



**AgEcon** SEARCH  
RESEARCH IN AGRICULTURAL & APPLIED ECONOMICS

*The World's Largest Open Access Agricultural & Applied Economics Digital Library*

**This document is discoverable and free to researchers across the globe due to the work of AgEcon Search.**

**Help ensure our sustainability.**

Give to AgEcon Search

AgEcon Search  
<http://ageconsearch.umn.edu>  
[aesearch@umn.edu](mailto:aesearch@umn.edu)

*Papers downloaded from **AgEcon Search** may be used for non-commercial purposes and personal study only. No other use, including posting to another Internet site, is permitted without permission from the copyright owner (not AgEcon Search), or as allowed under the provisions of Fair Use, U.S. Copyright Act, Title 17 U.S.C.*

# Mexican Meat demand Parameters Before and After NAFTA: Evidence from Household Surveys 1992–2004

**Jaime Malaga, Suwen Pan, and Teresa Duch-Carvallo**

A censored Nonlinear QUAIDS model was applied to estimate Mexican meat demand parameters using annual household survey data for six years from 1992 to 2004. Results suggest that in Mexico and throughout the analyzed period, beef and pork meat were luxury items while chicken was a normal good. Small but not significant changes in meat demand parameters were found after NAFTA implementation, suggesting that changes on consumer behavior might take longer periods to be quantifiable.

Since its implementation in 1994, the North American Free Trade Agreement (NAFTA) has been regarded as the most important change-driver of the Mexican economy. After NAFTA, Mexico became the largest market for U.S. meat exports, accounting for \$1.5 billion, of which \$712 million corresponds to beef and veal, \$246 to pork, and \$540 to poultry (USDA-FATUS 2006). Mexico also became the world's eighth largest producer and the seventh largest importer of meat (FAO 2006). According to the Mexican Agriculture Secretary (SAGARPA 2006) per capita meat consumption in Mexico increased 73 percent from 1990 to 2004, from 32.9 kg to 56.9 kg. This increase may be related to the fact that, through NAFTA, Mexicans have been exposed to new varieties, qualities, and types of meat products at lower prices. However, when this per capita consumption is compared to the levels of Canada and the United States (94 and 118 kg, respectively), Mexican per capita meat consumption is still low, suggesting a possible increase in consumption of all types of meat in Mexico as per capita income rises and consumer preferences become more in line with its NAFTA partners. This potential growth could provide the Mexican and foreign meat suppliers with the opportunity to expand their markets in Mexico.

The most recent research on Mexican meat demand systems have reported quite diverse results. Golan, Perloff, and Shen (2001) used 1992 (pre-NAFTA) survey data and found that the own-price elasticities of beef, pork, and poultry were -1.10, -0.56, and -0.63, respectively. Dong, Gould, and Kaiser (2004), with data from the Mexican house-

hold survey of 1998, analyzed information from households located in towns with more than 15,000 inhabitants and excluded households reporting only food consumption away from home. These authors estimated own-price elasticities for beef, pork, and poultry meat to be -0.63, -0.13, and -0.83, respectively. When comparing these results to those of Golan, Perloff, and Shen (2001), Dong, Gould, and Kaiser (2004) suggested that the differences were probably due to the methodology employed in their estimation of the demand system as well as to the peso devaluation of 1994. According to the results described above, it seems plausible that the parameters of the Mexican meat demand, which are critical to any projection of future meat consumption in Mexico, had been changing throughout and ever since the implementation of NAFTA.

This study provides updated meat demand parameters that will be useful to policy makers in and meat suppliers to Mexico and evaluates whether NAFTA has had an impact on those demand parameters.

To accomplish these objectives a Mexican meat demand system consisting of aggregated beef, pork, and chicken meat was estimated. In order to estimate the demand system it was necessary to deal with the censoring problem, thus a modification of the two-step censored methodology suggested by Shonkwiler and Yen (1999) was employed in which a multivariate probit model was used (Chen and Chen, 2002) in lieu of a unit probit model to calculate the probability that a household would purchase meat in general and any specific type of meat. The Nonlinear Quadratic Almost Ideal Demand System (NQAIDS) developed by Banks, Blundell, and Lewbell, (1997) was adopted to estimate the parameters of meat demand in Mexico from 1992 to 2004.

---

Malaga is Associate Professor, Pan is Research Scientist, and Duch-Carvallo is Post-Doctoral Research Associate, Department of Agricultural and Applied Economics, Texas Tech University, Lubbock.

## Methodology

### Demand System Estimation

To estimate the parameters of the Mexican meat demand system the Nonlinear Quadratic Almost Ideal Demand System (NQUAIDS) developed by Banks, Blundell, and Lewbell (1997) was used. Some authors, such as Banks, Blundell, and Lewbell (1997) and Lyssiotou, Pashardes, and Stengos (2002) emphasize that the Nonlinear QUAIDS model has the flexibility of including nonlinearities and interactions with household-specific characteristics in the utility function, which can be important for household survey data and also have better forecasting performance.

In the Nonlinear QUAIDS specification, the dependent variable is the budget share ( $w_i$ ) of each type of meat in a household:

$$(1) \quad w_i = p_i q_i / X,$$

where  $w_i$  is the budget share of the  $i$ th meat type purchased in a household,  $p_i$  is the price of the  $i$ th type of meat purchased,  $q_i$  is the amount of the  $i$ th type of meat purchased, and  $X = \sum p_i q_i$  is the total meat expenditure.

The demand model is given by

$$(2) \quad w_i = \alpha_i + \sum_j \gamma_{ij} \ln P_j + \beta_i (\ln X - \ln P) + \frac{\lambda_i}{\prod_j P_j^{\beta_j}} (\ln X - \ln P)^2 + \sum_k \kappa_{ik} R_k + \varepsilon_i,$$

where  $P$  is the corresponding price index;  $w_i$  is the budget share of the  $i$ th meat; and the  $\alpha$ 's,  $\beta$ 's,  $\gamma$ 's,  $\lambda$ 's and  $\kappa$ 's are parameters estimated,  $R$ 's are dummy variables corresponding to different demographic variables; and  $\varepsilon_i$  is the error term. The price index ( $\ln P$ ) in Equation 2 is defined as

$$(3) \quad \ln P = \alpha_0 + \sum_j \alpha_j \ln p_j + 1/2 \sum_i \sum_j \gamma_{ij} \ln p_i \ln p_j.$$

Symmetry and homogeneity constraints can still be imposed in Equation 2; however, adding up is guaranteed only in the absence of censoring, an issue that will be discussed in the next section. The use of Equation 2 in estimating the budget share equation in Equation 1 implies that the model is

truly nonlinear. We did not replace Equation 2 with any linear approximation because according to Buse (1994) and Green and Alston (1990) such linear approximations cause additional difficulties such as the discrepancies between the demand elasticities computed from the Linear AIDS and Nonlinear AIDS. They attribute the discrepancies to inappropriate elasticity formulas used for the Linear AIDS.

In order to avoid singularity of the variance-covariance matrix of error terms, the chicken meat equation was omitted from the demand system; parameters for this type of meat were calculated using the parameter constraints implied by adding-up, homogeneity, and symmetry.

### Censored Issues

Previous literature (Heien and Wessells 1991; Byrne, Capps, and Saha 1996; Shonkwiler and Yen 1999; Dong, Gould, and Kaiser 2004; and Pofahl, Capps, and Clauson 2005) agree that household-level data sets avoid the issue of aggregation over consumers and often provide large samples. However, these data sets present major estimation problems, mainly due to the fact that households do not consume all the commodities available to them at any given time. They create the necessity to obtain an empirical model that assures non-negativity of the predicted quantities purchased and that is agreeable with constraints implied by economic theory.

In this study we used a modification of the methodology proposed by Shonkwiler and Yen (1999) where the estimation of the demand system is realized by means of a two-step procedure with limited dependent variables.

Some authors, including Tauchmann (2005) and Yen and Lin (2006), consider the Shonkwiler and Yen approach inefficient due to the unit probit estimation in the first step. Thus, in order to improve efficiency and to account for the error correlation among the different meat-consumption equations, we conducted a multivariate-probit estimation using latent variables with a selection mechanism instead of the unit probit estimation in the first step to determine the probability that a given household will consume any type of meat (Chen and Chen 2002; Pan, Mohanty, and Welch 2008). The decision to purchase a given type of meat was modeled as a binary-choice problem depending on household size,

income, and dummy variables for the geographical region where the household was located.

The estimated parameters from the multivariate probit model were then used to calculate the cumulative density functions (CDF)  $\Phi_i(\cdot)$  and the probability density functions (PDF)  $\varphi_i(\cdot)$ , which, in turn, were used to estimate the unit value and the second step of the demand vector proposed by Shonkwiler and Yen (1999).

As suggested by Deaton and Muellbauer (1980) and Dong, Shonkwiler, and Capps (1998), the unit value is an indicator of the household preferences. To consistently estimate the parameters of the budget share equation in Equation 2, the following unit value equation was estimated:

$$(4) P_{it} = \Phi(Z'_{it}\hat{\alpha}_i)f(X'_{it}\beta_i) + \eta_{it}\varphi(Z'_{it}\hat{\alpha}_i) + \xi_{it},$$

where  $P_{it}$  is the unit value for each of the three types of meat,  $Z$ , and  $X$  includes income, urbanization, marriage status, age, and other household characteristics as well as quantity of meat consumed.

The parameter estimates from this procedure were then used to calculate the expected value of the different prices, especially for those households that do not consume any of the meats under consideration (i.e., the censored observations).

In the second step suggested by Shonkwiler and Yen (1999), Equation 2 was modified as follows:

$$(5) w_i = \Phi(\cdot)\{\alpha_i + \sum_j \gamma_{ij} \ln P_j + \beta_i(\ln y - \ln P) + \frac{\lambda_i}{\prod_j P_j^\beta} (\ln x - \ln P)^2 + \sum_{jk} \kappa_{ijk} R_k\} + \pi_i \varphi(\cdot) \varepsilon_i.$$

Therefore instead of using the traditional NQUAIDS specification of the budget share equation in Equation 2, we used Equation 5 to estimate the parameters needed to calculate the demand elasticities. Note that the traditional symmetry, homogeneity, and adding-up constraints can still be imposed in Equation 5 as follows:

$$(6) \sum_{i=1}^n \Phi_i(\cdot) \alpha_i = 1;$$

$$(7) \sum_{i=1}^n \Phi_i(\cdot) \gamma_{ij} = 0;$$

$$(8) \sum_{i=1}^n \Phi_i(\cdot) \beta_i = 0;$$

$$(9) \sum_{i=1}^n \Phi_i(\cdot) \lambda_i = 0;$$

$$(10) \sum_{i=1}^n \Phi_i(\cdot) \kappa_{ik} = 0.$$

## Data

Official Mexican Survey data for the years 1992, 1994, 1996, 1998, 2002 and 2004 was obtained from the Encuesta Nacional de Ingresos y Gastos de los Hogares (INEGI 1992, 1994, 1996, 1998, 2002, 2004). This survey is carried on for one week every two years and records data on food purchases and its monetary value for the three months prior to the survey week in households throughout Mexico. Socioeconomic characteristics of households are also recorded and include, among others, number, age, gender, level of education, and employment data of the persons living in the household; state and size of the town where the household is located; and frequency and place of food purchases.

The sample of households surveyed each year varies and is considered to be independent from the other years, thus the sample size used for the demand systems estimation also varied. For this study, only urban households namely located in towns larger than 15,000 inhabitants were considered (15,000 is the population threshold required by the Mexican government to be an urban town). The data analyzed were related exclusively to household purchases of meat. Only data on beef, pork, and poultry meat purchases were employed because they are considered to be the three main categories of meat consumed in Mexico. Around 20 percent of the households surveyed did not purchase any one of the meat categories of interest; around 60 percent households in the sample purchased both beef and poultry, but only 20 percent household purchased pork during the survey week. Average prices, quantities, and expenditure amounts and budget shares in the total meat expenditure are presented in Table 1. Beef and pork accounted for

Table 1. Price, Quantity, and Expenditure for Three Types of Meat in the Sample for 1992 to 2004.\*

	1992			1994			1996			1998			2002			2004		
	mean	Std error		mean	Std error		mean	Std error		mean	Std error		mean	Std error		mean	Std error	
	Meat quantity (kg)																	
Beef	13.84	0.22		14.39	0.20		12.10	0.18		12.46	0.21		11.40	0.13		10.03	0.10	
Pork	4.11	0.26		3.88	0.12		3.44	0.10		3.25	0.11		3.58	0.08		2.91	0.06	
Poultry	14.09	0.27		13.22	0.21		11.51	0.18		11.52	0.21		12.88	0.16		12.29	0.12	
	Meat price (pesos / kg)																	
Beef	15.44	0.05		13.43	0.04		12.08	0.03		11.37	0.03		9.86	0.02		11.31	0.02	
Pork	14.19	0.03		12.31	0.02		11.56	0.02		10.56	0.02		8.67	0.01		9.87	0.01	
Poultry	8.25	0.03		7.87	0.03		7.30	0.02		7.04	0.02		5.66	0.01		6.26	0.01	
	Total expenditure																	
Beef	213.63	3.44		193.35	2.71		146.16	2.07		141.71	2.25		112.43	1.22		113.39	1.13	
Pork	58.38	1.56		47.80	1.25		39.77	1.07		34.33	1.04		31.01	0.59		28.75	0.53	
Poultry	116.24	1.96		104.04	1.54		83.97	1.27		81.11	1.37		72.90	0.78		76.91	0.78	
	Budge share																	
Beef	0.53	0.005		0.55	0.004		0.54	0.005		0.50	0.005		0.50	0.004		0.50	0.003	
Pork	0.13	0.003		0.13	0.003		0.13	0.003		0.12	0.004		0.13	0.002		0.12	0.002	
Poultry	0.34	0.004		0.33	0.004		0.34	0.004		0.34	0.005		0.37	0.003		0.38	0.003	
Sample size	5,528			6,606			6,652			5,173			12,388			17,297		

\*Meat price and total expenditure in real pesos of 1992.



around 50 percent and ten percent, respectively, of total expenditures, with a declining trend over the past decade, while poultry accounted for around 40 percent of total expenditures, with an increasing trend over the past decade.

## Results

Multivariate probit estimates for beef, pork, and chicken meat purchased in the Mexican urban households are presented in Table 2. Household size was the only variable significant ( $p < 0.01$ ) for all equations across the years analyzed. As the number of members living in the household increased, purchases for all types of meat also increased. Income was significant ( $p < 0.01$ ) for purchases of beef in 1992–1996 and 2002–2004; in 1998 income did not ( $p > 0.01$ ) affect the probability of purchasing beef. In the case of the probability of purchasing pork, income was significant ( $p < 0.01$ ) in 1996 and 2004. Income affected ( $p < 0.01$ ) the probability of chicken meat purchases only in 1996. In all cases, as income increased the probability of purchasing meat also increased. Regarding regional dummies, there was not a clear effect of the geographical region where the household was located on the probability of purchasing a specific type of meat.

Parameter estimates for the Nonlinear QUAIDS model are presented in Table 3. Most of the parameters estimated are statistically significant ( $p < 0.05$ ); at the same time, most parameters associated with the quadratic term are significant ( $p < 0.05$ ) in every year, which supports the idea that, at least statistically, Nonlinear QUAIDS is a good specification for the estimation of Mexican meat demand.

Expenditure, compensated, and uncompensated own-price and cross-price elasticities are presented in Table 4. Throughout the analyzed period, the expenditure elasticities suggest that beef and pork were luxury items (in the elastic range) while chicken was a normal good. The uncompensated own-price elasticities for 1992 are a little higher than those found by Golan, Perloff, and Shen (2001) for the same year (their elasticities of beef, pork, and poultry were  $-1.10$ ,  $-0.56$ ,  $-0.63$ , respectively); this may be due to the different methodology and data set used since Golan, Perloff, and Shen (2001) employed a sample with households buying at least one of the five types of meat they considered (beef, pork, chicken, processed meat, and fish). Other fac-

tors explaining the difference may include the fact that they did not account for the sample selection issues when they dropped the households without meat consumption. Our elasticities are also higher than those reported by Dong, Gould, and Kaiser (2004): they found elasticities for beef, pork, and poultry of  $-0.63$ ,  $-0.13$ , and  $-0.83$ , respectively. The reason for those differences might be related to the fact that we have considered a more aggregated meat demand system than theirs and that we only accounted for three meat categories in our estimation. At the same time, all our expenditure elasticities of beef, pork, and poultry are a little higher for the years after NAFTA than for those before NAFTA implementation. The uncompensated price elasticities of chicken are slightly higher after NAFTA as well.

## Conclusion

Our study estimates Mexican meat demand parameters using six different annual surveys over a period of twelve years. We used an improved methodology over previous studies to take account for the endogenous relationship between unit values and types of meat. The elasticities found differ in some cases from the annual estimations of Golan, Perloff, and Shen (2001) using 1992 data and from those of Dong, Gould, and Kaiser (2004) using 1998 data, which were quite different from each other.

For all types of meat analyzed, 1996 and 1998 presented certain degree of variability. Data and results from 1996 and 1998 certainly reflect the state of the Mexican economy at that time, when Mexico was still recovering from a 1994 devaluation of 100 percent of the peso with respect to the US\$.

Of all three types of meat considered, beef presented the most variability, in terms of elasticity, throughout the period examined; however, elasticities at the end and beginning of the period were similar. Our results did not suggest that NAFTA implementation caused significant consumer behavior changes during the first ten years.

Our elasticities should provide a basis for a more confident estimation of price and income effects when forecasting the future trends of the Mexican meat market because they were estimated using the same methodology for the entire period. This becomes especially important because Mexico has turned into the second largest market for U.S. meat

Table 2. Estimated Probability of Consumption of Beef, Pork, and Chicken Meats in a Sample of Mexican Urban Households for 1992 to 2004.

	Beef	Pork	Chicken	Beef	Pork	Chicken	Beef	Pork	Chicken
	1992			1994			1996		
Intercept	0.15*	-0.92*	-0.37*	0.19*	-0.99*	-0.39*	0.03	-1.01*	-0.42*
Household size	0.07*	0.06*	0.08*	0.09*	0.09*	0.09*	0.07*	0.06*	0.08*
Income ( $10^{-2}$ )	0.40*	0.00	0.02	0.57*	0.07	-0.04	2.36*	0.43*	0.38*
North west	-0.07	-0.51*	-0.10	-0.22*	-0.38*	-0.15*	-0.10*	-0.42*	-0.06
North east	-0.11*	-0.54*	-0.33*	-0.21*	-0.54*	-0.37*	-0.02	-0.47*	-0.32*
Center	0.02	0.20*	0.62*	-0.08*	0.00	0.63*	-0.01	0.11*	0.61*
South south east	-0.09*	0.41*	0.52*	-0.25*	0.30*	0.69*	-0.09*	0.39*	0.67*
	1998			2002			2004		
Intercept	0.08*	-1.06*	-0.35*	0.04	-1.11*	-0.32*	-0.11*	-1.24*	-0.46*
Household size	0.10*	0.08*	0.09*	0.07*	0.09*	0.08*	0.10*	0.10*	0.11*
Income ( $10^{-2}$ )	0.26	-0.36	0.06	2.15*	0.29	0.09	0.35*	0.31*	-0.05
North west	-0.14*	-0.32*	-0.10*	-0.14*	-0.39*	-0.22*	-0.18*	-0.36*	-0.13*
North east	-0.18*	-0.44*	-0.29*	-0.09*	-0.49*	-0.35*	-0.02	-0.39*	-0.31*
Center	-0.01	0.14*	0.50*	-0.15*	0.12*	0.58*	-0.06*	0.07*	0.53*
South south east	-0.26*	0.47*	0.50*	-0.25*	0.35*	0.48*	-0.19*	0.32*	0.54*

\* significant at 0.01.

**Table 3. NQUAIDS Mexican Beef and Pork Demand Parameter Estimated for 1992 to 2004.**

	Parameter estimates					
	1992	1994	1996	1998	2002	2004
<b>Beef</b>						
$\Phi(.)$ *Beef intercept <sup>†</sup>	2.99*	2.06*	5.47*	2.05*	3.19*	6.55*
$\Phi(.)$ *ln(beef price) <sup>†</sup>	-1.83*	-1.97*	-2.55*	-2.11*	-3.19*	-4.91*
$\Phi(.)$ *ln(pork price) <sup>†</sup>	-0.52*	1.13*	-0.01	1.00*	1.78*	3.02*
$\Phi(.)$ *(lnX-lnP) <sup>†</sup>	0.30*	0.24*	0.13*	0.31*	0.33*	0.11*
$\Phi(.)$ *(lnX-lnP) <sup>2</sup>	0.24*	-0.04*	0.18*	-0.06*	0.25*	-0.05*
$\Phi(.)$ *IMR <sup>†</sup>	-0.89*	-0.58*	-0.52*	-0.44*	-0.47*	-0.52*
$\Phi(.)$ *Household size	0.05*	0.03*	-0.11*	-0.01	-0.03*	-0.21*
$\varphi(.)$ <sup>†</sup>	-0.08*	-0.50*	-3.73*	-0.58*	-1.29*	-3.72*
<b>Pork</b>						
$\Phi(.)$ *Pork intercept	0.35*	0.35*	1.02*	0.82*	0.83*	0.31*
$\Phi(.)$ *ln(pork price)	-1.54*	-2.13*	-2.37*	-2.66*	-4.34*	-4.03*
$\Phi(.)$ *(lnY-lnP)	0.24*	-0.01	0.18*	-0.07	0.25*	0.20*
$\Phi(.)$ *(lnY-lnP) <sup>2</sup>	-0.05*	0.02*	-0.05*	0.03*	-0.03*	-0.01*
$\Phi(.)$ *IMR	-0.20*	0.002	-0.001	0.07*	-0.14*	-0.09*
$\Phi(.)$ *Household size	0.04*	-0.002	0.005	-0.01	0.01*	0.02*
$\varphi(.)$	0.89*	0.28*	0.39*	0.16*	0.26*	0.21*
Survey's sample size	4654	5569	5408	4178	10083	13340
Likelihood	9079	10986	10636	8188	19888	26478

\* significant at five percent.

<sup>†</sup> $\Phi(.)$ : Cumulative density function based whether a household purchases a specific type of meat; Beef price: "Simulated" beef unit value; Pork price: "Simulated" pork unit value; Y: Total meat expenditure; IMR: Inverse mill ratio calculated based on whether a household purchases meat;  $\varphi(.)$ : Probability density function based on whether a household purchases a specific type of meat.

and also because the recent ending of the NAFTA liberalization process may impact relative domestic Mexican prices for chicken.

The high levels of expenditure elasticity found in this study for beef and pork in Mexico (luxury range) allows us to project a fast-expanding market for U.S. exports given the expected growth of Mexican income (faster than U.S. income growth for the next ten years, according to the Food and Agricultural Policy Research Institute).

The fact that meat demand parameters in Mexico

seem to change very slowly with time under NAFTA implementation suggests that similar situation could be expected in the numerous developing countries with whom the U.S. has signed or is negotiating Free Trade Agreements including liberalization of meat markets (Guatemala, Honduras, Nicaragua, Costa Rica, Dominican Republic, Chile, Peru, Colombia, Panama, etc.). The results indicate that initial expansion of meat consumption may be due mainly to lower tariffs and prices, and not due to consumption-behavior changes.



**Table 4. Estimated Uncompensated and Compensated Own-Price, Cross-Price, and Expenditure Elasticities of Three Types of Meat in Mexico, for 1992 to 2004.**

	Beef	Pork	Chicken	Beef	Pork	Chicken	Beef	Pork	Chicken
	1992			1994			1996		
	Uncompensated cross-price elasticities								
Beef	-1.07* (0.21)	-0.05 (0.06)	0.09 (0.03)	-1.08* (0.22)	-0.05 (0.05)	0.11 (0.06)	-1.22* (0.23)	-0.05 (0.05)	0.13 (0.07)
Pork	-0.04 (0.04)	-0.68* (0.15)	-0.27 (0.25)	-0.04 (0.03)	-0.60* (0.22)	-0.36 (0.28)	-0.04 (0.03)	-0.78* (0.24)	-0.55 (0.32)
Chicken	0.11 (0.07)	-0.26 (0.23)	-0.82* (0.33)	0.10 (0.08)	-0.38 (0.22)	-0.77* (0.32)	0.07 (0.09)	-0.37 (0.33)	-0.86* (0.32)
	Expenditure elasticities								
	1.03* (0.35)	0.97* (0.33)	0.96* (0.34)	1.03* (0.35)	0.99* (0.34)	0.96* (0.35)	1.16* (0.36)	0.92* (0.34)	0.78* (0.34)
	1998			2000			2004		
	Uncompensated cross-price elasticities								
Beef	-1.35* (0.22)	-0.07 (0.03)	0.12 (0.04)	-1.16* (0.21)	-0.14 (0.06)	0.23 (0.03)	-1.29* (0.21)	-0.04 (0.06)	-0.08 (0.03)
Pork	-0.07 (0.04)	-0.82* (0.25)	0.52 (0.33)	-0.12 (0.08)	-0.61* (0.25)	-0.27 (0.23)	0.10 (0.04)	-0.70* (0.25)	-0.39 (0.25)
Chicken	0.15 (0.06)	0.39 (0.45)	-0.85* (0.33)	0.25 (0.06)	-0.28 (0.23)	-0.99* (0.33)	-0.20 (0.06)	-0.64 (0.43)	-0.92* (0.33)
	Expenditure elasticities								
	1.30* (0.35)	1.04* (0.33)	0.55* (0.34)	1.25* (0.35)	1.07* (0.34)	0.67* (0.35)	1.39* (0.36)	1.05* (0.34)	0.70* (0.34)

\* significant at 0.01.  
Standard errors are in parenthesis.

Finally, as mentioned earlier, a note of caution may be appropriate in regard to this study. The estimations presented here are based on a relatively small historical data set. The findings will be enhanced as more data becomes accessible.

## References

- Banks, J., R. Blundell, and A. Lewbel. 1997. "Quadratic Engel Curves and Consumer Demand." *The Review of Economics and Statistics* 79: 527–539.
- Buse, A. 1994. "Evaluating the Linearized Almost Ideal Demand System." *American Journal of Agricultural Economics* 76(4):781–793.
- Byrne, P. J., O. Capps, Jr., and A. Saha. 1993. "Analysis of Food-Away-From-Home Expenditure Patterns for U.S. Households, 1982–89." *American Journal of Agricultural Economics* 78:614–627.
- Chen, K. and C. Chen. 2002. "Cross Product Censoring in a Demand System with Limited Dependent Variables: A Multivariate Probit Model Approach." Working Paper, University of Alberta, Edmonton, Canada.
- Deaton, A. and J. Muellbauer. 1980. "An Almost Ideal Demand System." *The American Economic Review* 70:312–326.
- Dong, D., B. W. Gould, and H. M. Kaiser. 2004. "Food Demand in Mexico: An Application of the Amemiya-Tobin Approach to the Estimation of a Censored Food System." *American Journal of Agricultural Economics* 86:1094–1107.
- Dong, D., J. S. Shonkwiler, and O. Capps, Jr. 1998. "Estimation of Demand Functions Using Cross-Sectional Household Data: The Problem Revisited." *American Journal of Agricultural Economics* 80:466–473.
- FAO. 2006. "Country profiles and mapping information system." Available at <http://www.fao.org/countryprofiles/index.asp?lang=en&iso3=MEX&subj=4>. [Accessed January 22, 2006.]
- Golan, A., J. M. Perloff, and E. Z. Shen. 2001. "Estimating a Demand System with Nonnegativity Constraints: Mexico Meat Demand." *Review of Economics and Statistics* 83:541–550.
- Green, R. and J. M. Alston. 1990. "Elasticities in AIDS Models." *American Journal of Agricultural Economics* 72(2):442–445.
- Heien, D. and C. R. Wessells. 1990. "Demand Systems Estimation with Microdata: A Censored Regression Approach." *Journal of Business and Economic Statistics* 8:365–371.
- Instituto Nacional de Estadística Geografía e Informática (INEGI). 2004. "Encuesta nacional de ingresos y gastos de los hogares (ENIGH)." Ags., México.
- . 2002. "Encuesta nacional de ingresos y gastos de los hogares (ENIGH)." Ags., México.
- . 1998. "Encuesta nacional de ingresos y gastos de los hogares (ENIGH)." Ags., México.
- . 1996. "Encuesta nacional de ingresos y gastos de los hogares (ENIGH)." Ags., México.
- . 1994. "Encuesta nacional de ingresos y gastos de los hogares (ENIGH)." Ags., México.
- . 1992. "Encuesta nacional de ingresos y gastos de los hogares (ENIGH)." Ags., México.
- Lyssiotou P., P. Pashardes, and T. Stengos. 2002. "Nesting Quadratic Logarithmic Demand Models." *Economic Letters* 7(3):369–374.
- Pan, S., S. Mohanty, and M. Welch. 2008. "India Edible Oil Consumption: A Censored Incomplete Demand Approach." *Journal of Agricultural and Applied Economics* 40(3):821–835.
- Pofahl, G. M., O. Capps, Jr., and A. Clauson. 2005. "Demand for Non-Alcoholic Beverages: Evidence from the ACNielsen Home Scan Panel." Paper presented at the American Agricultural Economics Association Annual Meeting, Providence, RI. July 24–27.
- SAGARPA. 2006. "Estadísticas pecuarias. Consumos nacionales aparentes 1990–2004." Available at <http://www.sagarpa.gob.mx/Dgg/ganind3.htm#cna>. [Accessed March 31, 2006.]
- Shonkwiler, J. S. and S. T. Yen. 1999. "Two-Step Estimation of a Censored System Of Equations." *American Journal of Agricultural Economics* 81: 972–982.
- Tauchmann, H. 2005. "Efficiency of Two-Step Estimators for Censored Systems of Equations: Shonkwiler and Yen Reconsidered." *Applied Economics* 37:367–374.
- USDA-FATUS. 2006. Available at <http://www.fas.usda.gov/ustrade/USTExFatus.asp?QI=>. [Accessed March 31, 2006.]
- Yen, S. T. and B. H. Lin. 2006. "A Sample Selection Approach to Censored Demand Systems." *American Journal of Agricultural Economics* 88(3):742–749.