# FOOD STAMPS: PROGRAM PARAMETERS AND STANDARDS OF LIVING FOR LOW-INCOME HOUSEHOLDS

**Mark Brown and S. R. Johnson**

The food stamp and other assistance programs for low-income households require continual adjustment if some form of equity across time is to be achieved. For this reason, cost-of-living adjustments and related mechanisms for reflecting changes in prices and the economic status of the target populations have been used in formulae for computing the food stamp bonus and other welfare transfers. For the Food Stamp Program (FSP), for example, the thrifty food plan is employed to adjust the allotment for food price changes and thus, the food stamp bonus (MacDonald). Also, important parameters determining eligibility, administration of the program, and participation rates have changed as the FSP has been adapted to perceived requirements of the low-income population.

The complexity of these temporal adjustment and equity problems is apparent. Thus, it is surprising that more extensive economic evaluations of standards of living for low-income households have not been undertaken. Perhaps one reason for absence of information on changes in standards of living is the extended data bases required to produce estimates that are reasonably reliable. Fortunately for the FSP, two survey data bases have become available recently that make it possible to conduct ambitious cost-of-living evaluations. Both data bases were assembled by those charged with administering, evaluating, and monitoring the FSP.

These data bases were employed to evaluate standards of living for food stamp households between the two survey periods in the present study. Three methods for making the standards of living evaluations were employed. The first was the Prais-Houthakker model. The second utilized a utility function permitting substitution based on relative price changes, the linear expenditure system (LES). The LES specification was designed to accommodate separate bonus and other income effects on food cost. In addition, a version of the LES admitting household-size effects was used. Third, more specialized cost-of-living comparisons based on food cost and bonus were made.

Objectives of the analysis were (1) to compare the cost-of-living for low-income households in the two time periods, (2) to examine factors that have contributed to the observed changes, and (3) to assess the impact of changes in FSP benefits and other program parameters that occurred over the period on standards of living for low-income households. Results will provide a basis for evaluating, in a macro sense, the design of the FSP and other income-transfer programs through standard of living maintenance and, perhaps more properly, their impacts on household expenditure patterns and the relation of these expenditure patterns to the overall cost-of-living for participating and eligible nonparticipating low-income households.

## DATA

Data used to analyze cost-of-living changes between 1977–78 and 1979–80 were from two USDA surveys. The first was the Survey of Food Consumption in Low-Income Households conducted as a part of the Nationwide Food Consumption Survey 1977–78 (NFCS-LI). This survey was for approximately 5,000 households and designed to represent the portion of the contiguous United States population eligible for participation in the FSP. An attempt was made to obtain a survey that included participating and eligible nonparticipating households, matched by socioeconomic factors and region and urbanization status on a proportional basis. Approximately 4,000 of the surveyed households had schedules usable for the present analysis. Of these households, about 43 percent were FSP participants and 57 percent eligible nonparticipants.

The second data source was the Survey of Food Consumption in Low-Income Households 1979–80 (SFC-LI). This survey was again intended to represent the eligible households for FSP participation in the contiguous United States. Approximately 3,000 households were surveyed. There were around 2,500 schedules[1] from this survey sufficiently complete for use in the present analysis.[2] For the SFC-LI survey,

Mark Brown is a Research Associate and S. R. Johnson is a Professor of Economics and Agricultural Economics, University of Missouri-Columbia.

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[1] Only households with foods costs that exceeded their FSP bonus levels were analyzed.

[2] Households were designated as eligible for the FSP and participating, eligible for the FSP and not participating, not eligible and unknown. Surprisingly, 826 or 28 percent of the 3001 surveyed households were designated as having unknown FSP status. However, based on the income levels of unknown households, it was apparent that these households should be treated as eligible nonparticipants. The mean income level for eligible nonparticipating households (for households of unknown status and eligible nonparticipating households, mean income levels were $90.61 and $108.63 per week, respectively).

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Variables used from the survey data were household size, measured as the number of equivalent male adults (m), weekly total and food cost (COST1), and five household weekly income variables. The household-size variable, m, had a scale based on actual macro nutrient intake for members of low-income households (see Johnson, Burt, and Morgan for details). Food cost was the value of food used from the household food supply during the week prior to the survey. The six household weekly income variables used were wages and nonwelfare income (WAGES/NONWELFARE); welfare-program income (WELFARE), excluding the FSP bonus; the FSP bonus (BONUS); in-kind food income (INKIND), the sum of the value of home-produced food, food received as gifts or payment, and Meals on Wheels food; and total income or expenditure (INC), INC = WAGES/NONWELFARE + WELFARE + BONUS + INKIND. A residual nonfood expenditure variable, INC - COST1, also was used in the portions of the analysis requiring information on both food and nonfood costs.

Other data used in the analysis of cost of living were average consumer prices for the two periods, 1977–78 and 1979–80, for food, nonfood, and all consumer goods. Consumer Price Indexes of the U.S. Department of Labor were employed for this purpose (see Table 1 for details). These indices are available for food and nonfood, although not necessarily using weights consistent with the consumption patterns of low-income food-stamp-eligible households.

## COST-OF-LIVING INDICES

In this section, several specifications of the cost-of-living index for food and nonfood consumer goods are analyzed. In fact, it is more appropriate to refer to the food-nonfood cost-of-living index as a subindex. That is, the index based on household expenditures for food and nonfood does not include all relevant costs. Costs of environment goods (e.g., air and water quality) and public goods (e.g., schools, parks, and roads) are excluded in such evaluations. Moreover, leisure and intertemporal consumption are ignored as well. However, if household utility is separable with respect to food and nonfood consumption, and time itself, the food-nonfood subindex depends only on food and nonfood prices, and other prices, although important for the complete cost-of-living index, do not have an impact (Deaton and Muellbauer, Pollack).

With appropriate separability assumptions, cost-of-living comparisons based on food and nonfood consumption can be determined straightforwardly from the cost function for these broadly defined items. In the present study, food-nonfood cost functions for the linear expenditure system (LES) and the Prais-Houthakker model (PHM) are employed. Both cost functions are specified using the equivalent male-adult scale, m,[3] based on observed consumer behavior patterns (for similar treatments of equivalent scales, see McClements; Prais; Prais and Houthakker; Singh and Nagar). In addition, more specific cost-of-living comparisons using food cost and bonus are evaluated. These costs-of-living comparisons are made for average or representative households in three categories: all FSP eligible, FSP participating, and FSP-eligible nonparticipants. Although the analysis centers on the average household within the sample participations, the results can be translated to households identified by the conditioning socioeconomic variables (Pollak and Wales).

### Prais-Houthakker

First, consider cost of living as evaluated using the Prais-Houthakker model (PHM). Recall that this model assumes right-angle or fixed proportion indifference curves (Prais; Prais and Houthakker; Muellbauer 1980). Thus, for the PHM, the Hicksian demand functions are independent of prices and instead depend only on the utility level. More formally, the PHM Hicksian demand equations are

$$(1) \quad \frac{x}{m} = f_x(u)$$

and

$$(2) \quad \frac{y}{m} = f_y(u)$$

where x and y are quantities of food and nonfood, respectively; and m, as already indicated, is the weighted household size or the number of equivalent male adults in the household. Observe that x/m and y/m are per capita household quantities of food and nonfood expressed for equivalent male adults. Moreover, implicitly it has been assumed in specifications (1) and (2) that the equivalent-scale measure, m, describes household requirements for both food and nonfood, and,

[3] m, the weighted household size variable, was computed from both household and individual intake data of the 1977–78 NFCS-LI. First, from the household data, weekly food cost (COST1) was regressed on weekly nutrient consumption of carbohydrates, fats and protein. Next, the estimated intercept of this relationship was adjusted downward to reflect daily individual food costs as opposed to weekly household food costs. This adjusted intercept, along with the coefficient estimates for the nutrient values, were then combined with each person's average daily intake levels for carbohydrates, fats, and protein to obtain an estimated daily food cost for each individual surveyed. The individuals were next classified into 15 age-sex groups, and the average daily food cost for each group was calculated. Then weights for the 15 groups were obtained by dividing each group's average daily food cost by the average daily food cost for males of age 23 to 50. Finally, an m value was found for each household by summing the weights of the household members. Formally, the weighted household size is

$$\sum_{g=1}^{15} w_g n_g$$

where $w_g$ is the weight of an individual in the $g^{th}$ age-sex group and $n_g$ is the number of individuals in the $g^{th}$ group in the household. The weight $w_g$ equals 0.39590 for infants, < 1 year old; 0.62002 for infants, 1–3; 0.73038 for children, 4–6; 0.83504 for children, 7–10; 0.94482 for males, 11–14; 1.02105 for males, 15–18; 1.01422 for males, 19–22; 1.00000 for males, 23–50; 0.89420 for males, 51+; 0.85495 for females, 11–14; 0.78840 for females, 15–18; 0.78157 for females, 19–22; 0.74516 for females, 23–50; 0.71047 for females, 51+; and 0.72924 for females, pregnant and/or nursing.

therefore, income. The notational convention is that $f_x$ and $f_y$ indicate the demand functions and u the utility level.

Using equations (1) and (2), the cost function $c(P_x, P_y, m, u)$ for the PHM can be written

$$(3) \quad c(P_x, P_y, m, u) = P_x m f_x(u) + P_y m f_y(u) = INC$$

where $P_x$ and $P_y$ are prices of food and nonfood, respectively; and income, INC, is as defined in the above section on data. That is, total household cost or total expenditure is loosely termed income (Deaton and Muellbauer; Muellbauer 1980; 1974). The cost-of-living index based on the cost function (3) between two periods for the average household, using the average household's utility level in the initial period as the base, is

$$(4) \quad I = \frac{P_x^1 m^1 f_x(u^o) + P_y^1 m^1 f_y(u^o)}{P_x^o m^o f_x(u^o) + P_y^o m^o f_y(u^o)}$$

where the superscripts o and 1 denote the base and comparsion periods for representative households, respectively. For the subsequent empirical work, the base period is 1977–78. The comparison period is 1979–80. As already anticipated, data used to represent the average household in the two periods are from the household surveys described above.

For evaluation of costs-of-living between the two sample periods, the averages from the two surveys were expressed in real terms. The conversion from nominal to real values was based on the Consumer Price Index (CPI), total or specialized to food and nonfood as required. Specifically, using the CPI, 1967 = 100, from 1977–78 to 1979–80 the food price between the two periods increased from 201.8 to 244.5. The corresponding nonfood price increased from 184.8 to 228.5. These prices, along with related sample statistics required for the evaluation of standards of living, are provided in Table 1.

Observe from Table 1 that, for households eligible to participate in the FSP, the average household size was 2.66 in 1977–78 and 2.47 in 1979–80. Also, note that for this household category, the average household income per week was $102.20 in 1977–78. Of average weekly income per household, $42.22 was food cost and $59.98 was nonfood cost. Other descriptive statistics for the two samples are summarized in Table 1. The table reports sample statistics for three categories of households: eligible for FSP, FSP participants, and FSP-eligible nonparticipants. The standards-of-living application discussed pertains to households that were eligible for the FSP. However, in general, results from the analysis for eligible households apply as well to the other two categories. This is evident from the relative values of the sample statistics reported in Table 1.

From equation (4), it is apparent that the sample statistics reported in Table 1 are sufficient for making average-household cost-of-living comparisons based on the PHM. Specifically, for the 1977–78 base period,

$$f_x(u^o) = 7.87\,(42.22/\,(\,(2.02)\,(2.66)\,)\,)$$

and

$$f_y(u^o) = (12.20(59.98/\,(\,(1.85)\,(2.66)\,)\,).$$

With these values and the price and household-size information provided in Table 1, the cost-of-living index between the two periods based on the PHM is 1.14 for the average eligible household.[4]

The PHM index is a Laspeyres price index and may overstate the true cost change required to maintain a given level of utility between the two periods (Deaton and Muellbauer; Phlips). This follows since the PHM does not admit substitution of commodities resulting from price and/or household-size changes (Deaton and Muellbauer). A model that does admit relative price effects, albeit restricted by a separability assumption for food and nonfood, is the household linear expenditure system with equivalent scales (Howe 1975; 1977; Stone).

## Linear Expenditure System

Demand equations in expenditure form for the LES are

$$(5) \quad P_x x = P_x m \gamma_x + \beta_x (INC - P_x m \gamma_x - P_y m \gamma_y)$$

and

$$(6) \quad P_y y = P_y m \gamma_y + \beta_y (INC - P_x m \gamma_x - P_y m \gamma_y)$$

where $\gamma_x$, $\gamma_y$, $\beta_x$, and $\beta_y$ are parameters such that $\frac{x}{m} > \gamma_x$, $\frac{y}{m} > \gamma_y$, and $\beta_x + \beta_y = 1$. In addition, the FSP bonus was allowed to effect food and nonfood expenditures differently than nonbonus income. Specifically, it was assumed that $\beta_x$ and $\beta_y$ depended linearly on the cash and bonus proportions of total income. Formally the assumption was

$$(7) \quad \beta_x = \beta_{x1} \frac{INC - BONUS}{INC} + \beta_{x2} \frac{BONUS}{INC}$$

and

$$(8) \quad \beta_y = \beta_{y1} \frac{INC - BONUS}{INC} + \beta_{y2} \frac{BONUS}{INC}$$

[4] The PHM also was calculated omitting households with an unknown FSP-participation status in the 1979–80 survey. The PHM index calculated from the sample data excluding the households with unknown status was 1.12, 2 percentage points less than the PHM index reported in Table 1. The difference of 2 percentage points pertains to the household-size variable, m. Excluding households with an unknown participation status, the mean household size was 2.43 for households eligible for the FSP. In contrast, including households of unknown FSP status and treating them as eligible nonparticipants, the mean household size was 2.47 for household, eligible for FSP participation.

Indices based on the linear expenditure system also were estimated omitting households with an unknown FSP-participation status, and including and treating such households as eligible nonparticipants. The indices based on the omission of households with an unknown FSP-participation status ranged from 1 to 3 percentage points less than the indices estimated treating households with an unknown FSP-participation status as eligible nonparticipants. Again, this difference can be attributed largely to the mean household-size difference.

**Table 1.** Income, Food Cost, and Nonfood Cost Variables Unadjusted and Adjusted for Prices and Household Size for the Average Households of the 1977–78 and 1979–80 Low-income Samples of the Nationwide Food Consumption Survey.

| Item | Eligible Households | | Eligible Households, In the FSP | | Eligible Households, Not In the FSP | |
|---|---|---|---|---|---|---|
| | 1977-78 | 1979-80 | 1977-78 | 1979-80 | 1977-78 | 1979-80 |
| Average Household Size | | | | | | |
| 1. Size (number of persons) | 3.26 | 3.05 | 3.50 | 3.08 | 3.11 | 3.02 |
| | (2.09)[a] | (1.94) | (2.15) | (1.96) | (2.04) | (1.93) |
| 2. m (number of equivalent male adults) | 2.66 | 2.43 | 2.84 | 2.44 | 2.55 | 2.41 |
| | (1.78) | (1.62) | (1.82) | (1.61) | (1.75) | (1.66) |
| Consumer Prices (1967=1.00)[b] | | | | | | |
| 3. All Commodities | 1.89 | 2.32 | 1.89 | 2.32 | 1.89 | 2.32 |
| 4. Food | 2.02 | 2.45 | 2.02 | 2.45 | 2.02 | 2.45 |
| 5. Nonfood, All Commodities Less Food | 1.85 | 2.29 | 1.85 | 2.29 | 1.85 | 2.29 |
| Average Household Food Cost (Weekly) | | | | | | |
| 6. COST1 | 42.22 | 47.52 | 46.11 | 49.67 | 39.75 | 39.77 |
| | (28.42) | (29.54) | (27.97) | (30.55) | (28.49) | (24.00) |
| 7. Real Per Equivalent Male Adult Food Cost (6/(2x4)) | 7.86 | 7.99 | 8.05 | 8.33 | 7.73 | 6.74 |
| Average Household Nonfood Cost (Weekly) | | | | | | |
| 8. INC-COST | 59.98 | 61.15 | 59.90 | 59.01 | 60.09 | 68.86 |
| 9. Real Per Equivalent Male Adult Nonfood Cost (8/(2x5)) | 12.20 | 11.00 | 11.42 | 10.59 | 12.76 | 12.48 |
| Average Household Income (Weekly) | | | | | | |
| 10. INC | 102.20 | 108.66 | 106.01 | 108.67 | 99.84 | 108.63 |
| | (63.79) | (62.37) | (70.57) | (64.14) | (58.93) | (55.53) |
| 11. Real Per Equivalent Male Adult Income (10/(2x3)) | 20.38 | 19.24 | 19.81 | 19.20 | 20.79 | 19.39 |
| Average Household Wage and Non-Welfare Income (Weekly) | | | | | | |
| 12. WAGES/NON-WELFARE | 52.23 | 37.57 | 36.04 | 30.57 | 61.09 | 62.09 |
| | (73.64) | (67.47) | (73.07) | (65.28) | (72.44) | (69.28) |
| 13. Real Per Equivalent Male Adult WAGES/ NON-WELFARE Income (12/(2x3)) | 10.41 | 6.65 | 6.73 | 5.40 | 12.72 | 11.08 |
| Average Household Welfare Income, Excluding Bonus Income (Weekly) | | | | | | |
| 14. WELFARE | 39.77 | 54.16 | 51.86 | 57.89 | 33.16 | 41.10 |
| | (38.86) | (39.93) | (38.52) | (35.41) | (37.43) | (50.69) |
| 15. Real Per Equivalent Male ADULT WELFARE INCOME (14/(2x3)) | 7.93 | 9.59 | 9.69 | 10.23 | 6.90 | 7.34 |
| Average Household Bonus Income (Weekly) | | | | | | |
| 16. BONUS | 18.34 | 20.49 | 18.34 | 20.49 | -- | -- |
| | (13.48) | (14.99) | (13.48) | (14.99) | | |
| 17. Real Per Equivalent Male Adult Bonus Income (16/(2x4)) | 3.20 | 3.44 | 3.20 | 3.44 | -- | -- |
| Average Household Inkind Income (Weekly) | | | | | | |
| 18. INKIND | 5.34 | 3.02 | 4.11 | 2.35 | 5.85 | 5.44 |
| | (8.48) | (5.86) | (6.07) | (5.13) | (9.30) | (7.47) |
| 19. Real Per Equivalent Male Adult Inkind Income (18/(2x4)) | .99 | .51 | .72 | .39 | 1.14 | .92 |
| Cost-of-Living Indexes | | | | | | |
| 20. Prais-Houthakker | | 1.14 | | 1.05 | | 1.20 |
| 21. Linear Expenditure System Without Size Economies | | 1.14 | | 1.05 | | 1.20 |
| 22. Linear Expenditure System With Size Economies | | 1.16 | | 1.10 | | 1.21 |

[a] Standard deviations are given in parentheses.

[b] The consumer prices are based on U.S. Department of Labor indexes reported in the *Survey of Current Business*, U.S. Department of Commerce, Bureau of Economic Analysis, June 1979, Vol. 59, No. 6, p. S-6, December, 1980, Vol. 60, No. 12, p. S-6, and January, 1982, Vol. 62, No. 1, p. S-6. The prices for All Commodities, Food, and Nonfood for 1977–78 are average prices for 1977 and 1978. Likewise, the prices for 1979–80 are the average prices for 1979 and 1980.

where $\beta_{x1}$, $\beta_{x2}$, $\beta_{y1}$, and $\beta_{y2}$ are parameters such that $\beta_{x1} + \beta_{y1} = 1$ and $\beta_{x2} + \beta_{y2} = 1$.

By pooling the 1977–78 and 1979–80 cross-section data, nonlinear ordinary least squares estimates of these parameters were obtained. These parameters and related statistics for the LES model are reported in Table 2.[5] Two sets of parameter estimates for the LES are provided. One set, labeled "Model 2" in Table 2, incorporates an economy of scale hypothesis, discussed in "Economies of Size" below. The other set of parameters, labeled "Model 1," are relevant for the present analysis.

In particular, the Model-1 estimates can be used to calculate a cost-of-living index for the LES. The cost function for the LES using expenditure equations and the income specification in (5) through (8) is

$$(9) \quad c(P_x, P_y, m, u) = m\left(u\left(\frac{P_x}{\beta_x}\right)^{\beta_x}\left(\frac{P_y}{\beta_y}\right)^{\beta_y} + P_x\gamma_x + P_y\gamma_y\right) = INC.$$

Applying the cost function (9), the LES cost-of-living index for the 1977–78 and 1979–80 average households, using the 1977–78 average household's utility level as a base (superscripts o and 1 for the 1977–78 and 1979–80 average households, respectively), is[6]

$$(10) \quad I = \frac{m^1\left(u^o\left(\frac{P_x^1}{\beta_x}\right)^{\beta_x}\left(\frac{P_y^1}{\beta_y}\right)^{\beta_y} + P_x^1\gamma_x + P_y^1\gamma_y\right)}{m^o\left(u^o\left(\frac{P_x^o}{\beta_x}\right)^{\beta_x}\left(\frac{P_y^o}{\beta_y}\right)^{\beta_y} + P_x^o\gamma_x + P_y^o\gamma_y\right)}.$$

For the same data used to evaluate the PHM cost-of-living index and the LES parameter estimates in Table 2, Model 1, equation (10), the cost-of-living index for the LES can be evaluated. The result of this evaluation, provided in Table 1, item 21, indicated that the cost-of-living for the 1977–78 average household eligible for the FSP increased by about 14 percent relative to the 1979–80 average household. This increase was the same as the cost-of-living increase indicated by the PHM for FSP eligibles (Table 1, item 20). It was expected that the cost-of-living increase for the PHM would be greater than the cost of living increases indicated by the LES. This was because the LES cost-of-living index admits substitution of commodities in response to relative price changes, while the PHM cost-of-living index does not.

Observe that the relative price of food in terms of nonfood fell from 1.09 (2.02/1.85) in 1977–78 to 1.07 (2.45/2.29) in 1979–80, implying a substitution effect toward food. However, for this expectation to be valid, the base commodity bundles ($x/m^o$ and $y/m^o$) must be the same in the PHM and LES indices. This result did not hold in the present analysis. In addition, the LES indices may not have been sensitive enough to reflect the substitution effect implied by the relatively small food price decrease, even if the LES and PHM indices had been based on the same commodity bundles.

### Special Indices

Specialized and more pragmatic comparisons between the two periods also can be made using the available data. Since the FSP is directed at food consumption and nutrition for low-income households, it is natural to make between-period comparisons of real per capita food cost. That is, supposing that real per capita food costs for the base period, 1977–1978, were those desired by the program, how do they compare to those for real per capita food costs in 1979–1980? A more specialized comparison involves the real per capita value for bonus. This comparison, of course, extends to only FSP-participating households.

Data from the two samples were applied to make cost-of-living comparisons between the two periods based on these subindexes. These subindexes are, of course, more restricted than the PHM-and the LES-based indices. However, they have the advantage of ease of communication and, more importantly, of being based on more accurately observable household data. Both the PHM and LES require household income and nonfood cost, difficult to obtain in weekly based surveys. The weekly survey was designed for obtaining household food cost. Results of the bonus and food cost comparisons are contained in Table 1, items 7 and 17, respectively. For all eligible households, the food cost comparison was quantitatively consistent with the PHM and LES indices. For FSP-participating households, however, it was not. The real-adult-equivalent bonus comparison shows the reason for this result. More discussion of these values is provided in the policy implications.

## ECONOMIES OF SIZE

Economies of size in consumption can be incorporated into the LES by specifying an exponent for FS10, that is, introducing $m^\theta$ in place of m in equations (5) and (6). For current purposes, this exponent is termed an economy of size parameter. It can be estimated simultaneously with the other parameters $\beta_{x1}$, $\beta_{x2}$, $\beta_{y1}$, $\beta_{y2}$, $\gamma_x$, and $\gamma_y$ for the LES model. If the value for $\theta$ is between zero and one, economies of size are said to exist, since cost-per-adult equivalent is reduced as m is increased.

From the pooled 1977–78 and 1979–80 data, parameter estimates of the LES, incorporating the economics of size hypothesis, were obtained. These parameter estimates are reported in Table 2, Model 2. Observe from Table 2 that all the reported parameter

[5] The LES Models 1 and 2 in Table 2 also were estimated omitting households with an unknown FSP participation status. The parameter estimates based on this exclusion, although different, were relatively close in magnitude to the parameter estimates based on the treatment of households with an unknown FSP-participation status as eligible nonparticipants and shown in Table 2.

[6] It is interesting to observe that the LES cost-of-living index is monotonically increasing with respect to income, a property that, in general, is undesirable. However, to some extent, this shortcoming is offset by the desirable property that the LES index provides for price-substitution effects, a major concern of the present analysis.

**Table 2.** Parameter Estimates for the Household Linear Expenditure System Based on 1977–78 and 1979–80 Pooled Data, Eligible Households.[a]

| Commodity | Parameter | Model 1 Without Size Economies | Model 2 With Size Economies |
|---|---|---|---|
| Food | $\beta_{x1}$ | .15 (.01)[b] | .12 (.01) |
| | $\beta_{x2}$ | .49 (.04) | .32 (.04) |
| | $\gamma_x$ | 5.46 (.06) | 8.22 (.18) |
| Nonfood[c,d] | $\beta_{y1}$ | .85 (.01) | .88 (.01) |
| | $\beta_{y2}$ | .51 (.04) | .68 (.04) |
| | $\gamma_y$ | 4(Restricted) | 4(Restricted) |
| Size Exponent | $\theta$ | 1(Restricted) | .73 (.01) |
| $R^2$ | | .56 | .58 |
| N | | 6306 | 6306 |

[a] Following standard procedures for singular error covariance matrices of expenditure systems, only the food expenditure equation was estimated nonlinearly, using weights provided to make the sample representative of the continental U.S. population.

[b] Standard errors are given in parentheses.

[c] The $\beta_{y1}$ and $\beta_{y2}$ parameters were determined from the adding-up restrictions $\beta_{y1} + \beta_{x1} = 1$ and $\beta_{y2} + \beta_{x2} = 1$.

[d] Based on examination of the data and a computed cost of shelter in the 1979–80 survey data of about $38 per household per week, a restriction of $4 was entered for $\gamma_y$. The estimate was based on the average scaled household size, an adjustment to real terms, and an assumption that approximately one-half of the observed average shelter cost represented the subsistence value. This produced more plausible results and in view of the limited price variation, appeared not an unreasonable approach. Other parameters were not overly sensitive to variations in this assumed or constructed subsistence figure.

estimates were statistically significant at high rejection levels. Also, note that the estimate for the economy of size parameter $\theta$ was 0.73, indicating economies of size. Comparing these results with those for Model 1, without the economies of size hypothesis, the major difference was for the food subsistence quantity that increased from $\gamma_x = 5.46$ to $\gamma_x = 8.22$.

Using the parameter estimates from Table 2, Model 2, and employing the same household income, size, and price data as previously used for equation (10), the cost-of-living index for the LES with economies of scale was 1.16 for eligible households. These values are reported in Table 1 along with earlier cost-of-living results. Comparing the cost-of-living results for Models 1 and 2, it is clear that the adjustment for economies of size made a significant difference. Specifically, the LES indices with economies of size indicates a 16-percent increase in the cost-of-living, while the LES indices without economies of size indicates a 14-percent increase. The decrease in the average household size over the comparison period resulted in fewer economies of size for the eligible households in 1979–80. In turn, to maintain the earlier 1977–78 standard of living, an additional cost would have to have been incurred to offset the loss that resulted from the achievement of fewer size economies. Similar results were obtained for both the FSP participants and nonparticipants partitions and are reported in Table 1.

## POLICY IMPLICATIONS

Based on the results presented in Table 1, it appears that the average FSP-eligible household for the 1979–80 sample relative to the average FSP-eligible household for the 1977–78 sample experienced a cost-of-living increase of 14 to 16 percent. The actual value of the increase estimate depends upon the specific cost-of-living index employed (14 percent for the PHM index and the LES index without size economies, and 16 percent for the LES index with size economies). This increase was less than the increase in commodity prices, approximately 23 percent, according to the consumer price index (see Table 1, Consumer Prices, All Commodities). The explanation for the difference in the cost-of-living increase relative to the CPI increase is that average household size (m) fell over this period from about 2.66 to 2.47 for households eligible for the FSP.

The index for the LES with size economies is higher because the average household size decreased over the period from 1977–78 to 1979–80. That is, smaller households relative to larger ones achieve fewer economies, and thus require additional costs to maintain a given standard of living.

Table 1 relates these results more particularly to the FSP, showing that the average real-per-equivalent-male-adult income fell from 1977–78 to 1979–80. This applies to all three reported categories: all eligible for FSP, FSP participants, and FSP-eligible nonparticipants. The decrease in real income per equivalent male adult indicates in itself that the standard of living for the average household in 1979–80 fell relative to the average household in 1977–78 (Brown and Johnson).

Entries in Table 1 for the three household categories, specifically items 12 through 19, reveal why the decrease in standard of living between 1977–78 and 1979–80 occurred. Specifically, real-average-per-equivalent-male-adult wages, nonwelfare income, and in-kind income (items 13 and 19 in Table 1) decreased more than the average-real-equivalent-male-adult welfare income and FSP-bonus income (items 15 and 17 in Table 1) increased.

Finally, the specific cost-of-living results for FSP participants suggest that on the average FSP benefits have more than kept pace with food price increases. In particular, average real values of food per equivalent male adult (item 7 in Table 1) and bonus per equivalent male adult (item 17 in Table 1) have risen from $8.05 to $8.33 and $3.20 to $3.44, respectively. This comparison suggests possible FSP cost savings, depending on the interpretation of the objectives of the legislation. For the objective of maintaining real food cost per equivalent male adult constant over time, say at the 1977–78 level, the $0.28 real difference in food cost per equivalent male adult implies that the 1979–80 nominal household weekly bonus could have been reduced on the average by at least $1.67. This is the 1979–80 nominal household equivalent of the $0.28 difference-per-adult equivalent. Alternatively, for the objective of maintaining a constant real-bonus level per equivalent male adult over the comparison period, say

again at the 1977–78 level, the $0.24 real difference in bonus per equivalent male adult indicates that the 1979–80 nominal-household bonus could have been reduced on the average by $1.41. This is the 1979–80 nominal-household equivalent of the $0.24 difference per adult equivalent. Last, using the LES indexes for participants in Table 1, the 1979–80 bonus could have been reduced by $1.24, the 1979—80 nominal bonus less the LES index without household-size effects times the 1977–78 nominal bonus, or $0.33, the latter difference adjusted for household-size effects.

The more specific scale (food cost and bonus) comparisons and those from the LES model have important policy implications. They show that if the FSP-participating households were the same between 1977–78 and 1979–80, the 1979–80 participants were better off. Alternatively, program benefits could have been reduced at about $1.50/$20.49, the ratio of the weekly increase in cost or the indices to average weekly bonus. When compared to total-program cost, this difference is significant. However, the comparison should be made with caution and adjusted for differences in orientation of the program over the period. These changes should be evaluated, given results showing that narrowly defined benefits for FSP participants increased over the comparison period.

## REFERENCES


Brown, M., S. R. Johnson, and J. Burt. "Equivalent Scales, Scale Economies and Food Stamp Allotments: Estimates for the Low-income Component of the 1977–78 NFC." Rpt. submitted to HNA, USDA, 1981.

Brown, M., and S. R. Johnson. "Engel Curves and Intertemporal Cost-of-Living Comparisons: An Application for the Food Stamp Program." Rpt. submitted to the HNA, USDA, 1982.

Deaton, A., and J. Muellbauer. *Economics and Consumer Behavior*. Cambridge: Cambridge University Press, 1980.

Johnson, S. R., J. Burt and K. Morgan. "Phase II—Expenditure Analysis." Rpt. submitted to HNA, USDA, 1981.

MacDonald, M. *Food, Stamps, and Income Maintenance*. New York: Academic Press, 1977.

McClements, L. "Equivalence Scales for Children." *J. Pub. Econ.* 8(1977):191–210.

Muellbauer, J. "Household Composition, Engel Curves and Welfare Comparisons Between Households: A Duality Approach." *European Economic Review* 5(1974):102–122.

Muellbauer, J. "Estimation of the Prais-Houthakker Model of Equivalence Scales." *Econometrica* 48(1980):153–176.

Howe, H. "Development of the Extended Linear Expenditure System from Simple Saving Assumptions." *European Econ. Rev.* 6(1975):305–310.

Howe, H. "Cross-Section Application of Linear Expenditure System: Responses to Sociodemographic Effects." *Amer. J. Agri. Econ.* 2(1977):141–148.

Phlips, L. *Applied Consumption Analysis*. Amsterdam and Oxford: North-Holland, 1974.

Pollak, R. A. "Subindexes in the Cost of Living Index." *Internat. Econ. Rev.* 16(1975):135–150.

Pollak, R. A., and T. J. Wales. "Demographic Variables in Demand Analysis." *Econometrica* 49(1981):1533–1551.

Prais, S. J. "The Estimation of Equivalent Adult Scales from Family Budgets." *Econ. J.* 63(1953):791–810.

Prais, S. J., and H. S. Houthakker. *The Analysis of Family Budgets*. Cambridge: Cambridge University Press, 1955.

Singh, B., and A. L. Nagar. "Determination of Consumer Unit Scales." *Econometrica* 41(1973):347–356.

Stone, J. R. N. "Linear Expenditure Systems and Demand Analysis: An Application to the Pattern of British Demand." *Econ. J.* 64(1954):511–527.