#18333

1990

THE EFFECT OF FUNCTIONAL FORM ON THE ESTIMATED MARGINAL PROPENSITIES TO SPEND OUT OF FOOD STAMPS AND MONEY INCOME AND THE IMPLICATIONS FOR A CASH-ONLY FOOD STAMP PROGRAM

J. William Levedahl
Economic Research Service
Washington, DC

Food stamp plan

Paper prepared for presentation at the AAEA Annual Meeting at Vancouver, B.C., August 4-8, 1990. The view expressed herein are those of the author and not necessarily those of ERS or USDA.

#8333

THE EFFECT OF FUNCTIONAL FORM ON THE ESTIMATED MARGINAL PROPENSITIES TO SPEND OUT OF FOOD STAMPS AND MONEY INCOME AND THE IMPLICATIONS FOR A CASH-ONLY FOOD STAMP PROGRAM

ABSTRACT

Using linear in the coefficients specifications (LCS), previous estimates of the marginal propensity to spend on food out of food stamps are about 4 to 5 times the MPS out of income. This magnitude implies that food expenditures would fall drastically if the program was cashed-out. The LCS and a specification of the expenditure equation based on a generalization of Roy's identity and a translog indirect utility function are estimated. The implications of these functional forms on cashing-out the Food Stamp Program are discussed.

1. Introduction

The conceptual basis for the relationship between food stamps and food expenditures was initially presented by Southworth. His formulation implies that the marginal propensities to spend (MPS) out of food stamps and money income are equal when food expenditures exceed food stamp benefits. Empirical estimates using various household surveys have consistently found, however, that for food at-home the MPS out of food stamps is several times greater than the MPS out of money income, see Senauer and Young for a summary of these estimates. All previous estimates of the MPS's have been obtained using expenditure equations that are linear in the coefficients.

However, not all evidence indicates unequal MPS's. When Puerto Rico initiated a cash-only program in 1982 no measurable reduction in food expenditures was observed (Devaney and Fraker). In addition, a 1982-83 USDA demonstration project involving the elderly found that a cash-only program had little affect on food expenditures. These exceptions suggest that additional research is needed to reconcile these differences. In fact, the Food and Nutrition Service (FNS) is currently conducting a survey

of household food expenditures designed to control for income and food stamps.

The principle finding of this paper is that the choice of a functional form for the food expenditure equation, and thus for the marginal propensities, results in alternative estimates of the change in food expenditures from cashing-out the Food Stamp Program (FSP).

The plan of the paper is as follows: In the next section, a generalization of Roy's identity for food stamp recipients is developed for both food expenditure at-home and away-from-home. In section three, this generalization and a translog indirect utility function are used to derive expenditure equations that are flexible and consistent with utility maximization. Using data from the 1979-80 Nationwide Food Consumption Survey (NFCS)-Low Income Supplement expenditure equations for the translog and the linear in the coefficients specifications are estimated and used to calculate the corresponding MPS's.

In section four the implication of cashing out the FSP implied by different functional forms is discussed.

2. The Food Expenditure Equation

The household is assumed to maximize utility with respect to food consumed at-home, food consumed away from home, and all other goods subject to income and food stamp constraints. This is denoted by

$$\max L = U(F,S,A,X) + g_1(Y - pF - p_aA - p_oX) + g_2(S_o - pS) \qquad (1)$$

where F, S are food purchased for at-home consumption using income and food stamps, respectively;

A is food purchased for away from home consumption;

X is a composite of all other goods;

p, p_a are the prices for food at-home and away from home, respectively;

p_o is the price of other goods;

Y is money income;

S_o is the dollar amount of food stamps; and

g_1, g_2 are Lagrangian multipliers.

L is maximized with respect to the variables F, S, A, X, g_1, and g_2 given S_o, Y, p, p_a, and p_o. Note that the utility of food bought with stamps or income does not necessarily provide the same utility.

When all stamps are used, $g_2>0$. $g_2=0$ if not all food stamps are used and no food purchases are made out of income. Only households whose food expenditures exceed the value of their food stamps ($g_2>0$) are considered.

Solving (1) and substituting the optimal values back into this equation gives,

$$\underline{L} = U(\underline{F},\underline{S},\underline{A},\underline{X}) + g_1(Y - p\underline{F} - p_a\underline{A} - p_o\underline{X}) + g_2(S_o - p\underline{S}) \qquad (2)$$

where the underlining denotes optimal values and $g_1 \geq g_2 > 0$. The demand function for at-home food purchased with income can be defined using (2) and the envelope theorem. The total differentials of the objective function with respect to changes in Y, p and S_o are

$$d\underline{L}/dY = g_1,$$

$$d\underline{L}/dp = -g_1\underline{F} - g_2\underline{S}, \text{ and}$$

$$d\underline{L}/dS_o = g_2.$$

Rearranging terms, the demand function for at-home food purchased with income is

$$\underline{F} = -(1/g_1)[d\underline{L}/dp + \underline{S}g_2]. \qquad (3)$$

For households receiving food stamps, this equation is a generalization of Roy's identity.

Define total demand for food at-home $\underline{D} = -(d\underline{L}/dp)/g_1$ and rewrite (3) as

$$\underline{F} = \underline{D} - (g_2/g_1)(S_o/p). \tag{4}$$

The ratio g_2/g_1 is the household's marginal evaluation of food bought with food stamps relative to food bought with income. This ratio equals one in the Southworth model. Equation (4) implies that S_o food stamps are equivalent to the quantity $(g_2/g_1)(S_o/p)$ of food bought with income. This quantity, previously bought with income, will be bought using food stamps. The more similar the marginal utilities of the food bought with food stamps and with income, the greater the substitution of food stamps for food bought with income.

At-home food expenditures from all sources is obtained by multiplying (4) by the price of food and adding S_o to both sides.

$$\underline{E} = p\underline{D} + (1 - g_2/g_1)\cdot S_o. \tag{5}$$

The fraction $(1 - g_2/g_1)$ is the proportion of S_o that results in new food expenditures.

The demand for food away-from-home is derived in a similar manner using Roy's identity applied to (2). Adding the resulting demand for food away-from-home to the demand for food at-home gives the total demand for food purchased with income is

$$\underline{F} + \underline{A} = -(1/g_1)[d\underline{L}/dp + \underline{S}g_2 + d\underline{L}/dp_a]. \tag{6}$$

Total expenditures on food is therefore,

$$\underline{TE} = p\underline{D} + p_a\underline{A} + (1 - g_2/g_1)\cdot S_o.$$

3. Estimates of the Marginal Propensities to Spend.

3.1 Specification of the Expenditure Equation

Previous estimates of the MPS's have used specifications of the food expenditure equation that are linear in the coefficients. The most common has been the linear specifications (Smallwood and Blaylock, Ranney and Kushman, Neenam and Davis, Chavas and Young, and Huang, Fletcher and Raunikar). In some cases, variables measuring an interaction between income or food stamps and other determinants has been included. In addition to the linear version, a semi-log linear version has been used (West and Price), as well as a double-log version (Senauer and Young).[1] Table 1 gives the expenditure equation for each of these functional forms.

Few reasons are given for choosing these linear in the coefficients specifications other than convenience in estimation. However, there are reasons for not choosing them. For one, all known theoretically consistent systems of consumer demand functions of three or more commodities that are linear in the coefficients have the property of unitary income elasticity for all commodities, Lau (1977). Therefore, if one wanted a food expenditure equation that was based on a theoretically consistent system of consumer demand, linear in the coefficients specification should not be chosen.

A second reason for avoiding linear in the coefficients specifications is the a-priori restrictions they place on the MPS's. In particular, these specifications are not flexible enough to estimate theoretically consistent MPS's.

The inflexibility can be illustrated for the marginal propensity to spend out of food stamps. For at-home food expenditures the theoretically consistent expression for MPS(S_o) from (4) is,

$$MPS(S_o) = 1 + p\delta D/\delta S_o - g_2/g_1(1 + \varphi) \geq 0 \qquad (7)$$

where φ is the elasticity of g_2/g_1 with respect to S_o. The $MPS(S_o)$ is measured relative to 1 since by assumption recipient households spend all their food stamps. The second term in (7) represent the change in food expenditures that results from the change in total at-home food demand when food stamps change. The third term represents the change in food expenditures that results from a relative change in the marginal value of food bought with food stamps compared to income.

Both the linear and semi-log linear versions specify $MPS(S_o)$ to be constant. Such a parameterization provides a poor approximation to (7) since it requires that no change occur in the marginal value of food bought with food stamps relative to income and/or in total at-home food demand as food stamp benefits change.

In the double-log version, $MPS(S_o) = cw$ for scalar $c \geq 0$ and the food expenditure share $w = E/Y$. If the share of food declines (from whatever source) then the marginal propensity to spend out of food stamps falls. From (7) this decline can occur in one of two ways: each food stamp stimulates less total at-home food demand, or each food stamp replaces a greater amount of food bought with income.

However, a decline in the food share is consistent with food stamps replacing a smaller, rather than a larger, amount of food bought with income. Likewise, a declining share is also consistent with an increase in the marginal utility of food at-home relative to other goods. In both cases, a declining share would be consistent with an increase in the $MPS(S_o)$, a result at variance with the parameterization of $MPS(S_o)$ in the double-log specification.

Ultimately, the response of the MPS(S_o) to a change in an exogenous variable is determined by the substitutability in the household's utility function between food bought with income and with food stamps as well as between total at-home food and all other goods.

The choice of an expenditure equation followed in this paper is to derive an expenditure equation that is based on a theoretically consistent and flexible demand equation. Compared to the linear in the coefficients specifications a flexible functional form imposes fewer a-priori restrictions on the MPS's, and, therefore, can be used to judge how well the linear in the coefficients specifications fit the data. A theoretically consistent expenditure equation also provides coefficient restrictions.

In this paper the translog indirect utility function is used to derive a flexible expenditure function. Write this utility function as

$$L(S_o,Y,p,p_a,p_o,Z) = -a_o - F(Z) - \ln x'a - (1/2)\ln x'A\ln x - \ln x'DZ \qquad (8)$$

where F depends on Z a kx1 vector of household attributes,

$$\ln x' = [\ln(S_o/Y) \quad \ln(p/Y) \quad \ln(p_a/Y) \quad \ln(p_o/Y)] \quad \text{and}$$

$$= [\ln x_1 \quad \ln x_2 \quad \ln x_3 \quad \ln x_4]$$

a_o is a scalar, a is a 4x1 vector, $A=(a_{ij})$ is a 4x4 symmetric matrix, and D is a 4xk matrix of coefficients corresponding to commodity specific demographic effects.

Using the generalized version of Roy's identity (3) and the indirect utility function (8) the demand for food at-home purchased with income is derived. Substituting this expression into the identity $E \equiv pF + S_o$ gives an expenditure equation that is consistent with utility maximization and is flexible.

$$E = Y\,(h_1/h_2) + S_o \qquad (9)$$

where $h_1 = a_1+a_2 + \sum_j (a_{1j}+a_{2j})\ \ln x_j + (D_p+D_s)Z$

$h_2 = \sum_j a_j + \sum_i \sum_j a_{ij}\ \ln x_j + (D_p+D_s+D_{pa}+D_{po})Z'$

The corresponding equation for total food expenditure is,

$$TE = Y(t_1/t_2) + S_o \qquad (10)$$

where

$t_1 = a_1+a_2+a_3 + \sum_j (a_{1j} + a_{2j} + a_{3j})\ \ln x_j + (D_p\ D_s\ D_{pa})Z$

$t_2 = h_2$

3.2 Empirical Results

In this paper the ratio of the MPS's is used to measure the difference between the marginal propensities to spend out of food stamp and income. The ratio is a better measure than, say, the difference between the MPS's because it captures correlation between the two marginal propensities that might exist across households. This correlation is important because it reflects upon how households adjust their food expenditures in respond to changes in food stamp and income. This correlation also implies that the mean ratio of the MPS's is the preferred measure compared to, say, the ratio of the mean MPS's.[2] For each functional form the ratio of the MPS's is defined in Table 1.

Data from the 1979-80 Nationwide Food Consumption Survey-Low Income Sample II (NFCS-II) were used to estimate the expenditure equations. This survey was administered after the elimination of the food stamp purchase requirement.[3] Only households who received food stamps and whose expenditures on food for at-home consumption exceeded the value of their

food stamps were used. In addition, households were deleted if their food expenditures in excess of food stamp benefits were greater than their average monthly income. In all 1210 households were included in the estimating sample.[4]

Information on household characteristics and food use was provided by a personal interview of the member most responsible for food planning and preparation. The household was contacted at least one week in advance of the interview and asked to keep notes on food usage and costs. During the actual interview prompts were used to aid recall. The recall data on the total money value of purchased food used in the last seven days (less alcoholic beverages) is the basis of the food expenditure variable. The weekly expenditure figure was adjusted to a monthly basis to conform with the other variables. The money value of both alcoholic beverages and food not purchased are excluded from the analysis since they cannot in principle be purchased with stamps.

3.2.1. Estimates of the MPS's Using the Linear in the Coefficients Specifications

Estimating equations for the linear, semi-log and double-log specifications used in estimating the MPS's were obtained from the expression in Table 1 by modelling the effect of household demographics as linear explanatory variables and by adding a random error term. The error term is assumed to have a zero mean and a constant variance. Previous studies that have found no self-selection bias between food stamp recipients and non-recipients in food expenditures (Ranney and Kushman, Devaney and Fraker).

Variables and their sample means are defined in table 2. This list

comprises variables found by previous studies to be significant in explaining food expenditures (Smallwood and Blaylock, Huang et al).

Coefficient estimates of the linear, semi-log, and the double-log specifications for both total and at-home food expenditures are given in table 3. The estimated mean ratios across households and their corresponding standard errors are given in table 4.

For at-home food expenditures, mean ratio of the MPS's significantly greater than one replicates the results from previous studies using the linear in the coefficients specifications. The values reported in table 4 are, however, somewhat larger than obtained by other studies using post-1979 data except for the estimate reported by Ranney and Kushman.

For total food expenditures the mean ratios are smaller than for at-home expenditures. This occurs because the marginal propensities to spend on food away-from-home out of food stamp is negative. This pattern is illustrated by the individual MPS's reported in table 5.

3.2.2 Estimates of the MPS's Using the Translog Functional Form

An estimating equation for at-home food expenditure was specified from (9) assuming that the cross section prices are constant.

$$(E - S_o)/Y = eh_1/eh_2 \qquad (11)$$

where $eh_1 = c + (SA1-a_{134})\ln(S_o) - (SA1+SA2)\ln(Y) + 2D'_{ho}Z$

$eh_2 = 1 + SA1\ln(S_o) - (SA1+SA2+SA3+SA4)\ln(Y) + 4D'_{ho}Z$

and $SAi = \sum_j a_{ij}$ and $a_{134} = a_{13} + a_{14}$.

The intercept term in the denominator of (10) has been normalized to 1, and

$c = a_1+a_2 + (a_{23}+a_{13})\ln(p_a) + (a_{14}+a_{24})\ln(p_o) + (a_{12}+a_{22})\ln(p)$.

The lack of price variation in the cross section precludes estimating the commodity specific effects of demographic variables identified by D in at-home and total expenditures equations. Instead each demographic variable is assumed to have a common overall effect on each commodity. These effects are denoted by the kxl vector D_o.

The estimating equation for total food expenditures is,

$$(E + p_aA - S_o)/Y = et_1/et_2 \qquad (12)$$

where $et_1 = c' + (SA1-a_{14})\ln(S_o) - (SA1+SA2+SA3)\ln(Y) + 3D'_{to}Z$

$et_2 = 1 + SA1\ln(S_o) - (SA1+SA2+SA3+SA4)\ln(Y) + 4D'_{to}Z$

and $c' = a_1+a_2+a_3 +(SA2-a_{24})\ln(p) +(SA3-a_{34})\ln(p_a) +(SA4-a_{14})\ln(p_o)$.

Both (11) and (12) were estimated using nonlinear least squares. These estimates are given below with standard errors in parentheses. Demographic variables are defined in table 1.

Food at-home

$c = 36.19$ (14.30) $\quad SA1 = 2.95$ (1.25) $\quad a_{134} = 4.06$ (2.16)

$SA2 = 3.13$ (2.65) $\quad SA3 + SA4 = -6.59$ (3.58)

$D'_{to}Z = 2.82$ NUM (0.64) $+ 3.35$ GM (0.61) $+ 1.91$ U/R (0.59) $- 0.54$ REGION (0.44) $+ 0.72$ RACE (0.47) $- 1.59$ SLR (0.99)

-3.93 P1 (2.18) $+ 0.43$ P2 (1.89) $+ 0.57$ P3 (1.02) $+ 9.48$ P4 (2.82) $- 0.35$ ELD (0.53) $+ 1.14$ WEL (0.48)

Total Food

$$c' = \underset{(22.51)}{34.42} \quad SA1 = \underset{(0.67)}{0.42} \quad a_{14} = \underset{(1.01)}{1.89}$$

$$SA2 + SA3 = \underset{(2.31)}{4.85} \quad SA4 = \underset{(3.06)}{-7.51}$$

$$D'_{to}Z = \underset{(0.52)}{1.53}\ NUM + \underset{(0.40)}{0.85}\ GM + \underset{(0.29)}{0.59}\ U/R - \underset{(0.28)}{0.29}\ REGION + \underset{(0.25)}{0.16}\ RACE - \underset{(0.73)}{1.02}\ SLR$$

$$\underset{(1.72)}{-2.66}\ P1 - \underset{(1.08)}{0.10}\ P2 + \underset{(0.85)}{1.90}\ P3 + \underset{(2.07)}{4.58}\ P4 - \underset{(0.37)}{0.34}\ ELD + \underset{(0.12)}{0.30}\ WEL$$

The mean ratio of the MPS's for at-home and total food expenditures are reported in table 4. Values of the mean MPS(Y) and MPS(S_o) are reported in table 5.

The results from table 4 indicated that the mean ratio MPS(S_o)/MPS(Y) for both at-home and total food expenditures using the translog functional form are greater than one but less than the ratios calculated from the linear in the coefficient specifications. Based on a two standard error interval, the difference is significant for the linear and semi-log but not for the double-log. Consequently, neither the linear nor the semi-log expenditure equation are supported by the data.

With the estimated translog specification the mean ratio is smaller than the ratio of the means which implies that households with large MPS(S_o) also have large MPS(Y). Specifically, the mean ratio for at-home food expenditures is 2.7 while the ratio of the mean MPS's is 3.6.

From a policy viewpoint, a positive correlation between the MPS's implies that the potential impact on food expenditures of a cash-out program would be smaller than if a nonpositive correlation existed. This follows since households that would have the largest reduction in food expenditures with the loss of food stamps will also be the ones whose

increase in food expenditures from the corresponding cash transfer will be the largest.

Since both the linear and semi-log versions imply that the marginal propensities are uncorrelated, the existence of a correlation is evidence of the failure of these functional forms to approximate the correct expenditure equation. The MPS's in the double-log version, on the other hand, are negatively correlated. In light of the positive correlation obtained with the more general translog specification, this negative correlation implies an unduly restrictive expenditure equation.

3.2.3 Effect of the Demographic Variables

The marginal impacts of the ith demographic variable on at-home and total expenditures (11)-(12) are:

$$\delta E/\delta Z_i = d_{hoi}.E_d \quad \text{and} \quad \delta TE/\delta Z_i = d_{toi}.TE_d$$

where

$$E_d = (Y/h_2)[2-4(h_1/h_2)] \quad \text{and} \quad TE_d = (Y/t_2)[3-4(t_1/t_2)]$$

where the d_{oi}'s are the coefficients corresponding to the ith demographic variable. At mean levels, $E_d = 5.34$ and $TE_d = 9.06$.

The demographic variables with the greatest impact on food expenditures are household size and age composition. Both the linear in the coefficients and the translog specifications identify family size as a significant determinant of food expenditures. Both specifications also identify (1) that an increase in the proportion of family members less than 3 years old decreases food expenditures (however, the effect is not precisely estimated), (2) that an increase in the proportion of family members between 20 and 39 year old increases food expenditures and (3) that the proportion of members between 13

and 19 years of age increases total food expenditures but not at-home food expenditures.

The major difference between the translog and the linear in the coefficients specifications in identifying demographic determinants of food expenditures occurred with the variable measuring the enrollment in other welfare programs. The translog specification identified this variable as significant in determining food expenditures. This result suggests the existence of cross program effects.

Other variables that were generally found to be significant by all specifications in determining food expenditures were the number of guest meals and living in an urban area. The linear version for both type of expenditure and the semi-log for at-home food expenditures also identified region as a significant factor.

4. Implication of the Estimated MPS's for a Cash-only Food Stamp Program.

A ratio of the MPS's greater than one has been used to argue that cashing-out of the FSP would result in a decline in food expenditures. However, the ratio of the MPS's can be used in this manner only if the functional form is linear. For other functional forms with non-linear marginal propensities no single point can measure the impact of a cash-only program.

Cashing out the FSP has two effects on food expenditures. First, food expenditures decline because of the loss of food stamps. In general, the decline in expenditures would be measured by integrating $MPS(S_o)$ over $[S_o,0]$ holding income constant. Equivalently, this effect can be measured by the difference between actual food expenditures and expenditures when no stamps are available holding income constant.

The second effect of cashing only the FSP is an increase in food expenditures resulting from the income transfer equal to the value of the food stamps. This effect equals the difference between food expenditures at the new income level and at the beginning income level, both evaluated at $S_o = 0$. The MPS(Y) schedule shifts upward when stamps are cashed out since food bought with income and stamps are substitutes.

In this paper, the ratio of the decline in food expenditures with the loss of food stamps to the gain in food expenditures from the income transfer is denoted as the expenditure ratio. This ratio is comparable to the ratio of the MPS's given in table 4. The difference between an expenditure ratio and a ratio of the MPS's is that the ratio of the MPS's is evaluated at just two points on the MPS's schedules whereas the expenditure ratio is based on expenditure levels evaluated over the range relevant for cashing-out the Food Stamp Program.

Table 6 gives mean expenditure ratios across households relevant to judging the impact of cashing-out the FSP. These ratios are given by functional form and type of expenditures. These ratios are interpreted as the " reduction in food expenditures from the loss of food stamps is __ times the increase from the income transfer."

For both the double-log and the translog specification the expenditure ratios are reduced substantially compared to their mean ratios reported in table 4. In fact, for the translog specification the results in table 6 imply that cashing-out the FSP will increase both at-home and away-from-home food expenditures. However, the ratios are not statistically significantly different from one using a two standard deviation test. In any case, this result is in marked contrast to previous conclusions about the impact of food stamps and income on food expenditures.

5. Conclusion

Results presented in this paper using the flexible translog expenditure equation indicate that previous estimates of the marginal propensity to spend on food using linear in the coefficients specifications overstate the impact of food stamps relative to income for generating both at-home and total food expenditures.

From a policy viewpoint this result is important for what it implies about a cash-only Food Stamp Program. Significant opposition to such a program has been based on a belief that food consumption would fall significantly if cash was provided in lieu of stamps. This paper concludes that the estimated effect of a cash-only Food Stamp Program on net food expenditures depends upon the functional form used to estimate the MPS's. However, this conclusion holds only to households enrolled in the program and who spend all their stamps.

When the MPS's are non-linear, as the results from the translog specification indicate, the ratio of the mean MPS's (or the mean ratio) cannot measure the effect on food expenditure of a cash-only program. Instead, the change in expenditures when food stamps go to zero and income is at its current level must be compared to the change in expenditure with no food stamps and income increases from its current level by an amount equal to the valve of the food stamps. When this comparison was made for the set of households used in this paper the net change in expenditures resulting from a cashing out of the program varied widely according to functional form. For both the double-log and the translog specifications the effect was smaller than predicted by the ratio of the MPS's. With the translog version a cash-only program was predicted to have no effect on food expenditures.

Besides the relative impact of food stamps or income on food expenditures any conversion of the Food Stamp Program to a cash-only program would face

other obstacles. For example, taxpayers have a strong preference for a program that is tied explicitly to food. In addition, as a food program, the Food Stamp Program can maintain a unique identity that distinguishes it from other cash welfare programs run by different agencies. An important aspect of a cash-only program that hasn't been addressed in this paper is the likely magnitude of the increased enrollment of the eligible non-participants that such a program would create.

Table 1: Expenditure Equation by Specification and Implied Ratio of the MPS's.

Specification[a]	$MPS(S_o)/MPS(Y)$
Linear	
$E = a + bY + cS_o$	c/b
Semi-log[b]	
$E = a + b\ln(Y) + cS_o$	$(c/b)\cdot Y$
Double-log[b,c]	
$\ln(E) = a + b\ln(Y) + cS_o/Y$	$(b/c - S_o/Y)^{-1}$
Translog[d]	
Defined in (9) and (11)	$\dfrac{1 + (Y/S_o)(1/eh_2)[(1-w)SA1 - a_{134}]}{w + (1/eh_2)[w(SA3+SA4) - (1-w)(SA1+SA2)]}$

a. E is expenditures and w is the appropriate share out of money income.
b. The versions of the semi-log used by Neenam and Davis and the double-log used by Senauer and Young were specified so that the expenditure equation of the non-participants could be estimated with the participants. However, previous studies have found no sample selection bias between the two groups (Devaney and Fraker, Ranney and Kushman).
c. This version is called the double-log because it can be written $\ln(E) = a + b\ln(Y) + \ln(1+cS_o/Y)$ using the approximation $\ln(1+a)=a$ providing $|a|\leq 1$.
d. Defined for at-home expenditures.

Table 2: Variable Definitions and Sample Means

Variables		Sample Means
N:	Number of food stamp recipients	1210
L:	At-home food expenditures in excess of food stamps as a proportion of after tax income	0.34
Food:	Monthly expenditure on food at-home	$199.29
Total:	Monthly expenditure on all food	$218.75
Y:	Monthly household income after taxes	$358.17
S_o:	Monthly value of food stamps	$ 89.27
Y/S_o:	Income/Food Stamp ratio	7.43
NUM:	The number of household members.	3.15
P1:	The proportion of household members under age 3.	0.06
P2:	The proportion of household members between ages 3 and 12.	0.17
P3:	The proportion of households members between ages 13 and 19.	0.18
P4:	The proportion of household members between ages 20 and 39.	0.11
RACE:	equals 1 if white; 0 otherwise	0.40
REGION:	equals 1 if household located in the South; 0 otherwise.	0.66
U/R:	equals 1 if household is located in an urban area; 0 otherwise.	0.53
SLR:	equals 1 if household had school lunches at reduced prices; 0 otherwise.	0.41
GM:	Number of guest meals served by the household.	0.60
ELD:	equals 1 if member of the household is 60 years or older; 0 otherwise.	0.37
WEL:	Average number of assistance programs other than food stamps	0.73

Table 3: Estimates of the Food at-home and Total Food Expenditure Equations Using the Traditional Linear in the Coefficients Specifications[a]

	At-home			Total		
Variables	Linear	Semi-log	Double-log	Linear	Semi-log	Double-log
Y	0.078 (0.012)			0.100 (0.010)		
ln(Y)		35.44 (4.91)	0.40 (0.04)		42.41 (5.82)	0.41 (0.04)
S_o	0.475 (0.050)	0.50 (0.05)		0.414 (0.060)	0.44 (0.06)	
S_o/Y			0.52 (0.06)			0.51 (0.06)
Constant	26.09 (7.96)	-145.12 (27.38)	2.18 (0.20)	26.63 (9.41)	-176.79 (32.42)	2.16 (0.21)
P1	- 9.23 (17.88)	- 8.13 (17.32)	0.12 (0.09)	-26.42 (20.53)	- 25.59 (20.50)	0.07 (0.09)
P2	10.12 (13.71)	6.70 (13.68)	0.24 (0.07)	- 1.30 (16.91)	- 5.23 (16.19)	0.23 (0.07)
P3	2.21 (10.45)	1.02 (10.22)	0.09 (0.05)	9.13 (4.21)	28.24 (12.10)	0.23 (0.06)
P4	61.55 (15.10)	57.05 (15.05)	0.43 (0.08)	70.83 (17.82)	65.49 (17.82)	0.47 (0.08)
RACE	10.09 (9.99)	9.02 (4.48)	0.05 (0.02)	5.93 (5.30)	4.91 (5.31)	0.03 (0.02)
REGION	-11.70 (4.36)	- 10.59 (4.26)	-0.02 (0.02)	-10.54 (5.16)	- 9.41 (5.31)	-0.02 (0.02)
U/R	18.35 (4.27)	17.48 (4.26)	0.06 (0.02)	19.91 (5.05)	18.74 (5.04)	0.06 (0.02)
SLR	-5.20 (6.66)	- 6.54 (6.64)	-0.01 (0.03)	- 9.70 (7.89)	- 10.57 (7.86)	-0.02 (0.04)
NUM	25.60 (1.95)	24.37 (1.98)	0.10 (0.01)	31.164 (2.29)	30.72 (2.34)	0.11 (0.01)
GM	10.65 (1.22)	10.51 (1.21)	0.05 (0.01)	10.53 (1.44)	10.45 (1.44)	0.05 (0.01)
ELD	- 3.57 (6.06)	- 2.80 (6.03)	-0.04 (0.03)	- 7.46 (7.16)	- 10.54 (7.14)	-0.06 (0.03)
WEL	5.13 (3.46)	4.50 (3.45)	0.03 (0.02)	3.71 (4.08)	2.83 (4.08)	0.02 (0.02)

a Standard errors are given in parentheses.

Table 4: Mean Value of the Ratio $MPS(S_o)/MPS(Y)$ for At-home and Total Food Expenditures for Alternative Functional Forms.

Expenditures:[a]	At-Home	Total
Functional Form:		
Linear in the Coefficients		
Linear	6.09 (0.955)	4.14 (0.693)
Semi-log[b]	5.06 (0.681)	3.72 (0.571)
Double-log	3.82 (0.460)[c]	3.08 (0.411)[c]
Translog	2.70 (0.510)[c]	2.11 (0.450)[c]

a. Standard errors in parentheses.
b. Evaluated conditional on mean income.
c. Standard error of the mean.

Table 5: Mean Marginal Propensities to Spend Out of Food Stamps and Money Income for Food at-home and Total Food by Functional Form[a]

Expenditures:	At-Home		Total	
	$MPS(S_o)$	MPS(Y)	$MPS(S_o)$	MPS(Y)
Functional Form:				
Linear in the Coefficients				
Linear	0.475	0.078	0.414	0.100
Semi-log[a]	0.500	0.099	0.440	0.118
Double-Log[b]	0.288	0.094	0.316	0.114
Translog	0.688	0.189	0.816	0.230

a. Evaluated at the mean food expenditure levels.
b. Evaluated at the mean income, food stamp and expenditure levels.

Table 6: Expenditure Ratios Measuring the Effect of Cashing-out the Food Stamp Program for At-home and Total Food Expenditures by Alternative Functional Form (standard error of the mean in parentheses)[a]

	At-Home	Total
Functional Form:		
Linear in the Coefficients		
Linear	6.09 (0.96)[b]	4.14 (0.69)[b]
Semi-log	5.06 (0.08)	3.72 (0.06)
Double-log	1.56 (0.05)	1.48 (0.04)
Translog	0.91 (0.08)	0.88 (0.07)

a. Entries should be interpreted as follows. The reduction in food expenditures from the loss of food stamps is ____ times the increase resulting from the income transfer.
b. standard error

FOOTNOTES

1. Versions of the semi-log and double-log were defined to avoid including $\log(S_o)$ for non-recipients. However, this paper considers only food stamp recipients. The food expenditure specification used by Huang, Fletcher and Raunikar and by Senauer and Young are within a Tobit model.

2. Only for the linear specification will this ratio equal the mean ratio of the MPS's. For other functional forms, in which the MPS's are nonlinear, the ratio of the means will not equal mean ratio.

3. Prior to January 1979, the Food Stamp Program contained a purchase requirement. Under this program all households of the same size received the same allotment of food stamps. However, the amount households paid for these stamps varied by household income.

4. The number of food stamp recipient households who did not spend all their food stamps represent approximately 11 percent of the sample,

REFERENCES

Clarkson, Kenneth. Food Stamps and Nutrition. Washington DC: American Enterprise Institute, 1975.

Chavas, Jean-Paul and M.L. Young. "Effects of the Food Stamp Program on Food Consumption in the Southern United States." Southern Journal of Agricultural Economics. 14(1982) 131-39.

Devaney, Barbara and Thomas Fraker. "Cashing Out Food Stamps: Impact on Food Expenditures and Diet Quality." Journal of Policy Analysis and Management. 5 (Summer, 1986): 725-41.

Hu, Teh-Wei and Norman Knaub. "The Effect of Cash and In-Kind Welfare Payments on Family Expenditures." Policy Analysis. 2 (Winter, 1976): 71-92.

Huang, Chung L., Stanley Fletcher and Robert Raunikar. "Modeling the Effects of the Food Stamp Program on Participating Households' Purchases: An Empirical Analysis." Southern Journal of Agricultural Economics. 13 (December, 1981): 21-8.

Lau, L. J. "Complete Systems of Consumer Demand Functions Through Duality" in M. D. Intriligator, ed. Frontiers of Quantative Economics. Vol. IIIa. (North-Holland: Amsterdam) 59-86.

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

Neenan, P.H. and C.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.

Olsen, Edgar O. "Some Theorems in the Theory of Efficient Transfers." Journal of Political Economy. 77 (1971): 166-76.

Ranney, Christine and John Kushman. "Cash Equivalence, Welfare Stigma and Food Stamps." Southern Economic Journal. 54 (April, 1987): 1011-27.

Senauer, Ben and Nathan Young. "The Impact of Food Stamps on Food Expenditures: Rejection of the Traditional Model." American Journal of Agricultural Economics. 68 (1986): 37-43.

Smallwood, David M. and James R. Blaylock. "Analysis of Food Stamp Program Participation and Food Expenditure." Western Journal of Agricultural Economics. 10 (July, 1985): 41-54.

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

West, D.A. and D.W. Price. "The Effect of Income, Assets, Food Programs and Household Size on Food Consumption." American Journal of Agricultural Economics. 58 (1976): 725-30.