

The Impact of Food Stamp Program Participation on Household Food Insecurity.

Elton Mykerezi
Assistant Professor, Department of Applied Economics
University of Minnesota, Twin Cities
218f Classroom Office Building
1994 Buford Avenue
St. Paul MN 55108
Tel# 612-625-2749
Email: myker001@umn.edu

Bradford Mills
Professor, Department of Agricultural and Applied Economics
Virginia Tech, Blacksburg VA
314 Hutcheson Hall
Blacksburg, VA 24060
Tel# 540-231-6461
Email: bfmills@vt.edu

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Abstract

The impact of Food Stamp Program (FSP) participation on household food insecurity (FI) is investigated using data from the 1996–1999 Panel Study of Income Dynamics. We use random variation in state’s rate of erroneous overpayments and underpayments of FSP benefits as well as state level certification period lengths to identify the causal effect of FSP participation on FI in an instrumental variable framework. Parameter estimates indicate that participation in the FSP reduces household FI by 22 to 29 percent for the median food insecure household. The study also finds that income variance and smoking increase both, household FI and FSP participation.

Introduction

The overwhelming objective of the FSP is to decrease food insecurity (FI) among low income households. The United States Department of Agriculture spent nearly \$53 billion on 15 food assistance programs in 2006, with the Food Stamp Program (FSP) being the largest single component at a total cost of \$32.8 billion (USDA, 2007). Despite these efforts, many U.S. households continue to report food insecurity and hunger.¹ For instance, in 2005 12.6 million households, comprising 11 percent of all U.S. households reported being food insecure. Over one-third of food insecure households (4.4 million) had at least one reported member who experienced hunger (Nord, Andrews, and Carlson, 2006).

A better understanding of the causes of FI and its response to food assistance is crucial for the design of effective food assistance policies. In fact, in recent years considerable attention has been devoted to measuring the impact of FSP use on FI. Most studies find either no significant relationship between FSP use and FI or, in some cases, a paradoxical positive correlation. Identifying the effect of FSP participation on the severity of FI with non experimental data has proven particularly difficult as households with higher severity of food insecurity are often more likely to choose to participate in the FSP. Attempts to control for heterogeneity that influences both FSP use and FI in cross-section data condition on a variety of household attributes via linear regression and non parametric estimators (eg. Gibson-Davis and Foster, 2006), two-stage estimators that rely on instruments

¹ Food insecurity is commonly defined as difficulty in providing enough food to sustain a healthy diet for all household members due to a lack of resources. Most of the recent literature on U.S. food insecurity uses measures derived from survey questions in the USDA Food Security/Hunger Core Module regarding conditions and behaviors common among households having difficulty meeting basic food needs. The responses to these questions are used to compute a food insecurity score. Households are then classified in three categories, food secure, food insecure, and food insecure with hunger based on the score. For a detailed discussion see (Bickel et al. 2000).

(Gundersen and Oliveira, 2001; Kabbani and Yazbeck, 2004, Jensen, 2002), and structural simultaneous equations models (Huffman and Jensen, 2006).²

Others have used panel data to control for potential unobserved heterogeneity that affects both FSP participation and FI. Ribar and Hamrick (2003), for instance, use longitudinal data to examine the impact of food assistance on transitions to and from food insufficiency and find a paradoxical positive impact of FSP participation on food insufficiency.³ Wilde and Nord (2005) use longitudinal data to estimate the impact of FSP participation on food insecurity with a household-fixed effects model and find no significant negative impact of FSP use on FI. Borjas (2004), in a natural experiment, finds that FI increased when immigrant populations became ineligible for social assistance during the welfare reform era, and concludes that the availability of public assistance reduces food insecurity. The finding is, however, not specific to the FSP and is based on a unique subset of the general population. In the study closest to the current effort, Yen et al. (2008) employ an instrumental variable model and find a significant negative impact of participation in the FSP on FI using data from the 1996–1997 National Food Stamp Program Survey. The authors attribute the differential finding with respect to the FSP impact to the use of a dataset that has a high share of food insecure households and that does not rely on self reporting to identify FSP participants.

This paper estimates the causal effect of FSP participation on FI following a similar instrumental variable approach to Yen et al. (2008) by employing FSP policy variables as instruments to control for the endogeneity of FSP participation. In addition, we explicitly

²Yen et al. (2008), Wilde (2007) and Huffman and Jensen (2006) provide thorough reviews of the literature on the impact of food assistance on food insecurity and insufficiency.

³ Food insufficiency is an older measure of food insecurity.

control for important and often previously omitted factors like income variability⁴ and inelastic expenditures on addictive substances that can potentially affect the observed empirical relationship between FI and FSP participation. In contrast to Yen et al. (2008), we use nationally representative data from the Panel Study of Income Dynamics (PSID) and measure FI via an index that is derived from the twelve-month FI module as opposed to a thirty day scale.

Our model and results are developed in the rest of the paper as follows. Section 2 presents the empirical strategy. Section 3 presents the data, provides descriptive statistics on the study variables, and discusses specification issues. Section 4 presents the results of the multivariate analysis, and section 5 concludes.

Empirical Strategy

Most empirical studies of the impact of FSP participation on FI have concluded that the empirical relationship is heavily dominated by self selection of food insecure households into the program. We use an instrumental variable approach to account for this potential endogeneity of FSP participation. Following Yen et al. (2008) we model FSP participation and FI as follows:

$$(1) F^* = x_1' a_1 + x_2' a_2 + e_1$$

$$(2) y^* = \gamma_1 F + x_1' b_1 + e_2$$

Where F_i^* is a latent indicator of Food Stamp Program use, y_i^* is a latent continuous measure of food insecurity applicable to the general population, x_1 is a vector of observed covariates associated with FI and FSP use, while x_2 is a vector of policy variables that only directly affect FSP use. α_1 , α_2 , γ_1 and β_1 , are vectors of regression parameters, and ε_1 and ε_2

⁴ See Bania and Leete (2006) for a discussion on the role of income variability in FI.

are random errors that are assumed to approximate a joint normal distribution with correlation r and finite variances s_1^2 and s_2^2 .

The reduced form of the system is given by equation (1) and

$$(3) y^* = x_1'(b_1 + g_1 a_1) + x_2'(g_1 a_2) + e_2^*$$

with $e_2^* = e_2 + g_1 e_1$ and with e_1 and e_2^* assumed to be distributed normally with correlation h and variances $w_1^2 = s_1^2$ and $w_2^2 = g^2 s_1^2 + 2gr s_1 s_2 + s_2^2$ respectively.

A positive food security score is only observed if households answered at least one question in the food security module in the affirmative. The score is censored at zero for the larger share of households that do not answer any of the questions in the affirmative. Similarly, FSP participation is measured via a binary indicator. Thus observed dependent variables can be expressed in terms of their latent counterparts as:

$$(4) F_i = 0 \quad \text{if} \quad F_i^* \leq 0$$

$$F_i = 1 \quad \text{if} \quad F_i^* > 0$$

and

$$(5) Y_i = \text{Max}(0, Y_i^*)$$

The likelihood function to be estimated is then:

$$(6) L = \prod_{y=0} \Psi(k H' \Pi_1, -\frac{H' \Pi_2}{w_2}, -kh) \times \prod_{y>0} \frac{1}{w_2} f\left(\frac{y - H' \Pi_2}{w_2}\right) \times \Phi\left(k \frac{H' \Pi_1 + h(y - H' \Pi_2) / w_2}{(1-h^2)^{1/2}}\right)$$

Where Ψ , f and Φ are the bivariate standard normal distribution function, the univariate standard normal probability density function and the univariate standard normal cumulative distribution function, respectively. $H = [x_1' x_2']'$, $\Pi_1 = [a_1', a_2']'$ and $\Pi_2 = [(b_1 + g_1 a_1)' (g_1 a_2)']'$, $k=2F-1$, while w_1 is normalized at one.

We use a conditional maximum likelihood estimator developed by Roodman (2007) to estimate the model.⁵

Data Model Specification and Descriptive Statistics

The primary source of data is the 1996 to 1999 surveys of the Panel Study of Income Dynamics (PSID). The PSID is a panel of a nationally representative sample of US individuals and the households in which they reside. The survey started with a sample of 4,800 U.S. individuals in 1968 and has traced these individuals annually, regardless of place of residence or living situation. The PSID included the food security core module in 1999. This study uses the 5,228 households that are present in the panel in all three survey rounds 1996, 1997 and 1999 and have full information on food insecurity, household income, assets, FSP participation, employment situation, state of residence, composition and demographic characteristics of the households. The data is also supplemented with state level FSP participation from the U.S. Census Bureau's Small Area Income and Poverty Estimates for 1998 and with 1998 FSP Quality Control Data on state-level average recertification periods among FSP participants and on state-level rates of overpayment and underpayment of FSP benefits due to administrative errors for the year 1998. This information is attached to PSID data based on the state of residence in 1998 as the reference period for FSP use and FI are the 1998 calendar year.

Food Insecurity Measure

Food insecurity is measured by a one dimensional index called the food security interval score that is derived from the questions in the food security module, as described in Bickel et al. (2000). As mentioned, this score is positive and continuous for all households

⁵ For details on the estimator used and STATA program see Roodman, David 2007. "CMP: Stata module to implement conditional (recursive) mixed process estimator," Statistical Software Components S456882, Boston College Department of Economics, revised 16 Apr 2008.

that answered at least one of the FI questions in the affirmative and it is set to 0 otherwise.

An ordered categorical measure that identifies families as food secure, food insecure without hunger, and food insecure with hunger is based on the interval score, has been widely used in the literature. However, the underlying interval score is arguably superior as it contains both information on whether a household is food insecure and on the severity of FI (Yen et al., 2008). Descriptive statistics on both, the continuous and categorical measures are presented in Table 1 for the entire sample and for the sub sample with incomes less than or equal to 150% of the poverty line. The small share of households with a positive FI score confirms the need for a censored variable approach. It is also worth noting that the proportions of the population that are classified as food insecure and food insecure with hunger, as well as average food security scores, are higher for food stamp program participants than for non participants in both the overall and the low-income samples. This difference may stem from observed and unobserved heterogeneity that confound the empirical relationship between FI and FSP participation.

Food Stamp Program Participation

Participation in the FSP is measured via an indicator that is equal to 1 if the respondent answered the following question in the affirmative: “Did you (or anyone in your family) use government food stamps at any time in 1998?” Descriptive statistics on FSP use are presented in table 2 by FI status. Nationally, only 8 percent of households have at least one member who receives food stamps, however participation rates are much higher (26 percent and 39 percent respectively), for the households that are classified as food insecure and food insecure with hunger.

Identifying Food Insecurity and FSP use Covariates

Three groups of covariates are included in both the food insecurity and the FSP use equations: 1-household income, unemployment and capital assets, 2-educational assets, demographic characteristics and habits, and 3-local economic conditions. Descriptive statistics on model covariates are presented in table 2.

Household physical assets are measured by the household's total wealth. Measures of income are current 1998 income normalized by the household composition-specific poverty line, and similarly normalized average income over the panel period. Stability of income and employment are accounted for by the inclusion of the variance of household's income over the years 1996-1999 and the months of unemployment of the head during the 1998 calendar year.⁶ Unstable economic circumstances may generate food insecurity even for relatively high income households. Bania and Leete (2006) find that income volatility increases food insecurity and Nord and Brent (2002) find that a large share of FI among relatively high income households can be explained by changes in economic circumstances during the survey year.

Educational assets and demographic characteristics include education level of the household head and the spouse if married, as well as the gender, age, marital status, and indicators of race and ethnicity of the household head from the 1999 survey. Household size and number of children present in 1998 are also included in both equations. An indicator of if the household head smokes is also included. Smoking may increase food insecurity by creating inelastic demand for a non-food item.

⁶ The PSID collects information on unemployment and non-participation in the labor force through separate questions based on standard labor definitions. So the unemployment variable used in this study is likely closely related with involuntary unemployment due to loss of a job.

Local economic conditions include indicators of residence in a non metropolitan county, a rural county and the percentage of population that is classified as poor in the respondent's state of residence in 1998.⁷

System Identification

Parameter estimates in the food insecurity equation are identified based on the following exclusion restrictions. The average recertification period for all FSP participants in 1998, the state-level share of FSP participants that received an erroneous overpayment and the share of state's FSP participants that received an erroneous underpayment of FSP benefits are included in the FSP use equation but excluded from the food insecurity equation. The state-level average certification period is hypothesized to affect transactions costs associated with FSP participation but to only influence household FI through impacts on FSP participation (Yen et al., 2008). The rates of benefit overpayment and underpayment result from random administrative errors and are unlikely to have a direct impact on household FI, but may affect the household's expected benefits and costs from FSP participation.

Sample Selection and Robustness

Of the 6,964⁸ households that are present in the 1999 survey only 5,228 are interviewed in all three rounds and are included in the final sample. To ensure that this sample attrition does not bias the findings the model is also estimated with the full 1999 sample without measures of the mean and variance of household income between 1996 and 1999. One additional concern is that the results may not be representative of the FSP-eligible

⁷ Non-metropolitan and rural residence indicators are generated from USDA-ERS Beale Codes. Counties with codes 4, 5 and 6 are classified as non metro, and those with codes 7, 8 and 9 are classified as rural.

⁸ The 1999 FI supplement contains 6967 records but 3 households provided invalid answers to the FI questions and were thus dropped.

population. Thus, the models are also estimated with the subset of households with current income that is no greater than 150 percent of the poverty line.

Results

Parameter estimates and associated standard errors for all four specifications (all income levels with mean and variance of income, income below 150% of the poverty line with mean and variance of income, all levels of income with 1998 income only, and income below 150% of the poverty line with 1998 income level) are presented in table 3.

The main parameter of interest, FSP participation, shows a significant negative effect on FI under all four specifications. Further, parameter estimates of FSP impacts on FI are similar across specifications, indicating that the result is robust to choice of sample.⁹ Equation errors are positively correlated ($p=0.05$) reaffirming the well documented existence of positive self selection from unobserved heterogeneity in FI and FSP participation.

The marginal effects of food stamp program participation are computed at the means of the respective samples and reported in Table 4 along with the average predicted level of FI conditional on a positive response for each sample. Parameter estimates associated with the panel sample restricted to households with incomes no greater than 150 percent of the poverty line indicate FSP participation is associated with a 27 percent reduction in the severity of food insecurity for the average household. Estimates range between a 22 percent reduction for the full panel sample to a 29 percent reduction for both the full and below 150 percent of the poverty line samples excluding mean and variance of income measures.

Several other factors have significant impacts on food insecurity. The discussion of the impact of the exogenous variables focuses on the marginal effects estimated at the

⁹ We also estimated the model with the full and the low income panel samples but excluded the mean and variance of income in order to obtain estimates of the FSP impact that are directly comparable to those estimated with the full 1999 sample. The FSP impact estimate is virtually identical.

respective sample means using reduced form equations (table 5).¹⁰ Focusing on marginal effects computed from the reduced form equation provides the overall (direct and indirect) impact of each exogenous variable on FI. As expected, accumulated wealth, current income and average income reduce household food insecurity as does education and age of the household head. Income variance increases FI ($p=0.10$) for the overall panel sample, but not the low income sample. Focusing on parameter estimates for other variables in the full panel sample, FI increases with the overall family size but the effect is negated if additional family members are children. Households headed by Blacks also show higher FI and, as expected, unemployment of the household head in 1998 increases FI. In addition, households are more food insecure if the household head smokes cigarettes. Smoking habits may be indicative of poor resource management abilities of households or it could increase food insecurity through inelastic demand for a non food product. Interestingly, FI is lower in rural areas in both full-income samples.

Turning to the FSP participation equation, the marginal effects of wealth and average income are significant and negative, while current income weakly lowers FSP participation for the sample that is restricted to those with incomes less than 150% of the poverty line only ($p=0.10$). The variance of income is, again, associated with higher FSP participation for the overall sample but not the low income sample, perhaps because some relatively high income households who are not usually eligible for food stamps may become eligible temporarily due to negative income shocks. FSP participation also increases with months of unemployment ($p=0.10$), is higher for households headed by a Black ($p=0.10$) and decreases with education of the household head.

¹⁰ Reduced form estimates are not presented but are available from the authors.

Smoking habits also increase FSP participation significantly for the full panel sample ($p=0.05$). Finally, the state-level rate of FSP benefit overpayment increases participation in the full sample ($p=0.10$). The FSP over and underpayment variables show a stronger association in the 1999 sample, with overpayment showing a positive association in both the full and the low income samples, while underpayment is negative and significant only in the full income sample.

Conclusions

The primary goal of the food stamp program is to increase household access to food and to combat household food insecurity and hunger. This paper presents evidence that FSP participation significantly reduces FI in a nationally representative sample of US households. In general, our findings corroborate the results of Yen et al. (2008) but with an FI measure generated over a twelve-month period as opposed to a 30 day period and with a fuller set of controls for household heterogeneity. Given the longer-term measure of FI the results suggest that FSP participation has a significant ameliorative long term effect on household well-being.

The study also presents some evidence that changes in economic circumstances over time and that consumption patterns can have important effects on both food insecurity and FSP participation. Rural areas appear to have lower levels of FI after controlling for other factors, so food insecurity does not increase with remoteness. We also find some evidence that FSP overpayments and underpayments significantly affect FSP participation, suggesting that participation is responsive to program management.

References:

Bania, Neil and Laura Leete, 2006. "Food Insufficiency and Income Volatility in the United States, 1991-2003", *Paper prepared for presentation at the 2006 Food Assistance and Nutrition Research Small Grants Conference* October 12-13, 2006, Economic Research Service, USDA, Washington DC.

Barsky, Robert B.; Kimball, Miles S.; Juster, F. Thomas; Shapiro, Matthew D., 1997 "Preference Parameters and Behavioral Heterogeneity: An Experimental Approach in the HRS." *Quarterly Journal of Economics.*, 112, S537 - S579.

Borjas, George. J. 2004. "Food Insecurity and Public Assistance." *Journal of Public Economics* 88(7-8):1421-43.

Bickel, G., M. Nord, C. Price, W. Hamilton, and J. Cook., 2000, *Guide to Measuring Household Food Security*, revised. Alexandria, VA: U.S. Department of Agriculture, Food and Nutrition Service, Technical Report.

Gibson-Davis, C., and M. Foster. 2006. "A Cautionary Tale: Using Propensity Scores to Estimate the Effect of Food Stamps on Food Insecurity." *Social Service Review* 80(1):93-126.

Gundersen, C. and V. Oliviera, 2001 "The Food Stamp Program and Food Insufficiency" *American Journal of Agricultural Economics* 83: 875-87.

Huffman S, Jensen Helen H. 2006. "Do food assistance programs improve household food security? Recent evidence from the United States." Ames IA: *Iowa State University, Center for Agricultural and Rural Development*; Report No.: 03-WP 335.

Jensen Helen H. "Food insecurity and the Food Stamp Program." *American Journal of Agricultural Economics*. 2002;84:1215-28.

Kabbani Nader S. and Myra Yazbeck Kmeid (2005) "The Role of Food Assistance in Helping Food Insecure Households Escape Hunger" *Review of Agricultural Economics* Volume 27, Number 3—Pages 439-445

Moffit, R.A. 1983. "An Economic Model of Welfare Stigma." *American Economic Review*, 73(5): 1023-1035.

Nord, Mark and C. Philip Brent, 2002. "Food Insecurity in Higher Income Households" U.S. Department of Agriculture, Economic Research Service, report E-FAN-02-016

Nord Mark, Margaret Andrews, and Steven Carlson, 2006. "Household Food Security in the United States, 2005" *Measuring Food Security*, United States Department of Agriculture, Economic Research Service. ERS report number 29.

Wilde, Parke. E. (2007) "Measuring the Effect of Food Stamps on Food Insecurity and Hunger: Research and Policy Considerations" *The Journal of Nutrition*, 137: 307–310

Wilde Parke, and Mark Nord (2005) "The Effect of Food Stamps on Food Security: A Panel Data Approach" *Review of Agricultural Economics—Volume 27, Number 3* Pages 425–432

Ribar, D. and K. Hamrick. *Dynamics of Poverty and Food Sufficiency*. Washington DC: U.S. Department of Agriculture, ERS FANRR 36, September 2003.

U.S. Department of Agriculture, Economic Research Service. "The Food Assistance Landscape FY 2006 Annual Report" Economic Information Bulletin 6-4 February 2007

Yen, Steven T. Margaret Andrews, Zhuo Chen, and David B. Eastwood, 2008. "Food Stamp Program Participation and Food Insecurity: An Instrumental Variables Approach" *American Journal of Agricultural Economics*. Vol. 90 Issue 1 pages 117–132

Table 1. Food Insecurity in PSID sample

<i>All</i>	Panel Sample		Poor Sample (inc<150% of poverty line)	
	Mean	S.E	Mean	S.E
Food Secure	0.919	0.274	0.778	0.416
Food Insecure w/o Hunger	0.059	0.235	0.144	0.351
Food Insecure w. Hunger	0.023	0.149	0.078	0.268
Food Security Scale	0.614	1.697	1.690	2.594
N	5,228		1,037	
<i>FSP Participants</i>				
Food Secure	0.692	0.462	0.687	0.464
Food Insecure w/o Hunger	0.196	0.398	0.191	0.394
Food Insecure w. Hunger	0.111	0.315	0.122	0.327
Food Security Scale	2.332	2.843	2.441	2.873
N	413		345	
<i>FSP non Participants</i>				
Food Secure	0.938	0.241	0.824	0.381
Food Insecure w/o Hunger	0.047	0.212	0.120	0.325
Food Insecure w. Hunger	0.015	0.122	0.056	0.231
Food Security Scale	0.466	1.469	1.316	2.358
N	4,815		692	

Table 2. Descriptive Statistics

	All Panel		Secure		Insecure		Hunger	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
Food Stamp Program Participation	0.08	0.27	0.06	0.24	0.26	0.44	0.39	0.49
Wealth (0,000)	15.11	81.05	16.40	84.44	0.83	4.61	-0.01	3.85
Normalized Income 99	4.45	5.75	4.69	5.92	1.85	1.44	1.46	1.31
Mean Normalized Income (96-99)	4.13	4.14	4.35	4.23	1.73	1.25	1.41	1.09
Variance Normalized Income (96-99)	6.40	124.14	6.93	129.52	0.45	1.51	0.53	1.78
Months Unemployed (Head)	1.04	5.04	0.86	4.46	2.71	8.61	4.16	10.35
Head Black	0.31	0.46	0.29	0.45	0.58	0.49	0.56	0.50
Head Other Non-White	0.03	0.17	0.03	0.17	0.05	0.21	0.03	0.16
Head Hispanic	0.01	0.07	0.00	0.07	0.02	0.13	0.00	0.00
Education Head	12.43	3.47	12.58	3.43	10.86	3.47	10.60	3.56
Education Spouse	7.45	6.78	7.77	6.78	4.27	5.87	2.76	5.00
Age Head	47.57	15.59	47.96	15.67	42.66	13.77	44.89	14.22
Head Single	0.39	0.49	0.37	0.48	0.58	0.49	0.71	0.45
Head Female	0.27	0.45	0.26	0.44	0.47	0.50	0.51	0.50
Family Size	2.77	1.49	2.76	1.45	3.09	1.77	2.71	1.91
Number of Kids	0.91	1.19	0.88	1.17	1.30	1.36	1.08	1.44
Head Smokes	0.10	0.30	0.10	0.29	0.10	0.30	0.14	0.35
Non Metropolitan County	0.21	0.41	0.22	0.41	0.18	0.38	0.23	0.42
Rural Area	0.14	0.34	0.14	0.35	0.14	0.35	0.11	0.31
Percent Poor (state 98')	12.57	2.67	12.52	2.65	13.15	2.70	13.19	3.01
Percent Cases Overpaid (state 98')	0.13	0.03	0.13	0.03	0.13	0.04	0.13	0.03
Percent Cases Underpaid (state 98')	0.09	0.03	0.09	0.03	0.09	0.03	0.09	0.03
Average Cert. Period (state 98')	9.95	2.56	9.95	2.56	9.89	2.61	10.18	2.40
N	5,228		4,802		307		119	

Table 3. Multivariate Results

<i>Food Insecurity Equation</i>	Panel Sample				1999 Sample			
	All		inc<=150% of pov.		All		inc<=150% of pov.	
	Param	S.E.	Param	S.E.	Param	S.E.	Param	S.E.
Wealth (0,000)	-0.091	0.023**	-0.559	0.122**	-0.117	0.020**	-0.343	0.067**
Normalized Income 99	-0.611	0.180**	0.265	0.659	-1.879	0.147**	-1.077	0.380**
Mean Normalized Income (96-99)	-1.569	0.313**	-2.102	0.573**				
Variance Normalized Income (96-99)	0.019	0.008**	0.059	0.089				
Months Unemployed (Head)	0.100	0.025**	0.038	0.023	0.105	0.018**	0.038	0.019**
Head Black	1.348	0.427**	0.795	0.554	1.869	0.332**	1.028	0.438**
Head Other Non-White	0.462	0.838	2.627	1.228**	1.061	0.469**	1.124	0.582*
Head Hispanic	1.191	1.751	-1.584	2.411	1.263	0.801	0.167	0.941
Education Head	-0.185	0.050**	-0.144	0.067**	-0.251	0.036**	-0.188	0.046**
Education Spouse	-0.072	0.049	-0.133	0.091	-0.134	0.038**	-0.109	0.057*
Age Head	-0.068	0.011**	-0.057	0.014**	-0.068	0.009**	-0.038	0.010**
Head Single	1.021	0.688	-0.730	1.057	0.444	0.525	-0.422	0.670
Head Female	0.526	0.483	0.193	0.662	1.265	0.395**	0.737	0.540
Family Size	0.885	0.234**	0.590	0.305*	0.703	0.201**	0.248	0.244
Number of Kids	-0.724	0.282**	-0.456	0.403	-0.075	0.233	0.253	0.320
Head Smokes	1.577	0.522**	1.777	0.937*	1.665	0.458**	1.406	0.713**
Non Metropolitan County	-0.364	0.369	0.108	0.559	-0.143	0.323	0.485	0.422
Rural Area	-0.746	0.423*	-0.584	0.560	-0.520	0.390	-0.649	0.467
Percent Poor (state 98')	0.087	0.054	0.120	0.076	0.081	0.048*	0.155	0.062**
Food Stamp Program Participation	-4.936	2.059**	-3.626	1.929**	-7.247	0.859**	-3.873	1.538**
Intercept	2.320	1.303*	4.020	2.020**	2.423	0.989**	1.380	1.264
S_1	6.312	0.548**	5.517	0.511**	6.924	0.354**	5.523	0.432**

Notes: ** and * denote significance at the $p=0.05$ and $p=0.1$ respectively.

<i>Food Stamp Equation</i>	Panel Sample				1999 Sample			
	All		inc<=150% of pov.		All		inc<=150% of pov.	
	Param	S.E.	Param	S.E.	Param	S.E.	Param	S.E.
Wealth (0,000)	-0.009	0.006	-0.108	0.025**	-0.013	0.005**	-0.057	0.013**
Normalized Income 99	-0.097	0.047**	-0.267	0.149*	-0.347	0.023**	-0.319	0.068**
Mean Normalized Income (96-99)	-0.437	0.076**	-0.351	0.128**				
Variance Normalized Income (96-99)	0.006	0.002**	-0.034	0.044				
Months Unemployed (Head)	0.018	0.004**	0.007	0.005	0.018	0.003**	0.012	0.004**
Head Black	0.397	0.082**	0.294	0.114**	0.433	0.061**	0.304	0.088**
Head Other Non-White	0.142	0.204	0.354	0.274	0.088	0.098	-0.053	0.136
Head Hispanic	0.459	0.377	0.310	0.501	0.354	0.153**	0.339	0.205*
Education Head	-0.035	0.010**	-0.036	0.014**	-0.036	0.007**	-0.029	0.010**
Education Spouse	-0.022	0.013*	-0.018	0.021	-0.013	0.008	-0.001	0.013
Age Head	-0.005	0.002**	-0.005	0.003	-0.007	0.002**	-0.003	0.002
Head Single	0.075	0.162	-0.162	0.243	0.103	0.106	0.077	0.154
Head Female	0.293	0.102**	0.411	0.136**	0.397	0.076**	0.471	0.106**
Family Size	0.048	0.050	-0.044	0.068	0.063	0.039	-0.049	0.055
Number of Kids	0.130	0.061**	0.245	0.082**	0.116	0.045**	0.261	0.064**
Head Smokes	0.338	0.127**	0.464	0.197**	0.278	0.096**	0.361	0.153**
Non Metropolitan County	0.091	0.089	0.106	0.126	0.032	0.068	0.011	0.097
Rural Area	0.092	0.096	0.054	0.126	0.126	0.076*	0.028	0.104
Percent Poor (state 98')	0.003	0.013	0.015	0.018	0.011	0.010	0.024	0.014*
Percent Cases Overpaid (state 98')	3.191	1.874*	1.417	2.326	2.807	1.193**	2.198	1.845
Percent Cases Underpaid (state 98')	-3.631	1.894*	0.866	2.467	-3.966	1.246**	-2.254	1.863
Average Cert. Period (state 98')	-0.002	0.014	-0.004	0.018	-0.005	0.009	-0.005	0.014
Intercept	-0.460	0.332	-0.211	0.479	-0.773	0.231**	-0.908	0.342**
<i>R</i>	0.717	0.147**	0.616	0.165**	0.862	0.041**	0.641	0.128**
L	-4,397.97		-2,119.32		-6,913.72		-3,446.20	
N	5,228		1,037		6,964		1,609	

Notes: ** and * denote significance at the $p=0.05$ and $p=0.1$ respectively.

S_2 is normalized to 1.

Table 4. Marginal Effects of Food Stamp Program Participation

	Panel Sample		1999 Sample	
	All	inc<=150% of pov.	All	inc<=150% of pov.
Marginal Effect	-0.57	-0.99	-0.90	-1.16
Percent Change	-0.22	-0.27	-0.29	-0.29
E(FI 0<FI, X)	2.60	3.74	3.09	4.03

Table 5. Marginal Effects of Exogenous Variables

<i>Food Insecurity Equation</i>	Panel Sample				1999 Sample			
	All		inc<=150% of pov.		All		inc<=150% of pov.	
	Param	S.E.	Param	S.E.	Param	S.E.	Param	S.E.
Wealth (0,000)	-0.0115	0.0026 **	-0.1290	0.0237 **	-0.0145	0.0023 **	-0.0871	0.0157 **
Normalized Income 99	-0.0704	0.0204 **	0.1809	0.1703	-0.1908	0.0108 **	-0.2023	0.0939 **
Mean Normalized Income (96-99)	-0.1592	0.0258 **	-0.4905	0.1322 **				
Variance Normalized Income (96-99)	0.0018	0.0010 *	0.0265	0.0232				
Months Unemployed (Head)	0.0093	0.0026 **	0.0076	0.0060	0.0084	0.0022 **	0.0056	0.0049
Head Black	0.1158	0.0438 **	0.1197	0.1332	0.1569	0.0403 **	0.1989	0.1143 *
Head Other Non-White	0.0318	0.1061	0.7412	0.4088 **	0.1352	0.0650 **	0.3521	0.1869 *
Head Hispanic	0.0952	0.2316	-0.4682	0.5220	0.0971	0.1072	-0.0697	0.2589
Education Head	-0.0187	0.0055 **	-0.0276	0.0165 *	-0.0274	0.0044 **	-0.0453	0.0124 **
Education Spouse	-0.0073	0.0060	-0.0320	0.0237	-0.0160	0.0048 **	-0.0322	0.0163 **
Age Head	-0.0086	0.0013 **	-0.0147	0.0037 **	-0.0087	0.0011 **	-0.0108	0.0029 **
Head Single	0.1091	0.0860	-0.1587	0.2870	0.0214	0.0666	-0.1573	0.1963
Head Female	0.0094	0.0545	-0.0982	0.1589	0.0581	0.0482	0.0419	0.1326
Family Size	0.1127	0.0286 **	0.1907	0.0807 **	0.0894	0.0255 **	0.0947	0.0702
Number of Kids	-0.1323	0.0339 **	-0.2333	0.0971 **	-0.0695	0.0294 **	-0.0391	0.0814
Head Smokes	0.1866	0.0676 **	0.3616	0.2616	0.1845	0.0626 **	0.3151	0.2159
Non Metropolitan County	-0.0593	0.0452	-0.0015	0.1493	-0.0231	0.0411	0.1849	0.1289
Rural Area	-0.1092	0.0504 **	-0.1743	0.1447	-0.1021	0.0482 **	-0.1659	0.1321
Percent Poor (state 98')	0.0149	0.0071 **	0.0456	0.0216 **	0.0111	0.0064 *	0.0541	0.0187 **
Percent Cases Overpaid (state 98')	0.7725	0.9492	4.8957	2.9616	0.1181	0.8715	3.7521	2.5818
Percent Cases Underpaid (state 98')	0.2839	1.0404	-2.8408	3.2357	1.5174	0.9320 *	0.1417	2.6919
Average Certification Period (state 98')	-0.0068	0.0077	-0.0306	0.0232	0.0000	0.0070	-0.0099	0.0203

Note: ** and * denote significance at the $p=0.05$ and $p=0.1$ respectively.

Food Stamp Equation

	Panel Sample				1999 Sample			
	All		inc<=150% of pov.		All		inc<=150% of pov.	
	Param	S.E.	Param	S.E.	Param	S.E.	Param	S.E.
Wealth (0,000)	-0.0001	0.0000**	-0.0334	0.0072**	-0.0002	0.0001**	-0.0181	0.0041**
Normalized Income 99	-0.0002	0.0002	-0.0834	0.0459*	-0.0046	0.0010**	-0.1068	0.0226**
Mean Normalized Income (96-99)	-0.0012	0.0005**	-0.1050	0.0392**				
Variance Normalized Income (96-99)(x100)	0.0017	0.0010**	-1.0093	1.1740				
Months Unemployed (Head)	0.0000	0.0000*	0.0023	0.0016	0.0002	0.0001**	0.0041	0.0013**
Head Black	0.0012	0.0007*	0.0860	0.0332**	0.0062	0.0019**	0.0996	0.0288**
Head Other Non-White	0.0008	0.0010	0.1161	0.1023	0.0002	0.0013	-0.0309	0.0440
Head Hispanic	0.0015	0.0029	0.1045	0.1878	0.0065	0.0047	0.1261	0.0798
Education Head	-0.0001	0.0000*	-0.0107	0.0044**	-0.0003	0.0001**	-0.0087	0.0032**
Education Spouse	-0.0001	0.0000	-0.0052	0.0064	-0.0002	0.0001*	-0.0001	0.0044
Age Head	0.0000	0.0000	-0.0014	0.0009	-0.0001	0.0000**	-0.0009	0.0007
Head Single	0.0000	0.0004	-0.0479	0.0775	0.0009	0.0014	0.0297	0.0503
Head Female	0.0008	0.0005	0.1207	0.0396**	0.0058	0.0020**	0.1525	0.0337**
Family Size	0.0001	0.0001	-0.0116	0.0211	0.0006	0.0005	-0.0151	0.0185
Number of Kids	0.0003	0.0002	0.0739	0.0259**	0.0017	0.0007**	0.0861	0.0216**
Head Smokes	0.0015	0.0010	0.1550	0.0742**	0.0056	0.0026	0.1329	0.0582**
Non Metropolitan County	0.0003	0.0003	0.0321	0.0407	0.0008	0.0009	0.0059	0.0326
Rural Area	0.0002	0.0003	0.0163	0.0399	0.0018	0.0013	0.0102	0.0354
Percent Poor (state 98')	0.0000	0.0000	0.0060	0.0056	0.0002	0.0001	0.0087	0.0048*
Percent Cases Overpaid (state 98')	0.0123	0.0072*	0.9934	0.7655	0.0556	0.0214**	1.2990	0.6633**
Percent Cases Underpaid (state 98')	-0.0108	0.0070	0.0615	0.8406	-0.0491	0.0217**	-0.8134	0.6965
Average Cert. Period (state 98')	0.0000	0.0000	-0.0051	0.0061	-0.0001	0.0001	-0.0036	0.0052

Note: ** and * denote significance at the $p=0.05$ and $p=0.1$ respectively.