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**FOOD STAMP PARTICIPATION AMONG LOW-INCOME HOUSEHOLDS:
THEORETICAL CONSIDERATIONS OF THE IMPACT ON THE DEMAND FOR FOOD***

Ron Mittelhammer and Donald A. West

The USDA's Food Stamp Program (FSP) is a major item in the department's budget. In effect from 1939 to 1943 and revived as a pilot program in 1961 [4:26-31], FSP has grown until, in 1973, it provided nearly \$4 billion in food stamps to an average of 12 million persons per month [9:568]. About 55 percent of the \$4 billion is federal subsidy. The program is continuing to expand as a result of a congressional mandate that FSP be in effect nationwide after June 30, 1974 [5:8]. Because of the FSP's growth, questions are now being asked about the program's impact on demand for food in the United States [for example, see 3].

In its pre-World War II inception, FSP was developed as an alternative to direct distribution of commodities to relief families [7:38-43]. Although the objective of improving food consumption among needy households was recognized, FSP was viewed primarily as a method for stimulating demand for farm products.¹ This latter objective is still recognized [6:387], but its importance seems diminished in an era when agricultural surpluses are not burdensome. Current concern, in contrast, centers more on the effect of an expanded FSP on the already strong demand for food.

The purpose of this paper is to examine the

impact of FSP on spending decisions of recipients and on the resulting demand for food. The effect of FSP transfer on household income and food expenditure patterns is analyzed.² Consumption theory and empirical illustrations are used to indicate how households under the program would alter their food expenditures. Brief comments are made regarding FSP's merits for needy households.

THEORETICAL CONSIDERATIONS

In 1945, Southworth [7] postulated an indifference framework for analyzing the effect of in-kind transfers on spending decisions of a consuming unit. That framework, modified to represent FSP purchase options is presented in Figures 1A and 1B.

Assume that a household has the initial budget constraint, AA', in Figure 1A. An eligible³ household may purchase food stamps in quarterly increments up to the maximum value of stamps specified for that household, given its size and net monthly income. In 1973, a family of four with a net monthly income of \$300 could purchase a maximum food stamp allotment of \$112 per month for \$82 and receive a net subsidy of \$30. The household had the option of purchasing any quarterly fraction of its maximum allotment

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* Paper presented at the Annual Meeting of the Southern Agricultural Economics Association, New Orleans, Louisiana, February 3-5, 1975.

¹ It should be noted that these objectives are consistent with one another to the extent the FSP transfers provide the potential for improving food consumption.

² Note that under the in-kind provision of FSP, most old food items in retail stores can be bought with food stamps. All non-food items such as tobacco products, soaps, pet food, etc., cannot be purchased with stamps.

³ To be eligible for the program, the household must possess less than \$1,500 in liquid assets (\$3,000 for elderly couple) and qualify under the net income guidelines. Net income of a household is gross income adjusted downward for taxes, medical costs, child care, disaster and educational expenses and excessive shelter costs. (See reference 10 for a more detailed explanation).

Figure 1A. FOOD STAMP PURCHASE OPPORTUNITIES

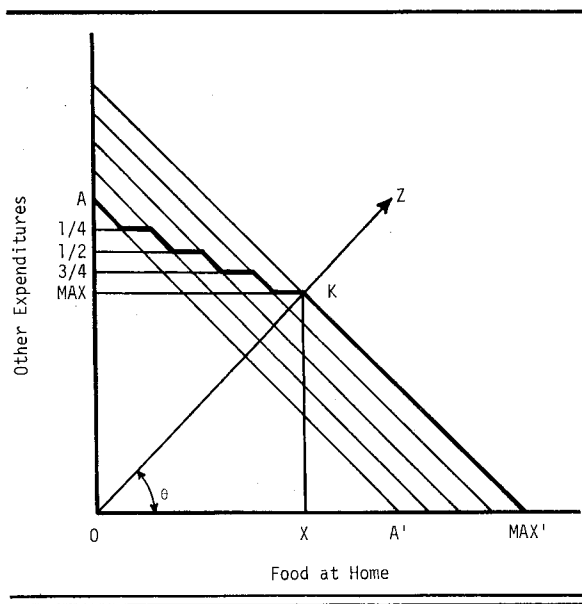
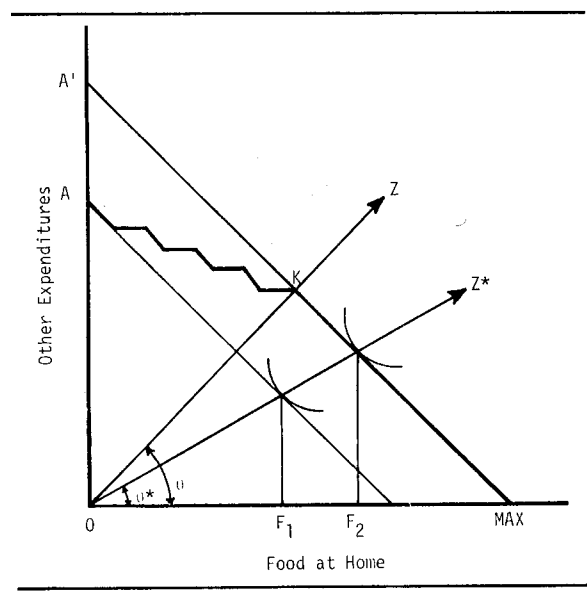


Figure 1B. CASE 1 — $\theta^* < \theta$, EQUILIBRIUM ON OZ LINE — IN-KIND PROVISION INOPERATIVE



with a proportional decrease in the subsidy it received.

These food stamp purchase opportunities are illustrated in Figure 1A. An eligible household with monthly income OA could purchase its maximum food stamp allotment at a cost of A-MAX, receiving MAX-K (equivalent to OX) in food

stamps, the difference between cost and value being subsidy (\$112-\$82 = \$30 in our example). Since food stamp transfer is in-kind, the relevant budget line for a household choosing the maximum allotment is the kinked line MAX-K-MAX'. Similar budget lines can be constructed to represent purchase of any quarterly increment of the maximum. The heavy black line, AK-MAX', is the budget constraint of the household.

Given this budget line, a rational household will purchase that amount of stamps which enables it to reach its highest indifference curve. For purposes of analysis, we assume the household possesses a utility function, $U(\bullet)$, homogeneous of degree K, such that:

$$U(tX_1, tX_2) = t^K U(X_1, X_2) \quad (1)$$

where X_1 is quantity of food consumed at home, X_2 is quantity of other expenditures, t has an arbitrary numerical value, and K is the degree of homogeneity.

For increasing amounts of income, maximization of the homogeneous utility function will trace an income-consumption line, such as OZ (Figure 1A), emanating from the origin. Given constant prices, tangency of budget constraints and indifference curves will occur along a locus of points (tX_1, tX_2) :

$$\frac{P_{x_1}}{P_{x_2}} = \frac{MU_{x_1}}{MU_{x_2}} = \frac{U_1(tX_1^\circ, tX_2^\circ)}{U_2(tX_1^\circ, tX_2^\circ)} = \frac{U_1(X_1^\circ, X_2^\circ)}{U_2(X_1^\circ, X_2^\circ)}$$

where U_i represents the derivative of the utility function with respect to the i^{th} expenditure item.

A resulting vector OZ passes through point K of the budget constraint. Note that $KX/OX = \tan \theta$, defining a particular angle θ that the vector OZ forms with the food axis where KX is amount of income remaining after purchase of food stamps and OX represents the value of food stamps purchased. We define two cases, using vector OZ and angle θ as the discriminant. In one case, food expenditures expand by amounts consistent with the household's income elasticity of demand for food consumed at home. In the second case, food expenditures increase by additional amounts, the added incentive being attributable to in-kind provisions of the FSP.

In theory, it is possible to construct specific income-consumption lines given a household's utility surface and constant product prices as de-

scribed in Case 1 below.⁴

Case 1: ($\theta^* < \theta$) If household's income consumption vector is such that $\tan \theta^* < \tan \theta$ (see Figure 1B), i.e., the amount spent for food consumed at home is greater than the maximum food stamp allotment, that household can be expected to increase expenditures for food along a vector such as OZ*. Given an increase in income as provided by FSP, food expenditures would increase from OF₁ to OF₂. If recipients were alternatively given a transfer of cash equivalent to the food stamp subsidy, their equilibrium level of food purchased and its utility would not change. In this case, the in-kind provision of the FSP is not restrictive.

The general criterion that can be used to distinguish Case 1, independent of the homogeneous utility function assumption, is whether tangency of indifference curve and budget line occurs to the right of the kink, K. A simple empirical test for this case is whether or not the household's food purchases are greater than its maximum food stamp allocation. Households not purchasing additional food belong to Case 2.⁵

Case 2: ($\theta^* > \theta$) If the income-consumption vector is such that $\tan \theta^* > \tan \theta$ (see Figure 2), the amount spent for food consumed at home is less than the maximum food stamp allotment. A household, in this case, will purchase more food under FSP than would be expected strictly as a result of the increase in income, given the household's income-elasticity for food expenditure. This added incentive to purchase food stems from the in-kind provision of FSP. We assume these low-income households do not become satiated with food within their range of choices, i.e., the marginal rate of substitution (MRS) of food for other

$$\text{items} = \frac{dx_2}{dx_1} > 0.$$

Figure 2A. CASE 2 — $\theta^* > \theta$, MRS DECLINING RAPIDLY

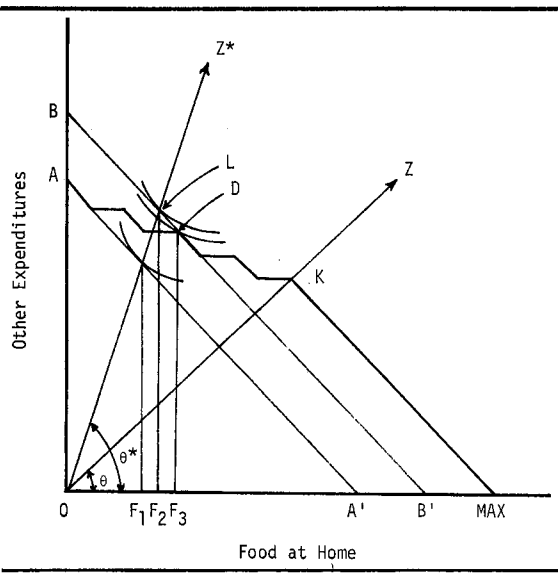


Figure 2A illustrates Case 2 where the MRS is declining rapidly. The household originally purchases OF₁ amount of food. Given an unrestricted subsidy of AB, expansion along the income-consumption vector OZ* indicates a tangency of the indifference curve with BB' at L and a food purchase equal to OF₂. Where a household is restricted to the kinked portion of the budget constraint by in-kind provisions of FSP, its highest attainable level of utility is represented by the indifference curve passing through point D. Utility maximization results in food purchases equal to

⁴ The equality of the ratio of marginal utilities to price ratios of the two goods can in general be represented as an implicit function of the form:

$$g[X_1, X_2] = 0$$

Taking the differential: $g_1 dx_1 + g_2 dx_2 = 0$

$$dx_2 = -\frac{g_1}{g_2} dx_1$$

Rewriting the arbitrary increments dx_2 and dx_1 :

$$(X_2 - X_2^0) = -\frac{g_1}{g_2}(X_1 - X_1^0)$$

$$X_2 = X_2^0 + \frac{g_1}{g_2} X_1^0 - \frac{g_1}{g_2} X_1$$

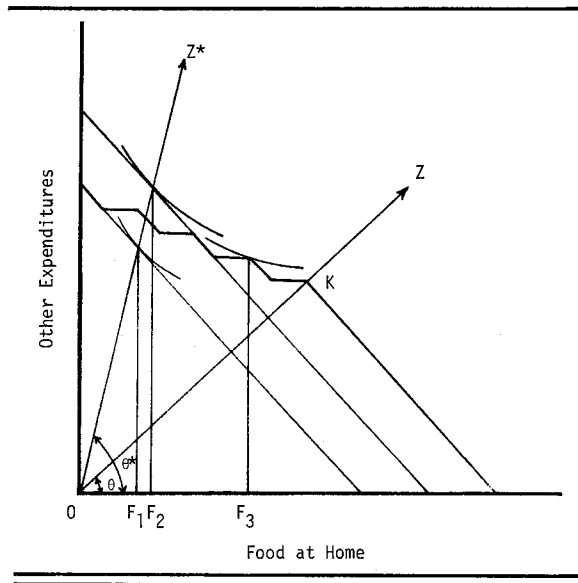
the income-consumption line is expressed explicitly if g_1 and $g_2 \neq 0$. But g_1 and g_2 are unequal to zero by the assumption of convex indifference curves, since:

$$g_1 = \frac{\partial}{\partial X_1} \left[\frac{U_1(X_1, X_2)}{U_2(X_1, X_2)} - \frac{PX_1}{PX_2} \right] = \frac{\partial}{\partial X_1} \left[\frac{U_1(X_1, X_2)}{U_2(X_1, X_2)} \right] = -\frac{\partial^2 X_2}{\partial X_1^2} < 0$$

and similarly for g_2 .

⁵ If a household purchases food exactly equal in value to the maximum food stamp allotment, it could belong to either case. This condition may be distinguished by examining a tangency condition of the indifference curve through that point. Partitioning of households assumes the desired market basket of food can be purchased with food stamps.

Figure 2B. CASE 2 — $\theta^* > \theta$, MRS DECLINING SLOWLY



OF_3 . The additional food purchased, F_2F_3 , is directly attributable to in-kind provisions of FSP.

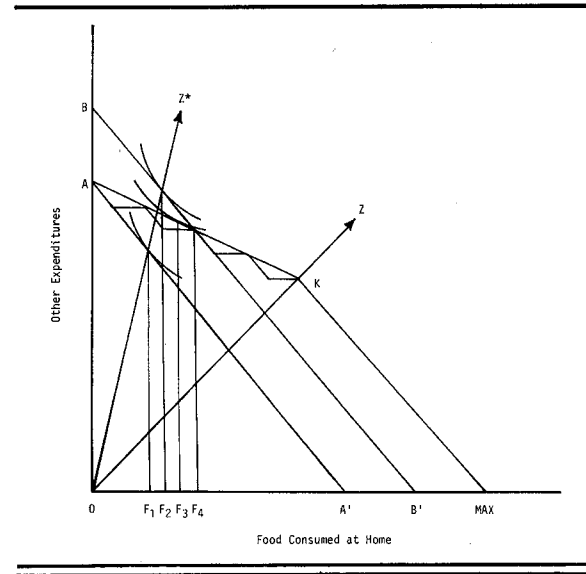
Amounts of additional food purchased under FSP clearly depend on the position and curvature of the indifference curves. Figure 2B illustrates Case 2 when the MRS declines more slowly, and additional food purchased is F_2F_3 . This is greater than when the decline in MRS was rapid. However, it seems that individuals possessing a high affinity for nonfood items, and expanding consumption along an income-consumption vector with θ^* substantially greater than θ , would possess indifference curves more like those in Figure 2A. Note that the form of transfer in Case 2 does influence behavior; an equivalent transfer with no in-kind restrictions, e.g., a cash transfer, would result in less food purchased and a higher level of utility. In general, without requiring that the utility function be homogeneous, a household belongs to Case 2 if it purchases less food for home consumption than allowed under its maximum food stamp allotment.

Analysis of Case 2 implicitly assumes that food stamps are not stored from month to month.⁶ Without this assumption, the budget constraint could be interpreted as an approximate straight line representing continuous combination of food stamp usage over time (Figure 3). In this case, the

relevant budget constraint is line AK-MAX, with only one kink at K.⁷

In this adaptation of Case 2, amounts of additional food purchased under the in-kind provision of FSP are reduced. Figure 3 illustrates the pre-transfer expenditure on food as OF_1 , given the initial budget line AA'. With a transfer of AB dollars, and in the absence of an in-kind provision we would expect food expenditures to increase to OF_2 . With the in-kind provision operative, but in the absence of storage over time, we would expect food expenditures to increase by F_2F_3 to OF_3 (given $MRS > 0$ as before, and

Figure 3. DAMPENING EFFECT OF STORAGE OF FOOD STAMPS



rapidly declining MRS as in Figure 2A; the additional effect would be greater if MRS declined more slowly as in Figure 2B). Given in-kind provision and storage over time, a tangency with straight line AK is possible, and should generally cause a dampening effect, as F_3F_4 , on the additional incentive to purchase food. The net result would be food purchases equal to OF_4 .

EFFECT ON AGGREGATE DEMAND FOR FOOD

For all N_1 households belonging to Case 1, aggregate increases in expenditures for food consumed at home can be forecast, all other things

⁶ Food stamps can be purchased in one month, and used in following months, as there is no restriction on intertemporal use.

⁷ For a household to attain a point on the budget constraint where AK approximates a straight line, it would have to purchase a combination of quarterly increments over time that would average out to that particular point, i.e., buy more than is needed one month, less the next, etc.

constant, by:⁸

$$\sum_{i=1}^{N_1} E_i S_i W_i = \text{Change in Aggregate Food Expenditures} \quad (3)$$

where: E_i = income elasticity of the i^{th} household,
 S_i = ratio of the food stamp subsidy to pre-transfer income of the i^{th} household (proportional change in income),
 W_i = pre-transfer food expenditure of the i^{th} household.

Empirical analysis of the consumption behavior of Case 2 households is much more difficult. The use of relationships (3) here will underestimate the change in food expenditures, but the degree of underestimation cannot be readily determined. Theoretically, food expenditures increase for all N_2 households in Case 2 can be represented by:

$$\sum_{i=1}^{N_2} E_i S_i W_i + F_i = \text{Change Aggregate Food Expenditures}$$

where E_i , S_i , and W_i are the same as before, and F_i represents purchase of additional food as motivated by the in-kind provision of FSP. Overall food expenditure increases could then theoretically be determined by merging (3) and (4).

The procedure's primary obstacle is determination of F_i , as no data are available on actual household behavior under Case 2. A carefully controlled social experiment in which similar households are given a transfer with and without

an in-kind provision may be necessary to generate accurate data.

However, relative importance of each of the two cases should be determined. Survey data from households participating in the FSP could be used. An estimate of numbers of households in each case can be determined, using the test of whether or not households spend more for food at home than their maximum food stamp allotments allow. The relative importance of added incentives to purchase food under the in-kind provision of FSP increases proportionately to the number of households for whom the provision is operative (Case 2).

EMPIRICAL ANALYSIS

Empirical analysis of FSP's effect on demand for food is hampered by lack of recent data on household expenditures for food. One of a few reliable sources is the Bureau of Labor Statistics' 1960-61 Survey of Consumer Expenditures [12].⁹ These BLS data were used to develop a schedule of mean incomes and food expenditures for households of six or more persons presented in Table 1.¹⁰ The schedule, restricted to households with annual incomes below \$5,000 in 1960-61, indicated that percentage of income allocated to food consumed at home decreases as household income rises. The income elasticity of food expenditure varies at lowest income categories due to dissaving; in general, however, it also decreases as incomes become larger¹¹ [see 13:100-101 for data

⁸ Let Q_F = Total consumption of food-at-home by the N_1 households
 Then:

$$Q_F = \sum_{i=1}^{N_1} Q_{iF} \text{ with } Q_{iF} = Q_{iF}(P_1, \dots, P_n, I), \text{ in general.}$$

$$\text{Now: } dQ_{iF} = \frac{\partial Q_{iF}}{\partial P_1} dP_1 + \dots + \frac{\partial Q_{iF}}{\partial P_n} dP_n + \frac{\partial Q_{iF}}{\partial I} dI$$

If all prices remain constant, i.e., $dP_i = 0, i=1, \dots, n$, then:

$$\begin{aligned} dQ_F &= \sum_{i=1}^{N_1} \frac{\partial Q_{iF}}{\partial I_i} dI_i \\ &= \sum_{i=1}^{N_1} \frac{\partial Q_{iF}}{\partial I_i} \cdot \frac{I_i}{Q_{iF}} \cdot \frac{dI_i}{I_i} \cdot Q_{iF} \\ dQ &= \sum_{i=1}^{N_1} N_{iF} \cdot \frac{dI_i}{I_i} \cdot Q_{iF} \end{aligned}$$

where N_{iF} is the income elasticity for food consumed at home for the i^{th} household. Multiplying both sides of the equation by the price of food consumed at home yields change in aggregate expenditure associated with small changes in income.

⁹ The U.S.D.A. Household Survey of 1965, while more recent, tends to overestimate food expenditures and contains less accurate data on income (see 1:26-27).

¹⁰ The choice of family size is arbitrary. Although a family of four is a commonly used measure, a higher percentage of large families tend to have low incomes. Consequently, results are presented for families which average seven persons in size (see 11:65).

Table 1. ANNUAL FAMILY FOOD EXPENDITURES AND INCOME, 1960-61: U.S. FAMILIES WITH SIX OR MORE PERSONS BY SELECTED INCOME CATEGORIES WITH ADJUSTMENTS TO 1973

Income and Food Expenditures in 1960-61				
Income Category	Mean Income ^a	Food Expenditures ^b	% of Income Spent on Food	Income Elasticity of Food Expenditure
\$ < 1000	\$ 637	\$ 550	86.3	---
1000-1999	1630	667	41.5	.24 ^c
2000-2999	2512	968	38.5	.83
3000-3999	3548	1157	32.6	.53
4000-4999	4633	1297	28.0	.43
5000-5999	5603	1481	26.4	.70

Amounts Adjusted to 1973 ^d				
Mean Income	Food Expenditures	% of Income Spent on Food	Income Elasticity of Food Expenditures	
\$ 928	\$ 783	84.4	---	
2385	964	40.4	.24	
3661	1378	37.6	.83	
5171	1648	31.9	.53	
6752	1847	27.4	.43	
8166	2109	25.8	.70	

^a Income after taxes and other money receipts.

^b Expenditures for food prepared at home.

^c Elasticities were calculated using the Arc elasticity formula:

$$\epsilon = \frac{E_2 - E_1}{E_1 + E_2} \div \frac{I_2 - I_1}{I_1 + I_2}$$

where E = expenditure and I = income.

^d Mean income is adjusted by the Consumer Price Index for all items. Food expenditures are adjusted by the food-at-home component of the Consumer Price Index.

SOURCE: U.S. Department of Labor, Bureau of Labor Statistics, "Consumer Expenditures and Income. Total United States, Urban and Rural, 1960-61," BLS Report No. 237-93, Supplement 3, Part A, May 1966, pp. 100-101.

on dissaving].

The income and food expenditure data was updated to 1973 (lower section) in Table 1. Income data were adjusted using the Consumer Price Index—all items. Food expenditures were adjusted using the food-at-home component of the Consumer Price Index.¹² Food prices rose at a rate just slightly less than the rate for all items; consequently, percentage relationships between mean income and food expenditures vary only slightly among the two time periods.

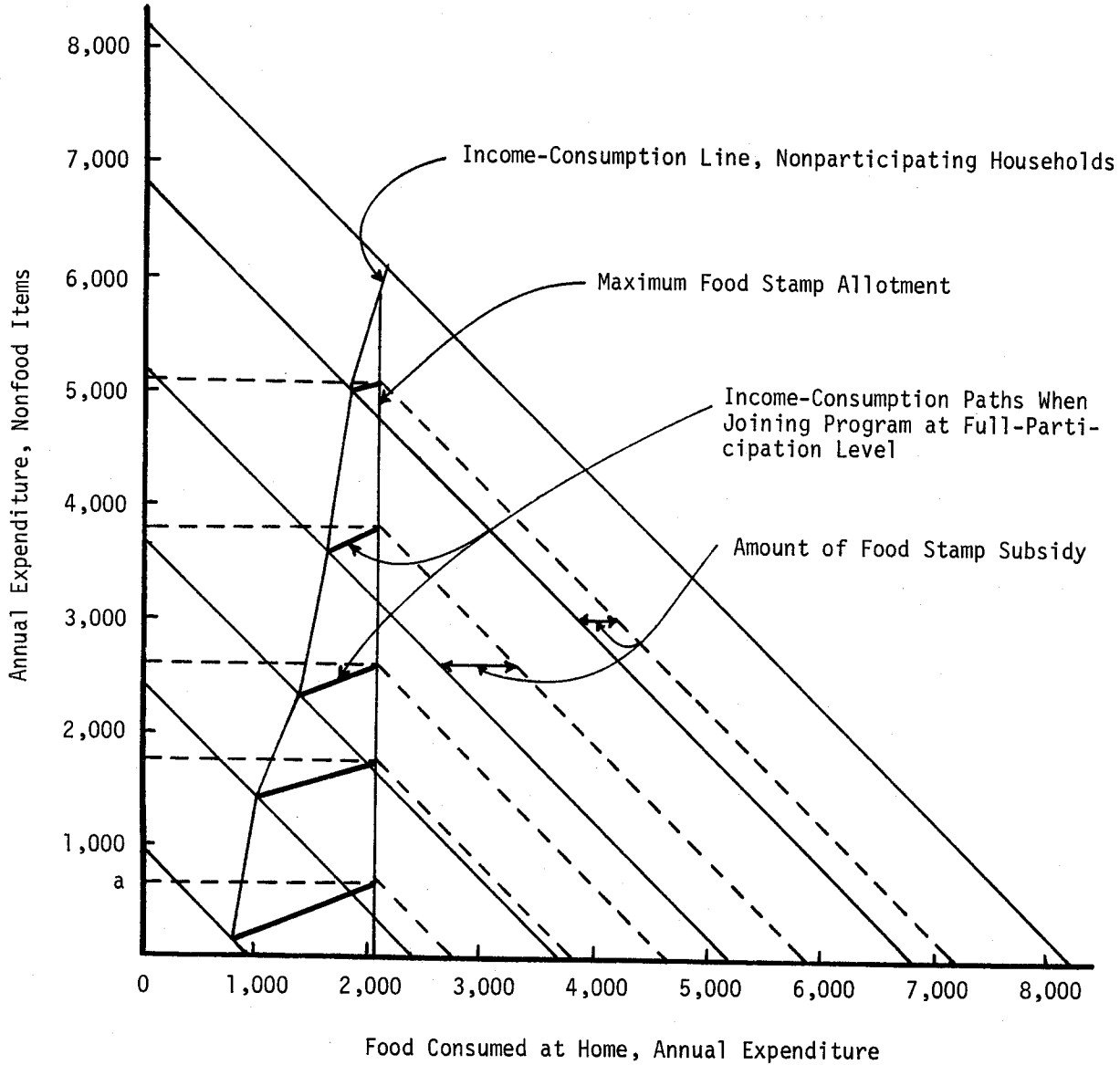
Income-consumption lines, based on BLS data

and updated to 1973, are graphed in Figure 4. The position of mean food expenditures can be compared with the maximum food stamp allotment (\$2,064 per year) available to families of seven persons in 1973.¹³ The mean food expenditures for families whose adjusted incomes are below \$3,000 are considerably less than the maximum food stamp allotment for seven-person families. The gap diminishes as incomes approach the (net) income maximum of \$7,200 which defined FSP eligibility for seven-person families during January to June in 1973.

¹² Index values of the CPI are for January of each year. These values are presented in (2).

¹³ The maximum food stamp allotment is calculated for a family of seven persons to be comparable with the mean family size of 7.0 for families in the BLS category containing six or more persons.

Figure 4. POSSIBLE INCOME-CONSUMPTION LINES FOR SEVEN-PERSON HOUSEHOLDS PARTICIPATING IN THE FOOD STAMP PROGRAM



^a The dashed lines represent budget lines which would exist if the maximum food stamp allotments were purchased. Similar lines could be drawn for fractional purchases as shown in Figure 1A.

Table 2 data have been assembled to illustrate the cost of food stamps and transfer subsidies in 1973 for typical seven-person families with the indicated pre-transfer incomes.¹⁴ Post-transfer budget lines, developed in the theoretical section and associated with the income levels, are also indicated in Figure 4. Heavy lines connect pre-

transfer food consumption (estimated from BLS data) with food consumption available to a seven-person family under its maximum FSP allotment. These lines indicate the slope of an income consumption line that could result if the family were to consume at its maximum allotment.

¹⁴ Note that we assume BLS data to be representative of behavior of households in a pre-transfer or non-participating sense, as the FSP program was only a pilot program at that point in time.

Table 2. ILLUSTRATION OF THE EFFECT OF FOOD STAMP PARTICIPATION ON INCOME AND FOOD EXPENDITURES FOR SEVEN-PERSON FAMILIES BY INCOME CATEGORY, JANUARY-JUNE, 1973

Annual Pre- Participation Income	Cost of Stamps ^a	Value of Subsidy	Annual Income with Participation	Maximum Allocation of stamps	Maximum Food Stamp Expenditure as % of Income
\$ 900	\$ 216	\$1,848	\$ 2,748	\$2,064	75.1
2,400	672	1,392	3,792	2,064	54.4
3,600	1,032	1,032	4,632	2,064	44.6
5,200	1,392	672	5,872	2,064	35.1
6,700 ^b	1,632	432	7,132	2,064	28.9
7,200 ^b	1,632	432	7,632	2,064	27.0

^a Annual cost of maximum allocation of stamps.

^b Seven-person families with adjusted net incomes in excess of \$7,199.88 were not eligible for FSP participation in January-June, 1973.

Comparison of income consumption lines with estimates from BLS data suggests that the FSP tends to stimulate a demand for food beyond that arising strictly from an income transfer, particularly among families with very low incomes. The component of additional demand arising from the in-kind provision of FSP diminishes as income levels rise. While these relationships must be interpreted with caution because of the use of indices and lack of current and complete data for their development, elasticity of food expenditures associated with transfers under FSP appears greater than income elasticity estimated from BLS data. Recipient families spending in excess of their maximum food stamp allotments are apparently those whose income consumption lines lie to the right of those indicated by BLS data, and/or those whose incomes are near the upper eligibility limits for the FSP.

The effect of the FSP on aggregate demand for food is a function of the number of eligible families in each income category and the stimulative effect at each income level. Food consumption for recipient households that spend amounts of cash in addition to their maximum FSP allotments is clearly unaffected by the in-kind aspects of FSP. An additional factor possibly influencing the effect of FSP on aggregate demand is option to purchase less than the maximum FSP allotment. This action would reduce the size of the FSP subsidy and lessen its effect on the demand for food. Further primary research is needed to accurately determine the proportions of FSP-recipient households in different income categories that exercise various purchase options.

SUMMARY AND IMPLICATIONS

The purpose of the paper was to examine the effect of the Food Stamp Program on demand for food among recipient householders. Examination in a theoretical framework indicated that increases in quantity of food demanded under the FSP are dependent on household preference for food consumed at home relative to other times. The demand for food among households whose preferred post-transfer expenditures on food are less than their maximum food stamp allocations are, in some cases, further increased by in-kind provisions of FSP.

Analysis based on the best available data suggests that demand for food among families with very low incomes will be additionally stimulated by in-kind provisions of FSP. Demand for food among families with incomes near the upper eligibility limit, or families with strong preferences for food, may be unaffected by the in-kind provisions.

If food purchases by most recipient families are unaffected by the form of subsidies, allocative efficiency could favor a cash subsidy program. Recipient households preferring less food than they could purchase with their maximum food stamp allotments would actually increase their utility under a cash transfer. Thurow argues convincingly, however, that transfer programs provide utility to donors as well as donees [8]. Individual-societal preferences, as revealed in the political process, seem to favor in-kind transfers in situations where adequate amounts of food may not be available to members of low-income households. Negative externalities such as impaired health could arise where household management patterns are such

that adequate amounts of food would not be purchased given a cash transfer. Examination of these issues lie beyond the scope of this paper but they

certainly suggest possibilities for further research. Such research is needed to estimate costs and benefits of the Food Stamp Program.

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