Comparisons of Hispanic Households' Demand for Meats with Other Ethnic Groups

Bruno A. Lanfranco, Glenn C. W. Ames, and Chung L. Huang

The objective of this research was to analyze the demand patterns of Hispanic households for meats in comparison with other ethnic groups using data from the 1998 *Consumer Expenditure Survey*. A system of demand equations of the LinQuad form were estimated for ten meat products using an incomplete system of censored equations. Hispanic households showed a clear preference for beef. Price, income, and household-size elasticities were estimated for each meat product by ethnic group. The demand for ground beef was the most income-inelastic product regardless of ethnicity. Household size had a positive effect on the probability of consuming a particular meat product but a negative effect on actual item expenditures

High birth and immigration rates have recently created a dramatic growth in the Hispanic population in the U.S. due to. In 1997, 29.7 million persons of Hispanic origin resided in the United States, representing 11.1 percent of the total population (U.S. Census Bureau, 1998). According to U.S. Census Bureau projections the Hispanic community is expected to compose 15.5 percent of the population by 2010. In addition, Hispanic buying power has been growing at a compound rate of 7.5 percent in the last decade, and today it has been estimated at $350 billion nationwide. Thus the Hispanic market is considered as the leading growth market in the United States (Fan and Zuiker, 1998).

Recent studies have shown that Hispanics may exhibit different consumption patterns compared to the rest of the U.S. population. In particular, different lifestyles and consumption patterns among ethnic groups imply different market potential and opportunities for producers, food processors, and retailers. Using the data from the 1987-88 *Nationwide Food Consumption Survey*, Holcomb, Park, and Capps (1995) estimated that U.S. households devoted an average of 15 percent of their income to total food expenditures, of which nine percent was spent on food at home (FAH) and six percent on food away from home (FAFH). However, Fan and Zuiker (1998) found that Hispanic households allocated significantly more of their budget to FAH, shelter, and apparel and significantly less to FAFH, entertainment, education, health care, and tobacco compared to non-Hispanic white households.

Lanfranco is a former graduate research assistant and Ames and Huang are professors, in the Deptartment of Agricultural & Applied Economics, The University of Georgia, Athens, Georgia.

Comparing different ethnic segments in the U.S. population, Fan and Lewis (1999) suggested that statistically significant differences in budget allocations exist between Hispanic Americans and African-Americans. According to their results, Hispanic households allocated a larger proportion of their budget to both FAH and FAFH than did African-Americans but less than non-Hispanic Caucasians.

Results obtained by Lanfranco, Ames, and Huang (2001) using a sample from USDA's 1994-96 *Continuing Survey of Food Intakes by Individuals* (CSFII 94-96) are consistent with these earlier findings. Hispanic and African-American households committed a higher share of their total budget expenditures to total food (TF) than non-Hispanic white households, 29.4 percent, 26.4 percent, and 18.2 percent, respectively. Non-Hispanic white households spent comparatively more on FAFH, reflecting high household income, *ceteris paribus,* than other ethnic groups. Furthermore, Lanfranco et. al. found that both Hispanics and African-Americans spent almost the same amount of money per adult equivalent on TF, FAH, and FAFH. In contrast, non-Hispanic white households spent a substantially higher amount of money for food per adult equivalent, especially for FAFH.

Objectives

The primary objective of this study is to analyze the demand for meats among various ethnic groups in the United States. Specifically, a system of demand equations for disaggregated meat products was estimated for four ethnic groups of households including Hispanic-Americans, African-Americans, non-Hispanic whites, and a composite other-ethnic-minority group.

This study focuses on the demand for meats because they are among the most important components of the American diet. In 1998, average per-capita consumption of meats in the United States, measured in carcass-weight equivalent, was 44.6 kg for beef and veal, 31.0 kg for pork, and 47.0 kg for poultry (USDA, 2001). In terms of budget share, red meats and poultry account for more than 28 percent of total at home food expenditures in 1998. Thus, it is imperative to examine how the demand for meats varies among different ethnic groups in the marketplace and to identify important and influential factors that may account for such observed differences in meat consumption patterns.

Data on U.S. Food Consumption

The data set used in this study was obtained from the *1998 Consumer Expenditure Survey* (CES) (U.S. Department of Labor, 2000a). The CES provides detailed expenditure and income information along with various socio-demographic characteristics for each consumer unit included in the survey. The data were aggregated at the household level and only those observations corresponding to households that completed all the information needed for the research were included in the analysis. The total sample contained 4,432 households that were divided into four different ethnic groups: 3,344 households identified as non-Hispanic white (WH), 409 Hispanic (HP) households, 392 African-American (AA), and 287 households classified as other ethnic minorities (OM), mainly Asian-Americans.

Ten meat products were included in the demand analysis: four types of beef (ground beef, roast, steak, and other beef), four types of pork (bacon, pork chops, ham, and other pork), one poultry product (fresh and frozen chicken) and one type of seafood (canned fish and seafood). The CES only reports expenditure levels; it does not provide prices or physical quantities. Therefore, Consumer Price Index (CPI) information was used to obtain the necessary price variation (U.S. Department of Labor, 2000b). CPI information was available for all selected meat categories on a monthly basis by region (Northeast, Midwest, South, and West), matching the categorization used by the CES. The physical quantities of meat demanded, measured in pounds consumed per week, were obtained by dividing the corresponding weekly expenditures on each meat product by their imputed price.

The average weekly per-capita meat expenditures among ethnic groups and the entire U.S. population are presented in Table 1 for comparison. Adult-equivalent units derived from the Amsterdam scale (Deaton and Muellbauer, 1980, p. 193) were used as a measure for the size of the household to express food expenditures on per-capita basis. On average, HP households were the largest in size with 2.79 equivalent adults, followed by OM households with 2.58, AA households with 2.20, and WH households with only 2.08 equivalent adults. Given these differences in household size among ethnic groups, presenting their average expenditures on an adult-equivalent basis gives a better insight into their consumption behavior.

OM households appear to have the highest weekly expenditure level for meat at $6.50 per adult equivalent (Table 1). Of this amount, $2.03 corresponded to seafood, $1.61 to beef, $1.51 to poultry, and $1.35 to pork—31 percent, 25 percent, 23 percent, and 21 percent, respectively. Households of AA origin ranked second, with a weekly per-capita meat expenditure of $6.24. Unlike the OM households, AA households spent the largest share of their meat expenditures ($1.86 per week) on pork products. HP households ranked third in the amount spent on total meat at $5.93 per capita, with almost half of that amount, $2.36 per week, on the beef products. WH households reported the lowest level of average weekly expenditures on total meat at $5.23 per capita, of which $1.90, $1.28, $1.19, and $0.87 was spent on beef, pork, poultry, and seafood, respectively.

In addition to per-capita meat expenditures, a few selected household characteristics are also presented in Table 1. Compared to the other ethnic groups, Hispanic households exhibited the largest and youngest families while non-Hispanic white families were the smallest and oldest. The average number of persons in HP households was 3.40, followed by OM households with 2.98, AA households with 2.67, and finally WH households with 2.41. The age of the head or reference person of the household averaged 41 years old for the HP group, 46 years old for both AA and OM groups, and 50 years for WH group.

The OM group had the highest household income, averaging more than $913 per week. The weekly household income of the WH group was about $880, followed by HP households with $623 and AA households with $581.

The proportion of households below the federal poverty threshold and the proportion of households receiving food stamps are two interesting statistics that further disclose the sample population's socioeconomic characteristics. Almost 26 percent of both Hispanic and African-American households were living below the poverty level and considered to be poor (Table 1). On the other hand, only 11 percent of non-Hispanic white households and 14 percent of other minority households were below the 1998 poverty threshold.

Food stamp recipients are generally households with children. Eligible household income is set at 130 percent of the poverty level (USDA, 2000). Participation in the food-stamp program also varies considerably by ethnic group. Hispanic households appeared to be the least likely to benefit from this income-transfer program, with less than 68 percent of the poor households receiving food stamps (Table 1). The OM group had the highest participation rate with more than 87 percent of the

Table 1. Average Weekly Per-Capita Meat Expenditures and Household Socio-Economic Characteristics by Ethnic Group, CES, 1998.

Expenditure Categories	Hispanic (HP)	Non-Hispanic White (WH)	African-American (AA)	Other Minority (OM)	All Households
Total Meat expenditures	5.93	5.23	6.24	6.50	5.47
Total Beef	2.36	1.90	1.60	1.61	1.89
Ground Beef	0.76	0.67	0.66	0.52	0.67
Roast	0.32	0.35	0.30	0.31	0.34
Steak	1.00	0.72	0.48	0.57	0.72
Other Beef	0.23	0.15	0.16	0.21	0.16
Total Pork	1.52	1.28	1.86	1.35	1.36
Bacon	0.21	0.21	0.27	0.18	0.22
Pork Chops	0.39	0.25	0.42	0.25	0.28
Ham	0.33	0.34	0.32	0.27	0.33
Other Pork	0.37	0.26	0.53	0.47	0.31
Total Poultry	1.26	1.19	1.58	1.51	1.25
Chicken	1.05	0.89	1.18	1.18	0.95
Total Seafood	0.82	0.87	1.20	2.03	0.97
Canned Fish	0.13	0.18	0.11	0.21	0.17
Household size (persons)	3.40	2.41	2.67	2.98	2.56
Household size, in adult equivalents	2.79	2.08	2.20	2.58	2.19
Age of household head	40.8	49.5	45.5	46.2	48.13
Household income ($/week)	623.00	879.75	581.07	913.62	831.83
% of household below the poverty level[a]	25.9	11.2	25.8	13.9	14.02
% of poor households receiving food stamps	67.9	73.6	81.2	87.5	74.65
Number of Households	409	3,344	392	287	4,432

Note: All expenditures are reported in $/week, per adult equivalent.

[a] The poverty level in 1998 was $16,530 per year for a family of four, including two children.

households below the poverty level receiving food stamps in 1998. The proportions of poor households in the AA and WH groups receiving benefits from the food stamp program were about 81 percent and 74 percent, respectively.

There are considerable differences among households of different ethnic backgrounds with respect to meat expenditures and socioeconomic characteristics. In general, households of Hispanic origin were younger and larger in size than all other household groups. The AA households were the poorest among the four ethnic groups. While the OM group appeared to have the highest average household income, they also were most likely to participate in and receive assistance from the food stamp program.

Model Specification

Empirical demand analysis often focuses on only a particular subset of commodities, such as different types of food, or even more specifically, different types of meats. In fact, most of the time the limitations of the data availability obliges researchers to deal with demand systems that are incomplete by nature. However, the proper account of the existing interrelationships among commodities as suggested by the economic theory requires the estimation of a complete demand system. Unfortunately, the inherent dimensionality problem of complete systems, known as the *degrees of freedom problem,* makes empirical estimation difficult (Bieri and de Janvry, 1972). Many efforts have been made in providing systematic approaches for maintaining and testing separability restrictions hypothesized in the context of full demand systems (Pudney, 1981; Moschini, Moro and Green, 1994; Eales and Unnevehr, 1988; Nayga and Capps, 1994). Although the problem of degrees of freedom can be drastically reduced by aggregating commodities or by assuming some type of additivity or separability among commodities, they imply further and sometimes quite restrictive assumptions about the structure of preferences.

In this study the incomplete-demand-systems approach developed by LaFrance and Hanemann (1989) was adopted to derive and specify demand equations for empirical estimation. An attractive feature of incomplete demand systems is that they permit the specification of demand functions of a more general form than complete systems allow (LaFrance, 1985; LaFrance and Hanemann, 1989; LaFrance, 1990). The demand functions for the commodities of interest do not necessarily need to have the same functional form as the demands for the other goods, which are included into the composite commodity. Nevertheless, LaFrance (1985; 1986; 1990) investigated integrability conditions of several functional forms commonly used to represent directly specified demand functions: linear, constant-elasticity, and semi-logarithmic demand models. He found that all of the considered models were quite restrictive in some way, in terms of recovering the structure of preferences within the incomplete-demand-systems approach.

More recently, Agnew (1998) pointed out that using the so-called LinQuad quasi-expenditure function is the only way to derive demand linear in deflated income and linear and quadratic in deflated prices and consistent with weak integrability. He also showed that the LinQuad admits different general specifications, including a logarithmic version. In a recent application of these models, Agnew (1998) found that both the LinQuad and its generalization met all integrability conditions, a feature not commonly seen in empirical work. Because of these desirable properties, the original LinQuad model was adopted in this study. In its final expression, after imposing symmetry to reduce the number of parameters to be estimated, the demand functions for this model is expressed as

$$(1)\quad q_i = \alpha_i + \sum_{j=1}^{K} \beta_{ij} p_j + \gamma_i \times \left[y - \sum_{j=1}^{K} \alpha_j p_j - \frac{1}{2} \sum_{j=1}^{K} \sum_{k=1}^{K} \beta_{jk} p_j p_k \right], \quad i, j, k = 1, \ldots, K.$$

Symmetry restriction is given by letting $\beta_{ij} = \beta_{ji}$ (Agnew, 1998). In addition, by deflating all prices and income by a linearly homogeneous concave function of all other prices the required zero-degree homogeneity is obtained. To correct for heteroscedasticity, deflated expenditure instead of physical quantity was used as the dependent variable (Agnew, 1998), by multiplying both sides of the equation by its corresponding price. Finally, a set of nine demographic and socioeconomic variables was included in the model to investigate the effects of these variables on the demand for meat. Denoting the l^{th} socioeconomic variable as g_l and its associate parameter in the i^{th} equation as χ_{il}, the system of demand equations from equation (1) is rewritten as

$$(2)\quad e_i = p_i \left\{ \alpha_i + \sum_{k=1}^{K} \beta_{ik} p_k + \sum_{l=1}^{L} \chi_{il} g_l + \gamma_i \left[y - \sum_{k=1}^{K} \alpha_k p_k - \frac{1}{2} \sum_{j=1}^{K} \sum_{k=1}^{K} \beta_{jk} p_j p_k - \frac{1}{2} \sum_{j=1}^{K} \sum_{k=1}^{K} \beta_{jk} p_j p_k - \sum_{k=1}^{K} \sum_{l=1}^{L} \chi_{kl} p_k g_l \right] \right\}$$

The Estimation Procedures

Equation (2) is censored when it is estimated using cross-sectional data such as the CES. Traditionally, the Tobit models have been commonly applied for the estimation of censored equations (Kennedy, 1998). As a single-equation approach, an important assumption underlying the Tobit model is that the decision to consume and the decision about the amount to consume are the same. Regarding food consumption, it has been argued that the determinants of the decision whether to consume from a particular food group are often not the same as the determinants of how much to consume, particularly when highly specified food groups are considered (Haines, Guilkey, and Popkin, 1988). In such a case, ignoring the two-step decision process would miss the true behavioral patterns, and the estimation results may be incorrect and erroneous.

Models involving a two-stage process imply that two dependent variables are analyzed: a dichotomous variable indicating whether or not an individual consumes a particular food item, and the actual quantity consumed for those who chose to consume(Guilkey, Haines, and Popkin, 1990). Accordingly, the two-step decision process for consumption of the t^{th} person can be described by the following equations, for $t = 1,\ldots, T$:

$$(3)\quad d_t^* = \mathbf{v}_t{'}\varphi + e_t^*$$

Dichotomous or Decision Equation

$$(4)\quad q_t^* = f(\mathbf{w}_t, \theta) + u_t^*$$

Regression or Level Equation

The dependent variable d_t^* in (3) is a reservation value and it is unobserved. Instead, we observe the binary realization d_t, which takes the value $d_t = 1$ (yes) when $d_t^* > 0$, and $d_t = 0$ (no) when $d_t^* \leq 0$. The dependent variable in (4) contains the consumption information of those individuals for which $d_t = 1$ (yes)—that is, $q_t = q_t^*$ when $d_t^* > 0$; otherwise their information is unobservable ($q_t = 0$). The vectors $\mathbf{v}_t$ and $\mathbf{w}_t$ represent the regressors included in the decision and level equation, respectively, which may or may not contain variables in common; θ and φ are their associate parameters. The term $f(\mathbf{w}_t, \theta)$ is a general deterministic component that can be nonlinear in θ. If $\mathbf{v}_t = \mathbf{w}_t$ and the residuals in (3) and (4) have a singular normal density ($e_t^* \equiv u_t^*$), then $\theta \equiv \varphi$ and the standard Tobit model emerges (Heckman, 1979, p. 155).

Under the hypothesis of selectivity bias, the disturbances e_t^* and u_t^* are assumed to be correlated through a correlation coefficient ρ following a bivariate normal distribution. Some alternatives to deal with this problem include the estimation of each individual equation using Heckman's two-step procedure (Heckman, 1976; 1979) and Amemiya's type II Tobit method (Amemiya, 1985), two "sample selection" models derived from the original Tobit.

This study uses the two-step procedure proposed by Shonkwiler and Yen (1999) instead of a direct maximum-likelihood estimation, which is cumbersome to implement due to complexities of the functional form chosen or of the size of the system. Following Maddala (1983), if for each of the K equations in (4), we use all the observations instead of using only the nonzero observations, the unconditional mean of q_t is

$$(5)\quad \mathrm{E}(q_t) = \Pr(d_t^* > 0) \times \mathrm{E}(q_t \mid d_t^* > 0) + \Pr(d_t^* \leq 0) \times \mathrm{E}(q_t \mid + d_t^* \leq 0)$$
$$= \Phi_t(\mathbf{v}_t\ \varphi) \times \left[f(\mathbf{w}_t, \theta) + \delta \frac{\phi_t(\mathbf{v}_t{'}\varphi)}{\Phi_t(\mathbf{v}_t{'}\varphi)} \right] + [1 - \Phi_t(\mathbf{v}_t{'}\varphi)] \times 0$$
$$= \Phi_t(\mathbf{v}_t{'}\varphi) \times f(\mathbf{w}_t, \theta) + \delta(\mathbf{v}_t{'}\varphi) \qquad , t = 1, \ldots, T$$

The term $\Phi(\mathbf{v}_t{'}\varphi)$ is the standard normal probability density function (pdf) of the probit equation, $\Phi(\mathbf{v}_t'\varphi)$ is the cumulative density function (cdf), and δ is an additional parameter to be estimated. Adding an error term, if the system has K equations (commodities) and T observations (individuals), equation (4) can be written as

$$(6)\quad q_{tk} = \Phi_t(\mathbf{v}_{tk}'\varphi_k)\times f(\mathbf{w}_{tk},\theta_k)+\delta(\mathbf{v}_{tk}'\varphi_k) + \varepsilon_{tk} \qquad t = 1,\ldots, T;\ k = 1,\ldots, K$$

The final expression used for estimation is obtained by substituting the LinQuad demand function of Equation (2) for general term $f(\mathbf{w}_t,\theta)$. Since the censoring is governed by separate stochastic processes, the model is not invariant to the choice of what equation is dropped to avoid singularity of the variance-covariance matrix when restrictions such as adding-up are imposed. In the case of incomplete demand systems, the natural choice is to discard the demand equation for the composite commodity (LaFrance and Hanemann, 1989).

The estimation of the system is carried out in a two-step procedure using all the observations. In the first step, equation (3) is estimated for each food item by maximum likelihood (MLE) probit procedure to obtain the consistent parameter estimates for φ_k. The estimated values of φ are then used to compute ϕ and Φ so that in the second step the system equations can be jointly estimated by MLE or SUR to obtain consistent estimates for the θ_k and δ_k parameters.

Results and Discussion

For the sake of brevity the results of parameter estimates obtained from the two-step estimation procedure will not be presented. In general, the results were satisfactory. In the first-step estimation, the estimated income coefficients all had a positive sign, except in a few cases (other pork for HP and AA, and ground beef and pork chop for OM) where the signs were negative and not significantly different from zero. The household-size coefficients were estimated with more statistical precision than the coefficients representing the level of income, regardless of the ethnic origin. For all ethnic groups and meat items, the coefficients associated with the household-size variable were positive. Most of them were significantly different from zero at the 10-percent-significance level. In general, the largest magnitudes corresponded to ground beef and chicken, except for the OM group, which reported the largest magnitudes for chicken and other pork.

The number of significant coefficients varied among ethnic groups. As expected, the larger the size of the sample the higher the number of statistically significant estimated parameters in a regression, *ceteris paribus*. In fact, for the WH group the associated coefficient of household size was statistically significant at the one-percent level for all the individual meat items. For HP households, the second largest group in number of households, all the estimated coefficients for this variable except bacon and canned fish were statistically different from zero at the one-percent-significance level. The estimated parameter for canned fish was not different from zero at any predetermined significance level for both AA and OM groups. For households of AA origin, the household-size coefficient for roast was found to be significant only at the ten-percent-significance level while the coefficient of pork chops was significant at the five-percent level. For OM households, this parameter was also significant at the five-percent level for other beef. For all the other meat items, the associated household-size coefficients were statistically different from zero at the one-percent-significance level.

In sum, the results of the probit estimations from the first step show that both income and household size are important factors affecting meat purchase decisions. However, the size of the household appeared to be more influential in the household's decision to spend on specific meat items than the level of income. In particular, both ground beef and chicken were by far the most responsive meat categories to changes in household size regardless of ethnic origin. The results suggest that as household size increases the probability of purchasing ground beef and chicken increases by 8 percent for HP households. The corresponding changes in the probability to purchase ground beef and chicken were, respectively, 11 percent and 8 percent for WH households, 12 percent for both products for the AA group, and 8 percent and 13 percent for the OM group.

For the second-step estimation results, income and household-size elasticities along with their corresponding confidence intervals at the 90-percent level are reported in Table 2. The magnitudes of the income elasticities were less than one in abso-

Table 2. Estimated Income and Household-Size Elasticities for Meats and 90-Percent-Confidence Intervals by Ethnic Groups, CES, 1998.

Meat	Hispanic (HP)		Non-Hispanic White (WH)		African-American (AA)		Other Minority (OM)	
Products	Income.	Household Size	Income	Household Size	Income	Household Size	Income.	Household Size
Ground Beef	.0332	- 1.5910	.0436	- 1.0976	.0739	- 1.0462	.0512	1.3452
	(- .0555 ~ .1219)	(- 2.5739 ~ - .6081)	(-.0156 ~ .1029)	(- 1.5605 ~ - .6347)	(- .1322 ~ .2800)	(- 20449 ~ - .0476)	(- .2079 ~ .3102)	(- 2.0355 ~ 4.7259)
Roast	.1713	- 1.7852	.1190	- 1.7759	.2349	- .9405	.2948	- 3.9276
	(- .0252 ~ .3678)	(- 3.8476 ~ .2772)	(- .0259 ~ .2639)	(- 2.9161 ~ - .6357)	(- .0618 ~ .5316)	(- 1.7970 ~ - .0840)	(- .0391 ~ .6286)	(- 8.8393 ~ .9841)
Steak	.0939	- .7813	.0437	.0375	- .1892	.1174	.2221	- .8544
	(- .0177 ~ .2056)	(- 1.5677 ~ .0051)	(- .0761 ~ .1635)	(- .4448 ~ .5198)	(- .5489 ~ .1704)	(- .8040 ~ 1.0388)	(- .1055 ~ .5496)	(- 2.7240 ~ 1.0153)
Other Beef	.0671	.7612	- .2642	.3382	- .0649	- .5103	.5435	- .6731
	(- .0639 ~ .1981)	(- .5245 ~ 2.0449)	(- .7622 ~ .2339)	(- 1.2221 ~ 18984)	(- .6949 ~ .5652)	(-20.3411 ~ 17.5247)	(.1454 ~ .9415)	(- 3.0099 ~ 1.6637)
Bacon	.1561	- 1.0440	.0927	- 2.2370	.1424	- .8235	- .0030	.9304
	(.0147 ~ .2975)	(- 1.9350 ~ - .1530)	(- .0020 ~ .1875)	(- 3.1633 ~ - 1.3108)	(- .1412 ~ .4260)	(- 2.3869 ~ .7380)	(- .4641 ~ .4582)	(- 1.9998 ~ 3.8606)
Pork Chops	- .1270	.5379	.1072	- .8745	- .0039	- 8.2003	- .0826	- 5.7761
	(- .3249 ~ .0709)	(- .9189 ~ 1.9948)	(.0018 ~ .2126)	(- 1.4766 ~ - .2724)	(- .3286 ~ .3207)	(- 15.8877~ - .5128)	(- .4449 ~ .2797)	(- 15.7750 ~ 4.2228)
Ham	.1632	- .9458	.0619	- 1.7561	- .0614	- 1.1695	.2802	- .9360
	(.0581 ~ .2683)	(- 1.7752 ~ - .1164)	(- .0800 ~ .2037)	(- 2.7592 ~ - .7530)	(- .3375 ~ .2147)	(- 3.8035 ~ 1.4645)	(- .0396 ~ .5999)	(- 3.4780 ~ 1.6060)
Other Pork	.1609	1.2933	- .0917	- .1360	- .0089	1.6329	.3217	- 2.2310
	(- .0095 ~ .3312)	(.0794 ~ 2.5072)	(- .4002 ~ .2169)	(- 1.2089 ~ .9369)	(- .2980 ~ .2803)	(- .3190 ~ 3.5848)	(- .0654 ~ .7089)	(- 6.0597 ~ 1.5978)
Chicken	.0390	- 1.6602	- .0259	.4386	- .1285	- .4184	.1109	- .5102
	(- .1185 ~ .1964)	(- 3.0016 ~ - .3187)	(- .1620 ~ .1101)	(- .9156 ~ 1.7927)	(- .3302 ~ .0732)	(- 1.3465 ~ .5096)	(- .0191 ~ .2409)	(- 1.6166 ~ .5962)
Canned Fish	.1070	.2607	- .0981	.1041	.3642	- .5145	- .3314	.3612
	(- .0568~ .2709)	(- .4891 ~ 1.0106)	(- .2616 ~ .0655)	(- .8192 ~ 1.0274)	(- .0156 ~ .7439)	(- 1.2789 ~ .2500)	(- .7983 ~ .1356)	(- 1.2495 ~ 1.9719)

Note: Numbers in parenthesis represent lower and upper bounds of confidence intervals of the elasticity estimates, respectively, at the 90 percent level of confidence lute value for all ethnic groups, suggesting that no meat item was regarded as a luxury good. The results show that WH households were in general the least responsive to changes in total income. The result may be attributed to the fact that WH households had relatively higher income compared to the HP and AA groups. For WH households the results indicate that only two meat items, roast and pork chops, had income elasticities greater than 0.10. On the other hand, the demand for meat in the OM group was found to be most responsive to changes in household income, with six out of ten meat items exhibiting income elasticity greater than 0.10, ranging from 0.11 for chicken to 0.54 for other beef.

The demand for ground beef was most income inelastic among meat products regardless of ethnicity. The estimated income elasticities were 0.03 for HP households, 0.04 for WH households, 0.07 for AA households, and 0.05 for OM households. Furthermore, the estimated income elasticities for ground beef are similar in magnitudes among different ethnic groups. On the other hand, the magnitude of the income elasticity for roast was always greater than 0.10, ranging from 0.12 for WH households to 0.29 for OM households. This is to be expected because roast is a high-quality cut as compared to ground beef. Therefore, more roast would be purchased relative to ground beef as household income rises, *ceteris paribus*.

For other meat products, greater differences were found among households of different ethnic backgrounds. For instance, AA households showed the largest income elasticity of 0.36 for canned fish, while the corresponding income elasticity was only about 0.11 for HP households. For other beef, the estimated income elasticity varies from 0.07 for HP group to as high as 0.54 for OM group. Similarly, income elasticities for bacon vary from 0.09 for WH households to 0.14 for AA households and 0.16 for HP households. Income elasticity for ham was found to be highly inelastic for WH households (0.06). These differences tend to support the hypothesis that demand for meat products may be quite different among ethnic groups due to specific tastes and preferences associated with ethnicity.

It should be noted that there are several negative income elasticities shown in Table 2, suggesting that some meat items may be considered inferior goods by some ethnic groups. This includes pork chops for HP, AA, and OM households and other beef, other pork products, and chicken for WH and AA households. Canned fish may also be considered an inferior good by WH and OM households, and bacon by households of the OM group. Most surprising was the case of steak, which appeared to be an inferior good for AA households with an estimated income elasticity of -0.19.

The estimated household-size elasticities exhibited negative signs in most of the cases, with magnitudes even greater than one in absolute value. Although the probability of consuming meat products increases with the size of the household, it seems that once the decision to consume is made, household size has a negative effect on the level of consumption. Nevertheless, important differences in the responsiveness to changes in household size can be observed among groups. In fact, only roast and ham had a negative household-size elasticity for all four ethnic groups. On the other hand, the household-size elasticities for canned fish were positive for WH, HP, and OM households, ranging from 0.10 to 0.36. Similarly, positive household-size elasticities were observed for HP (other beef and pork chops), WH (steak, other beef and chicken), AA (steak), and OM households (bacon). The household-size elasticity was positive and greater than one in the case of other pork for HP and AA households and for ground beef for OM group.

Conclusions

The focus of this study was to provide an insight into demand patterns of the Hispanic households for specific food categories in comparison with other ethnic groups. To this end a system of equations of the LinQuad form for ten disaggregated meat products was estimated using a two-step estimation procedure for a system of censored equations. Four different groups of households—Hispanic American, African American, non-Hispanic whites, and other ethnic minority—were included in the analysis. Although a vast array of information was generated, only results pertaining to household income and size were presented, because they are the most important socioeconomic characteristics that may affect meat demand.

A number of conclusions can be drawn from this study. Hispanic households appeared to have different food consumption patterns compared to other ethnic groups in the United States. Specifically, Hispanic households showed a clear preference and fondness for beef over other meat products. They spent more of their food expenditures on each beef item than any other ethnic groups, especially on steak and ground beef.

The effect of changes in household income on the probability of spending on steak was found to be important for all groups. This is expected, since steak was considered a luxury meat in this study. The results also showed that the size of the household had a positive effect on the probability of consuming a particular meat product. However, once a household chose to consume, household size had a negative effect on the amount of money spent on that item, especially among the higher-priced meats. This may have important implications for retailers in terms of presentation and convenience of meat products. Offering products especially designed for large households, such as family packs and special cuts, may not only take advantage of their higher probability relative to small households of purchasing the product, but also lead them to buy a larger quantity.

The demand for ground beef and chicken appeared to be least responsive to changes in household income. Not surprisingly, the most responsive meat item with respect to changes in household income was roast. Only other beef for the OM group and canned fish for the AA group showed an estimated income elasticity greater than 0.35.

The information presented in this study may be used to complement previous consumer demand research, providing useful insights about the meat-consumption patterns of the growing Hispanic community in the U.S. and the role of socioeconomic factors in the demand for meats in the U.S. Additionally, the comparison with other ethnic groups contributed to a broader understanding of the demand for meats within the context of the changing demographic composition of the U.S. population. As Hispanic households constitute a larger share of the U.S. population, their presence will impact the demand for meat products, especially beef.

References

Agnew, G. K. 1998. "LinQuad: An Incomplete Demand System Approach to Demand Estimation and Exact Welfare Measures." M.S. Thesis. Dept. of Agricultural and Resource Economics, University of Arizona.

Amemiya, T. 1985. *Advanced Econometrics*. Cambridge, MA: Harvard University Press.

Bieri, J. and A. de Janvry. 1972. *Empirical Analysis of Demand under Consumer Budgeting*. Giannini Foundation Monograph, No. 30.

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

Eales, J. S. and L. J. Unnevehr. 1988. "Demand for Beef and Chicken Products: Separability and Structural Change." *Amer. J. Agr. Econ.* 70(August):521-32.

Fan, J. X. and J. K. Lewis. 1999. "Budget Allocation Patterns of African Americans." *J. Cons. Affairs* 33(1):134-164.

Fan, J. X. and V. S. Zuiker. 1998. "A Comparison of Household Budget Allocation Patterns between Hispanic Americans and Non-Hispanic White Americans." *J. Family and Econ. Issues* 19(2):151-174.

Guilkey, D. K., P. S. Haines, and B. M. Popkin. 1990. "The Distribution of Food Consumption over a Year: A Longitudinal Analysis." *Amer. J. Agr. Econ.* 72(November):891-900.

Haines, P. S., D. K. Guilkey, and B. M Popkin. 1988. "Modeling Food Consumption Decisions as a Two-Step Process." *Amer. J. Agr. Econ.* 70(August):543-52.

Heckman, J. J. 1979. "Sample Selection Bias as a Specification Error." *Econometrica* 47:153-62.

Heckman, J. J. 1976. "The Common Structure of Statistical Models of Truncation, Sample Selection, and Limited Dependent Variables and a Simple Estimation for Such Models." *Ann. Econ. and Soc. Meas.* 5:475-592.

Holcomb, R. B., J. L. Park, and O. Capps, Jr. 1995. "Revisiting Engel's Law: Examining Expenditure Patterns for Food at Home and Away from Home." *J. Food Distrib. Res.* (September):1-8.

Kennedy, P. 1998. *A Guide to Econometrics*. Cambridge, MA: The MIT Press.

LaFrance, J. T. 1990. "Incomplete Demand Systems and Semilogarithmic Demand Models." *Austr. J. Agr. Econ.* 34(August):118-31.

LaFrance, J. T. 1986. "The Structure of Constant Elasticity Demand Models." *Amer. J. Agr. Econ.* 68(August):543-52.

LaFrance, J. T. 1985. "Linear Demand Functions in Theory and Practice." *J. Econ. Theory* 37(October):147-66.

LaFrance, J. T. and M. W. Hanemann. 1989. "The Dual Structure of Incomplete Demand Systems." *Amer. J. Agr. Econ.* 68(August):543-52.

Lanfranco, B. A., G. C. W. Ames, and C. L. Huang. 2001. "A Censored System Estimation of Hispanic Households Food Consumption Patterns." Dept. of Agr. & Applied Econ., FS-01-01. College of Agr. & Envir. Sciences, University of Georgia. Athens, GA: Faculty Series, January.

Maddala, G. S. 1983. *Limited Dependent and Qualitative Variables in Econometrics*. Cambridge, UK: Cambridge University Press.

Moschini, G., D. Moro, and R. D. Green. 1994. "Maintaining and Testing Separability in Demand Systems." *Amer. J. Agr. Econ.* 76(February):61-73.

Nayga, R. M. and O. Capps, Jr. 1994. "Test of Weak Separability in Disaggregated Meat Products." *Amer. J. Agr. Econ.* 76(November):800-08.

Pudney, S. 1981. "An Empirical Method of Approximating the Separable Structure of Consumer Preferences." *Rev. Econ. Stud.* 48:561-77.

Shonkwiler, J. S. and S. T. Yen. 1999. "Two-Step Estimation of a Censored System of Equations." *Amer. J. Agr. Econ.* 81(November):972-82.

U.S. Census Bureau. 1998. *Current Population Report*. Washington, D.C.

U.S. Department of Agriculture. 2000. "Food Stamps: About FSP – Introduction." *Food Nutrition Srvice*. http://www.fns.usda.gov/fsp/MENU/about/about.htm, Last modified: March 28.

U.S. Department of Agriculture, Foreign Agricultural Service. 2001. "FAS Online." URL:http://www.fas.usda.gov/dlp/circular/2001/01-03lp/livestock.htm, Last modified: March 21.

U.S. Department of Labor, Bureau of Labor Statistics. 2000a. "1998 Consumer Expenditure Diary Survey." *Consumer Expenditure Survey*. CD-ROM. U.S. Department of Labor, Bureau of Labor Statistics. Washington, D.C.

U.S. Department of Labor, Bureau of Labor Statistics. 2000b. "Consumer Price Indexes Home Page." http://www.bls.gov/cpihome.htm, Last modified: December 15.