss × savings			0.01*				0.01	
Income loss × mutual fund/stocks				-0.09				0.01
X ²	56.19***	54.81***	71.24***	59.92***				
F					2.58***	1.83*	2.13**	1.98*
R ²					0.107	0.080	0.091	0.082
N	829	829	829	829	334	334	334	334

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Note: The same as those for Table 2

security across almost all models, as it is exactly these savings that people need in times of economic crisis to secure food acquisition. More importantly, for low-income households, savings and homeownership provide a buffer to mitigate the negative consequences of income losses on food security. However, as indicated by the OLS analysis of both the full sample and the low-income sample, it remains unclear what factors are related to the degree of severity of food insecurity. In other words, although some factors have been identified as predictors of household food security status (security versus insecurity), it is not clear what factors are associated with the severity of food insecurity as none of the commonly used socioeconomic factors is.

This study has several limitations that need to be discussed. First, it is likely that household food security status is also affected by some other variables, such as food expenditures, which however are not included in the current study. Consequently, the estimates in the multivariate analyses might be biased. Second, the cross-sectional design of this study does not allow the researcher to see how changes in assets are related to food security in low-income households. For instance, in the presence of negative income shocks, if household assets are used to smooth consumption, then assets, especially savings, will presumably decrease. Third, the effects of household assets are not limited to smoothing consumption (Sherraden 1991). Household assets may have other preventive effects on

food security. For instance, households having a goal of asset accumulation may change in their behaviors which prevent the occurrence of negative income shocks (e.g., unemployment) and additional consumption needs and therefore help secure food consumption. The preventive effects of food security need to be examined in the future research to obtain a comprehensive understanding of the association between household assets and food security.

Despite these limitations, this study is the first to examine the independent role of household assets in food security. By focusing on asset effects, this study provides a unique perspective on the association between family economic resources and household food security. Studies have shown that reentering the FSP after exiting is common and former food stamp recipients are more likely than others to enter the FSP (Bartlett and Burstein 2004; Gleason et al. 1998). This may be attributed to their income fluctuation over a relatively long period of time. From a research point of view, in studying the association between family economic resources and household food insecurity, household assets (a stock of financial resources) should be considered because they may better reflect household consumption dynamics than a cross-sectional measure of income.

Findings from this study have implications for food assistance programs in the US. First, given the protective effects of household assets on food security, asset-related provisions of FSP can be revised accordingly for improving

food security. Most AFDC/TANF programs have liberalized or even abandoned asset tests for eligibility for welfare recipients. With some flexibility, many states have aligned food stamp eligibility with that of TANF programs. However, the official asset limit of FSP has stayed unchanged for 20 years (Dean 2005). The results of this study support the notion that encouraging asset accumulation can help buffer the effects of negative income shocks. More liberalized asset tests may be considered for the FSP in addition to the already relaxed vehicle asset rules as the goal of the program is to help people stabilize their food security.

Second, the current food assistance programs may consider setting up IDAs⁴ for participants. Essentially, the assumption about asset limits in FSP and other welfare programs is that individuals or households should rely on their own assets for consumption prior to recourse to public assistance. Low-income families however would have no means to accumulate assets for self-sufficiency if current consumption is always the priority. In this regard, current FSP asset rules have set constraints on asset accumulation for low-income families to engage in long-term development, such as post-secondary education and small businesses. To avoid FSP eligibility impeding with asset accumulation, IDAs may be created to encourage asset accumulation among FSP participants, which if implemented, will be consistent with the growing emphasis on self-sufficiency in publicly funded income support programs. This requires a longer term outlook on policies that seek to help people ultimately move away from poverty and move toward greater reliance on self and families.

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⁴ See footnote 1 for a brief description of IDAs.

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