ESSAYS IN FOOD DEMAND AND PRODUCTION IN MEXICO

By

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CHAPTER I

INTRODUCTION

The food industry is very important to the Mexican economy. Understanding both demand and supply issues is vital in this industry. Food consumption in Mexico is directly related with the agricultural industry, which plays a significant role in the economic growth and development of the country. The major annual crops produced in Mexico are also the main agricultural commodities that produce food. There are several issues affecting the agriculture in Mexico that at the same time impact the food industry. Mexico has faced severe limitations of arable land and water in the recent years and the recent growth in demand for food and feed crops makes the situation critical. Of particular importance is the increasing amount of land used for yellow corn production which is dramatically replacing primarily white corn plantings. Mexico is the only major corn producing nation whose main corn type is white, primarily grown for food. Switching from white corn to yellow corn production can imply further dilemmas such as concurrent increase in demand for more inputs, technology, financing and management. Most important, food security issues can arise, given the high dependence on corn to satisfy human consumption.

The main food groups consumed in Mexico are cereals and meats, which represent more than 30 percent of food consumption of Mexican households. Cereal and meat

industries are growing very fast and are directly related to the primary agricultural product in Mexico that is corn. On the other hand, white corn is the only agricultural commodity that is grown in all regions of Mexico and is the major staple and main source of calories for most of the Mexican population. Yellow corn is primarily used to produce cornstarch, cereals and livestock feed. About fifty percent of yellow corn in Mexico is used for feeding purposes within the emerging semi-intensive system in the livestock industry. Per capita consumption of protein in Mexico is about 100 grams per day where 40 percent is animal origin and 22 percent of that animal protein comes from imported meats (SAGARPA). Much of the rapid growth in cereal and meat demand in Mexico recently has been met with imported products that have increased significantly in recent years. Mexico is a major importer and exporter of food products and is a growing participant in a very dynamic economy in terms of international trade. When analyzing demand for cereals and meats, it is important to consider two major agricultural products, potatoes and beans. Empirical results from the present study suggest that beans, as a vegetable protein source, should be studied with meats for a complete meat demand specification and potatoes should be included with cereals as a starch source.

Food consumption patterns in Mexico have changed rapidly in recent years, mainly due to the rapid growth in the food industry, a more dynamic international trade in food products and increased levels of income. There are nearly 29.1 million households in Mexico that allocate about 42 percent of their total income to food, but consumer preferences differ by income level. Low income families distribute income in a very different way than high income level households. Income effects are greater for low income households than for high income households. Even though, Mexico has made significant efforts in reducing poverty, wide income distribution continues to be a significant problem and needs to be addressed in

demand analysis. It is very important for the Mexican agricultural industry, policy makers and Mexico's major trading partners to understand Mexican preferences of food, specifically for cereals and meats.

Growing demand for food and feed crops poses new opportunities and new challenges for Mexico. Although much of Mexico's crop production is in areas of less than ideal conditions due to water availability and soil quality, there is a considerable potential to increase productivity of the major crops among traditional producers, which constitute the majority in Mexico. Traditional producers differ from commercial producers in terms of production systems. The majority of these producers are considered subsistence farmers that have low or no participation in the market and have low access to technology. These producers mainly grow corn and beans that are also the most important agricultural crops in Mexico. In order to enhance productivity of the major crops, Mexico will require large investment in developing the production systems, training and increasing the access to technology, infrastructure and input markets. It will also require improvements in the marketing system to ensure that market values are passed back to the producers. As a result, Mexico faces an enormous challenge in balancing the growing demands for food and feed, enhancing crop production and infrastructure investment, and reducing income inequality.

This study seeks to address both demand and consumption for crops that produce food and feed. The present study consists of three essays on three main topics important to the agriculture in Mexico and the food industry. The first two papers are based on a nationwide survey on household income and expenditure to analyze consumer preferences and income effect on food demand, while the third paper simulates allocation of land on crop production for food and feed using mathematical optimization of the year of 2010.

CHAPTER II

MODELING HOUSEHOLD PREFERENCES FOR CEREALS AND MEATS IN MEXICO

Abstract

Using 2008 household data and a two-step censored model, this article analyzes separability among preferences of the major food groups in Mexico. The main objective of the present paper was to determine if beans and potatoes are separable from meats and cereals, respectively. Results indicate that beans belong to the protein source demand system and potatoes are not separable from cereals. Another major finding is that corn income elasticity, very close to one, might indicate a sensitive situation for low income households that consider this cereal their major source of calories.

Introduction

There are nearly 112 million people in Mexico who make up 28.2 million households. Cereals and meats are the most important food groups consumed in Mexico. Corn is the major cereal consumed with per capita consumption exceeding 100 kilograms per year. The main meats consumed by Mexican households are chicken, pork, and beef, but about 15 percent of chicken, 31 percent of pork and 14 percent of beef consumed are imported. In 2010, 97 percent of imported chicken, 88 percent of imported pork and 83 percent of imported beef were from the United States (Secretary of Economy, SIAVI). It is very important for the Mexican Agricultural Industry, policy makers and Mexico's major trading partners to understand Mexican preferences for cereals and meats.

As household cross-sectional data are more available, interest to conduct econometric analysis of consumer demand with economic and demographic effects increases. However, the use of micro survey data presents a major estimation issue. This type of data is censored because it contains a large amount of zero expenditure on several commodities, a situation that generates missing prices. Another important consideration while conducting demand analysis is the decision of what goods to include in each food group. When estimating demand systems, researchers often aggregate products by characteristics or nutritional attributes but it is not always clear how to group commodities with different characteristics. For example, should beans as a protein source be included in the meat group? Should potatoes be included as a starch along with the various cereals? The consumption of potatoes has grown in significantly during recent years and its use as starch makes potatoes comparable with cereals. Also, beans are the

major source of proteins for low income families. For these families, meats are substituted by beans. Is this sufficient support to include potatoes with cereals and beans with meats for food demand analysis? In 1936, Hicks and Leontief introduced the idea of separability among preferences through the *composite commodity theorem* to construct commodity groups for empirical analysis. In 1994, Moschini et al. provided empirical evidence to show differences in cross-elasticities when weak separability is rejected.

The data set used in this study is the 2008 National Survey of Income and Expenditure for Household (ENIGH) in Mexico. These cross-sectional data are rich sample with demographic effects, but the data are censored. To overcome this issue, this study uses a two-step estimation of a censored demand system proposed by Shonkwiler and Yen in 1999. The main objectives of this study are to estimate demand elasticities among cereals and meats in Mexico and to test the validity of weak separability regarding whether beans are part of the meat group and whether potatoes should be part of a demand system of cereals.

Conceptual Framework

The existence of a utility (measure of satisfaction) function is due to the axioms of choice that reduce the consumer's choice problems to the constrained maximization of utility and that allow preferences ordering (utility is ordinal). In 1936, Hicks and Leontief introduced the idea of separability among preferences through the *composite commodity theorem*. When preferences are separable, utility function can be divided into different

sub utilities typically required to be homothetic. A homothetic sub utility function $v_1(\mathbf{q})$ with *n* commodities entails that $\epsilon_{i\,=}\,\epsilon_j$ for all $(i, j) \in I$. Deaton and Muellbauer (1980) defined separability as a condition in which the conditional ordering on preferences in a group does not depend on consumption levels outside the group. The objective function for a household assuming separability of preferences is the following

$$\max_{q_1,q_{2,}\cdots,q_N} u(q) = v_1\left[q_1(\boldsymbol{p}, M_h, d_{kh})\right] + v_2\left[q_2(\boldsymbol{p}, M_h, d_{kh})\right] + \cdots + v_G\left[q_G(\boldsymbol{p}, M_h, d_{kh})\right] + \cdots + v_N[q_N(\boldsymbol{p}, M_h, d_{kh})] \quad (2.1)$$

$$\text{s. t. } \sum \boldsymbol{pq} = M_h$$

where *u(q)* represents the general utility of the household to be maximized, v_1, v_2,..., v_G,…, v_N are the sub utility functions, q_1, q_2,…, q_G,…, q_N are subvectors that are functions of price vector, shared income of the household M_h and the k^{th} demographic variables of the household (d_{kh}) subject to budget constraint.

The concept of separability, originally introduced by Hicks and Leontief, can be particularly useful for demand modeling of consistent aggregates. Demand analyses often assume separability to specify conditional (second stage) demand systems. For example, it is common to model demand for cereals as a function of the price of corn, wheat, rice and other cereals and total cereal expenditure. Such a procedure is acceptable if the direct utility function is weakly separable in the correct partition, which provides the necessary support for conditional demand functions to exist.

There are at least two disadvantages of conditional demand systems to model consumption. First, income often is unspecified resulting in unbiased elasticity estimates (Moschini et al.). Second, even though weak separability provides sufficient conditions

for two-stage demand systems, econometric issues may exist due to endogeneity in a group of expenditures. These issues can be overcome if a direct weak separability test is performed and can result in elasticities suitable for policy and welfare analysis.

In a household model there are several potential earners. Thus, the main objective in a household is to maximize utility of all the members subject to household income (a sum of individual incomes of potential earners).

In demand analyses, it is usually assumed that households face identical prices, hence behavioral discrepancies are due to expenditure differences and household characteristics (Deaton and Muellbauer, 1980). Demand systems in a household will not only depend on prices and total expenditure on the system, but also on household demographics (type of household, size, ages, location, and etcetera). Important considerations are that in a household, commodities are consumed jointly rather than separated into different bundles and purchase decisions are made based on all members' tastes and preferences. The solution of equation (2.1) must be the system of Marshallian demand functions. Conversely, Hicksian demands come from the dual problem of cost minimization at a certain utility level. Household demands (Marshallian or Hicksian) are aggregates of individual demands of the members of the household. In other words, demand for a good in a household would be the sum of individual demands of such commodity per household member. The aggregate Marshallian demand of the household would be as

(2.2) $$q_{ih} = f(\boldsymbol{p}, M_h, d_{kh})$$

where q_{ih} is the quantity demanded of good *i* by the h^{th} household, $\boldsymbol{p}$ is the vector of prices in the system, M_h is total income-expenditure of the family *h* and d_{kj} represents the k^{th} demographic variable of the *h* household.

Elasticities derived from Marshallian demand are usually called Marshallian or uncompensated elasticities, while Hicksian elasticities are named compensated elasticities. The aggregate (sum of individual) Hicksian demand of the household can be expressed as

(2.3) $$q_{ih}{}^{c} = h(\boldsymbol{p}, U_h, d_{kh})$$

where q_{ih} is the quantity demanded of good i by the h^{th} household, $\boldsymbol{p}$ is the vector of prices in the system, U_h is utility of the family, and d_{kj} represents the k^{th} demographic variable of the *h* household.

Axioms of choice allow maintaining a useful difference between preferences and utility functions that are ordinal. Choice depends on life-styles, age, gender, etcetera, rather than on opportunity or income constraint. Therefore, consumers, or in this case households, might formulate tastes and preferences over unfeasible possibilities. There are six axioms of choice. Axioms 1 to 5 imply the existence of a utility function that can be maximized and represents ordered preferences. Axiom 1, reflexivity, states that each bundle is as good as itself. The next axiom is completeness and permits consumers to compare or to be indifferent between two bundles. Transitivity or consistency (axiom 3), has the greatest empirical content from axiom 1 to 5. It says that if bundle q^1 is at least as good as q^2 and if q^2 is at least as good as q^3, then q^1 is at least as good as q^3. The fourth axiom is known as continuity and explains how bundles contain their own boundaries. Axiom 5, nonsatiation, provides evidence to conclude that utility function is non-

decreasing in each of its arguments and for all bundles in the choice set is increasing in at least one of its arguments. Finally, Axiom 6, convexity, implies that indifference curves are convex to the origin only when the utility function is quasi-concave. This axiom will not be generally assumed to hold.

Other important implications from demand studies are the properties of the demand. First property is *adding up* or Engel aggregation which states that total value of both Hicksian and Marshallian demands is equal to total expenditure. The second property, *homogeneity*, affirms that Hicksian demands are homogeneous of degree zero in prices and Marshallian demands are homogeneous of degree zero in total expenditure and prices. Another restriction is *symmetry;* this demand property explains how cross-price derivatives of the Hicksian demands are symmetric for all $i \neq j$ (good *i* and good *j*). Imposing the restrictions on the demand system reduces the number of coefficients to be estimated and improves degrees of freedom. These important implications are very useful for econometrical purposes when dealing with small datasets to increase the degrees of freedom.

Model Specification

This study uses a non-linear approximation of the AIDS model as follows

(2.4) $$w_{ih} = \rho_{i0} + \sum_{k=1}^{K} \rho_{ik}\, d_{kh} + \sum_{j=1}^{n} \gamma_{ih}\, ln(p_{ih}) + \beta_i \ln\left[\frac{x_h}{a(p_h)}\right] + u_{ih}$$

where w_{ih} is the budget share of the i^{th} good purchased by household *h*, ρ_{i0}, ρ_{ik} ,γ_{ih} and β_i are the parameters to be estimated, d_{kh} are the k^{th} demographic variables, $\ln(p_{ih})$ is

the log of the price of the i^{rh} good, x_h is the total expenditure, and $a(p_h)$ is a price index which is defined as

(2.5) $$\ln a(p_h) = \alpha_0 + \sum_{j=1}^{n} \delta_{jh} \ln(p_{jh}) + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \ln(p_{ih}) \ln(p_{jh})$$

In 1999, Blundell and Robin suggested a reduced form function for $\ln(x_h)$ to address the correlation issue between the error term u_{ih} and the log expenditure variable $\ln(x_h)$ as follows

(2.6) $$\ln(x_h) = \sum_{k=1}^{K} \rho_{ik} d_{kh} + \sum_{j=1}^{n} \delta_{ih} \ln(p_{ih}) + \omega \ln(x_h) + v_h$$

where v_h are computed residuals to be added into the non linear AIDS model. Adding-up restriction, homogeneity and Slutsky symmetry (properties of demand) can be imposed using

(2.7) $$\sum_{i}^{n} \rho_{i0} = 1, \sum_{i}^{n} \rho_{ik} = 0, \sum_{i=1}^{n} \gamma_{ij} = 0, \sum_{i}^{n} \beta_i = 0, \text{and} \sum_{i}^{n} \lambda_i = 0$$

(2.8) $$\sum_{i=1}^{n} \gamma_{ij} = 0 \text{ for any } j$$

(2.9) $$\gamma_{ij} = \gamma_{ji} \text{ for all } i \text{ and } j$$

Weak separability imposes restrictions on the degree of substitutability between goods from different groups and allows the use of total expenditure of the goods in the system, instead of total income. Moschini, et al. (1994) defined non-homothetic asymmetric weak separability as

(2.10) $$\sigma_{if} * e_m = \sigma_{im} * e_f \quad (i) \in I_g, (m, f) \in I_s, \text{and } g \neq s$$

where σ's are the Allen-Usawa elasticities, e is the expenditure elasticity, good *i* belongs to group I_g, good *m* and *f* belong to group I_s, and *g* and *s* are different groups of commodities. The separability and demand restrictions can be maintained or tested upon a parametric specification of a demand system. Imposing restrictions not only allows

testing demand properties and assumptions, but also, permits to obtain more reliable elasticities, specifically when dealing with small datasets.

Data and Procedure

The National Survey of Income and Expenditure for Mexican Households is a micro survey conducted by the National Institute of Statistics and Geography (INEGI) every two years. Households report quantity purchased and total expenditure on different byproducts during one week. The present study used the 2008 survey and calculated a weighted average price of each product to account for the relative importance of quantity of each byproduct on the price of a good. The number of households included in the cereals and meat models were 27,846 and 25,769, respectively.

The group of cereals included corn, wheat, rice, other cereals, and potatoes, and the one for meats comprised beef, pork, chicken, processed meats, fish and beans. The data contain zero expenditure for corn, wheat, rice, other cereals and potatoes for 12, 13, 68, 78, and 53 percent of households, respectively. Also 44, 75, 44, 34, 87, and 47 percent of households reported zero expenditure on beef, pork, chicken, processed meats, fish and beans, respectively. Missing prices, a consequence of censored data, were generated using Markov Chain Monte Carlo (MCMC) approach (MI procedure in SAS) with log of prices to avoid negative prices.

The demographic factors included were: size of the household, strata (1:more than 99,999 inhabitants; 2:from 15,000 to 99,999 inhabitants; 3:from 2,500 to 14,999

inhabitants; and 4:less than 2,499 inhabitants), regions (CR: Central Region; COR: Central Occidental Region; NWR: Northwest Region; NER: Northeast Region; and SR: South Region), poverty levels (1:very low; 2:low; 3:medium; 4:high; and 5:very high), and age and gender of the head of the household.

The first step of Shonkwiler and Yen (1999) is a multivariate probit regression (PROC QLIM in SAS) to estimate household's probability of purchasing a commodity. In this regression, the cdf denoted by $\Phi(\boldsymbol{z}_i'\boldsymbol{\tau}_i)$ and the standard normal probability density function (pdf) represented by $\phi(\boldsymbol{z}_i'\boldsymbol{\tau}_i)$ are calculated to generate the following model in the second step using the Full Information Maximum Likelihood in Proc Model (SAS)

(2.11) $$w_{ih} = \Phi\left(\boldsymbol{z}_i'\boldsymbol{\tau}_i\right) \cdot \left[\alpha_{ih} + \sum_{j=1}^{n} \gamma_{ij} \ln(p_{ih}) + \beta_i \ln\left[\frac{x_h}{a(p_h)}\right] + \kappa_i \hat{v}_h \right] + \varphi_i \cdot \phi\left(\boldsymbol{z}_i'\boldsymbol{\tau}_i\right) + \zeta_{ih}$$

When estimating demand systems, adding up restriction does not hold. It is recommended to use *n*-1 equations in order for adding up restriction to hold (Pudney, 1989). In this model, the residual goods were rice for cereals and pork for meats using the following identity

(2.12) $$w_r = 1 - \sum_{i=1}^{n-1} w_{ih}$$

where w_r is defined as the budget share of good *r* as a residual share.

To calculate Marshallian, Hicksian, expenditure, income and demographic elasticities, the following formulas were used

(2.13) $$e_{ij}^{m} = w_{ih}^{-1}\left\{\gamma_{ij} - \beta_i[\alpha_j + \sum_{k}^{n} \gamma_{jk} \ln(p_k)]\right\} \cdot \Phi_{\mathrm{i}} - \delta_{\mathrm{ij}}$$

(2.14) $$e_{ij}^{h} = e_{ij}^{m} + w_{ih} e_i$$

(2.15) $$e_i = 1 + w_{ih}^{-1} \cdot \beta_i \cdot \Phi_{\mathrm{i}}$$

(2.16) $$e_{M(i)} = e_i e_M$$

(2.17) $$e_{im}^{d} = w_{ih}{}^{-1}\{[\rho_{im} - \sum_{k}^{n}\gamma_{jk}\ln(p_k)] \cdot \beta_i\} \cdot \mathrm{d}_m\, \Phi_{\mathrm{i}}$$

where δ_{ij} is the Kronecker delta (1 if $i=j$ and 0 otherwise), w_i is the average budget share per commodity, e_M is the estimated parameter of household income in the reduced equation, d_m is equal to one for binary variables or the mean of the variable otherwise. To test for demand properties and separability by avoiding over rejection, a size corrected Likelihood Ratio statistic (Italianer, 1985 and Moschini, et al., 1994) was used

(2.18) $$LR_c = \left[-2\left(\ln L(\tilde{\theta}) - \ln L(\hat{\theta})\right)\right]\left[MN - \tfrac{1}{2}(P_{\hat{\theta}} + P_{\tilde{\theta}}) - \tfrac{1}{2}N(N+1)\right] \xrightarrow{d} X_J^2$$

where $\ln L(\tilde{\theta})$ is the restricted log likelihood value, $\ln L(\hat{\theta})$ is the unrestricted log likelihood, M is the number of equations, N is the total number of observations, $P_{\hat{\theta}}$ and $P_{\tilde{\theta}}$ are the number of parameters of the unrestricted and restricted model, respectively, and J are the restrictions to test.

Results

Tables II.1 and II.2 show the results from the multivariate probit procedure to estimate the probability of a household in consuming cereals and meats for the censored observations using household data. This first step is performed to incorporate this probability (cumulative density function) to the second step and get an estimate for all the households. Multivariate probit results show the effect of demographic factors, log of prices and log of income on the probability of consuming each product of each demand system. It is of interest to note that among all cereals and potatoes, the household income has a significant influence on the probability of consumption of corn, rice, other cereals

and potatoes. Empirical results indicate that as income increases, the probability of consuming wheat, other cereals and potatoes is greater than the probability of consuming corn and rice. Regarding the meats model, one can conclude that there is a positive relationship of income and the probability of consuming all types of meats. However, if income increases, the probability of consuming beans decreases. These findings are consistent with the current consumption patterns of Mexican households. Most of our variables included in the model are significantly different from zero, implying the effect of demographic, price and income variables into the probability of purchasing cereals and meats in Mexico. For example, size of the household has a positive effect on the probability of buying all cereals and meats, except for fish and beef.. Additionally, parameter estimates for the standard normal pdf (φ) in Tables II.5 and II.6 show the importance of censoring treatment in these models. The parameter estimates are statistically significant different from zero for the all the commodities in the two models, except for other cereals, providing evidence that it is important to account for zero observations in these commodities.

Non linear AIDS model's outcomes are presented in Tables II.5 and II.6. These tables also present the results from the reduced form expenditure equations for cereals and meats. Parameter estimates show that nearly all demographic and economic factors have significant effect on the quantity demanded for all the goods included in each system. Homogeneity and symmetry restrictions (Table II.3 and Table II.4) from the neoclassical demand theory show that these properties do not hold for the demand system of cereals. In this case, the number of parameters is relatively small to the number of observations. Therefore, this finding does not represent a problem for our estimates.

Demand properties are imposed on the demand system to increase the degrees of freedom (reduce the number of parameters estimated), which becomes very desirable when working with small samples. Of particular importance was to test for weak separability in order to determine whether potatoes and beans should be included in their respective food group. Results imply that weak separability does not hold in each of our cases (Case II and Case III), providing sufficient evidence to conclude that demand analysis for cereals and meats cannot be specified ignoring potatoes and beans, respectively. The size corrected Likelihood Ratio statistic (LR_c) leads to the same conclusion.

Uncompensated and compensated price, expenditure and income elasticities for cereals and meats are presented in Tables II.7 and II.8. Consistent with economic theory, all own price elasticities are negative. Uncompensated own price elasticities indicate that demand is elastic for all goods, except for beans. Elastic demand implies that quantity changes are proportionately larger than own price changes. On the other hand, Hicksian own price elasticities indicate that share of income devoted to some goods is small for most commodities, except for corn, wheat and beans. By removing the effect of income on the own price elasticities, corn and beans become inelastic.

Uncompensated cross price elasticities estimates show some gross complementary relationship (negative) for a significant number of cereal and meat commodities. On the other hand, Hicksian cross price elasticities indicate that most commodities are net complements, except for rice and corn, fish and beef, fish and chicken and pork and fish. Uncompensated cross price elasticities for meats demonstrate that Mexicans substitute beef, pork and chicken with beans, which was the main driving force to include beans

into the analysis of food demand for animal protein source products. Income effect offsets most of substitution effect among commodities in both models.

Income elasticities show that all goods are normal in the two models, but beef and fish are considered normal luxury commodities. This finding is consistent to the situation in Mexico. First, as households move to a higher level of income, they purchase more beef. Second, Mexican households do not consider fish as a part of their essential diet. Compensated price elasticities show that all commodities in the model for cereals are net substitutes, except for rice, which shows a net complementary relationship with corn.

Demographic variable effects on the demand for cereals and meats show the impact of heterogeneity across households in the demand for these food groups. These results are very important for the Mexican Industry and major trading partners of Mexico, because it shows how quantity demanded will change across regions and type of households. Demographic elasticities show how a percent change on certain characteristics of the household will affect the percent change on quantity demanded for cereals and meats (Tables II.9 and II.10). For instance, rural areas consume more corn, wheat, other cereals, beans and pork than urban areas. COR, NER and SR have a higher propensity to consume corn than CR, while NWR consumes less corn than CR. CR consumes more rice and chicken but less beans and fish than the rest of the country. Moreover, the lower the poverty level, the greater consumption of corn, beef, chicken and processed meats. However, low income families consume less wheat, rice, other cereals, potatoes, beans and fish than high income families.

Conclusions

This study sought to test whether beans and potatoes belong to the demand systems of meats and cereals, respectively. Empirical evidence suggests the inclusion of these two commodities in their respective food group. These results indicate that beans, as a vegetable protein source, should be included with meats for a complete meat demand specification and that potatoes should be included with cereals as a starch source.

Another major finding is that corn income elasticity (almost one) suggests that this commodity is very close to becoming a luxury good for Mexican households. Corn in Mexico is principally a food grain rather than a feed grain. Corn plays a central role among Mexican population as a critical component of the cultural heritage and identity of the Mexicans and as a food staple. Do results imply a major food security issue? Mexico has already lost its self-sufficiency in white corn because its domestic use has steadily outpaced its production. If corn becomes a luxury good in Mexico, low income families will not be able to afford their main source of calories, leaving a country in a cultural and political sensitive situation.

Table II.1 Parameter Estimates of the Multivariate Probit Model of Cereals, Mexico, 2008[a]

Parameter	Corn		Wheat		Rice		Other Cereals		Potatoes	
	Parameter	SE[c]	Parameter	SE	Parameter	SE	Parameter	SE	Parameter	SE
Intercept	-0.016	0.203	0.828***	0.195	0.877***	0.167	-3.035***	0.183	-0.468***	0.159
Household size	0.034***[b]	0.005	0.034***	0.005	0.095***	0.004	0.013***	0.004	0.087***	0.004
Strata 2	0.173***	0.037	-0.073**	0.031	0.089***	0.026	-0.087***	0.028	0.012	0.025
Strata 3	-0.013	0.042	-0.057	0.038	0.135***	0.032	-0.110***	0.036	0.078**	0.031
Strata 4	-0.440***	0.037	-0.127***	0.035	0.087***	0.030	-0.011	0.033	0.052*	0.029
COR	0.116***	0.029	0.014	0.028	-0.010	0.023	0.262***	0.026	-0.091***	0.022
NWR	-0.079**	0.037	-0.271***	0.034	-0.274***	0.031	0.551***	0.032	-0.029	0.028
NER	0.289***	0.043	-0.264***	0.036	-0.309***	0.033	0.425***	0.034	-0.132***	0.030
SR	-0.012	0.031	-0.114***	0.031	0.009	0.026	0.269***	0.029	-0.393***	0.025
Poverty Level 2	0.717***	0.044	-0.002	0.051	-0.078*	0.042	0.147***	0.051	0.151***	0.042
Poverty Level 3	0.991***	0.047	-0.034	0.053	0.035	0.044	0.078	0.052	0.223***	0.043
Poverty Level 4	1.147***	0.050	-0.164***	0.053	-0.046	0.045	0.066	0.052	0.148***	0.044
Poverty Level 5	1.098***	0.052	-0.041	0.056	0.016	0.047	0.097***	0.054	0.191***	0.046
Female	-0.063***	0.024	-0.011	0.022	-0.023	0.019	0.066***	0.021	0.013	0.018
Age	0.001**	0.001	-0.005***	0.001	0.000	0.001	-0.011***	0.001	-0.001	0.001
Log of price of corn	0.415***	0.042	-0.061	0.044	-0.129***	0.037	0.044	0.041	-0.066**	0.036
Log of price of wheat	-0.115**	0.024	0.200***	0.021	-0.137***	0.019	0.061***	0.020	-0.058***	0.018
Log of price of rice	-0.033	0.033	-0.015	0.031	0.082***	0.027	-0.029	0.028	0.006	0.025
Log of price of other cereals	0.002	0.014	-0.020	0.013	-0.029***	0.011	-0.002	0.012	-0.013	0.011
Log of price of potatoes	0.006	0.026	0.052**	0.025	-0.013	0.021	0.045**	0.023	0.036*	0.020
Log of household income	-0.042**	0.015	0.002	0.015	-0.108***	0.013	0.200***	0.014	0.028**	0.012

[a] Data is from 2008 National Survey of Income and Expenditure for Mexican Households (ENIGH), National Institute of Statistics and Geography (INEGI).

[b] One, two and three asterisks indicate significance at the 10, 5 and 1 percent level, respectively.

[c] Standard Error.

Table II.2 Parameter Estimates of the Multivariate Probit Model of Meats, Mexico, 2008[a]

Parameter	Beef		Beans		Fish	
	Parameter	SE[c]	Parameter	SE	Parameter	SE
Intercept	-3.488***[b]	0.193	3.235***	0.194	-3.988***	0.247
Size	0.023***	0.004	0.105***	0.004	-0.027***	0.005
Strata 2	0.010	0.026	0.090***	0.026	0.050	0.033
Strata 3	-0.013	0.032	0.142***	0.032	0.005	0.041
Strata 4	-0.274***	0.030	0.034	0.030	-0.183***	0.041
COR	0.151***	0.023	0.361***	0.023	0.043	0.029
NWR	0.066**	0.029	0.131***	0.029	0.118***	0.037
NER	0.254***	0.033	0.055*	0.032	-0.356***	0.049
SR	-0.138***	0.025	0.239***	0.026	0.198***	0.033
Poverty Level 2	0.009	0.045	-0.011	0.046	-0.290***	0.056
Poverty Level 3	0.169***	0.046	-0.115**	0.046	-0.276***	0.057
Poverty Level 4	0.149***	0.047	-0.096*	0.047	-0.399***	0.059
Poverty Level 5	0.278***	0.048	-0.147***	0.049	-0.408***	0.061
Female	-0.040***	0.019	-0.060***	0.019	-0.129***	0.025
Age	0.002***	0.001	0.001**	0.001	0.005***	0.001
Log of price of beef	0.107***	0.027	-0.098***	0.027	0.019	0.035
Log of price of beans	0.084***	0.026	0.034	0.026	0.053	0.034
Log of price of fish	-0.011	0.016	0.003	0.016	0.002	0.020
Log of price of pork	0.015	0.027	-0.011	0.027	-0.070***	0.034
Log of price of chicken	0.114***	0.022	-0.051**	0.022	0.068**	0.028
Log of processed meats	0.008	0.019	-0.060***	0.019	0.040	0.025
Log of household income	0.211***	0.013	-0.299***	0.013	0.263***	0.016

[a] Data is from 2008 National Survey of Income and Expenditure for Mexican Households (ENIGH), National Institute of Statistics and Geography (INEGI).

[b] One, two and three asterisks indicate significance at the 10, 5 and 1 percent level, respectively.

[c] Standard Error.

Table II.2 (Continued) Parameter Estimates of the Multivariate Probit Model of Meats, Mexico, 2008[a]

Parameter	Pork		Chicken		Processed Meats	
	Parameter	SE[c]	Parameter	SE	Parameter	SE
Intercept	-1.764***	0.213	-1.324***	0.191	-1.167***	0.198
Size	0.049***	0.005	0.030***	0.004	0.042***	0.004
Strata 2	0.153***	0.029	0.015	0.026	-0.045*	0.027
Strata 3	0.232***	0.035	0.050	0.032	-0.064*	0.033
Strata 4	0.007	0.034	-0.068**	0.030	-0.179***	0.031
COR	-0.151***	0.024	-0.550***	0.023	-0.102***	0.023
NWR	-0.673***	0.036	-0.824***	0.029	0.061***	0.031
NER	-0.732***	0.043	-0.820***	0.033	-0.224***	0.033
SR	0.451***	0.027	-0.213***	0.026	-0.273***	0.026
Poverty Level 2	0.428***	0.050	0.232***	0.044	0.371***	0.044
Poverty Level 3	0.436***	0.051	0.433***	0.045	0.460***	0.046
Poverty Level 4	0.506***	0.052	0.361***	0.046	0.560***	0.046
Poverty Level 5	0.616***	0.054	0.387***	0.047	0.584***	0.048
Female	-0.063***	0.021	-0.017	0.019	0.020	0.020
Age	-0.002***	0.001	0.002***	0.001	-0.012***	0.001
Log of price of beef	-0.108***	0.030	0.023	0.027	-0.026	0.028
Log of price of beans	-0.059**	0.029	-0.019	0.026	0.069***	0.027
Log of price of fish	-0.005	0.017	-0.017	0.016	0.004	0.016
Log of price of pork	0.013	0.030	-0.022	0.027	0.006	0.028
Log of price of chicken	-0.048**	0.024	0.096***	0.022	-0.006	0.022
Log of processed meats	-0.014	0.021	0.001	0.019	0.058***	0.020
Log of household income	0.118***	0.014	0.103***	0.013	0.127***	0.013

[a] Data is from 2008 National Survey of Income and Expenditure for Mexican Households (ENIGH), National Institute of Statistics and Geography (INEGI).
[b] One, two and three asterisks indicate significance at the 10, 5 and 1 percent level, respectively.
[c] Standard Error.

Table II.3 P-values of the Homogeneity, Symmetry and Separability Tests for Cereals

Case	Model for Cereals				
	LR Statistic	LR_c Statistic	Number of restrictions	$\chi^2_{0.05}$	P-value
I. Homogeneity and Symmetry Test	220.00	219.80	10	18.31	<0.001
II. Separability Test	240.00	239.79	12	21.03	<0.001
III. Separability Test	20.00	19.98	2	5.99	<0.001

Case I: H_0: Homogeneity and Symmetry Imposed, H_1: Unrestricted Model
Case II. H_0: Homogeneity, Symmetry and Separability Imposed, H_1: Unrestricted Model
Case III. H_0: Separability Imposed, H_1: Unrestricted Model

Table II.4 P-values of the Homogeneity, Symmetry and Separability Tests for Meats

Case	Model for Meats				
	LR Statistic	LR_c Statistic	Number of restrictions	$\chi^2_{0.05}$	P-value
I. Homogeneity and Symmetry Test	20.00	19.98	15	25.00	0.172
II. Separability Test	1060.00	1058.93	18	28.87	<0.001
III. Separability Test	52.00	51.94	3	7.81	<0.001

Case I: H_0: Homogeneity and Symmetry Imposed, H_1: Unrestricted Model
Case II. H_0: Homogeneity, Symmetry and Separability Imposed, H_1: Unrestricted Model
Case III. H_0: Separability Imposed, H_1: Unrestricted Model

Table II.5 Parameter Estimates of the Non Linear AIDS Model for Cereals, Mexico, 2008[a]

	Quantity of				
Parameter	Ln(m)	Corn	Wheat	Other Cereals	Potatoes
Intercept	-0.450***[b]	0.274***	0.510***	0.236***	0.064
Household size	0.013***	0.001	-0.012***	-0.013***	0.006***
Strata 2	0.066***	0.058***	-0.044***	-0.016**	-0.002
Strata 3	0.073***	0.046***	-0.046***	-0.022**	0.008
Strata 4	0.018**	-0.045***	-0.002	-0.005***	0.053***
COR	-0.026***	0.022***	-0.002	0.004	-0.027***
NWR	-0.065***	-0.049***	0.044***	0.000	0.033***
NER	0.044***	0.076***	-0.036***	-0.013	-0.003
SR	-0.031***	0.031***	0.016***	0.014	-0.091***
Poverty Level 2	0.120***	0.187***	-0.108***	-0.026*	-0.050***
Poverty Level 3	0.169***	0.243***	-0.149***	-0.043***	-0.068***
Poverty Level 4	0.174***	0.281***	-0.160***	-0.028**	-0.087***
Poverty Level 5	0.105***	0.231***	-0.127***	-0.008	-0.087***
Female	-0.001	-0.004	-0.011***	0.012***	0.013***
Age	0.002***	0.001***	0.001***	0.001**	0.001***
Log of price of corn	-0.397***	0.006	0.005**	-0.003***	0.005***
Log of price of wheat	-0.335***	0.005**	-0.038***	0.012***	0.013***
Log of price of rice	-0.051***	-0.014***	0.008***	0.023***	0.022***
Log of price of other cereals	-0.031***	-0.003*	0.012***	-0.037***	0.005***
Log of price of potatoes	-0.084***	0.005***	0.013***	0.005***	-0.044***
Ln(m)	-	0.041***	-0.018***	0.001	-0.030***
φ[c]	-	0.543***	-0.581***	-0.425	0.111***
Ln(y)	0.987***	-	-	-	-

[a] Data is from 2008 National Survey of Income and Expenditure for Mexican Households (ENIGH), National Institute of Statistics and Geography (INEGI).

[b] One, two and three asterisks indicate significance at the 10, 5 and 1 percent level, respectively.

Table II.6 Parameter Estimates of the non linear AIDS Model for Cereals, Mexico, 2008[a]

	Quantity of					
Parameter	Ln(m)	Beef	Beans	Fish	Chicken	Processed Meats
Intercept	0.204***[b]	0.617***	0.071***	0.884***	0.410***	-0.118***
Household size	0.020***	-0.022***	0.010***	-0.036***	-0.012***	0.006***
Strata 2	0.000	-0.008	0.002	0.001	-0.008	-0.026***
Strata 3	0.025***	-0.034***	0.048***	-0.045***	-0.017	-0.036***
Strata 4	0.071***	-0.044***	0.123***	0.011	0.007	-0.019*
COR	-0.001	0.081***	0.084***	0.021***	-0.156***	-0.024***
NWR	-0.027***	0.108***	0.106***	0.128***	-0.222***	0.076***
NER	0.003	0.193***	0.130***	0.121	-0.154***	-0.003***
SR	0.025	-0.049***	0.030***	0.015	-0.056***	-0.064***
Poverty Level 2	-0.089***	-0.037*	-0.125***	-0.002	0.026	0.044***
Poverty Level 3	-0.126***	0.006	-0.192***	-0.038	0.065***	0.052***
Poverty Level 4	-0.150***	0.010	-0.212***	-0.040	0.050***	0.096***
Poverty Level 5	-0.186***	0.034	-0.254***	-0.045	0.035	0.091***
Female	0.001	0.006	0.011***	0.035***	0.014***	0.011***
Age	0.001***	0.001***	0.002***	0.000	0.001***	-0.003
Log of price of beef	-0.203***	-0.065***	-0.012***	0.003	0.038***	0.016***
Log of price of beans	-0.149***	-0.012***	0.035***	-0.008***	-0.012***	0.008***
Log of price of fish	-0.038***	0.003	-0.008***	-0.073***	0.011***	0.010***
Log of price of pork	-0.072***	0.020***	-0.011***	0.058***	0.018***	0.000
Log of price of chicken	-0.198***	0.038***	-0.012***	0.011***	-0.066***	0.012***
Log of processed meats	-0.221***	0.016***	0.008***	0.010***	0.012***	-0.045***
Ln(m)	-	0.125***	-0.113***	0.138***	0.059***	-0.123***
φ[c]	-	-0.636***	0.945***	-0.427***	0.252***	-0.271***
Ln(y)	0.865***	-	-	-	-	-

[a] Data is from 2008 National Survey of Income and Expenditure for Mexican Households (ENIGH), National Institute of Statistics and Geography (INEGI).

[b] One, two and three asterisks indicate significance at the 10, 5 and 1 percent level, respectively.

Table II.7 Uncompensated and Compensated Price, Expenditure, and Income Elasticities for Cereals, Mexico, 2008

	Marshallian Price Elasticities					Expenditure
	Corn	Wheat	Rice	Other Cereals	Potatoes	Elasticities
Corn	-1.0243	-0.0259	-0.0550	-0.0397	-0.0262	1.0625
Wheat	0.0358	-1.1267	0.0898	0.0611	0.0652	0.9429
Rice	-0.2837	0.1826	-1.2118	0.5071	0.4771	0.9545
Other Cereals	-0.0309	0.1332	-0.0241	-1.4154	0.0541	1.0016
Potatoes	0.2253	0.5320	0.2000	0.2192	-2.6747	0.4655
	Hicksian Price Elasticities					Income
	Corn	Wheat	Rice	Other Cereals	Potatoes	Elasticities
Corn	-0.4157	0.2565	-0.0059	0.0549	0.0014	0.9190
Wheat	0.5759	-0.8761	0.1334	0.1451	0.0897	0.8156
Rice	0.2630	0.4364	-1.1677	0.5922	0.5019	0.8256
Other Cereals	0.5427	0.3995	0.0222	-1.3261	0.0802	0.8664
Potatoes	0.4920	0.6558	0.2215	0.2607	-2.6626	0.4027

Table II.8 Uncompensated and Compensated Price, Expenditure, and Income Elasticities for Meats, Mexico, 2008

	Marshallian Price Elasticities						Expenditure
	Beef	Beans	Fish	Pork	Chicken	Processed Meats	Elasticities
Beef	-1.5160	-0.0720	-0.2260	-0.1000	0.0590	0.1420	1.3336
Beans	0.1020	-0.8340	0.1540	0.0760	0.0460	-0.0150	0.7364
Fish	-0.1810	-0.2280	-3.1940	-0.2100	0.1130	0.3320	1.4372
Pork	0.2150	-0.1410	0.7000	-1.3170	0.2030	0.0110	1.0739
Chicken	0.0800	-0.0570	-0.0520	-0.0080	-1.3290	0.0740	1.1353
Processed Meats	0.2930	0.0510	0.3120	0.2080	0.1950	-1.2770	0.6296
	Hicksian Price Elasticities						Income
	Beef	Beans	Fish	Pork	Chicken	Processed Meats	Elasticities
Beef	-1.2439	0.2294	-0.1745	0.0023	0.3762	0.4311	1.1536
Beans	0.2525	-0.6670	0.1828	0.1327	0.2215	0.1450	0.6370
Fish	0.1119	0.0971	-3.1383	-0.1003	0.4546	0.6441	1.2432
Pork	0.4344	0.1023	0.7422	-1.2354	0.4578	0.2437	0.9290
Chicken	0.3118	0.1996	-0.0078	0.0785	-1.0594	0.3207	0.9820
Processed Meats	0.4216	0.1929	0.3369	0.2557	0.3452	-1.1406	0.5446

Table II.9 Demographic Elasticities for Cereals, Mexico, 2008

	Corn	Wheat	Rice	Other Cereal	Potatoes
Household size	-0.0015	-0.0367	0.2082	-0.1483	-0.0047
Strata 2	0.1011	-0.1631	-0.1809	-0.1742	-0.1417
Strata 3	0.0800	-0.1714	0.0136	-0.2457	0.2470
Strata 4	-0.0795	-0.0072	0.3723	-0.0517	1.9862
COR	0.0368	-0.0061	-0.1009	0.0418	-1.1098
NWR	-0.0866	0.1684	-0.2379	-0.0007	1.2231
NER	0.1313	-0.1334	-0.6569	-0.1418	-0.1694
SR	0.0541	0.0638	-0.0348	0.1582	-3.5544
Poverty Level 2	0.3263	-0.4036	-0.8753	-0.2862	-1.9774
Poverty Level 3	0.4242	-0.5595	-0.8848	-0.4861	-2.6855
Poverty Level 4	0.4904	-0.6005	-1.2743	-0.3112	-3.4071
Poverty Level 5	0.4017	-0.4772	-1.0264	-0.0926	-3.3941
Female	-0.0072	-0.0378	0.0738	0.1355	0.4590
Age	-0.0354	0.0861	0.1033	-0.0059	-2.7884

Table II.10 Demographic Elasticities for Meats, Mexico, 2008

	Beef	Beans	Fish	Pork	Chicken	Processed Meats
Household size	-0.2003	0.0811	-0.9890	0.1793	-0.0769	-0.2561
Strata 2	-0.0629	0.0149	0.0023	0.3252	-0.0410	-0.1839
Strata 3	-0.1901	0.2189	-1.1753	0.4162	-0.0790	-0.2312
Strata 4	-0.2390	0.5539	0.2563	-0.4444	0.0228	-0.1525
COR	0.3783	0.3801	0.5279	0.1130	-0.6614	-0.1782
NWR	0.5076	0.4779	3.2843	-0.7849	-0.9401	0.2824
NER	0.9243	0.5836	3.0923	-1.3565	-0.6522	-0.0811
SR	-0.2598	0.1421	0.3721	1.0538	-0.2424	-0.3597
Poverty Level 2	-0.2049	-0.5453	-0.0587	0.5717	0.1043	0.1382
Poverty Level 3	0.0064	-0.8399	-1.0005	0.4463	0.2681	0.1722
Poverty Level 4	0.0280	-0.9310	-1.0378	0.2949	0.2030	0.3746
Poverty Level 5	0.1435	-1.1164	-1.1779	0.5681	0.1414	0.3538
Female	0.0089	0.0574	0.8939	-0.3727	0.0546	-0.0166
Age	-1.0279	0.4002	-0.8219	0.0063	-0.2984	-3.2091

CHAPTER III

USING CENSORED CROSS SECTIONAL DATA TO ESTIMATE HOUSEHOLD INCOME ELASTICITIES, AN APPLICATION TO MEXICO

Abstract

The present study is concerned with how different levels of income affect consumption patterns of different food categories over time. Wide income distribution is a common characteristic in developing nations. This study uses the example of Mexico using the years of 1994, 2002 and 2010. In Mexico, lowest income households spend almost 45 percent on cereals and vegetables and spend less than 5 percent on away from home food consumption. Higher income household distribute income in a very different way. This paper has provided evidence of the need to incorporate various levels of income in models for consumer behavior. Income elasticities suggest that preferences experienced a major change during 1994 and 2010 than in 2002, especially for the bottom fifty percent of the households.

Introduction

This chapter presents a model of consumer demand to derive income elasticities of different levels of income using cross sectional data from expenditure surveys over time. There are at least two important considerations of demand analyses carried out in developing countries. First, there is a major trend in many developing economies of wide income distribution. While it is true that any nation faces differences in income levels, these differences are mostly obvious in developing economies. Second, consumer preferences around the world are in constant change due to very dynamic domestic and international markets. Is there then a way to measure if distribution of income affects distribution of consumption for nations with wide income inequalities over time? It should be clear that estimation of such vulnerability of income should preferably be attempted with panel cross sectional data. As an alternative, there is a large availability of cross sectional household surveys over specific years with detailed information on household consumption, income and characteristics. These surveys, mostly conducted once a year, have been widely used to estimate and analyze demand patterns of certain goods or group of commodities.

Given that there are only cross sectional household surveys for different years, researchers face the challenge to overcome the lack of the time dimension. Therefore, the main objectives of the present study are to determine different levels of income effect on consumption for various food groups and to determine if consumption patterns have changed over time by comparing different years while being consistent with consumer theory. The basis of this approach is the work by Engel in 1857 that suggest a

relationship between expenditure of certain categories and different income levels. Besides the lack of time dimension in expenditure surveys, data of household surveys are censored. Data include a significant amount of zero expenditure in some goods, a situation that leads to missing prices.

The estimation of Engel curves has a long history in applied demand analyses (Engel, 1857, Working, 1943), functional forms of Engel curves studies (Leser, 1963, Seale and Theil, 1986, Banks, et al., 1997, Lewbel and Pendakur, 2008) or demand system studies (Deaton and Muellbauer, 1980). Budget allocation on goods and services depends on the distribution of income as well as its level. A model that can capture patterns over time of preferences across different levels of income while being consistent with consumer theory can be used to derive economic policies and to do welfare analysis. Knowledge of income elasticities are useful for setting up pricing policies, in predicting demand patterns, and in understanding the impact of welfare programs on expenditure behavior. The present study uses data on Mexican household incomes and expenditures from a nationwide survey conducted every other year to investigate the effect of different levels of income on demand patterns of different food categories. The survey is conducted during the same period every other year facilitating comparisons over time.

Conceptual Framework

The model used in this paper is based on Engel curves such that total expenditure is a function of income by different levels. Engel curves show the relationship between

household expenditure on particular goods or groups of commodities and disposable household income. In 1857, Engel analyzed how household expenditures on different groups of commodities vary with income level. The main problems with his approach were the assumption of constant prices and the inclusion of household size as the only demographic variable. Demographic characteristics have profound influence on household consumption patterns. For example, it is reasonable to expect a household located in a rural area with more than one child to spend more on food than a family living in an urban area with only one child. Moreover, it is essential to consider utility functions that are consistent with such Engel curves.

A wide selection of functional forms for Engel curves has been investigated in the literature. In 1943, Working suggested that Engel curves can be approximated using budget share as a function of log of total expenditure. One of his major findings was that for the U.S., the share of food expenditures declines with rising income. Leser (1963) and Seale and Theil (1986) compared different functional forms of the Engel curve and stressed the advantage of using the Working approach. Banks et al., 1997 used non parametric analysis of consumer expenditure patterns for family expenditure survey data of U.K. households and found non-linear relationships between log expenditure and alcohol and between log expenditure and clothing, but a log linear relationship between expenditure and budget share. Given that most studies have found that linear logarithmic expenditure share model provides a robust description of food consumption, this study considers a log linear relationship between food categories expenditures and household income. Demands having expenditure shares that are linear in log total expenditure alone

are referred to as Price Independent Logarithmic (PIGLOG) by Muellbauer (1976), and are derived from indirect utility functions. The general form of demand for this study is

(3.1) $$w_{itd} = Ai(\mathbf{p}) + Bi(\mathbf{p})\ln x$$

for goods $i = 1,\ldots, N$ in time t for each decile d of income, where w is the budget share, $\mathbf{p}$ is the N vector of prices, $x = m/a(\mathbf{p})$ represents deflated income, and $A_i(\mathbf{p})$ and $B_i(\mathbf{p})$ are differentiable functions. Equation (3.1) shows a linear association between log income and expenditure shares.

Assuming the existence of demand functions, the consumer decides how much of each good to purchase faced with given prices and total income. These relationships giving quantities as a function of prices ($\boldsymbol{p}$) and total expenditure (x) are known as demand. For example Marshallian demand functions can be written as

(3.2) $$q_i = g_i\,(x, \boldsymbol{p})$$

In an Engel curve for households, family composition effects are abstracted and prices are absorbed into a functional form derived from Equation (3.2) as follows

(3.3) $$q_i = g_i\,(x)$$

Engel curves can be used to classify commodities into *necessities*, *luxuries* and *inferior goods*. Necessities are goods that have income elasticity less than one, while luxuries commodities have income elasticity greater than one. Inferior goods are those the purchase of which declines absolutely as x increases (income elasticity is less than zero). Luxuries goods take up a larger share of the budget of better-off households and vice versa for necessities. Inferior commodities are those the purchase of which declines absolutely as x increases. The relationship between total expenditure and quantity

demanded might vary by income levels, especially in countries that face wide income inequality.

Inequality measurement starts from an axiomatic approach to the direct measurement of inequality (Lorenz curve). There are three axioms for inequality. The first axiom is *mean independence* which requires that inequality only depends on the distribution of income or total expenditure. The second of these axioms, *anonymity*, that will be reasonable if expenditures are needs and prices are corrected. Finally, the third axiom (Dalton, 1920) is the *principle of transfers*, which entails that transfers of expenditure or income from a wealthier to a poorer individual must decrease inequality, but transfers are not large enough to change their relative positions.

Gini coefficient or the coefficient of variation is a method to evaluate income inequality. This measure is derived from the Lorenz Curve which represents the cumulative probability distribution of wealth. For this study, each sample is divided into different categories according to various levels of income using deciles to obtain the distribution of income. A decile is one of the values of a variable that divides sorted data into ten equal parts, so that each proportion represents one tenth of the sample population.

Model Specification

This study uses a non-linear approximation of the AIDS model to evaluate changes in consumer preferences over time as follows

(3.4) $$w_{ihtd} = \rho_{i0} + \sum_{k=1}^{K} \rho_{ik}\, d_{khtd} + \sum_{j=1}^{n} \gamma_{ih} \ln(p_{ih}) + \beta_i \ln\left[\frac{x_{htd}}{a(p_h)}\right] + u_{ihtd}$$

where w_{ihtd} is the budget share of the i^{th} good purchased by household *h* in the year *t* (t=1994, 2002, 2010) per decile *d* of income, ρ_{i0}, ρ_{ik}, γ_{ih} and β_i are the parameters to be estimated, d_{khtd} is the k^{th} demographic variable of the *h* household at time *t* per decile *d*, $\ln(p_{ih})$ is the log of the price of the i^{rh} good, x_{htd} is the total expenditure, and $a(p_h)$ is a price index which is defined as

(3.5) $$\ln a(p_h) = \alpha_0 + \sum_{j=1}^{n} \delta_{jh} \ln(p_{jh}) + 0.5 \sum_{i=1}^{n} \sum_{j=1}^{n} \gamma_{ij} \ln(p_{ih}) \ln(p_{jh})$$

One of the major econometric issues when using a form of AIDS model is endogeneity. Endogeneity might lead to biased estimates due to the likely correlation between the error term and the logarithm of total expenditure on the demand system. To overcome the issue of correlation between the error term u_{ihtd} and the log expenditure variable $\ln(x_{htd})$, Blundel and Robin (1999) suggested a reduced form function for $\ln(x_{htd})$ to generate an instrumental variable from the residuals. The following reduced function shows $\ln(x_{htd})$ as a function of demographic variables, log of prices and log of income and is defined as

(3.6) $$\ln(x_{htd}) = \sum_{k=1}^{K} \rho_{ik} d_{khtd} + \sum_{j=1}^{n} \delta_{ih} \ln(p_{ih}) + \omega \ln(x_{htd}) + v_{ihtd}$$

where v_{ihtd} are computed residuals to be added into the non linear AIDS model. One of the major advantages of AIDS models is the capability of imposing demand properties into them to test the validity of such properties. Adding-up restriction, homogeneity and Slutsky symmetry can be imposed directly on the parameters of Equation (3.4) as follows

(3.7) $$\sum_i^n \rho_{i0} = 1, \sum_i^n \rho_{ik} = 0, \sum_{i=1}^n \gamma_{ij} = 0, \sum_i^n \beta_i = 0, \text{and} \sum_i^n \lambda_i = 0$$

(3.8) $$\sum_{i=1}^{n} \gamma_{ij} = 0 \text{ for any } j$$

(3.9) $$\gamma_{ij} = \gamma_{ji} \text{ for all } i \text{ and } j$$

Data and Procedure

The National Institute of Statistics and Geography (INEGI) conducts a National Survey of Income and Expenditure for Mexican Households (ENIGH) every other year. In this micro survey, households report quantity purchased and total expenditure on different commodities during a week. Demand analysis using ENIGH offers several advantages. First, this survey is carried out between August and November every other year. The fact that ENIGH is conducted over the same period facilitates its implementation on empirical demand analyses over time to overcome the lack of panel cross sectional data. Second, this survey has a unique level of product disaggregation which allows researchers to consistently aggregate elementary products into composite goods or to perform demand analysis on disaggregated commodities. Comparison over time and consistent aggregation over products leads to more reliable demand elasticities and policy implications.

This study used a two-step estimation of a censored demand system model proposed by Shonkwiler and Yen in 1999. The model was estimated for the years of 1994, 2002 and 2010 and used nine food aggregates: cereals, meats, milk, egg, fats, vegetables, fruits, other food products and food away from home. To account for the relative importance of quantity consumed of each product on the price of the category, this study calculated a weighted average price. A major issue when dealing with survey information is censored data. In the ENIGH survey, data are recorded only when households make a purchase and during the time the survey is gathered. Therefore, household expenditure on certain products will be censored or incomplete. To address the

problem of missing prices, a consequence of censored data for expenditures, this study used Markov Chain Monte Carlo (MCMC) approach (MI procedure in SAS) to generate omitted data.

Household surveys typically report a weight variable that is the number of households nationally represented by the interviewed one. Of particular importance is the effect of different levels of income on expenditure on food composites. Therefore, the present study divided the data into ten deciles using the weighted variable. Weighted data were sorted to detect extreme observations in income. Income values below quantile 1 percent and above quantile 99 percent were eliminated.

The survey also reports a strata variable that accounts for the size of the community where the household is located. The strata factor includes four categories: 1 represents more than 99,999 inhabitants, 2 is for communities between 15,000 and 99,999 inhabitants, 3 depicts areas with population between 2,500 to 14,999, and 4 represents places with less than 2,499 inhabitants. This research used that strata factor and the definition of rural communities in Mexico to create an indicator variable to compare rural and urban areas. A rural community in Mexico is an area having less than 2,499 inhabitants. In addition to the demographic variable to compare rural areas from urban communities denoted by the indicator variable rural (1: less than 2,499 inhabitants, 0: otherwise), the model contains other demographic factors: size of the household, regions (CR: Central Region; COR: Central Occidental Region; NWR: Northwest Region; NER: Northeast Region; and SR: South Region), and age of the head of the household.

The first step consists on estimate a multivariate probit regression (PROC QLIM in SAS) to estimate household's probability of purchasing a commodity by deciles using the weight factor. In this regression (Shonkwiler and Yen, 1999), the cumulative density function denoted by $\Phi_{td}(\boldsymbol{z}_i^{'}\boldsymbol{\tau}_i)$ and the standard normal probability density function represented by $\phi_{td}(\boldsymbol{z}_i^{'}\boldsymbol{\tau}_i)$ are estimated to generate the following model in the second step using the Full Information Maximum Likelihood in Proc Model (SAS)

$$w_{ihtd} = \Phi_{td}(\boldsymbol{z}_i^{'}\boldsymbol{\tau}_i) * \left[\alpha_{ihtd} + \sum_{j=1}^{n} \gamma_{ij} \ln(p_{ihtd}) + \beta_i \ln\left[\frac{x_h}{a(p_h)}\right] + \kappa_i \hat{v}_h \right] + \varphi_i . \phi_{td}(\boldsymbol{z}_i^{'}\boldsymbol{\tau}_i) + \zeta_{ihtd} \quad (3.10)$$

Pudney (1989) suggested using *n*-1 equations in order for adding up restriction to hold. The residual category for each year was vegetables. Of particular interest is the calculation of income elasticities, but the present study also estimated own, cross price and demographic elasticities (Tables III.8 – III.37). To calculate Marshallian, Hicksian, expenditure, income and demographic elasticities, the following formulas were used

$$e_{ihtd}^{m} = w_{ihtd}^{-1}\{\gamma_{ij} - \beta_i[\alpha_j + \sum_{k}^{n} \gamma_{jk} \ln(p_k)]\} \cdot \Phi_{\mathrm{i}} - \delta_{\mathrm{ij}} \quad (3.11)$$

$$e_{ihtd}^{h} = e_{ihtd}^{m} + w_i e_i \quad (3.12)$$

$$e_{ihtd} = 1 + w_i^{-1} \cdot \beta_i \cdot \Phi_{\mathrm{i}} \quad (3.13)$$

$$e_{M(i),htd} = e_i e_M \quad (3.14)$$

$$e_{ihtd}^{d} = w_{ihtd}^{-1}\{[\rho_{im} - \sum_{k}^{n} \gamma_{jk} \ln(p_k)] \cdot \beta_i\} \cdot \mathrm{d}_m \Phi_{\mathrm{i}} \quad (3.15)$$

where δ_{ij} is the Kronecker delta (1 if *i=j* and 0 otherwise), w_{ihtd} is the average budget share per commodity *i* of the h^{th} household during time *t* per decile *d*, e_M is the estimated parameter of household income in the reduced equation, d_m is equal to one for binary variables or the mean of the variable otherwise.

To avoid over rejection on the properties of the demand, a size corrected Likelihood Ratio statistic (Italianer, 1985 and Moschini, et al., 1994) was used

$$LR_c = \left[-2\left(\ln L(\tilde{\theta}) - \ln L(\hat{\theta})\right)\right]\left[MN - \frac{1}{2}\left(P_{\hat{\theta}} + P_{\tilde{\theta}}\right) - \frac{1}{2}N(N+1)\right] \xrightarrow{d} X_J^2 \quad (3.16)$$

where $\ln L(\tilde{\theta})$ is the restricted log likelihood value, $\ln L(\hat{\theta})$ is the unrestricted log likelihood, *M* is the number of equations, *N* is the total number of observations, $P_{\hat{\theta}}$ and $P_{\tilde{\theta}}$ are the number of parameters of the unrestricted and restricted model, respectively, and *J* are the restrictions to test.

Results

Income distribution

In this section the main questions to answer are: is the distribution of income more equal than it was in the past? And does income inequality need to be considered for demand analysis? To answer these questions, the present paper uses Mexico's data from 1994 to 2010. Demand patterns depend on the distribution as well as the level of income (Peel, 2001). Differences on consumer preferences between low income and high income households are revealing. Lowest income households spend a higher proportion of their disposable income on food and use about 40 percent of their food budget on cereals and vegetables. On the other hand, highest income families allocate a high percentage of their food budget on higher value food (away from home food and other products). In addition to that, comparing different years of Mexican expenditure surveys illustrates some important trends in food consumption. Of particular importance are the changes in budget

allocation across levels of income and time given the wide income distribution in Mexico.

Table III.1 presents comparisons of quarterly income by deciles of income using 2010 as base year. The table also reports average income and the Gini coefficient per year. Deciles were calculated for the years 1994, 1998, 2002, 2006 and 2010 using the respective ENIGH survey.

Results indicate that income distribution has been a significant problem in Mexico from 1994 to 2010. As we can note, the bottom 50 percent of the households have received less than 17 percent of total income while the highest 10 percent have obtained over 43 percent of total income between 1994 and 2010. The Gini index for Mexico has varied between 52 and 57 percent from 1994 to 2010. Although Gini index is lower in 2010 than 1994, income inequality continues to be a problem in Mexico. Income is a major factor on demand patterns and it is usually positively related with food consumption. Given these results, we cannot ignore income distribution when analyzing food demand in Mexico.

Figure III.1 shows the distribution of income in Mexico in 1994 and 2010 represented in their respective Lorenz curves. The distribution of income in 2010 is to the left of the distribution of income in 1994, implying that there is less income inequality in the present. The distribution of income in developing countries is typically more equal at the bottom and less equal at the top than in advanced countries. Also, the degree of inequality increases, there is more weight to the distribution at the lower end of the scale (See also Table III.1). As shown in Figure III.1, it is possible to pass from one

distribution to another. In this example, the Mexican economy passed from 1994 distribution to 2010 distribution by a series of transfers from richer to poorer households. However, the change in income inequality was not very significant.

When dealing with demand analysis in Mexico, there is another important issue to consider. There is a high concentration of rural households in the lowest income groups and higher income inequality in rural communities than in urban areas. Table III.2 presents rural and urban quarterly income by deciles and proportion of total income per category for the years 1994, 2002 and 2010. The table also reports the average income and the Gini coefficient for rural and urban areas by years. Note a higher income inequality in rural areas than in urban communities. Rural and urban income inequalities have decreased by about 8.2 percent from 1994 to 2010. The distribution of income is more equal at the bottom and less equal at the top for both types of areas, indicating great income disparities across deciles and between urban and rural areas in Mexico. Table III.2 also confirms the relative poverty of rural residents. Even though rural households constitute a lower percent of total households in Mexico, they make up about 50 percent of the households in the bottom thirty percent of households (deciles I, II and III).

Estimating Relative Income Effects

In economies with wide income distribution, budget shares for low income household differ in large proportions from those with high income. Figure III.2 reports household budget share on different food categories across income levels and time (1994, 2002 and 2010). Figure III.2 shows that as income increases, there is a lower propensity to

consume cereals and a higher propensity for away from home food purchases. In this case, cereals include potatoes as a starch and meats take account of beans as an important source of protein in Mexico. It is commonly accepted that low income families make considerable substitutions between food categories and have a higher propensity to spend additional income on food. This is indicated by income elasticities for food that are larger for low income families than for high income families (Tables III.6 and III.7). The bottom ten percent of households (Decile I) spend almost 50 percent of their food budget on cereals, meats and eggs. Comparing the INEGI expenditure surveys of 1994, 2002 and 2010, there are evident trends in change of preferences over time. Away from home food consumption and other (sweeteners, coffee, tea, spices and condiments, other beverages and other miscellaneous food) are significant parts of higher value food demand and generally rising elements of expenditures as income increases. Figure III.2 indicates that the lowest income households spent less than 5 percent on away from home food in 1994 and doubled in 2010, while highest income households have spent twice as much as the lowest income households.

Figure III.2 shows that away from food consumption increased over time for most of the deciles, indicating that consumption of higher value commodities is now a more important component of Mexican diet than in the past. This implies that consumer preferences are changing, maybe due to the change of life style and living standards in the country. Choices mainly depend on demographic characteristics of the household and life style. The world is currently experiencing the growth of a universal consumer society, more or less heading towards western lifestyle standards despite remaining poverty and wide income disparities. Mexico has long faced higher concentrations of

population in urban areas. Cities attract migrants with the promise of higher living standards, but the wealth present in urban areas does not necessarily translate into prosperity. Lifestyle and living standards in the cities are closely intertwined with consumption because they highly influence market preferences. Urban communities are associated with improved basic services, education and health, with emphasis on equal opportunities for women to work, but also embraces a very competitive environment and a huge change in lifestyle. Mexican households are experiencing a remarkable change in lifestyle and living standards affecting consumer preferences and of course food consumption.

Budget allocation on food categories between high income households and low income households is revealing. Previous empirical studies have demonstrated that low income households have a higher propensity to spend additional income on food. The present study calculates expenditure and income elasticities by deciles to investigate this point using a Non Linear Aids Model for the years of 1994, 2002 and 2010 and per decile (Tables III.6 and III.7).

From Table III.6, at higher income levels, expenditure elasticity decreases for cereals and milk in 1994 and 2002, implying that increases in income by deciles continue to result in decreased food expenditure on those categories but by a smaller proportion. However, income and expenditure on those categories increased in 2010. Expenditure on fruit has a negative relationship with income growth in all the three years, indicating a possible trend towards less healthy food as income increases. Note that for most goods, at the highest income levels, expenditure elasticity is lower and for most of the goods elasticities decrease to levels similar to elasticity levels for all food categories. This is

consistent with consumer theory, because the higher the income level the lower the elasticities on food. Over time, low income households spend higher proportion of their budget on meat and eggs. Since these values are based on expenditures it could be that the increase or decrease is not in terms of additional quantity of food but could be due to change in prices. Therefore, it is important to analyze income elasticities (Table III.7) to account for income effect on budget share by category.

Table III.7 presents income elasticities for the nine food categories from 1994 to 2010. Income elasticities show that all aggregate commodities are normal across deciles and over time. Some income elasticities demonstrate the existence of luxury groups of food (meats and fats), where income has a significant effect on quantity demanded. Overall income effect on quantity demanded tends to be lower for low income families than for higher income households. For most groups of commodities, income seems to have a greater effect on quantity demanded during 2010 than before. There has been a change in consumer preferences of cereals, one of the major food groups in Mexico in terms of consumption. While in 1994 and 2002, an increase in income over deciles led to a decrease in quantity demanded in this category; in 2010 there is not an apparent increase or decrease on budget share for cereals across deciles of income. Another main food group in Mexico is meats. Table III.7 indicates a decrease in quantity demanded of this group as income level increases which is not generally expected in empirical demand analysis. These results might be due to the incorporation of beans in this food category. Beans are the major source of protein for low income families in Mexico, but it is also consumed in high proportions by entire Mexican population.

Estimating Price and Demographic Effects

Tables III.8 to III.37 report uncompensated and compensated price elasticities for food groups in Mexico by years and by deciles. Note that all groups of commodities are elastic in 1994 across deciles, except for food away from home for decile X. These elasticities estimates suggest that own price effects tend to be greater for low income families than for higher income families which are consistent with consumer theory. Also, compensated and uncompensated own price elasticities of demand will be more similar for high income families because the share of income devoted to these food groups is small. This situation implies that food is less important in a household's budget with higher income level than for those with lower income level because the amount of income compensation required to offset a price change will be small. It is important to consider that the budget share in food categories is greater for low income households than for high income households, as well. This pattern is the same across years, but in 2002 we start to see less elastic groups of commodities from decile VI. Additionally, uncompensated and compensated price elasticities differences indicate that income generally offsets substitution effect for higher income families. There are more complementary relationships for low income families than for high income families. Also, by comparing across years, one can conclude that there are more substitution effects between food categories in the present than in the past. This situation entails that consumer preferences are changing and households' views across food categories are different in the present.

Demographic elasticities for food groups in Mexico across income levels and years are also reported from Tables III.8 to III.37. These results show that demographic

characteristics such as size, urbanization, location and age tend to be more different across levels of income. Elasticities estimates also show more similarities for certain categories across years (vegetables, fruits and other). In general, results show significant differences (change in sign) for some demographic characteristics over time, indicating how Mexican households have suffered a transformation in life styles and consumer preferences of food categories from 1994 to 2010.

Conclusions

This paper has provided quantitative evidence of the effect of income distribution on consumption patterns over time, and of the need to incorporate various levels of income in models for consumer behavior. This study has particular application in problems of welfare analysis in economies with wide income distributions such as Mexico.

The concept that luxury goods are purchased more by high income households than low income households has caused controversy in economic development. When dealing with food subcategories, one can note that low income households will see some food categories such as meats as a luxury (2010 data) item while high income households might not. Food elasticities are generally lower for high income households because income has not a significant effect on food consumption as with low income families. In many discussions of poverty, the effect of income change as preventing the poor from purchasing some commodities has become very important for policy implications. Data on demand are usually presented in the form of aggregates across commodities by uses.

In this case, we aggregated data into different food categories to analyze consumption patterns on cereals, meats, milk, egg, fats, vegetables, fruit, other food and food away from home.

This model has a potential in marketing, where a study of income levels may give important clues to understanding major movements in consumer preferences among households in developing economies like Mexico. An important implication in estimating Engel curves is considering the appropriate form of preferences that support generalization in the shape for the relationship between total expenditure and budget share of specific goods or group of commodities. Some studies have provided empirical evidence that suggest a linear association in Engel curves for food. However, it might be important to test whether this relationship holds with more disaggregated food groups. Semi parametric and non parametric methods are alternative solutions to this problem.

Results suggest a need to estimate income elasticities across households' income and over time for better policy implications. Even though it seems that inequality has improved in Mexico and there is a growing middle class, economic issues have a different impact on low income households than on high income households. Heterogeneity across income levels over time needs to be captured in demand analysis to provide more reliable policy implications. Income elasticities suggest that preferences experienced a greater change during 1994 and 2010 than in 2002, especially for the bottom fifty percent of the households. Results also indicate a higher spending at convenience stores in the present than in the past indicated by the growth of away from home food consumption and other food. In addition, Mexican consumer preferences have experienced a significant change over time, especially for low income households.

Finally, across food categories income elasticities tend to be more equalized for high income levels indicating lower substitution among food groups for better-off households.

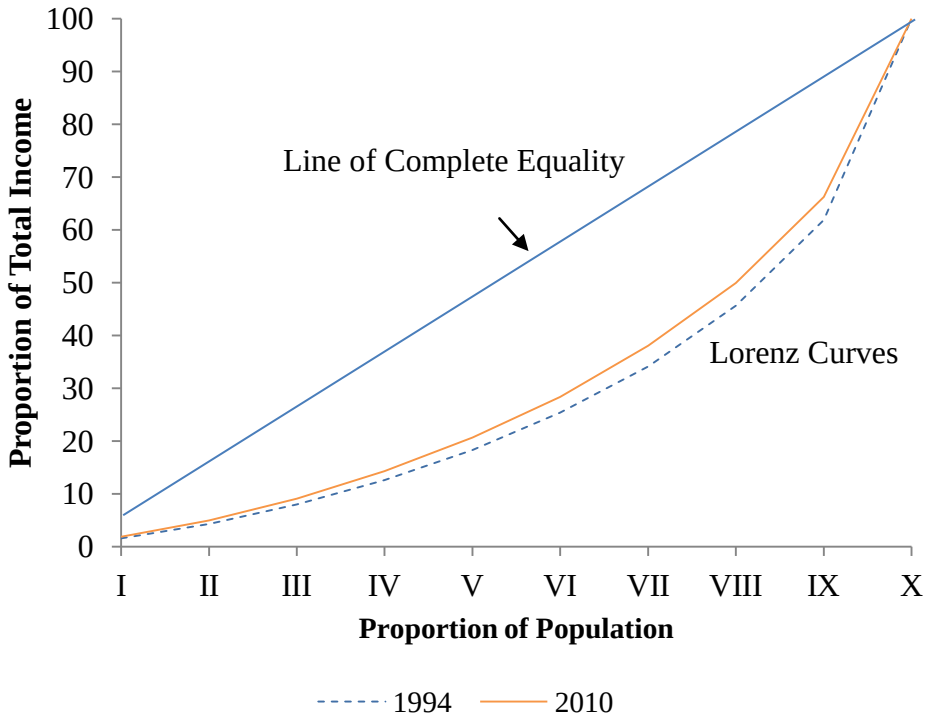


Figure III.1 Mexican Lorenz Curves of 1994 and 2010

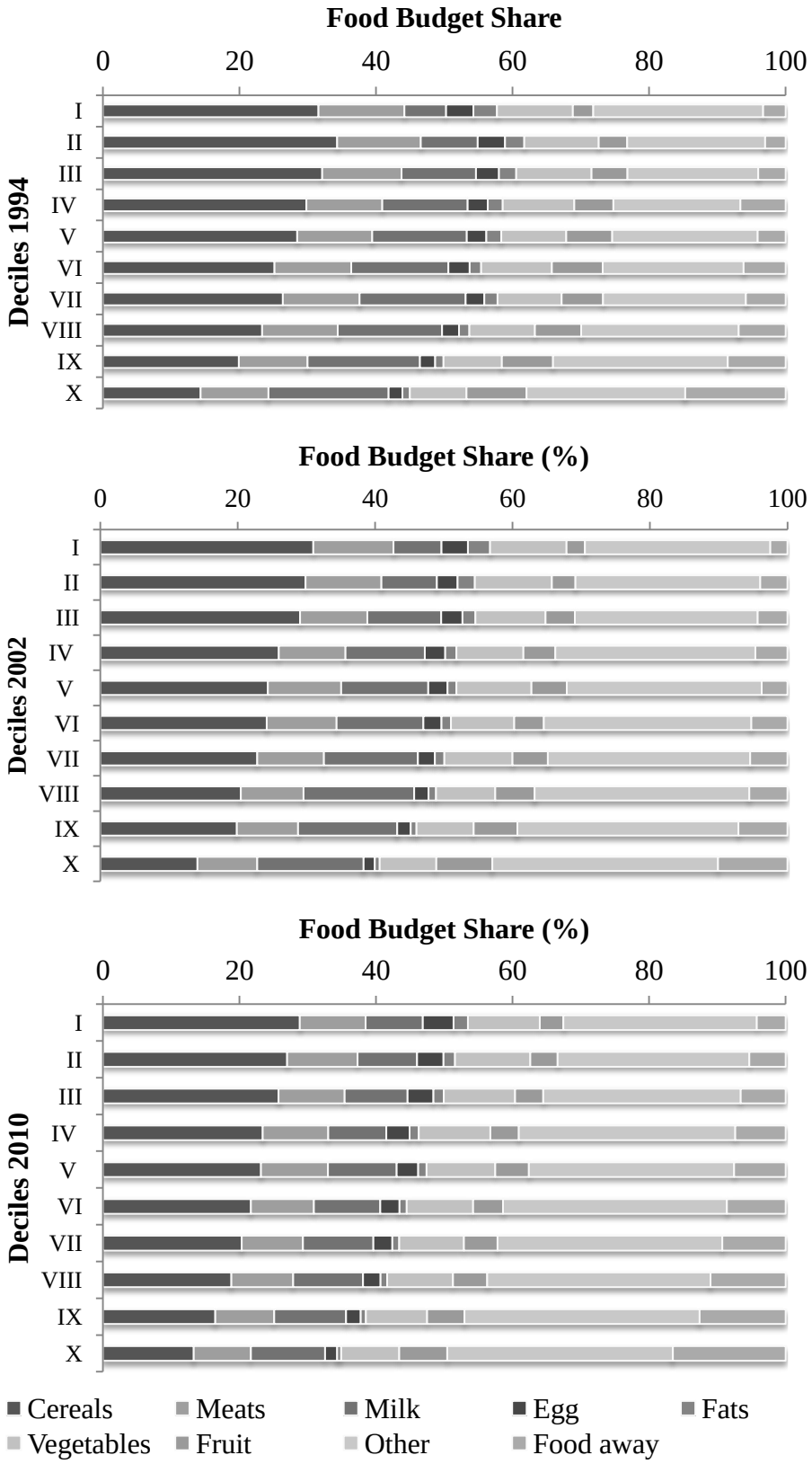


Figure III.2 Food Budget Shares per Deciles for Food in Mexico, 1994, 2002 and 2010

Table III.1 Quarterly Income (Pesos) by Deciles and Proportion of Total (Percentage), from 1994 to 2010 (2010=100)

Decile	1994		1998		2002		2006		2010	
	Income (Pesos)	Percent of Total	Income (Pesos)	Percent of Total	Income (Pesos)	Percent of Total	Income (Pesos)	Percent of Total	Income (Pesos)	Percent of Total
I	6,178.62	1.32	4,637.26	1.30	5,707.43	1.40	7,251.09	1.55	6,447.44	1.47
II	9,539.00	2.04	7,258.33	2.03	9,118.89	2.24	10,876.64	2.33	10,182.82	2.33
III	12,786.87	2.73	9,909.63	2.77	12,019.96	2.95	14,423.36	3.09	13,913.16	3.18
IV	16,162.60	3.45	12,702.07	3.55	15,268.83	3.75	17,716.84	3.79	17,835.06	4.08
V	20,175.12	4.31	15,930.21	4.45	19,086.04	4.68	21,753.28	4.65	22,180.40	5.07
VI	24,550.79	5.24	19,960.40	5.58	23,658.21	5.80	26,822.42	5.74	27,474.53	6.28
VII	31,609.14	6.75	25,807.38	7.21	29,724.74	7.29	33,898.87	7.25	35,135.77	8.04
VIII	43,117.33	9.21	34,468.99	9.63	39,939.31	9.80	44,533.80	9.53	46,576.34	10.65
IX	67,709.03	14.46	52,018.01	14.53	59,661.55	14.64	65,984.96	14.11	67,209.13	15.37
X	236,301.36	50.48	175,308.76	48.97	193,405.22	47.45	224,258.22	47.97	190,297.75	43.52
Average	46,812.99	-	35800.10	-	40,759.02	-	46,751.95	-	43,725.24	-
Gini Coefficient	57.26	-	56.30	-	54.73	-	54.39	-	52.01	-

Table III.2 Rural and Urban Quarterly Income (Pesos) by Deciles and Proportion of Total (Percent), 1994, 2002 and 2010 (2010=100)

Decile[a]	Rural			Urban		
	1994	2002	2010	1994	2002	2010
I	3605.90 1.07	3181.01 1.09	3745.46 1.12	9206.55 1.81	6000.00 1.91	8310.09 1.78
II	5201.70 1.54	4692.34 1.60	5815.78 1.73	12531.13 2.46	8400.00 2.68	12526.88 2.69
III	6613.37 1.96	6092.69 2.08	7766.06 2.31	16009.16 3.14	10720.00 3.42	16354.36 3.51
IV	8265.43 2.45	7965.24 2.72	10026.55 2.99	19487.19 3.82	13098.00 4.18	20455.49 4.39
V	10086.28 2.99	9896.47 3.38	12719.51 3.79	23630.14 4.63	16000.00 5.10	25205.00 5.41
VI	12479.99 3.70	11930.90 4.07	16001.15 4.76	29154.06 5.72	19350.00 6.17	30777.83 6.61
VII	15630.67 4.63	15253.28 5.21	20602.58 6.13	37439.96 7.34	24120.00 7.69	39106.08 8.40
VIII	21389.88 6.34	19807.07 6.76	27241.56 8.11	49101.58 9.63	32000.00 10.20	50475.53 10.84
IX	30356.03 8.99	28629.06 9.78	42164.15 12.55	77028.10 15.11	47100.00 15.02	72095.56 15.48
X	223857.17 66.33	185407.46 63.31	189793.65 56.51	236301.36 46.34	136800.00 43.62	190297.75 40.87
Average	33748.64	29285.55	33587.65	50988.92	31358.80	46560.46
Gini Coefficient	66.87	64.88	61.37	53.35	50.73	49.12

[a] Data is only for one three month period. .

Table III.3 Parameter Estimates of the Multivariate Probit Model of Food, Mexico, 1994[a]

Parameter	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruit	Other	Food Away
Intercept	0.239	-0.902***	-2.531***	0.110	0.275*	-0.119	-2.455***	-0.165	-4.458***
Household size	0.145***[b]	0.096***	0.027***	0.083***	0.089***	0.123***	0.015***	0.097***	-0.073***
Rural	-0.395***	-0.488****	-0.729***	-0.325***	0.055**	-0.261***	-0.351***	-0.053	-0.205***
COR	0.123**	-0.139***	0.313***	-0.277***	-0.063**	-0.067*	-0.161***	0.076**	0.116***
NWR	0.040	-0.138**	0.495***	-0.154***	-0.006	-0.381***	-0.499***	0.094	-0.025
NER	0.036	-0.469***	0.129***	-0.241***	0.045	-0.600***	-0.536***	0.196***	-0.214***
SR	0.245***	0.233***	-0.060**	0.008	0.024	-0.117***	-0.481***	0.244***	0.020
Age	-0.001	-0.001	-0.004***	-0.005***	-0.002***	-0.002***	-0.003***	-0.006***	-0.007***
Log of Price of Cereals	-0.033	-0.184***	0.121***	-0.049**	0.004	-0.049**	0.141***	0.160***	0.213***
Log of Price of Meats	-0.045	-0.042	0.286***	-0.149***	-0.421***	-0.068**	0.132***	-0.156***	0.100***
Log of Price of Milk	0.002	0.029	0.017	-0.014	0.080***	0.056***	0.021	0.069***	0.002
Log of Price of Egg	-0.155*	-0.047	-0.120**	-0.107**	-0.163***	-0.081	-0.147***	-0.093	0.027
Log of Price of Fats	-0.147*	0.037	-0.046	-0.017	-0.107**	-0.022	-0.090*	-0.162***	0.073
Log of Price of Vegetables	-0.121***	-0.146***	-0.096***	0.017	-0.047*	0.036	-0.280***	0.118***	0.075**
Log of Price of Fruit	-0.020	-0.021	-0.002	-0.057**	-0.014	-0.011	-0.025	-0.020	-0.016
Log of Price of Other	0.030	0.034**	-0.016	-0.003	-0.006	0.017	0.007	-0.014	-0.033**
Log of Price of Food Away	-0.052**	-0.036*	-0.031*	-0.020	-0.029*	-0.049***	-0.042***	-0.064***	-0.031*
Log of Income	0.166***	0.252***	0.309***	0.088***	0.058***	0.130***	0.339***	0.152***	0.401***

[a] Data is from 2002 National Survey of Income and Expenditure for Mexican Households (ENIGH)

[b] One, two and three asterisks indicate significance at the 10, 5 and 1 percent level, respectively.

Table III.4 Parameter Estimates of the Multivariate Probit Model of Food, Mexico, 2002[a]

Parameter	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruit	Other	Food Away
Intercept	0.543*[b]	0.452*	-2.966***	1.474***	1.307***	0.489**	-2.629***	-0.528**	-5.678***
Household size	0.137***	0.132***	0.023***	0.106***	0.097***	0.137***	0.010*	0.085***	-0.063***
Rural	-0.489***	-0.423***	-0.576***	-0.324***	0.210***	-0.186***	-0.246***	-0.148***	-0.044
COR	-0.136**	-0.404***	0.144***	-0.270***	-0.123***	-0.352***	-0.340***	0.193***	0.097***
NWR	-0.486***	-0.580***	0.067	-0.426***	-0.109***	-0.693***	-0.710***	-0.037	-0.022
NER	-0.193***	-0.624***	0.132***	-0.241***	-0.093***	-0.819***	-0.800***	0.180***	-0.504***
SR	-0.173***	-0.250***	-0.455***	-0.191***	-0.073**	-0.342***	-0.574***	0.256***	0.000
Age	-0.001	-0.001*	-0.003***	-0.006***	-0.001**	0.000	-0.002***	-0.005***	-0.008***
Log of Price of Cereals	0.010	-0.215***	0.220***	-0.074***	-0.089***	-0.142***	0.178***	0.128***	0.238***
Log of Price of Meats	-0.147***	-0.208***	0.177***	-0.214***	-0.414***	-0.144***	0.050*	-0.124***	0.119***
Log of Price of Milk	-0.033	0.072***	0.080***	-0.005	0.032**	0.106***	0.038**	0.042**	0.003
Log of Price of Egg	0.226***	0.036	-0.021	0.105**	-0.073	-0.040	-0.080*	0.025	-0.054
Log of Price of Fats	-0.028	0.000	-0.112***	0.015	0.045	0.007	-0.014	-0.056	0.014
Log of Price of Vegetables	-0.048	-0.065*	-0.076***	0.017	-0.123***	-0.005	-0.222***	0.039	0.076***
Log of Price of Fruit	-0.056	-0.014	-0.001	-0.026	-0.024	-0.028	-0.013	-0.020	-0.016
Log of Price of Other	0.020	-0.025*	-0.035***	-0.019*	-0.036***	-0.007	-0.016	0.030**	-0.006
Log of Price of Food Away	-0.023	-0.022	0.005	-0.043***	-0.030***	-0.042***	-0.025**	-0.025*	-0.011
Log of Income	0.120***	0.179***	0.295***	-0.028**	0.005	0.113***	0.306***	0.153***	0.449***

[a] Data is from 2002 National Survey of Income and Expenditure for Mexican Households (ENIGH)

[b] One, two and three asterisks indicate significance at the 10, 5 and 1 percent level, respectively.

Table III.5 Parameter Estimates of the Multivariate Probit Model of Food, Mexico, 2010[a]

Parameter	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruit	Other	Food Away
Intercept	2.462***	1.060***	-1.800***	3.168***	1.170***	0.967***	-2.190***	-0.716***	-6.003***
Household size	0.176***	0.159***	0.036***	0.125***	0.084***	0.150***	0.017***	0.068***	-0.076***
Rural	-0.394***	-0.261***	-0.433***	-0.099***	0.289***	-0.050*	-0.170***	-0.137***	-0.142***
COR	0.032	-0.174***	0.200***	-0.181***	0.067***	-0.212***	-0.267***	0.252***	-0.104***
NWR	-0.043	-0.565***	-0.016	-0.267***	-0.044	-0.586***	-0.498***	0.303***	-0.206***
NER	-0.151***	-0.574***	0.103***	-0.228***	0.050*	-0.767***	-0.688***	0.376***	-0.549***
SR	-0.076*	-0.139***	-0.491***	-0.024	0.019	-0.344***	-0.481***	0.306***	-0.137***
Age	0.001	-0.001	-0.004***	-0.005***	0.000	0.002***	0.002***	-0.006***	-0.011***
Log of Price of Cereals	-0.018	-0.303***	0.297***	-0.164***	-0.150***	-0.347***	0.143***	0.185***	0.332***
Log of Price of Meats	-0.138***	-0.127***	0.080***	-0.213***	-0.340***	-0.107***	0.092***	-0.030	0.213***
Log of Price of Milk	-0.020	0.063***	0.074***	-0.034***	0.029**	0.101***	-0.004	0.018	-0.018
Log of Price of Egg	-0.069	-0.022	-0.029	-0.046*	0.000	-0.072**	-0.078***	-0.027	0.043
Log of Price of Fats	-0.072	-0.059*	-0.015	-0.065**	-0.035	-0.016	-0.020	-0.010	-0.044*
Log of Price of Vegetables	0.027	0.016	-0.014	0.054***	-0.018	0.096***	-0.221***	0.052*	0.044**
Log of Price of Fruit	-0.040	0.004	-0.005	0.006	-0.017	-0.020	0.010	0.002	0.019
Log of Price of Other	-0.009	-0.042***	-0.055***	-0.035***	-0.015**	-0.035***	-0.047***	0.005	0.005
Log of Price of Food Away	-0.075***	-0.045***	-0.034**	-0.084***	-0.064***	-0.062***	-0.009	-0.070***	-0.027**
Log of Income	0.019	0.130***	0.169***	-0.085***	-0.004	0.093***	0.234***	0.145***	0.439***

[a] Data is from 2002 National Survey of Income and Expenditure for Mexican Households (ENIGH)

[b] One, two and three asterisks indicate significance at the 10, 5 and 1 percent level, respectively.

Table III.6 Expenditure Elasticities for Food Categories, Mexico, 1994, 2002 and 2010

Deciles	1994 Expenditure Elasticities								
	Cereals	Meats	Milk	Egg	Fats	Veggie	Fruits	Other	Away
I	1.119	1.080	1.070	0.547	0.924	1.004	1.203	0.838	1.076
II	1.030	1.089	1.015	0.388	1.152	0.987	0.980	0.990	1.100
III	1.035	1.071	0.877	0.751	0.964	0.949	1.085	0.931	1.455
IV	0.944	0.987	0.914	0.879	0.977	1.013	1.048	1.182	0.920
V	1.004	1.180	0.918	0.992	1.202	0.964	1.035	0.937	1.024
VI	0.899	1.072	0.950	1.048	1.438	1.038	1.118	1.003	1.017
VII	0.915	1.175	0.898	1.052	1.036	0.864	1.238	1.027	1.189
VIII	0.903	0.998	0.939	1.043	1.347	0.949	1.114	1.084	1.070
IX	0.904	1.158	0.953	1.090	1.316	1.120	1.131	0.931	1.006
X	0.913	1.007	0.802	1.058	1.237	1.122	1.021	1.028	1.152
Aggregated	1.001	1.139	0.944	0.756	0.950	0.957	1.052	1.002	1.026
Deciles	2002 Expenditure Elasticities								
	Cereals	Meats	Milk	Egg	Fats	Veggie	Fruits	Other	Away
I	0.962	1.043	1.308	0.890	0.864	0.972	1.059	0.992	0.948
II	0.911	0.844	1.204	0.823	0.856	0.924	0.857	1.202	0.942
III	0.897	0.882	1.113	0.888	0.974	0.883	0.757	1.226	0.951
IV	0.761	0.868	1.138	0.729	0.813	0.805	0.780	1.392	0.743
V	0.864	0.831	1.046	0.643	0.832	0.835	1.045	1.260	1.036
VI	0.846	0.781	1.016	0.796	0.987	1.010	0.882	1.236	0.918
VII	0.849	0.985	1.048	1.017	0.897	0.956	0.856	1.163	0.904
VIII	0.825	0.961	1.008	0.748	1.186	1.052	0.989	1.131	0.920
IX	0.491	1.083	1.014	0.892	1.294	0.985	1.006	1.282	1.028
X	0.796	1.034	0.979	1.144	1.004	1.131	1.031	1.019	1.053
Aggregated	0.856	0.923	1.051	0.803	0.897	0.966	0.979	1.168	1.007
Deciles	2010 Expenditure Elasticities								
	Cereals	Meats	Milk	Egg	Fats	Veggie	Fruits	Other	Away
I	0.930	1.169	0.988	0.862	1.021	1.053	0.969	0.995	1.150
II	1.030	1.049	0.918	0.867	1.069	1.077	0.875	0.998	0.866
III	0.967	1.187	0.862	0.906	1.047	1.105	1.182	0.927	1.105
IV	0.971	1.047	0.890	0.971	1.191	1.112	1.099	0.996	0.910
V	0.920	1.097	0.888	0.979	1.190	1.083	1.153	0.995	1.043
VI	0.937	1.155	0.892	0.923	1.432	1.144	1.169	0.956	0.986
VII	0.987	1.080	0.861	0.959	1.365	1.102	0.952	0.997	0.992
VIII	0.958	1.119	0.863	1.142	1.363	1.110	1.123	0.934	1.057
IX	0.885	1.128	0.918	0.897	1.320	1.067	1.054	1.052	0.906
X	1.012	0.986	0.898	1.166	1.116	0.993	0.909	1.071	0.945
Aggregated	0.926	1.147	0.910	0.818	1.010	1.099	1.019	1.011	1.003

Table III.7 Income Elasticities for Food Categories, Mexico, 1994, 2002 and 2010

Deciles	1994 Income Elasticities								
	Cereals	Meats	Milk	Egg	Fats	Veggie	Fruits	Other	Away
I	1.000	0.966	0.957	0.489	0.826	0.897	1.075	0.749	0.962
II	0.906	0.958	0.894	0.342	1.014	0.869	0.863	0.871	0.968
III	0.918	0.950	0.778	0.666	0.855	0.842	0.963	0.826	1.291
IV	0.879	0.919	0.852	0.818	0.910	0.943	0.976	1.101	0.857
V	0.825	0.969	0.754	0.815	0.987	0.791	0.850	0.770	0.841
VI	0.803	0.957	0.848	0.935	1.284	0.927	0.998	0.895	0.908
VII	0.792	1.017	0.777	0.911	0.897	0.747	1.072	0.889	1.029
VIII	0.799	0.883	0.831	0.922	1.191	0.840	0.985	0.959	0.947
IX	0.707	0.906	0.745	0.853	1.030	0.877	0.885	0.728	0.787
X	0.705	0.778	0.619	0.817	0.955	0.866	0.788	0.794	0.890
Aggregated	0.846	0.962	0.798	0.638	0.802	0.808	0.889	0.846	0.867
Deciles	2002 Income Elasticities								
	Cereals	Meats	Milk	Egg	Fats	Veggie	Fruits	Other	Away
I	0.802	0.869	1.090	0.742	0.720	0.810	0.883	0.827	0.791
II	0.733	0.679	0.969	0.662	0.689	0.743	0.689	0.967	0.758
III	0.726	0.713	0.900	0.718	0.788	0.714	0.612	0.991	0.770
IV	0.603	0.688	0.902	0.578	0.644	0.638	0.619	1.104	0.589
V	0.731	0.704	0.885	0.544	0.704	0.706	0.884	1.067	0.877
VI	0.720	0.665	0.864	0.677	0.839	0.860	0.750	1.051	0.781
VII	0.719	0.834	0.887	0.861	0.759	0.809	0.724	0.984	0.765
VIII	0.708	0.825	0.866	0.642	1.019	0.903	0.849	0.971	0.790
IX	0.359	0.791	0.740	0.651	0.945	0.719	0.734	0.936	0.751
X	0.483	0.628	0.595	0.694	0.609	0.686	0.626	0.619	0.640
Aggregated	0.684	0.737	0.840	0.642	0.717	0.772	0.782	0.934	0.805
Deciles	2010 Income Elasticities								
	Cereals	Meats	Milk	Egg	Fats	Veggie	Fruits	Other	Away
I	0.852	1.070	0.904	0.789	0.935	0.964	0.887	0.911	1.053
II	0.956	0.974	0.852	0.805	0.992	1.000	0.812	0.926	0.804
III	0.851	1.044	0.758	0.797	0.921	0.972	1.040	0.816	0.972
IV	0.855	0.922	0.783	0.855	1.048	0.979	0.968	0.877	0.801
V	0.823	0.981	0.794	0.876	1.064	0.968	1.031	0.890	0.933
VI	0.813	1.003	0.774	0.801	1.243	0.993	1.015	0.830	0.856
VII	0.861	0.942	0.752	0.837	1.192	0.962	0.830	0.870	0.866
VIII	0.818	0.955	0.737	0.975	1.164	0.948	0.959	0.797	0.903
IX	0.788	1.005	0.817	0.799	1.175	0.950	0.939	0.937	0.807
X	0.862	0.840	0.765	0.994	0.951	0.846	0.774	0.913	0.805
Aggregated	0.808	1.001	0.793	0.714	0.881	0.959	0.889	0.882	0.875

Table III.8 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile I

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.594	0.042	0.051	0.020	0.065	0.110	0.054	0.166	-0.071
Meats	0.168	-1.559	0.053	0.039	-0.087	0.011	0.016	0.249	0.049
Milk	0.411	0.127	-1.712	-0.081	0.165	0.037	0.042	-0.042	-0.076
Egg	0.409	0.177	-0.093	-1.526	0.437	-0.463	-0.073	0.449	-0.265
Fats	0.854	-0.283	0.294	0.476	-2.499	-0.378	-0.310	0.153	0.098
Vegetables	0.103	0.000	0.082	-0.110	0.069	-1.350	0.180	0.041	0.304
Fruits	0.873	0.105	0.089	-0.134	-0.360	-0.257	-2.256	0.293	-0.285
Other	0.295	0.178	0.038	0.116	0.069	0.106	0.083	-1.499	0.083
Food Away	-0.395	0.225	-0.133	-0.350	0.105	0.487	-0.254	0.271	-1.465
	Hicksian Price Elasticities								
Cereals	-1.241	0.183	0.119	0.065	0.104	0.235	0.087	0.444	-0.034
Meats	0.508	-1.423	0.119	0.082	-0.050	0.131	0.048	0.517	0.085
Milk	0.749	0.262	-1.647	-0.038	0.202	0.156	0.074	0.224	-0.040
Egg	0.582	0.246	-0.060	-1.504	0.456	-0.402	-0.057	0.585	-0.247
Fats	1.145	-0.167	0.350	0.513	-2.467	-0.275	-0.282	0.382	0.129
Vegetables	0.419	0.126	0.143	-0.069	0.103	-1.239	0.210	0.291	0.337
Fruits	1.253	0.257	0.162	-0.086	-0.318	-0.124	-2.220	0.592	-0.246
Other	0.559	0.284	0.089	0.149	0.098	0.199	0.108	-1.291	0.111
Food Away	-0.055	0.361	-0.067	-0.307	0.143	0.606	-0.222	0.538	-1.429
	Demographic Elasticities								
Size	0.008	-0.021	-0.072	-0.007	0.216	0.042	-0.034	0.039	-0.424
Rural	-0.056	0.054	-1.333	0.146	0.762	0.503	-1.302	0.206	-2.335
COR	0.184	-0.204	0.502	-0.856	-0.152	-0.229	-2.258	0.065	1.604
NWR	0.257	-0.116	-0.044	-0.317	2.607	-0.973	-2.369	0.073	3.719
NER	0.047	-0.351	1.547	-0.082	0.906	-0.647	-3.135	0.318	-0.522
SR	0.123	-0.037	-0.166	0.008	-0.019	-0.417	-2.093	0.165	2.062
Age	0.152	-0.055	0.034	-0.511	0.027	-0.006	0.164	0.136	0.053

Table III.9 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile II

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.635	0.047	0.090	0.102	0.072	0.150	0.004	0.220	0.004
Meats	0.148	-1.232	-0.003	0.050	-0.268	-0.010	0.017	0.140	-0.077
Milk	0.407	0.007	-1.849	-0.032	0.041	0.089	0.094	0.032	0.078
Egg	1.010	0.244	0.001	-3.127	0.812	-0.304	0.598	0.066	0.372
Fats	0.993	-1.136	0.126	1.075	-1.866	-0.367	-0.066	0.146	0.013
Vegetables	0.080	0.183	0.170	-0.161	-0.064	-1.419	-0.021	0.238	0.190
Fruits	0.109	0.074	0.188	0.514	-0.046	-0.194	-1.998	0.003	0.223
Other	0.390	0.092	0.016	0.002	0.022	0.097	0.003	-1.621	-0.013
Food Away	0.146	-0.279	0.225	0.417	0.014	-0.048	0.317	-0.097	-2.387
	Hicksian Price Elasticities								
Cereals	-1.282	0.174	0.176	0.144	0.101	0.263	0.047	0.429	0.034
Meats	0.521	-1.099	0.087	0.094	-0.238	0.108	0.062	0.360	-0.045
Milk	0.755	0.132	-1.765	0.009	0.069	0.200	0.136	0.238	0.109
Egg	1.144	0.292	0.033	-3.111	0.823	-0.262	0.615	0.145	0.383
Fats	1.388	-0.994	0.221	1.122	-1.834	-0.242	-0.018	0.379	0.047
Vegetables	0.419	0.304	0.252	-0.121	-0.036	-1.311	0.020	0.437	0.220
Fruits	0.445	0.195	0.270	0.554	-0.018	-0.088	-1.957	0.201	0.253
Other	0.730	0.214	0.098	0.042	0.050	0.205	0.044	-1.420	0.017
Food Away	0.523	-0.144	0.316	0.461	0.045	0.071	0.362	0.125	-2.354
	Demographic Elasticities								
Size	0.036	0.000	-0.083	0.256	-0.031	-0.022	-0.150	-0.001	-0.832
Rural	-0.039	-0.346	-0.232	0.405	0.980	-0.151	0.226	0.308	-0.744
COR	0.008	0.106	0.508	-0.629	-0.084	-0.121	-0.612	0.026	-0.957
NWR	-0.022	0.384	1.216	-0.440	0.222	-0.696	-2.187	0.216	-2.570
NER	0.057	-0.204	1.018	0.172	0.270	-0.837	-1.762	0.259	2.514
SR	-0.002	0.340	0.084	0.144	-0.143	-0.272	-1.721	0.065	1.520
Age	-0.012	0.070	-0.006	0.675	0.000	0.024	0.017	-0.003	0.358

Table III.10 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile III

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.555	0.050	0.090	0.004	0.040	0.120	0.070	0.193	-0.022
Meats	0.157	-1.329	0.093	-0.032	-0.069	-0.057	-0.008	0.183	-0.021
Milk	0.310	0.122	-1.807	0.029	0.109	0.089	0.039	0.197	0.027
Egg	0.138	-0.075	0.056	-1.520	0.398	0.090	-0.182	0.218	0.065
Fats	0.628	-0.287	0.399	0.512	-2.574	-0.461	-0.136	0.180	0.075
Vegetables	0.174	-0.010	0.114	0.018	0.064	-1.375	0.026	0.142	0.190
Fruits	0.479	-0.004	0.047	-0.126	-0.067	-0.042	-1.982	0.265	0.357
Other	0.357	0.131	0.120	0.052	0.040	0.067	0.090	-1.759	0.027
Food Away	-0.067	-0.008	0.065	0.076	0.080	0.059	0.503	0.082	-1.943
	Hicksian Price Elasticities								
Cereals	-1.223	0.170	0.203	0.039	0.066	0.234	0.124	0.391	0.020
Meats	0.501	-1.205	0.209	0.004	-0.042	0.061	0.049	0.388	0.022
Milk	0.592	0.224	-1.712	0.058	0.131	0.185	0.085	0.365	0.063
Egg	0.379	0.013	0.137	-1.495	0.418	0.173	-0.142	0.362	0.095
Fats	0.938	-0.175	0.504	0.545	-2.550	-0.355	-0.085	0.365	0.114
Vegetables	0.478	0.100	0.218	0.050	0.088	-1.271	0.076	0.323	0.229
Fruits	0.828	0.122	0.165	-0.089	-0.039	0.077	-1.924	0.473	0.401
Other	0.656	0.239	0.221	0.084	0.064	0.169	0.139	-1.581	0.064
Food Away	0.400	0.161	0.224	0.126	0.117	0.219	0.580	0.361	-1.884
	Demographic Elasticities								
Size	0.058	0.003	-0.017	0.087	-0.010	0.006	-0.152	-0.018	-0.607
Rural	0.105	-0.096	-0.563	-0.162	1.036	0.036	-0.040	0.177	-0.628
COR	0.058	-0.227	0.628	-0.654	0.136	-0.395	-0.594	0.266	-0.836
NWR	-0.073	-0.163	0.435	0.532	-0.509	-0.569	-1.235	0.514	1.494
NER	0.098	-0.366	0.312	0.026	0.364	-0.539	-1.116	0.538	-0.512
SR	0.072	0.227	-0.024	-0.395	0.375	-0.613	-0.749	0.248	1.252
Age	0.013	0.012	0.018	0.037	0.013	0.084	-0.144	0.011	1.535

Table III.11 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile IV

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.439	0.093	0.074	0.062	0.083	0.116	0.071	0.190	-0.007
Meats	0.202	-1.190	0.072	-0.085	-0.149	-0.079	0.073	0.113	0.010
Milk	0.146	0.075	-1.596	0.021	0.064	0.087	0.078	0.055	0.155
Egg	0.454	-0.318	0.046	-2.005	0.300	0.088	0.020	0.262	-0.050
Fats	0.885	-0.763	0.300	0.397	-2.065	-0.380	-0.054	0.349	0.031
Vegetables	0.037	-0.043	0.108	0.091	-0.021	-1.347	0.009	0.117	0.425
Fruits	0.277	0.140	0.145	0.007	-0.020	-0.211	-1.601	0.063	-0.033
Other	0.257	0.048	0.010	0.022	0.022	0.056	0.000	-1.549	-0.031
Food Away	-0.108	0.018	0.273	-0.022	0.013	0.159	-0.026	-0.031	-1.774
	Hicksian Price Elasticities								
Cereals	-1.158	0.198	0.192	0.090	0.104	0.215	0.125	0.365	0.056
Meats	0.496	-1.080	0.195	-0.055	-0.127	0.024	0.129	0.296	0.076
Milk	0.418	0.177	-1.482	0.048	0.084	0.183	0.130	0.225	0.216
Egg	0.716	-0.220	0.156	-1.979	0.319	0.181	0.070	0.426	0.009
Fats	1.176	-0.654	0.421	0.426	-2.044	-0.277	0.002	0.531	0.095
Vegetables	0.339	0.070	0.234	0.121	0.001	-1.240	0.067	0.305	0.493
Fruits	0.589	0.257	0.276	0.039	0.003	-0.101	-1.541	0.258	0.036
Other	0.609	0.180	0.158	0.057	0.048	0.180	0.068	-1.329	0.048
Food Away	0.166	0.121	0.388	0.005	0.033	0.256	0.027	0.141	-1.713
	Demographic Elasticities								
Size	0.049	0.002	0.039	0.091	0.037	-0.069	-0.088	-0.047	-0.503
Rural	0.028	-0.046	-0.292	-0.069	1.201	-0.060	0.445	0.036	-0.207
COR	0.128	-0.181	0.345	-0.547	-0.418	-0.485	-1.451	0.255	1.231
NWR	0.096	-0.301	0.433	-0.691	-0.505	-0.439	-2.221	0.431	1.587
NER	0.065	-0.351	0.599	0.085	-0.271	-0.621	-1.711	0.530	-0.130
SR	0.058	0.111	-0.162	-0.573	-0.887	-0.524	-1.646	0.428	2.424
Age	-0.033	0.006	0.131	-0.023	0.003	-0.053	-0.011	0.034	-0.356

Table III.12 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile V

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.340	0.011	0.038	0.045	0.035	0.082	0.026	0.142	0.040
Meats	0.022	-1.260	0.080	-0.089	-0.120	-0.026	0.044	0.246	0.007
Milk	0.092	0.081	-1.673	0.020	0.065	0.131	0.141	0.163	0.012
Egg	0.452	-0.310	0.045	-1.811	0.402	-0.139	0.272	0.186	-0.071
Fats	0.466	-0.559	0.345	0.531	-1.954	-0.279	-0.217	0.507	-0.370
Vegetables	-0.003	0.017	0.281	-0.036	0.077	-1.541	0.025	0.335	0.351
Fruits	0.114	0.084	0.266	0.114	-0.073	-0.026	-1.918	0.142	0.242
Other	0.205	0.145	0.112	0.038	0.065	0.104	0.059	-1.585	-0.076
Food Away	0.281	0.039	0.004	-0.051	-0.200	0.169	0.399	-0.466	-1.793
	Hicksian Price Elasticities								
Cereals	-1.055	0.121	0.177	0.073	0.057	0.177	0.094	0.356	0.081
Meats	0.358	-1.130	0.243	-0.055	-0.094	0.086	0.124	0.497	0.055
Milk	0.353	0.182	-1.546	0.046	0.085	0.218	0.203	0.359	0.050
Egg	0.734	-0.200	0.182	-1.782	0.424	-0.045	0.339	0.398	-0.031
Fats	0.808	-0.427	0.511	0.565	-1.927	-0.165	-0.136	0.763	-0.320
Vegetables	0.271	0.123	0.414	-0.009	0.098	-1.449	0.090	0.540	0.390
Fruits	0.409	0.198	0.409	0.144	-0.050	0.072	-1.848	0.362	0.284
Other	0.471	0.248	0.242	0.065	0.086	0.193	0.122	-1.385	-0.038
Food Away	0.572	0.152	0.145	-0.022	-0.178	0.266	0.468	-0.248	-1.751
	Demographic Elasticities								
Size	0.061	-0.035	-0.028	0.080	0.073	-0.012	-0.031	-0.025	-0.726
Rural	0.201	-0.122	-0.465	-0.185	0.531	0.045	-0.425	0.102	-0.036
COR	0.020	-0.359	0.530	-0.748	0.012	-0.223	-0.319	0.174	-0.553
NWR	-0.074	-0.113	0.313	0.447	1.242	-0.515	-1.241	0.542	-1.433
NER	0.004	-0.198	0.342	0.357	0.520	-0.392	-1.230	0.403	-0.901
SR	0.112	0.263	0.032	-0.345	-0.302	-0.468	-0.501	0.162	-1.159
Age	-0.006	-0.025	-0.004	-0.004	0.148	0.109	-0.047	-0.109	0.104

Table III.13 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile VI

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.374	0.042	0.123	0.038	0.106	0.114	0.097	0.197	0.038
Meats	0.022	-1.226	0.085	-0.025	-0.161	-0.017	0.013	0.205	0.005
Milk	0.171	0.077	-1.585	0.028	0.029	0.084	0.093	0.066	0.016
Egg	0.063	-0.073	0.101	-1.929	0.228	0.039	0.107	0.336	-0.116
Fats	1.145	-1.029	0.205	0.433	-2.887	-0.155	0.271	0.507	-0.290
Vegetables	-0.085	0.032	0.197	0.068	0.107	-1.411	0.220	-0.004	0.218
Fruits	0.227	0.029	0.167	0.046	0.060	-0.076	-2.086	0.194	0.047
Other	0.203	0.114	0.041	0.050	0.040	0.109	0.069	-1.597	0.070
Food Away	0.034	0.020	0.026	-0.056	-0.081	-0.081	0.058	0.239	-1.616
	Hicksian Price Elasticities								
Cereals	-1.148	0.143	0.252	0.065	0.121	0.207	0.164	0.383	0.093
Meats	0.291	-1.106	0.238	0.008	-0.143	0.094	0.093	0.426	0.071
Milk	0.409	0.184	-1.450	0.057	0.045	0.182	0.164	0.262	0.075
Egg	0.326	0.044	0.250	-1.897	0.246	0.147	0.185	0.552	-0.052
Fats	1.506	-0.867	0.410	0.477	-2.863	-0.007	0.379	0.803	-0.201
Vegetables	0.176	0.148	0.345	0.100	0.124	-1.303	0.297	0.211	0.282
Fruits	0.508	0.154	0.326	0.080	0.079	0.040	-2.002	0.425	0.116
Other	0.455	0.226	0.184	0.081	0.057	0.212	0.144	-1.390	0.132
Food Away	0.289	0.135	0.171	-0.024	-0.064	0.024	0.134	0.449	-1.553
	Demographic Elasticities								
Size	0.069	-0.013	0.009	0.055	-0.026	-0.043	-0.106	-0.044	-0.507
Rural	-0.026	-0.016	-0.456	0.047	1.225	0.041	-0.171	0.156	1.145
COR	0.015	-0.151	0.201	-0.738	0.483	-0.292	-0.694	0.213	1.177
NWR	-0.066	-0.045	-0.053	0.458	-0.018	-0.318	-1.065	0.448	0.452
NER	0.084	-0.079	0.388	0.156	0.218	-0.631	-1.806	0.459	-0.709
SR	0.102	0.347	-0.427	0.164	-0.155	-0.489	-0.953	0.174	2.640
Age	0.015	-0.003	0.000	0.016	0.221	-0.075	-0.028	-0.004	0.029

Table III.14 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile VII

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.390	0.134	0.106	0.049	0.082	0.072	0.029	0.198	0.048
Meats	0.245	-1.201	0.070	-0.082	-0.262	-0.111	-0.061	0.224	-0.026
Milk	0.152	0.072	-1.710	0.028	0.042	0.078	0.074	0.130	0.179
Egg	0.223	-0.299	0.068	-2.071	0.519	0.271	-0.163	0.238	0.184
Fats	0.768	-1.477	0.214	0.738	-1.275	-0.117	-0.205	0.391	0.021
Vegetables	-0.078	0.098	0.328	0.157	0.032	-1.276	0.096	0.365	0.091
Fruits	0.030	-0.084	0.163	-0.061	-0.052	-0.003	-1.413	0.345	0.138
Other	0.212	0.120	0.080	0.026	0.031	0.083	0.091	-1.608	-0.126
Food Away	0.151	0.014	0.483	0.135	0.055	0.035	0.177	-0.388	-1.282
	Hicksian Price Elasticities								
Cereals	-1.149	0.237	0.248	0.074	0.099	0.158	0.084	0.389	0.101
Meats	0.554	-1.068	0.252	-0.049	-0.239	-0.001	0.010	0.470	0.042
Milk	0.388	0.173	-1.570	0.052	0.060	0.163	0.128	0.318	0.231
Egg	0.500	-0.181	0.231	-2.042	0.539	0.370	-0.100	0.459	0.245
Fats	1.041	-1.361	0.375	0.766	-1.255	-0.019	-0.143	0.608	0.081
Vegetables	0.150	0.195	0.462	0.180	0.049	-1.195	0.148	0.546	0.141
Fruits	0.356	0.055	0.356	-0.027	-0.028	0.113	-1.338	0.604	0.209
Other	0.482	0.236	0.240	0.055	0.051	0.180	0.153	-1.393	-0.066
Food Away	0.464	0.148	0.668	0.168	0.078	0.147	0.249	-0.139	-1.213
	Demographic Elasticities								
Size	0.087	-0.063	0.044	0.056	0.050	-0.005	-0.210	-0.005	-0.781
Rural	0.074	-0.090	-0.417	0.404	0.954	-0.033	0.174	0.026	0.525
COR	0.087	-0.096	0.442	-0.626	-0.278	-0.281	-1.156	0.274	-2.063
NWR	0.113	-0.115	0.318	-0.193	0.142	-0.628	-1.233	0.311	0.158
NER	0.037	-0.031	0.209	0.097	-0.198	-0.701	-1.439	0.545	-0.770
SR	0.227	0.257	0.020	-0.373	-0.524	-0.577	-1.017	0.068	0.555
Age	0.052	0.041	0.255	-0.025	0.004	0.032	-0.172	0.058	0.287

Table III.15 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile VIII

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.208	-0.035	0.129	0.069	0.058	0.076	0.079	0.136	0.011
Meats	-0.131	-1.287	0.176	-0.041	-0.101	0.063	-0.087	0.310	0.075
Milk	0.163	0.135	-1.586	0.039	0.009	0.052	0.145	0.047	0.053
Egg	0.393	-0.184	0.190	-1.853	0.285	-0.112	-0.097	0.146	0.151
Fats	0.478	-0.735	0.024	0.472	-2.218	0.082	0.053	0.454	0.080
Vegetables	-0.029	0.122	0.108	0.012	0.091	-1.456	0.253	0.305	0.037
Fruits	0.180	-0.140	0.314	-0.032	0.014	-0.063	-1.976	0.247	0.091
Other	0.096	0.135	0.012	0.002	0.016	0.106	0.057	-1.483	-0.064
Food Away	-0.058	0.118	0.097	0.051	0.013	-0.013	0.082	-0.172	-1.182
	Hicksian Price Elasticities								
Cereals	-0.998	0.065	0.267	0.092	0.072	0.163	0.140	0.344	0.073
Meats	0.102	-1.176	0.328	-0.016	-0.086	0.159	-0.020	0.540	0.144
Milk	0.382	0.240	-1.442	0.062	0.024	0.142	0.209	0.264	0.118
Egg	0.636	-0.068	0.350	-1.827	0.300	-0.011	-0.026	0.387	0.222
Fats	0.792	-0.586	0.230	0.506	-2.198	0.212	0.144	0.765	0.173
Vegetables	0.192	0.227	0.253	0.036	0.106	-1.365	0.317	0.524	0.102
Fruits	0.440	-0.017	0.484	-0.004	0.031	0.044	-1.901	0.504	0.167
Other	0.348	0.255	0.178	0.029	0.032	0.211	0.131	-1.232	0.011
Food Away	0.191	0.236	0.261	0.077	0.029	0.090	0.154	0.075	-1.109
	Demographic Elasticities								
Size	0.072	-0.047	0.001	-0.036	0.025	-0.027	-0.215	-0.007	-0.087
Rural	0.102	-0.052	-0.375	0.538	2.341	-0.050	-0.228	-0.024	0.897
COR	0.027	0.019	0.256	-0.571	0.123	-0.159	-0.655	0.077	-0.535
NWR	-0.112	-0.299	0.115	0.276	-0.465	-0.112	-1.007	0.475	-0.972
NER	-0.020	-0.114	0.035	0.009	0.958	-0.504	-1.136	0.468	-0.502
SR	0.096	0.186	-0.096	-0.389	0.376	-0.320	-0.361	0.091	-0.114
Age	-0.035	0.000	0.042	-0.005	-0.036	0.009	-0.059	0.095	0.066

Table III.16 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile IX

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.206	-0.007	0.130	0.038	0.045	0.010	0.066	0.204	-0.028
Meats	-0.067	-1.297	0.014	-0.039	-0.082	0.074	0.006	0.297	0.002
Milk	0.133	0.017	-1.644	-0.001	0.029	0.020	0.129	0.216	0.022
Egg	0.135	-0.143	-0.032	-1.535	-0.190	0.100	0.121	0.318	0.080
Fats	0.366	-0.608	0.344	-0.342	-2.562	0.327	0.160	0.645	0.098
Vegetables	-0.189	0.075	0.195	0.014	0.085	-1.429	-0.131	0.097	0.148
Fruits	0.120	0.022	0.281	0.041	0.030	-0.197	-1.656	0.184	0.106
Other	0.161	0.141	0.157	0.049	0.052	0.131	0.073	-1.546	0.031
Food Away	-0.121	0.011	0.035	0.021	0.013	0.054	0.089	0.029	-1.282
	Hicksian Price Elasticities								
Cereals	-1.026	0.084	0.278	0.058	0.056	0.087	0.134	0.435	0.048
Meats	0.164	-1.180	0.205	-0.013	-0.068	0.173	0.092	0.594	0.100
Milk	0.323	0.113	-1.487	0.021	0.041	0.101	0.201	0.460	0.102
Egg	0.352	-0.033	0.147	-1.510	-0.177	0.193	0.202	0.597	0.172
Fats	0.628	-0.475	0.560	-0.312	-2.546	0.439	0.258	0.982	0.210
Vegetables	0.034	0.188	0.379	0.039	0.099	-1.334	-0.047	0.384	0.243
Fruits	0.345	0.136	0.467	0.066	0.044	-0.101	-1.572	0.473	0.202
Other	0.347	0.235	0.310	0.070	0.063	0.211	0.143	-1.307	0.109
Food Away	0.079	0.113	0.200	0.043	0.025	0.140	0.165	0.287	-1.197
	Demographic Elasticities								
Size	0.081	-0.054	0.034	0.089	-0.100	-0.097	-0.070	-0.003	-0.452
Rural	0.105	-0.091	-0.600	0.607	2.592	0.263	-0.136	-0.093	1.524
COR	0.057	-0.150	0.077	-0.606	-0.104	-0.211	-0.714	0.218	-0.136
NWR	0.022	0.052	0.444	0.000	-0.146	-0.390	-1.694	0.310	-1.667
NER	0.086	-0.123	-0.086	0.021	0.251	-0.280	-1.162	0.435	-1.668
SR	0.151	0.326	-0.667	-0.382	0.851	-0.274	-0.321	0.093	1.341
Age	-0.106	-0.014	0.016	-0.029	-0.034	-0.230	-0.121	0.017	-0.013

Table III.17 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 1994, Decile X

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.292	-0.060	0.112	0.006	0.019	0.122	0.032	0.225	0.009
Meats	-0.108	-1.218	-0.021	0.010	-0.081	0.030	0.090	0.282	0.086
Milk	0.123	0.034	-1.529	0.071	0.079	0.079	0.211	0.205	0.073
Egg	-0.061	0.053	0.232	-1.818	0.298	-0.167	0.078	0.396	0.026
Fats	0.054	-0.734	0.542	0.546	-2.310	-0.105	0.542	0.513	0.005
Vegetables	0.057	-0.113	0.134	-0.108	-0.079	-1.300	0.050	0.002	-0.041
Fruits	0.028	0.103	0.333	0.018	0.068	-0.178	-1.866	0.201	0.015
Other	0.124	0.115	0.116	0.028	0.018	0.080	0.070	-1.514	-0.024
Food Away	0.037	0.102	0.077	0.047	0.043	0.014	0.052	0.014	-1.037
	Hicksian Price Elasticities								
Cereals	-1.161	0.031	0.273	0.025	0.029	0.198	0.112	0.438	0.143
Meats	0.036	-1.118	0.157	0.030	-0.070	0.114	0.179	0.516	0.234
Milk	0.238	0.113	-1.388	0.087	0.087	0.146	0.282	0.392	0.191
Egg	0.090	0.159	0.418	-1.797	0.310	-0.079	0.171	0.642	0.181
Fats	0.230	-0.611	0.760	0.571	-2.296	-0.002	0.651	0.801	0.187
Vegetables	0.218	-0.002	0.332	-0.085	-0.067	-1.207	0.149	0.263	0.124
Fruits	0.174	0.205	0.513	0.039	0.079	-0.094	-1.776	0.438	0.165
Other	0.271	0.218	0.297	0.049	0.030	0.166	0.160	-1.275	0.127
Food Away	0.202	0.216	0.280	0.070	0.056	0.110	0.153	0.282	-0.868
	Demographic Elasticities								
Size	0.103	0.005	0.099	0.036	-0.153	-0.059	-0.018	-0.039	-0.433
Rural	0.367	0.057	-0.572	-0.098	1.929	-0.011	-0.716	0.051	0.449
COR	0.268	-0.073	0.537	-0.308	1.016	-0.525	-0.225	0.080	-1.550
NWR	0.091	-0.392	0.440	-0.424	-0.480	-0.331	0.003	0.243	-1.153
NER	0.143	-0.285	0.104	-0.193	0.978	-0.192	-0.951	0.516	-1.845
SR	0.281	0.190	0.189	-0.377	0.335	-0.559	-0.534	0.145	-1.036
Age	-0.010	-0.008	0.145	-0.001	0.005	-0.023	0.007	0.016	0.256

Table III.18 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile I

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.628	0.140	0.092	0.066	0.147	0.145	0.081	0.229	-0.006
Meats	0.338	-1.677	0.008	-0.093	-0.103	0.104	0.035	0.191	0.084
Milk	0.339	0.004	-1.580	-0.064	-0.077	-0.042	-0.094	0.216	-0.017
Egg	0.438	-0.267	-0.087	-2.091	0.504	0.213	0.254	0.044	-0.082
Fats	1.301	-0.354	-0.130	0.604	-2.779	-0.539	-0.344	0.162	0.022
Vegetables	-0.063	0.202	0.102	0.111	0.166	-1.231	0.097	-0.104	0.080
Fruits	0.799	0.171	-0.203	0.368	-0.418	-0.359	-2.043	0.055	-0.086
Other	0.252	0.087	0.062	0.008	0.021	0.019	0.008	-1.458	0.085
Food Away	-0.222	0.408	-0.006	-0.128	0.024	-0.437	-0.094	0.888	-2.196
	Hicksian Price Elasticities								
Cereals	-1.330	0.252	0.159	0.103	0.178	0.252	0.106	0.489	0.018
Meats	0.661	-1.556	0.080	-0.052	-0.069	0.220	0.063	0.472	0.110
Milk	0.745	0.156	-1.489	-0.014	-0.035	0.103	-0.059	0.569	0.016
Egg	0.714	-0.163	-0.025	-2.057	0.532	0.313	0.278	0.284	-0.059
Fats	1.568	-0.253	-0.070	0.638	-2.752	-0.443	-0.321	0.395	0.044
Vegetables	0.239	0.316	0.170	0.148	0.197	-1.123	0.123	0.158	0.105
Fruits	1.128	0.294	-0.129	0.409	-0.384	-0.241	-2.015	0.341	-0.059
Other	0.560	0.202	0.131	0.047	0.053	0.129	0.034	-1.191	0.110
Food Away	0.072	0.519	0.060	-0.092	0.054	-0.332	-0.069	1.144	-2.173
	Demographic Elasticities								
Size	0.008	0.001	-0.159	0.098	0.129	0.042	-0.122	0.021	-0.382
Rural	-0.034	0.145	-0.434	-0.339	1.176	0.088	0.133	0.051	-1.176
COR	0.048	-0.168	0.733	-0.315	-0.133	-0.473	-0.680	0.173	-1.312
NWR	-0.011	-0.143	0.277	0.220	1.648	-0.526	-2.557	0.353	-2.149
NER	0.009	-0.144	1.100	0.277	-0.686	-0.672	-1.561	0.270	-2.403
SR	0.029	0.255	-0.451	0.160	0.295	-0.424	-1.539	0.224	-0.561
Age	-0.036	-0.076	0.011	-0.065	0.026	0.039	0.027	0.031	-0.322

Table III.19 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile II

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.553	0.107	0.078	0.083	0.078	0.234	0.041	0.223	0.060
Meats	0.231	-1.430	0.057	-0.114	-0.057	0.106	0.133	0.159	0.042
Milk	0.183	0.049	-1.475	-0.038	0.007	0.085	-0.047	0.066	-0.008
Egg	0.550	-0.482	-0.088	-1.303	0.046	0.040	0.134	0.062	0.026
Fats	0.594	-0.335	0.033	0.048	-1.735	-0.219	0.303	0.102	-0.128
Vegetables	0.314	0.158	0.200	0.055	0.055	-1.743	0.167	0.184	0.146
Fruits	0.119	0.368	-0.101	0.114	0.224	0.073	-2.061	-0.147	0.053
Other	0.176	0.017	-0.020	-0.034	-0.031	0.021	-0.060	-1.410	-0.028
Food Away	0.237	0.064	-0.011	0.016	-0.081	-0.159	0.044	0.084	-1.684
	Hicksian Price Elasticities								
Cereals	-1.281	0.207	0.152	0.111	0.101	0.336	0.073	0.468	0.096
Meats	0.483	-1.337	0.125	-0.089	-0.036	0.201	0.162	0.386	0.075
Milk	0.542	0.182	-1.378	-0.002	0.038	0.220	-0.006	0.390	0.039
Egg	0.796	-0.391	-0.022	-1.278	0.066	0.132	0.162	0.283	0.059
Fats	0.850	-0.240	0.102	0.074	-1.713	-0.123	0.332	0.332	-0.094
Vegetables	0.590	0.260	0.274	0.083	0.078	-1.640	0.199	0.433	0.183
Fruits	0.375	0.463	-0.032	0.140	0.245	0.169	-2.032	0.083	0.087
Other	0.535	0.150	0.077	0.002	-0.001	0.156	-0.018	-1.086	0.020
Food Away	0.518	0.168	0.065	0.044	-0.057	-0.053	0.076	0.337	-1.647
	Demographic Elasticities								
Size	0.050	0.087	-0.073	0.097	0.004	-0.036	-0.129	-0.061	-0.588
Rural	0.051	-0.012	-0.620	-0.127	1.807	0.078	0.059	0.015	-0.607
COR	0.159	-0.197	0.685	-0.408	-0.273	-0.822	-2.108	0.252	0.710
NWR	-0.074	-0.121	0.711	-0.346	-0.779	-0.767	-2.099	0.434	1.752
NER	0.124	-0.369	0.892	0.287	-0.364	-0.947	-2.025	0.375	-0.681
SR	0.038	0.251	-0.186	-0.080	0.225	-0.589	-1.695	0.238	0.868
Age	0.134	0.065	0.022	0.006	-0.070	0.170	0.035	-0.108	-0.274

Table III.20 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile III

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.474	0.106	0.128	0.074	0.098	0.170	0.076	0.196	0.000
Meats	0.229	-1.497	0.018	-0.039	0.039	0.076	0.134	0.146	0.053
Milk	0.247	-0.004	-1.556	-0.012	-0.004	0.069	-0.025	0.144	-0.022
Egg	0.385	-0.159	-0.007	-1.324	-0.241	-0.136	0.082	0.203	-0.030
Fats	1.029	0.142	0.028	-0.409	-2.146	-0.902	0.453	0.313	-0.390
Vegetables	0.209	0.052	0.203	0.070	0.033	-1.364	0.085	0.017	0.180
Fruits	0.301	0.288	-0.028	0.068	0.206	-0.052	-1.768	-0.052	-0.045
Other	0.140	0.010	0.023	-0.016	-0.017	-0.004	-0.049	-1.423	0.028
Food Away	-0.223	0.093	-0.029	-0.022	-0.166	0.015	-0.054	0.414	-1.342
	Hicksian Price Elasticities								
Cereals	-1.214	0.194	0.224	0.102	0.115	0.262	0.114	0.435	0.038
Meats	0.486	-1.410	0.113	-0.011	0.056	0.166	0.172	0.381	0.091
Milk	0.571	0.105	-1.437	0.023	0.016	0.183	0.023	0.440	0.026
Egg	0.643	-0.072	0.089	-1.297	-0.225	-0.046	0.120	0.439	0.008
Fats	1.313	0.238	0.133	-0.379	-2.128	-0.803	0.494	0.572	-0.347
Vegetables	0.465	0.138	0.298	0.097	0.049	-1.274	0.123	0.251	0.218
Fruits	0.521	0.362	0.053	0.092	0.220	0.025	-1.736	0.149	-0.013
Other	0.496	0.130	0.154	0.023	0.006	0.121	0.004	-1.097	0.081
Food Away	0.054	0.186	0.073	0.008	-0.148	0.112	-0.013	0.668	-1.300
	Demographic Elasticities								
Size	0.033	0.038	-0.047	0.050	0.145	0.017	-0.123	-0.080	-0.531
Rural	0.057	-0.012	-0.351	-0.217	1.686	0.112	0.124	-0.052	0.252
COR	0.092	-0.213	0.164	-0.524	0.952	-0.327	-0.013	0.098	-0.733
NWR	0.099	-0.218	0.154	-0.112	0.341	-0.599	-1.454	0.307	0.017
NER	0.109	-0.310	0.060	0.171	0.706	-0.583	-1.203	0.321	-0.385
SR	0.026	0.437	-0.401	-0.071	0.523	-0.395	-0.881	0.173	0.436
Age	-0.153	0.073	0.021	-0.026	-0.011	0.270	-0.074	-0.626	-0.129

Table III.21 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile IV

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.304	0.174	0.133	0.089	0.109	0.175	0.121	0.221	0.055
Meats	0.264	-1.387	0.002	-0.072	-0.055	0.080	0.019	0.161	0.069
Milk	0.108	-0.021	-1.326	-0.046	-0.010	0.020	0.067	0.039	0.083
Egg	0.080	-0.272	-0.131	-1.325	0.126	0.280	0.083	0.135	0.103
Fats	0.457	-0.424	-0.001	0.218	-1.233	-0.213	-0.055	0.169	0.052
Vegetables	0.192	0.181	0.097	0.148	0.036	-1.467	0.198	0.194	0.183
Fruits	0.231	0.015	0.198	0.054	-0.012	-0.047	-1.806	0.131	-0.036
Other	0.090	0.014	-0.016	-0.022	-0.026	0.011	-0.015	-1.303	-0.045
Food Away	-0.127	0.130	0.247	0.076	0.033	0.062	-0.027	-0.045	-1.409
	Hicksian Price Elasticities								
Cereals	-1.106	0.248	0.221	0.111	0.121	0.249	0.156	0.442	0.090
Meats	0.490	-1.303	0.102	-0.046	-0.041	0.165	0.059	0.414	0.110
Milk	0.403	0.090	-1.194	-0.012	0.008	0.131	0.120	0.370	0.136
Egg	0.269	-0.201	-0.046	-1.304	0.137	0.351	0.116	0.347	0.137
Fats	0.668	-0.345	0.093	0.243	-1.220	-0.133	-0.017	0.406	0.090
Vegetables	0.401	0.259	0.190	0.172	0.049	-1.388	0.235	0.428	0.220
Fruits	0.433	0.091	0.288	0.077	0.000	0.029	-1.770	0.359	0.000
Other	0.452	0.149	0.145	0.020	-0.003	0.147	0.050	-0.898	0.020
Food Away	0.066	0.202	0.333	0.098	0.045	0.135	0.007	0.171	-1.374
	Demographic Elasticities								
Size	0.086	0.032	-0.042	0.182	0.250	-0.093	-0.108	-0.088	-0.585
Rural	0.007	0.013	-0.587	-0.093	1.951	0.177	-0.064	0.033	0.616
COR	0.037	-0.164	0.157	-0.276	-0.334	-0.390	-0.601	0.162	0.670
NWR	0.001	-0.206	0.149	-0.132	0.977	-0.328	-1.139	0.229	0.108
NER	0.182	-0.059	0.256	-0.041	0.395	-0.778	-1.633	0.251	-0.842
SR	0.036	0.310	-0.573	0.011	0.113	-0.390	-1.218	0.246	0.798
Age	-0.246	0.111	-0.228	0.118	0.023	0.366	-0.067	0.172	-0.813

Table III.22 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile V

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.386	0.088	0.139	0.045	0.045	0.146	0.083	0.195	0.055
Meats	0.133	-1.282	0.036	-0.072	-0.083	0.116	0.104	0.150	0.031
Milk	0.188	0.008	-1.493	-0.010	0.038	0.022	-0.024	0.177	0.004
Egg	0.066	-0.346	-0.012	-0.931	0.374	0.098	0.033	0.077	-0.086
Fats	0.107	-0.858	0.412	0.771	-1.318	0.030	-0.271	0.122	0.054
Vegetables	0.161	0.206	0.141	0.035	0.052	-1.267	-0.040	0.105	0.138
Fruits	0.208	0.169	-0.048	0.010	-0.070	-0.263	-1.293	0.136	0.077
Other	0.097	0.011	0.044	-0.031	-0.031	-0.008	-0.012	-1.369	-0.026
Food Away	0.103	0.028	0.030	-0.073	0.019	-0.061	0.107	0.086	-1.543
	Hicksian Price Elasticities								
Cereals	-1.175	0.181	0.249	0.069	0.056	0.240	0.128	0.439	0.087
Meats	0.336	-1.193	0.141	-0.049	-0.072	0.206	0.147	0.386	0.063
Milk	0.443	0.120	-1.360	0.019	0.052	0.136	0.030	0.473	0.044
Egg	0.223	-0.277	0.069	-0.913	0.382	0.168	0.067	0.259	-0.062
Fats	0.310	-0.769	0.517	0.794	-1.307	0.121	-0.228	0.358	0.086
Vegetables	0.365	0.295	0.246	0.058	0.063	-1.176	0.004	0.342	0.170
Fruits	0.463	0.281	0.084	0.039	-0.056	-0.150	-1.239	0.432	0.116
Other	0.404	0.146	0.204	0.004	-0.015	0.130	0.053	-1.012	0.022
Food Away	0.356	0.139	0.161	-0.044	0.033	0.052	0.160	0.380	-1.504
	Demographic Elasticities								
Size	0.113	0.053	-0.070	0.192	0.154	-0.060	-0.132	-0.079	-0.548
Rural	0.022	-0.025	-0.231	-0.128	1.471	0.007	-0.337	0.096	0.138
COR	0.188	-0.251	0.199	-0.154	-0.669	-0.314	-0.363	0.070	-0.350
NWR	0.159	-0.245	0.306	0.041	0.047	-0.509	-1.501	0.291	-0.990
NER	0.182	-0.309	0.176	0.184	0.191	-0.692	-1.273	0.373	-0.799
SR	0.117	0.143	-0.317	-0.040	-0.336	-0.491	-1.059	0.253	1.361
Age	0.088	0.032	-0.008	-0.167	0.012	0.258	-0.022	-0.144	0.098

Table III.23 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile VI

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.361	0.068	0.128	0.058	0.076	0.143	0.072	0.241	0.060
Meats	0.078	-1.050	0.053	0.001	-0.169	-0.059	0.101	0.161	0.065
Milk	0.154	0.020	-1.337	0.018	0.011	0.038	-0.047	0.079	-0.034
Egg	0.117	-0.095	0.101	-1.613	0.355	-0.020	-0.021	0.200	0.071
Fats	0.528	-1.452	0.118	0.668	-1.419	-0.065	0.121	0.481	-0.026
Vegetables	0.075	-0.028	0.168	-0.020	-0.006	-1.428	0.097	0.131	0.239
Fruits	0.145	0.178	-0.129	-0.013	0.042	0.041	-1.441	-0.004	0.041
Other	0.120	0.008	-0.003	-0.020	-0.015	0.006	-0.038	-1.338	-0.049
Food Away	0.066	0.075	-0.077	0.033	-0.005	0.122	0.032	-0.069	-1.465
	Hicksian Price Elasticities								
Cereals	-1.156	0.154	0.235	0.081	0.088	0.221	0.108	0.497	0.105
Meats	0.267	-0.970	0.152	0.021	-0.158	0.013	0.135	0.397	0.106
Milk	0.401	0.123	-1.209	0.045	0.025	0.131	-0.003	0.386	0.019
Egg	0.310	-0.014	0.201	-1.592	0.366	0.053	0.013	0.440	0.112
Fats	0.767	-1.352	0.242	0.694	-1.405	0.025	0.163	0.780	0.026
Vegetables	0.320	0.074	0.296	0.006	0.008	-1.335	0.141	0.436	0.292
Fruits	0.359	0.268	-0.018	0.010	0.055	0.122	-1.403	0.262	0.088
Other	0.419	0.134	0.153	0.013	0.002	0.119	0.016	-0.964	0.016
Food Away	0.288	0.168	0.039	0.058	0.007	0.206	0.072	0.209	-1.417
	Demographic Elasticities								
Size	0.081	0.061	0.000	0.147	0.068	-0.108	-0.050	-0.046	-0.409
Rural	0.233	-0.274	-0.580	-0.038	1.254	0.048	0.528	-0.022	0.762
COR	0.116	-0.064	0.094	-0.348	0.190	-0.501	-0.985	0.216	-0.872
NWR	0.150	-0.266	0.188	-0.073	0.466	-0.593	-1.640	0.194	0.513
NER	0.016	-0.124	0.233	0.140	0.695	-0.720	-1.751	0.414	-1.555
SR	0.161	0.328	-0.568	-0.356	0.369	-0.454	-1.377	0.248	-0.018
Age	0.087	0.139	0.011	0.053	0.013	-0.033	0.037	0.135	-0.347

Table III.24 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile VII

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.333	0.081	0.083	0.126	0.097	0.145	0.102	0.149	-0.023
Meats	0.095	-1.275	-0.017	-0.015	-0.158	0.036	0.127	0.166	0.036
Milk	0.066	-0.017	-1.535	-0.021	-0.001	0.069	0.083	0.200	0.051
Egg	0.791	-0.067	-0.094	-2.667	0.268	0.262	0.016	0.120	-0.087
Fats	0.916	-1.104	0.038	0.472	-2.016	0.246	0.352	-0.157	-0.144
Vegetables	0.122	0.067	0.207	0.192	0.107	-1.411	0.002	0.014	-0.014
Fruits	0.281	0.246	0.241	0.015	0.103	-0.231	-1.674	-0.063	-0.063
Other	0.055	0.025	0.066	-0.019	-0.036	0.017	-0.041	-1.319	0.038
Food Away	-0.266	0.065	0.142	-0.036	-0.034	-0.107	-0.063	0.370	-1.098
	Hicksian Price Elasticities								
Cereals	-1.140	0.163	0.199	0.147	0.109	0.229	0.146	0.399	0.023
Meats	0.319	-1.179	0.118	0.009	-0.144	0.134	0.177	0.456	0.089
Milk	0.305	0.085	-1.392	0.005	0.014	0.173	0.137	0.509	0.107
Egg	1.023	0.032	0.045	-2.642	0.282	0.363	0.068	0.420	-0.032
Fats	1.121	-1.017	0.160	0.494	-2.003	0.335	0.398	0.107	-0.096
Vegetables	0.341	0.160	0.338	0.216	0.120	-1.316	0.051	0.296	0.038
Fruits	0.476	0.329	0.358	0.036	0.115	-0.146	-1.631	0.189	-0.017
Other	0.320	0.138	0.225	0.010	-0.020	0.132	0.018	-0.976	0.101
Food Away	-0.059	0.153	0.266	-0.013	-0.022	-0.017	-0.017	0.636	-1.049
	Demographic Elasticities								
Size	0.060	0.001	0.000	0.102	-0.233	-0.096	0.001	-0.114	-0.475
Rural	0.118	-0.176	-0.261	0.047	2.430	-0.155	0.240	-0.031	0.646
COR	0.078	-0.185	0.250	-0.100	-0.492	-0.171	-0.762	0.115	-1.039
NWR	-0.004	0.012	0.160	0.040	-0.244	-0.420	-1.453	0.266	-0.459
NER	0.089	-0.145	-0.047	0.997	-0.164	-0.539	-1.320	0.353	-1.554
SR	0.043	0.068	-0.347	-0.305	1.024	-0.262	-1.175	0.234	0.449
Age	-0.368	0.009	-0.056	0.019	-0.029	-0.019	-0.089	-0.547	-0.121

Table III.25 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile VIII

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.269	0.119	0.177	0.078	0.057	0.036	0.099	0.153	0.027
Meats	0.171	-1.399	0.008	-0.036	-0.244	0.077	0.034	0.229	0.039
Milk	0.168	0.002	-1.321	-0.012	0.012	0.002	-0.030	0.140	-0.078
Egg	0.334	-0.171	-0.086	-1.512	-0.248	0.209	0.173	0.054	-0.115
Fats	0.237	-2.054	0.186	-0.473	0.063	0.689	-0.048	0.693	-0.007
Vegetables	-0.223	0.221	0.194	0.124	0.033	-1.401	0.120	0.013	0.022
Fruits	0.193	0.047	-0.082	0.061	-0.009	-0.111	-1.640	0.220	0.000
Other	0.045	0.039	0.046	-0.023	-0.002	0.044	0.014	-1.360	0.019
Food Away	-0.062	0.060	-0.221	-0.041	0.002	0.001	0.003	0.261	-1.043
	Hicksian Price Elasticities								
Cereals	-1.100	0.194	0.310	0.095	0.066	0.107	0.146	0.411	0.073
Meats	0.368	-1.312	0.163	-0.016	-0.234	0.160	0.089	0.529	0.092
Milk	0.374	0.093	-1.159	0.008	0.023	0.089	0.028	0.454	-0.022
Egg	0.487	-0.103	0.034	-1.496	-0.240	0.274	0.217	0.287	-0.073
Fats	0.480	-1.946	0.377	-0.449	0.076	0.791	0.020	1.064	0.059
Vegetables	-0.008	0.317	0.363	0.145	0.044	-1.311	0.181	0.341	0.081
Fruits	0.396	0.137	0.077	0.082	0.001	-0.026	-1.583	0.528	0.055
Other	0.277	0.142	0.228	0.000	0.010	0.141	0.079	-1.007	0.082
Food Away	0.127	0.144	-0.072	-0.022	0.012	0.080	0.056	0.548	-0.992
	Demographic Elasticities								
Size	0.073	0.056	-0.058	0.269	0.048	-0.033	-0.191	-0.050	-0.401
Rural	0.332	0.187	-0.434	-0.067	-0.527	0.220	0.053	-0.139	-0.339
COR	0.129	-0.164	0.457	-0.607	0.386	-0.292	-0.757	-0.084	0.044
NWR	-0.097	0.037	0.202	0.507	1.048	-0.355	-1.060	0.146	-0.294
NER	0.060	-0.015	0.023	-0.098	-0.801	-0.429	-1.525	0.329	-1.489
SR	0.075	0.227	-0.280	-0.700	-1.200	-0.191	-1.026	0.211	-0.184
Age	-0.107	0.030	0.011	-0.105	0.010	-0.026	0.006	-0.332	-0.059

Table III.26 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile IX

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.270	0.213	0.406	0.196	0.235	0.275	0.290	0.265	0.140
Meats	0.064	-1.164	-0.042	-0.036	-0.190	0.038	-0.101	0.197	0.024
Milk	0.308	-0.024	-1.559	-0.039	-0.020	0.023	0.054	0.124	0.020
Egg	0.153	-0.134	-0.268	-1.199	0.145	0.162	0.040	0.087	-0.008
Fats	1.306	-2.000	-0.319	0.347	-1.503	0.245	-0.349	0.782	-0.185
Vegetables	-0.053	0.223	0.220	0.053	0.097	-1.318	-0.012	0.029	-0.200
Fruits	0.340	-0.135	0.125	0.012	-0.046	-0.252	-1.927	0.337	0.314
Other	0.013	0.017	0.017	-0.034	-0.019	0.003	0.028	-1.282	-0.057
Food Away	-0.113	0.038	0.045	-0.002	-0.020	-0.026	0.281	-0.081	-0.897
	Hicksian Price Elasticities								
Cereals	-1.173	0.257	0.477	0.206	0.239	0.316	0.321	0.423	0.175
Meats	0.280	-1.067	0.114	-0.015	-0.181	0.129	-0.033	0.545	0.101
Milk	0.509	0.066	-1.413	-0.019	-0.011	0.108	0.118	0.450	0.092
Egg	0.330	-0.055	-0.139	-1.182	0.153	0.237	0.097	0.374	0.056
Fats	1.563	-1.885	-0.133	0.373	-1.492	0.353	-0.267	1.198	-0.093
Vegetables	0.143	0.311	0.362	0.073	0.105	-1.235	0.051	0.345	-0.130
Fruits	0.540	-0.045	0.270	0.032	-0.037	-0.168	-1.863	0.660	0.386
Other	0.267	0.131	0.202	-0.008	-0.008	0.110	0.109	-0.870	0.034
Food Away	0.091	0.130	0.193	0.019	-0.012	0.060	0.346	0.249	-0.824
	Demographic Elasticities								
Size	0.036	0.030	0.035	0.198	0.079	-0.139	-0.121	-0.040	-0.518
Rural	0.158	0.087	0.027	0.244	0.365	0.039	0.188	-0.162	-0.370
COR	0.415	-0.394	-0.015	-0.785	-0.559	-0.336	-1.228	0.138	-0.631
NWR	-0.030	0.120	0.079	-0.527	0.986	-0.433	-1.729	0.271	-0.097
NER	-0.014	-0.229	-0.034	-0.519	0.598	-0.633	-1.491	0.516	-1.322
SR	0.064	0.295	-0.418	-0.537	0.758	-0.130	-1.285	0.184	0.372
Age	-0.786	-0.043	-0.014	-0.002	0.075	-0.049	0.007	0.314	-0.056

Table III.27 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2002, Decile X

	Marshallian Price Elasticities								
	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
Cereals	-1.196	0.036	0.151	0.077	0.050	0.046	0.025	0.204	-0.021
Meats	-0.008	-1.185	0.070	-0.075	-0.106	-0.053	0.002	0.266	0.033
Milk	0.103	0.042	-1.645	-0.009	0.023	0.058	0.108	0.178	0.041
Egg	0.327	-0.395	-0.103	-1.458	0.251	-0.089	-0.035	0.406	0.064
Fats	0.201	-1.265	0.458	0.572	-1.275	0.058	0.363	0.081	0.375
Vegetables	-0.073	-0.081	0.260	-0.074	-0.104	-1.339	-0.005	0.054	-0.044
Fruits	-0.025	0.006	0.202	-0.006	0.032	-0.074	-1.782	0.233	0.290
Other	0.066	0.066	0.078	0.015	-0.003	0.080	0.053	-1.345	0.003
Food Away	-0.085	0.031	0.061	0.011	0.026	-0.029	0.233	0.024	-1.315
	Hicksian Price Elasticities								
Cereals	-1.084	0.106	0.275	0.090	0.056	0.112	0.090	0.465	0.059
Meats	0.138	-1.095	0.230	-0.059	-0.099	0.032	0.087	0.606	0.137
Milk	0.242	0.128	-1.493	0.007	0.030	0.138	0.188	0.500	0.140
Egg	0.488	-0.295	0.074	-1.440	0.259	0.005	0.059	0.782	0.179
Fats	0.343	-1.177	0.614	0.588	-1.268	0.141	0.445	0.411	0.476
Vegetables	0.086	0.017	0.435	-0.056	-0.096	-1.246	0.087	0.426	0.070
Fruits	0.120	0.096	0.362	0.011	0.040	0.011	-1.698	0.571	0.394
Other	0.210	0.155	0.236	0.032	0.004	0.163	0.136	-1.010	0.105
Food Away	0.064	0.123	0.224	0.027	0.034	0.057	0.319	0.370	-1.209
	Demographic Elasticities								
Size	0.059	0.035	0.029	0.016	0.284	-0.060	-0.030	-0.006	-0.428
Rural	0.328	-0.025	-0.447	0.617	1.387	-0.008	-1.208	0.010	1.010
COR	0.034	-0.075	0.075	-0.278	-1.193	-0.586	-0.515	0.192	0.262
NWR	0.190	0.257	0.112	0.199	-0.711	-0.260	-1.453	0.085	-0.341
NER	0.123	-0.029	0.068	0.608	-0.382	-0.629	-1.020	0.280	-0.736
SR	0.151	0.201	-0.253	0.141	0.043	-0.385	-0.830	0.155	0.032
Age	-0.440	-0.020	0.036	-0.052	-0.016	-0.033	-0.169	-0.019	0.419

Table III.28 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile I

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.638	0.109	0.120	0.101	0.050	0.185	0.137	0.238	0.025
Meats	0.252	-1.571	0.048	-0.036	-0.191	-0.003	-0.019	0.220	0.053
Milk	0.344	0.071	-1.843	0.024	0.033	0.088	-0.064	0.211	-0.082
Egg	0.520	-0.042	0.049	-2.169	-0.007	0.165	0.028	0.087	0.070
Fats	0.401	-0.805	0.127	-0.024	-2.107	0.039	0.399	0.301	0.230
Vegetables	0.039	0.103	0.228	0.196	0.079	-1.639	-0.013	0.054	0.071
Fruits	0.975	-0.016	-0.157	0.030	0.245	-0.449	-2.189	0.075	0.020
Other	0.223	0.081	0.063	0.014	0.024	0.076	0.011	-1.477	0.045
Food Away	0.028	0.152	-0.167	0.068	0.113	-0.102	0.014	0.289	-1.738
	Hicksian Price Elasticities								
Cereals	-1.370	0.199	0.198	0.143	0.070	0.283	0.169	0.502	0.064
Meats	0.589	-1.458	0.145	0.017	-0.166	0.120	0.021	0.552	0.103
Milk	0.629	0.167	-1.760	0.069	0.054	0.192	-0.030	0.491	-0.041
Egg	0.769	0.041	0.121	-2.130	0.012	0.256	0.058	0.331	0.107
Fats	0.696	-0.707	0.213	0.022	-2.085	0.147	0.435	0.590	0.273
Vegetables	0.342	0.204	0.316	0.244	0.101	-1.528	0.023	0.352	0.115
Fruits	1.255	0.078	-0.075	0.074	0.265	-0.347	-2.156	0.350	0.061
Other	0.510	0.177	0.147	0.059	0.045	0.181	0.045	-1.195	0.086
Food Away	0.359	0.263	-0.071	0.120	0.138	0.019	0.054	0.615	-1.690
	Demographic Elasticities								
Size	0.020	0.008	-0.023	0.163	0.104	-0.023	-0.102	-0.010	-0.310
Rural	0.053	0.059	-0.584	0.294	1.568	0.260	-0.093	-0.039	-1.039
COR	0.145	-0.346	0.313	-0.416	0.055	-0.450	-1.662	0.221	-0.224
NWR	-0.033	-0.524	0.213	-0.385	-0.352	-0.690	-2.138	0.634	-0.414
NER	0.130	-0.241	0.513	0.431	-0.088	-0.678	-2.338	0.272	-1.396
SR	-0.047	0.160	-0.279	-0.065	0.857	-0.266	-1.542	0.259	-0.139
Age	0.018	-0.198	-0.012	0.070	-0.031	-0.090	0.002	0.011	0.812

Table III.29 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile II

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.596	0.055	0.102	0.045	0.011	0.134	0.033	0.236	0.026
Meats	0.161	-1.363	0.036	-0.046	-0.102	-0.033	0.022	0.226	0.002
Milk	0.347	0.054	-1.933	0.025	0.010	0.060	0.074	0.152	0.084
Egg	0.370	-0.104	0.047	-1.706	0.069	0.054	0.155	0.135	-0.087
Fats	0.311	-0.599	0.017	0.148	-2.323	-0.125	0.299	0.555	0.250
Vegetables	0.036	0.003	0.163	0.033	0.027	-1.437	-0.086	0.119	0.075
Fruits	0.269	0.064	0.144	0.141	0.122	-0.429	-2.032	0.181	0.247
Other	0.234	0.085	0.046	0.018	0.034	0.086	0.027	-1.482	-0.014
Food Away	0.175	0.016	0.131	-0.064	0.083	-0.024	0.193	-0.075	-1.639
	Hicksian Price Elasticities								
Cereals	-1.318	0.161	0.192	0.085	0.029	0.248	0.074	0.525	0.080
Meats	0.444	-1.255	0.127	-0.005	-0.085	0.083	0.064	0.521	0.057
Milk	0.595	0.148	-1.854	0.061	0.025	0.162	0.111	0.410	0.133
Egg	0.604	-0.015	0.122	-1.672	0.084	0.150	0.189	0.379	-0.041
Fats	0.599	-0.489	0.110	0.189	-2.305	-0.007	0.342	0.855	0.307
Vegetables	0.327	0.114	0.256	0.075	0.045	-1.318	-0.043	0.422	0.132
Fruits	0.505	0.154	0.220	0.175	0.137	-0.332	-1.997	0.427	0.294
Other	0.503	0.188	0.132	0.057	0.050	0.196	0.067	-1.201	0.039
Food Away	0.408	0.105	0.207	-0.030	0.098	0.071	0.228	0.169	-1.593
	Demographic Elasticities								
Size	0.027	-0.001	0.027	0.140	0.124	-0.055	0.062	-0.036	-0.404
Rural	0.037	0.059	-0.270	0.162	1.218	0.067	-0.313	-0.033	-0.344
COR	0.115	-0.219	0.598	-0.352	0.260	-0.526	-1.209	0.198	-0.665
NWR	0.053	-0.326	0.345	-0.167	-0.048	-0.858	-1.886	0.539	-0.903
NER	-0.022	-0.138	0.779	0.138	0.782	-0.770	-2.588	0.403	-0.876
SR	-0.055	0.251	-0.241	-0.234	0.450	-0.474	-1.501	0.340	-0.256
Age	-0.044	-0.006	0.093	-0.085	-0.040	-0.140	0.234	-0.003	-0.780

Table III.30 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile III

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.529	0.072	0.114	0.041	0.028	0.122	0.066	0.259	-0.044
Meats	0.154	-1.527	0.034	-0.087	-0.109	-0.050	0.012	0.340	0.046
Milk	0.304	0.062	-1.746	0.037	0.094	0.176	-0.027	0.141	0.041
Egg	0.229	-0.181	0.071	-1.735	0.147	0.085	0.029	0.211	0.077
Fats	0.338	-0.597	0.515	0.360	-2.854	-0.675	0.247	0.716	-0.191
Vegetables	0.112	-0.015	0.122	0.033	0.039	-1.506	-0.033	0.106	-0.008
Fruits	0.358	0.059	-0.084	0.021	0.086	-0.121	-1.722	0.267	-0.003
Other	0.245	0.141	0.064	0.049	0.060	0.104	0.061	-1.579	0.087
Food Away	-0.208	0.084	0.038	0.037	-0.049	-0.052	-0.005	0.281	-1.254
	Hicksian Price Elasticities								
Cereals	-1.280	0.166	0.203	0.078	0.043	0.223	0.106	0.539	0.020
Meats	0.459	-1.412	0.144	-0.042	-0.091	0.074	0.061	0.683	0.124
Milk	0.526	0.145	-1.667	0.070	0.107	0.266	0.009	0.390	0.097
Egg	0.462	-0.093	0.154	-1.700	0.160	0.179	0.067	0.473	0.136
Fats	0.607	-0.496	0.612	0.400	-2.838	-0.565	0.290	1.019	-0.122
Vegetables	0.396	0.092	0.224	0.075	0.055	-1.391	0.012	0.426	0.065
Fruits	0.662	0.174	0.025	0.065	0.104	0.003	-1.673	0.608	0.075
Other	0.484	0.231	0.150	0.084	0.074	0.201	0.099	-1.311	0.149
Food Away	0.076	0.192	0.140	0.079	-0.032	0.063	0.041	0.600	-1.181
	Demographic Elasticities								
Size	0.059	-0.022	0.015	0.104	0.401	-0.003	-0.065	0.005	-0.409
Rural	0.000	0.068	-0.258	0.150	2.486	0.103	0.016	-0.047	0.076
COR	0.110	-0.338	0.133	-0.323	0.670	-0.424	-0.816	0.256	0.004
NWR	0.122	-0.206	0.015	0.128	0.931	-0.594	-1.113	0.362	-0.466
NER	0.076	-0.418	0.361	0.210	0.641	-0.750	-1.219	0.478	-0.685
SR	0.025	0.100	-0.279	0.060	0.696	-0.424	-1.039	0.290	0.089
Age	-0.068	-0.173	0.060	0.039	0.030	-0.036	0.010	0.216	0.263

Table III.31 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile IV

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.523	0.038	0.109	0.034	0.033	0.125	0.099	0.245	-0.008
Meats	0.071	-1.504	0.075	-0.061	-0.101	0.062	0.044	0.272	0.079
Milk	0.288	0.098	-1.666	0.051	0.049	0.078	-0.023	0.151	-0.037
Egg	0.181	-0.159	0.108	-1.912	0.252	0.043	0.004	0.369	0.009
Fats	0.442	-0.686	0.259	0.634	-2.460	-0.730	-0.083	0.936	-0.045
Vegetables	0.035	0.050	0.093	0.016	-0.034	-1.537	0.016	0.100	0.139
Fruits	0.517	0.112	-0.064	0.003	-0.027	-0.311	-2.142	0.327	0.153
Other	0.176	0.085	0.040	0.041	0.041	0.102	0.044	-1.487	0.026
Food Away	-0.042	0.112	-0.048	0.009	-0.003	0.037	0.091	0.109	-1.434
	Hicksian Price Elasticities								
Cereals	-1.296	0.131	0.191	0.067	0.046	0.227	0.140	0.552	0.064
Meats	0.316	-1.404	0.165	-0.025	-0.087	0.171	0.088	0.604	0.156
Milk	0.496	0.183	-1.591	0.082	0.062	0.171	0.014	0.433	0.028
Egg	0.408	-0.066	0.190	-1.879	0.265	0.145	0.044	0.676	0.081
Fats	0.721	-0.572	0.360	0.675	-2.444	-0.605	-0.034	1.313	0.043
Vegetables	0.295	0.156	0.187	0.054	-0.018	-1.420	0.063	0.453	0.221
Fruits	0.774	0.217	0.030	0.041	-0.012	-0.196	-2.096	0.676	0.234
Other	0.409	0.180	0.124	0.075	0.055	0.206	0.086	-1.172	0.099
Food Away	0.171	0.199	0.030	0.040	0.009	0.132	0.129	0.398	-1.367
	Demographic Elasticities								
Size	0.062	0.024	-0.013	0.082	0.093	-0.028	-0.063	-0.013	-0.558
Rural	0.029	0.121	-0.218	-0.092	1.790	0.191	0.262	-0.090	-0.297
COR	0.038	-0.178	0.413	-0.075	-0.366	-0.513	-1.284	0.214	-0.046
NWR	0.024	-0.352	-0.078	0.708	0.031	-0.699	-2.053	0.471	-0.223
NER	0.095	-0.338	0.557	0.345	0.796	-0.791	-1.859	0.331	-0.611
SR	0.013	0.157	-0.237	0.226	0.454	-0.447	-1.507	0.244	-0.002
Age	-0.014	-0.057	-0.066	-0.003	0.032	-0.318	-0.092	0.003	-0.484

Table III.32 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile V

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.437	0.111	0.124	0.039	0.042	0.083	0.061	0.228	-0.015
Meats	0.206	-1.481	0.072	-0.024	-0.134	-0.041	-0.029	0.255	0.044
Milk	0.250	0.088	-1.783	0.048	0.023	0.099	0.111	0.194	-0.011
Egg	0.137	-0.051	0.121	-1.973	0.144	0.113	0.069	0.332	-0.019
Fats	0.425	-1.018	0.104	0.379	-2.462	-0.206	0.056	0.890	0.072
Vegetables	-0.007	0.001	0.137	0.051	0.043	-1.445	-0.021	0.076	0.143
Fruits	0.189	-0.042	0.204	0.043	0.013	-0.163	-1.946	0.318	0.209
Other	0.161	0.087	0.063	0.036	0.037	0.076	0.054	-1.484	0.022
Food Away	-0.109	0.066	-0.030	-0.010	0.010	0.085	0.136	0.081	-1.381
	Hicksian Price Elasticities								
Cereals	-1.224	0.201	0.217	0.068	0.054	0.176	0.106	0.505	0.055
Meats	0.460	-1.373	0.182	0.010	-0.121	0.069	0.025	0.585	0.127
Milk	0.456	0.175	-1.694	0.076	0.033	0.188	0.155	0.461	0.056
Egg	0.364	0.045	0.219	-1.942	0.156	0.212	0.117	0.626	0.055
Fats	0.701	-0.901	0.224	0.417	-2.447	-0.086	0.115	1.248	0.162
Vegetables	0.243	0.107	0.246	0.086	0.056	-1.336	0.032	0.402	0.224
Fruits	0.456	0.071	0.320	0.080	0.027	-0.048	-1.889	0.665	0.296
Other	0.392	0.184	0.163	0.068	0.049	0.176	0.103	-1.184	0.097
Food Away	0.132	0.168	0.075	0.024	0.022	0.190	0.188	0.395	-1.302
	Demographic Elasticities								
Size	0.067	0.027	0.024	0.118	0.029	-0.058	-0.157	-0.038	-0.330
Rural	-0.018	0.038	-0.161	0.208	0.785	0.168	0.225	-0.038	-0.239
COR	0.045	-0.193	0.217	-0.284	-0.191	-0.540	-0.846	0.251	0.204
NWR	0.038	-0.331	0.036	0.462	-0.181	-0.798	-1.203	0.530	-0.556
NER	0.053	-0.195	0.160	-0.034	0.412	-0.762	-1.249	0.510	-0.959
SR	0.039	0.154	-0.296	-0.016	0.200	-0.510	-1.258	0.342	-0.114
Age	-0.105	-0.078	-0.041	0.002	-0.020	-0.225	-0.257	0.002	0.185

Table III.33 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile VI

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.446	0.038	0.115	0.013	0.068	0.113	0.098	0.229	-0.017
Meats	0.044	-1.403	0.104	-0.013	-0.180	-0.080	-0.006	0.323	0.037
Milk	0.234	0.120	-1.705	0.031	0.106	0.144	0.017	0.156	-0.051
Egg	-0.013	-0.001	0.075	-1.762	0.235	0.104	0.172	0.302	-0.152
Fats	1.119	-1.499	0.904	0.639	-4.550	-1.006	-0.475	1.646	0.050
Vegetables	-0.002	-0.045	0.131	0.002	0.084	-1.453	-0.056	0.056	0.114
Fruits	0.412	0.011	0.013	0.107	-0.115	-0.320	-1.757	0.379	-0.037
Other	0.155	0.108	0.057	0.039	0.065	0.099	0.064	-1.475	0.065
Food Away	-0.080	0.053	-0.069	-0.050	0.006	0.061	-0.017	0.198	-1.215
	Hicksian Price Elasticities								
Cereals	-1.243	0.125	0.206	0.039	0.077	0.205	0.139	0.537	0.063
Meats	0.294	-1.296	0.216	0.020	-0.169	0.032	0.045	0.702	0.136
Milk	0.427	0.202	-1.618	0.056	0.115	0.231	0.056	0.449	0.026
Egg	0.187	0.084	0.165	-1.736	0.244	0.194	0.212	0.605	-0.073
Fats	1.429	-1.367	1.044	0.679	-4.536	-0.866	-0.412	2.116	0.173
Vegetables	0.246	0.060	0.243	0.035	0.096	-1.341	-0.006	0.431	0.212
Fruits	0.665	0.119	0.126	0.140	-0.103	-0.206	-1.706	0.763	0.064
Other	0.363	0.196	0.150	0.066	0.075	0.192	0.106	-1.161	0.147
Food Away	0.134	0.144	0.027	-0.022	0.016	0.158	0.026	0.521	-1.130
	Demographic Elasticities								
Size	0.075	0.015	0.009	0.152	-0.009	-0.037	-0.105	-0.005	-0.426
Rural	0.096	0.045	-0.351	0.041	2.466	0.169	0.024	-0.083	0.066
COR	0.023	-0.287	0.303	-0.394	0.011	-0.535	-0.848	0.295	-0.230
NWR	0.023	-0.292	0.122	0.084	-0.044	-0.724	-0.995	0.409	-0.331
NER	-0.035	-0.294	0.173	-0.098	0.334	-0.799	-1.226	0.527	-0.585
SR	-0.048	0.124	-0.203	-0.115	-0.053	-0.603	-0.948	0.381	-0.215
Age	-0.072	-0.113	-0.110	-0.061	-0.017	-0.363	0.057	0.124	-0.074

Table III.34 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile VII

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.395	0.039	0.126	0.005	0.026	0.049	0.004	0.254	-0.049
Meats	0.076	-1.356	0.108	0.046	-0.175	-0.097	0.044	0.286	-0.061
Milk	0.255	0.112	-1.872	0.082	0.032	0.097	0.043	0.169	0.032
Egg	0.018	0.168	0.255	-2.515	0.227	0.181	0.178	0.362	0.073
Fats	0.471	-1.504	0.195	0.628	-3.050	-0.181	0.429	1.165	-0.058
Vegetables	-0.008	-0.050	0.241	0.038	0.046	-1.385	-0.007	0.066	-0.120
Fruits	0.004	0.091	0.063	0.101	0.088	-0.144	-1.784	0.265	0.125
Other	0.156	0.080	0.050	0.031	0.036	0.086	0.040	-1.441	0.026
Food Away	-0.113	-0.053	0.022	0.022	-0.006	-0.006	0.066	0.088	-0.936
	Hicksian Price Elasticities								
Cereals	-1.194	0.128	0.228	0.033	0.036	0.142	0.052	0.579	0.043
Meats	0.296	-1.259	0.220	0.076	-0.164	0.005	0.097	0.641	0.039
Milk	0.430	0.190	-1.783	0.106	0.041	0.179	0.085	0.453	0.112
Egg	0.213	0.254	0.354	-2.489	0.237	0.271	0.225	0.678	0.162
Fats	0.748	-1.381	0.336	0.666	-3.037	-0.052	0.496	1.615	0.068
Vegetables	0.216	0.049	0.355	0.069	0.057	-1.281	0.047	0.429	-0.018
Fruits	0.197	0.177	0.161	0.127	0.097	-0.054	-1.738	0.579	0.213
Other	0.358	0.170	0.153	0.059	0.046	0.180	0.089	-1.113	0.118
Food Away	0.089	0.037	0.124	0.049	0.004	0.087	0.115	0.414	-0.844
	Demographic Elasticities								
Size	0.062	0.003	0.050	0.087	-0.002	-0.026	-0.103	-0.025	-0.218
Rural	0.125	-0.183	-0.048	0.219	1.746	0.085	0.001	-0.101	0.166
COR	0.032	-0.107	0.253	-0.097	0.408	-0.325	-0.644	0.195	-0.768
NWR	0.062	-0.213	0.048	0.517	-0.049	-0.492	-0.637	0.351	-1.427
NER	0.120	-0.223	0.041	0.563	0.552	-0.781	-1.753	0.436	-1.015
SR	0.012	0.172	-0.241	0.127	-0.017	-0.438	-1.076	0.245	-0.200
Age	-0.022	0.069	0.047	0.013	0.050	0.145	0.068	0.002	-0.012

Table III.35 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile VIII

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.334	-0.007	0.141	0.060	0.010	0.032	0.003	0.241	-0.060
Meats	-0.043	-1.338	0.083	-0.041	-0.144	-0.023	0.036	0.313	-0.020
Milk	0.258	0.095	-1.767	0.047	0.042	0.144	0.036	0.182	-0.013
Egg	0.375	-0.111	0.133	-2.636	0.291	0.043	0.125	0.491	-0.040
Fats	0.050	-1.225	0.313	0.780	-2.758	-0.105	0.065	1.292	-0.536
Vegetables	-0.015	0.031	0.198	0.054	0.072	-1.387	-0.024	0.002	-0.182
Fruits	-0.022	0.080	0.044	0.064	0.009	-0.205	-1.722	0.412	0.092
Other	0.155	0.110	0.074	0.060	0.059	0.120	0.085	-1.452	0.064
Food Away	-0.119	-0.010	-0.026	-0.010	-0.050	-0.051	0.041	0.127	-0.841
	Hicksian Price Elasticities								
Cereals	-1.154	0.079	0.239	0.084	0.020	0.124	0.051	0.555	0.045
Meats	0.168	-1.237	0.197	-0.012	-0.133	0.084	0.092	0.679	0.103
Milk	0.420	0.173	-1.679	0.069	0.051	0.228	0.079	0.464	0.082
Egg	0.590	-0.007	0.250	-2.606	0.302	0.153	0.182	0.864	0.086
Fats	0.307	-1.101	0.453	0.815	-2.745	0.026	0.134	1.737	-0.386
Vegetables	0.194	0.131	0.312	0.083	0.083	-1.280	0.032	0.365	-0.060
Fruits	0.189	0.182	0.159	0.092	0.020	-0.097	-1.666	0.780	0.216
Other	0.331	0.194	0.169	0.084	0.068	0.210	0.132	-1.147	0.167
Food Away	0.080	0.085	0.082	0.017	-0.040	0.051	0.095	0.473	-0.725
	Demographic Elasticities								
Size	0.060	-0.021	0.005	0.085	-0.126	0.019	-0.107	0.018	-0.220
Rural	0.140	-0.095	-0.078	0.038	2.416	0.127	0.052	-0.187	0.488
COR	-0.012	-0.182	0.303	-0.240	-0.254	-0.467	-0.849	0.268	-0.357
NWR	-0.025	-0.181	0.111	0.573	-1.133	-0.565	-1.292	0.331	-0.175
NER	-0.033	-0.256	0.170	0.409	0.820	-0.681	-1.750	0.469	-0.587
SR	-0.024	0.170	-0.209	-0.095	0.160	-0.483	-1.260	0.339	-0.294
Age	-0.094	0.028	-0.063	0.030	0.353	0.274	-0.096	0.164	-0.200

Table III.36 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile IX

	Marshallian Price Elasticities								
	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
Cereals	-1.365	0.036	0.153	0.032	0.036	0.085	0.050	0.241	-0.025
Meats	0.019	-1.420	0.075	-0.046	-0.162	0.036	0.003	0.322	0.009
Milk	0.214	0.076	-1.826	0.004	0.052	0.139	0.017	0.160	0.095
Egg	0.080	-0.148	-0.020	-1.584	0.130	0.231	0.187	0.154	-0.045
Fats	0.332	-1.784	0.622	0.373	-2.378	-0.056	0.317	1.119	-0.159
Vegetables	0.002	0.102	0.298	0.037	0.022	-1.463	-0.154	0.058	-0.029
Fruits	0.087	0.020	0.019	0.075	0.045	-0.274	-1.405	0.272	0.117
Other	0.089	0.067	0.031	-0.006	0.009	0.057	0.028	-1.368	0.005
Food Away	-0.056	0.017	0.077	-0.003	-0.005	-0.020	0.054	0.061	-1.104
	Hicksian Price Elasticities								
Cereals	-1.219	0.112	0.247	0.051	0.043	0.164	0.098	0.546	0.087
Meats	0.205	-1.323	0.194	-0.022	-0.154	0.138	0.064	0.711	0.151
Milk	0.365	0.155	-1.729	0.024	0.059	0.221	0.067	0.476	0.211
Egg	0.227	-0.070	0.074	-1.565	0.137	0.312	0.236	0.464	0.068
Fats	0.549	-1.670	0.761	0.401	-2.368	0.062	0.389	1.574	0.008
Vegetables	0.178	0.194	0.410	0.060	0.030	-1.367	-0.096	0.426	0.105
Fruits	0.261	0.111	0.131	0.098	0.053	-0.179	-1.347	0.635	0.250
Other	0.263	0.158	0.142	0.017	0.017	0.152	0.085	-1.005	0.138
Food Away	0.093	0.095	0.173	0.016	0.002	0.062	0.104	0.373	-0.990
	Demographic Elasticities								
Size	0.061	0.010	0.043	0.126	0.168	-0.054	-0.153	-0.042	-0.105
Rural	0.002	0.053	-0.210	0.057	3.184	0.228	0.173	-0.064	-0.063
COR	0.021	-0.265	0.219	-0.226	-0.675	-0.394	-0.562	0.228	-0.348
NWR	0.043	-0.136	0.074	0.469	-0.439	-0.403	-1.327	0.231	-0.244
NER	0.022	-0.155	0.265	0.320	0.510	-0.591	-1.690	0.394	-0.943
SR	-0.079	0.044	-0.286	-0.388	-0.176	-0.361	-1.054	0.333	-0.219
Age	-0.162	-0.029	0.141	-0.025	0.060	0.010	-0.044	-0.071	-0.268

Table III.37 Uncompensated and Compensated Price and Demographic Elasticities for Food, Mexico, 2010, Decile X

	Cereals	Meats	Milk	Egg	Fats	Vegetables	Fruits	Other	Food Away
	Marshallian Price Elasticities								
Cereals	-1.288	-0.061	0.156	0.037	0.011	0.005	-0.033	0.228	-0.070
Meats	-0.093	-1.375	0.103	0.015	-0.058	0.147	-0.018	0.241	-0.006
Milk	0.200	0.086	-1.826	0.036	0.055	0.197	0.079	0.167	0.018
Egg	0.293	0.062	0.177	-2.031	-0.024	-0.093	0.107	0.311	-0.161
Fats	0.276	-0.839	0.876	-0.069	-3.141	-0.440	1.314	0.401	0.139
Vegetables	0.013	0.203	0.317	0.057	0.006	-1.455	-0.015	0.002	0.012
Fruits	-0.060	-0.025	0.109	0.026	0.109	-0.073	-1.620	0.224	0.249
Other	0.074	0.042	0.034	-0.002	-0.011	0.038	0.030	-1.345	0.031
Food Away	-0.048	0.002	0.013	-0.011	0.011	-0.019	0.113	0.105	-1.141
	Hicksian Price Elasticities								
Cereals	-1.154	0.024	0.266	0.055	0.017	0.091	0.039	0.562	0.098
Meats	0.038	-1.292	0.211	0.032	-0.052	0.231	0.051	0.566	0.157
Milk	0.319	0.161	-1.728	0.052	0.060	0.273	0.143	0.463	0.166
Egg	0.448	0.160	0.304	-2.010	-0.017	0.006	0.190	0.697	0.032
Fats	0.424	-0.746	0.998	-0.049	-3.135	-0.346	1.393	0.770	0.324
Vegetables	0.145	0.286	0.426	0.074	0.012	-1.371	0.055	0.330	0.176
Fruits	0.061	0.052	0.208	0.042	0.114	0.004	-1.556	0.525	0.399
Other	0.216	0.132	0.151	0.017	-0.005	0.129	0.106	-0.992	0.208
Food Away	0.077	0.081	0.116	0.006	0.017	0.061	0.180	0.417	-0.984
	Demographic Elasticities								
Size	0.080	0.017	0.062	0.090	-0.006	-0.040	-0.024	-0.041	-0.186
Rural	0.391	-0.122	-0.274	0.448	4.125	0.053	-0.561	-0.084	0.101
COR	-0.040	-0.243	0.117	-0.476	-0.981	-0.257	-0.463	0.162	0.130
NWR	0.029	-0.113	-0.112	0.146	-0.928	-0.205	-1.284	0.244	0.011
NER	0.020	-0.285	0.092	0.735	1.302	-0.487	-1.029	0.361	-0.556
SR	-0.046	-0.012	-0.254	-0.218	-0.462	-0.317	-1.078	0.332	-0.086
Age	0.027	0.003	0.021	0.100	-0.018	0.007	0.363	-0.252	-0.299

CHAPTER IV

CROPMEX, A CROP PROGRAMMING MODEL IN MEXICO

Abstract

Mexico has experienced important changes in production, consumption patterns, infrastructure, resources, and trade policies from 1994 to the present. Of particular importance is the effect of those transformations in the Mexican agriculture sector. One of the biggest challenges in Mexican agriculture is the transition from a more subsistence agricultural system to a more market based system with growing demands for food and feed crops. The present study develops a comparative static, multiregional, mathematical programming model of the crop subsector in Mexico. This study seeks to simulate the best allocation of resources among the major crops produced in Mexico that are white corn, yellow corn, beans, sorghum, rice and wheat. The present project also includes an example application of the model to simulate the removal of a cash payment into allocation of resources.

Introduction

The major factors affecting the global supply of grains in recent years have been food security, demand for biofuels and growing participation of agricultural commodities in the stock market. Also, production of those goods has been primarily influenced by the availability of resources, yield, price and expectations in the international market.

Agriculture plays an important role in the economic growth and development of a country due to its relationship to most industries, especially to the food industry. It is also a major concern for developing countries, such as Mexico, as it is considered an important source of employment and foreign exchange earnings. According to the 2010 National Survey of Occupation and Employment, agriculture is the fourth major source of employment in Mexico. About 13 percent of the economically active population in Mexico works in the agriculture sector. In 2010, agricultural exports exceeded 8.5 billion dollars and represented 2.88 percent of total exports (INEGI). Another important consideration is that the major crops (white corn, yellow corn, beans, sorghum, rice, and wheat) planted in Mexico are also the main agricultural goods that produce food and feed. The 2007 Mexican Census of Agriculture reports that food and feed grains represent about 64 percent of total planted area (annual and perennial crops) and about 90 percent of total planted area of annual crops. The major crops (grains) account for about 56 percent of total planted area and about 80 percent of total planted area of annual crops. Assessing the economic performance and resource allocation of the major crops in Mexico would be necessary to determine the most economically viable and sustainable crop production system.

Mexico has long faced serious limitations of water and arable land for food and feed crops. The 2007 Census of Agriculture in Mexico reports that only 18 percent of the crop land is irrigated and that half of the nation is arid and semi-arid. Much of crop production in Mexico is in areas of less than ideal conditions with inadequate managerial and physical resources. Along with these issues, there is a great heterogeneity of climates, soil qualities, property rights and resources throughout the country. Mexican crop producers also face rapidly changing market conditions that can imply opportunities and threats at the same time. In Mexico, there are two types of crop producers: commercial (large and medium farmers primarily located at the north and central occident) and traditional (small and subsistence farmers mainly situated at the south and center). As opposed to the purely market effect, there are also social and cultural implications. The transition to a more market based system implies changes in mindsets or lifestyles among Mexicans. Modeling efforts are crucial for informing policymakers on how these issues might affect the heterogeneous set of farms and farmers that characterize Mexican agriculture sector.

In recent years, growing demand for food and feed crops for different uses in the domestic and the international market have heightened the great dilemmas in the Mexican agricultural sector. They also pose new opportunities and challenges for Mexico. Rising domestic and international demand of some crops for industrial and feed purposes, such as yellow corn, entice the most productive farmers to switch to them, leaving Mexico reliant on the least productive producers to supply food crops. In 1976, Benito modeled peasant's response to modernization projects and concluded that labor-intensive technologies in corn production will make peasants more productive. Since small farmers are the majority in Mexico, the country faces a huge challenge in balancing growing

domestic demand for food and feed and implementing policies that support small farmers that require large investment in developing their production systems, training and access to technology and input markets (Mejia and Peel, 2009). Dryland is the most common method of production of small farmers and implies very low yield. The main objective of the present study is to develop a multiregional, static mathematical programming model for Mexico for the major crops in the country (CROPMEX). This study has been designed for policy planning for the major crops in Mexico, specifically for allocation of resources under a more market based system.

Mathematical programming has been widely used to model agriculture in many developing nations such as Mexico. Most of the studies implemented in Mexico focus on some regions (Simmons and Pomareda, 1975, Benito, 1976, Taylor and Anderson, 2003, Howitt and Msangi, 2005) or aggregate goods into different categories (Taylor and Anderson). Although many authors argue that the level of disaggregation is essential (Ahn, Singh and Squire, 1981, Taylor and Anderson, 2003, Howitt and Msangi, 2006), most of their studies disaggregate data regionally but aggregate it at other levels to build more flexible and simple models. The present study aggregates data into five regions and disaggregates major crops into irrigation and dryland to represent commercial and traditional producers, respectively.

Multiregional crop production studies in Mexico are scarce. One of the most detailed mathematical programming models for Mexican agriculture was developed by Duloy and Norton in 1973 with an agricultural sector model (CHAC) for Mexico. CHAC provided a basis to compare the equilibrium effects of price versus revenue expectations behavior and included thirty-three short-cycle crops for the year of 1974. CHAC was an

aggregate from different submodels of each region (Northwest, North, Central Plateau and South). CHAC's major conclusions were that Mexican agriculture was starting to face relatively low growth rates of farm income and employment and structural changes should be a priority for policy makers to allow expansion of the domestic demand. In 1975, Simmons and Pomareda analyzed one of the most competitive states in Mexican agriculture, Sinaloa. Simmons and Pomareda evaluated potential of export growth of tomato, pepper and cucumber under competitive and monopolistic supply structures and found that a more efficient market would decrease planted areas for these crops. In 2003, Taylor and Anderson used a household model of Michoacán, Mexico for four aggregate goods (staple, cash crops, market goods and leisure) using Cobb-Douglas functional forms. They recognized the need of models that can capture internal conflicts over resources and external market and nonmarket relationships. There is an inherent need to develop a more current model that allows interaction among regions for the major crops produced in Mexico.

Agricultural mathematical programming models represent a desirable alternative to model developing countries where lack of multi-period data has become one of the biggest challenges for empirical analysis. However, some researchers have also developed mathematical programming models for developed economies such as the United States given the complexity of some segments like agriculture. In 2007, Johansson, Peters and House designed the Regional Environment and Agriculture Programming Model (REAP) which was formerly known as U.S. Mathematical Programming Regional Agriculture Sector Model (USMP) in 1985. This model was designed for economic, environmental, technological and policy analysis of the major

commodity crops and some livestock industries in the United States. REAP is a price-endogenous mathematical programming model that incorporates the assumptions of neoclassical economics.

Conceptual Framework

The CROPMEX model is a static, partial, regional, mathematical programming model of Mexican crop production in which social welfare in the form of consumers' plus producers' surpluses are maximized. The model is written and maintained in GAMS (General Algebraic Modeling System). CROPMEX seeks to determine the set of prices and quantities that establish equilibrium by maximizing social benefit. The model takes as its data the technological coefficients on major crop production activities, levels of fixed resources, demand relationships and supply relationships for purchased inputs to generate a solution that provides equilibrium prices and quantities. The equilibrium established by the model is partial because consumer income, the prices of other minor crops, the prices of other agricultural activities and the prices of commodities produced outside the sector are held fixed. In specifying the CROPMEX model, it was assumed that the crop production system is composed of many competitive farmers none of whom can, through their individual actions, influence prices.

Additional assumptions about the mathematical programming model include optimization, fixedness, finiteness, determinism, continuity, homogeneity, additivity and proportionality (Hazell et al., 1986). In the CROPMEX model, social welfare is

maximized (optimized) subject to some constraints, in which at least one has a nonzero right hand side coefficient (fixedness). It is assumed that there are only a finite number of crop activities and constraints to be incorporated so that a solution may be sought. The CROPMEX model is deterministic because coefficients are known constants. Another important assumption is continuity where resources are assumed to be used and activities produced in quantities that are fractional units. It is presupposed that all units of the same resource or crop activity are identical (homogeneity). The assumptions of additivity (total product is the sum of individual products) and proportionally (gross margin and resource requirements per unit of activity are constant) together define linearity in the crop activities. Additivity and proportionality lead to an aggregate crop production function relating the value of the welfare maximization objective function and the fixed resources that has constant returns to scale. Constant returns to scale imply that if all fixed inputs increase by a particular amount, output increases proportionally.

The Model

CROPMEX is a subsector-wide model in the sense that it describes total national use and supply (irrigation and dryland production, imports, domestic demand and exports) for the main food and feed crops in Mexico. It is a one-period model for the base year of 2010. On the demand side, consumer behavior is considered as price-dependent, and thus market-clearing commodity price are endogenous in the model. The market form is taken to be competitive. Government policies, such as price supports (PROCAMPO[1]), are

[1] PROCAMPO is a program implemented from 1993 to facilitate the transition to more market-oriented policies. It consists of a direct cash payment at planting time on a per hectare basis to growers of the nine

evaluated as interventions in a basically competitive market as a possible application of the model developed in the present project. The objective function represents net social benefit (CPS), or consumer plus producer surplus. The objective function is written as

(4.1) $$\max \text{CPS} = \sum_c^C \left(\left(\sum_c^C \gamma_{dc} WS_c \right) + \chi_c P_{xc} - \mu_c P_{mc} \right) - \sum_c^C \sum_r^R \varphi_{c,r} NC_{c.r}$$

where γ_{dc} represents domestic consumption in thousand tons of each crop *c*, WS_c is the welfare segment of each crop, χ_c depicts the national exports in thousand tons of each major crop, P_{xc} is price of export of each crop, μ_c represent quantity imported of each crop in thousand tons, P_{mc} is the price of imported crop, $\varphi_{c,r}$ depicts the cropping activities in thousand per ha, and $NC_{c.r}$ represents cost of crop inputs (pesos per ha).

The welfare segment of each crop, WS_c, represent the sum of the area under demand and supply curves and is calculated using

(4.2) $$WS_c = \alpha_c Q_c + \frac{1}{2} \beta_c * {Q_c}^2$$

where Q_c is the quantity consumed in the domestic market, α_c represents the demand or supply curve intercept, and β_c is the demand or supply curve slope. The parameters for these curves are derived from the demand or supply for each commodity *c* in the base year, the commodity price in the base year and the price elasticity of demand or supply (ε_c). WS_c can be decomposed into components which correspond to consumers' surplus and producers' surplus as follows

(4.3) $$CS_c = \frac{1}{2} Q_c(\alpha_c - P) = -\frac{1}{2} \beta_c * {Q_c}^2$$

(4.4) $$PS_c = Q_c * P - c(Q_c) = Q_c(\alpha_c + \beta_c * Q_c) - c(Q_c)$$

Basic crops that are corn, wheat, rice, beans, sorghum, barley, soybeans, cotton and safflower. The amount varies by planting season and region.

The formula for deriving the slope parameter is

(4.5) $$\beta_c = (\varepsilon_c * Q_c^0) / P_c^0 \text{ such } \varepsilon_c \neq 0 \; \forall \; c = 1, \ldots, C$$

The intercept is then obtained from the equation

(4.6) $$\alpha_c = P_c^0 - \beta_c Q_c^0$$

where P_c^0 and Q_c^0 represent base year price and quantity, respectively, for commodity *c* and ε_c equals the price elasticity for commodity *c*. Equation (4.1) is maximized subject to a set of constraints that are the described in the following sections.

Balancing Constraints

The balancing constraints consist of three types: first, regional production of commodities must be consistent with cropping activities; second, consumption and production must be balanced nationally; and finally, resource availability must constrain resource use.

Regional production of commodities constraint guarantees that production cannot exceed the optimal level of physical units time the yields for those. Regional supply balances constrain production of crops to the area of production of that crop in the region multiplied by the yield in the region as follows

(4.7) $$S_c \leq \sum_c^C \sum_r^R \varphi_{c,r} NC_{c.r}$$

National consumption of major crop commodities is required to be less than or equal to crop production plus net imports. Gross production plus net imports of each crop must be equal to exports of each crop plus quantity times domestic consumption. National consumption constraint can be depicted as

(4.8) $$S_c + \mu_c = \chi_c + \sum_c^C \gamma_{dc} Q_s$$

A convexity constraint for domestic consumption that allows domestic consumption of a crop activity to vary independently of the consumption of other crop activities is represented algebraically by

(4.9) $$\sum_c^C \gamma_{dc} - 1 = 0$$

Land and Water Resources

Finally, resource constraints limit the use of resources to regional and national availabilities. The specific resources for the present study are land and water. Land is limited to the available land for crop production in each region while water is limited to available water. Land and water constraints are depicted as

(4.10) $$\sum_c^C \sum_r^R \varphi_{c,r} Land_{c,r} \leq Area_r$$

(4.11) $$\sum_r^R \varphi_{c,r} Water_{c,r} \leq Water_r$$

Nonnegativity constraints in GAMS are implied when the POSITIVE VARIABLE command is used when the variables are declared. The nonnegativity constraints for the present study were

(4.12) $$\gamma_{dc}, \chi_c, \varphi_{c,r}, \mu_c, S_c \geq 0$$

The present study also included upper values for production, export and imports of some crops. These upper values were based on historical data for crop production, available land and international trade data.

Data

In the CROPMEX model, information was pooled from several sources of data. The major sources of data were INEGI (Mexican National Institute for Statistics and Geography), SAGARPA (Secretary of Agriculture, Livestock, Rural Development, Fisheries, and Food), Secretaría de Economía (Ministry of Economics) and SEMARNAT (Secretary of Environment and Natural Resources). INEGI released in 2009 a census of the agriculture sector in Mexico which is based on a survey made in 2007. In many cases, comprehensive cross-section survey data are not available for multiple years.

National Demand Data

National demand data of the major crops produced in Mexico were mainly obtained from SAGARPA, Secretaría de Economía and SIAP (Servicio de Información Agroalimentaria y Pesquera or Information Service Agrifood and Fisheries). National demand data include import prices (pesos), domestic prices (pesos), export prices (pesos), domestic consumption (thousand tons) and elasticities (Tables IV.1, IV.2 and IV.3). Apparent domestic consumption of the base year was calculated with the following formula

(4.13) $$ADC = S_0 - X + M + DP - S_1$$

where S_0 represents beginning stocks of the base year, X and M depict exports and imports, DP is domestic production under two methods of production (irrigation and dryland), and S_1 represents ending stocks of the base year. Initial and ending stocks are from the 2010 Monthly Balance of Availability and Consumption for each major crop. Elasticities were estimated using an AIDS model for the year of 2008.

Domestic prices have been obtained from the 1980-2011 SIAP Yearbook, which reports prices of each crop and its subcategories. Some of the prices were weighted average prices of crop subcategories such as sorghum, wheat, rice and beans. In Mexico, there are three types of sorghum, five types of wheat, three types of rice and twenty three types of beans. Corn is divided into white and yellow types. Import and export prices in dollars are reported by the Ministry of Economics (SIAVI-Sistema de Información Comercial Vía Internet or Trade Information System Via Internet). Since prices are provided in dollars, their value in pesos (12.64 pesos for 1 dollar) was estimated using the 2010 exchange rate which was an average of 2010 daily exchange rate (Banco de México). SIAP publishes a Monthly Balance of Availability and Consumption (Balanza Mensualizada de Disponibilidad y Consumo) in a monthly basis that includes domestic consumption and the primary uses of each of the major crops planted in Mexico (Figure IV.2).

As mentioned before, the primary uses of the main annual crops planted in Mexico are food and feed. Corn is the most important crop produced in Mexico and it is also the main source of energy for the Mexican population. Mexico is the fourth largest corn producing country in the world. Contrary to other major corn producers, Mexico produces large quantities of white corn for food use (83 percent) and relatively small

quantities of yellow corn for feed purposes (68 percent). To satisfy the needs of yellow corn, the country imports large amounts of this annual crop (mainly from the U.S.). The second most important agricultural commodity produced in Mexico is beans. Beans are mainly devoted for food consumption (78%) and along with corn serve as nutrition food staples in Mexico. Another major feed grain in Mexico is sorghum. Mexico is the fourth largest sorghum producing country in the world. This grain is primarily used as a feed grain (96 percent) for local use or for export. Other important food grains are rice and wheat that are mainly used for human consumption (92 and 99.8 percent, respectively) and that are mainly imported to satisfy demand of these grains in Mexico. Wheat, a grain with unique proteins that form gluten, is largely imported from the United States to satisfy Mexican population needs. Regarding rice, from 1985 to 1998, Mexico decreased by half its cropped land for rice because it was cheaper to import the grain than to produce it. The United States is the main provider of imported crops for Mexico. In 2010, more than 97 percent of the imported crops were from the United States.

Land and Water Data

The resource limits in the CROPMEX model consist of land and water. Mexico is divided into five major regions (Figure IV.1): Northwestern Region (NWR), Northeastern Region (NER), Central Occidental Region (COR), Central Region (CR) and South Region (SR).

The NWR encompasses the states of Baja California, Baja California Sur, Sinaloa and Sonora and covers 20 percent of the total country area. The climate in this region is

78 percent tropical[2], 12 percent dry and 10 percent temperate. About 12 percent of all annual crops in Mexico are planted in the NWR. Sonora and Sinaloa have yields similar to those obtained on average in the U.S. for corn. For example, during the fall winter season of 2010, white corn in the NWR had an average yield of 12.03 metric tons/hectare (Mt/ha), which is equivalent to 173.94 bushels/acre (bu/ac). This is one of the most competitive agricultural regions in the country with an important amount of irrigated land (about 55 percent).

The NER includes the states of Chihuahua, Coahuila, Durango, Nuevo León and Tamaulipas and covers 34 percent of the total country area. The climate in this region is 70 percent tropical, 26 percent temperate and 4 percent dry. About 30 percent of the cropland in this region is irrigated and accounts for 30 percent of all irrigated land in the country (Mejia and Peel, 2009). This area cultivates about 20 percent of all the annual crops of the country.

The Central Occidental Region covers the states of Aguascalientes, Colima, Guanajuato, Jalisco, Michoacán, Nayarit, Querétaro, San Luis Potosí and Zacatecas. The COR represents 18 percent of the total country area and consist mostly of a tropical climate. This area cultivates the majority of the national annual crops (about 31 percent). The COR includes the area known as the Bajío[3] which is a major crop production region in the country due to the excellent weather throughout the year and a significant amount of irrigated land. The Central Region encompasses the states of Hidalgo, México, Morelos, Puebla, Tlaxcala and the capital of México (Distrito Federal). This region

[2] Tropical includes wet and dry tropics and dry includes arid and semi-arid climates.
[3] El Bajío mostly includes the plains areas of Guanajuato, Jalisco, Michoacán, Querétaro and Aguascalientes.

consists mostly of a temperate climate (52 percent) and high average altitudes. The CR is only 4 percent of the total country area but embraces the majority of the Mexican population. This area only produces about 15 percent of the annual crops of the country, where the dryland production system predominates. Along with the South Region, this area encompasses the majority of the subsistence production systems from all the country. Finally, the SR covers eight states: Campeche, Chiapas, Guerrero, Oaxaca, Quintana Roo, Tabasco, Veracruz and Yucatán. This region is generally associated with low productivity as most of the farmers are traditional producers and the predominant climate is dry. This region cultivates about 22 percent of all the annual crops in Mexico.

The land and water data were obtained from the 2007 Census of Agriculture and SEMARNAT, respectively. Crop land was calculated by subtracting perennial crops from total cultivated land reported in the 2007 Census of Agriculture (Table IV.4). This estimate was then compared to data of the 1980-2011 SIAP Yearbook to be more consistent. 2007 rice planted area was obtained from the 1980-2011 SIAP Yearbook because the Census of Agriculture aggregates this annual crop with other crops. This study also deducted land devoted to forage crops and barley. Mexico produces some forage crops such as forage corn, forage sorghum and forage wheat.

The available water was obtained from SEMARNAT with 2008 data from CNA (Comisión Nacional del Agua or National Water Commission). CNA reports volumes of water allocated for consumptive use type and administrative region as a source of supply in cubic hectometers[4]. The available water is reported for all hydrologic regions

[4] Cubic hectometers is a measure of volume, 1 cubic meter is equal to 1.0E-6 hectometers. 1 cubic hectometer is equivalent to 810.713 acre foot.

(administrative region) that differ from the 5 crop regions in the present study. To calculate the water available for crop region, this study used the total land available per municipality and the total water available per hydrologic region. First, we classified each municipality in their respective hydrologic region. Assuming that the available water is constant across municipalities by hydrologic region, we obtained an estimate of the amount of water that each municipality receives. The last step was the aggregation of data by crop regions.

Technical Relationships

There are several kinds of technical relationships: resource, input requirements and yield levels for the major crops in Mexico. Agricultural crop commodity yields are based on two methods of production, irrigation and dryland, and are weighted average yields (total production divided by total planted area) by crop and by region. The yield data set was obtained from the 1980-2011 SIAP Yearbook for the base year of 2010 (Table IV.5). The highest yields for the major annual crops are in the NWR, while the lowest yields are in the SR. The main factors affecting this large gap in yields of major crops in Mexico are the differences in use of agricultural inputs such as fertilizers, improved seeds and agrochemicals. Agricultural input consumption in Mexico is very limited, but some regions have a higher usage of them and consequently experience better yields. Figure IV.3 shows the percentage of area per region receiving improved seeds, fertilizers and agrochemicals (herbicides and insecticides). Note that the NWR is the region that uses more of these inputs. About 30 percent of the NWR utilizes agrochemicals and improved seeds and more than 40 percent of the NWR uses chemical fertilizers to grow crops.

Another important region regarding fertilizer usages is the CR that applies chemical fertilizer for more than 45 percent of the total land devoted to crop production.

Input requirements for the major crops in Mexico consist of seed, fertilizer, agrochemicals and mechanized work such as fallow and tracking. Of particular importance is the high cost of some of these inputs that is currently limiting the cultivated land in Mexico. The cost data set was obtained from SAGARPA that published Enterprise Budgets of the major crops for the year of 2007. Costs were adjusted using the annual producer price index (PPI) for the agriculture sector from 2008 to 2010 (2008:9.06, 2009:10.60, 2010:4.98) depending on the time where the Enterprise Budget was developed.

Results

A system that is more market based will consist on a very dynamic economy driven purely by supply and demand. As mentioned before, one of the biggest challenges in Mexican agriculture is the transition from a more subsistence agricultural system to a system that is more market based. The present project used as an example application the removal of a cash payment made to major crops produced into the allocation of resources among the major crops. The example implemented was the removal of PROCAMPO. In 1993, the Mexican government implemented a program (PROCAMPO) to compensate farmers for the anticipated negative effect of trade liberalization on the price of staple crops. The present project simulated the effect of removing PROCAMPO in the resource

allocation of the major crops as an example to show a possible application of the model. PROCAMPO, a cash transfer program on a per-hectare basis, has been in place for over fifteen years, and while it has suffered some transformations it continues to provide a subsidy to all farmers who were originally subscribed. PROCAMPO remains the largest agricultural program in Mexico and targets producers of the major crops. Of particular importance is the effect that these cash payments have on the production of white corn, yellow corn, sorghum, wheat, rice and beans. The present study assumed two scenarios to measure this effect. The first scenario represents the base year of 2010 crop production system in Mexico, while the second scenario pretends to determine the effect of the termination of PROCAMPO cash transfers.

Solutions to the model provide production quantities of each crop that maximize producer and consumer surplus (Table IV.6) under the two scenarios previously described. Table IV.6 presents the base year production of each of the crops considered in the model. Note that the presence of these government payments has a positive effect on the majority of the crops. However, the cancellation of these payments will have significant effects on the production of yellow corn and wheat. These two crops are relatively expensive to grow in Mexico. Yellow corn production, mostly used for feed, has increased from a very small level of production a few years ago to being one of the largest crops in terms of planted area in the present. Some states are growing yellow corn under very traditional production systems, implying a very low yield for this crop. On the other hand, yellow corn production offers increased profit potential for those commercial producers that grow crops under very sophisticated irrigation systems. One of the major problems of adopting yellow corn implies huge investments to enhance its productivity.

This is one of the possible explanations of the big effect of these payments on yellow corn production. Without the support from the government, growing yellow corn and wheat becomes very expensive for the traditional producers that also experience very low yield in these crops. Results suggest that the program has a positive impact on the majority of the crops that it is intended for, except for rice. In general, if this program is removed completely from all the farmers that grow staple crops in Mexico, production will decrease by 7.31 percent, implying that current consumption will need to be satisfied from external sources. The model results show that if PROCAMPO reduces imports for about 13 percent. These results suggest that the country under a system that is more market based will be better off by importing yellow corn.

Table IV.7 reports the impact on consumer and producer surplus when the government payment is equal to zero. As it was expected, the cash payment would have a positive effect on producers' surplus. If the government cancels this cash payment for the producers, there would be a decrease in consumer and producer surplus of about 2%. However, for producer surplus, its value will be reduced by 7.32%. Estimates of the model also indicate that the majority of the objective function value belongs to the consumers (about 90%).

Table IV.8 presents results on the total planting area for the major crops in Mexico (thousand hectares) by regions and by crops. Estimates indicate that these payments have a significant effect on crop production in the SR. Base data show that this cash payment allows SR to grow some yellow corn and sorghum. However, the removal of the payment would have a big effect on the area planted in this region (-33.7%). These results suggest that cash transfers represent a very significant contribution to farmers,

particularly the subsistence, with the potential of not only adding importantly to their income but also affecting their supply behavior in income generating activities such as crop production. The rest of the regions balance their losses with some other crops when the payment is no longer available indicating their capacity to allocate their scarce resources in other activities that are still productive for them. An important conclusion of the present study is that SR is potentially the region that needs more investment to enhance productivity.

Conclusions

The Mexican Agriculture Sector is very complex. Inevitably, model building is subject to the limitations of availability and reliability of data. A central conclusion of the present study seems, however, firmly based. CROPMEX appears to be a useful tool for analyzing the tradeoff of the government policy instrument PROCAMPO for the main crops produced currently in the country. The model has potential for improvement if data becomes more available for the agricultural system. Like all programming models, CROPMEX must be used with discretion. Results should be taken as indicative and it is recommended that the focus of the use of the model for policy analysis be general.

Growing demand for yellow corn, a feed crop, poses new challenges to Mexico. Yellow corn production is not feasible in all regions and even though it has a relatively high growth rate in terms of production in Mexico, some regions such as the SR will require large investments to enhance the productivity of this crop. Increased profit

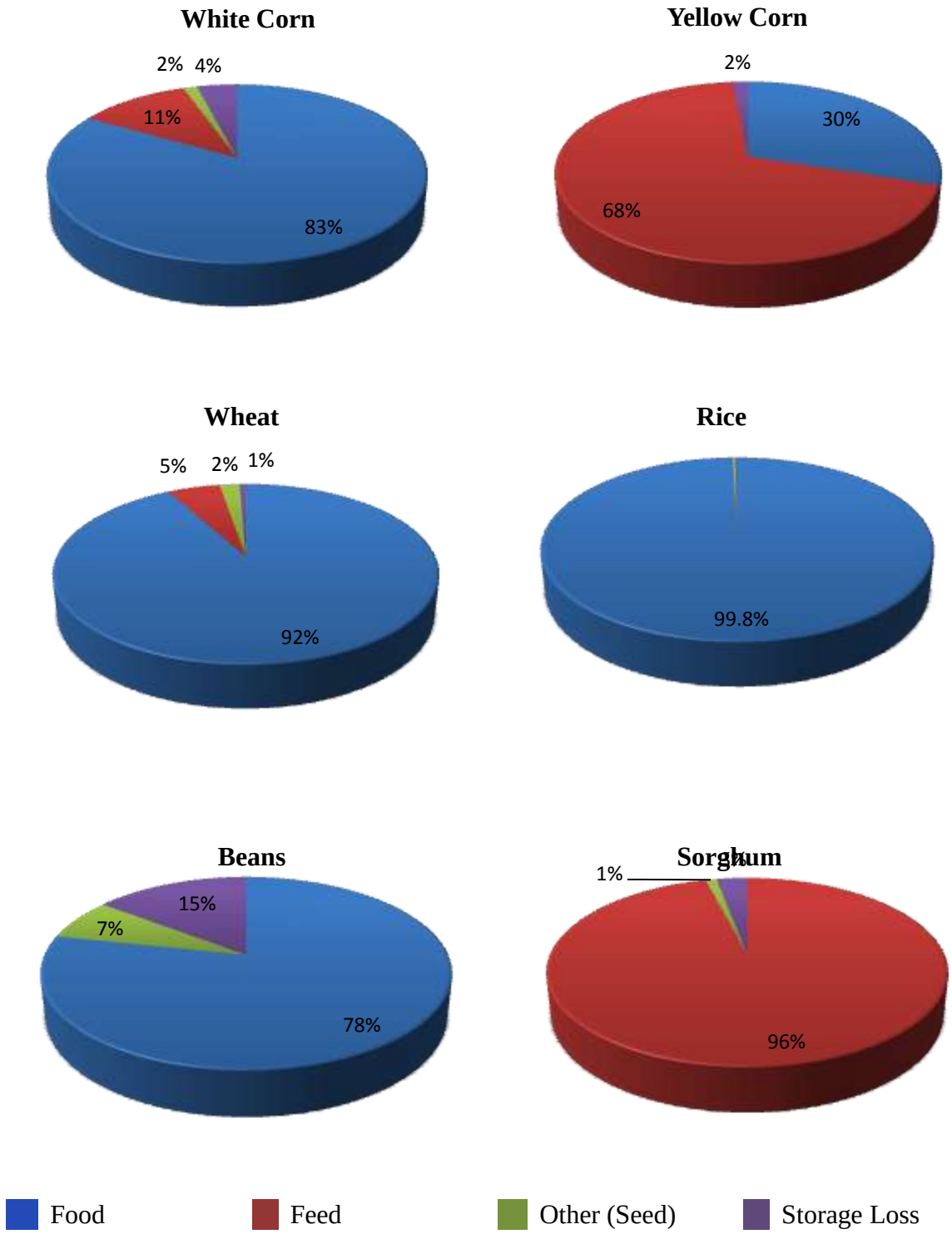
potential on this crop depends on the availability of agricultural inputs such as fertilizer and seed. As mentioned before, Mexico has faced significant competition for use of limited arable land for food production and the recent growth in demand for feed crops heightens this critical situation.

Although much of Mexico's crop production is in areas of less than ideal conditions, there is considerable potential to increase the productivity of some of the major crops. To achieve this potential, the agriculture sector in Mexico will require large investments in developing crop production systems, training and increasing access to technology and inputs markets.

It is recommended to add information of the infrastructure for the collection and storage of grains to the model as it is strategic for the growth of the agricultural sector in Mexico. This addition can allow Mexican government to reduce operational cost and add value to products.

Source: Mejia 2008

Figure IV.1 Crop Production Regions



Source: 2010 Monthly Balance of Availability and Consumption (SIAP - Information Service Agrifood and Fisheries)

Figure IV.2 Food, Feed and Other Use of the Major Grains in Mexico, 2010

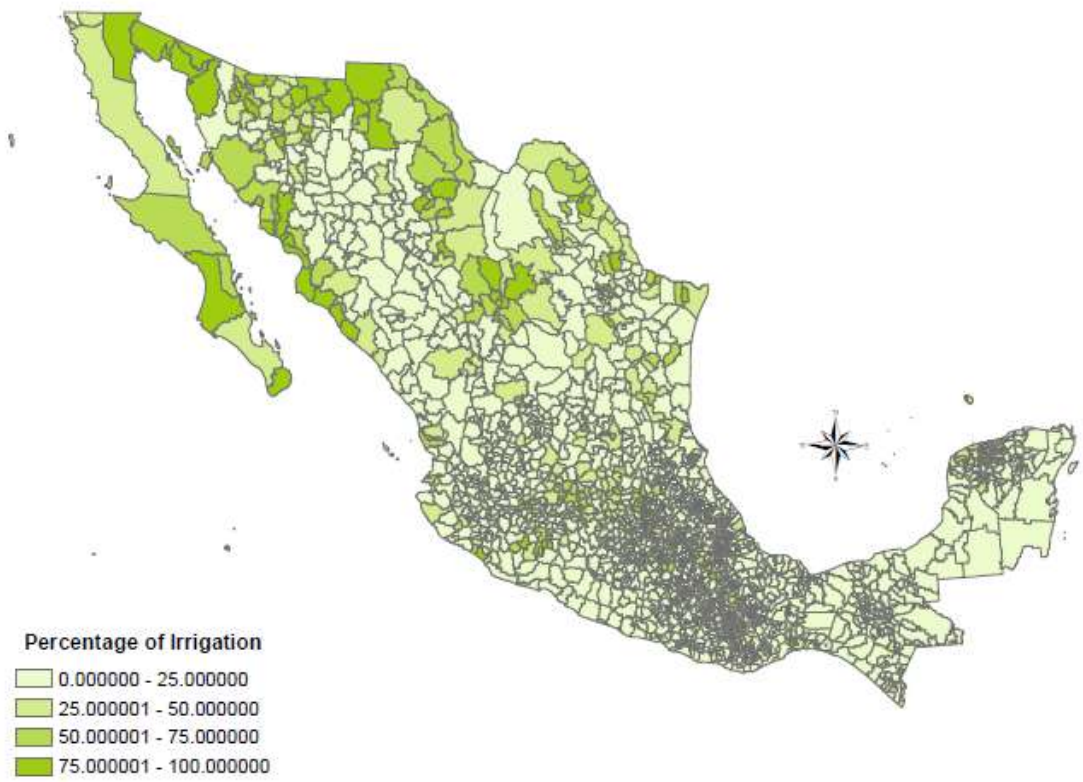
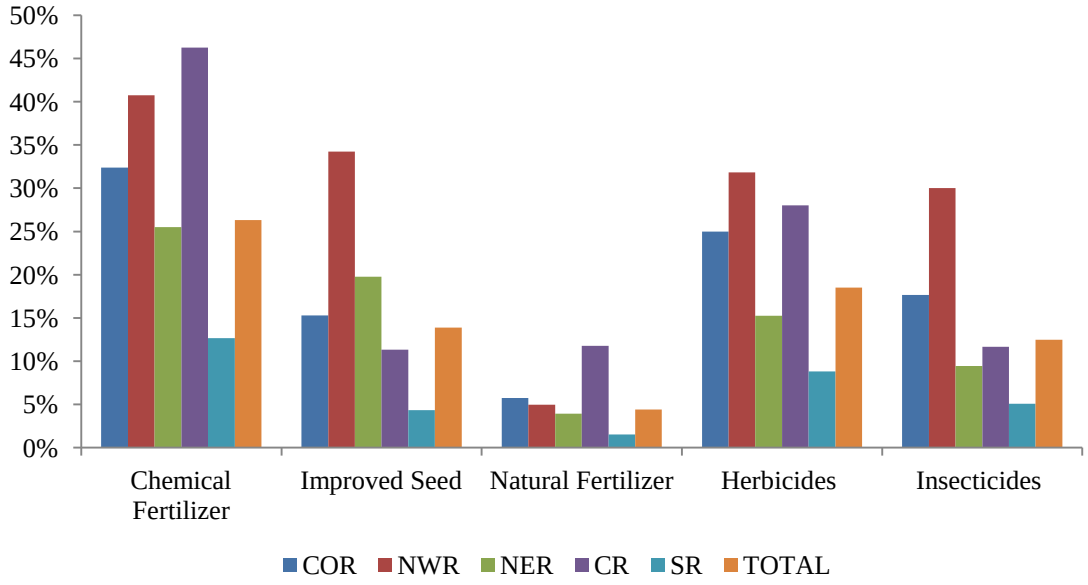
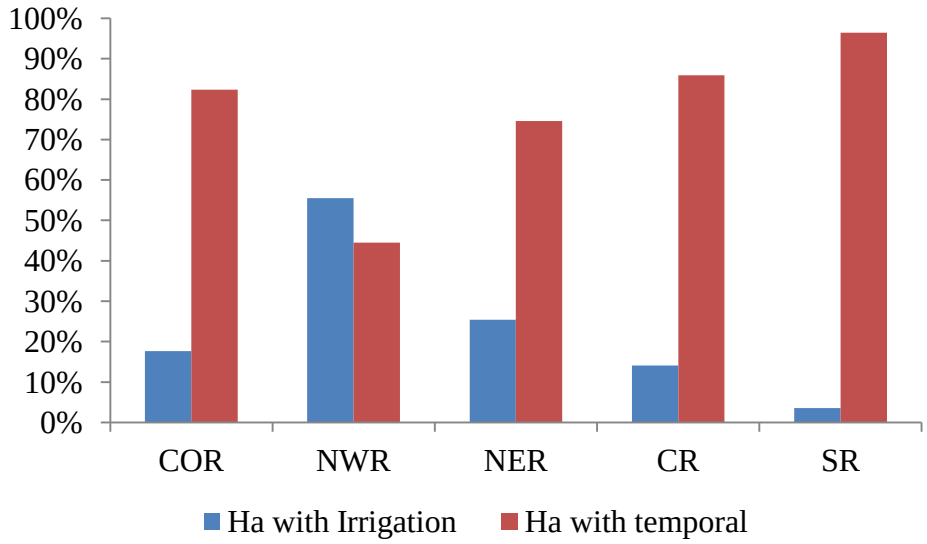


Figure IV.3 Percentage of Irrigation Land in Mexico by Municipality in 2007



Source: 2007 Census of Agriculture

Figure IV.4 2007 Percentage of Crop Area with Use of Main Agricultural Inputs by Region and National in Mexico



Source: 2007 Census of Agriculture

Figure IV.5 2007 Percentage of Crop Area with Irrigation by Region in Mexico

Table IV.1 2010 International Trade Data of the Major Annual Cops in Mexico

Export	Value (Dollars)	Volume (Kg)	Volume (Ton)	Price (Dollars)	Price[a] (Pesos)
White Corn	130,967,311	548,574,991	548,574.99	238.74	3,016.90
Yellow Corn	23,588	41,277	41.28	571.46	7,221.32
Sorghum	1,359	5,555	5.56	244.64	3,091.50
Wheat	87,639,647	435,032,699	435,032.70	201.46	2,545.73
Rice	3,487,170	5,535,269	5,535.27	629.99	7,961.01
Beans	27,601,698	29,528,382	29,528.38	934.75	11,812.17
Import	**Value (Dollars)**	**Volume (Kg)**	**Volume (Tons)**	**Price (Dollars)**	**Price (Pesos)**
White Corn	110,315,977	504,346,297	504,346.30	218.73	2,764.03
Yellow Corn	1,408,930,686	7,270,912,001	7,270,912.00	193.78	2,448.69
Sorghum	427,576,017	2,252,516,260	2,252,516.26	189.82	2,398.72
Wheat	719,392,469	2,939,875,029	2,939,875.03	244.70	3,092.22
Rice	288,118,153	788,932,131	788,932.13	365.20	4,614.93
Beans	113,182,571	117,469,300	117,469.30	963.51	12,175.56

Source: Ministry of Economics (SIAVI-Trade Information System Via Internet)

[a] Price in pesos was calculated using the exchange rate of 12.64 pesos per dollar (Banco de México)

Table IV.2 2010 National Apparent Consumption of the Major Annual Crops in Mexico (Thousand Tons)

	Beginning[a] Stocks	Exports[b] (Tons)	Imports[b] (Tons)	Domestic[c] Production	Ending[a] Stocks	Apparent Consumption
White Corn	2327.20	548.57	504.35	21165.67	2056.91	21391.73
Yellow Corn	980.40	0.04	7270.91	2018.37	645.01	9624.63
Sorghum	2549.04	0.01	2252.52	6940.22	1297.07	10444.70
Wheat	509.85	435.03	2939.88	3676.71	405.07	6286.33
Rice	199.20	5.54	788.93	216.68	158.79	1040.48
Beans	294.61	29.53	117.47	1172.15	408.35	1146.35

[a] 2010 Monthly Balance of Availability and Consumption (SIAP - Information Service Agrifood and Fisheries)
[b] Ministry of Economics (SIAVI-Trade Information System Via Internet)
[c] 1980-2011 SIAP Yearbook

Table IV.3 2010 Planted Area, Total Production and Domestic Price of the Major Annual Crops in Mexico by Method of Production

	Irrigation			Dryland		
	Planted Area (Thousand Hectares)	Production (Thousand Tons)	Domestic Price (Pesos)	Planted Area (Thousand Hectares)	Production (Thousand Tons)	Domestic Price (Pesos)
White Corn	1225.58	9080.90	2567.84	6179.34	12084.77	3040.05
Yellow Corn	194.11	1508.19	2484.94	204.86	510.18	2891.62
Sorghum	554.24	3224.42	2295.71	1334.49	3715.80	2247.29
Wheat	563.26	3434.37	2688.28	137.32	242.33	2793.10
Rice	28.77	162.76	3190.33	21.43	53.92	3133.54
Beans	344.61	453.67	9389.56	1567.15	718.48	8101.52

Source: 1980-2011 SIAP Yearbook

Table IV.4 Available Land (Thousand Hectares) and Water (m^3) for Major Annual Crops in Mexico by Crop Regions

	COR	NWR	NER	CR	SR	Total Land
Total area for crop production	8137.73	3103.05	5505.01	2683.84	10472.46	29902.09
Perennial	1789.65	547.97	980.92	425.13	4954.82	8698.48
Rice	13.72	1.159	1.20	1.10	56.36	73.53
Forage	374.66	510.68	840.53	72.38	77.58	1875.82
Other Crops	388.38	511.84	841.72	73.48	133.94	1949.36
Total Area Per Region	5598.77	1533.73	2843.04	2113.95	5362.47	17451.96
Available Water Per Region	1271620.00	1454310.00	1487100.00	4774010.00	6705070.00	15692110.00

Sources: 2007 Census of Agriculture and 1980-2011 SIAP Yearbook

Table IV.5 Yield for Major Annual Crops in Mexico by Method of Production and Region (MT/Ha and Bu/Acre)

Irrigated Crops	Metric Tons/ Hectare					Bushels/Acre				
	COR	NWR	NER	CR	SR	COR	NWR	NER	CR	SR
White Corn	6.54	10.11	5.02	4.84	3.17	104.22	161.04	80.01	77.18	50.51
Yellow Corn	8.52	9.98	7.58	3.42	3.05	135.72	158.91	120.79	54.52	48.55
Sorghum	7.46	6.36	4.31	5.89	3.50	118.78	101.30	68.61	93.79	55.70
Wheat	5.92	6.48	4.43	3.39	1.85	88.04	96.39	65.95	50.34	27.51
Rice	6.16	8.50	5.83	9.37	3.67	114.50	158.06	108.52	174.33	68.33
Beans	1.10	1.57	1.28	1.03	0.82	17.50	25.04	20.39	16.40	13.08
Dryland Crops	Metric Tons/ Hectare					Bushels/Acre				
	COR	NWR	NER	CR	SR	COR	NWR	NER	CR	SR
White Corn	2.48	0.79	0.92	1.89	1.78	39.56	12.60	14.66	30.13	28.41
Yellow Corn	5.34		1.33	1.96	1.57	85.12	-	21.16	31.25	25.03
Sorghum	3.08	0.77	2.97	4.67	2.56	49.01	12.26	47.38	74.34	40.73
Wheat	0.73	0.88	1.47	2.89	0.74	10.85	13.09	21.83	42.99	11.00
Rice	5.85				2.09	108.80	-	-	-	38.86
Beans	0.42	0.51	0.49	0.46	0.57	6.69	8.17	7.86	7.29	9.04

Source: 1980-2011 SIAP Yearbook

Table IV.6 CROPMEX. Production, Consumption, Imports and Exports (Thousand Tons): Base Data and Solution

Product	Units		Production	Consumption	Imports	Exports
			(Thousand Tons)			
White Corn	Tons	Base	24405.49	23448.64		605.00
		Shock	24245.13	23448.64		605.00
		Change	-160.36			0.00
		%Change	-0.66			0.00
Yellow Corn	Tons	Base	4954.83	10269.64	5532.61	1.00
		Shock	3853.28	10269.64	6447.61	1.00
		Change	-1101.55		915.00	0.00
		%Change	-22.23		16.54	0.00
Sorghum	Tons	Base	10478.08	11933.62	930.54	1.00
		Shock	10413.72	11933.62	930.54	1.00
		Change	-64.36		0.00	0.00
		%Change	-0.61		0.00	0.00
Wheat	Tons	Base	9733.58	6691.46	824.98	
		Shock	7320.41	6691.46	824.98	
		Change	-2413.18		0.00	0.00
		%Change	-24.79		0.00	
Rice	Tons	Base	1445.24	1199.27		7.00
		Shock	1445.24	1199.27		7.00
		Change	0.00			0.00
		%Change	0.00			0.00
Beans	Tons	Base	1857.23	1538.19		29.00
		Shock	1729.58	1538.19		29.00
		Change	-127.65			0.00
		%Change	-6.87			0.00
All Crops	Tons	Base	52874.45	55080.82	7288.13	643.00
		Shock	49007.36	55080.82	8203.14	643.00
		Change	-3867.09		915.00	
		% Change	-7.31		12.55	

Table IV.7 CROPMEX. Consumer and Producer Surplus in Millions of Pesos: Base Data and Solution

	Consumer and Producer Surplus	Producer Surplus	Consumer Surplus
Base (Value)	947156.20	96542.37	850613.90
Base (Percentage)	100.00	10.19	89.81
Shock (Value)	927584.10	89472.65	838111.50
Shock (Percentage)	100.00	9.65	90.35
Change	-19572.10	-7069.72	-12502.40
% Change	-0.02	-0.07	-0.01

Table IV.8 CROPMEX. Total planting area for major crops in Thousand Hectares: Base Data and Solution

			NWR	NER	COR	CR	SR
White Corn	Hectares	Base	782.00	269.04	2600.00	332.09	4187.33
		Shock	782.00	368.04	2728.70	1355.10	2707.09
		Change	0.00	99.00	128.70	1023.01	-1480.24
		%Change	0.00	36.80	4.95	308.05	-35.35
Yellow Corn	Hectares	Base	25.00	297.00	300.00	35	300.00
		Shock	25.00	198.00	300.00	7.00	0.00
		Change	0.00	-99.00	0.00	-28.00	-300.00
		%Change	0.00	-33.33	0.00	-80.00	-100.00
Sorghum	Hectares	Base	116.73	1606.00	750.00	86	25.14
		Shock	116.73	1606.00	750.00	86.00	0.00
		Change	0.00	0.00	0.00	0.00	-25.14
		%Change	0.00	0.00	0.00	0.00	-100.00
Wheat	Hectares	Base	400.00	105.00	350.00	1496.862	150.00
		Shock	400.00	105.00	350.00	661.85	150.00
		Change	0.00	0.00	0.00	-835.01	0.00
		%Change	0.00	0.00	0.00	-55.78	0.00
Rice	Hectares	Base	1.00	3.00	110.00	5.00	200.00
		Shock	0.00	2.00	110.00	4.00	200.00
		Change	-1.00	-1.00	0.00	-1.00	0.00
		%Change	-100.00	-33.33	0.00	-20.00	0.00
Beans	Hectares	Base	210.00	564.00	1488.77	160.00	500.00
		Shock	210.00	564.00	1360.08	0.00	500.00
		Change	0.00	0.00	-128.70	-160.00	0.00
		%Change	0.00	0.00	-8.64	-100.00	0.00
All Major Crops	Hectares	Base	1534.73	2844.04	5598.77	2114.95	5362.47
		Shock	1533.73	2843.04	5598.77	2113.95	3557.087
		Change	-1.00	-1.00	0.00	-1.00	-1805.38
		%Change	-0.07	-0.04	0.00	-0.05	-33.67

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Scope and Method of Study: The first essay analyzes separability among preferences of the major food groups in Mexico. A two-step censored model and separability restrictions were conducted to determine if beans and potatoes are separable from meats and cereals, respectively. The second essay uses the example of Mexico to determine different levels of income effect on consumption patterns of different food categories over time. Using a two-step censored model and cross sectional data for different years, this study estimates the relationship between expenditure of certain categories and different income levels by deciles over time. The third essay simulates allocation of resources among the major crops produced in Mexico. A multi-region, comparative static programming model of the crop subsector in Mexico was used to determine the effect of a more market based system.

Findings and Conclusions: The first essay found that preferences of cereals and meats are not separable from potatoes and beans, respectively. Empirical evidence suggest that beans, as a vegetable protein source, should be included with meats for a complete meat demand specification and that potatoes should be included with cereals as a starch source when studying Mexican preferences of cereals and meats. The second essay found that budget allocation on food categories between high income households and low income households is revealing. This study has provided quantitative evidence of the effect of income distribution on consumption patterns over time, and of the need to incorporate various levels of income in models for consumer behavior when wide income disparities are present. The third essay found that a more market based agricultural system has a significant effect on production of the major crops in Mexico. The study used as an example the impact that a cash payment (Procampo) has on the production of the major crops in Mexico. Results suggest that the program has a positive effect on the majority of the major crops except for rice. Mexico has faced significant competition of arable land for food production and the recent growth in demand for feed crops heightens this critical situation. Increased profit potential on feed crops such as yellow corn also depends on the availability of agricultural inputs such as fertilizer and seed.

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