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Impact of Retirements and Pensions on the Social Welfare of the Households from Minas Gerais State

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ABSTRACT

One of the main arguments for the existence of public social security systems relates to their potential use as income distribution and welfare policy tools. In this vein, several studies have sought to evaluate the effects of social security benefits on poverty and inequality. However, the evidence obtained from Brazilian studies regarding the effects of social security remains inconclusive, and studies evaluating the impact of social security on social welfare indices are scarce. The objective of this paper is to measure the impact of retirement and pensions provided by social security programs on the welfare level of households in the state of Minas Gerais, Brazil. The methodological approach is based on propensity score matching, and microdata from the National Household Sample Survey (Pesquisa Nacional por Amostra de Domicílios – PNAD, 2009) are used. The results demonstrate that income from retirement and pensions represents an important portion of beneficiary households' income, especially lower-income beneficiary households. The results suggest that social security has a positive effect on the incomes, access to knowledge and living conditions of the households analyzed. The impact of retirement and pensions on households in low-income groups (Classes D and E) tends to be more significant relative to the impact on middle class households (Class C).

Keywords: retirement and pensions, social welfare, households, propensity score matching, impact evaluation.

1 INTRODUCTION

Social security systems are an important area of public policy and social spending and produce direct or indirect effects on all members of society (Lee & Chang, 2006). In addition to their function as social insurance, public social security systems play an important role as income distribution mechanisms (Diamond, 1977). In this regard, the analysis of the socioeconomic impact of social security systems is the focus of numerous studies published in the international literature, including Bellettini and Ceroni (1999), Guillemard (1999), Arza (2006), Lee and Chang (2006), Clement (2007) and Goudswaard and Caminada (2010).

In Brazil, social security has been an important public policy tool in the social arena since the 1930s. Its main purpose is to guarantee the income of workers and their families in the event a worker loses the ability to work. The Brazilian social security system is one of simple redistribution (pay-as-you-go, or PAYG) that is similar to systems in countries such as Germany, France, Japan and the United States. Simply put, in a PAYG system, younger people (current payers) finance older people (retirees and pensioners) (Moura, Jesus Filho, Tafner, & Goldsmith, 2013).

Social security in Brazil is basically divided into two subsystems. The first subsystem is basic social security, which is managed by the government and comprises the General Social Security System (Regime Geral de Previdência Social - RGPS), which is intended for private sector workers and operates under the PAYG system (Zylberstajn, Afonso, & Souza, 2006), and the Special Social Security Systems (Regimes Próprios de Previdência Social - RPPS), which also operate under the PAYG system but are provided exclusively to civil servants. In addition, there are certain special systems that have adopted capitalization or are gradually transitioning toward it. The second subsystem, which is optional and complementary to the official social security system, refers to private pension plans and comprises Open Private Pension Funds (Entidades Abertas de Previdência Complementar - EAPC) and Closed Private Pension Funds (Entidades Fechadas de Previdência Complementar - EFPC).

This study focuses on the first subsystem, which is mandatory and covers the largest number of people. Benefits issued by the RGPS operate as a form of social insurance for workers and their families by replacing the taxpayer's income when he/she loses the ability to work due to illness, disability, old age, death or involuntary unemployment; RGPS even covers unemployment due to motherhood and confinement. The benefits granted by the RGPS are classified into three main groups: social security, accident and assistance. According to the Ministry of Social Security (2012), the RGPS issued 308.3 billion reais in 2012, corresponding to 26.0 million claims. This amount represents approximately 7.0% of Brazil's 2012 GDP.

RPPS benefits are a heterogeneous group of social security systems for the military and civil servants at federal, state and municipal levels (Zylberstajn et al., 2006). According to Calazans, Souza, Hirano, Caldeira, Silva, Rocha and Caetano (2013, p. 277), "regarding RPPS, more than 8 million people, including public servants and active, inactive and retired military personnel, are affiliated with one of the 2,236 RPPS existing in the country." Together, the RGPS and RPPS have more than 49.6 million members, which represents 53.5% of the employed, economically active population (Lima, Wilbert, Pereira, & Paulo, 2012).

Regarding the pervasiveness of Brazilian social security, retirement and pensions account for a notable share of the total income of Brazilian families. Daré and Hoffmann (2012) examined data from the National Household Sample Survey (Pesquisa Nacional por Amostra de Domicílios – PNAD) and found that income from retirement and pensions accounted for a significant portion of declared income; specifically, income from pensions represented 20.3% of total household income in 2009.

The literature has recognized that social security is a major social policy tool in Brazil, and studies have placed particular emphasis on social security's distributional aspects; on its impact on the goals of poverty reduction and the alleviation of income distribution inequality; and on its effects on the economy of small municipalities. In this context, the works performed by Hoffmann (2003, 2009, 2010), Afonso and Fernandes (2005), Cavalieri and Pazello (2005), Ueda (2005) Ferreira (2006), Moura (2007), Reis and Camargo (2007), Ferreira and Souza (2008) Silveira (2008), Marinho and Araújo (2010), Rangel (2011) Carvalho Filho (2012), Medeiros and Souza (2013) and Reis, Silveira and Braga (2013) merit attention.

Despite extensive literature on the subject, the empirical evidence remains inconclusive (Hoffmann, 2009). Certain studies indicate that retirement and pensions in Brazil reinforce inequality (Ueda, 2005; Ferreira, 2006; Ferreira & Souza, 2008; Rangel, 2011), whereas others indicate that RGPS retirement and pensions help to reduce inequality (Cavalieri & Pazello, 2005; Silveira, 2008). Studies that seek to identify the effects of retirement and pensions on poverty reduction are also noteworthy. For example, Delgado and Cardoso Junior (2000) analyzed the socioeconomic impact of the rural pension system on households in the South and Northeast regions of Brazil and concluded not only that rural social security represents a significant portion of household income in these areas but also that the Brazilian rural retirement pension program is efficient at combating poverty. However, the results of Marinho and Araujo (2010) suggest that rural retirement pensions *per capita* have no significant impact on poverty reduction.

Given the importance of determining the extent to which retirement and pensions are designed as welfare promotion tools for family and household beneficiaries, this article seeks to contribute to the evaluation of the social security system by answering the following question: What are the impacts of retirement and pensions on social welfare indicators in Minas Gerais households, considering the different

dimensions of the Household Welfare Index (HWI)?

This research advances the study of social security and its socioeconomic impact in Brazil and contributes to the debate on the subject. The analysis undertaken here is one of the first in the country to investigate the impact of retirement and pensions on multiple welfare indicators that collectively summarize the greatest possible number of relevant dimensions for quality-of-life analysis. Moreover, this study applies the methodological approach known as propensity score matching, which reduces selection bias in public policy research (Konisky & Reenock, 2013).

To perform the proposed analysis, microdata from the first Minas Gerais Household Sample Survey (Pesquisa por Amostra de Domicílios de Minas Gerais - PAD-MG) were used. This survey was conducted in 2011 by the João Pinheiro Foundation (Fundação João Pinheiro - FJP) in partnership with the World Bank. PAD-MG data were collected from 308 municipalities and a sample of 18,000 households, which represent the unit of analysis of this study. Note that one household can be inhabited by more than one family; the main family includes the head of household, who is the individual responsible for the family, and cohabiting families comprise groups of at least two people each who reside in the same household as the main family. Minas Gerais received 12.2% of the total benefits paid in the country in 2012, making it the second largest recipient of RGPS resources that year. Also in 2012, Minas Gerais accounted for 7.9% of all social security tax revenue in the country, ranking third (behind São Paulo and Rio de Janeiro) among states that contribute tax revenue to the RGPS (Ministério da Previdência Social, 2012).

This article is divided into five sections, including this introductory section. The following section summarizes empirical studies that investigate the socioeconomic impact of social security in Brazil. The third section describes the methodology, the database and selected variables. The fourth section analyzes the study results. Finally, the conclusions are presented in the fifth section.

2 EMPIRICAL EVIDENCE OF THE SOCIOECONOMIC IMPACT OF RETIREMENT AND PENSIONS IN BRAZIL

This section presents a review of the national literature regarding the effects of social security on the reduction of poverty and income distribution inequality and on access to the labor market and education.

Among the Brazilian studies that consider the effects of social security benefits on poverty reduction and on the reduction of rural poverty in particular, the works by Delgado and Cardoso Junior (2000) and Marinho and Araújo (2010) are noteworthy. In the first article, the authors performed a survey of 6,000 households in the South and Northeast regions of Brazil to assess the socioeconomic effects of rural social security. The authors concluded that possession of a rural retirement pension significantly affected the composition of household income. Marinho and Araújo (2010) used the panel data approach to evaluate the impact of rural retirement pensions on poverty reduction in rural regions of Brazilian states during 1995-2005; among other key findings, the authors revealed that retirement pension benefits *per capita* did not affect rural poverty in Brazil.

Important studies on the impact of retirement and pensions on income distribution inequality have been conducted by Hoffmann (2003, 2009), Ueda (2005), Afonso and Fernandes (2005), Cavalieri and Pazello (2005), Ferreira (2006), Ferreira and Souza (2008), Silveira (2008) and Rangel (2011). Each of these studies adopted the Gini coefficient decomposition method, either by analyzing the various components of household income or by calculating the internal rates of return (IRRs) provided by social security contributions and benefits. Another common feature of these studies is the use of data from PNAD and the Household Budget Survey (Pesquisa de Orçamentos Familiares - POF) to identify the various components of household income.

Hoffmann (2003) describes several important findings regarding the share of retirement and pensions in total household income. For example, the survey conducted by the author revealed that the share of social security benefits in total income tends to increase with income level. In addition, using the Gini coefficient decomposition method, Hoffman (2003) found that social security benefits reinforce income distribution inequality in Brazil. However, given the margin of error of the data used, there is no evidence that retirement and pensions contribute to increased distribution inequality of household income *per capita*.

Using the PNAD database for the period 1981 to 2001, Ferreira (2006) found that retirement pension income contributes to increased income distribution inequality in Brazil. According to the survey results, income derived from social security accounted for the second largest share of income in the Gini coefficient calculation, behind only primary job income. Following the same line of reasoning, Ferreira and Souza (2008) analyzed PNAD data for the years 1998 to 2003 and demonstrated the substantial contribution of social security benefits to income distribution inequality in Brazil. Similarly, Hoffmann (2009) evaluated data from the 2007 PNAD and found that official retirement and pensions are slightly regressive.

Ueda (2005) found that the public social security system contains strong regressive elements and thus contri-

butes to increased income distribution inequality. The author proposed the short-term establishment of mandatory closed private pension funds for statutory and military public servants to reduce both the privileges of these workers and the benefit ceiling. In a complementary fashion, Rangel's (2011) study shows that the institution of ceilings on civil servants' retirement and pensions has the potential to improve the distributive profile of public spending. However, this approach does not result in a significant reduction of income inequality as measured by the Gini coefficient.

Conversely, Silveira (2008) found that the share of household income *per capita* attributable to retirement and pensions is slightly progressive. The author combined POF data with information on government expenditures and the estimated number of retired state and municipal public employees to calculate progressivity measures for benefits paid by the RGPS and RPPS. The results showed that the former are progressive, whereas the latter are regressive. These results can be explained primarily by the duality of the social security system, which has specific rules for statutory military personnel and civil servants.

In line with the results found by Silveira (2008), Afonso and Fernandes (2005) also found evidence that suggests the existence of distributive features in social security. These authors found that groups with lower educational levels have higher IRRs and that the rates also differ by region.

Cavalieri and Pazello (2005) calculated the actuarially fair rates (those rates that equate the present value of contributions to the present value of benefits) separately for the RGPS and RPPS based on 10% of family income *per capita*. Estimates of the differences between the rates actually paid and the actuarially fair rates for the different groups enabled the determination of whether there was a transfer of resources between rich and poor. The results demonstrated that social security provided by the RPPS had a negative effect on income distribution. However, the same was not true for the RGPS; this social security system evinced a progressive character.

In addition to its effects on the reduction of poverty and of income distribution inequality, social security can affect education and the labor market. Hoffmann (2010) used PNAD data from 2003 and 2006 to test the study by Reis and Carmargo (2007) that evaluated the impact of retirement and pensions on education and youth participation in the labor force. Using data from PNAD 2006 and a multinomial *logit* model, Hoffmann (2010) confirmed the results obtained by Reis and Camargo (2007) that showed that income from retirement and pensions reduces the likelihood of young people "working and not studying" and substantially increases the likelihood of them "studying and not working." Similarly, Carvalho Filho (2012) analyzed rural social security and showed that granting retirement pensions decreased the participation rate in the labor market and increased school enrollment of children aged 10 to 14 years.

A literature review of the Brazilian studies that have evaluated the socioeconomic impact of social security reveals that the evidence is inconclusive. In an attempt to contribute to and advance the discussion, new studies using alternative methods to evaluate the impact of social security benefits can provide important evidence to facilitate an understanding of the issue and add new elements to the debate on social security in Brazil.

3 METHODOLOGY

Putting aside efficiency considerations, the ideal method of evaluating a specific existing public policy is to compare the situation of the individual who benefits from the policy (treatment group) with the situation faced by that same individual in the absence of such policy, as explained by Cavalieri and Pazello (2005). However, Konisky and Reenock (2013) note that one of the main difficulties encountered by those who study the impact of public policy is a lack of information about individuals in different situations, i.e., beneficiary individuals (treatment group) and non-beneficiary individuals (control group).

To quickly formalize this situation for purposes of analyzing the impact of social security, this study considers a household *i*, an impact assessment variable Y (e.g., household income *per capita*) and two possible states: D = 1 for the situation in which the household benefits from the policy and D = 0 for the situation in which it does not benefit. The value of the variable of interest for household *i* is represented by Y_1^i if some of its residents are entitled to social security (D = 1) and by Y_0^i if no resident is entitled to social security (D = 0).

The impact of social security on income *per capita* of household *i* can be represented by:

$$Y_i = DY_1^i + (1 - D)Y_0^i, \quad (1)$$

The impact of social security for household *i* and the average impact of social security on beneficiary households can be represented by $\Delta^i = Y_1^i - Y_0^i$ and $\Delta = E(\Delta^i/D = 1) = E(Y_1^i - Y_0^i/D = 1)$, respectively, where $E(Y_1^i - Y_0^i/D_i = 1)$ is related to the expected value conditional on receiving social security benefits.

Because it is not possible to analyze households in both situations, a group of households that did not benefit from social security is used as the control group to obtain an approximate measure of the benefit's impact on the variable of interest:

$$E(Y_1^i / D = 1) - E(Y_0^i / D = 0)$$
$$= E(Y_1^i \,|/ D = 1) - E(Y_0^i / D = 1) + E(Y_0^i / D = 1) - E(Y_0^i / D = 0) \quad (2)$$
$$= \Delta + E(Y_0^i \mid D = 1) - E(Y_0^i \mid D = 0)$$

Equation 2 represents the bias, or error measure, that is incurred when households are differentiated based exclusively on whether they receive social security benefits. The existence of selection bias, or participation in the policy, is another major problem associated with the evaluation of social policies and programs because randomization of the selection process of policy beneficiaries is usually absent. In this sense, a simple comparison between a group of beneficiaries and a group of non-beneficiaries would not be correct because the impact of the policy may be influenced by factors/variables that are external to the analyzed policy, and these factors/variables may in turn differ between the two groups.

In this context, evaluating the impact of public policies requires the adoption of an alternative strategy that takes into account the existence of selection bias. *Propensity score matching* (PSM) (Konisky & Reenock, 2013) allows comparisons between beneficiaries and non-beneficiaries and therefore allows impact assessment of a particular political or social program.

Baker (2000) states that PSM, which was developed by Rosenbaum and Rubin (1983), is one of the most popular methods used in policy and social program impact assessment literature. The application of PSM is required when groups of beneficiaries and non-beneficiaries are not selected randomly, which may lead to biased results because the groups are not comparable.

3.1 Calculation of propensity score.

The *matching* or pairing procedures are implemented using the *propensity score*, *P(X)*, which is defined by Rosenbaum and Rubin (1983) as the conditional probability of an individual receiving treatment given their observable characteristics:

$$P(X) = Probability\,(D = 1|X_i) \quad (3)$$

where $D = \{0, 1\}$ indicates the control and treatment groups, respectively, and X_i represents observable characteristics that supposedly correspond to the variables that can affect participation (selection) in the policy. Thus, the first step of the *propensity score* matching procedure is to calculate *P(X)*, which can be performed using a *logit* or *probit* model where the dependent variable is a *dummy* that is equal to 1 in the case of the treatment group (households with a resident who receives social security benefits) and 0 in the case of the control group.

Matching methods that use *propensity score* estimates aim to summarize the information contained in the variables that affect participation in the program by estimating, conditional on these variables, the probability of belonging to the beneficiary group (*propensity score* estimate). However, the use of this method is based on two main assumptions. The first assumption postulates the existence of common support and requires that in conditioning the variables used to estimate the *propensity score*, the probability of participation in a program is the same for beneficiaries and non-beneficiaries. There is a corresponding treatment group for each control group. The second assumption addresses the balancing of observable characteristics and hypothesizes that the results of the variable of interest (*Y*), conditioned on the probability of participation in the program, are independent of participation, i.e.:

$$(Y_0, Y_1 \perp D \mid P(X)) \quad (4)$$

where the symbol $\perp$ denotes statistical independence (Rosenbaum & Rubin, 1983).

The *propensity score* and the treatment effect were estimated using the *pscore* and *psmatch2* packages, which were developed by Becker and Ichino (2002) and are available in the *Stata* 11 program.

3.1.2 Calculation of average treatment effect.

After estimating the *propensity score,* one can estimate the policy's impact, which in PSM is called the average treatment effect on the treated and is represented by the acronym ATT. The estimated probability values are used as a dissimilarity measure to obtain pairs of observations, each of which comprises one household in the treatment group and one household in the control group.

The ATT may be estimated using various matching alternatives. According to Neder, Ribeiro and Juliano (2007), one of the best known matching methods among the various methods that exist in the literature is the *nearest neighbor* method. Each household in the treatment group is paired with a household from the control group whose estimated *propensity score* is as close as possible to its own. Other matching methods used in the evaluation literature are the *Kernel matching* method and the stratification method. The nearest neighbor method has certain operational variants that depend on the alternative number of neighbors selected for each treated pair.

Using the nearest neighbor matching method, the end result of the program evaluation is determined by the average results of comparisons between each beneficiary.

According to Melo and Duarte (2010), based on those notations, *V(i)*, which is the set of observations of the comparison group (non-beneficiaries) to be related to the beneficiary *i*, can be represented by:

$$V(i) = \min_j \|p_i - p_j\|, \qquad i \in B. \quad (5)$$

where p_i and p_j correspond to the probabilities of being benefitted by the program and B corresponds to all the beneficiaries of the public policy. Note that the definition of neighbor(s) to be compared with each observation of the beneficiary group (sets of type *V(i)*) does not obey any absolute measure of distance with respect to beneficiaries' *propensity score* estimates and there can be comparisons between pairs of observations.

3.2 Data source and selected variables.

The data used in this study were extracted from PAD-MG microdata, which were collected from a sample of 18,000 households in urban and rural areas in 308 municipalities from June to November 2009. A major characteristic of this survey is thus the degree of territorial breakdown, which allows comparisons between the socioeconomic characteristics of various state regions.

3.2.1 Variables used in the logit model.

The first step in estimating *propensity score matching* is selection of the independent variables to be included in the *logit* or *probit* model used to calculate the probability that at least one household member receives social security benefits. At this step, the model should include predictive variables that influence participation in the program as well as a set of control variables to ensure the quality of the matching, as shown in the following equation:

$$Prob(Beneficiary\ household_i = 1) = X_i\beta_i + Z_i\beta_i + \varepsilon_i \quad (6)$$

In equation (6), the dependent variable of the model is a dummy that takes a value of 1 if at least one household member receives social security benefits and a value of 0 otherwise. This can be explained by the variables that determine the receipt of social security benefits (*X*) and the control variables relating to household characteristics (*Z*). Table 1 shows the variables used in the *logit* model.

The variables used in the *logit* model to determine the receipt of social security benefits are as follows: contribution to social security, presence of a man over 65 years of age and presence of a woman over 60 years of age. Contribution to social security reduces the likelihood of a household member receiving social security benefits because, normally, the contribution by family members to social security indicates that they are of working age and therefore will only receive social security benefits in the future.

The two other determining variables for receiving social security benefits, the presence of men over 65 and the presence of women over 60, each increases the likelihood that a household member receives social security benefits because these are the minimum ages for receiving benefits.

Households in the treatment group were matched to households in the control group using the values estimated by the *logit* model. The purpose of including variables for household location, head-of-household characteristics, housing conditions and regional dummies is not only to calculate the probability of participation but also to pair the households in terms of observable characteristics. In short, these variables represent a control for calculating ATT.

Table 1 *Variables used in the logit model*

Variable	Description
Contribution to social security	Equal to 1 if a resident of the household contributes to social security
Presence of men over 65 years of age	Equal to 1 if any man in the household is over 65 years of age
Presence of women over 60 years of age	Equal to 1 if any woman in the household is over 60 years of age
Location of the household	Equal to 1 if the household is located in an urban area
Education level of the head of household	Number of years of formal education of the head of household
Race/color of the head of household	Equal to 1 if the head of household is white and 0 otherwise
Person employed in non-agricultural activity	Equal to 1 if a resident of the household is employed in a non-agricultural activity
Person employed in the formal sector	Equal to 1 if a resident of the household is employed in a formal activity
Income above the poverty line	Equal to 1 if the household income is above the poverty line (BRL 232.00 *per capita/month*)
Masonry residence	Equal to 1 if the residence is a masonry building and 0 otherwise
Number of bathrooms	Number of bathrooms in the residence
Sanitation	Equal to 1 if the residence has adequate sanitation
Regional dummies	Indicate the Planning Region of each researched household

Source: Developed by the authors.

3.2.2 Measures of social welfare for social security impact evaluation.

After presenting the variables selected for calculating the *propensity score* and for matching the households, the next step is to identify the variables of interest that will be used to assess the impact of retirement and pensions on social welfare in Minas Gerais households. Initially, total household income and household income *per capita* were selected as variables of interest and welfare proxies. As shown by Rocha (2003), despite the known conceptual and methodological problems that are encountered when measuring income, this parameter is recognized as an important *proxy* of welfare. At a minimum, the amount of income spent on private consumption should be assessed.

Although access to income is an important indicator of social welfare, it is certainly not the only indicator. Accordingly, it is increasingly important to develop welfare indicators that synthesize the maximum possible number of relevant dimensions for quality-of-life analysis.

To address the need for adequate welfare indicators, Barros and Carvalho (2002) (cited by Barros, Carvalho, & Franco, 2003) developed the Family Development Index (FDI). The FDI was initially based on information from a single source, namely, the Single Registry (Cadastro Único). However, it was later recalculated by Barros et al. (2003) using PNAD microdata.

The FDI comprises 48 dichotomous socioeconomic indicators that correspond to 6 dimensions (Barros et al., 2003). The first dimension investigates vulnerability due to family composition, i.e., this dimension represents the additional resources that the family requires due to the presence of children, disabled individuals, elderly individuals and/or pregnant women. The second dimension evaluates access to knowledge based on indicators for access to literacy, education and professional training. The third dimension, access to work, assesses the household's productive capabilities as a source of income and considers the availability of work, the formality of the job position and the remuneration for the work. The fourth dimension refers to resource availability and investigates environmental conditions that affect the ability to obtain adequate income to satisfy the needs of family members and the sustainability of these conditions (for example, the labor market or transfers of funds from other sources). The fifth dimension addresses factors relating to child development, including prohibitions against child labor, access to schools, school progress and childhood mortality. The last dimension of the FDI corresponds to housing conditions and includes indicators for occupancy conditions, access to water and access to adequate sanitation, among other indicators.

For the purposes of this study, an adapted version of the FDI was used, namely, the HWI. The decision not to use the FDI in its original form was based on several reasons related to the objectives of this study. First, there is no support in the literature for the proposition that retirement and pensions reduce the vulnerability of families because family vulnerability relates to the presence of people with characteristics that increase the family's demand for resources and assistance. In addition, the FDI was calculated based on data from the Single Registry and PNAD, whereas this study uses data from the PAD-MG. Finally, the child development dimension of the FDI did not vary between the control and treatment groups defined in this study, which eliminated the possibility of data comparison between the two groups.

Accordingly, the HWI comprises only the following four dimensions: access to knowledge, access to work, availability of resources and living or housing conditions. These dimensions encompass a set of 23 variables, which were selected according to Barros et al. (2003). Table 2 presents the dimensions, components and indicators that constitute the HWI.

In the HWI calculation formula, all dimensions and components are treated symmetrically by assigning the same weight to each, i.e., (i) each of the four dimensions accounts for 25% of the HWI; (ii) each dimension has multiple components, and each component is weighted equally for purposes of calculating the dimension value; and (iii) each component has several indicators, and each indicator is weighted equally for purposes of calculating the component value. Thus, assuming that each indicator takes a value of 0 or 1, the summary indicator is defined based on the basic indicators using the following equation:

$$HWI = \left(\frac{1}{4}\right) * \sum_k \left(\frac{1}{m_k}\right) * \sum_j \left(\frac{1}{n_{jk}}\right) * \sum_i B_{ijk} \qquad (7)$$

where m_k denotes the number of components of the *k-th* dimension; n_{jk} denotes the number of indicators of the *j-th* component of the *k-th* dimension; and B_{ijk} denotes the *i-th* basic indicator of the *j-th* component of the *k-th* dimension.

Table 2 *Dimensions, components and socioeconomic indicators that constitute the Household Welfare Index*

Dimension	Component	Socioeconomic indicator
Access to knowledge:	Literacy	C1: Absence of adult literacy
	Education	C2: Presence of at least one adult with complete primary education
		C3: Presence of at least one adult with complete secondary education
		C4: presence of at least one adult with higher education
	Professional training	C5: presence of at least one middle or high-level worker
Access to work	Quality of job position	T1 Presence of at least one adult employed in the formal sector
		T2: Presence of at least one adult employed in non-agricultural activity
	Remuneration	T3: Presence of at least one adult employed with income greater than 1 M/W
		T4: Presence of at least one adult employed with income greater than 2 M/W
Resource availability	Extreme poverty	R1: Household income per capita above the extreme poverty line
	Poverty	R2: Household income per capita above poverty line
	Income generation capacity	R3: Majority of household income does not come from transfers
Living conditions	Ownership	H1 Own home
	Housing deficit	H2: density of at least 2 inhabitants per household
	Type of construction of housing	H3: Permanent construction material
	Access to water supply	H4: adequate access to water
	Access to sanitation:	H5: adequate sanitation
	Access to garbage collection	H6: garbage collection
	Access to electrical energy	H7: Access to electricity
	Access to durable goods	H8: Access to oven and refrigerator
		H9: Access to oven, refrigerator, television or radio
		H10: Access to oven, refrigerator, television or radio and telephone
		H11: Access to oven, refrigerator, television or radio, telephone and computer

M/W: minimum wage.
Source: Adapted from Barros et al. (2003).

4 RESULTS AND DISCUSSION

4.1 Descriptive analysis of social security beneficiary households.

After the variable extraction process, the final database comprised a sample of 10,270 households, 73.28% of which were concentrated in urban areas. Of the total households in the sample, 2,743 (26.72%) were social security beneficiaries, most of whom (83.01%) were concentrated in urban areas. Proportionally, these results demonstrate that among rural households, the proportion of social security beneficiaries is approximately 27%, whereas among households in urban areas, this proportion is approximately 26%. Based on data from the 2007 PNAD, Hoffmann (2009) found that 34.9% of Brazilian households received some type of pension.

Note that PAD-MG data make it possible to determine whether the benefit received is a retirement pension or other type of pension. However, these data do not include information that allows us to determine whether the person is a beneficiary of the RGPS or the RPPS. For the purposes of this study, no procedure to separate the beneficiaries of these two systems was undertaken because the maximum value of benefits received in the sample was BRL 3,132.00, which is less than the ceiling established by the RGPS in 2009 (BRL 3,218.90).

The average income of surveyed households is also noteworthy. The results showed that the average total household income of the sample was BRL 1,431.23 and the average *per capita* income was BRL 435.14. With respect to beneficiary households, the results indicate a total income and average income *per capita* of BRL 1,782.77 and BRL 523.66, respectively. Among non-beneficiary households, the average total income and income *per capita* were BRL 1,303.15 and BRL 402.79, respectively.

Regarding the average amount received in retirement and pensions, the results showed that beneficiary households receive BRL 684.21 from social security, which on average represents 45.8% of total income. Considering the classification system established by the Social Policy Center at the Getulio Vargas Foundation (Centro de Políticas Sociais da Fundação Getulio Vargas - CPS/FGV) (Neri, 2010) based on 2009 PNAD microdata, which classifies the different economic strata into five income groups (according to total household income from all sources), as shown in Table 3, social security benefits are the main source of income for households in classes D and E. This means that social security is the main source of funds for these households, which indicates a dependency of these households on social security benefits.

Table 3 *Classification of households by income level, average amount of social security benefits received and share of these benefits in total household income*

CPS/FGV Classification (PNAD 2009)			Study Results (PAD-MG 2009)	
Classes	Lower limit	Upper limit	Average values received in retirement and pensions	Share of retirement and pensions in total household income
E	BRL 0.00	BRL 705.00	BRL 470.16	92.54%
D	BRL 705.00	BRL 1,126.00	BRL 570.20	61.18%
C	BRL 1,126.00	BRL 4,854.00	BRL 795.39	39.9%
B	BRL 4,854.00	BRL 6,329.00	BRL 1,196.00	20.72%
A	BRL 6,329.00			

Source: Developed by the authors.

For households in classes A, B and C, the scenario is different; social security funds represent, on average, a low proportion of total household income. In class C, the average value of retirement pensions and other pension funds was BRL 795.39, which accounts on average for 39.9% of total household income; for households in classes A and B combined, the average amount of social security benefits was BRL 1,196, which on average accounted for only 20.72% of their total income. These results corroborate the findings of Silva and Lopes (2009) based on 2006 PNAD data for the Northeast region. According to the authors, the share of income from social security tends to decrease in households with higher total income.

4.2 Estimation and discussion of propensity score.

This section uses the *logit* model to assess the probability that a household has at least one resident who receives social security benefits, as shown in Table 4. To perform the analysis, total household income was subdivided based on the classification system established by the CPS/FGV, which made it possible to evaluate the impact of social security on household welfare in different income brackets.

To that end, the results for three different subdivisions will be presented: the first subdivision assesses the impact on all households in the sample (10,270); the second analyzes the impact only on households in classes D and E, i.e., those with income up to BRL 1,126.00; and the third and final subdivision evaluates the effects of social security on households from class C, which includes households with incomes between BRL 1,126.00 and BRL 4,854.00. No models were estimated for households in classes A and B due to the small number of observations for these income brackets.

Note that social security beneficiary households accounted for 26.7% of total cases in the sample. Among the households in class C, beneficiaries represented 35.2% of households, whereas 17.5% of households in classes D and E were social security beneficiaries.

The results of the *logit* model are shown in Table 4, with PSM estimates for all sample households and for households in classes D and E and in class C. The final specifications of these models were obtained using iterative procedures recommended by the literature (trial and error) until specifications that achieved a balance between the variables included in the model were obtained. It is noteworthy that the estimated models showed an accuracy rate of over 80%, which indicates a high predictive power of the models used.

The estimates are in line with expectations. The results indicate that contributions to social security, the presence of a man over 65 years of age and the presence of a woman over 60 years of age were statistically significant and exhibited the expected signs in the three estimated models, except for the model for class D and E households, where the 'contribution to social security' variable was not significant.

The variables for the presence of a man over 65 years of age and a woman over 60 years of age in the household had the expected signs and were significant at the 1% level. As expected, these results show that the presence of men over 65 years of age and women over 60 years of age – the minimum ages at which urban workers are entitled to old-age retirement – increased the probability that the household benefitted from social security. As for contributions to social security, the negative sign indicates that the presence of social security payers reduces the likelihood that the household is a current beneficiary. This result can be explained by the fact that the beneficiary, in general, stops contributing to social security at the moment he/she begins to receive benefits.

For the other variables used to match the analyzed households, the results showed that the education level of the head of household, income above the poverty line and number of bathrooms each significantly affected the probability that the household received social security benefits in the three estimated models. Although these variables were used only to maintain the matching quality of the analyzed families, the negative effect of the education level variable is noteworthy. This result can be explained by the fact that the illiteracy rate has historically tended to be higher among the elderly and households with lower income *per capita*. As reported by the Brazilian Institute of Geography and Statistics (Instituto Brasileiro de Geografia e Estatística - IBGE) (Brazil, 2010), 42.6% of the country's illiterate population are over 60 years old.

Table 4 *Factors associated with receiving social security benefits*

Variables	All Sample Households		Class C Households		Classes D and E Households	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Contribution to social security	-0.282***	0.092	-0.389***	0.118	-0.230	0.156
Man over 65 years of age	3.240***	0.169	3.201***	0.235	3.321***	0.258
Woman over 60 years of age	3.012***	0.097	2.981***	0.129	3.062***	0.154
Location	0.011	0.122	-0.064	0.170	0.094	0.183
Education of head of household	-0.096***	0.009	-0.094***	0.011	-0.126***	0.018
Race/color	0.060	0.065	0.135	0.083	-0.082	0.111
Person employed in non-agricultural activity	0.086	0.113	-0.175	0.167	0.138	0.160
Person employed in formal sector	-0.021	0.088	-0.005	0.110	-0.252	0.155
Income above poverty line	1.068***	0.087	0.653**	0.257	0.648***	0.108
Construction material	0.098	0.134	-0.044	0.170	0.401*	0.233
Number of bathrooms	0.558***	0.076	0.317***	0.092	0.804***	0.144
Sanitation	0.078	0.117	0.185	0.164	-0.065	0.174
North	-0.421*	0.163	-0.199	0.216	-0.658**	0.269
Rio Doce	0.235	0.145	0.358*	0.185	0.179	0.245
Zona da Mata	0.646***	0.134	0.747***	0.170	0.552**	0.233
North West	-0.324**	0.149	-0.085	0.184	-0.778***	0.269
Central	0.305**	0.135	0.353**	0.181	0.356	0.219
South	0.083	0.124	0.042	0.154	0.167	0.219
Triângulo	-0.394***	0.140	-0.423**	0.171	-0.379	0.255
Alto Paranaíba	-0.142	0.121	-0.164	0.149	-0.108	0.217
Midwest	0.212*	0.125	0.247	0.154	0.185	0.227
Jequitinhonha and Mucuri	-0.120	0.152	0.125	0.210	-0.225	0.237
Constante	-2.830***	0.204	-1.571***	0.353	-3.128***	0.345
Number of observations	9,295		4,671		4,526	
LR chi2	3,309***		1,834***		1,178***	
Pseudo R2	0.323		0.311		0.310	
Model accuracy	86.66		83.33		90.41	

*** 1% significance, ** 5% significance, * 10% significance.
Source: Developed by the authors.

4.3 Impact of retirement and pensions on level of household welfare.

After matching based on PSM estimates, the impact of social security on the welfare level of households receiving retirement and pensions was estimated (ATT). Table 5 presents estimates of the impact of social security benefits on each variable of interest used as a *proxy* for welfare for each of the three analyzed subdivisions. The analysis was based on three points: (i) the magnitude of the estimated value of ATT; (ii) the sign of ATT; and (iii) ATT's statistical significance. If the estimate has a positive sign, then the effect favors the treatment group; if the sign is negative, then the effect is negative.

The results suggest that social security has a positive and significant impact on the average household income of all households in the sample (significance level <1%) and for households in classes D and E (significance level <10%) for both total income and income *per capita*. However, the same situation does not occur in class C households (significance level> 10%). Based on these findings, it can be inferred that receiving social security benefits has a more direct effect on the income of the poorest households. Delgado and Cardoso Junior (2000) and Hoffmann (2009) also found results that showed the share of income from retirement and pensions in total household income.

As shown in section 4.1, for households in classes D and E that benefit from social security, income from retirement and pensions accounts on average for over 60% of the average total household income. Based on these results, and using only household income *per capita* as an outcome variable and as a *proxy* for welfare, it may be argued that social security has a positive impact on household welfare and that this impact is greater on households located in the lower-income brackets (classes D and E) than it is on households located in class C.

With respect to the distributional impact of the social security system, the results of this study are consistent with those of Delgado and Cardoso Junior (2000, p. 25), who found that "the lower the considered income range, the more important social security benefits are in shaping household income." In addition, in line with the results presented by Delgado and Cardoso Junior (2000) and Dini, Jannuzzi, Ferreira and Arizono (1999), the empirical evidence in this study shows that social security does not significantly affect the income of class

C households. One possible explanation for this result is that labor income tends to be higher than social security income in these households (Dini et al., 1999), particularly as a result of the ceiling imposed by the RGPS. Therefore, the replacement of labor income by retirement and pensions in class C households would lead to a reduction in household income.

Although income is an important indicator, it cannot by itself address all the complex and multidimensional issues inherent in the concept of social welfare (Barros et al., 2003). Accordingly, other variables and indicators were tested to assess the impact of social security on other components associated with welfare in the surveyed households.

With regard to the impact of social security on the HWI and on the four dimensions that compose this index, the results indicate that in general, income from retirement and pensions had a significant effect on only three dimensions: access to work, access to knowledge and living conditions. Income from pensions contributes to improvements in living conditions, increased access to durable consumer goods and higher education levels of household members. This evidence is similar to the evidence presented by Delgado and Cardoso Junior (2000) and Reis and Camargo (2007).

Table 5 *Estimated impact of social security on household welfare level in Minas Gerais according to income class*

		All Households (Classes A, B, C, D and E)				Households – Class C Income of BRL 1,126.00 to BRL 4,854.00				Households – Classes D and E – Income of up to BRL 1,126.00			
	Sample	benef	control	ATT	t Test	benef	control	ATT	t Test	benef	control	ATT	t Test
Average total household income	without matching	1,819.21	1,297.40	521.81	22.06	2,170.88	1,958.67	212.21	8.55	792.35	688.82	103.53	9.72
	ATT	1,817.83	1,506.19	311.64	4.54***	2,173.93	2,099.96	73.98	1.08	789.99	700.27	89.73	4.09***
Average household income per capita	without matching	539.42	403.72	135.71	20.09	622.14	563.10	59.04	7.18	318.40	261.63	56.77	7.65
	ATT	538.78	474.70	64.90	3.55***	621.19	590.18	31.01	1.35	317.11	291.14	25.97	1.70*
Household welfare index	without matching	0.544	0.524	0.020	7.46	0.574	0.595	-0.021	-7.52	0.467	0.462	0.005	1.18
	ATT	0.544	0.537	0.007	1.02	0.576	0.579	-0.003	-0.34	0.467	0.473	-0.006	-0.72
HWI – Access to knowledge	without matching	0.398	0.357	0.040	7.92	0.424	0.414	0.010	1.37	0.324	0.307	0.017	2.48
	ATT	0.399	0.343	0.056	4.26***	0.427	0.408	0.019	0.99	0.324	0.278	0.046	3.23***
HWI – Access to work	without matching	0.546	0.616	-0.069	-10.17	0.625	0.783	-0.157	-21.67	0.348	0.474	-0.126	-12.45
	ATT	0.548	0.596	-0.048	-2.66***	0.632	0.690	-0.058	-2.75***	0.353	0.456	-0.103	-4.79***
HWI – availability of resources	without matching	0.959	0.890	0.068	17.50	0.993	0.988	0.005	2.94	0.878	0.809	0.069	8.79
	ATT	0.958	0.958	0.000	0.03	0.993	0.995	-0.002	-0.49	0.875	0.868	0.007	0.43
HWI – Housing conditions	without matching	0.816	0.754	0.062	18.97	0.827	0.791	0.037	8.80	0.785	0.722	0.063	11.81
	ATT	0.816	0.790	0.026	2.93***	0.828	0.800	0.028	2.31**	0.783	0.762	0.021	1.81*

*** 1% significance, ** 5% significance, * 10% significance.

Source: Developed by the authors.

The comparison of the HWI and its dimensions across different income classes shows that for households in class C, only the access to work and housing conditions dimensions were impacted by social security. For households in classes D and E, the effect of retirement and pensions was significant for the access to knowledge, access to work and housing conditions dimensions.

The negative impact of social security benefits on access to work may be explained by the fact that a portion of these benefits is transferred to other household members. Thus, an increase in retirement and pensions can influence the choice of household members of whether to participate in the labor market or to study. A reduction in the proportion of the household group members in the workforce is not necessarily an undesirable outcome, especially if it is replaced by access to education. This finding is consistent with the results found by Carvalho Filho (2012), who determined that the granting of retirement pensions to rural workers decreases the rate of participation in the labor market.

By comparison, the results regarding the effects of social security on HWI dimensions indicate that the average effects of income from retirement and pensions on access to knowledge were significant only for households in classes D and E (significance level <1%). For the dimensions access to work and housing conditions, income from retirement and pensions had a significant impact on households in classes D and E and on households in class C; however, the impact was more significant in class C households.

5 CONCLUSION

The results of the descriptive data analysis reveal that social security covers a large number of households, benefiting an average of 26.72% of analyzed households. In addition, social security income represents a signi-

ficant portion of household income for lower-income households. The scenario is different for households in higher income classes (classes A, B and C); in these classes, social security income represents, on average, a low proportion of total household income. These results corroborate those of Silva and Lopes (2009).

Regarding the impact of social security on Minas Gerais household welfare variables, the estimated results showed positive effects on the income, access to knowledge and housing conditions variables. Overall, the survey data indicated that the impact of social security tends to be greater for households in lower-income brackets than it is for middle-class households. Accordingly, it can be inferred that in addition to the social insurance function, the social security system has intra-generational distributive characteristics; i.e., it transfers resources between individuals of the same generation. These results are consistent with studies by Afonso and Fernandes (2005) and Cavalieri and Pazello (2005), which showed the contribution of social security for households in lower income brackets and with less education. Based on these findings, it can be inferred that social security plays a key role for households and households with lower income and exerts an income distribution function. These results differ from those of other studies, including Ferreira (2006) and Moura (2007), each of which demonstrated that social security systems do not work well as income distribution mechanisms.

As a suggestion for future research, it would be interesting to replicate this study in other states or even across the country. To that end, PNAD and POF microdata could be used to assess the impact of retirement and pensions. Furthermore, the use of POF would allow assessment of the impact on household consumption, which is another element associated with social welfare level.

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