Expenditures on Food Away from Home by All-Income and Low-Income Households: Analysis Using USDA's 1985 and 1986 Continuing Survey of Food Intakes by Individuals (CSFII) Data

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ABSTRACT

Data from USDA's Continuing Survey of Food Intakes by Individuals 1985 and 1986, all income and low income, were utilized to estimate relationships between expenditures on food away from home and household characteristics using a household production framework and correcting for possible sample selection bias due to refusal to participate in the survey. Estimated income elasticities were .54 for the all-income and .68 for the low-income samples.

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The proportion of after-tax income allocated to food in the United States has been in a long-term decline. Whereas in 1930 that proportion was 24.4 percent, in 1984 it was 15.1 percent (Kurland and Dunham). All of the decline in food expenditures as a proportion of income has occurred in the food at home (FAH) category--from 20.2 percent in 1930 to 10.8 percent in 1984. By contrast, the proportion of after-tax income spent on food away from home (FAFH) has remained remarkably constant since 1930, at slightly over 4 percent. Thus, currently, about 30 cents of the food dollar goes to the consumption of food away from home. This figure clearly points out the importance of FAFH as a component of the food industry, the consumer's budget, and the consumer's overall dietary intake.

Several authors have recently analyzed the consumption of FAFH (McCracken and Brandt 1987, Morgan and Goungetas, Lippert and Love, Kinsey, Kolodinsky, Haines, Smallwood and Blaylock, Prochaska and Schrimper, Redman, Sexauer, Lee and Brown, Yang). Major objectives of these studies have been to identify and estimate the impact of sociodemographic factors influencing the demand for FAFH. However, the main focus of these studies has been estimation of income elasticities of the demand for FAFH. It has been found that estimated income elasticities for expenditures on FAFH exceed those for FAH (Lee and Brown, Smallwood and Blaylock, Huang and Raunikar). Thus, one may expect changes in income to have a larger impact on FAFH than on FAH.

The predominant theoretical tool employed for analyzing consumption of FAFH has been household production theory. This is mainly in order to incorporate into the analysis the value of the householder's time and related proxies available from survey data. Statistical estimation techniques utilized, besides some form of ordinary least squares (Prochaska and Schrimper, Redman, Morgan and Goungetas), include Tobit analysis (McCracken and Brandt 1987, Kolodinsky, Haines, Yang) and switching regressions analysis (Lee and Brown). Data analyzed have been mainly from the Consumer Expenditure Surveys (Kolodinsky, Lippert and Love, Redman); the Nationwide Food Consumption Surveys (Prochaska and Schrimper, Lee and Brown, McCracken and Brandt 1987, Morgan and Goungetas, Haines, Smallwood and Blaylock); the Panel Study of Income Dynamics (Kinsey); and the Continuing Survey of Food Intakes by Individuals, Low Income (CSFII-LI), 1985 and 1986 (Yang).

In her analysis of CSFII-LI 1985-86 data from low-income households containing at least one female 19-50 years of age, Yang obtained FAFH income elasticities of the order of magnitude of .6. These income elasticity estimates were smaller than those obtained in previous studies. In addition, Yang compared regression results obtained from the Tobit and OLS techniques (Tobin, McDonald and Moffitt, Fomby et al.). She concluded that, even though 27 percent of low-income households reported 0 expenditures on FAFH in the previous 2 months, the results were very similar. For example, the Tobit estimate of the income elasticity for FAFH was .59, while the OLS estimate was .65. Because these reported expenditures on FAFH were for a period of 2 months prior to the survey interview, the amount of censoring in the sample appears minimal. Thus, OLS regression may be appropriate for analysis of CSFII FAFH data.

Based on this premise, FAFH data from the CSFII-LI 1985-86 and from the all-income CSFII 1985-86 were analyzed for this study using OLS regression in order to compare FAFH consumption behavior of low-income and all-income households. In addition, the regression results were corrected for possible sample selection bias due to household refusal to participate in the survey using a Heckman two-step procedure. The estimated relationship between FAFH and socioeconomic factors for this study was identical to that of Yang, which was based on household production theory.

Theoretical Framework

Analysis of the demand for FAFH can take place under either of two theoretical frameworks: Classical consumer theory, or household production theory. Detailed and formal discussions of these theories can be found in microeconomic theory textbooks (Varian, Russell and Wilkinson) or journal articles (Becker, Gronau).

The main result of either theory is the derivation of household demand functions for goods and services. In classical consumption theory, quantities of goods and services demanded depend on market prices and the household's income. For empirical estimation purposes, these variables explain only a small portion of the total variation in quantity demanded (Cramer). The researcher is thus forced to attribute the residual variation in observed demand to differences in tastes. Unfortunately, there exists no theory of formation of tastes to guide the researcher in selecting the appropriate proxies on a-priori grounds. Instead, whatever sociodemographic variables are available are incorporated in the analysis as ad hoc proxies for tastes. Thus, a great weakness of traditional theory is that it relies

largely on differences in tastes to explain behavior when it can neither explain how tastes are formed nor predict their effects (Becker, Lancaster, Muth, Michael and Becker).

By contrast, in household production theory, where the household is thought to be both a consumption and a production unit, quantities demanded of market goods and services serve as inputs into a household production function which yields as outputs final consumption goods. Thus, demands for market goods and services are derived demands for production inputs. Other inputs utilized by the household include household members' time or labor, human and physical capital, and other variables reflecting the environment under which household production takes place.

Under household production theory, the (derived) demands for market goods and services depend not only on market prices and the household's income, but also on the value of the household's time (i.e., the wage rate of the household's labor at equilibrium), the household's availability of human and physical capital, and other variables reflecting the household production environment. A consequence of relevance here is that in response to an increase in the value of the household's time, the household, much like a firm, will tend to employ less time-intensive production processes (Becker, Gronau, Michael and Becker).

Statistical Model

It is clear from the preceding discussion that, in empirical demand analysis choice of theoretical framework may significantly affect estimates of parameters. That is, if household production theory is a more realistic

description of household consumption behavior, an estimate of, or proxies for, the value of the household's time must be included in the empirical specification in order to avoid an omitted variable bias.

Ideally, the demand for FAFH would be estimated as part of a system of demands. This would be tedious at best, even assuming that available data permit such an approach. In this study, as in most other studies of the demand for FAFH, a single equation approach is taken. This is a highly restrictive approach and thus the results should be interpreted accordingly.

Since a portion of screened, eligible households refused to participate in the surveys, the potential for sample selection bias exists (Maddala, Amemiya, Heckman and Macurdy). Following Amemiya (p. 385-389), expenditures on FAFH are observed only if an eligible household decides to participate in the survey. This model can be written as:

$$Y^*_{1i} = X'_{1\cdot i} B_1 + U_{1i}$$

$$Y^*_{2i} = X'_{2\cdot i} B_2 + U_{2i}$$

$$Y_{2i} = Y^*_{2i} \text{ if } Y^*_{1i} > 0$$

$$= 0 \quad \text{if } Y^*_{1i} \leq 0$$

where $i = 1, 2, \ldots, N$

and (U_{1i}, U_{2i}) are i. i. d.

drawing from a bivariate normal distribution with zero mean and variances of σ_1^2 and σ_2^2 and covariance $\sigma_{1,2}$. It is assumed that only the sign of Y^*_{1i} is observed. That is, $Y^*_{1i} = 1$ if household participates, $Y^*_{1i} = 0$ otherwise.

Assuming a logistic, rather than normal, distribution for the specification, and following Heckman and Macurdy, Heckman's two-step estimator can be

obtained by applying OLS to the sample with $Y^{*}_{1i} = 1$, i.e., participating households, to estimate $Y^{*}_{2i} = X'_{2i} B_2 + M_i A + \underline{e}_i$ (1)

where $M_i = -[LNF(X_{1i}\gamma) - X_{1i}\gamma \cdot F(-X_{1i}\gamma)] / F(X_{1i}\gamma)$

and $F(X_{1i}\gamma) = \frac{e^{X_{1i}\gamma}}{1+e^{X_{1i}\gamma}} = P(Y^{*}_{1i} = 1)$.

Data and Variable Definitions

Data from USDA's 1985 and 1986 Continuing Survey of Food Intakes by Individuals (CSFII) and 1985 and 1986 Continuing Survey of Food Intakes by Individuals, Low Income (CSFII-LI) were utilized in this analysis. The CSFII and CSFII-LI were the first nationwide surveys to collect dietary and other information on U.S. all-income and low-income households and individuals within sample households year by year. The samples consisted of women 19 to 50 years old and their children 1 to 5, and were drawn on a yearly basis. Even though information was collected from each participating woman and child for up to six times at approximately 2-month intervals, this study utilized information obtained through personal interview on the first day of the surveys.

In the CSFII 1985, there were 1,893 households containing at least one age-eligible woman, of which 1,341 households (71 percent) participated. In the CSFII 1986, there were 1,722 households containing at least one age-eligible woman, of which 1,352 households (79 percent) participated. In the CSFII-LI 1985, 1,386 households were eligible to participate in the survey. Of these, 1,223 (88 percent) participated. Finally, in the 1986 CSFII-LI, 2,176 households were eligible to participate in the survey. Of these, 1,916, or 88 percent, participated.

Since the purpose of the analysis was to analyze household expenditures on FAFH, only one set of data from each household was analyzed. The personal characteristics were those of the female head, if age-eligible, or those of the household meal planner/preparer, or of the oldest respondent, in that order. Deletion of unusable schedules resulted in a total of 3,520 CSFII and 3,433 CSFII-LI households being included in the analysis. Of these, 2,367 CSFII and 2,886 CSFII-LI were in the selected (participating) sample.

As discussed previously, the regression results were obtained through a two-step procedure to correct for possible selectivity bias due to refusal of eligible households to participate in the surveys. In the first step, an ad-hoc logistic regression model was estimated for each of the two (full) samples. The dependent variable took a value of 1 if the household participated, or 0 if the household refused to participate even though it was eligible by having a female member 19-50 years (and meeting the income criterion of 130 percent of poverty for the low-income sample). The independent variables were the age-sex composition of the household, race and ethnic origin of homemaker, geographic division, urbanization status, year, month, day of month and time of interview, and whether the household was a farm household. In addition, the logistic regression for the low-income sample contained last month's income as an independent variable. Then the variable M_i of equation (1) was computed and included as an independent variable in the two regression equations for expenditures on FAFH, which were then estimated by OLS. In theory, these estimates are biased because of the presence of zero reported expenditures on FAFH (about 8 percent and 27 percent for the all-income and low-income samples, respectively). However,

Yang pointed out that both Tobit and OLS results for the low-income sample were quite similar. Thus it was felt that the potential selectivity bias due to reported FAFH expenditures truncation was negligible. Instead, statistical attention was paid to the potential for selectivity bias because of FAFH expenditures truncation due to nonparticipation.

Table 1 shows descriptive statistics of the variables used in the model. The dependent variable was the household's usual expenditures on food away from home for the 2 months prior to the survey, reported by the main meal planner and/or preparer. This was expressed as expenditures on FAFH per week.

The measure of income utilized was last month's household income per week, including the value of food stamps obtained, if applicable. The remaining independent variables were variables thought to serve as proxies for the household's value of time[1] (employment of female head, age/sex composition, presence of children 1 to 5 years of age, household headship, single-person household[2]); as proxies for prices and/or the household production environment (region, urbanization, and type of eating establishment attended 1 day prior to interview by respondent (McCallum), race of respondent, Food Stamp Program participation); as proxies for physical capital (tenancy); and of human capital (age, education of respondent).

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[1]Given the unavailability of wage/employment information on non-eligible household members, the homemaker's value of time could not be imputed by a procedure such as utilized by McCracken and Brandt (1986). Instead, proxies had to be used.

[2]Sexauer and Mann.

Results

The relevance of the findings to household production theory and their implications in general have been discussed extensively in Yang for the low-income sample. Discussion of results from this study will be limited mainly to comparisons of the findings from the two samples.

Descriptive statistics and regression results for the two samples are shown in Table 1. The means columns reveal some important differences between the all-income and low-income samples. Households in the all-income sample had, on average, about three times as much income and expenditures on FAFH as those in the low-income sample. They also tended to have an older homemaker, fewer children, more adult males, and were more likely not to be on food stamps, to have more than high-school education, work full time, be white, own their home, and to have eaten at a sit-down restaurant on the day prior to the interview than those households in the low-income sample.

The estimated marginal propensities or income coefficients for the all-income and low-income samples were quite similar at 2.7 and 3.3 cents per additional dollar of income. These translate to income elasticities of .54 and .68, respectively (Table 2). Table 2 presents a summary of previous studies on FAFH, including data source, analytical method, and estimated income elasticities. As can be seen from Table 2, estimated income elasticities have been relatively homogeneous and seem to have been in a secular decline. The average estimated income elasticity from the studies presented in Table 2 ranges from .53 to .71.

In addition to income, regression results from the all-income sample similar to those of the low-income sample and their impact on expenditures on FAFH were: Number of children 6 to 12 years of age (-), number of males 19 to 50 (+) and number of females 19 to 50 (+), being in a nonmetropolitan household (-), and having eaten at a sit-down restaurant (+), fast-food (+), or multiple eating establishments (+) on the day prior to the interview. There were no sign reversals approaching statistical significance. However, several variables which were found to be statistically significant in the low-income sample did not even approach significance in the all-income sample. Most notable of these was the homemaker's age, which was found to be negatively related in previous studies (Redman, Sexauer, Lippert and Love, Yang).

Summary and Conclusions

Previous analysis of 1985-86 CSFII-LI data showed that OLS estimation of expenditures on FAFH relationships is robust relative to Tobit analysis. Accepting this finding, this study utilized data from combining the 1985 and 1986 CSFII all-income surveys and 1985 and 1986 CSFII-LI surveys to obtain an "all-income" and a "low-income" sample. Since some survey information was available for eligible households refusing to participate, this study employed a two-step Heckman procedure to correct for possible selectivity bias in estimated relationships between expenditures on FAFH and available household and individual characteristics postulated by household production theory to be important. A comparison of the estimated relationships from the all-income and low-income samples revealed several similarities and no conflicting results. Estimated income elasticities, for example, were .54 and .68 for the two samples, respectively, in broad agreement with previous findings. In addition, selectivity bias due to refusal to participate appeared to be minimal in both sets of results from the analysis of expenditures on food away from home.

TABLE 1.--Summary Table of Means and Selectivity Bias Corrected Regression Coefficients Estimating Relationships between Household Expenditures on Food Away from Home, and Several Household Characteristics; 1985 and 1986 CSFII (N=2,367) and CSFII-LI (N=2,886), Day 1.

	CSFII 1985-86 ALL INCOME			CSFII 1985-86 LOW INCOME		
VARIABLE	MEAN	PARAMETER ESTIMATE	T*	MEAN	PARAMETER ESTIMATE	T*
expenditure on FAFH, per week	24.1514736			8.3684364		
intercept		-1.43962296	-0.323		8.39750040	4.972
income, last month, per week,+fsp bonus	478.7220928	0.02744135	12.356	172.0103588	0.03296827	7.509
food stamp participant	0.1064639	-2.22928116	-0.999	0.4421344	-3.69317785	-6.381
homemakers age	34.1968737	0.001903271	0.023	32.0443520	-0.10476907	-2.974
education: gradeschool or less	0.0401352	-3.40619726	-1.130	0.1164241	-1.55179332	-2.006
education: more than highschool	0.4072666	-0.10610314	-0.083	0.1943867	1.51380968	2.438
race: black	0.0874525	1.80772521	0.789	0.3038808	-1.11692731	-1.671
race: asian/pasific islander/other	0.0380228	-0.30624750	-0.098	0.0478170	-1.29248856	-1.091
race: aleut/eskimo/am. indian	0.0067596	-2.41671651	-0.346	0.0467775	1.91398352	1.534
employment status: 1-20 hrs/week	0.1001267	-0.93067203	-0.446	0.0921691	0.43851358	0.519
employment status: >20 hrs/week	0.5661174	2.39213227	1.660	0.2997228	2.18100152	3.719
# of children, <1 yr	0.0735108	-3.00890266	-1.337	0.1396396	-1.04846911	-1.513
# of children, 1 to 5 yrs	0.3983946	-1.98230108	-1.037	0.6704782	-0.33157506	-0.628
# of children, 6 to 12 yrs	0.5297845	-2.24033800	-3.003	0.7442827	-0.64547326	-2.329
# of males 13 to 18 yrs	0.2082805	0.40577942	0.348	0.2463617	0.19465512	0.412
# of males 19 to 50 yrs	0.7769328	4.02845705	2.898	0.6018711	2.18286960	3.949
# of females 13 to 18 yrs	0.1994085	1.05371337	0.854	0.2522523	0.07263380	0.160
# of females 19 to 50 yrs	1.1111111	5.36152530	3.178	1.1146916	1.31326375	1.987
# of persons 51 to 59 yrs	0.0959020	1.16141811	0.614	0.0793486	-0.41430350	-0.515
# of persons >60 yrs	0.0718209	-1.81860026	-1.006	0.0772696	-1.23337438	-1.604
child aged 1 to 5 yrs present	0.3075623	-0.16462321	-0.059	0.4695080	-1.68155955	-1.913
single person household	0.0663287	-3.53287812	-1.267	0.0388080	-0.21096329	-0.161
male head present	0.7482045	0.30314258	0.146	0.5391545	-0.91384501	-1.248
tenancy: own home	0.6311787	2.32389267	1.596	0.2948718	0.52344806	0.869
tenancy: occupy without payment of cash	0.0168990	-0.89416925	-0.199	0.0315315	0.54273564	0.400
urbanization: suburban	0.4989438	-0.52690484	-0.365	0.2737353	-0.31035161	-0.496
urbanization: nonmetro	0.2408112	-4.42271491	-2.576	0.3218988	-1.68479955	-2.625
region: east	0.2036333	0.90320657	0.541	0.2286902	-0.92679627	-1.375
region: north	0.2762991	-2.36810063	-1.553	0.1957727	-2.13694943	-3.162
region: west	0.1880017	0.38358528	0.221	0.2234927	-3.10828002	-4.277
eating place yesterday: restaurant	0.1119561	8.86979517	4.525	0.0557866	3.28586787	3.172
eating place yesterday: fast food	0.1098437	6.83600356	3.501	0.1094941	2.06291493	2.663
eating place yesterday: noncommercial	0.1803971	2.10540308	1.290	0.1476091	0.53577849	0.785
eating place yesterday: multiple	0.1673004	5.20603250	2.991	0.0699931	5.17511694	5.420
lamda**	0.6917526	2.29653386	1.197	0.3596756	-2.36818413	-1.908
F-Value		16.92			13.94	
R-Squared		0.20			0.14	

* Estimated Regression Coefficients are Consistent, T-Values Possibly Biased Due to Heteroscedastic Specification (See Text).

** From Decision of Eligible Households to Participate in Survey Equations 1985 and 1986 CSFII (N=3,520) and CSFII-LI (N=3,433).

Table 2.--Food away from home: empirical studies

Researcher	Data source	Dependent variable	Analysis	Income elasticity
Prochaska & Shrimper (1973)	1965-66 USDA Household Food Consumption Survey --Spring portion	Number of meals on FAFH Total expenditures on FAFH	OLS	0.31-1.16
Redman (1980)	1972-73 & 1973-74 Consumer Expenditure Survey --Diary portion	Total expenditures on FAFH	OLS	>0
Derrick, Dardis & Lehfeld (1982)	1972-73 Consumer Expenditure Survey	Total expenditures on FAFH	OLS	0.89-1.63
Smallwood & Blaylock (1981)	1977-78 USDA Nationwide Food Consumption Survey	Total expenditures on FAFH	OLS	0.81
Kinsey (1983)	1978 Panel Study of Income Dynamic	Total expenditures on FAFH	Tobit	0.48
Haines (1983)	1977-78 USDA Nationwide Food Consumption Survey	Individual expenditures on FAFH --Restaurant; fast food; cafeteria	Tobit	<1.00
McCracken & Brandt (1987)	1977-78 USDA Nationwide Food Consumption Survey --Spring portion	Total expenditures on FAFH and by type of food facilities --Restaurant; fast food; other commercial facilities	Tobit	0.24
Kolodinsky (1987)	1980 Consumer Expenditure Survey	Total expenditures on FAFH	Tobit	0.10-0.30
Lee & Brown (1986)	1977-78 USDA Nationwide Food Consumption Survey	Total expenditures on FAFH	SR*	--
Yang (1988)	1985 and 1986 Continuing Survey of Food Intakes by Individuals, Low-Income	Usual expenditures on FAFH in last 2 months	Tobit and OLS	0.59 0.65
Basiotis & Yang (1989)	(1) 1985 and 1986 Continuing Survey of Food Intakes by Individuals	Usual expenditures on FAFH in last 2 months	Heckman** two-step	0.54
	(2) 1985 and 1986 Continuing Survey of Food Intakes by Individuals, Low-Income	Usual expenditures on FAFH in last 2 months	Heckman** two-step	0.68

*Switching regression.
**Heckman two-step procedure correcting for possible selectivity bias due to refusal to participate.

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