Consumer Demand for Meat Cuts and Seafood

[1]Christopher Davis, [2]Steven Yen, and [3]Biing-Hwan Lin

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[1]Economist with the Markets and Trade Economics Division,
Economic Research Service, U.S. Department of Agriculture. 1800 M street, NW, Washington D.C. 20036. Phone: (202) 694-5167. Email Address: chrisdavis@ers.usda.gov
[2]Associate Professor in the Department of Agricultural Economics
the University of Tennessee, Knoxville, Tennessee.
Phone: (865) 974-7474. Email address: syen@utk.edu
[3]Senior Economist with the Food Economic Division,
Economic Research Service, U.S. Department of Agriculture. 1800 M Street, NW, Washington D.C. 20036. Phone: (202) 694-5458. Email Address: blin@ers.usda.gov

Abstract

Household at-home consumption of different types and cuts of meat and fish products is investigated by estimating a large censored demand system with a two-step procedure using ACNielsen's Homescan data. We find different price and expenditure elasticities between low-income and high-income households. High income households are less responsive to price changes, and the substitution patterns also differ between the low- and high-income households. Whereas the uncompensated elasticities suggest a mixture of gross substitutes and complements among the products for both low- and high-income households, the compensated elasticities suggest net substitution is the obvious pattern for the low-income households[1].

Key words: censored dependent variables; sample selection model; meat; fish

JEL Classification: D12; C34

[1] **Disclaimer**: The opinions and analysis presented represent the authors' idea and do not necessarily reflect Economic Research Service or the U.S. Department of Agriculture position.

Meat is the number one source of protein for most Americans in their daily diets and is the main course of each meal they consume. Americans' per-capita meat consumption is one of the top-three highest in the world. Consumption of beef, pork, and fish over the past decade has declined or increased only marginally compared to the relatively rapid increase for poultry, resulting in a growing per-capita consumption of total meat and fish. In 2004, each American consumed 201 pounds, on a boneless "carcass" weight, of beef, pork, poultry and fish (USDA-ERS). Identifying the factors that underlie the growing meat consumption will allow examination of the effects of policy and market shocks on and prediction of future meat demand. U.S. meat industries can also make use of such information to design effective meat marketing strategies.

Coinciding with the growth in meat consumption have been challenges both consumers and meat industries have had to consider. There have been a number of disease outbreaks in the beef cattle and poultry industries around the world that have fueled a growing interest in determining what effects these types of incidents have had or might have on the consumption of meat products. Essential pieces of information for understanding consumers' responses to meet supply shocks are the demand elasticities for the meat products. The overall objective of this analysis is to investigate the price and non-price factors affecting the demand for specific cuts of meat, such as steaks, ground beef, pork ham, pork chops, processed pork, chicken/turkey breasts and wings, leg-quarters, other meat cuts, as well as types of fish.

There is a large body of empirical literature on demand for meat products in the U.S., but less has been done to examine such demand by cuts. Aggregated meat models have been estimated extensively and reported throughout the literature (Eales and Unnevehr 1993; Kinnucan et al. 1997; Moschini and Meilke 1989; Purcell and Raunikar 1971; Thompson 2004). Results from the aggregate meat models, specifically the price and the income/expenditure relationships and statistical significance, are important information and provide insights to the validity and to some degree, the accuracy of our research findings.

Using a dynamic framework based on in the Almost Ideal Demand System for beef, pork and chicken, Kesavan et al. (1993) found demands for beef and pork are not as price responsive as chicken, results that are in contrast with the Moschini and Meilke (1989) findings that demands for beef and pork are much more own-price and expenditure elastic than chicken or fish. Kesavan et al. (1993) also reported that beef, pork, and chicken are substitutes among themselves rather than complements as found by Moschini and Meilke (1989) except for beef and pork which are found to be substitutes. Total expenditure elasticities for beef, pork, and chicken are all inelastic and are so demands for the products not very responsive to changes in disposable income according to Kesavan et al. (1993).

Eales and Unnevehr (1988) conducted one of the few studies that examine disaggregate meat products, particularly whole birds, parts and processed chicken, hamburgers, beef table cuts, pork, and non-meat foods also using a dynamic Almost Ideal Demand System approach. Their results indicated that significant and fairly large cross-price substitution effects existed between two chicken products and between two beef products, as well as among chicken parts, processed chicken and pork. The empirical results suggest that whole birds and hamburgers are inferior goods, while chicken parts/processed and beef table cuts are normal goods.

Cheng and Capps (1988) investigated the demand for finfish (cod, flounder/sole, haddock, perch and snapper) and shellfish (crabs, oysters and shrimp). Each expenditure equation was estimated separately, using the two-step procedure for Heckman's (1979) sample selection model. Explanatory variables included regional, urbanization and demographic variables as well as prices of poultry (whole chicken), red meat (sirloin steak, round steak, ground beef, and loin chops) and fish. All own-price elasticities for fresh and frozen seafood products were negative, statistically significant, and inelastic except for oysters (which was elastic). Poultry is a gross complement for snapper, and red meat is a gross substitute for both cod and snapper. Income elasticities for crabs, oysters, and total finfish are positive and statistically significant, implying that these goods are normal goods.

Capps and Lambregts (1991) disaggregated finfish (including catfish, oreodory, tuna, pollock, perch, scrod, salmon, flounder, trout, whitefish, halibut, swordfish, rockfish and shark) and shellfish (such as shrimp, crab, lobster, oysters, and scallops) products obtained from scanner data and estimated their relationships to the demand for beef, pork and poultry using a seemingly unrelated regression approach. Their findings indicated that all own-price elasticities are negative, elastic (with the exception of oysters), and statistically significant. Cross-price elasticities signify that poultry and beef are complements for shrimp and lobster; pork is a substitute (complement) for rockfish (tuna); poultry is a substitute (complement) for tuna (trout); and beef is a substitute for pollock, swordfish, and rockfish. They also found other finfish to be substitutes for catfish, whitefish, halibut, swordfish, and rockfish.

In this study we disaggregated beef, pork, and poultry into more cuts than in previous studies, and unlike the single-equation approach as used in Cheng and Capps (1988), we investigate the demand for these meat products along with different types of fish by estimating a theoretically plausible system of demand functions (henceforth, demand system). We separate fish into finfish and shellfish as in Cheng and Capps (1988) and Capps and Lambregts (1991), but divide finfish into saltwater and freshwater fish, along with three of the more popular fish products consumed: shrimp, tuna and salmon. This study also includes non-price variables such as socio-demographic characteristics. ACNielsen's 2004 Homescan data are used. The

Homescan data include weekly household food purchases (expenditures and quantities) for home consumption, product attributes, and promotion information (sales and use of coupons). The sample data contains zero observations in the expenditure levels of most products that are accommodated with a multivariate sample selection model (Yen and Lin 2006), estimated with a two-step procedure initiated by Shonkwiler and Yen (1999).

Demand Specification and Econometric Procedure

Our empirical analysis is based on the assumption that meat and fish are separable from all other consumer goods. We use a demand system derived from the Translog indirect utility function (Christensen, Jorgenson, and Lau 1975) for *n* goods:

$$\log V(p_1,\ldots,p_n,m)=\alpha_0-\sum_{i=1}^{n}\alpha_i\log(p_i/m)-\frac{1}{2}\sum_{i=1}^{n}\sum_{j=1}^{n}\beta_{ij}\log(p_i/m)\log(p_j/m), \quad (1)$$

where $p_1,\ldots, p_n$ are prices and m is total meat and fish expenditure (henceforth, total expenditure). Applying Roy's identity to Equation (1) yields the deterministic equations for expenditure-share (s_i)

$$s_i=\frac{\alpha_i+\sum_{j=1}^{n}\beta_{ij}\log(p_j/m)}{\sum_{j=1}^{n}\alpha_j+\sum_{k=1}^{n}\sum_{j=1}^{n}\beta_{kj}\log(p_j/m)},\ i=1,\ldots,n. \quad (2)$$

Homogeneity is implicit in Equations (1) and (2) by the use of normalized prices (p_i / m), and the symmetry restrictions

$$\beta_{ij}=\beta_{ji}\ \forall\ i,j \quad (3)$$

are imposed. Demographic variables h_ℓ are incorporated in the demand system (2) by parameterizing α_i such that[2]

(4) $$\alpha_i = \alpha_{i0} + \sum_{\ell=1}^{L} \alpha_{i\ell} h_\ell, \; i = 1,...,n-1.$$

Such demographic specifications for the $n-1$ equations (only) are explained below.

To accommodate zero observations in the expenditure shares, we use a two-step estimation procedure suggested by Shonkwiler and Yen (1999), formally motivated by the multivariate sample selection model of Yen (2005) and Yen and Lin (2005). Let $\mathbf{x} = [\log p_1 / m,...,\log p_n / m, h_1,...,h_L]¢$ be a vector of explanatory variables and let $\boldsymbol{\theta}$ be a vector containing all parameters (α's and β's), and consider an n-equation system in which each expenditure share w_i is generated by a deterministic function $f_i(\mathbf{x};\boldsymbol{\theta})$ which constitutes the RHS of the share equations (2), and an unobservable error term v_i. The first k equations are subject to the sample selection rule

(5) $$\begin{aligned} w_i &= d_i\,[\,f_i(\mathbf{x};\boldsymbol{\theta}) + v_i\,],\; i = 1,...,k \\ &= f_i(\mathbf{x};\boldsymbol{\theta}) + v_i, \qquad i = k+1,...n \end{aligned}$$

such that each indicator variable d_i is modeled with a binary probit

(6) $$d_i = 1(\mathbf{z}'\gamma_i + u_i > 0),\; i = 1,...,k$$

where $1(\cdot)$ is a binary indicator function, $\mathbf{z}$ is a vector of explanatory variables, γ_i is a vector of parameters, and u_i is a random error.

2 It can be verified that along with the specific form of the indirect utility function (1) this linear demographic specification implies the effect of demographic variable h_ℓ on expenditure for good i is directly related to the corresponding parameter $\alpha_{i\ell}$. The Translog indirect utility function is often written with opposite signs for the coefficients of the linear terms $\log(p_i/m)$ to those in Equation (1), in which case the effect of h_ℓ on expenditure of good i are indirectly related to $\alpha_{i\ell}$.

The expenditure shares in Equation (5) do not add up to unity unless $d_1 = \ldots = d_k = 1$, that is, when none of the dependent variables are subject to sample selection. We follow the simple approach suggested in Yen and Lin (2006), by estimating the first $n - 1$ equations with the nth good treated as a residual category (cf. Pudney 1989). The resulting estimates are not invariant with respect to the equation excluded. Yen and Lin (2006) however demonstrated in an application to food consumption in China that excluding alternative equations from the system did not cause discernable differences in the elasticity estimates.

Assuming the concatenated error vector $[u_1,\ldots,u_k,v_1,\ldots,v_k,v_{k+1},\ldots,v_{n-1}]¢$ is distributed as (k+n–1)-variate normal distribution with zero means and a finite covariance matrix with elements $\sigma_{ij}\ (i, j = 1,\ldots,k+n-1)$, the sample selection model can be estimated with the ML procedure (Yen and Lin 2006). However, for a large system (14 equations), the ML procedure would require estimation of a much larger number of parameters than the two-step procedure and, worse of all, evaluations of k-level integration (where k is the number of products containing zero expenditures) for all sample observations which, along with the large sample size for the current application, is not feasible.[3] A practical alternative is to estimate the system with a two-step procedure. The two-step procedure is motivated by the unconditional mean of the expenditure shares

(7) $$E(w_i) = \Phi(\mathbf{z}_i'\gamma_i)\ f_i(\mathbf{x};\theta) + \sigma_{k+i,i}\phi(\mathbf{z}_i'\gamma_i),\quad i = 1,\ldots,k$$

where $\phi(\cdot)$ and $\Phi(\cdot)$ are univariate standard normal probability density and cumulative distribution functions, respectively, and $\sigma_{k+i,i}$ is the covariance between the error terms of the ith

3 In the current application we estimate $n - 1 = 13$ equations with $k = 12$ equations subject to sample selection, which requires estimation of a 25×25 covariance matrix with 325 elements.

selection (u_i) and the ith level equation (v_i). The unconditional means (7) follow from the bivariate normality of error terms $[u_i, v_i]¢$ for i = 1,...,k, and suggest a two-step estimation procedure which, as initially suggested in Shonkwiler and Yen (1999) for a linear system, consists of two steps: (i) a probit estimation based on a binary outcome for $d_i = 1(w_i > 0)$ to obtain ML estimates $\hat{\gamma}_i$ for each of i = 1,...,k; (ii) estimate the partially augmented nonlinear system

(8)
$$\begin{aligned} w_i &= \Phi(\mathbf{z}'\hat{\gamma}_i)\, f_i(\mathbf{x};\boldsymbol{\theta}) + \hat{\eta}_i\phi(\mathbf{z}'\hat{\gamma}_i) + \xi_i\,, && i = 1,\ldots,k \\ &= f_i(\mathbf{x};\boldsymbol{\theta}) + v_i\,, && i = k+1,\ldots,n-1 \end{aligned}$$

with ML or other procedures, such as an iterated seemingly unrelated regression procedure (where ξ_i is a composite and heteroscedastic error term). The partially augmented second-step system (8) relates to the partially selected system in Equation (5) and (6) (also see Yen and Lin (2006)) and is a slight modification of the procedure in Shonkwiler and Yen (1999) where sample selectivity is corrected for every equation in the system. This slight modification is needed in modeling systems with mixed censored-noncensored goods as the first-step probit cannot be estimated for commodities with no or few zero observations. The two-step estimates are less efficient than the ML procedure in Yen and Lin (2006) but are statistically consistent. Demand elasticities can be derived by differentiating the unconditional mean (7) for censored goods and by differentiating the share equations for other goods by conventional means.

Data

Data for the different cuts of meat and types of fish are compiled from ACNielsen's 2004 Homescan data. The data come from a nationally representative panel of U.S. household consumers, who recorded food items purchased for at-home consumption. At home panel householders scanned in either the Uniform Product Code (UPC) or a designated code (for random weight food items) for all food items purchased at all retail outlets. The data include product characteristics, quantity and expenditure for each food item purchased by the household, as well as detailed household demographics. The Homescan data are well suited for estimating household food demands for home consumption.

The complete Homescan panel consists of more than 50,000 households, but only 12,000 households reported purchases of both random-weight and UPC-coded food items in 2004. We use data from 8,229 of these households that reported purchases for at least 10 months in 2004. Household income and household size are used to express income as a percent of the Federal poverty level, defined as the poverty-income ratio (PIR). At a cutoff PIR of 350 percent, the sample is stratified into low- and high-income groups.

Numerous types of meat and fish products were recorded in the Homescan data, which is especially true for UPC-coded foods. There is a detailed description of each UPC-coded food item. As the first step, we specified about 100 similar types of meat and fish products. Then we calculated their shares of the total spending on meat and fish and then combined them into 46 groups. For example, there are 7 different cuts of beef, ground beef, steak, roast, stew, ribs, beef bacon, and other beef. It is not feasible to estimate a demand system for 46 food categories. In this study, we put more emphasis on fish products than has previously been done, focusing on 14 meat and fish groups: ground beef, beef steaks, other beef, pork, boneless poultry (chicken and turkey), other poultry, other meat, shrimp, other shellfish, freshwater fish (mainly catfish, trout, and tilapia), salmon, other saltwater finish, canned tuna, and other canned fish. All expenditures are aggregated to an annual level. Descriptive statistics for these product groups are provided in table 1.

The price for each product group is derived as the unit value—defined as the expenditure divided by the corresponding quantity. One methodological issue relates to unobserved prices, or unit values, for products not purchased by the households. Empirical analysts have struggled with only limited success in addressing the missing-price issues, drawing on the missing wage literature in labor supply estimation (e.g., Wales and Woodland 1980). Apart from a lack of instruments to predict prices paid by consumers with different characteristics, the common practice of attributing price differentials solely to quality differences (thus mixing the missing- and endogenous-price issues) is also questionable.[4] We follow a simple procedure of filling the missing prices with regional averages for corresponding market areas where the households reside. The Homescan data provide two types of location data—four Census regions and 52 scantrack markets for all urban areas. In this study, we derived average prices for each of the 14 meat and fish groups by the 52 scantrack markets plus all rural areas as a whole to proxy the prices faced by non-consuming households.[5] This "zero-order imputation" is both simple and straightforward, although more complicated approaches to such missing-price issues might be considered in future analyses.

Table 1 presents the sample statistics. Other meat is a broad category consisting of sausage, hot dogs, various lunch meats, and canned meats. It was consumed by 98.2% of the low-income households and 97.6% of the high-income households; it also has the highest average expenditure (over $100 per year) and expenditure share (approximately 30%) among all products considered, for both the low-income and high-income households. Other poultry is the

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[4] Whereas demographic variables such as gender and education can be good predictors of wage rates according to human-capital theory, using these variables to predict prices paid for food items is less convincing.

[5] Alternative proxies for missing prices might include average prices by Census regions.

next popular item for both low- and high-income households, with over 80% of the households consuming and nearly $50 per year in average spending. This is followed by ground beef, with over 80% of the households consuming and for which low-income households spend considerably more (an average of $56.4 per year among the consuming households) than high-income households ($49.8 per year). Pork was consumed by about 79.6% of the households and averaged over $60 per years in spending by both the low-income and high-income households. It is also worth noting that steaks were consumed by a larger proportion of households in the high-income sample than that of the low-income sample; the average spending is also much higher among the high-income households ($73.9 per year among the consuming) than the low-income households ($54.3 per year among the consuming). These different consumption patterns, such as the larger average expenditure of ground beef by low-income households, steaks by high-income households, and larger proportion of steak-consuming households in the high-income sample, are likely to be disguised by the use of pooled sample and highlight the importance of segmenting the households by income level.

Among the fish products, canned tuna was consumed by over 70% of the low-income households with an average spending of $13.1 per year, and by 69.4% of the high-income households with an average spending of $15.5 per year among the consuming. Other canned fish includes all canned fish except canned tuna (the biggest canned fish item), which was consumed by slightly over 80% of both low-income and high-income households, with a mean spending of over $16 per year. The proportion of consuming households are considerably lower among both low-income and high-income households for other fish products, most of which have a mean expenditure share of under 7% even among the consuming households. In general, higher prices for fish were paid than for meat products. For instance, the average price of shrimp paid by the low-income households is as high as \$6.41 per lb., followed by \$4.88 for other shellfish, \$4.88 for freshwater finfish, and \$4.73 for salmon. The prices of meat products are considerably lower except steaks, which is \$4.25 per lb. paid by the low-income households. High-income households in general paid a slightly higher price for each corresponding product than did low-income households. The lowest prices paid are seen in other poultry and other canned fish, at \$1.34 and \$1.26 per lb. respectively, for the low-income households.

Also presented in table 1 are sample statistics for demographic variables. Average household size is 2.54 for the low-income sample and 2.24 for the high-income sample. Both samples are dominated by households headed by individuals between 40 and 60 years of age, with 56% of the low-income households in that category and an even higher proportion (67%) for the high-income sample. The racial and ethnicity distribution of Homescan panelists is 75% Whites, 14% Blacks, 9% Hispanics, 2% Asians and 2% other races for the low-income sample. The high-income sample features a slightly higher proportion of Asians (4%). It is important to note that this is household distribution not population distribution. Hispanic households tend to be larger in size than other households, so the Hispanic share of U.S. households is smaller than the share of U.S. population.

Estimation Results

An empirical issue in the two-step estimation is selection of explanatory variables for the first and second steps. Due to the nonlinear functional forms in the selectivity terms and expenditure share equations the model is fully identified even without exclusion restrictions. Our empirical strategy is to economize on the demographic variables in the second-step due to the large size of the demand system.[6] Variables used in both steps are household size, and dummy variables indicating age of the household head (< 40 and 40–60), races (White, Black, Hispanic and Asian), regions (East, Central and South) and presence of children. As the first-step requires only univariate probit estimation, additional variables are included in the selection equation. These variables are PIR and dummy variables indicating marital status of household head (married, widowed and divorced), education (high school, some college, and college and above), and employment status of household heads. Our justification for excluding these variables from the second step is that the relevant income variable in a demand system is total expenditure (and not income) and these education and employment variables are directly related to household income. While the marital status variables are not directly related to income, they are excluded mainly because of the problems encountered during nonlinear estimation.

The large proportions of households consuming other meat (98.2% for the low-income sample and 97.6% for the high-income sample) prevented reliable estimation of the selection equation and therefore, following the partially augmented second-step system in equation (8), this product category was not corrected for sample selectivity.

ML estimates of the selection equations are not presented due to space consideration, but we summarize the results here.[7] First, inclusion of all variables is justified by statistical significance. For instance, for the low-income sample, household size is significant in all but four (pork, freshwater finfish, salmon and other saltwater finfish) of the thirteen equations estimated, and PIR is significant in all but three equations (ground beef, other shellfish and canned tuna), while presence of children is significant in only three equations (ground beef,

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[6] Nonlinear functional form can fail to generate sufficient variation to identify the parameters in some applications.

[7] First-step results are available upon request.

boneless chicken and other saltwater finfish). All multiple-category dummy variables (age, races, regions, marital statuses, and education) are also justified by statistically significant. Second, as to goodness of fit, McFadden's R^2 values are mostly below the 5% statistical significance level, despite the large sample size, which is not unusual for cross-sectional data. However, for correction of sample selectivity, predictive power of the selection equations weighs more heavily than goodness of fit. The percentage of correct predictions, at a probability cut-off of 0.5 (Wooldridge 2002, p. 465), are all greater than 60%, ranging from 64.2% for shrimp to 81.6% for ground beef and other poultry for the low-income sample. The predictive powers of the selection equations are comparable for the high-income sample.

The second-step estimates for the Translog demand system are presented in table 2 for the low-income sample. Among the demographic variables, household size has negative effects on the consumption of pork, freshwater finfish, salmon and other saltwater finfish. Relative to their older counterparts, households headed by younger individuals (age < 40, 40–60) spend less (i.e., a smaller proportion of total expenditure) on other beef, pork, other poultry, but more on ground beef and salmon. Racial differences are notable, with White households spending more on ground beef and steaks but less on freshwater finfish; Black households spending more on pork and other poultry but less on other meat and canned tuna; Hispanic households spending more on steaks, other beef, other poultry but less on freshwater finfish and other saltwater finfish; and Asian households spending more on steaks and pork but less on other saltwater finfish and canned tuna. That Asian households spend less on finfish is somewhat of a puzzle, given the important role of fish in Asian's diet (Bean 2003). As in the probit analysis, regional differences are also obvious. Specifically, relative to those in the West, households in the East spend more on pork, shrimp and canned tuna but less on ground beef, steaks, other beef, other meat and other saltwater finfish; households in the Central region spend more on pork and other meat but less on steaks, other beef, boneless poultry, other poultry and canned tuna; whereas households in the South spend more on pork but less on boneless poultry and other poultry. Presence of children increases consumption of ground beef, boneless poultry and freshwater finfish but decreases consumption of other meat.

Among the 105 coefficients for the quadratic price terms (β_{ij}), slightly under one-half (or 47) are statistically significant at the 10% level of significance or higher. As to the selectivity terms, the covariance estimates for all the meat products and two of the fish products (shrimp and canned tuna) are significant at the 10% level or higher. The significance of the covariance estimates (and selectivity variables) highlights the importance of accommodating the zeros in expenditure shares.

Turning to the second-step estimates for the high-income households, presented in table 3, the effects of age are similar to those for the low-income sample. Specifically, younger households spend less on other beef, pork, and other poultry than older households, whereas spending on other shellfish is also lower by households in the 40–60 age category. Whites spend more on boneless poultry and other meat but less on other poultry, freshwater finfish, salmon and other saltwater finfish; Blacks spend more on other poultry but less on ground beef, steaks, other beef, salmon and other saltwater finfish; Hispanics spend more on steaks and boneless poultry but less on other saltwater finfish. The Asian households spend more on shrimp, less on ground beef and, similar to findings for the low-income sample, less on ground beef, other saltwater finfish and canned tuna. As in the low-income sample, regional differences are also notable. As for coefficients for the quadratic price terms, over one half (or 56%) of the coefficients are statistically significant at the 10% level of significance or higher. In addition, the selectivity terms are significant in all but one equation (other saltwater finfish) at the 10% level or higher.

Demand Elasticities

Low-Income Households

Table 4 presents the uncompensated price and expenditure elasticities for the low-income sample. All own-price elasticities are statistically significant, are slightly greater than (though not statistically different from) unity (in absolute values) for ground beef, other poultry, shrimp and other shellfish, and statistically greater than unity for pork, boneless poultry, freshwater finfish, salmon, and other saltwater finfish. Demands for freshwater finfish and salmon are notably elastic, having own-price elasticities of –1.89 and –1.72, respectively. About one third of the uncompensated cross-price elasticities are significant, suggesting a mixture of gross complements and substitutes among the products. Both substitutability and complementarity exist among the meat products. For instance, ground beef is a gross complement for steaks but gross substitutes to boneless poultry, other poultry and freshwater finfish. Pork is a gross substitute to boneless poultry and three of the fish products (other saltwater finfish, canned tuna and other canned fish), and boneless poultry is a gross substitute to the other meat products such as ground beef, other beef, pork and other poultry. Gross substitutability is the more obvious pattern among the fish products. The total expenditure elasticities vary widely, ranging from 0.21 for canned tuna and 0.38 for other canned fish to 1.18 for other beef and other saltwater finfish. Although the expenditure elasticities for ground beef, steaks, other beef, pork, boneless poultry, other poultry, shrimp, other shellfish, freshwater finfish and other saltwater finfish are only slightly above unity, they are all estimated with relative high precision, relatively to the cross-price elasticities, and are significantly greater than unity.

Table 5 presents the compensated price elasticities for the low-income households. The compensated own-price elasticities are significantly greater than unity for boneless poultry (–1.28), freshwater finfish (–1.78) and salmon (–1.62) and are no different (statistically) from unity for ground beef (–0.94), pork (–0.95), other poultry (–1.01), shrimp (–1.08), other shellfish (–1.07) and other saltwater finfish (–1.24). The remaining products have compensated own-price elasticities under unity, ranging from –0.59 for other meat to –0.81 for other beef. Unlike the uncompensated elasticities which suggest a mixture of gross substitutes and complements among the meat and fish products, the compensated cross-price elasticities suggest a pattern of net substitutions. For no obvious reason, steaks are net complements for ground beef, other beef and salmon, as are ground beef and other beef for steaks, boneless poultry for canned tuna, and other canned fish for ground beef and boneless poultry. Ground beef, pork and other meats are net substitutes to most other products according to the cross-price elasticities. The compensated cross-price elasticities exhibit less of a pattern for freshwater finfish, salmon and other saltwater finfish, with about one half of the cross-price elasticities being positive.

High-Income Households

The uncompensated price and total expenditure elasticities for high-income households are presented in table 6. All own-price elasticities are significant and negative but, in contrast to elasticities for the low-income households, these elasticities are all significantly less than unity, ranging from a low –0.26 for shrimp, to –0.34 for canned tuna, to as high as –0.91 for pork and –0.94 for other poultry. Among the significant cross-price elasticities, 54 are negative and 38 are positive. Unlike the low-income households for which steaks are not responsive (significantly) to most other prices, the cross-price elasticities suggest steaks are a gross complement for all other meat products except pork and for three of the fish products (salmon, other saltwater finfish and canned tuna). Pork, other beef, other poultry and other meat are gross complements for most of the other meat products. Other more obvious patterns include the cross-price elasticities of salmon and other canned fish and, perhaps less obviously, other saltwater finfish, which suggest gross substitution among many of the other fish products.

The total expenditure elasticities are also very precisely estimated as in the low-income sample. The expenditure elasticities are only slightly (but significantly) above unity for most products, within a narrow range of 1.03 for shrimp to 1.17 for pork and other shellfish. As in the low-income sample, the expenditure elasticities are also very low for canned tuna (0.54) and other canned fish (0.15).

Table 7 presents the compensated price elasticities for high-income households. Unlike results for the low-income sample which suggest net substitution among most products, 29 of the compensated cross-price elasticities are significant and negative while 67 are positive. Steaks, shrimp and other shellfish are obviously net complements for many other meat and fish products, whereas ground beef, pork, other poultry, other meat, other saltwater finfish and, most obviously other canned fish, are net substitutes for many products. All compensated own-price elasticities are significant, negative and less than unity, ranging from –0.28 for steaks to –0.86 for other poultry.

Concluding Remarks

We investigate at home consumption by households of different types and cuts of meats and fish products by estimating parameters of an unusually large demand system. The Homescan data offer a unique opportunity for such an investigation. As in other micro survey data, our data features zero purchases of many products even though the data were aggregated to the annual level, mainly due to the disaggregate levels of the products considered. Although many statistical estimators exist for censored systems, the large number of products considered in this study prevents the use of ML estimators such as the system Tobit estimator (Yen, Lin, and Smallwood 2003), the multivariate sample selection estimator (Yen and Lin 2006), the Kuhn-Tucker approach (Wales and Woodland 1983), and the virtual-price approach (Lee and Pitt 1986). The two-step procedure used in the current study is the result of practical considerations associated with having to estimate a large demand system. Although the two-step estimator is less efficient than the ML estimator of Yen and Lin (2006) which motivates the two-step procedure, it is statistically consistent.

We investigate the demand for meat and fish products separately for low-income and high-income samples. We find notable differences in the elasticity estimates between the two groups of households. In general, higher-income households are less responsive to price changes, and the substitution patterns also differ between the low- and high-income households. Whereas the uncompensated elasticities suggest a mixture of gross substitutes and complements among the products for both low- and high-income households, the compensated elasticities suggest net substitution is the obvious pattern among low-income households.

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Table 1. Sample Statistics

	Low-Income Sample			High-Income Sample		
Variable	% con-suming	Mean	S.D.	% con-suming	Mean	S.D.
Expenditures ($ / year)						
Ground beef		46.09	59.78		40.17	47.42
Consuming households	81.77	56.36	61.58	80.61	49.84	48.04
Steaks		37.44	63.88		54.13	87.50
Consuming households	68.96	54.29	70.73	73.25	73.89	94.83
Other beef		31.01	46.80		34.85	51.54
Consuming households	72.21	42.95	50.21	71.60	48.68	55.11
Pork		51.27	64.39		52.73	61.08
Consuming households	79.58	64.43	66.04	79.60	66.25	61.58
Boneless poultry		24.26	40.24		30.19	45.96
Consuming households	65.14	37.24	44.75	71.69	42.12	49.44
Other poultry		39.85	53.79		37.74	48.49
Consuming households	81.62	48.82	55.74	80.93	46.63	49.91
Other meat		101.12	103.56		108.69	107.62
Consuming households	98.15	103.02	103.59	97.56	111.40	107.56
Shrimp		9.73	24.88		14.95	32.16
Consuming households	35.88	27.13	35.40	45.89	32.59	40.99
Other shellfish		6.52	18.13		10.37	27.75
Consuming households	31.46	20.74	27.40	36.83	28.15	39.89
Freshwater finfish		5.18	21.25		9.06	27.54
Consuming households	24.57	21.08	38.78	32.87	27.57	42.41
Salmon		4.91	16.41		9.83	25.87
Consuming households	22.62	21.71	28.73	33.94	28.97	37.65
Other saltwater finfish		2.79	11.58		3.00	11.92
Consuming households	16.38	17.05	24.00	17.33	17.33	23.91
Canned tuna		9.64	18.32		10.73	18.74
Consuming households	73.33	13.14	20.29	69.41	15.46	20.81
Other canned fish		13.20	18.61		13.56	17.50
Consuming households	80.32	16.43	19.44	80.41	16.86	18.03
Quantities (lb. / year)						
Ground beef		22.77	30.10		17.49	21.15
Consuming households		27.85	31.09		21.69	21.53
Steaks		9.60	15.57		10.91	16.33
Consuming households		13.91	17.07		14.89	17.46

Other beef	12.40	19.22	11.87	17.63
Consuming households	17.17	20.73	16.57	18.87
Pork	26.36	37.43	23.01	30.18
Consuming households	33.12	39.19	28.90	31.22
Boneless poultry	10.34	17.69	11.71	18.28
Consuming households	15.86	19.81	16.34	19.76
Other poultry	36.72	50.49	31.65	43.30
Consuming households	44.98	52.47	39.08	45.01
Other meat	31.38	29.77	28.63	26.81
Consuming households	31.97	29.74	29.34	26.76
Shrimp	1.62	3.96	2.21	4.68
Consuming households	4.52	5.53	4.80	5.95
Other shellfish	1.63	4.50	2.14	11.53
Consuming households	5.17	6.79	5.81	18.43
Freshwater finfish	1.32	5.56	1.79	5.28
Consuming households	5.38	10.19	5.46	8.05
Salmon	1.16	3.77	2.03	5.09
Consuming households	5.14	6.52	5.97	7.26
Other saltwater finfish	0.89	3.80	0.93	4.69
Consuming households	5.45	7.96	5.35	10.17
Canned tuna	4.87	9.19	4.56	7.34
Consuming households	6.64	10.17	6.57	8.03
Other canned fish	14.01	17.93	11.83	14.36
Consuming households	17.20	18.51	14.58	14.70
Expenditure shares				
Ground beef	0.11	0.11	0.09	0.09
Consuming households	0.14	0.11	0.11	0.09
Steaks	0.08	0.10	0.10	0.11
Consuming households	0.11	0.10	0.14	0.11
Other beef	0.07	0.08	0.07	0.08
Consuming households	0.10	0.08	0.10	0.08
Pork	0.12	0.11	0.11	0.10
Consuming households	0.15	0.10	0.14	0.09
Boneless poultry	0.06	0.09	0.07	0.09
Consuming households	0.09	0.09	0.10	0.10
Other poultry	0.10	0.10	0.09	0.09
Consuming households	0.12	0.10	0.11	0.09
Other meat	0.30	0.20	0.29	0.20
Consuming households	0.31	0.20	0.29	0.20

Shrimp	0.02	0.05	0.03	0.07
Consuming households	0.07	0.07	0.07	0.09
Other shellfish	0.02	0.04	0.02	0.05
Consuming households	0.05	0.06	0.06	0.07
Freshwater finfish	0.01	0.04	0.02	0.05
Consuming households	0.05	0.07	0.06	0.07
Salmon	0.01	0.05	0.02	0.06
Consuming households	0.06	0.09	0.07	0.08
Other saltwater finfish	0.01	0.03	0.01	0.03
Consuming households	0.04	0.05	0.04	0.05
Canned tuna	0.04	0.08	0.03	0.07
Consuming households	0.05	0.09	0.05	0.08
Other canned fish	0.05	0.09	0.04	0.08
Consuming households	0.06	0.09	0.06	0.09
Prices ($ / lb.)				
Ground beef	2.22	0.61	2.47	0.68
Steaks	4.25	1.61	5.02	2.07
Other beef	2.76	0.92	3.14	1.13
Pork	2.36	0.92	2.67	1.00
Boneless poultry	2.56	0.76	2.73	0.85
Other poultry	1.34	0.72	1.50	0.83
Other meat	3.43	1.31	4.05	1.51
Shrimp	6.41	1.39	6.81	1.75
Other shellfish	4.88	1.92	5.33	2.22
Freshwater finfish	4.83	1.22	5.24	1.60
Salmon	4.73	1.12	4.97	1.48
Other saltwater finfish	3.70	0.72	3.85	0.79
Canned tuna	2.18	1.00	2.50	1.15
Other canned fish	1.26	1.10	1.54	1.54
Demographic variables				
Used in 1st and 2nd steps:				
Household size	2.54	1.57	2.24	1.08
Age < 40 (household head)	0.14		0.13	
Age 40–60	0.56		0.67	
Age > 60 (ref.)	0.30		0.20	
White	0.73		0.74	
Black	0.14		0.13	

Hispanic	0.09		0.08	
Asian	0.02		0.04	
Other race (ref.)	0.02		0.02	
East	0.22		0.22	
Central	0.18		0.16	
South	0.41		0.37	
West (ref.)	0.19		0.25	
Children (present)	0.31		0.19	
Used in 1st step only:				
Married	0.50		0.62	
Widowed	0.13		0.05	
Divorced	0.19		0.13	
Single (ref.)	0.18		0.19	
PIR (poverty income ratio)	2.18	0.82	5.72	1.71
< High school	0.03		0.01	
High school	0.27		0.09	
Some college	0.37		0.25	
College (and above)	0.33		0.65	
Female head employed	0.44		0.62	
Male head employed	0.39		0.60	
Sample size	4005		4224	

Source: ACNielsen's Homescan panel, 2004.

Table 2. Second-Step Estimates of Translog Demand System: Low-Income Households

Variable	Ground Beef	Steaks	Other Beef	Pork	Boneless Poultry	Other Poultry	Other Meat
Demographic variables (α_{ij})							
Constant	–0.014	–0.232***	–0.036	–0.081***	–0.044	–0.034	0.538***
	(0.038)	(0.039)	(0.030)	(0.030)	(0.036)	(0.029)	(0.037)
Household size	0.003	–0.003	0.000	–0.009***	0.000	0.004	0.005
	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Age < 40	0.035***	0.009	–0.069***	–0.066***	0.057***	–0.053***	0.052***
	(0.011)	(0.012)	(0.012)	(0.013)	(0.011)	(0.012)	(0.015)
Age 40–60	0.025***	0.008	–0.037***	–0.032***	0.024***	–0.018***	0.024**
	(0.007)	(0.007)	(0.007)	(0.008)	(0.007)	(0.007)	(0.010)
White	0.052*	0.052**	–0.004	0.036	0.020	–0.030	–0.013
	(0.028)	(0.026)	(0.022)	(0.023)	(0.024)	(0.021)	(0.030)
Black	–0.022	–0.017	–0.027	0.065***	–0.002	0.146***	–0.055*
	(0.028)	(0.027)	(0.022)	(0.024)	(0.024)	(0.024)	(0.032)
Hispanic	0.015	0.067**	0.042*	0.019	–0.003	0.043*	–0.028
	(0.029)	(0.028)	(0.023)	(0.025)	(0.025)	(0.023)	(0.033)
Asian	–0.019	0.057*	0.039	0.070**	–0.031	0.012	–0.112***
	(0.036)	(0.035)	(0.028)	(0.031)	(0.033)	(0.029)	(0.042)
East	–0.022**	–0.023**	–0.034***	0.020**	–0.008	0.004	–0.036***
	(0.010)	(0.010)	(0.008)	(0.009)	(0.009)	(0.009)	(0.014)
Central	0.011	–0.027***	–0.017**	0.042***	–0.022**	–0.034***	0.041***
	(0.010)	(0.011)	(0.008)	(0.010)	(0.010)	(0.009)	(0.014)

South	0.001	–0.004	–0.001	0.019**	–0.017**	–0.017**	0.007
	(0.009)	(0.008)	(0.007)	(0.009)	(0.008)	(0.008)	(0.012)
Children	0.017*	–0.008	–0.007	–0.009	0.030***	0.009	–0.031**
	(0.010)	(0.010)	(0.008)	(0.010)	(0.010)	(0.009)	(0.015)
Quadratic price coefficients (β_{ij})							
Ground beef	–0.017						
	(0.012)						
Steaks	–0.050***	0.061***					
	(0.007)	(0.009)					
Other beef	0.002	–0.031***	0.019**				
	(0.007)	(0.006)	(0.008)				
Pork	–0.001	0.002	–0.010*	–0.029***			
	(0.007)	(0.006)	(0.006)	(0.009)			
Boneless poultry	0.026***	–0.004	0.016***	0.031***	–0.047***		
	(0.008)	(0.007)	(0.006)	(0.007)	(0.010)		
Other poultry	0.016***	0.000	–0.017***	–0.014***	0.011**	–0.013**	
	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.007)	
Other meat	–0.019**	–0.015**	–0.015**	–0.040***	0.000	–0.005	0.077***
	(0.009)	(0.008)	(0.007)	(0.008)	(0.008)	(0.007)	(0.013)
Shrimp	0.003	0.001	0.000	–0.003	–0.011	–0.004	0.008
	(0.009)	(0.007)	(0.007)	(0.008)	(0.008)	(0.006)	(0.009)
Other shellfish	0.008	0.016***	0.007	–0.007	–0.006	–0.012**	–0.007
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.007)
Freshwater	0.013	–0.010	0.001	–0.015**	0.007	–0.012**	0.013*
finfish	(0.008)	(0.007)	(0.007)	(0.007)	(0.007)	(0.006)	(0.008)

Salmon	0.005	–0.029***	–0.011	0.010	–0.008	0.011	0.006
	(0.010)	(0.009)	(0.008)	(0.009)	(0.009)	(0.007)	(0.010)
Other saltwater	0.007	–0.012*	0.000	0.008	–0.012	0.002	–0.017**
finfish	(0.009)	(0.007)	(0.007)	(0.008)	(0.008)	(0.006)	(0.008)
Canned tuna	0.000	0.004	–0.003	0.012**	–0.013**	0.003	0.009
	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.005)	(0.006)
Other canned	–0.021***	0.013**	0.009**	0.000	–0.008	0.006	0.028***
fish	(0.005)	(0.005)	(0.004)	(0.005)	(0.005)	(0.005)	(0.007)
Selectivity term:	0.042**	0.166***	0.120***	0.086***	0.095***	0.232***	
Covariance	(0.022)	(0.025)	(0.020)	(0.019)	(0.021)	(0.026)	

Table 2 continued

Variable	Shrimp	Other Shellfish	Freshwater Finfish	Salmon	Other Saltwater Finfish	Canned Tuna	Other Canned Fish
Demographic variables (α_{ij})							
Constant	0.021	0.003	0.178***	0.152***	0.111*	0.243***	
	(0.034)	(0.039)	(0.040)	(0.050)	(0.063)	(0.036)	
Household size	–0.004	–0.002	–0.013***	–0.016***	–0.012***	0.003	
	(0.003)	(0.003)	(0.003)	(0.004)	(0.003)	(0.003)	
Age < 40	–0.006	0.005	0.011	0.066***	0.023	–0.009	
	(0.014)	(0.013)	(0.014)	(0.023)	(0.024)	(0.009)	
Age 40–60	–0.006	–0.008	0.006	0.022*	0.008	0.003	
	(0.008)	(0.008)	(0.009)	(0.013)	(0.011)	(0.006)	
White	–0.016	–0.003	–0.043**	0.030	–0.022	–0.017	
	(0.021)	(0.018)	(0.022)	(0.037)	(0.026)	(0.021)	
Black	0.011	0.023	–0.049	0.020	–0.034	–0.038*	
	(0.021)	(0.018)	(0.023)	(0.039)	(0.030)	(0.021)	
Hispanic	–0.024	–0.024	–0.045*	0.042	–0.045*	–0.007	
	(0.023)	(0.024)	(0.024)	(0.040)	(0.025)	(0.023)	
Asian	0.002	0.010	–0.029	0.014	–0.068**	–0.093***	
	(0.026)	(0.024)	(0.028)	(0.045)	(0.031)	(0.030)	
East	0.031***	0.006	–0.001	–0.003	–0.024*	0.016**	
	(0.010)	(0.013)	(0.013)	(0.013)	(0.013)	(0.009)	
Central	0.000	–0.017	–0.005	0.008	–0.005	–0.014*	
	(0.012)	(0.011)	(0.012)	(0.021)	(0.012)	(0.008)	

South	0.006	–0.007	0.004	0.014	–0.018	0.000	
	(0.009)	(0.009)	(0.011)	(0.015)	(0.012)	(0.007)	
Children	–0.004	–0.008	0.022**	0.001	0.013	0.008	
	(0.010)	(0.009)	(0.011)	(0.015)	(0.011)	(0.008)	
Quadratic price coefficients (β_{ij})							
Shrimp	–0.012						
	(0.013)						
Other shellfish	–0.012**	–0.008					
	(0.007)	(0.007)					
Freshwater finfish	–0.009	0.004	–0.073***				
	(0.008)	(0.006)	(0.010)				
Salmon	0.010	–0.007	0.016*	–0.070***			
	(0.010)	(0.008)	(0.009)	(0.016)			
Other saltwater finfish	–0.006	0.008	–0.011	0.019*	–0.026**		
	(0.009)	(0.006)	(0.008)	(0.010)	(0.012)		
Canned tuna	–0.004	–0.004	0.013**	0.004	–0.003	0.021***	
	(0.006)	(0.005)	(0.006)	(0.007)	(0.006)	(0.006)	
Other canned fish	0.027***	0.009	0.043***	0.035***	0.018**	0.002	–0.058***
	(0.006)	(0.006)	(0.006)	(0.008)	(0.007)	(0.004)	(0.013)
Selectivity term: Covariance	0.051**	0.026	–0.036	–0.029	–0.031	0.057*	
	(0.022)	(0.026)	(0.024)	(0.027)	(0.038)	(0.030)	
Log likelihood	68774.698						

Note: Asymptotic standard errors in parentheses. Levels of statistical significance: *** = 1%, ** = 5%, * = 10%.

Table 3. Second-Step Estimates of Translog Demand System: High-Income Households

Variable	Ground Beef	Steaks	Other Beef	Pork	Boneless Poultry	Other Poultry	Other Meat
Demographic variables (α_{ij})							
Constant	0.061***	–0.288***	0.005	–0.005	–0.030	0.091***	0.460***
	(0.024)	(0.035)	(0.022)	(0.024)	(0.030)	(0.020)	(0.029)
Household size	0.002	0.011***	0.005*	–0.003	0.006*	–0.004	0.001
	(0.003)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.004)
Age < 40	0.029***	–0.012	–0.056***	–0.038***	0.082***	–0.023***	0.015
	(0.008)	(0.010)	(0.010)	(0.009)	(0.010)	(0.008)	(0.011)
Age 40–60	0.015***	0.013**	–0.026***	–0.015***	0.034***	–0.010**	0.001
	(0.005)	(0.006)	(0.005)	(0.005)	(0.007)	(0.005)	(0.008)
White	0.004	0.022	–0.013	0.000	0.048***	–0.035***	0.038*
	(0.016)	(0.019)	(0.014)	(0.017)	(0.017)	(0.014)	(0.022)
Black	–0.048***	–0.067***	–0.028*	0.022	0.019	0.058***	0.026
	(0.017)	(0.021)	(0.015)	(0.017)	(0.018)	(0.015)	(0.023)
Hispanic	–0.003	0.037*	–0.002	–0.016	0.033*	–0.011	0.012
	(0.017)	(0.021)	(0.016)	(0.018)	(0.018)	(0.015)	(0.024)
Asian	–0.047***	0.006	0.008	0.022	–0.002	0.009	–0.031
	(0.019)	(0.022)	(0.017)	(0.019)	(0.021)	(0.017)	(0.027)
East	0.009	0.003	–0.035***	–0.006	–0.003	0.008	–0.019**
	(0.006)	(0.007)	(0.006)	(0.006)	(0.007)	(0.006)	(0.009)
Central	0.020***	–0.006	–0.023***	0.021***	–0.013*	–0.020***	0.031***
	(0.007)	(0.008)	(0.006)	(0.007)	(0.007)	(0.006)	(0.010)

South	0.018***	–0.001	–0.023***	0.007	–0.002	–0.007	0.008
	(0.006)	(0.007)	(0.005)	(0.006)	(0.006)	(0.005)	(0.008)
Children	–0.004	–0.026***	–0.017***	–0.012*	0.003	0.002	0.017
	(0.007)	(0.009)	(0.007)	(0.007)	(0.007)	(0.006)	(0.011)
Quadratic price coefficients (β_{ij})							
Ground beef	0.028***						
	(0.008)						
Steaks	–0.024***	0.113***					
	(0.005)	(0.010)					
Other beef	–0.014***	–0.025***	0.065***				
	(0.005)	(0.005)	(0.007)				
Pork	0.015***	–0.011**	–0.019***	0.010			
	(0.005)	(0.005)	(0.005)	(0.007)			
Boneless poultry	0.012**	–0.026***	–0.002	0.011**	0.024***		
	(0.006)	(0.005)	(0.005)	(0.005)	(0.008)		
Other poultry	–0.001	–0.012***	–0.009**	–0.016***	0.009**	0.007	
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)	
Other meat	–0.019***	–0.026***	–0.016***	–0.025***	0.005	0.009*	0.079***
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.010)
Shrimp	–0.002	0.009	–0.009*	0.003	–0.018***	–0.004	0.010
	(0.006)	(0.006)	(0.005)	(0.005)	(0.006)	(0.004)	(0.006)
Other shellfish	–0.001	0.013***	0.005	–0.006	–0.004	–0.008**	–0.015***
	(0.004)	(0.005)	(0.004)	(0.004)	(0.005)	(0.004)	(0.005)
Freshwater	0.005	–0.002	–0.004	–0.008	–0.006	–0.007*	0.012**
finfish	(0.005)	(0.005)	(0.005)	(0.005)	(0.005)	(0.004)	(0.005)

Salmon	0.001	–0.018***	0.005	0.005	–0.019***	0.008*	0.013*
	(0.006)	(0.006)	(0.005)	(0.006)	(0.006)	(0.005)	(0.007)
Other saltwater	0.002	–0.024***	–0.003	0.008	0.010*	–0.003	–0.003
finfish	(0.006)	(0.005)	(0.005)	(0.005)	(0.006)	(0.004)	(0.006)
Canned tuna	–0.004	–0.009***	0.000	0.001	0.001	0.001	0.001
	(0.004)	(0.004)	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)
Other canned	–0.009***	–0.003	0.002	–0.002	–0.004	0.014***	0.016***
fish	(0.003)	(0.004)	(0.003)	(0.003)	(0.004)	(0.003)	(0.005)
Selectivity term:	0.031*	0.256***	0.096***	0.071***	0.125***	0.105***	
Covariance	0.017	0.024	0.015	0.015	0.020	0.019	

Table 3 continued

Variable	Shrimp	Other Shellfish	Freshwater Finfish	Salmon	Other Saltwater Finfish	Canned Tuna	Other Canned Fish
Demographic variables (α_{ij})							
Constant	–0.055	–0.082***	0.031	0.098***	0.195***	0.100***	
	(0.036)	(0.034)	(0.030)	(0.034)	(0.054)	(0.023)	
Household size	–0.009***	–0.007**	–0.007**	–0.016***	–0.009***	0.003	
	(0.004)	(0.003)	(0.003)	(0.004)	(0.004)	(0.003)	
Age < 40	0.004	0.003	–0.003	0.007	0.004	–0.012	
	(0.011)	(0.010)	(0.011)	(0.011)	(0.014)	(0.008)	
Age 40–60	0.007	–0.010*	–0.006	–0.001	0.002	0.002	
	(0.007)	(0.006)	(0.006)	(0.007)	(0.008)	(0.004)	
White	–0.011	–0.023	–0.044**	–0.052**	–0.064***	0.007	
	(0.019)	(0.018)	(0.019)	(0.022)	(0.018)	(0.013)	
Black	0.004	0.014	–0.027	–0.041*	–0.059***	–0.004	
	(0.020)	(0.019)	(0.019)	(0.023)	(0.021)	(0.013)	
Hispanic	0.005	–0.020	–0.032	–0.047	–0.058***	0.017	
	(0.021)	(0.020)	(0.020)	(0.024)	(0.019)	(0.014)	
Asian	0.053**	0.019	0.014	–0.022	–0.066***	–0.051***	
	(0.022)	(0.020)	(0.021)	(0.025)	(0.021)	(0.018)	
East	0.023***	0.017**	0.022***	–0.011	–0.035***	0.015***	
	(0.008)	(0.008)	(0.007)	(0.008)	(0.009)	(0.006)	
Central	–0.018*	–0.027***	–0.011	–0.023**	–0.002	–0.002	
	(0.010)	(0.009)	(0.010)	(0.012)	(0.010)	(0.005)	
South	0.004	–0.002	0.003	–0.013*	–0.031***	0.004	
	(0.007)	(0.007)	(0.007)	(0.007)	(0.011)	(0.005)	

Children	0.019**	–0.001	0.001	0.015	0.011	–0.003	
	(0.009)	(0.008)	(0.009)	(0.010)	(0.009)	(0.006)	
Quadratic price coefficients (β_{ij})							
Shrimp	0.064***						
	(0.010)						
Other shellfish	0.005	0.030***					
	(0.005)	(0.006)					
Freshwater	–0.026***	–0.003	0.032***				
finfish	(0.006)	(0.004)	(0.007)				
Salmon	–0.030***	–0.026***	0.010*	0.023**			
	(0.007)	(0.005)	(0.006)	(0.009)			
Other saltwater	–0.004	–0.001	–0.037***	0.015**	0.011		
finfish	(0.006)	(0.004)	(0.006)	(0.007)	(0.008)		
Canned tuna	–0.003	–0.005	0.005	–0.002	0.010***	0.032***	
	(0.004)	(0.003)	(0.004)	(0.004)	(0.004)	(0.004)	
Other canned	0.006	0.006	0.019***	0.010**	0.008*	–0.004	0.011
fish	(0.004)	(0.004)	(0.004)	(0.005)	(0.005)	(0.003)	(0.007)
Selectivity term:	0.116***	0.111***	0.037**	0.066***	–0.041	0.094***	
Covariance	(0.026)	(0.020)	(0.017)	(0.019)	(0.031)	(0.020)	
Log likelihood	74020.665						

Note: Asymptotic standard errors in parentheses. Levels of statistical significance: *** = 1%, ** = 5%, * = 10%.

Table 4. Uncompensated Price and Total Meat Expenditure Elasticities: Low-Income Households

Variable	Ground Beef	Steaks	Other Beef	Pork	Boneless Poultry	Other Poultry	Other Meat
Ground beef	–1.07***	–0.22***	0.03	0.03	0.14***	0.10***	–0.11***
	(0.06)	(0.04)	(0.03)	(0.04)	(0.04)	(0.03)	(0.04)
Steaks	–0.25***	–0.67***	–0.15***	0.03	–0.02	0.01	–0.08*
	(0.04)	(0.05)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Other beef	0.02	–0.19***	–0.86***	–0.05	0.11***	–0.10***	–0.11*
	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)	(0.03)	(0.05)
Pork	0.01	0.04	–0.02	–1.09***	0.14***	–0.04*	–0.19***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.02)	(0.03)
Boneless poultry	0.19***	–0.01	0.12***	0.23***	–1.33***	0.08*	–0.01
	(0.05)	(0.05)	(0.04)	(0.05)	(0.07)	(0.04)	(0.06)
Other poultry	0.10***	0.02	–0.09***	–0.06*	0.07*	–1.06***	–0.04
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Other meat	–0.03	0.00	–0.01	–0.06***	0.01	0.01	–0.84***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Shrimp	0.03	0.02	0.01	–0.01	–0.10	–0.03	0.07
	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.08)
Other shellfish	0.11	0.22***	0.10	–0.08	–0.07	–0.14*	–0.09
	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.09)
Freshwater finfish	0.19*	–0.06	0.06	–0.12	0.11	–0.12*	0.14
	(0.10)	(0.09)	(0.08)	(0.09)	(0.09)	(0.07)	(0.10)
Salmon	0.08	–0.24***	–0.08	0.16	–0.07	0.14*	0.04
	(0.11)	(0.09)	(0.09)	(0.09)	(0.10)	(0.08)	(0.11)
Other saltwater finfish	0.15	–0.11	0.05	0.19*	–0.15	0.07	–0.28*
	(0.13)	(0.11)	(0.11)	(0.11)	(0.11)	(0.09)	(0.13)
Canned tuna	0.01	0.09	–0.04	0.23*	–0.23*	0.06	0.16
	(0.11)	(0.09)	(0.09)	(0.10)	(0.10)	(0.08)	(0.11)
Other canned fish	0.12	0.02	0.18*	0.25***	–0.47***	0.04	0.09
	(0.09)	(0.07)	(0.08)	(0.08)	(0.08)	(0.06)	(0.09)

Table 4 continued.

Variable	Shrimp	Other Shellfish	Fresh-water Finfish	Salmon	Other Saltwater Finfish	Canned Tuna	Other Canned Fish	Total Meat Expenditure
Ground beef	0.02	0.05	0.08*	0.03	0.05	–0.03	–0.17***	1.06***
	(0.04)	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.03)	(0.01)
Steaks	0.01	0.09***	–0.05	–0.15***	–0.06	0.01	0.04*	1.25***
	(0.04)	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.03)	(0.01)
Other beef	0.00	0.05	0.01	–0.07	0.01	–0.03	0.03	1.18***
	(0.05)	(0.03)	(0.04)	(0.05)	(0.05)	(0.03)	(0.03)	(0.01)
Pork	0.00	–0.02	–0.05*	0.05	0.05	0.03	–0.06***	1.17***
	(0.03)	(0.02)	(0.03)	(0.04)	(0.03)	(0.02)	(0.02)	(0.01)
Boneless poultry	–0.08	–0.04	0.05	–0.06	–0.08	–0.11***	–0.09***	1.10***
	(0.06)	(0.04)	(0.05)	(0.06)	(0.05)	(0.04)	(0.04)	(0.02)
Other poultry	–0.02	–0.06*	–0.06*	0.06	0.02	0.00	0.01	1.12***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.02)	(0.01)
Other meat	0.03	–0.01	0.05***	0.02	–0.02	–0.01	0.00	0.86***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)
Shrimp	–1.10***	–0.11*	–0.08	0.09	–0.05	–0.04	0.23***	1.09***
	(0.12)	(0.06)	(0.07)	(0.10)	(0.08)	(0.06)	(0.05)	(0.03)
Other shellfish	–0.15*	–1.09***	0.06	–0.08	0.11	–0.06	0.08	1.10***
	(0.08)	(0.09)	(0.07)	(0.10)	(0.08)	(0.06)	(0.06)	(0.03)
Freshwater finfish	–0.10	0.07	–1.89***	0.21*	–0.11	0.11	0.41***	1.12***
	(0.10)	(0.07)	(0.13)	(0.11)	(0.10)	(0.07)	(0.06)	(0.03)
Salmon	0.11	–0.06	0.19*	–1.72***	0.23*	0.00	0.25***	0.98***
	(0.11)	(0.08)	(0.09)	(0.17)	(0.11)	(0.08)	(0.07)	(0.04)
Other saltwater finfish	–0.08	0.13	–0.14	0.30*	–1.35***	–0.10	0.13*	1.18***
	(0.14)	(0.09)	(0.11)	(0.15)	(0.17)	(0.10)	(0.07)	(0.04)
Canned tuna	–0.06	–0.07	0.23*	0.07	–0.04	–0.64***	0.02	0.21***
	(0.11)	(0.09)	(0.11)	(0.13)	(0.11)	(0.11)	(0.07)	(0.07)
Other canned fish	0.07	0.07	–0.11	0.06	0.09	0.00	–0.79***	0.38***
	(0.09)	(0.07)	(0.09)	(0.11)	(0.10)	(0.06)	(0.05)	(0.04)

Note: Asymptotic standard errors in parentheses. Levels of statistical significance: *** = 1%, ** = 5%, * = 10%.

Table 5. Compensated Price Elasticities: Low-Income Households

Variable	Ground Beef	Steaks	Other Beef	Pork	Boneless Poultry	Other Poultry	Other Meat
Ground beef	–0.94***	–0.17***	0.08*	0.16***	0.18***	0.15***	0.20***
	(0.06)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)
Steaks	–0.10***	–0.61***	–0.09***	0.19***	0.04	0.07***	0.28***
	(0.04)	(0.05)	(0.03)	(0.03)	(0.04)	(0.03)	(0.04)
Other beef	0.16***	–0.13***	–0.81***	0.10***	0.16***	–0.04	0.23***
	(0.05)	(0.04)	(0.05)	(0.04)	(0.04)	(0.03)	(0.05)
Pork	0.15***	0.09***	0.03	–0.95***	0.19***	0.02	0.15***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)
Boneless poultry	0.32***	0.04	0.17***	0.37***	–1.28***	0.14***	0.31***
	(0.05)	(0.05)	(0.05)	(0.05)	(0.07)	(0.04)	(0.05)
Other poultry	0.24***	0.07*	–0.03	0.08***	0.11***	–1.01***	0.28***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Other meat	0.08***	0.04*	0.03	0.05***	0.05*	0.05***	–0.59***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Shrimp	0.17*	0.07	0.06	0.12*	–0.06	0.03	0.38***
	(0.08)	(0.07)	(0.07)	(0.07)	(0.07)	(0.06)	(0.08)
Other shellfish	0.24***	0.27***	0.15*	0.07	–0.03	–0.09	0.23***
	(0.08)	(0.07)	(0.07)	(0.07)	(0.08)	(0.06)	(0.09)
Freshwater finfish	0.33***	–0.01	0.11	0.02	0.15*	–0.06	0.46***
	(0.10)	(0.09)	(0.08)	(0.09)	(0.09)	(0.08)	(0.10)
Salmon	0.20*	–0.20*	–0.04	0.29***	–0.02	0.19***	0.32***
	(0.11)	(0.09)	(0.09)	(0.09)	(0.10)	(0.08)	(0.11)
Other saltwater finfish	0.29*	–0.06	0.11	0.34***	–0.10	0.13	0.06
	(0.13)	(0.11)	(0.11)	(0.11)	(0.11)	(0.09)	(0.13)
Canned tuna	0.03	0.09	–0.03	0.25***	–0.22*	0.07	0.22*
	(0.11)	(0.09)	(0.09)	(0.10)	(0.10)	(0.08)	(0.11)
Other canned fish	0.17*	0.04	0.20***	0.30***	–0.45	0.05	0.20*
	(0.09)	(0.08)	(0.08)	(0.08)	(0.08)	(0.06)	(0.09)

Table 5 continued.

Variable	Shrimp	Other Shellfish	Freshwater Finfish	Salmon	Other Saltwater Finfish	Canned Tuna	Other Canned Fish
Ground beef	0.04	0.07	0.18***	0.14*	0.15*	–0.01	–0.25***
	(0.05)	(0.04)	(0.05)	(0.06)	(0.08)	(0.03)	(0.08)
Steaks	0.03	0.11***	0.08	–0.02	0.06	0.03	–0.05
	(0.05)	(0.04)	(0.05)	(0.06)	(0.08)	(0.03)	(0.10)
Other beef	0.03	0.08	0.13***	0.05	0.12	–0.02	–0.06
	(0.05)	(0.05)	(0.05)	(0.07)	(0.08)	(0.04)	(0.09)
Pork	0.02	0.00	0.06	0.17***	0.16*	0.04	–0.14
	(0.04)	(0.04)	(0.04)	(0.05)	(0.07)	(0.03)	(0.09)
Boneless poultry	–0.06	–0.01	0.16***	0.06	0.03	–0.09*	–0.17*
	(0.06)	(0.05)	(0.06)	(0.08)	(0.08)	(0.04)	(0.09)
Other poultry	0.00	–0.04	0.05	0.18***	0.12*	0.02	–0.08
	(0.04)	(0.04)	(0.05)	(0.06)	(0.07)	(0.03)	(0.09)
Other meat	0.04	0.01	0.13***	0.11***	0.06	0.00	–0.07
	(0.03)	(0.03)	(0.03)	(0.04)	(0.06)	(0.02)	(0.07)
Shrimp	–1.08***	–0.09	0.03	0.20*	0.05	–0.03	0.15
	(0.12)	(0.07)	(0.08)	(0.10)	(0.10)	(0.06)	(0.10)
Other shellfish	–0.13	–1.07***	0.17*	0.03	0.21*	–0.05	–0.01
	(0.09)	(0.09)	(0.08)	(0.10)	(0.10)	(0.06)	(0.10)
Freshwater finfish	–0.08	0.09	–1.78***	0.33***	–0.01	0.12*	0.32***
	(0.10)	(0.08)	(0.13)	(0.12)	(0.11)	(0.07)	(0.11)
Salmon	0.13	–0.04	0.29***	–1.62***	0.32***	0.01	0.18*
	(0.11)	(0.08)	(0.10)	(0.17)	(0.12)	(0.08)	(0.11)
Other saltwater finfish	–0.05	0.16*	–0.02	0.42***	–1.24***	–0.09	0.03
	(0.14)	(0.10)	(0.12)	(0.16)	(0.18)	(0.10)	(0.12)
Canned tuna	–0.06	–0.06	0.25*	0.10	–0.02	–0.63***	0.00
	(0.11)	(0.09)	(0.11)	(0.13)	(0.12)	(0.11)	(0.07)
Other canned fish	0.08	0.08	–0.07	0.10	0.12	0.01	–0.82***
	(0.10)	(0.07)	(0.09)	(0.11)	(0.11)	(0.07)	(0.06)

Note: Asymptotic standard errors in parentheses. Levels of statistical significance: *** = 1%, ** = 5%, * = 10%.

Table 6. Uncompensated Price and Total Meat Expenditure Elasticities: High-Income Households

Variable	Ground Beef	Steaks	Other Beef	Pork	Boneless Poultry	Other Poultry	Other Meat
Ground beef	–0.77***	–0.16***	–0.09**	0.15***	0.10**	0.00	–0.18***
	(0.06)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)
Steaks	–0.14***	–0.33***	–0.14***	–0.06**	–0.15***	–0.07***	–0.16***
	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)
Other beef	–0.11***	–0.19***	–0.43***	–0.14***	–0.01	–0.07**	–0.16***
	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.03)	(0.04)
Pork	0.10***	–0.03	–0.10***	–0.91***	0.07**	–0.09***	–0.18***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.02)	(0.03)
Boneless poultry	0.11**	–0.21***	0.00	0.11***	–0.78***	0.09**	0.03
	(0.05)	(0.05)	(0.04)	(0.05)	(0.07)	(0.04)	(0.05)
Other poultry	0.00	–0.07**	–0.05*	–0.11***	0.08**	–0.94***	0.05
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)
Other meat	–0.05	–0.04**	–0.03*	–0.05***	0.02	0.04***	–0.79***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.03)
Shrimp	–0.03	0.09	–0.12**	0.02	–0.21***	–0.05	0.12*
	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)	(0.05)	(0.07)
Other shellfish	–0.02	0.15***	0.05	–0.10*	–0.06	–0.11**	–0.18***
	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.05)	(0.07)
Freshwater	0.07	–0.02	–0.05	–0.10	–0.09	–0.10*	0.15**
finfish	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)	(0.08)
Salmon	0.01	–0.21***	0.06	0.06	–0.23***	0.10*	0.15**
	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.05)	(0.08)
Other saltwater	0.08	–0.46***	–0.02	0.27**	0.27**	–0.04	–0.17
finfish	(0.14)	(0.12)	(0.12)	(0.12)	(0.13)	(0.10)	(0.14)
Canned tuna	–0.08	–0.19***	–0.01	0.01	0.01	0.02	0.02
	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)	(0.06)	(0.09)
Other canned	–0.03	–0.05	0.26***	0.26***	–0.41***	0.12**	–0.12
fish	(0.09)	(0.08)	(0.08)	(0.08)	(0.09)	(0.06)	(0.10)

Table 6 continued.

Variable	Shrimp	Other Shellfish	Freshwater Finfish	Salmon	Other Saltwater Finfish	Canned Tuna	Other Canned Fish	Total Meat Expenditure
Ground beef	–0.01	0.00	0.05	0.01	0.03	–0.05	–0.13***	1.04***
	(0.05)	(0.03)	(0.04)	(0.05)	(0.05)	(0.03)	(0.03)	(0.02)
Steaks	0.05	0.08***	–0.01	–0.10***	–0.14***	–0.06***	–0.04	1.26***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.02)
Other beef	–0.08*	0.05	–0.03	0.04	–0.02	–0.01	–0.01	1.19***
	(0.04)	(0.03)	(0.04)	(0.05)	(0.04)	(0.03)	(0.03)	(0.02)
Pork	0.02	–0.03	–0.04	0.03	0.06*	–0.01	–0.06***	1.17***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.02)	(0.02)	(0.01)
Boneless poultry	–0.16***	–0.03	–0.05	–0.17***	0.10**	0.00	–0.07**	1.06***
	(0.05)	(0.04)	(0.05)	(0.06)	(0.05)	(0.04)	(0.03)	(0.02)
Other poultry	–0.03	–0.06**	–0.05	0.07*	–0.02	–0.01	0.07***	1.07***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.02)	(0.02)	(0.02)
Other meat	0.03	–0.04**	0.05***	0.04**	0.00	–0.02	–0.01	0.84***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.01)	(0.02)	(0.01)
Shrimp	–0.26**	0.06	–0.31***	–0.34***	–0.05	–0.03	0.09*	1.03***
	(0.11)	(0.06)	(0.06)	(0.08)	(0.07)	(0.05)	(0.05)	(0.03)
Other shellfish	0.07	–0.59***	–0.05	–0.36***	–0.03	–0.05	0.13***	1.17***
	(0.07)	(0.08)	(0.06)	(0.07)	(0.06)	(0.05)	(0.05)	(0.03)
Freshwater finfish	–0.37***	–0.04	–0.55***	0.14*	–0.52***	0.06	0.25***	1.16***
	(0.08)	(0.06)	(0.10)	(0.08)	(0.07)	(0.05)	(0.05)	(0.03)
Salmon	–0.35***	–0.31***	0.12*	–0.73***	0.18**	–0.03	0.12**	1.07***
	(0.08)	(0.06)	(0.07)	(0.11)	(0.08)	(0.05)	(0.05)	(0.03)
Other saltwater finfish	–0.08	–0.01	–0.85***	0.36**	–0.71***	0.19**	0.03	1.15***
	(0.14)	(0.10)	(0.13)	(0.16)	(0.20)	(0.10)	(0.08)	(0.05)
Canned tuna	–0.07	–0.10	0.09	–0.05	0.21***	–0.34***	–0.07	0.54***
	(0.09)	(0.07)	(0.08)	(0.09)	(0.09)	(0.09)	(0.05)	(0.05)
Other canned fish	–0.08	0.26***	0.02	0.19*	0.08	–0.01	–0.64***	0.15***
	(0.10)	(0.07)	(0.09)	(0.10)	(0.11)	(0.06)	(0.06)	(0.06)

Note: Asymptotic standard errors in parentheses. Levels of statistical significance: *** = 1%, ** = 5%, * = 10%.

Table 7. Compensated Price Elasticities: High-Income Households

Variable	Ground Beef	Steaks	Other Beef	Pork	Boneless Poultry	Other Poultry	Other Meat
Ground beef	–0.66***	–0.12***	–0.03	0.27***	0.14***	0.08***	0.11**
	(0.06)	(0.04)	(0.04)	(0.04)	(0.04)	(0.03)	(0.04)
Steaks	–0.01	–0.28***	–0.07***	0.09***	–0.10***	0.03	0.18***
	(0.03)	(0.04)	(0.03)	(0.03)	(0.03)	(0.02)	(0.03)
Other beef	0.01	–0.15	–0.36***	0.00	0.04	0.02	0.17***
	(0.04)	(0.04)	(0.05)	(0.04)	(0.04)	(0.03)	(0.04)
Pork	0.22***	0.01	–0.03	–0.77***	0.12***	0.00	0.14***
	(0.03)	(0.03)	(0.03)	(0.04)	(0.03)	(0.02)	(0.03)
Boneless poultry	0.22***	–0.17***	0.06	0.24***	–0.74***	0.17***	0.32***
	(0.05)	(0.05)	(0.04)	(0.05)	(0.07)	(0.04)	(0.05)
Other poultry	0.10***	–0.03	0.01	0.02	0.12***	–0.86***	0.34***
	(0.03)	(0.03)	(0.03)	(0.03)	(0.03)	(0.04)	(0.04)
Other meat	0.03*	–0.01	0.02	0.05***	0.06***	0.10***	–0.56***
	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.02)	(0.03)
Shrimp	0.08	0.12**	–0.06	0.14**	–0.17***	0.03	0.40***
	(0.07)	(0.06)	(0.06)	(0.06)	(0.07)	(0.05)	(0.07)
Other shellfish	0.10*	0.19	0.12**	0.03	–0.01	–0.02	0.14**
	(0.06)	(0.06)	(0.05)	(0.06)	(0.06)	(0.05)	(0.07)
Freshwater finfish	0.19***	0.03	0.01	0.04	–0.04	–0.01	0.47***
	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.06)	(0.08)
Salmon	0.12*	–0.17***	0.12*	0.19***	–0.19***	0.18***	0.44***
	(0.07)	(0.07)	(0.06)	(0.07)	(0.07)	(0.05)	(0.08)
Other saltwater finfish	0.19	–0.41***	0.04	0.41***	0.31**	0.05	0.14
	(0.14)	(0.12)	(0.12)	(0.12)	(0.13)	(0.10)	(0.14)
Canned tuna	–0.02	–0.17*	0.02	0.08	0.03	0.06	0.17**
	(0.08)	(0.08)	(0.07)	(0.08)	(0.08)	(0.06)	(0.09)
Other canned fish	–0.01	–0.04	0.27***	0.27***	–0.41***	0.14**	–0.08
	(0.09)	(0.08)	(0.08)	(0.08)	(0.09)	(0.06)	(0.10)

Table 7 continued.

Variable	Shrimp	Other Shellfish	Freshwater Finfish	Salmon	Other Saltwa-ter Finfish	Canned Tuna	Other Canned Fish
Ground beef	–0.04	–0.05	0.07	0.01	0.13**	–0.05	0.14**
	(0.05)	(0.04)	(0.05)	(0.05)	(0.07)	(0.03)	(0.06)
Steaks	0.02	0.02	0.02	–0.10***	–0.01	–0.06***	0.28***
	(0.04)	(0.03)	(0.03)	(0.04)	(0.06)	(0.02)	(0.07)
Other beef	–0.11**	–0.01	–0.01	0.05	0.09	–0.02	0.29***
	(0.05)	(0.04)	(0.04)	(0.05)	(0.07)	(0.03)	(0.07)
Pork	–0.01	–0.09***	–0.01	0.04	0.18***	–0.02	0.23***
	(0.04)	(0.03)	(0.04)	(0.04)	(0.06)	(0.03)	(0.06)
Boneless poultry	–0.19***	–0.09*	–0.03	–0.17***	0.20***	–0.01	0.20***
	(0.06)	(0.05)	(0.05)	(0.06)	(0.07)	(0.04)	(0.06)
Other poultry	–0.06	–0.11***	–0.03	0.07*	0.09	–0.01	0.34***
	(0.04)	(0.03)	(0.04)	(0.04)	(0.06)	(0.03)	(0.06)
Other meat	0.01	–0.08***	0.07***	0.05*	0.08*	–0.02	0.20***
	(0.03)	(0.03)	(0.02)	(0.03)	(0.05)	(0.02)	(0.05)
Shrimp	–0.29***	0.00	–0.29***	–0.34***	0.06	–0.04	0.35***
	(0.11)	(0.06)	(0.07)	(0.08)	(0.08)	(0.05)	(0.07)
Other shellfish	0.04	–0.65***	–0.03	–0.36***	0.09	–0.05	0.42***
	(0.07)	(0.08)	(0.06)	(0.07)	(0.08)	(0.05)	(0.08)
Freshwater finfish	–0.40***	–0.10*	–0.52***	0.14**	–0.40***	0.05	0.54***
	(0.08)	(0.06)	(0.10)	(0.08)	(0.09)	(0.05)	(0.08)
Salmon	–0.38***	–0.37***	0.14**	–0.72***	0.28***	–0.03	0.39***
	(0.08)	(0.06)	(0.07)	(0.11)	(0.09)	(0.05)	(0.08)
Other saltwa-ter finfish	–0.11	–0.07	–0.83***	0.36**	–0.60***	0.18**	0.32***
	(0.14)	(0.10)	(0.14)	(0.16)	(0.20)	(0.10)	(0.11)
Canned tuna	–0.08	–0.13*	0.11	–0.05	0.27***	–0.34***	0.06
	(0.09)	(0.07)	(0.08)	(0.09)	(0.09)	(0.09)	(0.07)
Other canned fish	–0.09	0.25***	0.03	0.19*	0.10	–0.01	–0.60***
	(0.10)	(0.07)	(0.09)	(0.10)	(0.11)	(0.06)	(0.06)

Note: Asymptotic standard errors in parentheses. Levels of statistical significance: *** = 1%, ** = 5%, * = 10%.