The Demand for Sweet Spreads: Demographic and Economic Effects for Detailed Commodities

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In this paper we estimate the price and income elasticities for five sweet spreads using a two-stage budgeting procedure. The first stage modeled the consumer's budget decision as a Tobit model, where total sweet spread expenditures are based on income and demographic variables. The second stage, including only those households with nonzero first stage expenditures, was treated as a standard consumer allocation problem using the AIDS model. To incorporate population demographics, the AIDS model was expanded by specifying the constant term as a linear function of demographic variables. The coefficients for the prices and expenditures are highly significant and demand is elastic for all five goods. The most significant demographic effects are due to household size, and female food shopper. The theoretical restrictions of homogeneity and symmetry were tested and rejected for the complete system.

This paper provides estimates of the demand structure for five sweet spreads: syrup, molasses, honey, jellies, and jams. The national consumption of syrup, molasses and honey increased nearly twenty-five percent from 1970 to 1982 while the value of the jams and jellies produced has increased an average of twelve percent per year since 1972.[1] Equally important, honey bees figure prominently in the pollination of many crops. The demand for honey affects the number of honey bee colonies maintained and available for pollination activity. This study's immediate focus is on the economic and demographic determinants of sweet spread demand.

The changing demographic profile of the U.S. population has had significant impacts on the demand for food. Changes, such as the postwar baby-boom, the gradual aging of the population and increases in female labor force participation rates have had significant impacts. These impacts become more evident the greater the commodity detail analyzed. For example, total vegetable demand has changed little over the past 40 years. However, the mix between fresh, frozen, and canned has changed dramatically, as has the relative importance of various kinds of vegetables. Demographic effects are more evident when analyzing cross-section data. Demographic time series data often display smooth trends exacerbating the multicollinearity problems already inherent in time series. Also, for food items, the level of commodity detail available in time series data is often limited to the farm level raw agricultural products. This paper attempts to alleviate these problems by utilizing cross-section data for individual households.

The purpose of the analysis reported in this paper is four-fold: 1) to estimate the price and income elasticities of demand for each of five sweet spreads: syrup, molasses, honey, jellies, and jams. 2) to measure the impact of demographic related variables such as family size, urbanization, housing tenure, region, race, occupation, and employment on demands for these spreads. 3) to test if the estimated parameters are consistent with the restrictions implied by economic theory. 4) to enumerate problems encountered and benefits

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[1] Syrups exclude all corn syrups, including high-fructose corn syrup. See: U.S. Department of Agriculture, *Agricultural Statistics,* 1983, p. 95. National Food Brokers Association. *The Almanac of the Canning, Freezing, Preserving Industries,* 1985, p. 558.

realized when highly detailed commodities and micro (household) data are analyzed.

Model Specification

Consumer demand for sweet spreads is modeled here as a two-stage budgeting procedure. In the first stage the consumer determines total sweet spread expenditure based on income and demographic considerations. The second stage consists of a standard consumer allocation problem subject to the budget constraint determined in the first stage. The two-stage budgeting procedure implies that sweet spread items are separable from other items in the consumer's utility function.[2]

The model selected for the second stage allocation problem is the Almost Ideal Demand System (AIDS) (Deaton and Muellbauer, 1980a). The AIDS model has several advantages. The restrictions of economic theory are readily imposed. Hence, the testing of these restrictions is facilitated. The model is easy to estimate, does not impose any *a priori* restrictions on the degree of substitution among commodities, and is compatible with household budget behavior by allowing for nonlinear Engel curves. The AIDS demand model can be derived from the German polar form cost (expenditure) function,

$$\text{(1)} \qquad \ln m(U, p) = \ln P + U\, b(p)$$

where

$$\text{(2)} \quad \ln P = \alpha_0 + \sum_{i=1}^{n} \alpha_i \ln p_i + \tfrac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \ln p_i \ln p_j$$

$$\text{(3)} \quad b(p) = \beta_0 \prod_{i=1}^{n} p_i^{\beta_i}$$

and where m is the minimum expenditure needed to achieve utility level U facing prices P_i for n commodities. It can be shown that,

$$\text{(4)} \quad w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln(m/P)$$

where Wj, the budget share, equals Pjqi/m and qi is the quantity consumed of the ith good.

The price elasticities for the AIDS model are given by,

where is the Kronecker delta. The expenditure ela δ_{ii} ity is

$$\text{(5b)} \quad e_i = 1 + \beta_i/w_i.$$

The theoretical restrictions of demand theory can be applied to the parameters of the AIDS model. Adding up requires that

$$\text{(6a)} \quad \sum_{i=1}^{n} \alpha_i = 1$$

$$\text{(6b)} \quad \sum_{i=1}^{n} \beta_i = 0$$

and

$$\text{(6c)} \quad \sum_{i=1}^{n} \gamma_{ij} = 0 \qquad , j = 1, \ldots, n.$$

For the demand functions to be homogeneous of zero degree in prices and income it is necessary that,

$$\text{(7)} \quad \sum_{j=1}^{n} \gamma_{ij} = 0 \qquad i = 1, \ldots, n.$$

Lastly, symmetry is satisfied if,

$$\text{(8)} \quad \gamma_{ij} = \gamma_{ji} \qquad i \neq j.$$

As mentioned above, the commodities of interest are syrup, molasses, honey, jellies, and jams. For purposes of this study it was assumed that these goods form a separable group or branch. Under this assumption the expenditure variable, m, is total expenditure on this group. Hence, price elasticities derived under this assumption are only partial elasticities, since total expenditure for each branch will be a function of a price index of these goods also. Lack of data prevented the inclusion of all other prices in the first stage allocation model described below. Hence, sweet spread prices were also excluded from that model. If the effects of the sweet spread prices on sweet spread expenditure is small, then the partial elasticities will be quite close to the total elasticities. This will be true if the elasticity of substitution between groups is near unity.

To incorporate demographic variables, the

[2] See Deaton and Muellbauer (1980b) for a complete discussion of separability.

AIDS model was expanded by specifying each αi as a linear function of demographic variables. Thus, the model with demographic variables can be specified as

$$(9) \quad w_i = \alpha_i + \sum_{j=1}^{n} \gamma_{ij} \ln p_j + \beta_i \ln(m/p)$$

where

$$(10) \quad \alpha_i = \rho_{i0} + \sum_{k=1}^{s} \rho_{ik} d_k$$

with d_k equal to the kth demographic variable of which there are s. Translating and scaling were not used as demographic specifications because of the nonlinear techniques required for estimation and because other studies have concluded that scaling and translating do not fully capture demographic effects (Barnes and Gillingham).

The first stage budgeting decision was modeled as,

$$(11) \quad W_j = \phi_o + \sum_{k=1}^{s} \phi_k d_k + \phi_{s+1} \ln y$$

where Wj = m/y, y is total income and d_k are the demographic variables. The above (11) could be considered to arise from a first stage utility function with group expenditures being the arguments. However, since price data do not exist on the other groups, prices were excluded from the model.

Data Considerations and Estimation Procedures

The data used for this analysis are from the Nationwide Food Consumption Survey in the Spring of 1977 (U.S. Department of Agriculture). Data from 3,196 households across the nation were collected in an interview with the person identified as most responsible for food planning and preparation. The interviewer recorded the form, the quantity and the cost of each food purchased and used in the household during the week prior to the interview. Other information collected included income, education, employment status and occupation, number of meals eaten in the household^ participation in food programs and other household characteristics. In addition, the households were classified according to region and urbanization.

An approximation was introduced into the AIDS model in order to use a linear estimator such as 3SLS. Estimation of the model as given by (9) is highly nonlinear due to the presence of the price index P defined by (2). Deaton and Muellbauer suggest using the geometric index,

$$(12) \quad \ln G_k = \sum_{i=1}^{n} \bar{w}_i \ln p_{ik} \qquad k = 1, \ldots H$$

where H is the sample size (number of households) and W| are mean budget shares, as an approximation. This renders the system linear and the final form for estimation is

$$(13) \quad w_{ik} = \rho_{i0} + \sum_{l=1}^{s} \rho_{il} d_l + \sum_{j=1}^{n} \gamma_{ij} \ln p_{jk} + \beta_i \ln(m/G)_k + \mu_{ik}$$

where μ_{ik} s an error term from an n-dimensional multivariate normal distribution. In order to satisfy the adding up criterion, restriction (6a) is replaced by restrictions

$$(6d) \quad \sum_{i=1}^{n} \rho_{i0} = 1$$

and

$$(6e) \quad \sum_{i=1}^{n} \rho_{il} = 0 \qquad l = 1, \ldots, s.$$

For complete systems of demand equations such as the AIDS model, the error covariance matrix is singular due to the adding-up property. The standard procedure is to drop one good and estimate using maximum likelihood. It is known (Pollak and Wales, 1969) that maximum likelihood estimates are invariant to which good is dropped. Also iterative 3SLS estimates are identical to maximum likelihood estimates for complete demand systems (Dhrymes).

For many households, there were no recorded purchases of any of the five items. Observations where consumers did not allocate any income to sweet spreads (i.e., m = 0) were dropped from the AIDS second stage data set. This reduced the sample size to 1,554 observations since more than half of the households did not purchase any of the sweet spread items during the week the sample was taken. Dropping the observations with no purchases is a result of the decision to model the process as a two-stage procedure. The first stage is the decision to determine how much to spend with one possible outcome being zero.

Given these considerations the complete demand system, using the sample of observations purchasing at least one sweet spread, was estimated by iterative 3SLS.

For demand system models where some budget shares are zero, the usual stochastic assumption of a multivariate normal distribution of the error terms leads to a certain difficulty. At the micro level, demand and hence, budget shares for many items will be zero. Because the multivariate normal is not restricted to the unit simplex, estimated budget shares could be negative or greater than one. Woodland has investigated this problem by comparing estimates made assuming a multivariate normal with those obtained using a Dirichlet distribution which is bound by the unit simplex. Woodland compared both specifications and found the results quite close for several applications.

The first stage budgeting equation (11) was estimated as a truncated model by the Tobit procedure. Deleting only those observations with nonreported income from the original sample of 3,196 households, the model was truncated so that Wj ^ 0.

Empirical Results

The estimates of the second stage model given by (13) with adding up, homogeneity and symmetry imposed are presented in Table 1. The coefficients for the price variables (the -yy's) are highly significant—only two out of 15 parameters have t-ratios less than 1.96 (95 percent confidence). The expenditure coefficients (the pi's) are all significant. With regard to the demographic variables, only region is consistently significant. Household size, tenancy, origin, and male shopper are moderately significant. Occupation, location and employment were generally not significant. Although a number of variables are highly significant it is of interest to note that on average about 10 percent of the variation in each equation is explained by the model. The low R^2's point out the substantial heterogeneity of demand at the micro level.[3]

Table 2 presents the Tobit estimates for the first stage budget allocation, equation (11). Deleting those observations with nonreported income, the total sample size was 2,599 of which 1,117 had zero expenditures on sweet spreads. Highly significant demographic variables were household size, origin, race, and food shopper. Comparison with nontruncated OLS estimates of the model showed smaller standard errors for the Tobit model and three (insignificant) variables: tenancy, female worker and female farmer, exhibited sign reversals. More importantly, the overall income effect for group expenditure is negative. The income elasticity of sweet spread expenditures is —0.266.

The expenditure and price elasticities for the second stage budget allocations are given in Table 3. Demand is elastic for all goods and cross price effects are positive in general. Relatively large cross price effects occur for many items and are particularly strong for molasses, jellies and jams. All goods are substitutes in the Hicks-Alien sense and the degree of substitution is quite high. The standard errors for these elasticities are not given. However, since w^'-yy — By is an extremely close approximation to (5a), the t-ratios for the -yy's, which are given in Table 1 will be extremely close to the t-ratios for the elasticities. Examination of these ratios indicates that 19 of the 25 coefficients have t-ratios exceeding 2.0. Hence price effects are quite significant.

The final column in Table 3 gives the income elasticity for each individual item. This elasticity is the product of the expenditure elasticity and the income elasticity of all sweet spreads expenditures, —0.266. The elasticities indicate that all goods considered are inferior goods.

Table 4 presents elasticities for the various demographic variables. Since many of the demographic effects are represented by dummy variables, the elasticity computation requires some explanation. These elasticities were computed at the sample means of the dummy variables. Hence they only pertain to aggregate relations and not to individual households. These elasticities include the effects of demographics on the first stage budget decision as well as the second stage expenditure allocation problem. Of all the variables, the greatest demographic effect appears to be due to household size. Household size in the molasses equation has the greatest elasticity of the demographic variables. Female food shopper also has large elasticities. To some extent, tenancy and rural location exhibit relatively large demographic elasticities.

[3] Low R^2's could of course indicate an omitted variable or improper model specification. Early experience with alternative specifications and the **wide** variety of demographic variables present persuaded the authors of the inherent heterogeneity.

Table 1. Estimates of Second Stage AIDS Allocation Model*

Variable	Syrup	Molasses	Honey	Jellies	Jams
HH Size	-0.00005	-0.00002	- 0.00033	0.00036	0.00004
Suburban	(0.8360)	(1.0274) -	(6.8151) -	(5.5986) -	(0.7435)
	0.0290	0.0150	0.0242	0.0138	0.0240
Rural	(1.2199)	(1.9136) -	(1.2483) -	(0.5392)	(1.1035)
	0.0230	0.0037	0.0339	0.0107	0.0039
Region: Northeast	(0.9366) -	(0.4547)	(1.6936) -	(0.0403)	(0.1720)
	0.0224	0.0183	0.0641	0.0510	0.0171
North Central	(0.7779)	(1.9205)	(2.7192) -	(1.6412)	(0.6500) -
	0.0049	0.0018	0.0685	0.0882	0.0265
South	(0.1721) -	(0.1860)	(2.9278) -	(2.8561)	(1.0113) -
	0.0030	0.0140	0.0888	0.1488	0.0711
Tenancy: Owned	(0.1052) -	(1.5050)	(3.8630)	(4.8894)	(2.7587)
	0.0464	0.0062	0.0207	0.0038	0.0157
Origin: Spanish	(2.1104)	(0.8586) -	(1.1538)	(0.1608) -	(0.7807) -
	0.0161	0.0215	0.0831	0.0586	0.0191
Race: Black	(0.2854)	(1.1577)	(1.8143) -	(0.9638)	(0.3709) -
	0.0624	0.0121	0.0658	0.0448	0.0535
Male Work	(1.9410)	(1.1419) -	(2.5149) -	(1.2888) -	(1-8168) -
	0.0933	0.0091	0.0154	0.0170	0.0519
Female Work	(2.3597)	(0.6963)	(0.4771) -	(0.3989)	(1.4328) -
	0.0261	0.0002	0.0168	0.0101	0.0197
Male Occup: Professional	(1.3593) -	(0.0344)	(1.0752) -	(0.4886)	(1.1174)
	0.0498	0.0031	0.0262	0.0167	0.0563
Manager	(1.1211) -	(0.2106) -	(0.7235)	(0.3469) -	(1.3832)
	0.0453	0.0123	0.0415	0.0483	0.0645
Farmer	(1.9393) -	(0.7766) -	(1.0569)	(0.9273)	(1.4608)
	0.0850	0.0190	0.0514	0.0327	0.0199
Clerical	(1.1779) -	(0.7963) -	(0.8736) -	(0.4190)	(0.3018)
	0.0778	0.0184	0.0104	0.0072	0.0994
Craftsmen	(1.3778) -	(0.9891) -	(0.2257) -	(0.1176)	(1.9240) -
	0.0067	0.0040	0.0121	0.0380	0.0151
Operative	(0.1507) -	(0.2725) -	(0.3329)	(0.7847)	(0.3675)
	0.0407	0.0105	0.0094	0.0314	0.0105
Service	(0.8007) -	(0.6286)	(0.2268) -	(0.5708)	(0.2264)
	0.1083	0.0289	0.0014	0.0757	0.0050
Female Farmer	(1.9221) -	(1.5584) -	(0.0304)	(1.2436)	(0.4797) -
	0.0483	0.0363	0.0875	0.0220	0.0250
Food Shopper: Female	(0.4164)	(0.9499)	(0.9279) -	(0.1760)	(0.2355) -
	0.0105	0.0145	0.0508	0.0469	0.0211
	(0.3012)	(1.2549)	(1.7830)	(1.2404)	(0.6591)
Male	0.0347	0.0064	-0.0736	0.0429	-0.0105
	(0.7416)	(0.4166)	(1.9283)	(0.8472)	(0.2442)
Female & Male	0.0173	0.0204	-0.0152	-0.0266	0.0040
Syrup Price	(0.4068) -	(1.4544)	(0.4375)	(0.5780)	(0.1033)
	0.0804	0.0056	0.0375	0.0056	0.0316
Molasses Price	(6.6409)	(1.2860) -	(4.5658)	(0.6734)	(3.7945)
	0.0056	0.0314	0.0077	0.0105	0.0076
Honey Price	(1.2860)	(4.5835)	(1.7400) -	(3.0772)	(1.8644)
	0.0375	0.0077	0.0865	0.0223	0.0191
Jellies Price	(4.5658)	(1.7400)	(8.6100)	(3.1455) -	(2.5330)
	0.0056	0.0105	0.0223	0.1043	0.0658
Jams Price	(0.6734)	(3.0772)	(3.1455)	(9.7759)	(8.5250) -
	0.0316	0.0076	0.0191	0.0658	0.1241
Expenditure	(3.7945)	(1.8644)	(2.5330)	(8.5250) -	(11.9022) -
	0.1424	0.0149	0.0381	0.1700	0.0254
Intercept	(11.3810)	(3.4211)	(3.7313)	(12.5909)	(2.2212)
	0.1235	0.0007	0.3713	0.2329	0.2717
Mean Dependent Variable	(2.8032)	(0.0456)	(10.3713)	(4.9045)	(6.7525)
	0.2756	0.0194	0.1422	0.3683	0.1939
R^2	0.1168	0.0358	0.1239		0.1219
Standard Error	(.3525)	(.1162)	(.2869)		(.3225)
SSRegression	25.5260	0.7782	18.0880		22.2640
SSErrors	193.0600	20.9670	127.9400		161.6700

Log of Likelihood Function = 93.093

* t-ratios in parentheses

Table 2. Estimates of First Stage Budget Allocation Model Using Tobit Procedure

		Coefficient	t-ratio
HH Size		0.0000003	8.981
Suburban		0.0000177	1.562
Rural		0.0000247	2.167
Region:	Northeast	-0.0000047	-0.353
	North Central	-0.0000214	-1.624
	South	-0.0000175	-1.346
Tenancy:	Owned	0.0000097	0.947
Origin:	Spanish	-0.0000788	-3.246
Race:	Black	-0.0000321	-2.112
Male Work		-0.0000036	-0.181
Female Work		-0.0000068	- 0.727
Male Occup:	Professional	0.0000462	2.060
	Manager	0.0000236	0.988
	Farmer	0.0001584	4.171
	Clerical	0.0000127	0.463
	Craftsmen	0.0000177	0.812
	Operative	0.0000038	0.155
	Service	0.0000058	0.225
Female Farmer		-0.0000033	-0.067
Food Shopper:	Female	-0.0000336	-2.033
	Male	-0.0000592	-2.750
	Female & Male	-0.0000427	-2.124
Income		-0.0000537	-7.513
Intercept		0.0004169	6.490
Mean Dependent Variable		0.0000424	
R^2		0.061	
Standard Error		0.0001952	

Within the second stage expenditure allocation the restrictions implied by economic theory were tested in the following manner. Homogeneity of degree zero in prices and income was tested equation by equation and for the whole system. For each individual equation the test statistic is:

$$(14) \quad F = \frac{(SSE_R - SSE_U)/Q}{SSE_U/(H-K)}$$

where SSE_R is the sum of squared errors from the restricted model SSEy is the similar sum for the unrestricted model, Q is the number of restrictions imposed on the restricted model, H is the sample size, and K the number of parameters.[4]

The computed F statistics for this test were syrup = 24.41, molasses = 11.36, honey = 0.36, jellies = 4.08, and jams = 5.52. The ratio for (14) is distributed as F(Q, H - K), for which F.Q5 (1,1525) = 3.84 and $F_{.0}$i (1,1525) = 6.64. Hence, the hypothesis of zero degree homogeneity is clearly rejected for syrup and molasses, marginally rejected for jellies and jams, and cannot be rejected for honey. When the complete system is restricted to be homogeneous of degree zero in prices and expenditure the appropriate statistic is the likelihood ratio test, where the ratio of the likelihood function of the restricted and unrestricted system forms the ratio X.[5] The statistic — 21nX is X^2 (£,R) where R is the number of restrictions. For homogeneity for the complete system, the computed statistic is 37.4 which exceeds the X^2(-05, 5) — 11.07. Hence, homogeneity for the whole system was rejected. Next, symmetry for the whole system was tested and rejected. Lastly, both symmetry and homogeneity were imposed on the complete system and tested jointly. Again they were rejected.

The rejection of these theoretical restrictions does not necessarily imply a rejection of utility maximization on the part of the consumer. Many other conditions, as indicated in Byron (1970), Muellbauer (1975) and Barnett (1979), could exist which give rise to this result. Several writers indicate that aggregation over consumers leading to non-negligible non-symmetric biases are the leading cause of rejection of the theoretical restrictions. This is particularly plausible in view of the results obtained by Lau (1977). These biases cause rejection of the restrictions rather than any violation of theory. Also, the restrictions could

[4] For a further description of the test see Johnston, p. 206.
[5] See Berndt and Savin for a description of the test.

Table 3. Price, Expenditure, and Income Elasticities for Sweet Spreads Model

Equation	Syrup	Molasses	Honey	Jellies	Jams	Expenditure	Income
Syrup	-1.388	0.015	0.075	-0.225	0.006	1.517	-.404
Molasses	0.145	- 2.626	0.306	0.176	0.231	1.768	-.470
Honey	0.214	0.051	-1.640	0.029	0.078	1.268	-.337
Jellies	0.101	0.033	0.115	-1.064	0.275	0.538	-.143
Jams	0.187	0.041	0.114	0.402	-1.613	0.869	-.231

Table 4. Demographic Elasticities for Sweet Spreads Model

	Syrup	Molasses	Honey	Jellies	Jams
HH Size	2.438	2.623	1.469	1.139	1.479
Suburban	0.249	-0.012	0.121	0.063	0.164
Rural	0.341	0.296	0.176	0.121	0.186
Region: Northeast	-0.056	0.167	-0.133	0.018	-0.002
North Central	-0.197	-0.211	-0.296	-0.008	-0.152
South	-0.211	-0.002	-0.382	0.061	-0.241
Tenancy: Owned	0.121	0.490	0.295	0.090	0-189
Origin: Spanish	-0.105	-0.167	-0.067	-0.044	-0.065
Race: Black	-0.101	-0.079	-0.156	-0.031	-0.103
Male Work	0.124	-0.365	-0.127	-0.054	-0.201
Female Work	-0.058	-0.107	-0.126	-0.023	-0.094
Male Occup: Professional	0.197	0.279	0.160	0.085	0.166
Manager	0.066	0.034	0.097	0.016	0.079
Farmer	0.091	0.095	0.086	0.036	0.057
Clerical	0.008	-0.020	0.015	0.009	0.037
Craftsmen	0.098	0.086	0.072	0.053	0.046
Operative	-0.001	-0.025	0.012	0.009	0.009
Service	-0.012	0.108	0.010	0.017	0.009
Female Farmer	-0.002	-0.017	0.004	0.000	-0.002
Food Shopper: Female	-0.812	-0.457	-0.951	-0.209	-0.557
Male	-0.205	- 0.220	-0.235	-0.065	-0.130
Female &	-0.171	-0.085	-0.161	-0.072	-0.100

be rejected if the utility function were incorrectly specified or if, for example, the assumption of separability does not hold.

Summary and Conclusions

In this paper, we estimated the price and income elasticities of demand for each of the sweet spreads: syrup, molasses, honey, jellies, and jams using a two stage budgeting procedure. In the first stage, the consumer determines total sweet spread expenditure based on income and demographic considerations. The first stage was estimated as a truncated model by the Tobit procedure. The Almost Ideal Demand System was used as a framework for the second stage expenditure allocation problem. To incorporate population demographics, the AIDS model was expanded by specifying the constant term as a linear function of demographic variables. The coefficients for the price variables are highly significant, in general. Demand is elastic for all five sweet spreads and most cross price effects are positive. All goods are substitutes in the Hicks-Alien sense. The greatest demographic effects on sweet spread purchases are due to household size, female food shopper, tenancy and rural location. Within the second stage expenditure allocation the tests of the theoretical restrictions of adding up, homogeneity and symmetry resulted in the rejection of homogeneity for syrup and molasses, marginal rejection for jellies and jams and no rejection for honey when the test was performed equation by equation. Homogeneity and symmetry were rejected for the complete system.

Some problems were encountered when the detailed data for commodities and households were used. A significant proportion of the households had not purchased any of the spreads during the week the data was collected. This phenomena was modeled as a two stage budgeting procedure wherein the first stage, the decision concerning how much to spend on sweet spreads (including zero) was estimated as a Tobit model. The second stage, encompassing only those households with nonzero first stage expenditures, was then treated as a standard consumer allocation problem using the AIDS model. However, there are significant insights and benefits gained from using detailed data for commodities and households. First, this analysis has shown there are strong own-price anc cross-price effects among detailed com modities. Second, the analysis indicates thai the demographic profile of the U.S. populatior has a significant impact on the demand for tto commodities studied. Third, our results indi cate that although economic variables (price;

and income) and demographic variables are highly significant, a great deal of the variation in individual household demand behavior remains unexplained.

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