

Age structure and Household Consumption in Brazil

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Abstract: Brazil is facing a demographic challenge due to important changes in age structure of its population. In the last fifty years, the proportion of people aged under 10 dropped from 30% to 17% while the proportion of aged over 60 increased from 5% to 10%. Changing in age structure population can affect both demand and supply of goods and services. On the demand side, changes in age distribution can alter the composition of household consumption among types of goods and services. It occurs because preferences usually vary along life-cycle. The aim of this paper is to estimate the association between household expenditure composition and the presence of children and elderly individuals in households. This is the first attempt to estimate how household expenditure composition varies among households with different age structure in Brazil. A typology of households was built to take into account household age structure. Seven household groups were defined. The association between household age structure and consumption composition was estimated through econometric models for consumption items present in Expenditure Consumption Survey (Pesquisa de Orçamento Familiar, abbreviated as POF) which were aggregated into 15 groups. For each household group and each type of product, a model was run allowing the estimation of “*household-type semi-elasticity*”. Mains results showed that households with elderly or children present different patterns of consumption when compared to households composed by only two adults. The marginal effects are greater for health-related goods, specifically health insurance and inpatient care.

Key words: Demographic Changes, Age Structure, Consumption, CLAD Model.

Resumo: O Brasil está enfrentando um desafio demográfico devido a importantes mudanças na estrutura etária da população. Nos últimos 50 anos, a proporção de pessoas com idade inferior a 10 caiu de 30% para 17%, enquanto a proporção de idosos acima de 60 anos aumentou de 5% para 10%. A alteração na estrutura etária da população pode afetar tanto a demanda e quanto a oferta de bens e serviços. Do lado da demanda, as mudanças na distribuição etária podem alterar a composição do consumo das famílias entre os tipos de bens e serviços. Isto ocorre porque as preferências normalmente variam ao longo do ciclo de vida. O objetivo deste trabalho é estimar a associação entre a composição das despesas domiciliares e a presença de crianças e idosos nos domicílios. Esta é a primeira tentativa de estimar como composição das despesas domiciliares varia entre os domicílios com diferente estrutura etária no Brasil. Uma tipologia domiciliar foi construída considerando a estrutura etária dos domicílios. Foram definidos sete grupos domiciliares. A associação entre a estrutura etária dos domicílios e a composição do consumo foi estimada por meio de modelos econométricos para os itens de consumo presentes na Pesquisa de Orçamento Familiar – POF que foram agregados em 15 grupos. Para cada tipologia domiciliar e cada tipo de produto, um modelo foi estimado obtendo assim uma “*semi-elasticidade de tipologia domiciliar*”. Os principais resultados mostraram que os domicílios com idosos ou crianças apresentam diferentes padrões de consumo quando comparado com os agregados domiciliares compostos apenas por dois adultos. Os efeitos marginais são maiores para produtos relacionados com a saúde, especificamente plano de saúde e serviços de atendimento hospitalar.

Palavras chave: Mudanças demográficas, Estrutura etária, Consumo, Modelo CLAD.

Área 12 - Economia Social e Demografia Econômica

JEL Classification: D12; E21; J10.

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1. Introduction

The demographic transition has occurred differently across countries depending on the level of economic development. In most developed countries, the demographic transition process has already been completed and took two centuries to occur. By contrast, in some developing economies, such as China and Brazil, this process has been fast and is still in its second stage, which is characterized by declining fertility rates and increasing mortality rates. As other developing economies, Brazil is facing another demographic challenge due to important changes in age structure of its population. In the last fifty years, the proportion of people aged under 10 dropped from 30 to 17% while the proportion of aged over 60 increased from 5 to 10%. According to United Nations projections, in 2050, the proportion of elderly people (aged over 60) will represent 29% of the whole population (United Nations, 2011).

Changing in age structure population can affect both demand and supply of goods and services. On the demand side, changes in age distribution can alter the composition of household consumption among types of goods and services. It occurs because preferences usually vary along life-cycle. As a consequence, if population is aging very fast this process might involve changes in household consumption. It is necessary to reorganize the supply of goods and services to face these significant changes in the aggregated demand composition. In turn, such changes are likely to trigger substantial sectorial shifts (Denton and Spence, 1999; Fougère *et al.*, 2007; Lefèbvre, 2008).

Some important research has been done in this topic. Dewhurst (2006) used an input-output matrix, disaggregated for elderly and non-elderly, to quantify sectorial impacts of changes in consumption pattern associated to aging. Luhrmann (2005) using Almost Ideal Demand System (AIDS) estimated household demand for goods and services in Germany between 2000 and 2040. Lefèbvre (2006) used a pseudo panel to examine the aging effect on aggregate consumption in Belgium in two steps. In the first step the author estimated the aging effect on the household expenditure of goods and services and in the second step, taking into account the household consumption composition, the author predicted the aggregated consumption by industrial sectors until 2050. Main results showed that an increase in expenditure on housing, health and leisure and reduction in expenditure on clothing, equipment and transport.

Recently, Kim *et al.* (2015) have proposed an extension to the regional econometric input-output model (REIM) for the Chicago region integrated into a demand system that allows heterogeneity in household consumption. The authors used aggregate consumption data present in Consumer Expenditure Survey (CES) for the years of 1987–2011 and the Consumer Price Index (CPI) to estimate the almost ideal demand system (AIDS) with age- or income group fixed effects. In the extended model, distinct spending patterns by cohort are major forces that drive differentiated changes in output, employment, and income. The main conclusions reveal that a demographic change (e.g. an aging population) results in compositional changes in consumption in the long run, consequently influencing other variables.

In the Brazilian context, Almeida (2002), using data from The Consumer Expenditure Survey (Pesquisa de Orçamento Familiar - POF) estimated, for Brazilian metropolitan areas, the consumption pattern considering two types of households: households with an elderly head and households with all residents aged below 60. Main results showed that increasing age increases the probability of consuming medicines products, goods and services related to health, and personal expenses and leisure. Similar work was done by Neri *et al.* (2004). The authors compared the consumption vector observed in the whole population with that one observed in households in which the proportion of elderly people is equal or higher than 50%. Recently, Zanon (2012) by using an input-output matrix examined how population aging affects the Brazilian productive structure. Data from Consumer Expenditure Survey-2008 was used to disaggregate household consumption vector between elderly households (households with at least 50% of elderly) and nonelderly households (households with less than 50% of elderly). All of these studies indicated that population aging causes an increase in expenses of goods and services related to health, domestic services, leisure goods and services in general.

The aim of this paper is to estimate the association between household expenditure composition and the presence of children and elderly individuals in households. This is the first attempt to estimate how household expenditure composition varies among households with different age structure in Brazil. A typology of households was built to take into account household age structure. Seven household groups

were defined. The association between household age structure and consumption composition was estimated through econometric models. For each household group and each type of product a model was run allowing the estimation of *household-type semi-elasticity*. All consumption items present in Expenditure Consumption Survey were aggregated into 15 groups. In fact, 13 semi-elasticity's coefficients were estimated for each type of household. Finally, a consumption vector was also estimated for each household group making it possible to compare the consumption pattern among households with different age structure.

2. Data

This paper uses Consumer Expenditure Survey data set for the years of 2002-2003. This survey is carried out by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística – IBGE, 2004) every five years. The main aim of this survey is to estimate household consumption expenditure in order to subsidize the build of the National Consumer Price Index (INPC).

The 2002/2003 survey contains information about the population living in urban and rural areas in Brazil. Its sample is representative for the 27 federal units, nine metropolitan areas, as well as for the whole country. The sample size included 182,333 individuals living in 48,470 households. Data collection is conducted through six questionnaires, five of them are organized according to type of expenditure: 1) household and residents characteristics; 2) collective expenditure in durable household goods 3) collective expenditure in food and cleaning, 4) individual expenditure; 5) individual earnings and wages. The last questionnaire investigates living conditions perception (IBGE, 2004).

In this paper, we use all collective and individual expenditure items calculated and annualized by IBGE. The expenditure of goods and services were mapped into 15 categories of goods and services: food, textiles and clothing, fuel and transportation, medicines, health insurance, inpatient care, durables goods, other goods, energy, private education, financial services and insurance, services, services provided to families, food consumed out of the household and housing. Services provided to families include mainly caregivers to elderly and children. All expenditures are calculated and annualized by IBGE.

3. Household Typology

In order to analyze aging effect on expenditure composition it is necessary to classify households according to the presence of elderly residents and children. The classification of households is done taking into account the number of adults (residents aged from 15 to 59 years stratified into two age groups), elderly persons (residents aged over than 59 stratified into three age groups) and children (residents aged from 0 to 14 years stratified into three age groups) in the household. The disaggregation of elderly individuals and children by age is important to allow the use demographic projections, even though their use is out of the scope of this paper.

Seven types of households were defined: households with only two adults; households with two adults and one child (0-4 years old, 5-9 years old, 10-14 years old); households with two adults aged from 15 to 49 and one adult aged from 50 to 59; households with two adults aged from 15 to 49 years and one elderly aged from 60 to 69 and finally two adults aged from 15 to 49 years and one elderly over 70's. Households including only two adults (15-49) were considered as the reference category for the comparison of expenditure composition. In order to allow the identification of aging effect, households with elderly and children living together were excluded from the sample. The seven groups of households defined in our typology represents 20% of the total sample (48.470 households) surveyed by POF in 2002-2003, that is, 9.516 households. Table 1 reports the distribution of households according to each group. The largest group corresponds to households with only two adults (3.221 observations).

Table 1: Distribution of households according to the household typology

Households typology	Number of observations	Frequency
Two adults (15-49) - reference category	3221	33.85
Two adults (15-49) and one child (0-4)	2682	28.18
Two adults (15-49) and one child (5-9)	1381	14.51
Two adults (15-49) and one child (10-14)	959	10.08
Two adults (15-49) and one adult (50-59)	723	7.60
Two adults (15-49) and one elderly (60-69)	323	3.39
Two adults (15-49) and one elderly (70+)	227	2.39
Total	9516	100.00

Source: Authors' elaboration.

Table 2 shows the distribution of expenditures disaggregated by the 15 groups of goods and services for each household type. It is worth mentioning that the most important expenditure items are common to all types of households. Independently of the presence of children or elderly residents, three groups of goods and services represent at least 40% of the whole budget: food, durable goods and housing. Despite of the same consumption pattern, it is observed that the consumption of food increases with the presence of children or elderly in the household, while expenditure with durable goods highly decreases for households with elderly over seventies. Another item of expenditure sensitive to household composition is the consumption of services that expand their participation from 6% in households with two adults to around 15% for domiciles with two adults aged from 15 to 49 and one adult aged from 50 to 59 years. Regarding health services, the presence of elderly over seventies matter for health insurance and inpatient care expenditure. Even though these items do not represent high participation in the whole budget, they increase substantively: health insurance expenditure increases from 1.3% to around 3% for households with one elderly over seventies. Finally private education expenditure is also conditioned on the presence of children in the household.

Table 2: Distribution of expenditure according to household types, Brazil, 2003 - disaggregated by 15 groups of goods and services (%).

Products	2 Adult only	2 adults and					
		1 child (0-4)	1 child (5-9)	1 child (10-14)	1 adult (50-59)	1 elderly (60-69)	1 elderly (70+)
Food	9.52	12.94	12.19	11.97	10.08	13.39	15.60
Textiles and clothing	5.39	5.36	4.49	5.27	4.69	4.80	4.48
Fuel and transportation	8.33	7.20	7.43	8.12	8.08	3.48	8.04
Medicines	1.71	1.83	1.50	1.43	2.32	2.79	4.92
Health insurance	1.32	1.35	1.67	1.70	2.00	1.51	2.94
Inpatient care	0.32	0.37	0.67	0.63	0.34	0.50	1.48
Durable goods	13.24	13.20	13.14	12.08	10.81	10.51	8.33
Other goods	6.27	6.06	6.61	6.83	5.97	5.76	7.23
Energy	2.91	3.16	3.45	3.39	3.01	3.35	3.58
Private education	1.95	1.84	3.70	3.23	3.55	1.68	2.40
Financial services and insurance	5.62	5.45	5.15	5.28	3.91	5.16	4.77
Services	6.38	10.91	12.04	11.71	14.89	10.86	11.26
Services provided to families	4.79	4.17	4.90	3.53	4.70	4.31	5.41
Food out of the household	6.33	4.51	5.37	5.25	4.88	4.98	3.57
Housing	25.91	21.65	17.67	19.58	20.78	26.93	16.00
Total	100	100.00	100.00	100.00	100.00	100.00	100.00

Source: POF 2003/2004.

3. Methodology

The aim of this paper is to analyze the effects of household composition, especially the presence of elderly and child, will be explored in terms of the allocation of household expenditure on consumer goods. Specifically, the effects of presence of elderly and children are measured through the estimation of demand semi-elasticities of household composition.

One difficulty of estimating semi-elasticities on household expenditure regards data distribution. Usually, there is a large portion of zeros, especially when household expenditure is disaggregated by various products. The presence of high number of zeros occurs due to a significant fraction of households present no any expenditure on various products. The tables 1 and 2 in the Appendix B reports the expenditure distributions for all product groups taking into account the household typology. One possible method of estimation is the Tobit Model which provides consistent estimates by maximum likelihood. The censored regression analysis usually applies when the dependent variable is censored. Regarding expenditure distributions, observations assume only non-negative values, which means, that data distribution is left-censored at zero. In this cases, zero values are obtained as a result of the choice of optimal consumption vector.

In a censored distribution, only values above the censoring point (in this case, expenditure = 0) are relevant for the estimation of the dependent variable, which means a non-negative expenditure constraint on the estimation of the expenses⁵. Typically, the Tobit model expresses the observed response (y) in terms of an underlying latent variable. The general formulation of the Tobit model can be represented by the following relation (Tobin, 1958):

$$y^* = x' \beta + u \quad (1)$$

where y^* is an unobserved latent variable, x is a $k \times 1$ vector of control variables, β is a $k \times 1$ vector of parameters to be estimated, and u is the random error term. The errors are assumed *i.i.d.*, and in this case:

$$u | x \sim N(0, \sigma^2) \quad (2)$$

In other words, the error term u has a constant σ^2 . This implies that the latent variable $y^* \sim N(x\beta, \sigma^2)$ follows a normal homoscedastic distribution.

As the latent variable y^* , is not observed in all its domain, it is defined a new random variable y , transformed from the original y^* , which represents the response observed only for values greater than zero and which are censored for values equal to zero. In this case, it follows that:

$$y = \max(0, y^*) \quad (3)$$

This implies that y equals y^* when $y^* > 0$ and y equals zero when $y^* \leq 0$. Formally, there is:

$$y = \begin{cases} y^* & \text{when } y^* > 0 \\ 0 & \text{when } y^* \leq 0 \end{cases} \quad (4)$$

For a problem solving corner, $E[y | x]$ has zero as the lower limit. Thus:

$$E[y | x] \geq \max(0, x' \beta) \quad (5)$$

⁵ The usual least squares estimator fails in this case, being biased even in large samples where: a) the zeros in the data are kept and treated like any other observation, or b) all zero observations are removed. Thus, the estimators for the coefficients would be inconsistent (Wooldridge, 2000; Cameron and Trivedi, 2005; Cameron and Trivedi, 2009).

The conditional expectation of y is always non-negative. By the fact that y^* is normally distributed, y has a continuous distribution over strictly positive values. Particularly, the density of y given x is the same as the density of y given x for positive values.

The Tobit model is based on homoscedastic variance of the error term u . If $u \sim N(0, \sigma^2)$ – normal and homoscedastic – then the $\hat{\beta}$ estimator is consistent and efficient. Otherwise, it is inconsistent. Pagan and Vella (1989) describe the conditional moment test that can be implemented after the Tobit model estimation. If one of the null hypothesis of normality or homoscedasticity of errors is discarded, one option is to use the Censored Least Absolute Deviations (CLAD) estimator (Powell, 1984; Wooldridge, 2000; Cameron and Trivedi, 2005), which is consistent since the median $(u_i | Z)_i = 0$.

3.1 Censored Least Absolute Deviations Estimator (CLAD) ⁶

The CLAD estimator is a generalization of the semiparametric estimator Least Absolute Deviations (LAD) proposed by Powell (1984) as an alternative to the Tobit model when data distribution is heteroscedastic. Unlike the standard censored regression estimator, Tobit, or other approaches by maximum likelihood, the CLAD estimator is robust to heteroscedasticity being consistent and asymptotically normal for a wide class of error distributions. The properties of the LAD estimator are presented in Koenker and Basset (1978).

Starting from equation (1) and considering that the median of u given x equals zero:

$$y^* = x\beta + u \quad \text{Med}(u | x) = 0 \quad (6)$$

Equation (6) implies that $\text{Med}(y | x) = x\beta$; in this case the median of y^* is linear in x . By the fact that $y = \max(0, y^*)$ is a non-decreasing function, it follows that:

$$\text{Med}(y | x) = \max[0, \text{Med}(y^* | x)] = \max(0, x\beta) \quad (7)$$

As shown in equation (7), $\text{Med}(y | x)$ does not depend on the distribution of u given x . $E(y | x)$ and $E(y | x, y > 0)$ depend. In addition, the average and median functions have different forms. The conditional median of y is zero for $x\beta \leq 0$ and linear in x for $x\beta > 0$. In contrast, the conditional expectation $E(y | x)$ is never equal to zero and it is a nonlinear function of x . Note that equation (7) has the equation (6) as its only hypothesis; no other hypothesis about the errors distribution is necessary. Thus, by (7), the CLAD estimator $\hat{\beta}$ can be estimated by the following minimization problem:

$$\min_{\beta} \sum_{i=1}^N |y_i - \max(0, x\beta)| \quad (8)$$

For the linear model, the CLAD method provides estimates of regression coefficients by minimizing the sum of absolute residuals. It is a generalization of the sample median to the context of regression as well as OLS is a generalization of the sample mean to the linear model. If the dependent variable y^* is observed, then the median is the regression function $x'\beta$ under the condition that the errors have a median equals zero. Thus, the estimated CLAD can be used to estimate the unknown coefficients (Wilhelm, 2008).

Powell shows that the consistency of this estimator does not depend on any other assumption about the error distribution. Thus, u is robust to heteroscedasticity, consistent, and asymptotically normal for a wide class of error distributions, since it only considers the median equals zero (see Deaton, 1997, Powell,

⁶ To this methodology, it was used as reference: Wilhelm, 2008; Wooldridge, 2000 and Powell (1984).

1984 and Buchinsky, 1994). The CLAD estimation procedure is operational by an algorithm proposed by Buchinsky (1994)⁷.

As a limitation of the model, the estimator requires that at least 50% of the observations are uncensored. However, in some cases, depending on the context analyzed, another quantile than the median can be used in estimate and the parameters are obtained from a censored quantile regression model (for further details see Wooldridge, 2000; Buchinsky, 1994).

3.2 Model Specification

In this paper, an econometric model CLAD is run to estimate the *semi-elasticities of types of households*. Additionally, a bootstrap procedure is estimated to obtain consistent estimations of standard errors. The data source is 2002-2003 POF. One model for each product (except food and housing) and each household type is estimated in order to obtain *semi-elasticities* of household composition. Six different specifications for each product (13) are estimated. For all models the household reference category are households with only two adults living. Semi-elasticities on food and housing expenditures are not estimated because these types of expenditure are common to all individuals living in the household, therefore it is not adequate to assume that elderly or children living in the domicile can cause variations in the budget share of these consumption items.

In all household typologies only 25% of total households present positive expenditures on health insurance and education (See Appendix A). Specifically for inpatient care, only 10% of households spend with this product. As noted earlier, a limitation of the CLAD model lies in the fact that the estimator requires that at least 50% of the observations are uncensored. In that manner, it is not possible to estimate median semi-elasticities for these three products (education, hospital care, health insurance). In order to find a solution, these products' estimation were done using other quantiles. In these cases, Least Absolute Deviations (LAD) model was used. For each type of household (k) 13 models were estimated corresponding to different products (i). To accomplish this task 78 models were estimated, 13 products and 6 types of household.

Table 3 describes dependent and independent variables included in the estimation. Independent variables regards socioeconomic and demographic characteristics of households. The dependent variables are the annual expenditure per product for each household typology. Households were classified in seven categories according to the number of adults, elderly and children: households with two adults, two adults and one child aged 0-4, two adults and a child of 5-9 years, two adults and one child 10-14, two adults and one adult aged 50-59, two adults and an elderly 60-69, two adults and an elderly 70 years or more. The total sample was split into k groups according to household typology. Each subsample was composed by households with only two adults and households for each type defined in the household typology. In order to identify each type of household a dummy variable was built corresponding to zero if the household is composed by two adults (reference category) and 0 otherwise.

These dummy variables aim to capture marginal effects on consumption of goods and services resulting from the presence of children and elderly in the domiciles.

Control variables concerns socioeconomic status, head of household characteristics and local of residence. The annual total expenditure per capita is used as independent variable instead of the total annual income. Annual total expenditure is a proxy for household permanent income, being therefore, more adequate to estimate marginal effects regarding household composition. Usually household expenditure fluctuates less than income because individuals can use savings or credit to finance their consumption. Besides, it is less subject to measurement errors in the Consumer Expenditure Survey because individuals have to register all expenditures in a booklet provided by the interviewer while income information is self-reported. Schooling of household head is also included in the model as proxy variable to socioeconomic status. It also allows to control for information effect. Individuals can choose to consume differently conditioned on their information. It is particularly important for healthcare services and goods. The local

⁷ For further details, see Buchinsky (1994).

of residence is included because there may be regional differences in the cost of living. A categorical variable was built considering 5 great regions in Brazil: Southeast, Northeast, North, South and Midwest.

Table 3: Dependent and independent variables included in the models

Dependent variables	Description
$Expen_i$	Logarithm of Total household expenditure on the following 13 groups of goods and services: Textiles and clothing, Fuel and transportation, Medicines, Health insurance, Inpatient care, Durable goods, Other goods, Energy, Private education, Financial services and insurance; Services, Services provided to families and Food out of the household.
Independent variables	Description
$dhouse$	Set of 7 <i>dummies</i> that identifies each type household defined in the typology (one dummy per model): - 2 adults of 15-49 years (reference category: <i>dummy</i> =0); - 2 adults and 1 child of 0-4 years; - 2 adults and 1 child of 5-9 years; - 2 adults and 1 child of 10-14 years; - 2 adults and 1 adult of 50-59 years; - 2 adults and 1 elderly of 60-69 years; - 2 adults and 1 elderly of 70 years old or more.
Control variables	Description
$Expen_total$	Logarithm of total household expenditure per capita - used as <i>proxy</i> a permanent income.
$schooling$	Years of formal education of household head.
age	Age of household head.
$dregions$	<i>Binary Dummies</i> for the following regions: - North; - Northeast; - Southeast (reference category: <i>dummy</i> =0); - Midwest; - south;

Source: The authors.

The specification of the model is described by:

$$Expen_i = \beta_1 + \beta_2(dhouse) + \beta_3(\ln Expen_total) + \beta_4(schooling) + \beta_5(age) + \beta_6(dregions) \quad (9)$$

were $Expenditure_i$ is the expenditure (in reais) with good i ; $\ln spent$ is the logarithm of the total household expenditure; $schooling$ corresponds to the years of formal education of the head of the household; age is the head of the household age; $dregion$ refers to the household localization, a *categorical* variable was created distinguishing five Brazilian regions; $dhouse$ corresponds to binary variable or household typology ($dhouse$ is equal to zero if the household is composed by two adults and 0 otherwise) and; ε is the random error term.

4. Results

This paper used the CLAD approach to estimate censored models instead of Tobit models. Tobit models are usually adequate for dependent variables presenting normal and homoscedastic distributions. The test results regarding Tobit estimations rejected the null hypothesis that the data come from a normally distributed population (Appendix B). Table 1 of Appendix B shows that Tobit estimations presented heteroscedastic and non-normal distribution of errors, resulting in inconsistent estimated parameters (Wooldridge, 2000; Cameron and Trivedi, 2005; Powell, 1984). According to Wilhelm (2008) when heteroscedasticity or non-normality cause bias, CLAD model proposed by Powell (1984) is the best alternative to the censored regression. Given the large number of models (78 differ models), this section focus on the main results concerning the coefficients of the six household dummies. Full results are reported in Appendix C⁸. All estimations were implemented using Stata 11 software.

In general, the models present a satisfactory goodness of fit to the data. Most of the estimated coefficients for control variables are statistically significant. Table 4 reports the marginal effects estimated for each type of household using CLAD. As the dependent variable is the logarithm of the expenditure with each product, household dummy coefficients can be interpreted as semi-elasticities since captures the marginal effect of the presence of an elderly person or to a child at domiciles compared to the reference household. The reference category are households with only two adults living.

Analyzing the dummies coefficients, the results corroborate the hypothesis tested: households with elderly or children show different patterns of consumption when compared to households composed by only two adults. For all types of household composition marginal effects are greater for health-related goods, specifically health insurance and inpatient care. Other important result regards the association between age and medicines expenditure. The semi-elasticity estimated for medicine's expenditure increases monotonically with elderly age.

Private education expenditure also shows association with presence of children in the household. Semi-elasticities estimated points out the expected effect, a higher increment is found for children aged between 5 and 15. This association is also important for household with adults aged between 50 and 59. This pattern can be related to university expenses to youth.

Table 4: Marginal effect from the presence of children and elderly classified into 13 products according to age and household typologies using estimates of CLAD Model⁹

Products	2 adults (15-49) e 1 child			2 adults (15-49) e 1 adult/ elderly		
	0 - 4	5-9	10-15	50 - 59	60 - 69	70+
Textiles and clothing	0.34 ***	0.35 ***	0.52 ***	0.45 ***	0.29 **	0.34 *
Fuel and transportation	0.42 ***	0.60 ***	0.49 ***	0.96 ***	0.64 ***	0.15
Medicines	0.94 ***	0.72 ***	0.49 ***	1.27 ***	1.50 ***	1.87 ***
Health insurance	3.19 ***	1.93 ***	1.58 ***	1.28 *	1.55 **	2.08 *
Inpatient care	1.35 ***	1.70 ***	1.31 ***	1.87 ***	1.61 **	2.17 **
Durable goods	0.67 ***	0.64 ***	0.65 ***	0.79 ***	0.84 ***	0.87 ***
Other goods	0.44 ***	0.41 ***	0.54 ***	0.46 ***	0.56 ***	0.49 ***
Energy	0.25 ***	0.33 ***	0.37 ***	0.37 ***	0.26 **	0.45 ***
Private education	0.72 ***	2.53 ***	2.22 ***	1.97 ***	1.17	0.66
Financial services and insurance	1.34 ***	1.33 ***	0.94 ***	1.46 ***	1.88 **	0.99
Services	0.91 ***	1.13 ***	1.23 ***	1.20 ***	1.01 **	0.82 *
Services provided to families	0.46 **	0.53 ***	0.52 ***	0.82 ***	0.69 ***	0.44 **
Food out of the household	0.21 **	0.74 ***	0.94 ***	0.96 ***	0.78 **	0.58

Note: *** p<0.01, ** p<0.05, * p<0.1

Source: The authors.

⁸ All equations were weighted by sample expansion factor.

⁹All the estimates by model CLAD are reported in Appendix C.

Concerning medicines expenditure (third row of Table 4), it is observed that the presence of one elderly persons aged over 70 increases this annual expenditure in 187% compared to households with only two adults living. A smaller effect is also found for the presence of children in households. For households with two adults and one child, independently of child age, the coefficient is always higher than zero and significant. Besides there is a child age effect on household expenditure on medicines. Child growth reduces the needs of medicines as their immunological is more developed. The coefficient decreases as the child age increases, showing that there is life-cycle effect on this type of expenditure. For households with the presence of one child aged between 0-4 years this coefficient is 0.94, decreasing to 0.72 for the presence of a child aged between 5-9 years and to 0.49 for the presence of a child aged between 10-14 years.

With respect to health insurance expenditure (Table 4), the magnitude of the effect associated to the presence of children and elderly individuals is very high. The presence of one child aged between 0-4 years increases the health insurance expenditure in 319% compared to households with two adults while the presence of an elderly person aged over 70 increases this type of expenditure in 208%. An age effect is also observed for this type of health expenditure. Estimated semi-elasticities present a well-behaved pattern, the U-curve. It starts with a high effect for children aged 0-4 (319%), after decreases as child age increases and then increases with age of elderly individuals.

The expenditure effect associated to inpatient care is also important mainly to households with elderly person aged over 70. In these households this expenditure increases by 217 % when compared to households composed of only two adults (Table 4). Despite this significant association, age effect on inpatient care expenses is not well behaved as it was observed for other types of healthcare expenditure. In this case the U-shaped curve is not observed. This different pattern is probably related to acute events that occur independently of age.

5. Conclusion

This paper investigated the empirical relationship between household expenditure composition and the presence of children and elderly individuals in households of Brazil. For this, it was proposed a methodology to disaggregate the consumer expenditure by age groups using the Consumer Expenditure Survey (2002-2003). As the information of Consumer Expenditure Survey of Brazil is aggregated by households, the CLAD model was used to capture the marginal effects of each age group (adults, elderly, and children) in household expenditure.

Similar to what other studies (e.g. Luhrmann, 2005; Dewhurst, 2006, Lefèbvre, 2006; Almeida, 2002; Zanon, 2012), the results showed that changes in the age structure of the population have significant effects on Brazilian aggregate consumption. The results obtained in the econometric model revealed different consumption patterns depending on the household type.

Analyzing the dummies coefficients, the results showed that the presence of children and elderly individuals changed the consumption pattern resulting in different budget allocation favoring healthcare expenditure. For the healthcare categories expenditure, semi-elasticities increased monotonically with age. The results also showed that expenditures on medicines are more important for extreme age groups, which means in the age group between zero and four years old and in the age group for persons 70 years old or more.

This paper is the first attempt to estimate effects of changing population age structure over consumption profiles. Results showed that aging can affect aggregate demand through changes in consumption pattern. The parameters estimated in this paper can subsidize public policy and planning of healthcare supply and other goods and services.

Acknowledgements

We would like to thank Professor Mark Ottoni-Wilhelmor who kindly provided his files to simulate the marginal effects of CLAD model.

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Appendix A. Average expenditure with 13 products in Brazil by household typology

Table 1: Expenditure on each product for households with adults and elderly in Brazil, 2003.

	2 adults (15-49) and 1 adult (50-59)												
	Textiles and clothing	Fuel and transportation	Medicines	Health insurance	Inpatient care	Durable goods	Other goods	Energy	Private education	Financial serv. and insurance	Trade and services	Serv. provided to families	Food out of the household
Mean	1285.49	2215.14	634.76	547.55	93.26	2963.00	1635.50	826.05	973.70	1071.82	4082.43	1288.10	1338.55
Std. Dev.	1714.99	3418.14	970.58	1500.65	333.45	6220.74	2317.27	755.19	2726.64	2883.63	12226.80	2761.09	2788.40
Percentiles													
1%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	75.36	0.00	0.00	0.00	0.00	11.88	37.64	57.60	0.00	0.00	0.00	0.00	0.00
25%	326.88	253.76	35.52	0.00	0.00	180.19	278.28	357.36	0.00	0.00	347.60	60.60	44.00
50%	787.40	1079.16	250.80	0.00	0.00	810.95	910.00	673.44	0.00	95.16	1214.28	290.96	421.72
75%	1632.08	2828.28	810.36	283.20	0.00	2081.86	2172.62	1102.80	366.45	873.60	3093.92	1177.70	1305.36
90%	2937.96	5391.88	1732.20	1928.16	247.20	8404.51	4193.84	1619.00	2912.00	3123.86	7680.11	3506.18	4232.20
95%	3699.52	8602.20	2863.80	2842.80	600.00	15956.07	5133.64	2073.12	5171.78	6324.01	12481.20	5063.72	5673.28
99%	11270.28	14013.28	5337.48	10692.00	1760.00	25481.10	12081.10	4042.80	13471.20	10849.38	104838.20	16698.10	12230.80
	2 adults (15-49) and 1 elderly (60-69)												
Mean	928.20	672.01	539.38	292.37	96.03	2031.20	1112.32	647.02	325.02	997.75	2099.43	832.26	961.99
Std. Dev.	1089.33	1140.62	746.20	825.86	329.42	4947.82	1787.62	565.61	1009.92	3803.38	4688.54	1662.57	1583.78
Percentiles													
1%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	60.00	0.00	0.00	0.00	0.00	0.00	21.56	68.40	0.00	0.00	0.00	3.96	0.00
25%	232.41	0.00	0.00	0.00	0.00	83.13	211.27	275.52	0.00	0.00	108.60	51.08	0.00
50%	526.08	245.44	312.84	0.00	0.00	393.49	542.33	513.48	0.00	53.87	702.97	181.60	304.12
75%	1271.24	774.80	637.92	118.80	0.00	1654.96	1452.63	942.84	0.00	456.40	1987.90	866.40	1500.72
90%	2279.28	1820.00	1389.12	811.20	350.20	4479.20	2489.36	1397.40	1167.84	2130.74	4766.28	2002.84	2558.08
95%	2710.68	2805.24	2327.04	1575.60	588.00	13390.00	4168.40	1561.92	2080.98	4534.05	8149.50	4058.28	4085.64
99%	5428.86	5170.00	3562.32	5495.76	1280.44	24809.00	8370.54	2616.00	6480.00	26949.00	30309.00	8721.61	7757.88
	2 adults (15-49) and 1 elderly (70+)												
Mean	809.01	1453.07	889.95	532.17	267.26	1504.88	1307.09	646.75	433.66	861.81	2035.99	977.04	645.10
Std. Dev.	1298.88	2580.27	1317.98	1686.88	859.73	2702.91	2085.18	652.63	1491.91	2677.58	3691.56	3081.80	1113.32
Percentiles													
1%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
10%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	60.00	0.00	0.00	0.00	0.00	0.00
25%	95.28	0.00	42.72	0.00	0.00	76.84	189.00	240.00	0.00	0.00	0.00	40.80	0.00
50%	412.64	482.56	342.72	0.00	0.00	505.64	602.00	435.24	0.00	0.00	553.73	153.52	166.32
75%	769.28	2197.20	1157.40	321.36	72.00	1991.36	1406.56	818.88	0.00	296.28	2606.80	619.95	819.40
90%	2067.72	3384.48	2826.36	1533.00	484.80	3232.80	3952.08	1805.76	1206.45	3052.80	6558.12	1645.88	1783.60
95%	4580.92	4447.28	4224.84	2857.68	2160.00	7025.04	4967.86	2242.44	2070.00	5448.96	8394.96	5150.12	2328.84
99%	5248.88	16573.12	5189.52	10422.72	3120.00	13723.44	6837.70	3048.24	8400.00	9206.88	13337.23	16192.56	5687.12

Source: Authors' calculation from Household Budget Survey of Brazil.

Table 2: Expenditure on each product for households with adults and children in Brazil, 2003.

	2 adults (15-49) and 1 child (0-4)													
	Textiles and clothing	Fuel and transportation	Medicines	Health insurance	Inpatient care	Durable goods	Other goods	Energy	Private education	Financial serv. and insurance	Trade and services	Serv. provided to families	Food out of the household	
Mean	951.60	1278.86	325.71	239.67	65.89	2344.32	1076.23	561.52	327.57	968.01	1938.26	741.67	801.40	
Std. Dev.	1265.69	2012.71	480.03	647.09	350.46	4589.83	1941.07	586.67	1179.70	3273.41	4567.16	1775.45	1744.07	
Percentiles														
1%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5%	0.00	0.00	0.00	0.00	0.00	5.20	7.44	0.00	0.00	0.00	0.00	0.00	0.00	
10%	58.20	0.00	0.00	0.00	0.00	44.64	42.60	0.00	0.00	0.00	0.00	0.00	0.00	
25%	232.00	19.80	24.00	0.00	0.00	255.00	184.68	183.24	0.00	0.00	2.24	34.24	0.00	
50%	544.40	561.60	186.00	0.00	0.00	830.01	563.88	453.96	0.00	9.14	514.80	124.00	176.80	
75%	1180.02	1686.28	430.68	100.80	0.00	2026.40	1226.04	730.20	0.00	481.55	1770.32	515.60	906.88	
90%	2217.48	3325.92	821.88	722.16	200.00	5825.58	2691.84	1187.88	561.00	2220.00	4842.06	1861.80	2123.92	
95%	3416.00	4925.52	1172.64	1497.60	376.00	10586.42	3723.76	1594.08	2194.68	5235.92	8442.40	4308.24	3427.96	
99%	7111.20	9204.00	1971.12	3264.00	937.28	25232.75	7751.40	2537.88	7623.00	15783.44	24242.61	8541.12	7245.80	
	2 adults (15-49) and 1 child (5-9)													
Mean	916.91	1518.20	306.39	342.11	137.00	2684.38	1351.40	705.74	756.87	1053.04	2458.97	1000.58	1097.45	
Std. Dev.	1003.05	2594.66	421.39	1328.04	1590.82	5904.28	2835.69	865.23	2939.04	3105.85	4984.95	2586.53	2225.22	
Percentiles														
1%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5%	0.00	0.00	0.00	0.00	0.00	15.40	2.80	0.00	0.00	0.00	0.00	0.00	0.00	
10%	60.00	0.00	0.00	0.00	0.00	54.32	45.16	82.92	0.00	0.00	0.00	0.00	0.00	
25%	212.80	59.28	11.76	0.00	0.00	242.04	216.60	252.60	0.00	0.00	93.25	36.36	22.36	
50%	662.19	732.00	160.68	0.00	0.00	840.73	621.43	546.00	0.00	59.40	744.34	173.92	352.04	
75%	1210.08	1978.28	445.20	106.84	0.00	2199.02	1460.44	840.00	360.00	828.00	2794.72	745.50	1361.88	
90%	2046.18	3705.00	803.28	741.60	202.00	6748.60	3123.14	1324.68	1523.40	2730.96	6622.46	2193.57	2802.80	
95%	2862.30	5367.60	1076.16	1824.32	360.00	12446.80	4703.64	2097.00	3779.40	5046.68	9187.56	4595.36	4203.20	
99%	4589.60	14593.76	2297.28	4821.60	1616.00	26002.28	9659.92	3219.84	11383.20	10933.59	24824.80	16108.04	13163.28	
	2 adults (15-49) and 1 child (10-14)													
Mean	1062.68	1638.81	287.57	342.03	127.98	2436.69	1377.13	683.10	652.13	1065.00	2362.09	711.83	1058.82	
Std. Dev.	1237.27	2499.41	460.37	894.25	987.83	4949.41	2088.44	697.17	1692.53	3418.80	4667.01	1350.55	1678.20	
Percentiles														
1%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
5%	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	
10%	72.00	0.00	0.00	0.00	0.00	36.12	50.88	119.64	0.00	0.00	0.00	8.40	0.00	
25%	276.16	84.96	0.00	0.00	0.00	276.10	219.92	300.60	0.00	0.00	214.24	47.52	76.96	
50%	721.80	748.80	112.32	0.00	0.00	878.37	640.97	552.84	0.00	51.10	774.10	222.20	455.52	
75%	1365.18	2255.76	386.40	191.48	0.00	2072.04	1720.21	860.88	229.50	662.72	2367.14	612.00	1391.52	
90%	2471.56	4154.80	785.52	1187.76	168.00	6113.87	3563.64	1327.80	2127.00	2719.00	6749.18	2078.00	2443.48	
95%	3635.60	6035.52	1124.88	1900.80	382.32	11449.50	5081.40	1691.04	3712.00	5139.96	10606.00	4002.12	3895.16	
99%	5325.76	11024.40	2169.96	3893.40	2310.00	23976.40	8927.83	3210.80	9803.76	15381.53	19256.45	6456.56	8209.76	

Source: Authors' calculation from Household Budget Survey of Brazil.

Appendix B

Table 1: Tests results to conditionals moments of Tobit model

Test	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+
Textiles and clothing						
Homoscedastic	5402.90 (0.00)	6033.70 (0.00)	7705.40 (0.00)	4097.50 (0.00)	3685.80 (0.00)	1022.00 (0.00)
Normality	4706.80 (0.00)	3564.60 (0.00)	3246.60 (0.00)	2965.10 (0.00)	2648.90 (0.00)	2478.10 (0.00)
Fuel and transportation						
Homoscedastic	5847.70 (0.00)	7136.60 (0.00)	7068.40 (0.00)	2849.60 (0.00)	6743.40 (0.00)	4191.80 (0.00)
Normality	4399.20 (0.00)	3324.20 (0.00)	2994.70 (0.00)	3008.90 (0.00)	2969.40 (0.00)	2924.80 (0.00)
Medicines						
Homoscedastic	15739.00 (0.00)	12260.00 (0.00)	10156.00 (0.00)	4915.70 (0.00)	3357.00 (0.00)	2486.50 (0.00)
Normality	5330.90 (0.00)	4134.40 (0.00)	3742.10 (0.00)	2604.40 (0.00)	2321.10 (0.00)	2231.50 (0.00)
Health insurance						
Homoscedastic	89472.00 (0.00)	83143.00 (0.00)	36158.00 (0.00)	51377.00 (0.00)	39961.00 (0.00)	10882.00 (0.00)
Normality	309.31 (0.00)	240.09 (0.00)	313.62 (0.00)	213.47 (0.00)	184.36 (0.00)	255.28 (0.00)
Inpatient care						
Homoscedastic	276594.00 (0.00)	269177.00 (0.00)	220283.00 (0.00)	141637.00 (0.00)	98269.00 (0.00)	78092.00 (0.00)
Normality	386.65 (0.00)	279.81 (0.00)	251.30 (0.00)	241.35 (0.00)	215.53 (0.00)	187.36 (0.00)
Durable goods						
Homoscedastic	14233.00 (0.00)	17404.00 (0.00)	13478.00 (0.00)	8695.10 (0.00)	6951.50 (0.00)	4958.70 (0.00)
Normality	3392.00 (0.00)	2474.20 (0.00)	2466.00 (0.00)	2534.00 (0.00)	1967.00 (0.00)	2115.90 (0.00)
Other goods						
Homoscedastic	10573.00 (0.00)	3914.80 (0.00)	3801.60 (0.00)	764.95 (0.00)	1498.20 (0.00)	1012.10 (0.00)
Normality	4126.60 (0.00)	3223.10 (0.00)	2934.20 (0.00)	3016.20 (0.00)	2595.50 (0.00)	2558.80 (0.00)
Energy						
Homoscedastic	61660.00 (0.00)	49109.00 (0.00)	3546.10 (0.00)	26377.00 (0.00)	17656.00 (0.00)	13310.00 (0.00)
Normality	5206.00 (0.00)	3877.70 (0.00)	39303.00 (0.00)	3328.90 (0.00)	2987.70 (0.00)	2897.20 (0.00)
Private education						
Homoscedastic	111285.00 (0.00)	41338.00 (0.00)	46762.00 (0.00)	35096.00 (0.00)	27836.00 (0.00)	25341.00 (0.00)

Test	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+
Normality	318.91 (0.00)	258.65 (0.00)	222.76 (0.00)	233.01 (0.00)	234.91 (0.00)	202.33 (0.00)
Financial services and insurance						
Homoscedastic	32361.00 (0.00)	21136.00 (0.00)	21408.00 (0.00)	13717.00 (0.00)	10831 (0.00)	5536.90 (0.00)
Normality	302.47 (0.00)	272.81 (0.00)	256.18 (0.00)	235.00 (0.00)	200.05 (0.00)	203.33 (0.00)
Services						
Homoscedastic	5662.50 (0.00)	6936.00 (0.00)	21286.00 (0.00)	6184.30 (0.00)	6185.20 (0.00)	2782.40 (0.00)
Normality	1753.90 (0.00)	1671.50 (0.00)	1671.50 (0.00)	1599.40 (0.00)	1482.40 (0.00)	1455.90 (0.00)
Services provided to families						
Homoscedastic	6751.00 (0.00)	4939.90 (0.00)	4755.30 (0.00)	1038.20 (0.00)	2090.20 (0.00)	2199.20 (0.00)
Normality	2639.00 (0.00)	1994.80 (0.00)	1469.40 (0.00)	2195.80 (0.00)	1811.20 (0.00)	1726.20 (0.00)
Food out of the household						
Homoscedastic	9877.30 (0.00)	8063.90 (0.00)	10519.00 (0.00)	2690.40 (0.00)	2401.50 (0.00)	1089.10 (0.00)
Normality	3542.30 (0.00)	2457.90 (0.00)	2199.90 (0.00)	2066.70 (0.00)	1649.40 (0.00)	1723.80 (0.00)

Source: The authors.

Appendix C. Results of CLAD model - Brazil 2003

Table 1: Expenditure on textiles and clothing

Variables	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+
log (total household spent)	0.88 *** (0.02)	0.89 *** (0.02)	0.88 *** (0.02)	0.86 *** (0.02)	0.88 *** (0.03)	0.87 *** (0.02)
Age of householder	-0.06 *** (0.02)	-0.08 *** (0.02)	-0.05 ** (0.02)	-0.06 *** (0.02)	-0.07 *** (0.01)	-0.04 *** (0.01)
Schooling of householder ²	0.00 *** (0.00)	0.00 *** (0.00)	0.00 * (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)
Schooling of householder	0.00 ** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 * (0.00)
Dummy	0.34 *** (0.06)	0.35 *** (0.07)	0.52 *** (0.07)	0.45 *** (0.07)	0.29 ** (0.08)	0.34 ** (0.08)
North	0.07 (0.06)	0.07 (0.07)	0.04 (0.07)	0.00 (0.07)	0.1 (0.08)	0.03 (0.08)
Northeast	0.07 (0.05)	0.05 (0.06)	0.08 (0.06)	0.06 (0.06)	0.07 (0.06)	0.07 (0.06)
South	-0.02 (0.06)	0.00 (0.07)	-0.05 (0.07)	-0.03 (0.07)	-0.08 (0.08)	-0.07 (0.07)
Midwest	0.04 (0.05)	-0.03 (0.06)	0.01 (0.06)	0.03 (0.06)	-0.01 (0.07)	0.01 (0.07)
Number of obs	5903	4602	4180	3944	3544	3448
Pseudo R2	0.17	0.17	0.16	0.17	0.17	0.17

*** p<0.01, ** p<0.05, * p<0.1

Source: The authors.

Table 2: Expenditure on fuel and transportation

Variables	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+
log (total household spent)	1.52 *** (0.04)	1.53 *** (0.04)	1.55 *** (0.05)	1.43 *** (0.03)	1.49 *** (0.05)	1.57 *** (0.05)
Age of householder	0.13 *** (0.04)	0.01 (0.04)	0.01 (0.04)	0.08 *** (0.02)	0.05 ** (0.02)	0.01 (0.02)
Schooling of householder^2	0.00 *** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 *** (0.00)	0.00 * (0.00)	0.00 (0.00)
Schooling of householder	0.01 ** (0.00)	0.01 ** (0.00)	0.01 ** (0.00)	0.01 ** (0.00)	0.01 *** (0.00)	0.01 * (0.00)
Dummy	0.42 *** (0.13)	0.60 *** (0.12)	0.49 *** (0.14)	0.96 *** (0.11)	0.64 *** (0.14)	0.15 (0.17)
North	0.10 (0.13)	0.15 (0.12)	0.17 (0.14)	0.23 ** (0.11)	0.2 * (0.14)	0.15 (0.17)
Northeast	-0.12 (0.11)	-0.14 (0.11)	-0.14 (0.12)	-0.15 * (0.09)	0.01 (0.12)	-0.09 (0.14)
South	0.00 (0.13)	-0.14 (0.12)	-0.02 (0.14)	0.07 (0.10)	0.07 (0.14)	-0.04 (0.16)
Midwest	-0.02 (0.12)	0.11 (0.11)	-0.03 (0.12)	0.12 (0.09)	0.15 (0.12)	0.07 (0.14)
Number of obs	5903	4602	4180	3944	3544	3448
Pseudo R2	0.19	0.19	0.19	0.20	0.19	0.19

*** p<0.01, ** p<0.05, * p<0.1

Table 3: Expenditure on medicines

Variables	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+
log (total household spent)	0.96 *** (0.04)	0.95 *** (0.04)	1.04 *** (0.06)	1.04 *** (0.05)	1.06 *** (0.06)	1.08 *** (0.06)
Age of householder	0.02 (0.04)	-0.01 (0.04)	0.01 (0.05)	0.04 (0.03)	-0.01 (0.03)	0.00 (0.02)
Schooling of householder^2	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Schooling of householder	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Dummy	0.94 *** (0.12)	0.72 *** (0.13)	0.49 *** (0.18)	1.27 *** (0.15)	1.50 *** (0.19)	1.87 *** (0.19)
North	-0.35 *** (0.12)	-0.40 *** (0.13)	-0.51 *** (0.18)	-0.50 *** (0.15)	-0.5 ** (0.19)	-0.50 ** (0.19)
Northeast	-0.25 ** (0.10)	-0.40 *** (0.11)	-0.49 *** (0.15)	-0.48 *** (0.12)	-0.43 ** (0.16)	-0.45 *** (0.16)
South	-0.19 (0.12)	-0.25 * (0.13)	-0.24 (0.17)	-0.39 ** (0.15)	-0.24 (0.19)	-0.23 (0.19)
Midwest	-0.24 ** (0.11)	-0.29 ** (0.12)	-0.36 ** (0.16)	-0.37 *** (0.13)	-0.38 ** (0.17)	-0.34 ** (0.17)
Number of obs	5903	4602	4180	3944	3544	3448
Pseudo R2	0.06	0.05	0.05	0.09	0.09	0.09

*** p<0.01, ** p<0.05, * p<0.1

Table 4: Expenditure on health insurance

Variables	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+
log (total household spent)	5.66 *** (0.26)	5.82 *** (0.26)	5.85 *** (0.26)	2.96 *** (0.15)	3.06 *** (0.16)	3.05 *** (0.17)
Age of householder	0.92 *** (0.24)	0.58 ** (0.23)	0.49 ** (0.24)	0.24 ** (0.10)	0.17 ** (0.08)	0.14 ** (0.06)
Schooling of householder^2	-0.01 *** (0.00)	-0.01 ** (0.00)	-0.01 * (0.00)	0.00 ** (0.00)	0.00 (0.00)	0.00 ** (0.00)
Schooling of householder	0.05 *** (0.01)	0.05 *** (0.01)	0.05 *** (0.01)	0.03 *** (0.01)	0.03 *** (0.01)	0.03 *** (0.01)
Dummy	3.19 *** (0.74)	1.93 *** (0.73)	1.58 *** (0.79)	1.28 ** (0.42)	1.55 ** (0.50)	2.08 ** (0.53)
North	-3.14 *** (0.74)	-3.06 *** (0.73)	-3.58 *** (0.79)	-1.36 *** (0.42)	-2.0 *** (0.50)	-2.12 *** (0.53)
Northeast	-0.65 (0.56)	-0.67 (0.56)	-0.95 (0.58)	-0.34 (0.32)	-0.21 (0.35)	-0.10 (0.37)
South	-0.44 (0.61)	-0.59 (0.57)	-0.24 (0.59)	-0.40 (0.34)	-0.07 (0.37)	-0.11 (0.39)
Midwest	-1.47 ** (0.59)	-2.12 *** (0.59)	-2.28 *** (0.61)	-0.66 *** (0.17)	-0.96 *** (0.37)	-0.96 ** (0.39)
Number of obs	5903	4602	4180	3944	3544	3448
Pseudo R2	0.10	0.10	0.10	0.17	0.17	0.17

*** p<0.01, ** p<0.05, * p<0.1

Table 5: Expenditure on inpatient care

Variables	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+
log (total household spent)	3.16 *** (0.16)	2.94 *** (0.16)	3.10 *** (0.17)	2.39 *** (0.11)	2.45 *** (0.12)	2.37 *** (0.14)
Age of householder	0.20 (0.14)	0.03 (0.14)	0.01 (0.14)	-0.02 (0.07)	-0.04 (0.06)	-0.08 * (0.04)
Schooling of householder^2	0.00 * (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Schooling of householder	0.00 (0.01)	-0.01 (0.01)	-0.02 (0.01)	-0.01 (0.01)	-0.01 * (0.01)	-0.01 (0.01)
Dummy	1.35 *** (0.43)	1.70 *** (0.44)	1.31 *** (0.48)	1.87 *** (0.30)	1.61 ** (0.32)	2.17 ** (0.37)
North	-1.33 *** (0.43)	-1.55 *** (0.44)	-1.45 *** (0.48)	-1.20 *** (0.30)	-1.2 *** (0.32)	-1.22 *** (0.37)
Northeast	-0.61 ** (0.35)	-1.53 *** (0.37)	-1.62 *** (0.41)	-1.23 *** (0.25)	-1.21 *** (0.26)	-1.36 *** (0.31)
South	-0.51 (0.40)	-0.69 * (0.40)	-0.80 * (0.43)	-0.80 *** (0.27)	-0.79 ** (0.29)	-0.62 ** (0.34)
Midwest	-0.69 ** (0.37)	-1.57 *** (0.38)	-1.69 *** (0.42)	-1.37 *** (0.26)	-1.38 *** (0.27)	-1.25 *** (0.32)
Number of obs	5903	4602	4180	3944	3544	3448
Pseudo R2	0.09	0.08	0.08	0.10	0.09	0.10

*** p<0.01, ** p<0.05, * p<0.1

Table 6: Expenditure on durables goods							Table 7: Expenditure on other goods						
Variables	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly			Variables	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+		0-4	5-9	10-14	50-59	60-69	70+
log (total household spent)	1.42 *** (0.03)	1.42 *** (0.03)	1.42 *** (0.03)	1.43 *** (0.03)	1.42 *** (0.03)	1.42 *** (0.03)	log (total household spent)	1.11 *** (0.02)	1.08 *** (0.03)	1.09 *** (0.03)	1.07 *** (0.03)	1.08 *** (0.03)	1.10 *** (0.03)
Age of householder	-0.06 ** (0.02)	-0.06 ** (0.02)	-0.05 ** (0.02)	-0.04 * (0.02)	-0.04 ** (0.02)	-0.05 *** (0.01)	Age of householder	-0.03 (0.02)	-0.02 (0.02)	0.00 (0.02)	-0.03 ** (0.02)	-0.02 (0.02)	-0.03 ** (0.01)
Schooling of householder^2	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	Schooling of householder^2	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Schooling of householder	-0.01 *** (0.00)	-0.01 *** (0.00)	-0.01 *** (0.00)	-0.01 *** (0.00)	-0.01 *** (0.00)	-0.01 *** (0.00)	Schooling of householder	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Dummy	0.67 *** (0.08)	0.64 *** (0.08)	0.65 *** (0.08)	0.79 *** (0.10)	0.84 *** (0.10)	0.87 *** (0.10)	Dummy	0.44 *** (0.07)	0.41 *** (0.08)	0.54 *** (0.08)	0.46 *** (0.08)	0.56 *** (0.09)	0.49 ** (0.10)
North	0.12 (0.08)	0.08 (0.08)	0.09 (0.08)	0.16 (0.10)	0.3 ** (0.10)	0.16 (0.10)	North	0.11 (0.07)	0.14 * (0.08)	0.16 * (0.08)	0.07 (0.08)	0.1 (0.09)	0.15 (0.10)
Northeast	0.09 (0.07)	0.06 (0.07)	0.13 ** (0.07)	0.20 ** (0.08)	0.24 *** (0.08)	0.15 * (0.08)	Northeast	0.18 ** (0.06)	0.12 * (0.07)	0.18 *** (0.07)	0.09 (0.07)	0.13 * (0.07)	0.13 (0.08)
South	0.02 (0.08)	-0.04 (0.08)	0.12 (0.08)	0.13 (0.10)	0.17 (0.10) *	0.04 (0.10)	South	-0.16 ** (0.07)	-0.13 (0.08)	-0.12 (0.08)	-0.17 ** (0.08)	-0.16 * (0.09)	-0.15 (0.10)
Midwest	-0.05 (0.07)	-0.15 ** (0.07)	-0.06 (0.07)	0.00 (0.09)	-0.03 (0.09)	-0.14 (0.09)	Midwest	-0.12 ** (0.06)	-0.20 ** (0.07)	-0.17 ** (0.07)	-0.24 *** (0.07)	-0.21 *** (0.08)	-0.19 ** (0.08)
Number of obs	5903	4602	4180	3944	3544	3448	Number of obs	5903	4602	4180	3944	3544	3448
Pseudo R2	0.21	0.20	0.20	0.20	0.19	0.19	Pseudo R2	0.19	0.19	0.19	0.19	0.18	0.18
*** p<0.01, ** p<0.05, * p<0.1							*** p<0.01, ** p<0.05, * p<0.1						

Table 8: Expenditure on energy							Table 9: Expenditure on private education						
Variables	2 adults (15-49) and 1 child			2 adults (15-49) and 1 adult/elderly			Variables	2 adults (15-49) and 1 child			2 Adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+		0-4	5-9	10-14	50-59	60-69	70+
log (total household spent)	0.52 *** (0.02)	0.48 *** (0.02)	0.47 *** (0.02)	0.47 *** (0.02)	0.46 *** (0.02)	0.46 *** (0.02)	log (total household spent)	2.18 *** (0.07)	2.44 *** (0.07)	2.45 *** (0.06)	2.83 *** (0.08)	2.76 *** (0.09)	2.72 *** (0.16)
Age of householder	0.03 ** (0.01)	0.02 (0.02)	0.02 (0.02)	0.03 ** (0.01)	0.02 (0.01)	0.03 *** (0.01)	Age of householder	0.07 (0.06)	-0.01 (0.09)	-0.04 (0.07)	-0.05 (0.09)	-0.03 (0.07)	-0.01 (0.05)
Schooling of householder^2	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 *** (0.00)	Schooling of householder^2	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Schooling of householder	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	0.00 *** (0.00)	Schooling of householder	0.04 *** (0.01)	0.04 *** (0.00)	0.04 *** (0.01)	0.04 *** (0.01)	0.04 *** (0.01)	0.04 *** (0.01)
Dummy	0.25 *** (0.05)	0.33 *** (0.05)	0.36 *** (0.06)	0.37 *** (0.06)	0.25 ** (0.07)	0.47 *** (0.06)	Dummy	0.72 *** (0.25)	2.53 *** (0.22)	2.22 *** (0.25)	1.97 *** (0.38)	1.17 (0.58)	0.66 (0.41)
North	-0.38 *** (0.05)	-0.41 *** (0.05)	-0.24 *** (0.06)	-0.31 *** (0.06)	-0.4 *** (0.07)	-0.33 *** (0.06)	North	-0.31 (0.25)	-0.20 (0.22)	-0.18 (0.25)	-0.56 (0.38)	-0.2 (0.58)	-0.11 (0.41)
Northeast	-0.51 *** (0.04)	-0.48 *** (0.04)	-0.46 *** (0.05)	-0.45 *** (0.05)	-0.47 *** (0.06)	-0.44 *** (0.05)	Northeast	0.60 *** (0.15)	0.76 *** (0.20)	0.62 *** (0.21)	0.41 (0.26)	0.49 (0.35)	0.49 (0.33)
South	0.15 *** (0.05)	0.20 *** (0.05)	0.14 *** (0.05)	0.18 *** (0.06)	0.16 ** (0.07)	0.18 *** (0.06)	South	0.33 (0.26)	-0.23 (0.29)	-0.01 (0.21)	0.27 (0.46)	0.14 (0.61)	0.11 (0.41)
Midwest	0.00 (0.05)	-0.04 (0.05)	0.01 (0.05)	0.00 (0.05)	-0.01 (0.06)	0.00 (0.05)	Midwest	-0.46 *** (0.16)	-0.26 (0.21)	-0.10 (0.20)	-0.33 (0.31)	-0.20 (0.36)	-0.10 (0.36)
Number of obs	5903	4602	4180	3944	3544	3448	Number of obs	5903	4602	4180	3944	3544	3448
Pseudo R2	0.10	0.10	0.10	0.11	0.10	0.10	Pseudo R2	0.14	0.27	0.26	0.25	0.17	0.16
*** p<0.01, ** p<0.05, * p<0.1							*** p<0.01, ** p<0.05, * p<0.1						

Table 10: Financial services and insurance							Table 11: Expenditure on services						
Variables	2 adults (15-49) and 1 child			2 Adults (15-49) and 1 adult/elderly			Variables	2 adults (15-49) and 1 child			2 Adults (15-49) and 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+		0-4	5-9	10-14	50-59	60-69	70+
log (total household spent)	4.08 *** (0.12)	3.96 *** (0.14)	3.89 *** (0.16)	3.45 *** (0.13)	3.49 *** (0.18)	3.59 *** (0.14)	log (total household spent)	3.14 *** (0.08)	2.88 *** (0.07)	2.86 *** (0.08)	2.55 *** (0.07)	2.78 *** (0.08)	2.81 *** (0.08)
Age of householder	0.60 *** (0.10)	0.53 *** (0.11)	0.56 *** (0.13)	0.32 *** (0.08)	0.15 ** (0.08)	0.12 ** (0.04)	Age of householder	0.24 *** (0.07)	0.06 (0.06)	0.08 (0.07)	0.10 ** (0.05)	0.04 (0.04)	0.03 (0.03)
Schooling of householder^2	-0.01 *** (0.00)	-0.01 *** (0.00)	-0.01 *** (0.00)	0.00 *** (0.00)	0.00 * (0.00)	0.00 ** (0.00)	Schooling of householder^2	0.00 *** (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 ** (0.00)	0.00 (0.00)	0.00 (0.00)
Schooling of householder	0.00 (0.01)	0.01 (0.01)	0.00 (0.01)	0.00 *** (0.01)	0.00 (0.01)	0.00 (0.01)	Schooling of householder	0.01 ** (0.00)	0.01 ** (0.00)	0.01 (0.00)	0.00 (0.00)	0.01 * (0.00)	0.01 (0.00)
Dummy	1.34 *** (0.29)	1.33 *** (0.34)	0.94 *** (0.41)	1.46 *** (0.32)	1.88 ** (0.45)	0.99 (0.35)	Dummy	0.91 *** (0.22)	1.13 *** (0.20)	1.23 *** (0.24)	1.20 *** (0.20)	1.01 ** (0.24)	0.82 * (0.23)
North	-1.48 *** (0.29)	-1.63 *** (0.34)	-1.57 *** (0.41)	-1.20 *** (0.32)	-1.2 *** (0.45)	-1.38 *** (0.35)	North	0.28 (0.22)	0.16 (0.20)	0.15 (0.24)	0.32 (0.20)	0.2 (0.24)	0.37 (0.23)
Northeast	-0.63 *** (0.23)	-1.00 *** (0.28)	-0.70 ** (0.33)	-0.51 *** (0.25)	-0.81 ** (0.37)	-0.75 *** (0.28)	Northeast	-0.37 ** (0.18)	-0.40 ** (0.17)	-0.31 (0.19)	-0.37 ** (0.16)	-0.40 ** (0.20)	-0.36 * (0.19)
South	0.55 ** (0.26)	0.45 ** (0.28)	0.22 (0.35)	0.27 (0.27)	0.10 (0.40)	0.15 (0.30)	South	0.07 (0.22)	0.09 (0.20)	0.07 (0.23)	0.12 (0.19)	0.14 (0.24)	0.16 (0.23)
Midwest	-0.82 *** (0.25)	-1.07 *** (0.28)	-1.31 *** (0.34)	-0.99 *** (0.26)	-1.15 *** (0.38)	-1.06 *** (0.29)	Midwest	0.04 (0.20)	0.01 (0.18)	0.00 (0.21)	-0.02 (0.17)	0.06 (0.21)	0.04 (0.21)
Number of obs	5903	4602	4180	3944	3544	3448	Number of obs	5903	4602	4180	3944	3544	3448
Pseudo R2	0.17	0.17	0.17	0.17	0.17	0.17	Pseudo R2	0.25	0.24	0.24	0.25	0.25	0.25
*** p<0.01, ** p<0.05, * p<0.1							*** p<0.01, ** p<0.05, * p<0.1						

Table 12: Financial services and services provided to families							Table 13: Food out of the household						
Variables	2 adults (15-49) 1 child			2 adults (15-49) e 1 adult/elderly			Variables	2 adults (15-49) 1 child			2 adults (15-49) e 1 adult/elderly		
	0-4	5-9	10-14	50-59	60-69	70+		0-4	5-9	10-14	50-59	60-69	70+
log (total household spent)	1.57 *** (0.03)	1.63 *** (0.04)	1.55 *** (0.03)	1.55 *** (0.04)	1.54 *** (0.03)	1.58 *** (0.04)	log (total household spent)	2.02 *** (0.06)	1.93 *** (0.06)	1.91 *** (0.06)	1.86 *** (0.06)	1.94 *** (0.06)	1.95 *** (0.06)
Age of householder	-0.01 (0.02)	-0.02 (0.03)	-0.02 (0.03)	-0.02 (0.02)	-0.03 (0.02)	-0.03 ** (0.01)	Age of householder	-0.08 ** (0.05)	-0.10 * (0.06)	-0.09 * (0.05)	-0.06 (0.04)	-0.11 *** (0.03)	-0.07 *** (0.02)
Schooling of householder^2	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 * (0.00)	Schooling of householder^2	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 ** (0.00)	0.00 (0.00)
Schooling of householder	0.01 *** (0.00)	0.01 *** (0.00)	0.01 *** (0.00)	0.01 *** (0.00)	0.01 *** (0.00)	0.01 *** (0.00)	Schooling of householder	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)	0.00 (0.00)
Dummy	0.46 ** (0.09)	0.53 *** (0.11)	0.52 *** (0.10)	0.82 *** (0.11)	0.69 *** (0.10)	0.44 ** (0.12)	Dummy	0.21 ** (0.16)	0.74 *** (0.19)	0.94 *** (0.18)	0.96 *** (0.19)	0.78 ** (0.18)	0.58 (0.19)
North	-0.15 * (0.09)	-0.15 (0.11)	-0.14 (0.10)	-0.22 ** (0.11)	-0.1 (0.10)	-0.12 (0.12)	North	0.32 ** (0.16)	0.15 (0.19)	0.05 (0.18)	0.15 (0.19)	0.2 (0.18)	0.08 (0.19)
Northeast	0.06 (0.07)	0.04 (0.10)	0.06 (0.08)	0.05 (0.09)	0.04 (0.09)	0.07 (0.10)	Northeast	0.23 * (0.14)	-0.03 (0.16)	-0.05 (0.15)	0.02 (0.16)	0.14 (0.15)	0.10 (0.16)
South	0.04 (0.09)	-0.12 (0.11)	-0.02 (0.09)	0.07 (0.11)	0.08 (0.10)	0.14 (0.12)	South	-0.17 (0.17)	-0.19 (0.18)	-0.15 (0.18)	-0.14 (0.19)	-0.05 (0.18)	-0.08 (0.19)
Midwest	0.24 *** (0.08)	0.18 ** (0.10)	0.26 *** (0.09)	0.25 *** (0.09)	0.25 *** (0.09)	0.30 *** (0.10)	Midwest	-0.44 *** (0.15)	-0.61 *** (0.17)	-0.75 *** (0.16)	-0.55 *** (0.17)	-0.43 *** (0.16)	-0.54 *** (0.17)
Number of obs	5903	4602	4180	3944	3544	3448	Number of obs	5903	4602	4180	3944	3544	3448
Pseudo R2	0.27	0.27	0.27	0.27	0.26	0.26	Pseudo R2	0.17	0.17	0.17	0.19	0.19	0.19
*** p<0.01, ** p<0.05, * p<0.1							*** p<0.01, ** p<0.05, * p<0.1						

Source: The authors.