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Abstract

Food expenditure patterns were examined for Hispanic households in the U.S. Engel curves for three food categories: food eaten at-home, food eaten away-from-home, and for total food, were estimated using four different functional forms. Confidence intervals for income and household elasticities were computed and results compared with previous research.

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Introduction

Since April 1998, *The Atlanta Journal Constitution* has been dedicating broad coverage to one of the most outstanding population phenomena of this decade. "The United States is currently experiencing the largest sustained wave of immigration in its history, with 1.2 million legal and illegal aliens arriving here each year" (Emling, April 19, 1998). Camarota (1999) reported 26.3 million foreign-born persons in the United States. Of this number, 13.4 million came from Latin America; 7.1 million from Mexico (53%), 2.8 million from Caribbean countries (11%), 1.8 million from Central America (7%), and 1.6 millions from South America (6%). According to the U.S. Census Bureau, by 2010 the Latino population is expected to comprise 15.5% of the population.

Corporations and businesses perceive the emergent Hispanic communities as a major sector of the U.S. economy. Latino's buying power has been estimated at $350 billion nationwide (*The Atlanta Journal Constitution*, April 19, 1998 p. P1). According to the University of Georgia's Selig Center for Economic Growth, the nation's Latino buying power grew 65.5% in the 1990-97 period, an outstanding compound annual growth rate of 7.5% (Holsendoph, April 19, 1998). Income growth combined with high birth and immigration rates for the Latin American population are responsible for the emergence of the Hispanic market in the United States (Fan and Zuiker, 1998).

Immigrants usually carry with them many of their traditions, customs, and food habits as they settle in the U.S. When possible, the new immigrants try to maintain a diet at least similar to what they were accustomed to eating in their country of origin. This helps make the adaptation process less traumatic in their new country. The increasing demand for ethnic food represents a challenge for food processors, distributors and retailers. Thus, for the food industry it is very important to know more about the consumption patterns of this growing sector of the U.S consumers.

Objectives

The objective of this paper is to analyze the expenditure patterns of the Latin population in the United States, during the period 1994-1996, for total food (TF), considered as a whole category, and two broad subcategories: food eaten at home (FAH), and food eaten away from home (FAFH).

Methodology

According to Engel's law, food expenditures for poorer households represent a higher share of their total expenditure than for higher income households, and the same is true for large households over small households at the same level of expenditures (Deaton and Muellbauer, 1980, p. 193). In this study, we test Engel's law for the particular case of the Hispanic community living in the US. Engel curves were estimated for the three food groups using different functional forms. Cross sectional data were utilized to investigate how Hispanic households allocate their food budget in response to income and household size through their respective expenditure elasticities, and more specifically, how they allocate food expenditures between food eaten at home and food eaten away from home.

The Hispanic Consumer Data Set

The data set used in this research was constructed from information collected from the USDA 1994-96 Continuing Survey of Food Intakes by Individuals (CSFII94-96). Only households of Hispanic origin that participated in the 1994-96 two-day survey and provided information about food consumption were selected for analysis. The total sample consisted of 643 households. Households which did not report any amount of money for weekly income (INCWK), total food expenditure (TF), and food eaten at home expenditure (FAH) categories were excluded from the study. Households reporting zero expenditure for the category food away from home (FAFH) were included in the data set.

Income and expenditure values were constructed on a weekly basis. Reported annual, before-tax household income for the previous calendar year was used as a proxy for actual income. Annual income was transformed into weekly income (INCWK) by dividing by 52. In cases where respondents were allowed to report their expenditures per month, the values were transformed into dollars per week by dividing by four. In all cases, the answers represent the amount in dollars the household spent on each food category, during the last three months preceding the survey.

The expenditures in FAFH were obtained directly from the survey. The expenditures for the category FAH were computed as the total amount spent at grocery stores, food stores, salad bars, delis, etc., (including purchases made with Food Stamps, during the three months prior to the survey), less the amount spent on nonfood items in those stores. This category also includes weekly expenditures on food brought into the home from specialty stores (bakeries, liquor stores, delicatessens, meat markets, vegetable stands, health food stores, etc.), and at fast food outlets, when the food was *brought into the home*. The amount of total food expenditures (TF) is a summation of FAH and FAFH.

Several demographic and socio-economic variables were included in the analysis of Hispanic consumers. One of the most important variables is household size. The use of the number of individuals in the household as a measure for household size may not be appropriate, since it is expected that adults and children, and even male and female members of the same age, influence household expenditures on food in a different way. Deaton and Muellbauer (1980, p. 193) indicated that this issue can be reconciled with the use of adult equivalent scales. Buse and Salathe (1978) pointed out that the use of one number to account for individuals of various types can simplify the measurement and testing of expenditure behavior. The theoretical and practical implications of household equivalence scales have captured the attention of researchers, because they play an important role in the analysis of welfare policies (Buse and Salathe, 1978; Muellbauer, 1980; Brown and Johnson, 1984; Deaton, 1997). Many studies that use different approaches to derive different weights or scales are available in the literature (Muellbauer, 1980).

For the purposes of this study, we chose the so-called Amsterdam scale used by Stone (1954), based on nutritional studies (Deaton and Muellbauer, 1980, p. 193). This variable was identified as HHSIZE. The main reason for this choice was its simplicity. This scale represents household members in relation to the reference unit, an adult male, 18 years old and over. Each adult female is represented by 0.90 equivalent adult males; males and females from 14-17 years are 0.98 and 0.90 equivalent adult males, respectively, and individuals under 14 years old from both sexes are valued as 0.52 equivalent adult males, in terms of the Amsterdam Scale (Deaton and Muellbauer, 1980, p. 193).

Information about national origin allowed the classification of the households into four categories: Mexican (O_MEX), which includes persons classified as Mexican-American or Chicano; Puerto Rican (O_PRI); Cuban (O_CUB), and persons Other Spanish/Hispanic origin.

Dummy variables representing origins were used to take into account possible differences among these groups in expenditure patterns. To avoid collinearity problems, the dummy for Other Spanish/Hispanic consumers was dropped.

Other variables were hypothesized to influence food demand. The tenure status of the household dwelling was considered through a simple binary variable (T_OWNER), accounting for dwelling owners. Four binary variables account for differences in education of the household head: G_ELEM accounts for individuals who completed or attended one or more years of elementary school; G_HIGH variable correspond to individuals with one or more years of high school, have a high school degree or a General Education Degree (GED); households whose household head declared having one to four years of college education are identified by the variable G_COLL, and those with five or more years of college correspond to G_GRAD. The value by default corresponds to persons who never attended school.

Another set of dummy variables allows for shifts in food demand due to urbanization status. Two variables, Central City location (U_MSAINC), and Outside Central City (U_MSAOUT), account for households located in Metropolitan Statistical Area (MSA). The default identifies households located outside the MSA. Binary variables for two income transfer payments for low-income households were also considered in this study; these included the Women, Infants and Children (WIC) and the Food Stamp Program (F_STAMP).

Finally, two binary variables were used to identify the year of the of the data collection. While the value by default corresponded to households interviewed in 1994, the variables Y_95 and Y_96 were used to represent households surveyed in 1995 and 1996, respectively.

Characterization of the Sample of Hispanic Consumers

The CSFII94-96 survey includes information about 8067 U.S. households; 727 were identified as Hispanic households, or about 9% of the sample. Only 643 of the 727 Hispanic households (88.5%) were included in the data set. Households of Mexican origin, the vast majority of the Latin population in the United States, averaged 43.9% of the sample during the study period. Puerto Ricans averaged 11.0%, Cubans 2.6%, and households of other Hispanic origin accounted for the remaining 42.5%. All these ethnic categories included recent immigrants, and households of Hispanic origin with more than one generation in the U.S. In fact, more than one-half (55.8%) of Hispanics were born in the United States, according to reports of the Census Bureau (Reed and Ramirez, 1998).

Households located in the suburban areas (outside central city) represented more than 40% of the Hispanic community. Households living in the central city averaged about 36% of the sample, while households living outside the metropolitan statistical area constituted the smallest urbanization status group of 21%.

The average household consisted of four individuals, ranging from one to eight members. Eleven households had more than eight members; the maximum number was 13 members, reported by one household. Almost 52% of the households have no children younger than 5 years of age. Thirty-one percent of households had only one child, 13% of the households reported 2 children, while the remaining 4%, reported up to four children 5 years old or younger. The average age of household head was 41 years old.

With respect to educational level of the household head, about 1.3 % of the household heads never attended school. In 27.6% of the cases, the household head reported that he or she had received only a primary education, although only 5% finished the 8th grade; 41.1% attended at least one year of high-school, but the percentage of individuals that earned a high school or a GED was only slightly more than 27%. On average, 23.5% of the household heads attended at least one year of college, but only 6.5% went to graduate school.

About 54% of the respondents claimed to be fully employed during the week preceding the survey. However, the level of unemployment for the sampled household heads was very high, 32%. With 1% of the households reporting undetermined employment status, the remaining 13% of the respondents reported to be employed part-time or were employed but did not work the week prior to the survey. Almost 26% of the individuals that were partially or fully employed (18% of the total) declared they were professionals, managers, officers or proprietors. About 63% were classified as service worker or similar, operative, craftsman or foreman, and 10% worked as clerical or sales workers. These figures are similar to the profiles presented by Fan and Zuiker (1998) for the Hispanic population.

In the July 1998 issue of the Current Population Reports of the Census Bureau, Reed and Ramirez (1998) reveal that 26.4% of all Hispanic families in the U.S. were living below the poverty level in 1996. Our data set showed that roughly 48% of the selected household can be categorized as ranging from zero to 130% of this poverty threshold.[1]

A total of 144 households in the study (22.4%) received some food stamps[2] for at least one month in the previous calendar year. The WIC program was another income transfer payment for low-income households considered in this study. About 20% of the households received benefits under the WIC program.

Functional Form and Statistical Procedures

The Marshallian demand functions, $\boldsymbol{q}_i = g_i(\boldsymbol{y},\boldsymbol{p})$ define the rules by which the consumer decides how much to purchase of each good as a function of prices and total expenditures. If prices are absorbed into the functional form we obtain $\boldsymbol{q}_i = g_i(\boldsymbol{y})$, a function that relates income to the demand for each commodity at constant prices. This relationship is commonly referred to

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[1] In 1996, the average poverty threshold for a family of four was $16,036; for a family of nine persons or more, the threshold was $31,971; and for an unrelated individual aged 65 and over, it was $7,525. The poverty thresholds are updated each year to reflect changes in the Consumer Price Index (CPI-U) for All Urban Consumers (U.S. Bureau of Labor Statistics, 1998).

[2] Cash subsidies from the government, worth $73 per person (USDA, Agricultural Statistics, 1998).

as an Engel curve (Varian, 1992, p. 116-118).

Several functional forms have been used to estimate Engel curves (Deaton and Muellbauer (1980). In this paper we closely followed the approach of Holcomb, Park and Capps (1995), estimating the Engel curves for the three food categories, TF, FAH and FAFH, using four different functional forms: double-logarithmic, semi-logarithmic, quadratic and the so called Working-Leser functional form. All the four models are linear in the parameters so, in principle, they can be estimated using OLS. However, as in the previously mentioned study, the category FAFH presents a censored-response problem that causes a sort of selectivity bias. The estimation of this model by OLS gives inconsistent estimates of the parameters (Maddala, 1983).

Holcomb, Park and Capps (1995) chose the two-step Heckman procedure (HP) to deal with this problem, considering this method to be less restrictive and easier to implement than the Tobit estimation technique. Heckman (1979) noted that with self-selectivity, there is an omitted variable bias in the OLS estimates, with a magnitude given by the so-called inverse Mills ratio. If this omitted variable were included in the regression, then OLS is consistent. The two steps are as follows: first, run a Probit model which deals with the decision problem (buy FAFH) and compute the inverse Mills ratio. Second, estimate the Engel curve by OLS using the estimated inverse Mills ratio as a one of the regressors.

Davidson and MacKinnon (1993) suggest the use of a full step Maximum Likelihood method (FIML) which makes use of the information about the covariance between the residuals of the probit and the regression equations, giving more efficient estimates, rather than the HP procedure. Amemiya (1983) describes a sample selection model (SS) that he calls a Type II Tobit model, which is a generalization of the original Tobit. It connects the probit equation that stands for the decision problem with the original regression equation through the possible correlation between their disturbances, is assumed to be joint normally distributed. This method maximizes a likelihood function using starting values from probit and OLS estimations.

A major weakness of the sample selection model is that it is sometimes affected by collinearity problems (Leung and Yu, 1996). In addition, the TSP manual reports that some problems appear to occur when the probit equation is dominating the likelihood function and the intercepts become distorted. In this case, the estimated correlation coefficient of the residuals is slightly less than one in absolute value and the residual covariance matrix is nearly singular. The standard error or the correlation coefficient and its covariance with other parameters is set to zero, and in these cases, it is not clear how to interpret the model (TSP 4.5 Reference Manual, 1999. p.257).

In this study, the models for TF and FAH were estimated by least squares. The presence of heteroscedasticity was noted using a simple Lagrangian Multiplier test on squared fitted values and the general White test (Greene, 1995, p. 549-555). Thus, the standard errors of the coefficient estimates were computed using the heteroscedasticity consistent estimator (HLS) proposed by White (1980), with the correction suggested by Davidson and MacKinnon (1993). The equations for FAFH were estimated using a two-part model (TP), with the level equation estimated using HLS, and a sample selectivity model computed using both the two stage procedure (HP) developed by Heckman (1979) and the Type II Tobit or sample selection model (SS) described by Amemiya (1985). Leung and Yu (1996) discussed the advantages and disadvantages of these methods. As in previous studies, various socioeconomic variables were used to investigate the possible influence of these factors on consumer expenditure patterns.

Empirical Models

The mathematical formulation of the equations can be written as:

Double-logarithmic model:

$LnExpenditure = \alpha_0 + \alpha_1 LnINCWK + \alpha_2 LnHHSIZE + \alpha_3 LnAGE + \alpha_4 S\_FEM + \alpha_5 O\_MEX + \alpha_6 O\_PRI + \alpha_7 O\_CUB +$

α_8R_NEAST + α_9R_MWEST + α_{10}R_SOUTH + α_{11}U_MSAINC + α_{12}U_MSAOUT + α_{13}G_ELEM + α_{14}G_HIGH + α_{15}G_COLL + α_{16}G_GRAD + α_{17}F_STAMP + α_{18}T_OWNER + α_{19}WIC + α_{20}Y_95 + α_{21}Y_96

Semi-logarithmic model:

Expenditure = β_0 + β_1LnINCWK + β_2LnHHSIZE + β_3LnAGE + β_4S_FEM + β_5O_MEX + β_6O_PRI + β_7O_CUB + β_8R_NEAST + β_9R_MWEST + β_{10}R_SOUTH + β_{11}U_MSAINC + β_{12}U_MSAOUT + β_{13}G_ELEM + β_{14}G_HIGH + β_{15}G_COLL + β_{16}G_GRAD + β_{17}F_STAMP + β_{18}T_OWNER + β_{19}WIC + β_{20}Y_95 + β_{21}Y_96

Quadratic model:

Expenditure = δ_0 + δ_1INCWK + δ_2HHSIZE + δ_3AGE + δ_4INCWK^2 + δ_5HHSIZE^2 + δ_6AGE^2 + δ_7INCWKxHHSIZE + δ_8INCWKxAGE + δ_9AGExHHSIZE + δ_{10}INCWKxAGExHHSIZE + δ_{11}S_FEM + δ_{12}O_MEX + δ_{13}O_PRI + δ_{14}O_CUB + δ_{15}R_NEAST + δ_{16}R_MWEST + δ_{17}R_SOUTH + δ_{18}U_MSAINC + δ_{19}U_MSAOUT + δ_{20}G_ELEM + δ_{21}G_HIGH + δ_{22}G_COLL + δ_{23}G_GRAD + δ_{24}F_STAMP + δ_{25}T_OWNER+ δ_{26}WIC + δ_{27}Y_95 + δ_{28}Y_96

Working-Leser model:

ValueShare = γ_0 + γ_1LnINCWK + γ_2LnHHSIZE + γ_3LnAGE + γ_4S_FEM + γ_5O_MEX + γ_6O_PRI + γ_7O_CUB + γ_8R_NEAST + γ_9R_MWEST + γ_{10}R_SOUTH + γ_{11}U_MSAINC + γ_{12}U_MSAOUT + γ_{13}G_ELEM + γ_{14}G_HIGH + γ_{15}G_COLL + γ_{16}G_GRAD + γ_{17}F_STAMP + γ_{18}T_OWNER + γ_{19}WIC + γ_{20}Y_95 + γ_{21}Y_96

The prefix Ln stands for the natural logarithm of the variable. The dependent variables were specified as expenditures on TF, FAH and FAFH, respectively. In the case of FAFH, the estimated inverse Mills ratio was added as a regressor for the two-step Heckman procedure.

Results and Discussion

The estimated regression coefficients for the three food categories using the double-logarithmic (DL) and the semi-logarithmic (SL) model are presented in Table 1. Table 2 provides the same information for the quadratic (QM) and the Working-Leser (WL) models.

Performance of the Empirical Models

The DL, SL, and WL models performed reasonably well in terms of providing statistically significant coefficient estimates for all food groups. The estimated coefficients for the logarithm of weekly income (LINCWK) were statistically significant at the 1% level for all food groups in all models, except when FAFH was estimated by the SS method in the WL model. Even in this case, weekly income appeared to have an important effect at the consumer decision stage, since its coefficient was significant at the 1% in the probit equation. These estimations were not reported in this paper due to the lack of space. In these three models, income was statistically significant at the 1% in the decision equation, regardless to the estimation procedure utilized.

The estimated parameters for the other key variable, logarithm of household size (LHHSIZE), were significant at the 1% significance level for TF and FAH, with these models. For FAFH, household size appeared to have the same significant effect in the probit equation estimated independently of the level equation (TP and HP methods). This coefficient was also significant using the SS method in the DL model.

Concerning the signs of the estimated parameters for LINCW and LHHSIZE, they were all positive, as expected, with the DL and SL models. The WL model, where the dependent variable represents expenditure shares, provided coefficients for the logarithm of weekly income with a negative sign, as expected. On the other hand, the QM model had the weakest performance. The coefficients for both weekly income (INCWK) and its squared term ($INCWK^2$) were statistically significant at the 1% level, only in the case of FAFH using the SS method. As with the other models, income appeared to have a decisive effect in the participation decision to spend money on FAFH.

A word of caution should be noted with respect to the estimation procedures used for the FAFH models. Even when the presence of selectivity bias could not be confirmed from the significance of the coefficient associated with the inverse Mills ratio included in the level regression of the HP procedure, the statistical significance of the correlation coefficient rho (r) from the SS method suggests this possibility, at least for the DL model. As pointed out by Davidson and MacKinnon (1993), the SS method provides, in this case, more efficient estimates.

Total food (TF)

Analyzing the results from the perspective of the food categories, across models, we observe that income and household size both had significant effects on the expenditures for TF, with the exception noted of the QM model, where the estimated parameters were not significantly different from zero. This effect was positive in all cases for LHHSIZE. In the case of LINCWK, it was positive for DL and SL, and negative for WL, as expected, since the dependent variable in the case of the WL model was budget share spent on food rather than expenditures in total food.

Food eaten at home (FAH)

The variables LINCWK and LHHSIZE were found to be positive and statistically different from zero at the 1% significance level for the DL and SL models. Again, for the WL model, where the dependent variable represents the budget share of the expenditures in FAH, the sign was positive for household size and negative for income, as expected.

Food eaten away from home (FAFH)

When FAFH was estimated using either DL or SL, the variable LINCWK was positive and statistically significant at the 1% level for all the estimation methods (TP, HP, and SS). Using the WL model, LINCWK showed negative and significant parameter estimates at the 1% level. As noted before, INCWK and its squared term $INCWK^2$ were also found to have a significant effect on FAFH at the 1% in the QM model estimated using SS method. In the QM model, the coefficient associated with the variable AGE^2 was significantly different from zero at the 1% level, when estimated by the SS model. On the other hand, HHSIZE showed no significant effects on FAFH expenditures.

The F_STAMP coefficients were statistically significant using the three estimation methods in the SL and the QM models; using HP and SS in the DL model, and using TP and HP in the WL model.

Income and Household Size elasticities

Income and household elasticities, computed at the sample means, except for the DL model that yields the elasticities directly from the coefficient estimates, are reported in Table 3. In general, all the estimated income elasticities are less than one for all food categories, confirming that Engel's law holds with regard to Hispanic consumers in the U.S. Income elasticity for TF showed similar estimated values for all the models (between 0.28 and 0.34). The same occurred with FAH although with smaller magnitudes (between 0.20 and 0.27). As expected, elasticity estimates were larger for FAFH than for TF and FAH. However, there were important differences among the models depending on the method used.

For the DL, SL, and QM models, the HP method produced slightly higher income elasticities (0.53, 0.79, and 0.78, respectively) than the TP method (0.51, 0.64, and 0.75, in the same order). The opposite is true for the WL model, which produced an income elasticity of 0.22 using the HP method, as compared to an income elasticity of 0.38 for the TP method. On the other hand, the SS procedure yielded the largest magnitudes of the income elasticities for FAFH, ranging from 0.69 with the DL model to 1.04 with both the SL and WL models.

The value of the household size elasticity ranged between 0.32 and 0.39 over the different models for TF. The FAH category gave the higher magnitudes, ranging from 0.39 to 0.47. FAFH elasticities were smaller in magnitude, independent of the model and estimation procedure. The point estimates of household size elasticities ranged from –0.18 to 0.13 for FAFH.

With respect to the confidence intervals for the income and household size elasticities, it is clear that the range depends on which model was used to derive the elasticities. Thus, the DL model produced the narrowest ranges whereas the widest ranges were obtained for the elasticities derived from the QM model.

Conclusions

Engel's law was verified for Hispanic households in the U.S., despite the functional form utilized. As Holcomb, Park and Capps (1995, p. 4) noted, the Working-Leser form provides a direct verification of Engel's law through the parameter estimates for the logarithm of income. As expected, share expenditures for total food decrease with higher incomes. The estimated coefficients of the logarithm of weekly income substantiate this formulation. Another important observation is that large households have a higher budget share for food than smaller households, at the same level of total expenditure (Deaton and Muellbauer, 1980, p. 193). The coefficients for the logarithm of household size were positive and statistically significant, confirming this assessment.

The complete verification of Engel's law resides in the observation of the magnitude of the income elasticities. Holcomb, Park and Capps (1995) explicitly showed that if Engel's law holds for a certain commodity, then the income elasticity for that commodity must be less than one. However, the confirmation of Engel's law for total food by no means implies that it must hold for specific commodities or food categories. In the case of TF and FAH, all the income elasticities were consistently less than one. It means the household expenditures on food are very inelastic with respect to variations in income, especially for food that is consumed at home. In their study, Holcomb, Park, and Capps (1995) estimated the budget share for total food in the U.S. population as 15.3%, where 9.5% corresponded to food eaten at home, and the remaining 5.8% corresponded to food eaten away from home.

In contrast, the results obtained in this research suggest that Hispanic households devote a much higher proportion of their budget to total food, 29.4%. However, the proportion spent in food away from home is smaller, only a 3.6%. Most of their expenditures in total food correspond to food eaten at home (25.8%). By comparison, the average American household spends only about 15.3% of their income on food. Thus, the lower income Hispanic households are spending a larger share of their income on food, as expected from economic theory.

Despite of these findings, it seems that Engel's law also holds for FAFH, although the magnitudes of the income elasticities estimated from the SS method were almost unity. This is a plausible result, considering the low proportion of FAFH in the budget of many Hispanic families, especially those with lower incomes. It seems reasonable that the elasticity of FAFH is unitary elastic or even behaves as a luxury good. Fan and Lewis (1999) found similar behavior of African American households with respect to FAFH. They reported that income elasticity of FAFH for African Americans households was estimated to be about unity. In every case, it is clear that the FAFH is more sensitive to variations in income than TF and FAH.

The effects of the household size on food demand appear to be more important for TF, and particularly for FAH, rather than for FAFH. Household size elasticities for TF and FAH ranged from 0.31 to 0.47, depending on the estimation model. The magnitudes of the household size elasticities for FAFH were never greater than 0.13.

With regard to socioeconomic characteristics, the results reveal an important effect related to urbanization status. Households located in the metropolitan statistical area spent more money on total food, and particularly on food eaten at home, than households located outside this area.

Food Stamp recipient households spend less money on food eaten away from home. This is not a surprising result due to the association of food stamps with lower incomes. However, no statistical significance was found for coefficients associated with households participating in the WIC program. Although there were important variations in some of the confidence intervals for the income and household elasticities derived from the different models, it appears that the Engel's law is a very robust assessment, regardless of national origins and other socioeconomic characteristics of the Hispanic consumers. Since the elasticities were estimated at the means of the data, the important variability observed in income distribution and size of households explain part of these wide ranges. Nevertheless, the consistency among the results obtained with the different empirical models and estimation procedures utilized in this study, allow us to report some important findings about the food expenditure patterns of the Hispanic population in the U.S. as discussed in the preceding section.

Table 1- Parameter Estimates and Standard Errors for DL and SL models of Hispanic Food Consumption,1994-96.

	Double Logarithmic Model					Semi-Logarithmic Model				
Dep. Var.	TF	FAH	FAFH			TF	FAH	FAFH		
Indep. Var.	HLS	HLS	TP	HP	SS	HLS	HLS	TP	HP	SS
Constant	2.99653***	3.13478***	-0.157361	-0.231153	-0.675726	-98.1045***	-48.9464	-50.5936***	-58.2609***	-56.9698***
	(0.345459)	(0.350919)	(0.696131)	(0.786420)	(0.883755)	(33.4885)	(28.8324)	(18.3032)	(21.0339)	(18.4171)
LINCWK	0.293291***	0.212074***	0.509444***	0.533190***	0.693359***	29.4669***	17.8508***	11.0606***	13.5279***	17.9318***
	(0.031937)	(0.032746)	(0.068590)	(0.158412)	(0.102819)	(3.46406)	(2.88239)	(2.01414)	(4.96367)	(1.66257)
LHHSIZE	0.393217***	0.474103***	0.132255	0.122232	0.066997	33.3244***	34.7207***	1.46460	0.423157	-3.04107
	(0.045500)	(0.047525)	(0.101313)	(0.107991)	(0.105867)	(4.66295)	(3.80420)	(2.46937)	(2.93631)	(2.66070)
LAGE	-0.134167**	-0.103577	-0.096695	-0.118409	-0.237529	0.240854	1.10407	2.08254	-0.173632	-5.91158
	(0.061129)	(0.064079)	(0.133525)	(0.205095)	(0.155135)	(5.73979)	(4.88083)	(3.35658)	(6.15973)	(3.53122)
S_FEM	-0.032838	0.005865	-0.131298	-0.139156	-0.185642**	-0.186205	3.66399	-4.04433*	-4.86089**	-5.40208**
	(0.038980)	(0.039626)	(0.083430)	(0.094212)	(0.090342)	(3.95216)	(3.26884)	(2.33776)	(2.40633)	(2.48556)
O_MEX	-0.014250	0.012512	-0.011799	-0.020281	-0.065081	0.142529	1.84342	-1.24750	-2.12888	-3.71157
	(0.041971)	(0.042035)	(0.089745)	(0.099196)	(0.096596)	(4.50454)	(3.68571)	(2.25958)	(2.76524)	(2.63324)
O_PRI	-0.075867	-0.082439	-0.017976	-0.019757	-0.008867	-10.2472	-7.51261	-4.53485	-4.71996	-3.68385
	(0.065879)	(0.073681)	(0.139731)	(0.140395)	(0.157790)	(6.57633)	(5.88289)	(3.22866)	(3.27548)	(4.36923)
O_CUB	-0.117815	-0.150822	-0.401806	-0.408441	-0.441475*	-5.42513	-9.83978	7.13406	6.44458	2.94376
	(0.150634)	(0.137197)	(0.395055)	(0.401926)	(0.268055)	(17.0495)	(10.0819)	(22.9839)	(23.6092)	(7.41444)
R_NEAST	0.039197	0.084243	-0.060923	-0.081212	-0.240421	4.47336	8.61453	0.415835	-1.69218	-7.01426*
	(0.063412)	(0.067445)	(0.151814)	(0.188674)	(0.165583)	(6.92582)	(5.84069)	(4.64957)	(5.56652)	(4.05743)
R_MWEST	-0.050224	-0.027266	-0.247215	-0.251223	-0.301248*	-6.02138	-3.04035	-2.65682	-3.07325	-4.14364
	(0.066971)	(0.068439)	(0.171805)	(0.176331)	(0.164486)	(6.72572)	(5.60198)	(3.55695)	(3.60797)	(4.55201)
R_SOUTH	-0.071154	-0.057177	0.075188	0.063972	-0.002933	-4.88013	-2.83944	-0.270733	-1.43616	-3.75549
	(0.044992)	(0.044367)	(0.097000)	(0.113963)	(0.106100)	(4.88013)	(3.81873)	(3.66221)	(4.00415)	(2.86522)
U_MSAINC	0.166466***	0.172908***	0.172790	0.170933	0.168921	16.4004***	14.7898***	2.31920	2.12631	1.37168
	(0.058220)	(0.059074)	(0.118296)	(0.119981)	(0.128605)	(5.66257)	(4.67568)	(3.30444)	(3.30990)	(3.37488)
U_MSAOUT	0.145894***	0.164580***	0.081273	0.078140	0.069054	11.7789**	11.8744***	1.33135	1.00583	0.091261
	(0.054491)	(0.055039)	(0.116415)	(0.119124)	(0.120217)	(5.24177)	(4.20955)	(3.24777)	(3.33304)	(3.17239)
G_ELEM	-0.160147	-0.217233	-	-	-0.264737	-11.8545	-15.2124	-	-	-7.64232
	(0.157166)	(0.154464)			(0.474729)	(11.1650)	(11.3001)			(5.78692)
G_HIGH	-0.223633	-0.312323**	-	-	-0.116274	-15.9817	-22.2824**	-	-	-5.99996
	(0.157468)	(0.154825)			(0.472987)	(11.1311)	(11.2260)			(5.14655)
G_COLL	-0.200510	-0.277841*	-	-	-0.182609	-15.8633	-21.9669*	-	-	-6.70192
	(0.160752)	(0.158142)			(0.477699)	(11.7318)	(11.5698)			(6.24615)
G_GRAD	-0.259914	-0.380655**	-	-	-0.304386	-23.8707*	-28.9928**	-	-	-7.26879
	(0.173540)	(0.176645)			(0.494921)	(13.6828)	(13.1358)			(7.43051)
F_STAMP	-0.019474	0.014572	-0.263210*	-0.262890**	-0.271018**	-5.98773	-3.61236	-4.52586**	-4.49260**	-0.791588
	(0.048005)	(0.048544)	(0.115651)	(0.115590)	(0.115508)	(4.40306)	(3.8126)	(2.27233)	(2.28043)	(1.88886)
T_OWNER	-0.019088	-0.007638	-0.048658	-0.047139	-0.041882	-2.12568	-1.38384	-2.17498	-2.01719	-0.649796
	(0.047190)	(0.047102)	(0.098659)	(0.099503)	(0.094698)	(4.92029)	(4.09798)	(3.30180)	(3.39944)	(1.01880)
W_YES	-0.055712	-0.065371	-0.086374	-0.089374	-0.094816	-1.29239	-1.38197	0.289220	-0.022406	-0.065624
	(0.049196)	(0.050440)	(0.117876)	(0.120341)	(0.111579)	(5.28703)	(4.66486)	(2.94539)	(3.00479)	(0.397700)
Y_95	0.009136	-0.003407	0.043397	0.042662	0.037149	3.19293	1.83435	0.826127	0.749770	-1.30399***
	(0.041592)	(0.042568)	(0.098957)	(0.099509)	(0.093126)	(4.29693)	(3.57212)	(2.99404)	(3.02889)	(0.215915)
Y_96	0.021448	0.037194	0.08176	0.084580	0.099354	4.64450	4.56936	0.448308	0.490249	-0.367728***
	(0.044358)	(0.044364)	(0.097754)	(0.097685)	(0.098084)	(4.79652)	(3.92541)	(3.00509)	(2.99866)	(0.085377)
I. Mills R.	-	-	-	0.081080	-	-	-	-	8.42456	-
				(0.510342)					(15.0938)	
SIGMA	-	-	-	-	0.913001***	-	-	-	-	27.4934
					(0.078888)					(≈ 0.00000)
RHO	-	-	-	-	0.684519***	-	-	-	-	≈1.0000
					(0.194611)					(≈ 0.00000)

Note: Std. errors in parenthesis. Significance of 2-tail t-test: *** - 1% level; ** - 5% level; * - 10% level.

Table 2- Parameter Estimates and Standard Errors for QM and WL models of Hispanic Food Consumption, 1994-96.

	Quadratic Model					Working-Leser Model				
Dep. Var.	TF	FAH	FAFH			TF	FAH	FAFH		
Indep. Var.	HLS	HLS	TP	HP	SS	HLS	HLS	TP	HP	SS
Constant	77.8756***	81.5121**	10.9423	10.4004	20.5486	1.53889***	1.44200***	0.196302***	0.214233***	0.050553
	(37.1574)	(33.5579)	(17.0918)	(16.4485	(19.9752)	(0.110571)	(0.106341)	(0.042162)	(0.048732)	(0.053830)
LINCWK	-	-	-	-	-	-0.194369***	-0.188764***	-0.022273***	-0.028043***	0.001319
						(0.010736)	(0.010469)	(0.004038)	(0.009521)	(0.003710)
LHHSIZE	-	-	-	-	-	0.099565***	0.101756***	-0.001657	0.000779	-0.004978
						(0.013734)	(0.012156)	(0.006386)	(0.006196)	(0.005599)
LAGE	-	-	-	-	-	-0.042573**	-0.032714*	-0.001701	0.003575	0.000945
						(0.018118)	(0.016856)	(0.008232)	(0.012859)	(0.006415)
INCWK	0.002370	-0.033833	0.061177	0.061889*	0.071499***	-	-	-	-	-
	(058668)	(0.051840)	(0.035635)	(0.033912)	(0.022661)					
HHSIZE	4.54633	5.94277	-4.99976	-5.15986	-1.28489	-	-	-	-	-
	(11.4942)	(10.9299)	(6.08851)	(6.88270)	(3.58786)					
AGE	-0.384264	-0.955601	0.437352	0.440972	-0.559116	-	-	-	-	-
	(0.816310)	(0.727700)	(0.468601)	(0.460696)	(0.359367)					
$INCWK^2$	-0.00016	-0.000006	-0.000011**	-0.000011	-0.000014***	-	-	-	-	-
	(0.000012)	(0.000010)	(0.000006)	(0.000010)	(0.000005)					
$HHSIZE^2$	-0.801420	-0.900244	0.720216	0.720319	0.163052	-	-	-	-	-
	(0.801219)	(0.651876)	(0.468756)	(0.472353)	(0.177160)					
AGE^2	-0.005260	0.000650	-0.003930	-0.004182	0.005078**	-	-	-	-	-
	(0.006052)	(0.005410)	(0.004048)	(0.005027)	(0.002062)					
IN x HS	0.020366	0.019771	-0.008543	-0.008272	-0.006161	-	-	-	-	-
	(0.017357)	(0.017200)	(0.010807)	(0.012235)	(0.008163)					
IN x AG	0.001156	0.001338	-0.000861	-0.000833	-0.000653	-	-	-	-	-
	(0.001225)	(0.001046)	(0.000804)	(0.000978)	(0.000495)					
AG x HS	0.197119	0.233306	-0.027251	-0.026127	0.004132	-	-	-	-	-
	(0.187921)	(0.181649)	(0.108272)	(0.112327)	(0.062860)					
IN x AG x HS	-0.000244	-0.000313	0.000289	0.000283	0.000166	-	-	-	-	-
	(0.000399)	(0.000382)	(0.0002693)	(0.000296)	(0.000188)					
S_FEM	-1.95529	2.07738	-4.42965*	-4.57800	-6.37598**	0.002712	0.013626	-0.010462**	-0.008552*	-0.012197**
	(3.94005)	(3.30562)	(2.32731)	(3.08522)	(2.49219)	(0.011201)	(0.009977)	(0.005109)	(0.004570)	(0.005336)
O_MEX	-0.409697	1.39225	-0.816431	-0.993977	-3.68655	-0.006761	-0.000488	-0.003710	-0.001648	-0.008072
	(4.48632)	(3.71774)	(2.30806)	(3.28104)	(2.62946)	(0.012395)	(0.011406)	(0.004501)	(0.005219)	(0.005642)
O_PRI	-12.3620*	-9.27179	-4.92685	-4.95193	-4.67499	-0.006102	-0.000482	-0.006596	-0.006163	-0.006549
	(6.59303)	(5.92490)	(3.21951)	(3.17232)	(4.34943)	(0.020450)	(0.019448)	(0.007736)	(0.007880)	(0.009256)
O_CUB	-5.78259	-9.76679	6.68530	6.57785	3.89288	-0.001589	-0.011271	0.020021	0.021634	0.005305
	(17.0459)	(9.22496)	(23.5943)	(23.8195)	(7.46720)	(0.039388)	(0.027490)	(0.043705)	(0.044696)	(0.015880)
R_NEAST	6.24426	10.2086*	-0.043785	-0.513884	-8.48012**	0.007170	0.014484	0.003365	0.008295	-0.012762
	(7.04833)	(5.81584)	(4.80438)	(8.46269)	(4.11705)	(0.018598)	(0.016760)	(0.010041)	(0.010311)	(0.008714)
R_MWEST	-4.80586	-2.01331	-2.72043	-2.81362	-4.75183	-0.011595	-0.002911	-0.010719	-0.009745	-0.013572
	(6.49546)	(5.52814)	(3.58274)	(3.86447)	(4.57925)	(0.021060)	(0.019591)	(0.007077)	(0.007092)	(0.009772)
R_SOUTH	-4.38293	-2.35465	0.099050	-0.158012	-4.46829	-0.021718*	-0.018986*	0.001679	0.004401	-0.005909
	(4.97802)	(3.84028)	(3.76272)	(5.22449)	(2.86204)	(0.012325)	(0.010730)	(0.006925)	(0.007128)	(0.006091)
U_MSAINC	15.5339***	13.7989***	1.83213	1.84892	2.91105	0.049123***	0.047305***	0.006843	0.007294	0.004240
	(6.00386)	(4.94778)	(3.44699)	(3.45680)	(3.37068)	(0.017145)	(0.016007)	(0.007003)	(0.007019)	(0.007242)
U_MSAOUT	12.2366**	12.0671***	1.03078	0.994440	1.97653	0.033315**	0.030261**	0.007687	0.008448	0.004342
	(5.24928)	(4.21604)	(3.26838)	(3.30057)	(3.17401)	(0.014960)	(0.013572)	(0.006828)	(0.006804)	(0.006800)
G_ELEM	-12.2366	-15.8051	-	-	-8.16216	-0.057904	-0.076182	-	-	-0.018044
	(13.4573)	(12.6791)			(16.1422)	(0.057919)	(0.056162)			(0.034669)
G_HIGH	-18.0540	-23.4945*	-	-	-4.493036	-0.073343	-0.098239*	-	-	-0.012289
	(13.4818)	(12.7067)			(16.1328)	(0.057638)	(0.055771)			(0.035094)
G_COLL	-19.3029	-23.6083*	-	-	-4.66916	-0.050440	-0.071146	-	-	-0.013950
	(14.0549)	(13.0699)			(16.1667)	(0.058337)	(0.056481)			(0.034858)
G_GRAD	-28.2029*	-31.2392**	-	-	-7.99310	-0.049032	-0.072005	-	-	-0.015191
	(15.9691)	(14.5704)			(16.2845)	(0.060204)	(0.057887)			(0.035093)
F_STAMP	-10.0800**	-6.67033*	-5.26857**	-5.29456**	-3.89110***	0.001988	0.013127	-0.015867**	-0.015944**	-0.002732
	(4.38006)	(3.74067)	(2.19493)	(2.22286)	(1.43198)	(0.017530)	(0.016266)	(0.007229)	(0.007217)	(0.004462)
T_OWNER	-3.34224	-2.00353	-1.84838	-1.82179	-0.730217***	0.002967	0.009229	-0.005034	-0.005403	-0.003742***
	(4.98116)	(4.17390)	(3.29045)	(3.38842)	(0.249615)	(0.013355)	(0.012059)	(0.006776)	(0.006970)	(0.001023)
W_YES	-1.46550	-2.23805	0.849099	0.804916	-0.927213	-0.012384	-0.012583	0.002229	0.002957	-0.002441
	(5.17027)	(4.64397)	(2.84343)	(2.92583)	(1.39067)	(0.017585)	(0.016457)	(0.007374)	(0.007444)	(0.004189)
Y_95	3.08398	1.82760	0.534487	0.527159	-0.033036	0.006033	0.002019	0.002966	0.003145	-0.007155***
	(4.33306)	(3.58714)	(3.19043)	(3.19038)	(0.924791)	(0.012426)	(0.011474)	(0.006183)	(0.006278)	(0.001908)
Y_96	5.63259	5.24185	0.930670	0.932169	0.583760	0.009192	0.006505	0.004047	0.003949	0.000527
	(4.75297)	(3.91220)	(2.9531)	(2.96323)	(0.773030)	(0.013226)	(0.011922)	(0.005550)	(0.005529)	(0.001888)
I. Mills R.	-	-	-	1.76381	-	-	-	-	-0.019701	-
				(22.4240)					(0.032675)	
SIGMA	-	-	-	-	27.6261	-	-	-	-	0.059388
					(≈ 0.00000)					(≈ 0.00000)
RHO	-	-	-	-	≈1.0000	-	-	-	-	≈1.0000
					(≈ 0.00000)					(≈ 0.00000)

Note: Std. errors in parenthesis. Significance of 2-tail t-test: *** - 1% level; ** - 5% level; * - 10% level.

Table 3 - Income and Household Size Elasticities at the Mean for Hispanic Consumers, 1994-96.

TF	FAH	FAFH			TF	FAH	FAFH		
HLS	HLS	TP	HP	SS	HLS	HLS	TP	HP	SS
		Double Logarithmic Model					Semi Logarithmic Model		
Income Elasticities					Income Elasticities				
0.29329	0.21207	0.50944	0.533319	0.69336	0.27844	0.20134	0.64417	0.78787	1.04435
(0.2408~0.3458)	(0.1582~0.2659)	(0.3966~0.6223)	(0.2726~0.7938)	(0.5242~0.8625)	(0.0266~0.5303)	(0.0221~0.3806)	(-0.9123~2.2007)	(-1.1601~2.7359)	(-1.4647~3.5534)
Household Size					Household Size				
0.39322	0.47410	0.13226	0.12223	0.066997	0.31489	0.39162	0.08529	0.02465	-0.17711
(0.3184~0.4681)	(0.3959~0.5523)	(-0.0344~0.2989)	(-0.055~0.2999)	(-0.1072~0.2412)	(0.0274~0.6024)	(0.0515~0.7317)	(-0.2274~0.3980)	(-0.2628~0.3121)	(-0.6724~0.3182)
		Quadratic Model					Working-Leser Model		
Income Elasticities					Income Elasticities				
0.31250	0.20889	0.74490	0.78211	0.97986	0.33878	0.26870	0.37843	0.21740	1.03682
(-0.5777~1.2026)	(-0.7376~1.1553)	(-3.020~4.5098)	(-3.3325~4.8968)	(-2.2739~1.2408)	(-0.4925~1.1701)	(-0.6584~1.1958)	(-1.2187~1.9756)	(-1.8316~2.2664)	(0.8328~1.2408)
Household Size					Household Size				
0.37664	0.46744	-0.00852	-0.02457	0.03453	0.33871	0.39422	-0.04623	0.02174	-0.13892
(-0.5907~1.3439)	(-0.6412~1.5761)	(-3.3168~3.2997)	(-3.6695~3.6203)	(-2.1125~2.1816)	(-0.0986~0.7760)	(-0.1158~0.9049)	(-0.3795~0.2871)	(-0.2858~0.3293)	(-0.5864~0.3085)

Note: Numbers in parenthesis represent the lower and upper bounds of the confidence intervals of the elasticity estimates, respectively, at the 90% level of confidence.

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