Analysis of Food Stamp Program Participation and Food Expenditures

David M. Smallwood and James R. Blaylock

A two equation model is developed to examine jointly the determinants of household food stamp program participation and program effects on food expenditures. The model is unique in that it postulates that the participation decision is based on a cost-benefit ratio, selected socioeconomic characteristics, and the potential for increasing both food and nonfood expenditures. Data from the 1977–78 USDA Nationwide Food Consumption Survey Supplemental Low Income Sample is used to estimate the model. Findings suggest that households, in making the participation decision, place equal value on the potential for increasing their food and nonfood expenditures. However, at the margin, bonus stamp income is found to have more than twice the impact of money income on food expenditures. The model's potential for policy analysis is also examined.

A fundamental objective of the Food Stamp Program (FSP) is to increase the diet quality of low income households via increasing their food expenditures to that of a reference standard. To achieve this goal, eligible households choosing to participate in the program are provided with an income subsidy in the form of food stamps which can only be spent on food for home consumption.[1] The effectiveness of the program in achieving this goal can, in part, be evaluated by analyzing participation rates of the target population and the subsequent effect of this in-kind transfer on food expenditures.

Many microeconomic analyses of the FSP have modeled the household's decision to participate in the program separately from the program's effect on food expenditures (Neenan and Davis; Epperson *et al.*; Huang *et al.*; Lane *et al.*). In general, a single equation logit or probit model has been used to examine the participation decision as a function of household characteristics and income. Food expenditures are usually modeled separately from the participation decision and specified as a function of household characteristics, money income, bonus stamp income, and an FSP participation variable.

The purpose of this paper is to develop and estimate an economic model of behavior which considers simultaneously the likelihood of participation by eligible households and the effect of program participation on food expenditures. The proposed model postulates that a household's decision to participate in the Food Stamp Program is influenced by the potential for enhancing both its food and nonfood expenditures. Although food stamps may only legally be used to purchase food, households are afforded an opportunity to reallocate some money to nonfood use that

David M. Smallwood and James R. Blaylock are agricultural economists with the United States Department of Agriculture, Economic Research Service, National Economics Division. The views expressed in this paper are not necessarily those of ERS or USDA.

[1] Food stamps with several minor exceptions may only legally be used to purchase foods at authorized "retail food establishments" which are intended for use and/or preparation at home. Food stamps may not be used to purchase foods traditionally referred to as away-from-home food, such as at fast-food establishments and restaurants. Henceforth, unless otherwise specified, the word food will be used to denote food which may be purchased with stamps.

Western Journal of Agricultural Economics, 10(1): 41–54

was previously allocated to food. The model disaggregates net program benefits (bonus food stamps) into these two components and allows each to have potentially different effects on participation rates, and hence, household food expenditures. The model also incorporates a cost/benefit ratio which measures the relative cost of program entry to the total monetary benefits accruing to household participation. Hopefully, disaggregation of net program benefits together with the cost/benefit ratio will allow for improved estimates of a household's behavioral responses to FSP policy instruments. Also, because the model contains explicit FSP policy instruments, it may be used to simulate the effects of proposed program changes on food expenditures and program participation.

The following section contains the development of an economic model of participant behavior in the FSP. An outline of the proposed statistical model is presented in the third section. Data and variable specification are discussed in the fourth part. The fifth section contains empirical results and a discussion of their relevance to policy analysis. A section containing conclusions and future research directions concludes the paper.

Theoretical Framework

Prior to elimination of the purchase requirement in 1979, the value of the stamps received, termed the allotment, was based on household size.[2] The amount an eligible household was required to pay for the stamps, termed the purchase requirement, was based on both household size and income. The difference between the allotment and the purchase requirement, termed the bonus, is the net subsidy or transfer of in-kind income to the household.

A conventional economic model of household behavior as developed by Southworth and advanced by Mittelhammer and West; Clarkson; Huang *et al.*, and others provides the conceptual framework for this study.[3] Since this model is well known, only the highlights will be presented here. Briefly, participant behavior is modeled within the classical household utility maximizing framework of demand theory and incorporates a modified income constraint to allow for the in-kind provisions of the FSP. Within this framework, the household is assumed to maximize utility subject to a budget constraint which is determined, in part, by FSP participation and program rules.

The above model implies that the effect of bonus stamps on food expenditures is identical to that of money income for those households that spend more than their allotment of stamps on food at home. Only in the case where the allotment exceeds desired food expenditures is the effect of the FSP on food expenditures hypothesized to be larger than that of a cash transfer. Empirically, the number of households in this latter group appears to be limited. Food expenditure data for participating and eligible nonparticipating households contained in the supplemental

[2] The assumption of a purchase requirement is kept throughout this discussion because of its importance as a policy instrument. The program as it exists today can be expressed in this framework by setting the purchase requirement equal to zero. It should be noted that when the purchase requirement was eliminated the allotment was decreased by approximately the same amount (Stucker and Boehm).

[3] Household income has traditionally been considered exogenous in FSP models. While the authors believe that the labor supply effects of the Food Stamp Program are important, especially when considered jointly with other means-tested welfare programs, such as Aid to Families with Dependent Children, they are beyond the scope of this study. For an excellent review of the literature on the labor supply effects of means-tested transfer programs, see Danziger *et al.*

low-income sample to the 1977–78 USDA Nationwide Food Consumption Survey reveals that the average weekly food expenditures exceeded the average weekly allotment by more than $7 per household and that less than 5% of the households participate in the program on a partial basis (i.e., purchase less than the full allotment). Thus, few households appear to be constrained by the allotment.

The hypothesis that bonus food stamps affect food expenditures the same as money income is generated from a model that simplifies from the complexities of actual budgeting decisions in low income households. West and Price found the household budgeting process to be quite complex with the marginal propensities to spend (MPS) on food differing by source of income. In addition, virtually all empirical studies of the FSP have found the MPS for food out of bonus income to be two to three times the size of the MPS for food out of cash income (West and Price; Benus *et al.*; Neenan and Davis; Huang *et al.*; Chen and Johnson; Johnson *et al.*).

Several possible explanations for more complex spending behavior than is implied by the conventional model come readily to mind. First, a household's reported income (i.e., last month's) may not accurately portray the household's financial status relevant to this month's food purchases. Transitory income fluctuations embodied in reported income may cause a systematic bias to occur in the estimated money income and bonus income response parameters (Friedman). Second, food stamp coupons may facilitate financial management and budgeting in low income households. For example, food stamp households cannot be pressured by bill collectors to pay their financial obligations with stamps. Third, low-income households may be hedonistic in their financial planning like that which is commonly observed with enlisted military personnel. That is, they spend their money and stamps today and heavily discount the value of future consumption. Consequently, if all stamps are used early in the month, the household may use periodic cash receipts to supplement food purchases at the end of the month. Due to these and other possibilities, it is important that a true statistical evaluation of the theoretical model allow for potential differences between the effects of bonus income and money income on food expenditures. It is then possible to statistically test the validity of the theoretical model.

A household's decision to enter the FSP is based on expected costs and benefits. The major benefit derived from FSP participation is the in-kind income transfer associated with the bonus food stamps (i.e., the value of the food stamp allotment less the purchase requirement). This increase in income, while in the form of food stamps, may free-up income previously allocated to food and thus enable participating households to increase both food and nonfood expenditures. To the extent that stamps are less fungible than cash, *households may place differing values on bonus stamps in terms of the participation decision.* That is, eligible households may place different values on the potential for increasing food expenditures versus the potential for increasing nonfood expenditures depending upon their ability to allocate the in-kind income as they would cash.

Another economic factor associated with program participation is measured by a cost/benefit ratio. This is defined as the *ratio of the purchase requirement to the allotment.* The purchase requirement measures the direct financial outlays required for program participation and the allotment represents the gross benefits of participation. While it would also be desirable to include indirect costs incurred in program participation, such as time, gasoline, child care, and the psychic costs of program stigma, these are not included

due to data limitations.[4] While not modeled formally, other studies have pointed to the purchase requirement as a substantial deterrent to program participation for many households (Rungeling and Smith; Epperson *et al.*; Searce *et al.*; Love).[5] Many economic models of the FSP emphasize the net benefits of participation (i.e., the bonus) and choose to ignore financial problems that households may have in collecting the required cash needed to purchase a month's worth of stamps. The allocation of scarce cash resources to purchase food stamps may reduce substantially the liquidity of an already "poor" household. Thus, by participating in the program a household could place itself at considerable risk to unanticipated financial obligations, even if only on a temporary basis. The cost/benefit ratio represents a balance between the relative costs and benefits of program participation. Another similar interpretation is that it represents the price of participation in the sense that it measures the direct cost per dollar of the food stamp allotment.

Disaggregation of bonus income into food and nonfood expenditure components allows one to examine separately their effects on FSP participation. Under a pure income transfer program, one would expect a household to allocate additional income between food and nonfood so as to obtain equal benefit from the marginal food and nonfood dollar. Otherwise, the household could always reallocate expenditures towards the more highly valued item. Conversely, an "effective" food oriented program from society's viewpoint may be thought of as one in which a household's consumption opportunities and/or purchase incentives are enhanced primarily in the direction of more food (Thurow). Under a food oriented program, a household's consumption opportunities are more limited than that of a pure income transfer and possibly less preferred from the household's viewpoint. Thus, with a food oriented program the implicit value of the marginal food dollar may be less than that of the marginal nonfood dollar and the subsequent influence of the stamps on a household's decision to participate in the FSP may be less than that of a pure income transfer.

In the following section a simultaneous equations model of FSP participation and food expenditures is developed which incorporates the above enhancement and cost-benefit hypotheses.

Statistical Model

Based on the preceeding theoretical discussion, a two equation statistical model of a household's behavioral response to the Food Stamp Program is proposed. One equation is used to model a household's decision to participate in the FSP and the other is used to model a household's food expenditure response. The model and its development follows closely the pioneering work of Schmidt in his analysis of the impact of unions on wage rates.

The expected dollar value of bonus food stamps represents the most obvious economic benefit to participating households. However, as discussed above, the value households place on the bonus stamps will depend on restrictions that the stamps place on their ability to allocate resources. Consequently, one must estimate the influence of the program on spending behavior. The food expenditure enhancement (FEE) is estimated as the difference between food expenditures conditioned on

[4] To the extent that stigma and other important "cost" variables are correlated with variables included in the model, their effects will be confounded with other effects attributed to these variables. Consequently, our reported parameter estimates may include an effect for stigma.

[5] Approximately 17 percent of the eligible nonparticipating households in the sample used in this study, said they weren't participating because "it cost too much."

being in the program versus being out of the program. The nonfood expenditure enhancement (NEE) is then *calculated as a residual*: the expected dollar bonus less the food expenditure enhancement. Assuming that the marginal propensity to spend on food out of bonus income lies between 0 and 1, both FEE and NEE will be non-negative.

Mathematically, the food expenditure-FSP participation model can be expressed for each household i as:

$$\log \frac{P(D_i = 1)}{P(D_i = 0)} = Q_i\delta + \alpha_1(FEE_i) + \alpha_2(NEE_i) + \alpha_3(PR_i/ALLOT_i) \quad (1)$$

$$FE_i/F_i = Z_i\beta + (D_iX_i)\gamma + e_i \qquad i = (1, \ldots, N), \quad e_i \sim N(0, \sigma^2) \quad (2)$$

where

- P: denotes the probability of an event;
- D_i: participation in the FSP; $D_i = 1$ if household participates, zero otherwise;
- Q_i: row vector of socioeconomic variables;
- δ: column vector of parameters;
- α_1, α_2, α_3: scalar parameters;
- FE_i: food expenditures;
- FEE_i: food expenditure enhancement, $F_iX_i\gamma_i$;
- NEE_i: nonfood expenditure enhancement, $EB_i - FEE_i$;
- F_i: household size;
- EB_i: expected bonus;
- PR_i: purchase requirement
- $ALLOT_i$: allotment
- Z_i: row vector of explanatory variables;
- β: column vector of parameters:
- (D_iX_i): row vector of interactions found by multiplying a vector of exogenous variables X_i by the scalar participation dummy D_i;
- γ: column vector of parameters;
- e_i: normally distributed error term with zero mean, constant variance, and assumed independent of D_i and Z_i;

and Q_i and X_i may be subsets of the variables in Z_i.

The household food expenditure enhancement (i.e., the difference between per capita food expenditure conditional on participation times household size) can be derived from equation (2) as follows:

$$\begin{aligned} FEE_i &= [(FE_i \mid D_i = 1) - (FE_i \mid D_i = 0)] \\ &= [(Z_i\beta + X_i\gamma + e_i) - (Z_i\beta + e_i)]F_i \\ &= F_iX_i\gamma. \end{aligned} \quad (3)$$

The value of $F_iX_i\gamma$ corresponds to the food expenditure enhancement (FEE) portion of the bonus in equation (1). The expected bonus minus $F_iX_i\gamma$ is the potential increase in nonfood expenditure (NEE) associated with program participation in equation (2).

Estimation requires the independence of e_i and D_i. This appears to be reasonable in the present context since participation is modeled as a function of the food and nonfood expenditure differentials rather than the level of expenditures. The error term in the expenditure equation is assumed to be the same for a household whether or not it participates in the Food Stamp Program; hence, it cancels out when the differential is calculated as in equation (3) above. Consequently, e_i does not affect the determination of D_i, and the independence of D_i and e_i, although D_i is endogenous, is a reasonable assumption (Schmidt).

The food expenditure equation is specified on a per capita basis. This allows one to interpret the effects of dummy variables on regional location, race, and other factors as being an expenditure differential associated with an individual. For example, the household effect of race on a two member household is twice as large as for a one member household. This appears more reasonable than the assumption of a constant differential per household independent of its size because it also

allows the effects of the other variables, including the Food Stamp Program, to differ by household size.[6] Also, the per person expenditure equation may easily be interpreted as a household equation by multiplying through by household size.

Two testable hypotheses follow directly from the conventional economic model. First, if the influence of bonus stamp income is equivalent to that of money income, the model predicts that the marginal effect of enhanced nonfood expenditures on participation is the same as the marginal effect of enhanced food expenditures. Thus, one hypothesis is that $\alpha_1 = \alpha_2$ in the participation equation. Second, the theory implies that the marginal propensity to spend on food out of money income is equal to that out of bonus stamp income. That is, the coefficients on money income and bonus income in the expenditure equation are equal. Alternatively, under an effective food-oriented program individuals would be forced to spend more on food than they otherwise would if given cash resources. Thus, from the marginal conditions of consumer demand, this implies that the marginal food dollar would be less preferred than the marginal nonfood dollar, and consequently, $\alpha_1 < \alpha_2$ in the participation equation. Also, an effective food oriented program would imply that the marginal propensity to spend on food out of bonus income exceeds that out of money income in the food expenditure equation.

Efficient parameter estimators for the model can be obtained by the method of maximum liklihood and consistent, although not generally efficient, estimators, may be obtained by a recursive procedure (Schmidt). The latter procedure consists first of OLS estimation of the expenditure equation. Next, the food and nonfood expenditure enhancements associated with program participation are calculated from the OLS parameters and the relevant characteristics of each household. The differentials are then entered into the participation equation which is estimated via the logit procedure. These recursive estimators are consistent but not asymptotically efficient unless $\alpha_1 = \alpha_2$. In the special case of $\alpha_1 = \alpha_2$, one can combine the two endogenous components, FEE and NEE, to form the expected bonus. Since the expected bonus is predetermined, the two equations can be estimated independently.[7] In the case where $\alpha_1 \neq \alpha_2$ the consistent estimates are useful as starting values for the more complex maximum likelihood estimators.

Data

Data for the analysis of FSP participation and food expenditures are obtained from computer tapes of the 1977–78 USDA Nationwide Food Consumption Survey, Low Income Supplemental Sample (NFCS-LI).[8] The NFCS-LI data were collected between November 1977 and March 1978 from a representative sample of approximately 4,500 low income households deemed eligible for the Food Stamp Program. Approximately 41 percent of the sample households were participating in the Food Stamp Program.

Information on household characteristics and food use was obtained during personal interviews with the household member(s) most responsible for food planning and preparation. The sample households were contacted at least one-week prior to

[6] In addition, heteroscedasticity in the error term which is commonly observed in household expenditure models is often mitigated in per capita specifications.

[7] Of course, one cannot be sure that $\alpha_1 = \alpha_2$ until simultaneous estimation of the system is complete.

[8] Public use tapes of the 1977–78 NFCS are available from National Technical Information Service, U.S. Department of Commerce.

the interview and asked to keep unstructured notes on household food usage and costs. During the actual interview a detailed food list was used to assist the homemaker to recall the kinds, quantities, and values of foods used from home supplies during the last 7 days. The recall data on the total money value of purchased food used (less alcoholic beverages) provides the basis for this study. The money value of alcoholic beverages and nonpurchased food are excluded from the analysis since they cannot be directly purchased with stamps.

Household food expenditures are postulated to be a function of region and urban location of household residence, race, number of guest meals served, household money income, and whether the household receives reduced or free school lunches. These variables are typical of those used in similar types of expenditure equations and, hence, will not be elaborated upon. The effects of household age composition are accounted for by including the proportion of household members in specified age groups. *This approach may be viewed as a pragmatic alternative to a theoretically pure adult equivalent scale specification.* To allow for slope and intercept changes between participants and nonparticipants, the above variables, bonus income, and a unit vector (to allow for a change in the intercept) were interacted with the dummy participation variable. Only bonus income, the North Central region, urbanization, and variables representing the presence of infants and the elderly were found to be statistically significant.

The decision to participate in the FSP is postulated to be influenced by region and urban location of household residence, home ownership, race, employment status of male and/or female head, education level of household head, presence of person(s) over 65 years old in the household, presence of only a female household head, a participation cost/benefit ratio, and the potential food and nonfood expenditure enhancements. The location of household residence variables are not of direct interest but are included in the model to adjust for environmental and related factors which are not directly observable.

Home ownership is expected to have a negative influence on participation. Households which own homes will generally have both higher assets and future income streams than similar non homeowning households, hence, the need to supplement food expenditures via program entry is diminished.

Sex, age, education, race, and employment status of the household head, as well as the presence of both a male and female head, measure characteristics of individuals in the household that are expected to be related to the household's employment opportunities, earning potential and permanent income. Epperson *et al.* and Lane *et al.* found that money income was negatively related to FSP participation. Consequently, the effect of these variables on participation is hypothesized to be inversely related to their effect on income.

The cost/benefit ratio is expected to be negatively related to participation. Higher costs of program entry relative to expected benefits make the program less attractive to eligible households.

Both the food and nonfood differentials should be positively related to program entry as both variables essentially relate to program benefits. The higher the potential benefits to participation the greater is the probability a household will enter the FSP.

The actual variables utilized in the analysis are described in Table 1. The variables corresponding to the vectors Q_i, X_i, and Z_i are detailed in the same table. The actual sample size used in the analysis is 3,852. The loss in observations from the original sample is due largely to missing

TABLE 1. Definitions of Model Variables.

Label	Included in Vector Q_j	Z_j	X_j	Definition
NC	✓	✓	✓	NC = 1 if household resides in North Central; zero otherwise
S	✓	✓		S = 1 if household resides in South; zero otherwise
W	✓	✓		W = 1 if household resides in West; zero otherwise
U	✓	✓	✓	U = 1 if household resides in an SMSA suburban area; zero otherwise
HO	✓			HO = 1 if household owns a home; zero otherwise
R	✓	✓		R = 1 if household head is black; zero otherwise
D				D = 1 if household received food stamps last month and this month; zero otherwise
GM		✓		Number of guest meals
SLR		✓		SLR = 1 if household had school lunches at reduced prices; zero otherwise
FEE				Food expenditure enhancement
NEE				Nonfood expenditure enhancement
FE/F				Dollar value per person of purchased food used from home supplies in a week
EM	✓			EM = 1 if household has an employed male head; zero otherwise
EF	✓			EF = 1 if household has an employed female head; zero otherwise
FH	✓			FH = 1 if household has a female head and no male head; zero otherwise
E	✓			E = 1 if household head is at least a high school graduate; zero otherwise
P1/F		✓	✓	Proportion of household composed of members under age 3
P2/F		✓		Proportion of household composed of members of age 3 to 12
P3/F		✓		Proportion of household composed of members of age 13 to 19
P4/F		✓		Proportion of household composed of members of age 20 to 39
P5/F		✓	✓	Proportion of household composed of members of age 65 or older
Y/F		✓		Last month's household income in dollars on a weekly per person basis
EB			✓	Expected weekly bonus value of food stamps to eligible households regardless of whether they participate
ELD	✓			ELD = 1 if male or female household head is 65 years or older; zero otherwise
PR/ALLOT	✓			Expected weekly purchase requirement divided by expected weekly allotment

data on income and reporting errors in food stamp information.

Empirical Results

Due to cost considerations, the statistically consistent recursive estimator mentioned above was used during preliminary model selection. Parameter estimates for the selected model were found to be robust to the entry and exit of other socioeconomic variables considered. Subsequently, these parameter estimates were used as starting values in obtaining the maximum liklihood estimates reported in Table 2. Estimates obtained from the two procedures were found to be virtually identical.

Results from the estimated expenditure equation reveal that urbanization and geographic region of household residence, size and age composition of the household, number of guest meals served, race, number of reduced price and free school lunches, money income, and participation in the Food Stamp Program were significant determinants of the level of food expenditures. For example, per person

weekly food expenditures were found to be highest in the Northeast region and lowest in the South. Blacks were found to spend more per person on food from home supplies than nonblacks. Whether this latter result is due to underlying racial influences on the types and quantities of food purchased is unknown. As would be expected, food expenditures increased with the number of guest meals served.

Households with children receiving reduced or free school lunches spent less than their counterparts not receiving the lunches. This is consistent with the hypothesis that government subsidized meals substitute, at least partially, for meals that would otherwise have been purchased by the household.

The estimated marginal propensity to spend (MPS) on food out of bonus income was over twice as large as that for money income and the two coefficients were found to be statistically different at the 0.05 level. The MPS on food out of money income was about 9.9 cents per dollar and the corresponding MPS out of bonus income was approximately 23 cents per dollar. The above indicates that one can reject the hypothesis generated from the traditional economic model that bonus income is allocated the same as money income.

In addition to the estimated effect of bonus income on food expenditures, an additional program participation effect was found which varies with region and urban locations of household residence and age of household members. The participation effect on food expenditures was found to be significantly larger for household members under three and those 65 and older than for those of other ages. For example, holding bonus income and other factors constant, the participation effect increased food expenditures \$3.14 (\$2.9435 + \$0.1981) weekly for each child under 3 years and \$1.72 (\$1.5218 + \$0.1981) weekly for each adult 65 years or older compared with the participation effect for the base group (all other ages) of approximately \$0.20 per person per week. Consequently, the program appears to increase food expenditures most for those population subsets often identified

TABLE 2. Asymptotically Efficient Estimates of FSP Participation and Food Expenditure Model.

	Participation Equation		
Variable	Coefficient	Variable	Coefficient
Constant	1.2639 (0.2491)	FH	0.5774 (0.0880)
NC	−0.8101 (0.1777)	E	−0.3996 (0.0933)
S	−1.2395 (0.1443)	ELD	−0.3417 (0.198)
W	−1.1639 (0.1841)	R	0.3201 (0.0816)
U	−0.4246 (0.1245)	PR/ ALLOT	−1.4477 (0.3564)
HO	−0.6589 (0.0832)	FEE	0.0265 (0.0161)
EM	−1.5216 (0.1314)	NEE	0.0256 (0.0078)
EF	−1.055 (0.1168)		
Variable	Food Expenditure Equation		
	Coefficient	Variable	Coefficient
Constant	11.4846 (0.5574)	P3/F	2.3751 (0.6594)
NC	−0.9760 (0.5025)	P4/F	−0.6411 (0.5117)
S	−1.4548 (0.3625)	P5/F	−2.3494 (0.3701)
W	−0.5524 (0.4760)	Y/F	0.0991 (0.0082)
U	−0.1346 (0.3250)	D	0.1981 (0.7782)
SLR	−0.9754 (0.3250)	(EB/F)*D	0.2328 (0.1098)
R	1.0271 (0.2070)	NC*D	0.9501 (0.6021)
GM/F	1.2453 (0.1015)	U*D	−0.9600 (0.5689)
P1/F	−7.8727 (1.2201)	(P1/F)*D	2.9435 (1.6894)
P2/F	−3.4046 (0.6600)	(P5/F)*D	1.5218 (0.5393)

Note: Asymptotic standard errors in parentheses.

TABLE 3. Effects of a 1-Unit Change in the Independent Variables on the Probability of FSP Participation by Eligible Households.[a]

Independent Variable	Change in Probability
Region	
North Central	−0.1713
South	−0.2955
West	−0.2265
SMSA, non central city	−0.0953
Home ownership	−0.1509
Race	0.0750
Female head only	0.1344
Female head works	−0.2167
Male head works	−0.2974
Elderly head	−0.0788
Education of meal planner	−0.0909
Cost-benefit ratio[b]	−0.0032
Expected bonus stamps	0.0060

[a] The effects of changes in the independent variables are computed from the estimated participation equation evaluated at the mean values of the independent variables.
[b] A unit change in the cost-benefit ratio is assumed to be a 1-percentage point change.

TABLE 4. Effect on the Probability of FSP Participation Given Changes in the Purchase Requirement.[a]

Purchase Requirement	Allotment	Bonus Value			Probability of Participation
		Total	FEE	NEE	
0	32	32	9.93	22.07	0.61
5	32	27	8.74	18.26	0.53
13[b]	32[b]	19	6.83	12.17	0.39
18	32	14	5.63	8.37	0.31
25	32	7	3.96	3.04	0.21
0	19	19	6.83	12.17	0.53

[a] All variables except the weekly purchase requirement, allotment, and expected bonus are evaluated at the sample means.
[b] Sample means of allotment and purchase requirement rounded up.

as most in need of public assistance (i.e., the elderly and infants).[9]

Most coefficients estimated in the participation equation were statistically significant at the usual confidence levels with the signs as expected *a priori*. The model correctly classifies 72.6 percent of the observations using the (0.5, 0.5) criteria. For this criterion, a correct classification means that the predicted probability equals or exceeds 0.5 for participating households or is below 0.5 for nonparticipating households.

The estimated effects of the independent variables on the probability of FSP participation are reported in Table 3. Variables, other than the one being examined, are held constant at their respective sample means. For example, the probability of FSP participation in the Northeast (omitted base) region ranges from 17 to 30 percentage points higher at the sample means than in the other three regions. The probability of participation was lowest in the South followed by the West and North Central regions.

Households residing in the suburban portion of an SMSA were found less likely to participate in the program. These households had a probability of participation approximately 10 percentage points less than other households. Eligible households which don't own a home had a probability of participation that was 15 percentage points higher than for homeowners. Black households were about 7 to 8 percentage points more likely to participate than similar nonblack households. Households with only a female head were 13 percentage points more likely to participate than other similar households. A working male or female head of house-

[9] An expenditure equation similar to the one above, except that interactions between household age composition, region, urbanization, and FSP participation were excluded, was estimated. The result was to increase the effect attributed to bonus income to about 3 times the effect of money income (i.e., an MPS for money income of 0.10 and an MPS for bonus income of 0.32). This latter result is consistent with some earlier studies (Neenan and Davis; West and Price) which also omitted the interaction effects but is misleading as the model omits statistically relevant variables which are correlated with the included variables. The net effect is to attribute effects to bonus income which should be attributed to other variables.

hold was associated with a reduction in the probability of FSP participation ranging from 22 to 30 percentage points over households with unemployed heads. Households with an elderly head were about 8 percent less likely to participate than similar nonelderly households. Also, households in which the primary meal planner had completed high school were 10 percent less likely to participate in the FSP than similar households where the meal planner has less education.

The cost/benefit ratio was negatively related to participation, as expected.[10] A 10 percent increase in the cost/benefit ratio was asociated with a 3.2 percentage point decline in the likelihood of participation at the sample means. This indicates that as the purchase requirement is decreased (with the allotment held constant) participation would be expected to increase. Consequently, the purchase requirement may be viewed as a significant deterrent to participation.

The effects of the potential food and nonfood expenditure enhancements on FSP participation were found to be virtually identical and a statistical test for the equality of α_1 and α_2 was not rejected at the .05 level. This implies that households, in deciding whether or not to participate in the FSP, place equal value on the potentials for increasing food and nonfood spending. However, as shown above, those households that actually decide to participate appear to allocate bonus income more towards food expenditures than would be predicted via an equivalent amount of money income. Consequently, the fact that potential benefits are in the form of food stamps rather than cash does not appear to be a deterrent to participation although the bonus stamp benefits are allocated differently than the money income. Furthermore, this result ($\alpha_1 = \alpha_2$) is of particular importance because it implies that the two-equation system need not be estimated simultaneously and that a simpler model which combines the food and nonfood expenditure enhancements into the expected bonus provides efficient parameter estimates. Also, as shown in Table 3, a $10 increase in the expected weekly bonus stamps was associated with a 6 percentage point increase in the likelihood of program participation.

The model can be used to simulate the effects of policy instruments on the probability of participation and the subsequent effect on the food and nonfood enhancements. The major policy instruments by which administrators can influence participation and food expenditures are the allowable deductions from income, the purchase requirement, asset limits, and the allotment amount. Changes in asset limits and allowable income deductions have been the primary policy instruments used. Since the purchase requirement is determined by household size, income, and allowable income deductions, changes in income and allowable income deductions can be viewed within our model as direct changes in the purchase requirement. This, in turn, will influence bonus stamp income and the cost-benefit ratio.

Presented in Table 4 are the results of alternate scenarios involving hypothetical changes in the purchase requirement. For example, if the purchase requirement is eliminated and all other exogenous variables including the allotment are evaluated at their sample means, the probability of participation increases from 0.39 to 0.61. In addition, the household's weekly food and nonfood expenditure enhancements increase from $6.83 and $12.17 to

[10] A purchase requirement to income ratio variable was tried as an alternative to the purchase requirement to allotment ratio in a preliminary model specification. However, all specifications that included an income term gave problems due to the close functional relationship between the FSP variables and income. Because we thought that program benefits were more important to participation than the potential effect of declining marginal utility of income, we chose not to include income terms.

$9.93 and $22.07, respectively, under this scenario. Conversely, increasing the purchase requirement or decreasing the allowable income deductions decreases bonus income, the food and nonfood expenditure enhancements, and the probability of participation. Also presented in Table 4 are the results of simultaneously eliminating the purchase requirement and reducing the allotment by the same dollar amount. This scenario is similar to the legislated removal of the purchase requirement in January 1979. Our simulations indicate that eliminating the purchase requirement would increase the probability of participation by 14 percentage points from the base probability calculated at the sample means of all variables. Assuming no change in the eligible population, this implies a 36-percent increase in program enrollment. Actual FSP enrollment increased 17.9 percent and 15.9 percent, respectively, in the two calendar years following the elimination of the purchase requirement (EPR). Of course, actual enrollment growth during this time was partially due to an increase in eligible households caused by poor economic conditions. In summary, while regulations governing net transfers per household changed only modestly with elimination of the purchase requirement, total program cost increased substantially due to increased enrollment.

Conclusions

An economic model of household behavior was developed to analyze the effects of FSP policy control variables on food expenditures and program participation rates. The model postulated that FSP participation by eligible households is determined, in part, by the opportunities households have and choices households make with regard to the allocation of their in-kind income transfer. The opportunities to enhance food and nonfood spending via program participation and receipt of bonus stamp income were found to have the same effects on program participation. In the context of our model, this finding implies that the participation decision can be considered independently of the allocation of both money income and food stamps to food and nonfood items. Thus, there was no indication that households with a greater preference for food (larger food expenditure enhancement) were more likely to participate than other households.

Statistical tests revealed that the level of expected bonus stamp income has a significant positive influence on the probability of program participation. For example, a $10 increase in expected weekly bonus stamp income was found to increase the probability of participation by approximately 6 percentage points. Also, additional bonus stamp income was found to have more than twice the effect on food spending as additional money income. This suggests that replacing stamps with cash would be substantially less effective as a food enhancing program.

Food expenditure differentials associated with FSP participation were found to be larger for households with elderly persons or infants present. Whether this effect is due to pure program effects or to the type of household self-selecting into the program is not clear. Some simple tests for sample selection bias using Heckman's procedure did not indicate its presence for this sample. In any case, these household types appear to benefit more from FSP participation in terms of increased food expenditures than others.

The cost-benefit ratio associated with participation, defined as the ratio of the expected purchase requirement to the allotment, was found to be a significant factor influencing participation. Program participation was found to decline markedly as the cost-benefit ratio was increased. Since the most needy households tend to have lower cost-benefit ratios, this result suggests that policy instruments which influence this ratio can be used as

effective tools to control program cost while minimizing the deleterious effects of program budget reductions. That is, the purchase requirement, if re-enacted, could be used as a policy instrument to limit participation of "marginal" households without further restricting the eligibility requirements or reducing the net transfer of benefits per household. In this sense, the purchase requirement may be a politically acceptable means of controlling the FSP budget.

These empirical findings together with those of Clarkson, Huang *et al.*, Mittelhammer and West, and many others suggest that the traditional indifference curve model of consumer behavior used to analyze the FSP does not adequately explain the effects of FSP on food spending. To better understand the determinants of program participation and the program effects on food spending and nutritional adequacy, improved economic models will have to be developed. Future research efforts on theoretical modeling will probably be most fruitful in the area of modeling the income constraint and those factors related to financial management and resource allocation in low income households. Lastly, we offer our results in hope that this research may stimulate debate on the appropriateness of the traditional food stamp model and will generate hypotheses which can be tested with more recent data (after elimination of the purchase requirement) such as the 1979–80 supplemental low income sample to the USDA Nationwide Food Consumption Survey.

References

Benus, J., J. Kmenta, and H. Shapiro. "The Dynamics of Household Budget Allocation to Food Expenditures." *Review of Economics and Statistics*, 58(1976): 129–38.

Chen, Jain-Shing A. and Stanley R. Johnson. "Food Stamp Program Participation and Food Cost: A Simultaneous Equations Analysis with Qualitative and Continuous Dependent Variables." Paper presented at the Regional Research Committee Meeting, S-165, Atlanta, Georgia, October 19, 1982.

Clarkson, Kenneth. *Food Stamps and Nutrition.* American Enterprise Institute, Washington, D.C., 1975.

Danziger, Sheldon, Robert Haveman, and Robert Plotnick. "How Income Transfer Programs Affect Work, Savings, and the Income Distribution: A Critical Review." *Journal of Economic Literature*, (1981): 975–1028.

Epperson, J. E., C. L. Huang, S. M. Fletcher, and W. K. Searce. "The Determinants of Food Stamp Program Participation." *Southern Journal of Agricultural Economics*, 12(1980): 93–7.

Friedman, Milton. *A Theory of the Consumption Function.* Princeton University Press, Princeton, N.J., 1957.

Heckman, Jes. "Sample Selection Bias as a Specification Error." *Econometrica*, 47(1979): 153–61.

Huang, Chung L., Stanley M. Fletcher, and Robert Rauniker. "Modeling the Effects of the Food Stamp Program on Participating Households' Purchases: An Empirical Application." *Southern Journal of Agricultural Economics*, 13(1981): 21–8.

Johnson, Stanley, James Burt, and Karen Morgan. "The Food Stamp Program: Participation, Food Costs, and Diet Quality for Low Income Households." *Food Technology*, 35(1981): 58–70.

Lane, Sylvia, John Kushman, and Christine Ranney. "Food Stamp Program Participation: An Exploratory Analysis." *Western Journal of Agricultural Economics*, 8/1(1983): 13–26.

Love, H. G. "The Reasons Participants Drop Out of the Food Stamp Program: A Case Study of Its Implications." *American Journal of Agricultural Economics*, 52(1970): 387–94.

Mittelhammer, Ron and Donald A. West. "Food Stamp Participation Among Low-Income Households: Theoretical Considerations of the Impact on the Demand for Food." *Southern Journal of Agricultural Economics*, 7(1975): 223–31.

Neenan, Pamela H. and Carlton G. Davis. "Impact of the Food Stamp Program on Low Income Household Food Consumption in Rural Florida." *Southern Journal of Agricultural Economics*, 9(1977): 89–97.

Rao, C. R. *Linear Statistical Inference and Its Applications.* John Wiley and Sons, Inc., New York, 1965.

Rungeling, B. and L. H. Smith. *Factors Affecting Food Stamp Program Nonparticipation in the Rural South.* University of Mississippi: Center for Manpower Studies, January 1975.

Schmidt, Peter. "Estimation of a Simultaneous Equations Model with Jointly Dependent Continuous and Qualitative Variables: The Union-Earnings Question Revisited." *International Economic Review,* (1978): 453–65.

Searce, W. K., P. J. Marshall, and R. B. Jensen. "Food Stamps: A Study in Two Virginia Localities." Department of Agricultural Economics, Virginia Polytechnic Institute and State University, Blacksburg, Virginia, March 1975.

Southworth, Herman M. "The Economics of Public Measures to Subsidize Food Consumption." *Journal of Farm Economics,* 27(1945): 38–66.

Stucker, Thomas A. and William T. Boehm. "A Guide to Understanding the 1977 Food and Agricultural Legislation." Agricultural Economic Report No. 411, U.S. Department of Agriculture, Economics Statistics and Cooperative Service, Washington, D.C., September 1978.

Thurow, Lester C. "Cash Versus In-Kind Transfers." *American Economic Review,* 64(1974): 190–95.

West, Donald A. and David W. Price. "The Effects of Income, Assets, Food Programs, and Household Size on Food Consumption." *American Journal of Agricultural Economics,* 8(1976): 725–30.