Nereus
Núcleo de Economia Regional e Urbana da Universidade de São Paulo
The University of São Paulo Regional and Urban Economics Lab

DEMAND ELASTICITIES FOR FOOD PRODUCTS: A TWO-STAGE BUDGETING SYSTEM

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TD Nereus 09-2005

São Paulo
2005

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Abstract

The object of this paper is to estimate demand elasticities for a basket of staple food important for providing the caloric needs of Brazilian households. These elasticities are useful in the measurement of the impact of structural reforms on poverty. A two-stage demand system was constructed, based on data from Household Expenditure Surveys (POF) produced by IBGE (The Brazilian Bureau of Statistics) in 1987/88, and in 1995/96. We have used panel data to estimate the model, and have calculated income, own-price, and cross-price elasticities for seven groups of goods and services and, in the second stage, for eight sub groups of staple food products. We estimated those elasticities for the whole sample of consumers, and for two income groups. This procedure allowed for the comparison of the results across the groups.

Keywords: Brazil; Demand Elasticity; Two-Stage Budgeting System; Estimating Demand Systems; Poverty; Income Inequality;

JEL Classification: Q11; D12

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* This paper was developed as part of a study on the impacts of commercial reforms at the world level on income inequality and poverty in Brazil. The study was commissioned by OCDE – Organization for Cooperation and Development to Fipe - Fundação Instituto de Pesquisas Econômicas. The authors wish to thank the support from both organizations, and from CNPq – Brazilian Council for Research. The ideas expressed in this paper do not represent the views of these institutions.
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1. Introduction

As Blundell (1988) emphasizes, there are few aspects of political economy that don't require some knowledge of consumer's household behavior. Empirical evidence on consumer's behavior is more and more important in the formulation and analysis of economic policies. Several channels exist through which consumption affects economic activity, such as the impact of tax structure, the effect of real interest rates on savings, the demand for credit, etc. The impact of structural reforms on relative prices and their effects on the income of the poor is an important subject recently debated among economists and society. In Brazil, "Fome Zero" (Zero Hunger), a Federal Government project, emphasizes the importance of measuring the effect of government policies upon poverty.

The links between government policy and poverty have drawn considerable attention in economic theory. Winters (2000) and McCulloch, Winters and Cirera (2001) developed a theoretical framework for linking such reforms to poverty in the trade area, showing that removing tariffs on staple food products is expected to cause impacts upon poverty. In the same way, investments in rural roads infrastructure reduce the cost of food transportation, and thus also have an impact on poverty. Another way to understand the links between structural changes in the economy and poverty is by understanding the links between relative price changes and consumption. Consumption theory has been extensively studied, with many theoretical and empirical works trying to understand, and to measure, the effects of economic policies on individuals and families. One of the most often used practices to measure the effect of price changes on consumption is to estimate demand functions. Most empirical papers estimating demand functions have used time series, for consumption data are available in most developed countries, as highlighted in Blundell (1988), and Deaton (2000). As consumption data sets are not usually available in underdeveloped countries, the estimation of demand functions in these situations is rare. In the Brazilian case, demand studies have mainly calculated just income elasticities (Hoffmann, 2000; Bertasso, 2000, and Menezes et. al., 2001). However, as discussed in Deaton (1988), cross-sections of consumption expenditure budgets for different areas of a country have the necessary information on prices to estimate a complete demand system, leading to the calculation of income, own-price and cross-price demand elasticities.

In the past, some authors have calculated price-elasticities for Brazil using cross-sections data, such as Simões and Brant (1981), Alves, Disch and Evenson (1982), and Thomas, Strauss and Barbosa (1989). More recently, Asano and Fiusa (2003) have estimated an *Almost Ideal Demand System* (AIDS) using household expenditure surveys for two different years, calculating income and price elasticities for groups of products such as food, housing, clothing, personal expenditure, transportation and communication, and health. These results are very important, but they are too aggregate to provide useful information for policy.

The objective of this article is to present income, own-price and cross-price elasticities for a basket of staple food important for providing the caloric needs of Brazilian households. Our aim is to estimate elasticities which can be used to the measurement of the impact of structural reforms on poverty, although we do not do so in this paper. A two-stage demand system model commonly used in agricultural studies was constructed. We have first used panel data to estimate the model for all households in the sample, and have calculated the elasticities. We have then split the sample into two income groups, and have calculated the same elasticities for each group.

This study has four sections, besides this introduction. The next section presents the methodology employed in the construction of the Two-Stage Budget Model. Following that, a description of the database and of the procedures to allocate products to groups is offered. The third part deals with the estimation of the model. The last section discusses and analyses the results.

2. Methodology

One important problem in the analysis of the allocation problem faced by consumers is the large number of commodities and services. The Marshallian demand function is the theoretical form more frequently used to deal with the allocation of consumption between m elementary commodities. It can be written in vector form as

$$\boldsymbol{q} = \boldsymbol{f}(\boldsymbol{p}, y) \qquad (1)$$

in which $\boldsymbol{q}$ is a $m \times 1$ vector of commodity quantities, $\boldsymbol{p}$ is a vector of nominal prices, and $y = \boldsymbol{q'p}$ is total expenditure. The estimation of such a demand function would require the knowledge of prices and quantities of all consumption items, making it practically impossible to be estimated. Simplifying alternatives require a series of restrictive assumptions about consumer behavior[4]. As Deaton and Muelbauer (1980) discuss, the solution to this problem involves the estimation of a two-stage budgeting (TSB), for which only the weak separability of preferences hypothesis is required. The idea is that the allocation occurs in two independent steps. In the first step, total expenditure is allocated between n broad groups of products; in the second, the group expenditure is allocated to elementary commodities within each group.

The first step can be formally expressed as

$$\boldsymbol{x} = \psi(\mathbf{P}, y) \qquad (2)$$

In which $\boldsymbol{x}$ is a $n \times 1$ vector of groups, and $\boldsymbol{P}$ is a $n \times 1$ vector of group price indexes.

The Marshallian demand function in the second stage can be formally expressed as

$$\mathbf{q}_r = \mathbf{h}_r(\mathbf{p}_r, x_r) \qquad (3)$$

[4] Barten (1977) reviews the results of different empirical studies on demand homogeneity, Slutsky symmetry and preference independence. Selvanathan and Selvanathan (2005) deal with the addictivity of the utility function using data for nine commodity groups from 45 countries.

in which $\mathbf{q}_r$ is a $m_r\ x\ 1$ sub vector of commodities in the rth group $\mathbf{q}$; $\mathbf{p}_r$ is the equivalent sub vector of rth prices $\mathbf{P}$, and x_r is the expenditure on the rth product of x. For each group, the restriction is imposed that $x_r = \mathbf{q}_r{'}\mathbf{p}_r$; it is also imposed that $\Sigma\ x_r = y$ and $\Sigma\ m_r = m$.

Under the weak separability of preferences hypothesis, it is expected that both total and conditional Marshalian demand functions give the same results. Formally,

$$\mathbf{f}_r(\mathbf{p}, y) = \mathbf{h}_r[\mathbf{p}_r, \psi_r(\mathbf{P}, y)], \qquad r = 1, ..., n \qquad (4)$$

Once the demand structure within each group is known, it is possible to know the total demand for each commodity. However, there are problems connected with the first-stage allocation, since it is not possible to replace the price of the goods in the group with a single price index. Gorman (1959) argues that the necessary and sufficient conditions for price aggregation consistency are restrictive and, in a way, implausible. It requires homothetic preferences within each group, and the strong separability of preferences hypothesis. However, authors such as Michalek and Keyzer (1992) and Edgerton (1997) show that, under the two less restrictive conditions presented below, the two-stage budgeting system leads to an approximately correct budgetary allocation. The first condition states that the weak separability of preferences theorem must be respected; the second requires that the price index for each group is not too sensitive to changes in the utility function. Under these two conditions, it is possible to show that the relationships among elasticities in the two stages are maintained.

Following Edgerton (1997), we assume that the preference structure is such that, in the first stage, consumers choose how to spend their income among groups of products, such as food, housing, transportation, health services, education, etc. In the second stage, the level of expenditure in each group, as determined in the first stage, is allocated to the commodities in that group. The model we have estimated is the Almost Ideal Demand System (AIDS), proposed by Deaton and Muelbauer (1980), which can be presented as

$$w_i = \alpha_i + \sum \gamma_{ij} \ln p_j + \beta_i \ln\left[\frac{M}{P}\right] \qquad (5)$$

Where w_i is the share of the i^{th} good in the consumer's budget; M is total expenditure, p_j is the price of i^{th} good, and P is a properly defined price aggregator. This price aggregator is given by:

$$\ln P = \sum_i \alpha_i \ln(p_i) + \frac{1}{2}\sum_i \sum_j \gamma_{ij} \ln(p_i)\ln(p_j)$$

Some restrictions are imposed to enable identification of the parameters. The adding-up, homogeneity and symmetry parameter restrictions are derived from the standard demand theory:

$$\sum_i \alpha_i = 1, \sum_i \beta_i = 0, \sum_i \gamma_{ij} = 0, \sum_j \gamma_{ji} = 0 \ and \ \gamma_{ji} = \gamma_{ij} \quad (6)$$

The most usual form of linearization of the system was proposed by Deaton and Muellbauer (1980b), and consists in substituting the Stone Price Index, $\ln P^* = \sum_{i=1}^{n} w_i \ln p_i$, for *lnP*, in (5). The resulting model is called LAIDS (Linear Almost Idea Demand System). Both the first and second-stage equation systems are based in (5), and are subject to the restrictions described in (6).

Using the AIDS model to estimate the two-stage budgeting demand function presents several advantages. Probably the most important is that it is a flexible functional form. The AIDS substitution pattern implies an unconstrained pattern of conditional cross-price across products within sub-segments. This is an advantage, because competition is probably higher among differentiated products within sub-groups. Another important advantage of the AIDS model is the perfect aggregation over consumers, without requiring linear Engle curves. This is very important in studies of aggregate data. Finally, the demand function derived from this model crosses the price axis, avoiding the presence of virtual prices.

Income, own-price, and cross-price elasticities are easily derived from this demand system. In the first stage, they assume the following format

$$\eta_r = 1 + \frac{\beta_r}{w_r} \quad \text{and} \quad \varepsilon_{rs} = \frac{\gamma_{rs} - \beta_r w_s}{w_r} - \delta_{rs} \tag{7}$$

Where η_r is income-elasticity, ε_{rs} is own-price elasticity, and δ_{rs} is Kronecker's delta, equal to unity for every $s = r$, and zero otherwise; the share of each commodity group in the budget is defined as $w_r = (\boldsymbol{P_r}, \boldsymbol{Q_r})/y$; the vectors of price index and quantity are, respectively, $\boldsymbol{P_r}$ and $\boldsymbol{Q_r}$.

In the second stage, income and conditional price-elasticities are calculated similarly,

$$\eta_{(r)i} = 1 + \frac{\beta_{(r)i}}{w_{(r)i}} \quad \text{and} \quad \varepsilon_{(r)ij} = \frac{\gamma_{(r)ij} - \beta_{(r)ij} w_{(r)j}}{w_{(r)i}} - \delta_{ij} \tag{8}$$

The share of commodity i in total expenditure within its group is given by

$$w_{(r)i} = (\boldsymbol{p_{ri}}, \boldsymbol{q_{ri}})/x_r$$

Where $\eta_{(r)i}$ is income-elasticity, $\varepsilon_{(r)ij}$ is the price-elasticity calculated within each group, and δ_{ij} is Kronecker's delta, equal to unity for every $i = j$. Following Edgerton (1997), total price and income-elasticities are, respectively

$$E_i = \eta_{(r)i.}\eta_i \tag{9}$$

$$e_{ij} = \delta_{rs}\varepsilon_{(r)ij} + \eta_{(r)i} w_{(s)j}[\delta_{rs} + \varepsilon_{rs}] \tag{10}$$

Where total income-elasticity is E_i, and total price-elasticity is e_{ij}. Equation (10) indicates that, for two commodities within group *r*, the total price-elasticity is the same as the price-elasticity inside the group, plus a factor. This factor equals the relative change in the price index ($w_{(r)j}$), multiplied by its effect on the expenditures with the group [$1+\varepsilon_{(r)r}$], and by the income-elasticity within the group ($\eta_{(r)i}$). If the within-group price-elasticity is unitary (ε_{rr} = -1), expenditure with the group is not affected by price variations, that is, total and conditional elasticities are the same ($e_{ij} = \varepsilon_{(r)ij}$). If, however, $\varepsilon_{rr} = 0$, price variations affect expenditure with the group in the same proportion. The smaller the within-group income-elasticity ($\eta_{(r)i}$), and the share ($w_{(r)j}$), the smaller the difference between the within-group price-elasticity ($\varepsilon_{(r)ij}$) and total price-elasticity (e_{ij}).

3. Data Set

We have used price data from two Household Expenditure Surveys developed by IBGE, The Brazilian Bureau of Statistics (available for download at www.ibge.gov.br). Micro data are available for two points in time: 1995-96 and 1987-88. The sample is composed of around 14,000 families in 1987/88, and around 16,000 families in 1995/96. Households belong to the 10 most important metropolitan areas in Brazil: Belém (North), Fortaleza, Recife and Salvador (Northeast), Belo Horizonte, Rio de Janeiro and São Paulo (Southeast), Curitiba and Porto Alegre (South), and Brasília (Center-West). The surveys present 404.366 observations in 1987/88, and 347,569 in 1995/96.

In the first stage, we have aggregated consumption items into 8 groups: food, housing, clothing, transportation, health and personal care, personal expenditure, education and tobacco. The data was aggregated into 10 income deciles, 10 metropolitan regions, and 2 years. In the second stage, expenditure on staple food products was aggregated into the following sub groups: fruits, sauces, vegetables, sugar, coffee, meat, milk, oil and margarine, ham and sausage, and rice and beans. As in the first stage, we have 10 x 10 x 2 observations for each sub group. Therefore, each step considered 200 observations. Tables 1 and 2 describe the variables and present general statistics.

The first stage estimation requires a price index for each commodity group. Since IBGE provides prices for 130 non-food items for each region, consisting of 70% of non-food expenditure in 1999, the price index constructed corresponds to the geometric mean for each region, as follows.

$$\ln P_{smk} = \sum_i w_{i(s)mk} \ln p_{i(s)m} \qquad (11)$$

Where $w_{i(s)mk}$ is the participation of good *i*, from commodity group *s*, in region *m*, for income decil *k*;$p_{i(s)m}$ is the price of product *i*, from commodity group *s*, in region *m*.

4. Estimation

As described before, within the TSB, it is assumed that in the first stage consumers choose how to spend their income among groups of products; in the second stage, expenditure allocated to food commodities in the first stage is allocated to the 11 sub groups of food commodities.

The model estimated in the first stage is

$$w_{rmkt} = \alpha_0 + \sum \gamma_{rs} \ln p_{rmkt} + \beta_{rmkt} \ln\left[\frac{M}{P*}\right] + \phi Z_{mk} + \lambda_t + \xi_{rmkt} \quad (12)$$

Where subscript t indicates the year, Z_{mk} is a vector of household demographic and regional characteristics, and ξ_{rmkl} is the error term. The random effect, λ_t, affects all regions in the same way in the same year, but varies with time. When the random effect is correlated with the explanatory variable, the OLS or GLS estimators are biased (Aralano, 1982). To solve this problem, a time dummy is included in the model in order to correct for the fixed effect bias.

The model estimated in the second-stage model is almost the same of the first stage. The only difference is that it deals with sub groups of commodities.

$$w_{i(r)mkt} = \alpha_0 + \sum \gamma_{i(r)s} \ln p_{i(r)mkt} + \beta_{i(r)mkt} \ln\left[\frac{M}{P*}\right] + \phi Z_{mk} + \lambda_t + \xi_{i(r)mkt} \quad (13)$$

The estimation method employed is the Interactive Seemingly Unrelated Regression (ISUR), which is equivalent to the Full Information Maximum Likelihood method

(FILM). When ISUR is employed to estimate a LAIDS model, the property of addictivity of the demand function implies that the variance and covariance matrices are singular. To solve for that, one of the equations is taken off of the system. In order to keep the property of homogeneity, all prices must be normalized by the price referring to excluded equation. The coefficients for this equation are then recuperated, based on the addictivity property. Symmetry was imposed in the estimation process.

5. Results

5.1. General results

The above models were initially estimated for the whole sample of households, regardless of their income levels. Later, households were split according to income, and the models were estimated each group. Table 3 displays the results of the estimation of equation 12 for the whole sample, in which the homogeneity and symmetry constrains are imposed. The tobacco equation was excluded, to avoid singularity, but its coefficients were later recovered with the use of the homogeneity property. We have included three variables to take into account the influence of demographic factors: gender and age of the household head, and age squared. Three variables were included to consider the influence of spatial factors: latitude, a time-latitude interaction dummy, and density. The first two were included as proxies of transportation costs and amenities for living in the more developed areas (South and Southeast regions); density was included as a proxy for the effects of agglomeration. Some articles include education and household size as explanatory variables, but we chose not to do so for two reasons. First, our income data refers to the household income, and so we are controlling for the household size. Second, education is highly correlated with income. Therefore, if we included education, income would not be significant. Since the objective is to estimate income elasticities, we decided not to include education in the model.

The coefficients of latitude were significant for all groups of products, except for education. Since food and fuel are shipped from the South and Southeast regions to the North and Northeast by truck, transportation cost raises the prices of these products in those regions. Latitude have a negative impact on housing, clothing and health, which are products and services that are more expensive in the richer regions, because the amenities of living in developed regions increase their prices. The coefficients on density were only significant for housing (positive) and clothing (negative).

Expenditure on Housing and education increases with the age of the household head, but expenditure on clothing decreases. People tend to live in rented houses and spend more money on education at the beginning at the life cycle. On the other hand, people tend to spend more money with clothing at intermediate ages. The results also indicated that households headed by men tend to spend less on housing and more on clothing. As for significance, 4 out of 7 own-price coefficients, and all income coefficients were significant (1% or 5% significance levels). Based on these coefficients, equation (7) was calculated, leading to the own-price and income elasticities for groups of products presented in Table 5.

Table 4 displays the estimated coefficients for sub groups of food products. Equation 13 was estimated with the imposition of homogeneity and symmetry constraints. The equation for rice and beans was excluded to avoid singularity, but its coefficients were later recovered with the use of the homogeneity property. The same demographic and spatial variables were included. Since density was not significant in the food group equation estimated in the first stage, it was not used it in the second stage. Instead, we included macro region dummies to control for regional characteristics, that is, factors that vary across macro regions but are fixed in the time, such as institutions, colonization culture, weather, etc.

In both years, latitude had a positive impact on fruits, sugar and coffee, and a negative impact on vegetables, meat and wheat. However, its impact on sauces was negative in 1988 and positive in 1996. The impact on milk in 1988 was not significant, but it was positive in 1996. Age and gender of the household head were not significant. All income coefficients, and around half of the price coefficients, were significant. Total elasticities were calculated using equations (9) and (10). Following Deaton (2000), the standard errors for elasticities are obtained by the Delta's method. Tables 5 and 6 display the within-group and total elasticities, respectively.

As Table 5 displays, consumption expenditure elasticities for groups are positive and significant. The results indicate that food products and tobacco are the only necessities, whereas, Housing, Clothing, Transportation, Health and Personal Care, Personal Expenditures and Education are luxury goods. All own-price elasticities are negative and significant, with Food and Housing significantly less then one, that is, these groups are own-price inelastic. One can not reject the hypothesis that the price-elasticities for Clothing, Health, Personal Expenditure, Transportation and Education are equal one; The price-elasticity for tobacco is larger then 1, indicating a price-elastic demand.

Table 6 displays total income, own-price and cross-price elasticities for sub groups of staple food products. Total income elasticities are significant and positive, except for rice and beans, for which we could not reject the hypothesis that they are equal to zero. All sub groups of staple food are classified as necessities. The largest elasticities are observed for fruits, ham and sausage, and milk. The smallest income elasticities are displayed by rice and beans, and wheat. All own-price elasticities were negative. Sauces, vegetables, sugar, coffee, meat, wheat, and rice and beans were significantly less than one, thus being own-price inelastic. For other products, such as fruits, milk, oil and margarine, and ham and sausage, we could not reject the hypothesis that the own-price elasticity is equal to one. It is also worth noticing that we could not reject the hypothesis that cross-price elasticities are not equal to zero for 30 out of 55 cross-price elasticities. In the majority of the cases, the substitution and complementary relationships were respected, as it can be observed in Table 7.

5.2. Results by income group

The LAIDS model permits the calculation of elasticities for different income groups. In order to do that, we have divided the sample into two parts: the 5 lowest and the 5 highest deciles. We have then calculated income and own-price elasticities of groups of products and services for those two income groups. Table 8 and 9 display the results for groups of products and services, and for products, respectively. It shows that poor people present higher income elasticities for the groups Food, Education, and Tobacco. In other words, an increase in income of poor households will lead to higher expenditure on those groups. Poor people also have higher own-price elasticities for Food and Education, but lower for Tobacco. Thus, except for Tobacco, price changes affect poor people's expenditure much more than the richest. In general, the results indicate that income elasticities are higher for poor people in all cases, illustrating the large income inequality present in Brazilian society. As for individual products (Table 9), income elasticities are in general higher for poor people, probably reflecting the huge income inequality present in Brazilian society. Own-price elasticities are important for coffee and rice & beans, for which prices matter more for poor people than for rich people.

6. Conclusions

In this paper we have estimated a Two-Stage Budget System based on data from two Household Expenditure Surveys conducted in Brazil in 1987/88 and 1995/96. As far as we know, this is the first study to estimate extensively income, own-price and cross-price elasticities for staple food in Developing Countries, and it is certainly so in Brazil. Following Edgerton (1997), we have assumed that preferences are weakly separable and that price indices are good approximations of true cost-of-living indices, which are precisely the assumptions needed to estimating the model.

In the first step we have estimated a LAIDS model for 8 groups of consumption goods and services; in the second step we have extended the model to 11 staple food items, which cover around 90% of all expenditure on food. The Two-Stage Budgeting technique was then used to calculate between-group elasticities and total elasticities for staple food groups and sub groups. The confidence intervals for the elasticity estimates were calculated using the Delta method.

All calculated income-elasticities are positive and significant, and all own-price elasticities are negative. Although negative own-price elasticities are theoretically possible, finding negative results is rare in empirical studies on demand system estimations. Another important contribution of this study was the calculation of elasticities for two income groups. Since Brazil has a high income inequality, it is expected that income and price-elasticities are different between the richest and the poorest. The results supported this expectation, indicating that income-elasticities are higher for the poorest for all staple food. Moreover, own-price elasticities are higher for the poorest households in the case of rice and beans, the most consumed staple food commodities in Brazil.

These results are an important step forward in understanding household consumption habits in Brazil, and highlight the consumption differences between poor and rich in the country. The elasticities calculated in this study are powerful instruments in helping policymakers in devising polices targeted at poor people

7. References

Alves, D., Disch, R. and Evenson, R. "The Demand for Food in Brazil." Anais do IV Encontro Brasileiro de Econometria. Águas de São Pedro, 1982.

Asano, S. and Fiusa, S. "Estimation of the Brazilian Consumer Demand System," *Brazilian Review of Economics*, Rio de Janeiro (23): pp. 255-294. Nov. 2003.

Barten, A. P. (1977) "The systems of consumer demand functions approach: a review" *Econometrica*, 45, 23-51

Bertasso, B F. *O Consumo Alimentar em Regiões Metropolitanas Brasileiras: Análise da Pesquisa de Orçamentos Familiares/IBGE 1995/96*. Dissertação (Mestrado). São Paulo, 2000.

Blundell, R. "Theory and Empirical Evidence – a Survey". The Economic Journal, (98) No. 389, 16-65, March 1988

Deaton, A. "Quality and Spatial Variation in Prices," *American Economic Review*. (78): 418-30, 1988.

Deaton, A. and Muellbauer, J. "Almost Ideal Demand System" *American Economic Review* (70): 312-326, June 1980.

Edgerton, D. "Weak Separability and Estimation of Elasticities in Multistage Demand System". *American Journal of Agricultural Economics* (79): 62-79, Feb. 1997.

Gorman, W. M. "Separability, Utility and Aggregation" *Econometrica* (27): 469-81, July, 1959.

Hoffmann, R. "Elasticidades-renda das Despesas e do Consumo Físico de Alimentos no Brasil Metropolitano em 1995–96". *Agricultura em São Paulo*, (47) n.1, São Paulo, 2000.

Menezes, T., Silveira, S., Magalhães, L. and Diniz, B. "Elasticidade Renda dos produtos alimentares no Brasil e Regiões Metropolitanas: uma aplicação dos micro-dados da POF 1995/96," Anais do XXXI Encontro Nacional de Economia – ANPEC, Porto Seguro-BA, Dec. 2003.

Michalek, J. and Keyzer, M. "Estimation of a Two-Stage LES-AIDS Consumer Demand System for Eight EC Countries" *European Review of Agricultural Economics*. (19): 137-63, 1992.

Selvanathan, S. and Selvanathan, E. A. (2005) "Is Utility Additive? Further Evidence", *Applied Economics*, V37 i1 p83(4) Jan.

Simões, R. and Brandt, S.A. "Sistema completo de equações de demanda para o Brasil" in: Anais do III Encontro da Sociedade Brasileira de Econometria, Olinda-PE, Dec. 1981.

Thomas, D., Strauss, J. and Barbosa, M. M. T. "Estimating the impact of income and prices changes on consumption in Brazil" Yale Economic Growth Discussion Paper, N. 589, New Haven-CT, 1989.

Table 1 – Groups of products and variable description

Variable	Description
Product Groups	
Food	Described in table 2
Housing	House rent, Home maintenance
Clothing	Men and Women clothing
Transportation	Urban bus and fuel
Health and Personal Care	Health insurance, Shampoo, Soap, Toilet Paper, etc.
Personal Expenditure	Maids, Hairdresser Sewing Professionals Movies, Clubs, Magazines.
Education	Tuition for Elementary and High Schools
Tobacco	Tobacco
Sub Groups of Food Products	
Fruits	banana, orange, lemon
Sauces	garlic, mayonnaise, tomato sauce, salt
Vegetables	potato, onion, manioc, tomato, cabbage
Sugar	sugar, biscuits
Coffee	coffee
Meat	beef, chicken, fish, pork
Wheat	plain flour, spaghetti, bread
Milk	yogurt, milk, butter, cheese
Cooking Oil	margarine, soy oil
Ham	sausage, ham, salami
Rice & beans	rice, beans
Explanatory Variables	
Gender of Household Head (Man=1)	probability of household head to be a man
Age of Household Head	household head age
Latitude	
Exppc	household per capita expenditure on consumption
Lys	exppc divided by stone price index
Densitrm	metropolitan region density

Table 2 – Descriptive Statistics for Groups of Products and Services

	North				Northeast				Southeast				South				
Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max	Me
PRICE																	
Food	4.26	0.97	3.32	5.21	4.03	0.35	3.54	4.48	3.95	0.52	3.34	4.70	3.79	0.40	3.38	4.27	3
Housing	71.1	30.80	41.1	101	53.67	24.59	26.8	84.38	86.42	46.44	36.5	166.3	77.0	40.23	36.6	132	
Clothing	41.1	0.43	40.7	41.5	45.91	3.82	40.7	52.31	46.46	8.16	36.5	57.01	48.6	9.89	36.4	61.7	5
Transportation	5.23	3.93	1.40	9.06	4.27	3.01	1.29	8.13	3.42	2.26	1.38	7.60	3.52	1.95	1.49	5.71	4
Health and Personal Care	25.1	3.77	21.4	28.7	21.74	3.94	17.9	29.03	26.62	7.93	18.3	37.06	22.6	6.16	15.7	29.5	2
Personal Expenditure	64.9	27.45	38.1	91.6	59.41	11.21	47.2	81.95	72.50	8.57	60.1	83.18	66.6	18.98	45.9	86.3	7
Education	173	35.63	138	208	201.1	66.93	120	305.6	381.7	130.1	213	513.7	315	104.8	211	443	
Tobacco	1.40	0.08	1.33	1.48	1.36	0.13	1.16	1.48	1.40	0.08	1.33	1.48	1.40	0.08	1.33	1.48	1
SHARE																	
Food	0.32	0.10	0.12	0.45	0.32	0.11	0.11	0.57	0.24	0.09	0.06	0.44	0.24	0.10	0.07	0.44	0
Housing	0.16	0.05	0.09	0.31	0.16	0.05	0.10	0.31	0.22	0.06	0.13	0.41	0.19	0.05	0.12	0.29	0
Clothing	0.15	0.05	0.09	0.22	0.15	0.05	0.08	0.26	0.14	0.05	0.07	0.24	0.17	0.06	0.07	0.26	0
Transportation	0.12	0.02	0.08	0.16	0.13	0.03	0.06	0.20	0.14	0.02	0.07	0.20	0.13	0.02	0.07	0.19	0
Health and Personal Care	0.14	0.02	0.11	0.18	0.12	0.03	0.07	0.21	0.14	0.03	0.08	0.19	0.15	0.03	0.08	0.21	0
Personal Expenditure	0.07	0.03	0.03	0.15	0.06	0.02	0.02	0.12	0.07	0.02	0.03	0.13	0.07	0.03	0.03	0.12	0
Education	0.02	0.02	0.00	0.08	0.03	0.02	0.00	0.10	0.02	0.02	0.00	0.07	0.02	0.02	0.00	0.08	0
Tobacco	0.02	0.01	0.00	0.03	0.03	0.01	0.01	0.05	0.03	0.01	0.01	0.06	0.03	0.01	0.01	0.06	0
VARIABLES																	
Gender (Man=1)	0.73	0.07	0.56	0.90	0.74	0.07	0.50	0.85	0.76	0.06	0.58	0.89	0.78	0.05	0.66	0.86	0
Age of Household Head	45.1	1.78	41.8	48.6	44.32	2.27	39.3	49.39	45.32	2.36	41.1	52.99	43.6	2.07	39.9	49	4
Latitude	-1.38	0.00	-1.38	-1.38	-8.84	2.88	-12.7	-5.82	-22.11	1.62	-23.6	-19.89	-27.7	2.39	-30.1	-25.3	-1
Lys	0.21	0.48	-0.46	1.44	0.08	0.56	-1.05	1.49	0.21	0.56	-0.81	1.53	0.31	0.50	-0.61	1.50	0
Exppc	23.6	20.10	7.16	76.2	20.02	18.65	4.13	76.04	29.12	24.17	6.19	101.5	30.4	23.84	7.78	96.4	3
Densitrm	2983.69	290.73	2700.32	3267.05	10898.71	6395.96	5255.32	20798.87	28509.86	23456.93	5069.77	60654.66	3459.00	1293.78	2060.78	4989.69	257

Table 3 – Descriptive statistics for sub groups of food products

	North				Northeast				Southeast				South			
Variable	*Mean*	*Std. Dev.*	*Min*	*Max*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Mean*	*Std. Dev.*	*Min*	*Max*	*Mean*	*Std. Dev.*	*Min*	*Max*
PRICE																
Fruits	1.55	0.07	1.48	1.62	0.86	0.14	0.68	1.04	1.03	0.14	0.83	1.27	0.96	0.06	0.87	1.03
Sauces	5.36	0.16	5.21	5.52	5.69	1.60	4.01	8.80	5.89	2.06	3.94	9.61	5.34	0.16	5.11	5.55
Vegetables	1.00	0.02	0.98	1.02	0.81	0.10	0.61	0.89	0.85	0.13	0.69	1.04	0.93	0.08	0.85	1.06
Sugar	2.54	0.29	2.26	2.82	2.75	0.28	2.29	3.12	2.60	0.30	2.12	2.87	2.64	0.14	2.48	2.82
Coffee	7.58	0.81	6.79	8.36	7.52	0.92	6.40	8.99	6.72	0.72	5.35	7.74	7.42	0.65	6.81	8.34
Meat	4.99	1.88	3.16	6.83	5.07	1.28	3.61	6.51	5.85	1.64	3.98	8.08	5.41	1.59	3.76	7.11
Wheat	2.70	0.37	2.35	3.06	2.42	0.07	2.33	2.55	2.69	0.39	2.22	3.18	2.41	0.31	2.11	2.89
Milk	8.96	1.94	7.07	10.85	6.79	0.76	5.64	7.69	3.74	0.70	2.98	5.21	2.81	0.69	1.80	3.47
Oil	2.78	0.13	2.65	2.90	2.48	0.07	2.37	2.58	2.08	0.15	1.80	2.24	2.25	0.15	2.11	2.49
Ham	8.13	0.74	7.40	8.85	7.22	1.41	5.30	9.72	7.60	0.87	6.02	8.63	7.69	0.70	7.08	8.77
Rice & beans	1.40	0.26	1.15	1.66	1.33	0.26	0.94	1.63	1.23	0.20	0.95	1.51	1.07	0.12	0.91	1.24
SHARE																
Fruits	0.03	0.01	0.02	0.06	0.04	0.01	0.01	0.05	0.04	0.01	0.02	0.06	0.03	0.01	0.02	0.05
Sauces	0.01	0.00	0.01	0.01	0.01	0.00	0.01	0.03	0.02	0.00	0.01	0.04	0.02	0.01	0.01	0.03
Vegetables	0.03	0.01	0.02	0.04	0.03	0.01	0.01	0.06	0.04	0.01	0.02	0.09	0.05	0.01	0.03	0.07
Sugar	0.06	0.01	0.04	0.07	0.09	0.01	0.06	0.12	0.08	0.02	0.05	0.12	0.08	0.02	0.05	0.12
Coffee	0.03	0.01	0.02	0.05	0.04	0.01	0.02	0.06	0.04	0.01	0.02	0.06	0.04	0.01	0.02	0.07
Meat	0.50	0.02	0.46	0.53	0.33	0.04	0.25	0.48	0.30	0.05	0.22	0.40	0.32	0.05	0.19	0.44
Wheat	0.13	0.03	0.08	0.18	0.16	0.04	0.07	0.22	0.13	0.03	0.06	0.21	0.13	0.03	0.07	0.19
Milk	0.09	0.03	0.06	0.16	0.14	0.03	0.08	0.23	0.17	0.03	0.09	0.27	0.17	0.03	0.11	0.22
Oil	0.04	0.01	0.02	0.06	0.04	0.01	0.03	0.06	0.05	0.01	0.02	0.08	0.05	0.01	0.03	0.08
Ham	0.01	0.00	0.00	0.02	0.01	0.01	0.00	0.03	0.04	0.01	0.01	0.07	0.04	0.01	0.02	0.07
Rice & beans	0.08	0.02	0.05	0.10	0.11	0.05	0.04	0.24	0.11	0.04	0.03	0.21	0.07	0.03	0.03	0.15
VARIABLES																
Man	0.73	0.07	0.56	0.90	0.74	0.07	0.50	0.85	0.76	0.06	0.58	0.89	0.78	0.05	0.66	0.86
Age	45.06	1.78	41.77	48.65	44.32	2.27	39.30	49.39	45.32	2.36	41.12	52.99	43.64	2.07	39.87	48.97
Latitude	-1.38	0.00	-1.38	-1.38	-8.84	2.88	-12.68	-5.82	-22.11	1.62	-23.63	-19.89	-27.71	2.39	-30.08	-25.35
Lys	0.01	0.31	-0.52	0.65	-0.07	0.35	-0.88	0.62	0.10	0.30	-0.59	0.68	0.17	0.23	-0.33	0.57
Expenditure	3.94	1.36	2.15	6.81	3.37	1.38	1.32	7.17	3.80	1.44	1.62	8.15	3.83	1.05	1.95	5.94
Density	331.52	32.30	300.04	363.01	1210.97	710.66	583.92	2310.99	3167.76	2606.33	563.31	6739.41	384.33	143.75	228.98	554.41
N. of obs.	20	20	20	20	60	60	60	60	60	60	60	60	40	40	40	40

Table 4: Estimated coefficients for groups of products and services

	(1)	(2)	(3)	(4)	(5)	(6)	(7)
food	0.16699	-0.0617	-0.03133	-0.01307	-0.01876	-0.01016	0.01223
	(5.42)**	(6.89)**	(1.80)	(1.05)	(1.37)	(1.11)	(1.34)
housing	-0.06170	0.04505	0.00722	0.01073	0.00716	0.00554	-0.00608
	(6.89)**	(6.51)**	(1.25)	(2.04)*	(1.46)	(1.80)	(1.57)
clothing	-0.03133	0.00722	0.02354	0.00443	-0.00283	-0.00801	-0.02654
	(1.80)	(1.25)	(1.30)	(0.50)	(0.29)	(1.10)	(3.68)**
transport & Communication	-0.01307	0.01073	0.00443	-0.02173	0.00849	0.01638	0.01542
	(1.05)	(2.04)*	(0.50)	(2.05)*	(1.12)	(3.01)**	(2.88)**
health & personal care	-0.01876	0.00716	-0.00283	0.00849	0.02234	0.01128	-0.00775
	(1.37)	(1.46)	(0.29)	(1.12)	(2.03)*	(2.05)*	(1.39)
personal expenditure	-0.01016	0.00554	-0.00801	0.01638	0.01128	-0.00261	-0.00270
	(1.11)	(1.80)	(1.10)	(3.01)**	(2.05)*	(0.46)	(0.70)
education	0.01223	-0.00608	-0.02654	0.01542	-0.00775	-0.00270	-0.00199
	(1.34)	(1.57)	(3.68)**	(2.88)**	(1.39)	(0.70)	(0.36)
tobacco	-0.0442	-0.0079	0.0335	-0.0207	-0.0199	-0.0097	0.0174
lys	-0.18806	0.03281	0.02603	0.03449	0.04112	0.04601	0.02691
	(27.11)**	(6.31)**	(6.85)**	(8.92)**	(11.82)**	(22.27)**	(10.04)**
(mean) gender	0.07127	-0.12206	0.09216	0.02242	-0.03679	-0.01216	-0.03041
	(1.47)	(3.34)**	(3.49)**	(0.83)	(1.52)	(0.85)	(1.63)
(mean) age	0.05116	-0.11927	0.04367	0.02912	-0.00236	0.00869	-0.02701
	(1.85)	(5.74)**	(2.86)**	(1.86)	(0.17)	(1.05)	(2.53)*
age2	-0.00055	0.00136	-0.00053	-0.00037	0.00003	-0.00010	0.00032
	(1.76)	(5.87)**	(3.08)**	(2.08)*	(0.21)	(1.07)	(2.66)**
latt1	3.33E-04	-0.0002	-0.0008	0.00025	-0.0003	1.8E-05	-0.0001
	(0.60)	(0.51)	(2.48)*	(0.86)	(0.97)	(0.10)	(0.47)
latt2	0.003	-0.0021	-0.0006	0.00138	-0.0009	-0.0009	-3E-05
	(5.90)**	(5.93)**	(1.62)	(3.81)**	(2.77)**	(4.66)**	(0.11)
(mean) densitrm	-3.6E-07	6.2E-07	-3E-07	3.5E-08	-7E-08	-1E-07	7.9E-08
	(1.92)	(4.89)**	(2.84)**	(0.32)	(0.76)	(1.57)	(1.07)
year== 1988.0000	-0.05481	0.02125	0.09725	-0.08825	0.01178	0.04154	-0.0063
	(1.77)	(1.48)	(4.95)**	(4.17)**	(0.71)	(3.72)**	(0.50)
Constant	-0.66916	2.68428	-0.7803	-0.59738	0.11231	-0.1523	0.74743
	(1.07)	(5.72)**	(2.25)*	(1.69)	(0.36)	(0.81)	(3.09)**
Observations	200	200	200	200	200	200	200

Absolute value of z statistics in parentheses; * Significant at 5%; ** Significant at 1%

Table 6 – Estimated income and own-price elasticities for groups of products and services

	Expenditure Elasticity	Own-Price Elasticity
food	**0.301**	**-0.192**
	(0.00)	(0.00)
housing	**1.173**	**-0.795**
	(0.00)	(0.00)
clothing	**1.171**	**-0.872**
	(0.00)	(0.28)
transportation	**1.258**	**-1.197**
	(0.00)	(0.01)
health & personal care	**1.304**	**-0.876**
	(0.00)	(0.13)
personal expenditure	**1.690**	**-1.085**
	(0.00)	(0.31)
education	**2.063**	**-1.106**
	(0.00)	(0.63)
tobacco	**0.303**	**-2.840**
	(0.01)	(0.00)

Table 7 – Estimated elasticities for food products

	fruit	sauce	vegetables	sugar	coffee	meat	wheat	milk	oils	ham	rice & beans
Expenditure Elasticity											
	0.495	**0.364**	**0.378**	**0.236**	**0.183**	**0.375**	**0.118**	**0.441**	**0.349**	**0.484**	**0.006**
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.831)
Own-Price and Cross-Price Elasticities											
fruit	**-0.743**	**0.277**	**-0.764**	**-0.684**	**0.095**	**0.186**	**0.334**	**0.410**	**-0.105**	**-0.119**	**-0.661**
	(0.430)	(0.000)	(0.001)	(0.003)	(0.562)	(0.407)	(0.174)	(0.002)	(0.691)	(0.648)	(0.055)
sauce		**-0.618**	**-0.590**	**-0.329**	**0.246**	**0.009**	**0.305**	**0.319**	**0.026**	**0.004**	**-0.316**
		(0.000)	(0.000)	(0.033)	(0.037)	(0.971)	(0.105)	(0.022)	(0.867)	(0.982)	(0.096)
vegetables			**-1.679**	**-0.421**	**0.748**	**1.071**	**-0.006**	**0.466**	**-0.341**	**-0.325**	**-1.075**
			(0.016)	(0.076)	(0.000)	(0.000)	(0.981)	(0.001)	(0.127)	(0.158)	(0.003)
sugar				**-0.676**	**0.111**	**0.327**	**0.257**	**0.260**	**0.369**	**-0.225**	**0.157**
				(0.023)	(0.154)	(0.005)	(0.030)	(0.000)	(0.002)	(0.041)	(0.955)
coffee					**-0.116**	**-0.288**	**0.290**	**0.287**	**-0.354**	**-0.558**	**0.852**
					(0.000)	(0.161)	(0.175)	(0.023)	(0.069)	(0.002)	(0.040)
meat						**-0.595**	**0.083**	**0.070**	**0.115**	**0.031**	**0.276**
						(0.000)	(0.052)	(0.092)	(0.000)	(0.257)	(0.046)
wheat							**-0.354**	**0.051**	**-0.337**	**-0.369**	**-0.196**
							(0.000)	(0.399)	(0.000)	(0.000)	(0.004)
milk								**-1.024**	**0.186**	**-0.046**	**0.145**
								(0.761)	(0.000)	(0.242)	(0.981)
oils									**-1.490**	**0.781**	**0.110**
									0.099	(0.000)	(0.905)
ham										**-0.092**	**-2.268**
										0.0633	(0.000)
rice & beans											**-0.245**
											(0.000)

Table 8 – Estimated elasticities by income group

	food	housing	clothing	transportation	health & personal care	personal expenditure	education	tobacco
				Expenditure elasticity				
50% poorest	0.454	1.185	1.183	1.283	1.348	1.956	3.276	0.464
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
50% richest	0.109	1.167	1.159	1.241	1.278	1.568	1.770	0.099
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.511)
100%	0.301	1.173	1.171	1.258	1.304	1.690	2.063	0.303
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.009)
				Own-price elasticity				
50% poorest	-0.327	-0.779	-0.860	-1.213	-0.852	-1.100	-1.195	-2.411
	(0.000)	(0.000)	(0.274)	(0.015)	(0.111)	(0.396)	(0.676)	(0.000)
50% richest	-0.021	-0.804	-0.882	-1.186	-0.890	-1.078	-1.084	-3.386
	(0.000)	(0.000)	(0.288)	(0.013)	(0.138)	(0.265)	(0.595)	(0.000)
100%	-0.192	-0.795	-0.872	-1.197	-0.876	-1.085	-1.106	-2.840
	(0.000)	(0.000)	(0.280)	(0.014)	(0.130)	(0.310)	(0.630)	(0.000)

Table 5: Estimated coefficients for food products

		(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
fruit		0.00840	0.00959	-0.02865	-0.02675	0.00257	-0.00161	0.00874	0.01114	-0.00493	-0.00494
		(0.71)	(3.71)**	(3.34)**	(3.16)**	(0.43)	(0.20)	(0.98)	(2.28)*	(0.52)	(0.52)
sauce	**2**	0.00959	0.00657	-0.01105	-0.00695	0.00390	-0.00445	-0.00777	0.00363	-0.00017	-0.00029
		(3.71)**	(4.21)**	(4.19)**	(2.52)*	(1.86)	(1.07)	(2.14)*	(1.47)	(0.06)	(0.10)
vegetables	**3**	-0.02865	-0.01105	-0.02760	-0.01872	0.02806	0.03177	-0.00424	0.01371	-0.01462	-0.01343
		(3.34)**	(4.19)**	(2.51)*	(2.03)*	(4.45)**	(3.43)**	(0.47)	(2.48)*	(1.68)	(1.50)
sugar	**4**	-0.02675	-0.00695	-0.01872	0.02032	0.00636	0.00331	0.01123	0.01043	0.02613	-0.01959
		(3.16)**	(2.52)*	(2.03)*	(1.79)	(1.04)	(0.36)	(1.20)	(1.79)	(2.81)**	(2.25)*
coffee	**5**	0.00257	0.00390	0.02806	0.00636	0.03039	-0.02081	0.00606	0.00548	-0.01405	-0.02070
		(0.43)	(1.86)	(4.45)**	(1.04)	(4.87)**	(2.84)**	(0.80)	(1.22)	(2.03)*	(3.20)**
meat	**6**	-0.00161	-0.00445	0.03177	0.00331	-0.02081	0.05015	-0.00689	-0.01484	0.02693	0.00382
		(0.20)	(1.07)	(3.43)**	(0.36)	(2.84)**	(1.71)	(0.48)	(1.06)	(3.08)**	(0.41)
wheat	**7**	0.00874	-0.00777	-0.00424	0.01123	0.00606	-0.00689	0.07073	-0.01192	-0.05157	-0.05348
		(0.98)	(2.14)*	(0.47)	(1.20)	(0.80)	(0.48)	(4.21)**	(1.44)	(5.28)**	(4.88)**
milk	**8**	0.01114	0.00363	0.01371	0.01043	0.00548	-0.01484	-0.01192	-0.01991	0.02301	-0.00973
		(2.28)*	(1.47)	(2.48)*	(1.79)	(1.22)	(1.06)	(1.44)	(1.66)	(4.03)**	(1.65)
oils	**9**	-0.00493	-0.00017	-0.01462	0.02613	-0.01405	0.02693	-0.05157	0.02301	-0.02391	0.03467
		(0.52)	(0.06)	(1.68)	(2.81)**	(2.03)*	(3.08)**	(5.28)**	(4.03)**	(1.77)	(3.50)**
hams &	**10**	-0.00494	-0.00029	-0.01343	-0.01959	-0.02070	0.00382	-0.05348	-0.00973	0.03467	0.02308
		(0.52)	(0.10)	(1.50)	(2.25)*	(3.20)**	(0.41)	(4.88)**	(1.65)	(3.50)**	(1.82)
rice & beans	**11**	0.027	0.005	0.045	-0.003	-0.026	-0.067	0.039	-0.010	-0.001	0.060
lys		0.023	0.004	0.010	-0.017	-0.014	0.082	-0.083	0.070	0.007	0.016
		(9.64)**	(2.54)*	(3.53)**	(5.28)**	(5.40)**	(8.28)**	(17.09)**	(9.91)**	(2.66)**	(5.14)**
sex		0.007	-0.007	-0.012	-0.017	-0.016	0.086	-0.014	-0.033	-0.013	-0.002
		(0.68)	(1.09)	(1.01)	(1.29)	(1.45)	(2.10)*	(0.68)	(1.13)	(1.17)	(0.13)
age		-0.001	-0.002	0.002	-0.003	-0.014	0.031	0.024	-0.011	-0.001	0.003
		(0.11)	(0.47)	(0.26)	(0.36)	(2.34)*	(1.35)	(2.14)*	(0.70)	(0.11)	(0.37)
age2		5.46e-06	1.41e-05	-1.69e-05	2.82e-05	1.55e-04	-3.56e-04	-2.64e-04	1.13e-04	5.93e-06	-3.02e-05
		(0.09)	(0.37)	(0.23)	(0.33)	(2.30)*	(1.40)	(2.08)*	(0.62)	(0.08)	(0.38)
latt1		3.460e-04	-1.47e-04	-2.17e-03	2.03e-03	1.83e-03	-4.94e-03	-6.90e-04	6.94e-04	-1.19e-03	-2.07e-03
		(0.89)	(0.83)	(5.51)**	(4.67)**	(5.38)**	(4.62)**	(1.13)	(0.90)	(2.96)**	(4.76)**
latt2		0.001	-0.000	-0.002	0.003	0.002	-0.006	-0.000	-0.001	-0.001	-0.002
		(2.15)*	(0.08)	(5.38)**	(7.22)**	(5.71)**	(5.80)**	(0.87)	(1.60)	(1.67)	(5.68)**
rg=1.0000		-0.033	-0.016	0.021	-0.061	-0.034	0.302	0.033	-0.060	0.009	0.003
		(4.06)**	(3.95)**	(2.34)*	(6.48)**	(4.58)**	(11.51)**	(2.40)*	(3.43)**	(1.08)	(0.32)
rg= 2.0000		-0.021	-0.006	-0.010	-0.027	-0.012	0.099	0.048	-0.002	-0.001	-0.005
		(3.16)**	(2.14)*	(1.53)	(3.98)**	(2.30)*	(5.55)**	(5.08)**	(0.17)	(0.07)	(0.77)
rg= 3.0000		-0.009	0.004	-0.014	0.009	0.019	-0.037	0.008	0.006	0.000	-0.009
		(1.83)	(2.24)*	(2.97)**	(1.67)	(4.83)**	(3.25)**	(1.17)	(0.73)	(0.02)	(1.78)
rg= 4.0000		-0.007	0.004	-0.007	0.028	0.027	-0.070	0.032	-0.010	0.002	-0.017
		(1.41)	(1.65)	(1.36)	(4.85)**	(6.15)**	(4.95)**	(4.21)**	(1.00)	(0.32)	(3.17)**
year= 1988		-0.010	-0.003	-0.043	0.002	0.032	0.033	-0.004	0.009	-0.034	-0.052
		(0.89)	(0.89)	(3.63)**	(0.20)	(3.63)**	(1.78)	(0.28)	(0.91)	(2.86)**	(4.69)**
Constant		0.062	0.061	-0.060	0.166	0.389	-0.562	-0.342	0.494	-0.006	-0.002
		(0.50)	(0.82)	(0.41)	(0.99)	(2.91)**	(1.11)	(1.37)	(1.35)	(0.04)	(0.02)
N. of Obs.		200	200	200	200	200	200	200	200	200	200

Absolute value of z statistics in parentheses. * Significant at 5%; ** Significant at 1%

Table 9 - Estimated elasticities for rich and poor households

	Fruits	Sauces	Vegetables	Sugar	Coffee	Meat	Wheat	Milk	Oil	Ham & Sausage	Rice & Beans
Expenditure elasticity											
50% poorest	0.804	0.550	0.577	0.362	0.297	0.574	0.213	0.691	0.527	0.787	0.095
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.003)
50% richest	0.171	0.131	0.136	0.084	0.061	0.134	0.034	0.156	0.126	0.168	-0.024
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.041)
All households	0.495	0.364	0.378	0.236	0.183	0.375	0.118	0.441	0.349	0.484	0.006
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)	(0.831)
Own price elasticity											
50% poorest	-0.710	-0.614	-1.732	-0.698	-0.213	-0.656	-0.414	-1.081	-1.507	0.085	-0.357
	(0.456)	(0.000)	(0.015)	(0.023)	(0.000)	(0.000)	(0.000)	(0.362)	(0.094)	(0.066)	(0.000)
50% richest	-0.756	-0.618	-1.641	-0.655	-0.018	-0.512	-0.291	-0.964	-1.477	-0.183	-0.103
	(0.395)	(0.000)	(0.018)	(0.022)	(0.000)	(0.000)	(0.000)	(0.625)	(0.106)	(0.059)	(0.000)
All households	-0.743	-0.618	-1.679	-0.676	-0.116	-0.595	-0.354	-1.024	-1.490	-0.092	-0.245
	(0.430)	(0.000)	(0.016)	(0.023)	(0.000)	(0.000)	(0.000)	(0.761)	(0.099)	(0.063)	(0.000)