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INTERRELATIONSHIP BETWEEN HOUSEHOLD FOOD EXPENDITURE AND FIXED EXPENSES

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PREFACE

This study contributed to Southern Regional Project S-119, "Analysis of Domestic Food Demand and Consumption Behavior." The general goal of this study was to focus on the relationship between fixed expenses and food expenditures as household incomes increase.

ACKNOWLEDGEMENT

Recognition is given to Dr. James G. Snell for his role in the development of this research project. Dr. Snell was the Tennessee Experiment Station representative to S-119 until January, 1979, at which time he accepted a position with the Kansas State University team at Los Banos College in Laguna, Philippines.

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THE INTERRELATIONSHIP BETWEEN HOUSEHOLD FOOD EXPENDITURE AND FIXED EXPENSES

By John R. Brooker and Roger A. Hinson*

INTRODUCTION

A stated goal of government policy is to enable the country's population to consume a nutritionally adequate diet through the dissemination of nutritional information and income subsidies. An often used, though imperfect, gauge of an increasing or decreasing nutritional level is personal expenditure for food. Attempts to estimate the consumption function for food have been derived from the theory of demand. The determinants of this function usually include income and a set of socioeconomic variables, which are assumed to influence the preferences of any household. Traditionally, such analysis has been based on the proposition that a progressively smaller proportion of income is allocated to food as income rises. This "law" was first stated by Engel in the 1850's.

This perception of the relationship between income and food expenditure may not be sufficiently descriptive in an economy with an advanced system of credit, and where this purchasing instrument is available to the general public. In such economies, there may be alternative presentations of the relationship between food, other goods and services, and income.

Another factor which could cause changes in the food share of the consumer's budget is persistent inflation. Current consumption of goods and services becomes increasingly attractive because obligations will be repaid with cheaper dollars. A general expectation by consumers of a growing standard of living in material terms may also influence the balance of current versus deferred consumption.

These three factors—available credit, inflation, and a growing standard of living in material terms—may combine to influence food expenditure. Given proper incentives, consumers may allocate a large

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proportion of increases in income to a group of expenses over which they have little control in the short run. These will be referred to as "fixed," and defined as expenses which are either necessary (rent or mortgage payments) or are contractual obligations (auto payments, other credit payments) which must be paid at some specified rate per time period. These expenses are not "fixed" in the sense of being predetermined, but can be adjusted by the household in response to income adjustments. The food share of the budget may be affected because quality tradeoffs (and possibly quantity reductions) are possible.

The theory of demand has provided the framework for modeling a consumption function for food. On an aggregate, it has been shown that food is a normal good when evaluated on the basis of income elasticity. In extending the regression model to attain estimates of elasticity at alternative levels of income, the issue of whether there may be income ranges at which elasticities either increase at a slower rate or are even negative has been raised. In both the 1967 USDA survey of household food consumption [11] and a 1967 consumption and expenditure survey [14], this "issue" has apparently appeared for the individual food category "meats" and for aggregate food expenditure. The income range at which the suggestion of negative elasticities occurred was, in 1967 dollars, between \$3,000 and \$9,000.

Although it is not theoretically unexpected that goods and services may have different income elasticities, depending on the level of income, earlier research has not led to such a conclusion for food in the aggregate. Meats are a preferred source of protein in the American diet; one would expect that given additional income, some proportion of the increase would be allocated to meats regardless of income level. For aggregate food expenditure, the expected relationship is described by the classic Engel curve. Some negative elasticities have appeared in research reports, and these do not appear to be well explained by accepted theory. These elasticities may imply that an important explanatory factor or factors have been omitted.

One such factor may be the relationship between fixed expenses as described above and food expenditure. If the fixed budget share increases and residual income (defined as take-home pay minus fixed expense) decreases, there may be a negative effect on food expenditure. These adjustments could or would probably vary between income levels.

For this study, three levels of household income were selected on the basis of prior research, which found negative elasticities and/or suggestions that behavioral changes occur just above the government specified poverty level [13]. Low income was defined as \$8,000 or less (1978 prices). A moderate income was specified as \$8,001 to

\$16,000, with a so-called high income group with incomes above \$16,000.

Given these income levels, the basic hypothesized interrelationship between fixed expenses (FIXED) and food expenditure (FOOD) is for a direct relationship in the low income group, inverse in the moderate income group, and again direct for the higher income group. These changes would be due to adjustments in the relative magnitudes of marginal utilities between income levels.

Consumption studies often state that permanent income is the primary factor which determines the level of consumption of any commodity. Since permanent income is unobservable, an often used measure of income is gross income minus income tax. Rather than that formulation, it was postulated that 1) fixed expenses are based on household take-home pay (gross income less all payroll deductions) because the household has that amount of money in hand to distribute during a particular time period, and 2) for food expenditure, residual income is the appropriate determining variable.

Two sets of data were used in this study. The 1972-73 Bureau of Labor Statistics Survey (BLS), Interview Portion [12], was used to estimate the aggregate relationships. A fourth quarter, 1978 survey¹ in Knox County, Tennessee, was the data source for the analysis focusing on individual food categories. The BLS survey data were restricted to the Southeast region and to two Standard Metropolitan Statistical Area sizes. The Goldfeld-Quandt test was used to check for heteroskedasticity and a correction was made by dividing each variable value by the variable which appeared to be the source of the variance problem [8].

OBJECTIVES

The specific objectives of this study were to: 1) compare elasticity estimates from alternative algebraic forms of the Engel curve, using residual income, with earlier income elasticity estimates, 2) evaluate the effects of income and a set of socioeconomic variables on the values of fixed expenses and food expenditure within the three income groups, 3) compare the distributional effects of selected variables on expenditures for individual food categories, and 4) estimate individual food group elasticities.

COMPARISON OF ENGEL FUNCTIONS

The Engel curve was investigated through several algebraic forms. Results from two of the functions are presented. First, the semilog form which facilitates the assumption that elasticities decrease over

¹ For a detailed discussion of the 1978 Knox County survey, the interested reader is referred to Hinson [6].

the range of the data and are inversely proportional to the level of residual income. Second, the linear form where elasticities depend on the value of the estimated coefficient at each income level, and on the relative magnitudes of the food expenditure and residual income variables.

As previously stated, one aim of this study was to compare Engel curves calculated with residual income (RESINC) to a group of elasticities from prior research that were calculated from other formulations. These elasticity estimates vary widely. Tomek reported a representative group of elasticities at different points in time, in different family types (Table 1). The values ranged from 0.08 to 0.52. If these estimates were measured at the data means, they should be roughly comparable to the values calculated in this study at the moderate income level. Because of the structure of the elasticity formula, the lower values of RESINC should result in elasticity estimates which are higher than most of the reported elasticities.

Table 1. Estimated income (or expenditure) elasticities for food, United States, at different times between 1935 and 1972

Source	Date of data	Elasticity	Comments
Burk (1951) [2]	1935-36	0.49	entire U. S.
Burk (1951) [2]	1941	0.49	entire U. S.
George and King [5]	1955	0.27	entire U. S.
George and King [5]	1965	0.28	entire U. S.
Price [9]	1955	0.28	urban
		0.16	single women, age 20-64
		0.36	couple, 2 children
Rockwell [10]	1955		nonfarm
		0.25	low income
		0.21	medium income
		0.15	high income
			farm
		0.08	low income
		0.19	medium income
		0.15	high income
Lee and Phillips [1]	1960-61	0.52	urban
		0.50	rural nonfarm
		0.26	farm
Benus, et. al. [1]	1968-72	0.20	entire U. S.

As noted in the previous paragraph, the primary difference between Engel curves estimated in this study and previous research effort lies in the definition of income. The dependent variable was total food expenditure (FOOD), which was used because data regarding quantities consumed were not available and since the effect on budget shares was the important criterion. Residual income (RESINC) was the independent variable. It has also been suggested [3] that a correlation between income and consumer unit size (CUSIZE) probably exists and this should be accounted for in the process of estimation. Hence, CUSIZE was also included in the equation.

The estimated semilog model is:

$$\text{FOOD} = -3587 + 527 \text{XLOG} + 291 \text{CUSIZE} \quad R^2 = 0.38$$

(-15) (29) (17)

where, XLOG is the natural log of RESINC and the numbers in parentheses are t scores. All coefficients were significant at the $\alpha = 0.01$ level.

Comparisons between functional forms of the Engel curve are not based on the parameter estimates themselves, but rather on income elasticities. Such values are comparable between models because changes are converted to percentages.

For the semilog functional form, the estimated income elasticities (Table 2) are similar in magnitude to the group of elasticities presented in Table 1, and decrease as RESINC increases. The latter result is a direct consequence of the functional form. Prior research which compared alternative forms of the Engel curve selected the semilog forms as the most acceptable, based on the agreement with *a priori* expectations [9].

Table 2. Elasticity of food expenditure with respect to the natural log of residual income, estimated from semilog Engel function, for three income groups

Income group		Elasticity ^a
Low:	Less than \$8,000	0.54
Moderate:	Between \$8,000 and \$16,000	0.34
High:	Greater than \$16,000	0.22

^aThe elasticity estimating formula is b/Y , where: b = value of the estimated regression coefficient for the natural log of residual income, RESINC; Y = mean value of the dependent variable FOOD in income group $i = 1, \dots, 3$.

Data Source: 1972-73 Bureau of Labor Statistics Survey [12].

The estimated coefficients from the linear Engel functions are presented in terms of marginal propensities to consume food from residual income (MPC_{food}). In this case, the MPC_{food} decreases as level of income increases. At the moderate income level the MPC_{food} was 0.24, a decrease from the low income group's 0.39 (Table 3). The MPC_{food} was even lower with the high income group, (.04). Thus, the linear form had much the same pattern as the semilog form.

Income elasticities at the low and moderate income levels were higher than those derived with the semilog form (Table 4). At high income level the elasticity estimate was virtually the same as the semilog estimate.

The pattern of elasticities was much the same between the semilog and linear forms of the curve. That pattern conformed closely to the principle stated in Engel's law, that a declining proportion of income is devoted to food expenditure as the level of living increases. To this point, there appears to be no evidence of an effect consistent with the idea that some factor has been incorrectly omitted from the model, even though residual income has been used.

Table 3. Estimated coefficients for marginal propensity to consume food variable and consumer unit size variable from linear Engel function, for three income groups

Income group	Variable			R^2
	Intercept	MPC_{food}	CUSIZE	
Low	154 (1.6)	0.39 (0.6)	-45 (1.0)	0.75
Moderate	617 (4.0)	0.24 (6.0)	99 (4.7)	0.30
High	367 (2.0)	0.04 (2.0)	350 (11.0)	0.37

^aNumbers in parentheses are t-ratios.

Data Source: 1972-73 Bureau of Labor Statistics Survey [12].

Table 4. Elasticity of food expenditure with respect to residual income, for three income groups, estimated from linear Engel function

Income group	Elasticity ^a
Low: Less than \$8,000	1.8
Moderate: Between \$8,000 and \$16,000	0.8
High: Greater than \$16,000	0.2

^aThe elasticity estimating formula is $MPC_{\text{food}} \frac{\bar{X}}{\bar{Y}}$, where MPC_{food} = the marginal propensity to consume food from residual income (RESINC); $\bar{X}_i$ = mean of RESINC in income group i , $i=1, \dots, 3$; $\bar{Y}$ = mean of FOOD in income group i , $i=1, \dots, 3$.

Data Source: 1972-73 Bureau of Labor Statistics Survey [12].

MODEL SPECIFICATION

The interrelationship between the FIXED and FOOD variable was analyzed with a two equation simultaneous system, referred to hereafter as the BLS model². This model was estimated with two stage least squares. The distributional effects between specific food categories were estimated with a separate equation for the FIXED variable and for each of the food categories, referred to hereafter as the Knox Model². The food categories were meats, dairy and dairy products, produce, grocery, and meals outside the home. Two stage least squares was used as the estimating procedure for this model. The equations specified to comprise these two models are:

$$\text{BLS Model: } Y_1 = f(Y_2, X_1, X_3, \dots, X_{10})$$

$$Y_2 = f(Y_1, X_2, \dots, X_8)$$

$$\text{Knox Model: } Y_1 = f(Y_2, X_1, X_3, \dots, X_8, X_{10}, X_{11}, X_{12})$$

$$Y_3 = f(Y_1, Y_2, X_2, \dots, X_8, X_{10}, X_{12})$$

$$Y_4 = f(Y_1, Y_2, X_2, \dots, X_8, X_{10}, X_{12})$$

$$Y_5 = f(Y_1, Y_2, X_2, \dots, X_8, X_{10}, X_{12})$$

$$Y_6 = f(Y_1, Y_2, X_2, \dots, X_8, X_{10}, X_{12})$$

$$Y_7 = f(Y_1, Y_2, X_2, \dots, X_8, X_{10}, X_{12})$$

where:

Y_1 = FIXED = Fixed expense—collected under the selected headings of shelter, utilities, auto expense, specified recreational expense, and “net change in amount owed other creditors at end of survey year” for BLS data. In the Knox survey, respondents were asked for the total of all regular, committed expense. There is presumed to be some divergence between the two groups of data with respect to this variable value.

Y_2 = FOOD = Total food expenditure—includes grocery purchases meals.

Y_3 = MEAT = Expenditure on meat products.

Y_4 = DAIRY = Expenditure on dairy products.

Y_5 = PRODUCE = Expenditure on produce products.

Y_6 = GROCERY = Expenditure on dry grocery products.

Y_7 = OUT = Expenditure on meals outside the home.

X_1 = INC = Income—gross income less all payroll deductions.

² For a detailed discussion of the BLS and Knox models, the interested reader is referred to Hinson [6].

- X_2 = RESINC = Residual income—INC minus fixed expense.
- X_3 = CUSIZE = Consumer unit size—consumption is strongly influenced by the number and age/sex composition of individuals in the household. Analysis of food expenditure on the basis of eleven age/sex subgroups defined by nutritionists and use for calculating estimates of weekly food cost [4] revealed that sex had no significant effect on expenditure, and that the only significant age distinction was between the less than 12 years and the 12 years and greater age groups.
- X_4 = AGEHD = Age of CU (consumer unit) head—expenditures for FOOD and FIXED would be expected to change as the family unit grows older.
- X_5 = LIFECY = State in the family life cycle—this specification permits an interaction between CUSIZE and AGEHD. As age increases, the value should increase, more rapidly through the years when children are 12 years or greater and are still at home. As children leave home, the values will decrease, although not as rapidly as in the early stages because of the effect of AGEHD. Here, these effects are formulated as a continuous variable rather than as a qualitative one.
- X_6 = RACE = Race—the variable measures consumption expenditures as the difference between “blacks” and “whites and other non-blacks.”
- X_7 = EDHEAD = Education of CU head—differences are measured from the “college graduate, graduate work” base group.
- ED1 = some grade school
 - ED2 = some high school
 - ED3 = high school graduate
 - ED4 = some college
 - ED5 = college graduate, graduate work
 - ED6 = none, not reported
- X_8 = OCHEAD = Occupation of CU head—it is expected that different motivating factors and peer groups would produce different levels of consumption than the “self-employed, professional, and administrative group.”
- OC1 = not working, not retired, other
 - OC2 = clerical, sales, and service workers
 - OC3 = self-employed, salaried professional and technical, and salaried managers and administrators
 - OC4 = craftsmen, operatives

OC5 = retired

OC6 = unskilled laborers

X₉ = OCSO = Occupation of CU spouse—these groups were identical to the occupation of OCHEAD groups.

X₁₀ = RENTOWN = Renter or owner of principal residence—to an extent, the asset level and permanent income of the CU may be indicated.

RO1 = owners

RO2 = both owned and rented during survey year

RO3 = renters

X₁₁ = NUMINC = Number of incomes—more than one source of income may lend a feeling of stability, encouraging the fixed expenses.

X₁₂ = BULKSTOR = Bulk storage capacity for food—economies may result from bulk storage of food.

Results from BLS Model

With the BLS Model, the sets of estimated coefficients for the endogenous variables, FIXED and FOOD, were expected to reflect the changing marginal utilities associated with the different income levels. These coefficients were expressed in terms of annual dollar changes.

The first set of coefficients were parameter estimates from the FIXED equation. When income increases by \$1, FIXED decreases by \$1.03 in the low income group, increases by \$0.45 in the moderate income group, and is essentially unchanged in the high income group (Appendix Table 1). When the effect of the endogenous variable FOOD was considered, FIXED was unchanged in the low income group, increased \$0.37 in the middle group, and increased \$0.92 in the high income group. The initial decrease in FIXED implies that FOOD has a high priority in the preference of the CU, because income does not appear to have been allocated to FIXED and was therefore available for commitment to the FIXED category. However, there was essentially no response in FIXED to changes in FOOD (-0.005). Then, at the moderate income level the estimates reveal that there was a significant increase in FIXED when income increased and a corresponding increase when FOOD increased (0.37). Finally, estimates for the high income group reveal no relationship between income and FIXED, but a positive relationship between FOOD and FIXED (0.92). Thus, the implication is that some different relationship exists at the different income levels. And, this pattern of changes in FIXED in response to income changes seem to support the basic hypothesis of this study.

Both CUSIZE and AGEHD were inversely related to FIXED re-

ardless of income level. In the case of CUSIZE³, a possible explanation is that real income per family member decreased as size increased, hence it may not be unreasonable to associate lower fixed expense with larger household size. In the case of AGEHD, a more conservative attitude toward debt and fixed commitments may be likely as age increases. Additionally, commitments made in the past do not reflect the inflated price level associated with current terms of trade.

The state of LIFEYC was significantly⁴ different from zero at the low income level, but not at the moderate or high levels of income (Appendix Table 1).

Five sets of qualitative variables concerned with socioeconomic characteristics were identified. For education and occupation of CU head, and the renter-owner distinction, both slope and intercept differences were permitted. The slope changes for the other two groups were determined to have no effect and were deleted.

A qualitative variable to account for race was included with the base representing "blacks," and it was expected that "whites and other nonblacks" would have higher fixed expense. The coefficient was \$183 for the low income group and \$387 for the moderate income group, both of which were statistically significant. The difference between the two groups was not significant at the high income level.

With respect to educational achievement, slope coefficients were seldom significant regardless of income level (Appendix Table 1). The intercepts were generally significant at the low income level, but were not otherwise. In terms of coefficient size, all values were largest in absolute values at the moderate income level. With respect to direction of change, the intercept dummies at the moderate income level were positive, whereas the intercepts were mostly negative for both the low and high income groups.

The distinction with respect to differences between the base occupational group (professional, technical, managers) and the included groups seemed to be clear at the low income level, but otherwise vague. The base group was significantly higher at the low income level.

³ A single measure of consumer unit size, based on change in total food expenditure given changes in family composition, was included in both the FIXED and FOOD equations. This measure specifies two groups within the family, with individuals 12 and above years of age assigned the value of 1, and those less than 12 assigned the value of 0.38. It seems likely that this ratio may not be unrealistic for FIXED, since additions to the family probably require additions to fixed expenses in the form of additional housing space, transportation, and other expenses.

⁴ The term "significant" is used exclusively throughout this report to refer to the statistical significance of a variable at the $\alpha = 0.10$ level.

The distinction between renters and owners of a principal residence should reflect the permanent income of the CU to the extent the level of assets is affected. The only significant difference was with renters (RO2) at the moderate income level. It was not surprising that those CUs who were both renters and owners (RO3) during the survey year were not different from the base. There appeared to be little distinction to be drawn from the results of the occupation of the CU spouse dummy groups.

In the second equation of the BLS model with FOOD as the dependent variable, a different set of parameters was involved. FOOD was postulated to be a function of RESINC and was expected to be influenced to some extent by the FIXED variable. The distinction between renters and owners was deleted because food is dependent on residual income regardless of whether the residual is in terms of rent or mortgage payments. Occupation of CU spouse was deleted because it has generally not been a significant variable in earlier research.

The estimates of RESINC come from the variable MPC_{food} (marginal propensity to consume food from residual income). The behavior of the estimates was really an unknown quantity, but is in a sense analogous to the Engel curve estimates. Here, the estimate was highest at the moderate income level rather than at the low income level, a result possible from the simultaneous system of equations or the fact that the expenditure system was not complete. The 20 cent and 12 cent increases in MPC_{food} at the moderate and high income levels were significant (Appendix Table 2).

The variable FOOD was expected to have a direct relationship with the FIXED variable at the low income level. The parameter estimate was not significant at the low income level. The relationship was expected to be inverse at the moderate level, and the estimated coefficient was negative and significant (-0.4). Next, FOOD and FIXED were expected to be positively related at the high income level. The estimated coefficient was negative and significant. It should be noted that the decline at the high income level was at least not as large as the decline at the moderate income level.

Estimates of the CUSIZE variable were positive and significant with respective increases of \$195, \$345, and \$397 when CUSIZE increased one unit (Appendix Table 2). Age of CU head was significant at the low income level but not at the moderate or high incomes. Stage in the life cycle was inversely related to food and significant at the low and moderate income levels.

With respect to education, there was an indication of the possibility of behavioral changes between income groups. For the low income group, all intercept coefficients except the "no education" group (ED6) were positive. On the other hand, all intercepts were

negative for the moderate income group. The pattern here was just opposite the analogous estimates from the equation with **FIXED** as the dependent variable. It appears that the more highly educated CUs spend proportionately less on food at low income levels but reverted to proportionately higher rates of expenditure at the moderate and higher income levels. Possibly the highly educated CUs differ in preferences and expectations from CUs with similar incomes but less formal education.

Elasticities of both **FIXED** and **FOOD** were calculated with respect to selected explanatory variables. The elasticity of **FIXED** with respect to MPC_{fixed} is an indirect measure of income elasticity. The respective values as income increased through the three groups are -1.54, 1.64, and 0.01 (Table 5). Thus, **FIXED** was inferior in the low income group, became superior at the moderate income level, and then was essentially zero at the higher income level. These coefficients support the basic hypothesis that the proportion of income devoted to fixed expenses changes direction at least twice as income increase.

The elasticity of **FIXED** with respect to **FOOD** was -0.01, 0.28, and 0.75 at the low, moderate, and high income levels, respectively. It was expected that the relationship would be strongest at the low income level. However, the moderate and high income groups elasticities are not out of line with the expected proportions.

Table 5. Elasticities for fixed expenses and food expenditures with respect to selected variables in the BLS model, by income groups

Variable	Income group		
	1-Low	2-Moderate	3-High
FIXED			
MPC_{fixed}	-1.54	1.64	0.01 ^a
FOOD	-0.01 ^a	0.28	0.75
CUSIZE	-0.07 ^a	-0.30 ^a	-0.44
AGEHD	-0.53	-0.34	-0.53
LIFECY	0.16	0.04 ^a	0.09 ^a
FOOD			
MPC_{food}	0.41 ^a	0.68	0.59
FIXED	-0.02 ^a	-0.60	-0.44
CUSIZE	0.80	0.59	0.58
AGEHD	-0.64	0.09 ^a	0.06 ^a
LIFECY	-1.37	-0.47	-0.03 ^a

^aParameter estimate for the relationship between these two variables was not significant at the 0.10 level.

Data Source: 1972-73 Bureau of Labor Statistics Survey [12].

The elasticities of FIXED with respect to CUSIZE were consistently negative at all three income levels, and increased in size from -0.07 at the low income level to -0.44 at the high income level.

The second set of elasticities dealt with the response of the FOOD variable to changes in selected factors. First, changes in MPC_{food} are somewhat analogous to the Engel curves presented earlier, and to the elasticities calculated from those equations. In contrast to the Engel curve results at the three income levels, the elasticity was lowest rather than highest for the low income group. This change was quite substantial and may indicate that some other expenses which come from residual income may be vital to consumers at the low income level.

The elasticity of FOOD with respect to CUSIZE was positive at all levels of income, in contrast to the negative values for the elasticities of FIXED with respect to CUSIZE. With respect to AGEHD, the elasticity value was negative and fairly large at the low income level, but positive and small at both the moderate and high income levels. Elasticity of FOOD was consistently negative with respect to LIFECY, although the estimate approached zero in the high income group.

Both the pattern of change between income levels and the magnitudes of estimated coefficients are important to the analysis of the FIXED-FOOD interrelationship. One of the patterns of interest is the percentage change of mean values between income groups for the FIXED and FOOD variables.

Comparison of the percentage change between the low and moderate and the moderate and high income groups, appears to support the hypothesis that food expenditure increased less slowly between the former groups than did fixed expenses (Table 6). The strength of this relationship was at least partially supported by the fact that FOOD was more stable than FIXED. The increase in FOOD was less

Table 6. Mean values for the food expenditures and fixed expense variables, by income group, and percent change between groups in each expense category, estimated from BLS model

Income group		Variable			
		FOOD		FIXED	
		Mean value	Percent change between groups	Mean value	Percent change between groups
Low:	Less than \$8,000	0.216	34%	0.233	91%
Moderate:	\$8,000 to \$16,000	0.291	-27%	0.444	-38%
High:	Greater than \$16,000	0.210		0.272	

Data Source: 1972-73 Bureau of Labor Statistics Survey [12].

than in FIXED between the lower income groups, 34 percent to 91 percent. On the other hand, the decrease in FOOD, 27 percent, was less than the decrease in FIXED, 38 percent, between the upper income groups. In terms of proportional change, the proposed FIXED-FOOD relationship under investigation seems to have some support. Also, FOOD seems to show more "stickiness" than FIXED in terms of both upward and downward movement.

In general, with respect to the FIXED and FOOD variables and the level of income the following statements seem valid:

1. MPC_{fixed} responded to changes in income in a pattern that would be consistent with the hypothesized effect on FOOD. This does not provide conclusive evidence that food expenditure decreases at the moderate income level, but does support that contention.

2. Residual income was directly related to food expenditure at all income levels, and the effect was strongest at the moderate income level.

3. Neither FIXED nor FOOD appeared to have any influence on each other at the low income level.

4. FIXED had an inverse effect on FOOD at the moderate and high income levels, and had the greater effect at the moderate income level.

5. There was a direct effect on FIXED from changes in FOOD, but the parameter estimates were lower than anticipated.

Results from Knox Model

The Knox model utilized a separate data set from the BLS model and included some detail about individual food categories. Due to limited response from the Knoxville survey, particularly at the low income level, information regarding the low and moderate income levels were combined. Thus, the low income group in the Knox model analysis was defined as \$16,000 or less, while the high income group remained at the same level as in the BLS model.

The estimation of the fixed expenditure equation revealed that few of the included variables had any significant effect on FIXED (Appendix Tables 3-8). Only the RENTOWN distinction was significant at the low income level. At the high income level FOOD caused FIXED to decrease by 18 percent, and one each of the educational and occupational groups was significantly different from the base.

The remainder of this set of equations refers to individual food groups, specifically meats, dairy, produce, grocery, and meals outside the home. The MPC for each of the categories is examined. In only two cases, both at the low income level, are the coefficients significant. For meats, the MPC was -0.11 (Appendix Table 4). In the other case, the MPC for meals out had the expected results with a positive

0.13 coefficient.

The food categories were expected to respond to FIXED, just as in the BLS model. The FOOD variable was also included to get a picture of changes in the composition of the food basket as total expenditure increased.

As found to be the general case, the significant relationships were mostly in the low income group. FIXED had a significant effect on meats, dairy, produce, and meals out, all at the low income level (Appendix Tables 4, 5, 6, and 8). It is interesting to note the strength of preference displayed with meats. When FIXED (an expense with which meats was hypothesized to be competitive) increased, expenditure on meats also increased. All the other categories, including meals out, had inverse relationships.

The estimated coefficients for FOOD give a general estimate of the proportion of an additional food dollar that would be devoted to each specific category. At the low income level, meats, dairy, produce, and grocery were significantly related to food in a positive manner. The only categories in the high income group to be significantly affected were dairy and meals out. This seems to indicate that these categories have the stronger claims on additional food dollars at that income level.

Consumer unit size had a significant negative effect on meals out for the high income group (Appendix Table 8). The relationship between CUSIZE and dairy expenditure was positive and significant at the high income level (Appendix Table 5).

With respect to AGEHD, meats and produce expenditures increased while grocery expenditures decreased (Appendix Tables 4, 6, 7). Results regarding LIFECY are significant and positive for both income groups in relationship to dairy products (Appendix Table 5).

The race, education, occupation, and bulk storage dummy variables were never significantly different from the base group at the high income level. At the low income level there were significant differences for meats, produce, and grocery.

The elasticities calculated for the various endogenous variables in the Knox model were not consistent with those calculated from the BLS model. With respect to income, FIXED was a normal good (Table 7). A contrast existed with CUSIZE, where the values in the Knox model were positive, while negative in the BLS model. The calculated elasticities for FOOD, AGEHD, and LIFECY revealed that FIXED was inferior with respect to these variables.

The various food category elasticities are presented in the remainder of Table 7. In every case the sign of the elasticity coefficient changed between income groups. The elasticities take into account both socioeconomic variables and fixed expenses, so the possibility of absolutely greater values is probably enhanced. The value for

Table 7. Elasticities for fixed expenditure and food expense with respect to selected variables, Knox model, by income group

Variable	Income group ^a	
	Low (\$16,000 or less)	High (Greater than \$16,000)
FIXED		
INCOME ^b	0.35 ^g	0.12 ^g
FOOD	-0.05 ^g	-0.08
CUSIZE ^c	0.34 ^g	0.40 ^g
AGEHD ^d	-0.55 ^g	-0.75 ^g
LIFECY ^e	-0.08 ^g	-0.31 ^g
MEATS		
RESINC ^f	-0.43	0.43 ^g
FOOD	0.70	0.67 ^g
FIXED	1.51	-0.03 ^g
DAIRY		
RESINC ^f	0.19 ^g	-0.18 ^g
FOOD	0.89	9.81
FIXED	-0.84	-0.04 ^g
PRODUCE		
RESINC ^f	0.1 ^g	-0.18 ^g
FOOD	0.77	0.75 ^g
FIXED	-0.75	0.40 ^g
GROCERY		
RESINC ^f	-0.08 ^g	0.42 ^g
FOOD	-1.58	0.54 ^g
FIXED	-0.01 ^g	-0.59 ^g
MEALS OUT		
RESINC ^f	0.97	-0.21 ^g
FOOD	0.93 ^g	2.30
FIXED	-2.59	-0.10 ^g

^a Group 1 is equivalent to Groups 1 and 2 in BLS model.

^b INCOME is equivalent to MPC_{fixed}.

^c Consumer unit size.

^d Age of head of consumer unit.

^e Stage of life cycle.

^f RESINC is equivalent to MPC_{food}.

^g Parameter estimate for the relationship between these two variables was not significant at the 0.10 level.

Data Source: 1978 Knox County Survey [6].

meals out should not be overemphasized because services as well as food are consumed.

The response of individual food groups to FOOD was generally without the 0.6 to 0.9 range. Grocery at the low income level (-1.58) and meals out at high income level (2.30) were exceptions.

The food categories generally switched from inferior to normal goods with respect to FIXED. Two values stand out. Meats appear to be strongly preferred at the low income level with an elasticity of 1.51. Secondly, at the low income level, the elasticity of meals out is -2.59.

In terms of the effect of income and residual income, significance levels did not provide strong support for their inclusion in this model. Income was not a significant regressor in the FIXED equation, and RESINC was significant in only two categories, both at the low income level. But again, sample size was a limiting factor, particularly with the high income group.

The interrelationship between FOOD and FIXED was explored through examination of signs of estimated coefficients. For the food categories at the low income level, a negative relationship was postulated. The categories should have increased with increasing total food expenditure. The irregular agreement with *a priori* expectations necessitate caution in the extraction of conclusions from the results of the Knox model.

A conclusion which does seem warranted, however, both due to the size of the changes and agreement with expected results, is that expenditures on meals out is much more likely to adjust rapidly than expenditures in other food groups. This result is reasonable because meals out includes other services, and these services are expected to be more elastic than for individual food groups.

IMPLICATIONS REGARDING FOOD POLICY

Implications from this study of the allocation of income to food and other items were derived in order to help evaluate public policies and the instruments or programs chosen to accomplish the stated program objectives. Two objectives, educational information and income assistance for low income citizens have both been advocated to enhance the nutritional level of U.S. food consumers. In the latter case, assistance is currently granted in the form of bonus food stamps. The idea has been advanced, based on an argument that efficient resource allocation is accomplished when an individual can act on his own evaluation of his marginal utility, that this assistance should be granted in cash. Based on the results of the models analyzed in this study, the contention can be made that additions to total income in the form of cash would be allocated to other products besides food.

At low incomes, it appears that changes in residual income result in increases in food expenditures. However, increases in residual income result from decreases in fixed expenses and vice versa. When fixed expenses decrease at low income levels, there is no substantial change in food expenditure. It appears that the statement cannot be made that there would be an increase in food expenditure when fixed expenses decrease. Hence, results from this study suggests that additional income alone may not accomplish the goal of an adequate level of nutrition.

At the moderate income level it appears that an even stronger statement may be made. Increases in fixed expenses (which again result in a decline in residual income) actually precipitates a decline in the level of food expenditure. It may be implied that there would be a substitution of fixed expenses for food expenditures, and that additions to total income would bear little relationship to the accomplishment of nutritional goals. However, this effect is of limited impact since it may be presumed that most food stamp assistance would accrue to consumers in the low income group.

Another consideration about the effect on food expenditure is related to the possibility of substitution of food stamps for income. The real effect of a move to cash income supplements would not be as large as implied by this analysis because that would incorporate the assumption that food stamps are a dollar-for-dollar addition to total food expenditure.

Considering the recent (March 1980) actions to curb consumer credit, it might be speculated that there will be a stimulation of demand for food. As the credit load and the proportion of income devoted to the fixed expenses decreases, residual income increases. Of course, this scenario is constructed from data gathered at a single point in time. Changes in macroeconomic variables such as income, unemployment, price levels, and consumers' expectations may induce changes in the relationships evaluated in this report.

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Appendix Table 1. Parameter estimates and t-ratios for explanatory variables in the fixed expenditure equation, BLS model, by income groups

Variable	Income group					
	Low-less than \$8,000		Moderate-\$8,000 to \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
MPC _{fixed} ^b	*-1.03	-6.8	*0.45	2.9	0.002	0.05
FOOD	-0.005	-1.1	*0.37	5.6	*0.92	6.4
CUSIZE ^c	-48.0	-1.0	-230.0	1.6	*-432.0	-2.4
AGEHD ^d	*-10.0	-3.5	*-15.0	-1.8	*35.0	-3.0
LIFECY ^e	*217.0	3.8	5611.0	0.3	22125.0	0.5
RACE ^f	*183.0	2.2	*387.0	2.2	-58.0	-0.2
EDHEAD: ^g						
ED1-I ^h	*-350.0	-1.8	1802.0	1.3	-1332.0	-1.1
ED1-S ^h	-0.02	-0.1	-0.25	-1.3	0.07	0.9
ED2-I	*-333.0	-1.9	*2852.0	2.1	-799.0	-0.7
ED2-S	0.09	0.7	*-0.36	-1.9	0.06	0.7
ED3-I	*-546.0	-2.4	1506.0	1.3	*-1497.0	-1.8
ED3-S	0.13	0.9	-0.21	-1.2	0.07	1.2
ED4-I	642.0	2.2	2899.0	1.8	*-1468.0	-1.7
ED4-S	-0.2	-1.1	*-0.36	-1.7	0.07	1.2
ED6-I	*-576.0	-2.7	1764.0	0.9	405.0	0.2
ED6-S	-0.005	-0.03	-0.25	-0.9	-0.02	-0.1

Appendix Table 1. Parameter estimates and t-ratios for explanatory variables in the fixed expenditure equation, BLS model, by income groups (continued)

Variable	Income group					
	Low-less than \$8,000		Moderate-\$8,000 to \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
OCHEAD: ⁱ						
OC1-I ^h	*-4066.0	-24.0	-217.0	-0.2	-771.0	-0.6
OC1-S ^h	*1.25	11.5	0.03	0.2	0.07	0.8
OC2-I	*-3526.0	-16.1	-434.0	0.4	-1100.0	-1.4
OC2-S	*1.11	9.7	0.03	0.2		
OC4-I	*-3415.0	-10.4	*1733.0	1.7	-1038.0	-1.1
OC4-S	*1.05	7.5	-0.27	-1.9	0.07	1.0
OC5-I	*-3614.0	-13.9	679.0	0.5	43510	0.2
OC5-S	*1.14	9.2	-0.16	-0.9	-0.01	-0.1
OC6-I	*-3731.0	-10.4	-1849.0	-1.0	-30.0	-0.0
OC6-S	*1.1	6.6	0.26	1.0	0.03	0.14
RENTOWN: ^j						
RO2-I ^h	-1151.0	-0.6	*10257.0	7.2	675.0	0.6
RO2-S ^h	0.5	0.9	*-1.11	-5.6	0.1	1.1
RO3-I	-228.0	1.2	14.0	0.0	3.0	0.0
RO3-S	0.01	0.1	0.06	0.1	0.04	0.6
OCSP: ^k						
OC1-I ^h	70.0	0.6	*308.0	1.9	136.0	0.7
OC2-I	*582.0	1.9	80.0	0.4	24.0	0.1
OC4-I	255.0	0.5	-99.0	-0.3	-245.0	-0.7

Appendix Table 1. Parameter estimates and t-ratios for explanatory variables in the fixed expenditure equation, BLS model, by income groups (continued)

Variable	Income group					
	Low-less than \$8,000		Moderate-\$8,000 to \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a

FOOTNOTES—continued

^a* indicates statistical significance at the $\alpha = 0.10$ level.

^bMarginal propensity to consume.

^cConsumer unit size.

^dAge of head of consumer unit.

^eStage of life cycle.

^fRace:

Whites and other nonblacks = 0
Blacks = 1

^gEducation of CU head:

ED1 = some grade school complete
ED2 = some high school complete
ED3 = high school graduate
ED4 = some college complete
ED5 = college graduate, graduate work
ED6 = none, not reported

^hLetters I and S represent intercept and slope coefficients, respectively.

ⁱOccupation of CU head:

OC1 = not working, not retired, other
OC2 = clerical, sales, service workers
OC3 = self-employed, salaried professional and technical, and salaried managers and administrators
OC4 = craftsmen, operatives
OC5 = retired
OC6 = unskilled laborers

^jRent-own:

RO1 = owners
RO2 = both owners and renters
RO3 = renters

^kOccupation of CU spouse:

OC1 = not working, not retired, other
OC2 = clerical, sales, service workers
OC3 = self-employed, salaried professional and technical, and salaried managers and administrators
OC4 = craftsmen, operatives
OC5 = retired
OC6 = unskilled laborers

Data Source: 1972-73 Bureau of Labor Statistics Survey [12].

Appendix Table 2. Parameter estimates and t-ratios for explanatory variables in the food expense equation, BLS model, by income groups.

Variable	Income group					
	Low-less than \$8,000		Moderate-\$8,000 to \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
MPC _{food} ^b	0.09	0.4	*0.2	3.6	*0.12	4.2
FIXED	-0.02	-1.6	*-0.4	-4.6	*-0.33	-2.3
CUSIZE ^c	*195.0	5.9	*345.0	10.7	*397.0	6.3
AGEHD ^d	*-5.0	-2.5	3.1	1.1	2.9	0.5
LIFECY ^e	*-355.0	-36.0	*-3441.0	-5.7	-5852.0	-0.5
RACE ^f	*710.0	13.8	36.0	0.3	*383.0	2.3
EDHEAD: ^g						
ED1-I ^h	96.0	0.6	-262.0	-0.9	139.0	0.2
ED1-S ^h	0.2	0.8	-0.01	-0.2	-0.05	-0.8
ED2-I	*850.0	5.3	*-693.0	-3.2	182.0	-0.4
ED2-S	-0.35	-1.3	*0.12	2.3	-0.03	-0.6
ED3-I	*425.0	2.9	-277.0	-1.4	359.0	1.1
ED3-S	0.04	0.2	0.006	0.1	-0.03	-0.9
ED4-I	178.0	1.2	*-1119.0	-3.3	*862.0	-2.4
ED4-S	-0.02	-0.1	*0.2	2.6	*-0.07	-1.9
ED6-I	-197.0	-1.1	-463.0	-1.2	-14.0	-0.03
ED6-S	0.4	1.4	0.03	0.4	-0.02	-0.4

Appendix Table 2. Parameter estimates and t-ratios for explanatory variables in the food expense equation, BLS model, by income groups. (continued)

Variable	Income group					
	Low-less than \$8,000		Moderate-\$8,000 to \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
OCHEAD: ⁱ						
OC1-I ^h	209.0	1.8	252.0	0.7	-398.0	0.7
OC1-S ^h	0.2	1.0	-0.04	-0.6	0.01	0.3
OC2-I	203.0	1.5	*805.0	4.3	157.0	0.5
OC2-S	0.003	0.0	*-0.17	-3.5	-0.01	-0.3
OC4-I	*-810.0	-6.8	34.0	0.2	-448.0	-1.1
OC4-S	*0.5	2.6	-0.02	-0.4	0.04	0.9
OC5-I	*443.0	3.3	*919.0	2.1	*1143.0	0.9
OC5-S	-0.09	-0.5	*-0.21	-2.4	*-0.17	-1.6
OC6-I	*-246.0	-2.4	*664.0	2.6	-1078.0	-0.8
OC6-S	*0.5	2.7	*-0.2	-2.5	0.07	0.5

^a* indicates statistical significance at the $\alpha = 0.10$ level.

^bMarginal propensity to consume.

^cConsumer unit size.

^dAge of head of consumer unit.

^eStage of life cycle.

^fRace:

Whites and other nonblacks = 0

Blacks = 1

^gEducation of CU head:

ED1 = some grade school complete

ED2 = some high school complete

ED3 = high school graduate

ED4 = some college complete

ED5 = college graduate, graduate work

ED6 = none, not reported

^hLetters I and S represent intercept and slope coefficients, respectively.

ⁱOccupation of CU head:

OC1 = not working, not retired, other

OC2 = clerical, sales, service workers

OC3 = self-employed, salaried professional and technical, and salaried managers and administrators

OC4 = craftsmen, operatives

OC5 = retired

OC6 = unskilled laborers

^jRent-own:

RO1 = owners

RO2 = both owners and renters

RO3 = renters

^kOccupation of CU spouse:

OC1 = not working, not retired, other

OC2 = clerical, sales, service workers

OC3 = self-employed, salaried professional and technical, and salaried managers and administrators

OC4 = craftsmen, operatives

OC5 = retired

OC6 = unskilled laborers

Data Source: 1972-73 Bureau of Labor Statistics Survey [12].

Appendix Table 3. Parameter estimates and t-ratios for explanatory variables in the fixed expenditure equation, Knox model, by income groups

Variable	Income group ¹			
	Low-less than \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
MPC _{fixed} ^b	0.14	1.45	0.03	0.2
FOOD	-0.07	-0.7	*-0.18	-2.1
CUSIZE ^c	270.0	1.43	625.0	0.5
AGEHD ^d	-22.0	-1.3	-77.0	-1.0
LIFECY ^e	-3712.0	-0.4	-157419.0	-0.5
RACE ^f	153.0	1.6	— ^m	
EDHEAD: ^g				
ED1-I ^h	278.0	0.5	-4804.0	-1.6
ED2-I	-746.0	-1.2	— ^m	
ED3-I	-223.0	-0.4	*-4154.0	-2.1
ED4-I	308.0	0.5	1089.0	0.7
OCHEAD: ⁱ				
OC1-I ^h	-853.0	-0.9	-1937.0	-0.8
OC2-I	-212.0	-0.3	— ^m	
OC4-I	-157.0	-0.2	*4493.0	2.1
OC5-I	314.0	0.4	— ^m	
OC6-I	-269.0	-0.3	476.0	0.3
RENTOWN: ^j	*987.0	2.4	-2688.0	-1.7
NUMINC ^k	118.0	0.6	-671.0	-0.8

Footnotes a-j listed on Appendix Table 1.

^kNumber of incomes in the CU.

^lGroup 1 is equivalent to Groups 1 and 2 in BLS model.

^mNo respondents in the survey identified in this group.

Data Source: 1978 Knox County Survey [6].

Appendix Table 4. Parameter estimates and t-ratios for explanatory variables in the meats expense equation, by income group

Variable	Income group ^k			
	Low-less than \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
MPC _{meats} ^b	*-0.11	-1.9	0.01	1.1
FIXED	*0.27	2.3	-0.003	-0.1
FOOD	*0.22	2.1	0.13	1.4
CUSIZE ^c	-25.0	-0.4	79.0	1.5
AGEHD ^d	*8.0	2.7	0.6	0.1
LIFECY ^e	*356.0	2.4	-1506.0	-1.7
RACE ^f	-123.0	-1.3	— ^m	
EDHEAD: ^g				
ED1-I ^h	159.0	1.2	261.0	1.1
ED2-I	149.0	0.9	— ^m	
ED3-I	*234.0	1.8	118.0	0.9
ED4-I	66.0	0.5	79.0	0.7
OCHEAD: ⁱ				
OC1-I ^h	*-395.0	-2.1	-81.0	-0.3
OC2-I	163.0	1.1	— ^m	
OC4-I	*313.0	1.8	-85.0	0.7
OC5-I	-175.0	-1.1	— ^m	
OC6-I	*-283.0	-1.8	3.0	0.0
BULKSTOR: ^j	6.0	0.1	58.0	0.8

Footnotes a-i listed on Appendix Table 1.

^jBulk food storage capacity.

^kGroup 1 is equivalent to Groups 1 and 2 in BLS model.

^mNo respondents in the survey identified in this group.

Data Source: 1978 Knox County Survey [6].

Appendix Table 5. Parameter estimates and t-ratios for explanatory variables in the dairy equation.

Variable	Income group ^k			
	Low-less than \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
MPC _{dairy} ^b	0.02	1.2	-0.003	-0.8
FIXED	*-0.06	-1.9	-0.003	-0.2
FOOD	*0.11	3.9	*0.11	3.1
CUSIZE ^c	8.2	0.5	*44.0	2.1
AGEHD ^d	-1.1	-1.3	1.9	1.1
LIFECY ^e	*132.0	3.2	*1962.0	5.5
RACE ^f	37.0	1.5	— ^m	
EDHEAD: ^g				
ED1-I ^h	12.0	0.4	119.0	1.3
ED2-I	23.0	0.5	— ^m	
ED3-I	26.0	0.7	13.0	0.2
ED4-I	34.0	0.9	49.0	1.0
OCHEAD: ⁱ				
OC1-I ^h	22.0	0.4	75.0	0.8
OC2-I	52.0	1.3	— ^m	
OC4-I	15.0	0.3	-68.0	-1.4
OC5-I	48.0	1.1	— ^m	
OC6-I	46.0	1.1	-16.0	-0.3
BULKSTOR ^j	-22.0	-1.1	5.0	0.2

Footnotes a-i listed on Appendix Table 1.

^jBulk food storage capacity.

^kGroup 1 is equivalent to Groups 1 and 2 in BLS model.

^mNo respondents in the survey identified in this group.

Data Source: 1978 Knox County Survey [6].

Appendix Table 6. Parameter estimates and t-ratios for explanatory variables in the produce equation, by income group

Variable	Income group ^k			
	Low-less than \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
MPC _{produce} ^b	0.01	1.4	-0.002	-0.3
FIXED	*-0.05	-2.6	0.02	0.6
FOOD	*0.09	5.0	0.07	1.1
CUSIZE ^c	*-39.0	-4.1	25.0	0.6
AGEHD ^d	*1.1	2.1	0.3	0.1
LIFECY ^e	*183.0	7.2	-28.0	0.1
RACE ^f	-3.0	-0.2	— ^m	
EDHEAD: ^g				
ED1-I ^h	*-37.0	-1.7	97.0	0.6
ED2-I	*-57.0	-2.0	— ^m	
ED3-I	24.0	1.1	144.0	1.5
ED4-I	-35.0	-1.5	28.0	0.3
OCHEAD: ⁱ				
OC1-I ^h	*-107.0	-3.4	182.0	1.0
OC2-I	*-51.0	-2.1	— ^m	
OC3-I	-7.0	-0.2	-39.0	-0.4
OC5-I	*-86.0	-3.2	— ^m	
OC6-I	*-70.0	-2.6	80.0	0.7
BULKSTOR ^j	*-57.0	-4.4	67.0	1.3

Footnotes a-i listed on Appendix Table 1.

^jBulk food storage capacity.

^kGroup 1 is equivalent to Groups 1 and 2 in BLS model.

^mNo respondents in the survey identified in this group.

Data Source: 1978 Knox County Survey [6].

Appendix Table 7. Parameter estimates and t-ratios for explanatory variables for the grocery equation, by income group

Variable	Income group ^k			
	Low-less than \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
MPC _{grocery} ^b	-0.02	-0.5	0.02	1.1
FIXED	-0.002	-0.0	-0.13	-1.6
FOOD	*0.45	7.6	0.22	1.2
CUSIZE ^c	53.0	1.6	138.0	1.4
AGEHD ^d	*-9.0	-5.2	-14.0	-1.7
LIFECY ^e	*-676.0	-7.8	2607.0	1.5
RACE ^f	61.0	1.1	— ^m	
EDHEAD: ^g				
ED1-I ^h	113.0	1.5	115.0	0.3
ED2-I	136.0	1.4	— ^m	
ED3-I	6.0	0.1	-216.0	-0.9
ED4-I	-12.0	0.2	15.0	0.1
OCHEAD: ⁱ				
OC1-I ^h	*543.0	4.9	58.0	0.1
OC2-I	43.0	0.5	— ^m	
OC4-I	-97.0	-0.9	88.0	0.4
OC5-I	*253.0	2.7	— ^m	
OC6-I	*367.0	4.0	-64.0	-0.2
BULKSTOR ^j	*89.0	2.0	27.0	0.8

Footnotes a-i listed on Appendix Table 1.

^jBulk food storage capacity

^kGroup 1 is equivalent to Groups 1 and 2 in BLS model.

^mNo respondents in the survey identified in this group.

Data Source: 1978 Knox County Survey [6].

Appendix Table 8. Parameter estimates and t-ratios for explanatory variables in the meals out equation, by income group

Variable	Income group ^k			
	Low-less than \$16,000		High-greater than \$16,000	
	Parameter estimate	t-ratio ^a	Parameter estimate	t-ratio ^a
MPC _{meals out} ^b	*0.13	2.1	-0.004	-0.3
FIXED	*-0.24	-1.8	-0.009	-0.1
FOOD	0.15	1.3	*0.37	2.3
CUSIZE ^c	7.0	0.1	*-226.0	-2.4
AGEHD ^d	0.8	0.2	4.0	0.5
LIFECY ^e	-3.0	-0.1	-1454.0	-0.9
RACE ^f	28.0	0.3	— ^m	
EDHEAD ^g				
ED1-I ^h	-231.0	-1.6	*-709.0	-1.8
ED2-I	-250.0	-1.4	— ^m	
ED3-I	*-286.0	-2.0	-102.0	-0.4
ED4-I	-54.0	-0.4	-103.0	-0.5
OCHEAD ⁱ				
OC1-I ^h	-62.0	-0.3	-487.0	-1.2
OC2-I	-217.0	-1.4	— ^m	
OC4-I	-243.0	-1.3	159.0	0.7
OC5-I	-39.0	-0.2	— ^m	
OC6-I	-65.0	-0.4	-101.0	-0.4
BULKSTOR ^j	-22.0	-0.3	-144.0	-1.1

Footnotes a-i listed on Appendix Table 1.

^jBulk food storage capacity.

^kGroup 1 is equivalent to Groups 1 and 2 in BLS model.

^mNo respondents in the survey identified in this group.

Data Source: 1978 Knox County Survey [6].

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