The Role of the Demographic Transition to Changes in Income Inequality and Poverty Rates in Brazil

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Abstract

Brazil is among the 30% wealthiest economies in the world, measured by its per capita income. Yet, about one third of the Brazilian population is below the poverty line. Fortunately, in the last decade, poverty rates have been declining mainly because of more equal income distribution in a context of better macroeconomic conditions. Nonetheless, other factors responsible for these improvements need to be examined more systematically, including demographic changes. In the context of a rapid demographic transition, one should expect large effects on social and economic measures from changes in population composition. In this article, we examine how changes in the age composition of adults have affected income inequality and poverty rates in Brazil. We use a counterfactual micro-simulation model to disentangle each one of these effects during two time periods that were characterized by important economic and demographic changes.

Introduction

Brazil is among the 30% wealthiest economies in the world, measured by its per capita income. Yet, about one third of the Brazilian population remained below the poverty line in the beginning of this decade (Barros et al. 2006). Whereas the prevalence of poverty is still high, there has been a substantive decline in extreme poverty during the current decade (about 4 percentage points, between 2000 and 2007), and the proportion of the extreme poor (about 4%) is now significantly lower in Brazil than in many other developing countries. Because of these improvements, the first of the Millennium Goals established by the United Nations was adapted in the Brazilian case, becoming more ambitious: instead of reducing extreme poverty rate by half of the 1990 level, the current goal is to reduce it to one quarter.

There is a high correlation between poverty rates and income inequality in Brazil. The 10% richest of the Brazilian population accounts for about 45% of the total income (Barros et al. 2006) and thus, policies that improve the income distribution are key to reduce poverty (Barros, Henriques e Mendonça, 2001). Accordingly, in the last century, despite the large increase in the GDP per capita (from US$1.8M in 1950 to 6.7M in 2000), the persistency of income inequality (the 2000 Gini coefficient of 0.593 was close to the historical average) has avoided significant declines of poverty rates in Brazil. It was only in the current decade that the steady decline in inequality led to a substantive reduction in poverty. Between 2001 and 2007, while the Gini coefficient declined from 0.593 to 0.521, the per capita income of the 10% poorest grew by 7% per year, almost three times faster than the national average (Barros, 2009).

Several reasons explain the current pattern. First, the set of measures taken in the 1990 decade to stabilize the Brazilian economy that kept inflation under control with positive effects for wages, mainly for the poorer. Second, the policy of minimum wage increases which has had favored low-wage workers and beneficiaries of the social security system.

Finally, in the current decade, the development and expansion of two large cash transfer programs: *bolsa familia* directed to poor families, particularly those with school age children and the *BPC*, the non-contributory pension system in Brazil that extended coverage to elderly unable to fulfill the usual contribution criteria.

The demographic changes have been also responsible for poverty alleviation, since they have reduced family size and the dependency ratio within the families, through increases in the relative number of adults (Hailu e Soares, 2009). Nonetheless, we still have to learn more about how these demographics effects are associated to poverty and inequality measures trends. To do that, in this article, we examine how changes in the households' age composition affected income inequality and poverty rates in Brazil. Looking at both economic measures is necessary because of the strong ties between them. We use a counterfactual micro-simulation model developed by IPEA (2006) to disentangle each one of the demographic effects over the last two decades: 1985-1995, and 1995-2005, covering most of the recent changes in social policy and in the macroeconomic parameters as well as the consequences of the demographic transition in Brazil.

Demographic Factors in the Analysis of Income Inequality and Poverty Rates

It is noteworthy that, as in many other developing countries, the demographic transition started late in Brazil (early 1950s), but once it started, mortality and fertility rates changed very fast. Over four decades, total fertility rate had declined from about 6 to 2 children per women and life expectancy at birth increased by 25 years. In this context of rapidly demographic transition, one should expect large effects on social and economic measures from changes in population composition.

The role played by demographic compositional effects on per capita family income inequality and poverty rates can be measured in many different ways. For example, one could use the age dependency ratio (share of adults) within the family as a measure of the weight of potential income earners living in the family. The association is straightforward: children generally do not earn income and therefore, the larger the share of adults in the family, the larger the *per capita* family income should be (IPEA, 2006, p. 34). Since poor families tend to have more offspring than wealthy families, the higher dependency ratios among the poorer should contribute to larger inequality and poverty rates in the population. If fertility is declining faster among the poor families, such has been the case for Brazil in the past years (Berquo & Cavenaghi 2006) one should expect declining inequality and poverty rates because of the first-order effects of changes in age composition within the families.

The share of adults in the family summarizes a wide range of demographic characteristics which potentially affect family size and structure. These include changes through new births, deaths, divorces, marriages, and, in a broader sense, through the departure of individuals who start new families. Therefore, the share of adults is a too broad measure and one should consider that changes in the age of adults in each family are not neutral with respect to family income distribution. This is true because younger and older adults may have lower income.

Recent changes in Family Composition in Brazil

The composition of families has changed in Brazil, as a result of both of demographic and socioeconomic factors (Camarano et al., 2004; Medeiros and Osório, 2000). The decline in fertility, the increasing frequency of divorces, and the excess male mortality have led to increasing numbers of widows. These sociodemographic phenomena directly affected family composition, reducing its size and the number of offspring and increasing average age and number of households with only one individual (mainly women).

Socioeconomic conditions are intrinsically connected with the choices of individuals regarding co-residence and family formation, thus affecting marriage, divorce, early departure, and co-residence of adult offspring and grandchildren with the elderly. In many developed countries, income, mobility and level of education are positively correlated with the tendency of the elderly to live alone (see Michael, Fuchs and Scott (1980) for evidence for the U.S. case). In Brazil, co-residence has been favored by the increasing time spent by children in school, which has postponed the end of youth economic dependence to older ages. In addition, the recent extension of social insurance programs to an increasing share of the elderly population has provided this age group with better financial conditions which may increase the likelihood of co-residence between old and young generations (Camarano et al., 2004), although Paulo (2008) showed it may indeed increase the chances of elderly to live alone.

Methodology

Data

Our results are based on data from PNAD, a nationally representative household survey collected annually in Brazil since the 1970s, except for the census years. We use data from the years 1985, 1995 and 2005 surveys, in order to compare the different patterns of income inequality and poverty over the last two decades that have been reported in the literature, namely, the small positive change in income inequality between 1985 and 1995 and the steadily decline both in income inequality and poverty rates between 1995 and 2005.

Although the concept of family income inequality has been employed throughout this article, it should be noted that our unit of analysis in the simulations is, in fact, the household. Usually, family refers to groups connected by bonds of kinship (including non-biological offspring and conjugal relationships which may or may not be legally established) not limited by the boundaries of the physical household (Medeiros & Osorio, 2000). Given the difficulty of identifying kinship bonds in the survey, we use the concepts of household and family as they were interchangeable in our analysis. While a household may be made up of several families, in the case of Brazil, we expect extended families to constitute a minor proportion within the sample.

Model

In this study, we use counterfactual micro-simulations to measure the role played by demographic changes on income inequality and poverty rates according to changes in the age distributions of adults within the families. We answer "what if" type of questions by asking what would happen to income inequality and poverty rates in the following decade, if the distribution of age among adults for each family were kept constant.

Assuming that *per capita* income is $y = a.r$ where a equals the number of adults in the family and r is the income per adult in the family, we perform two micro-simulations, In the first one, we only consider changes the proportion of adults in the family. In the second simulation model, we combine income distribution by age with the age distribution of adults in each family. Therefore, *per capita* family income is the product of the number of adults by age and age-specific income: $y = \sum_{i=1}^{k} \frac{n_i^A}{n} \left(\frac{1}{n_i^A} \sum_{j \in i} y_j \right)$. To keep our analysis parsimonious while still capturing the age effect, we categorize age according to three groups: i) adults 15 to 29 years older, ii) adults 30 to 59 years older and iii) adults aged 60 years and older.

Following the methodology proposed by IPEA (2006), we estimate three effects responsible for changes in *per capita* family income in each micro-simulation round. They are: the marginal change in the distribution of adults according to age; the marginal change in the family income distribution per adult according to age; and the interaction between the two marginal changes plus other sources of variation non-explained. We measure each of these effects based on the construction of a random variable x, which bears the order of each family in the distribution of the age groups. We then assign, randomly, values of family income observed in three years of data according to the random variable x, to measure the effects discussed above. The random assignment of families protects our results from being biased by heterogeneity among families.

In the case of income inequality we chose to summarize the effect of changes in the age distributions by means of the Gini coefficient. For poverty rates we used the proportion of people with per capita family income lower than ¼ of minimum wage (extreme poverty).

Results

The level of inequality did not change significantly in Brazil, between 1985 and 1995, rising only slightly from 0.595 to 0.599. The first simulation, which divides the population into two large age groups (children and adults) shows that increasing the proportion of adults to the 1995 levels, while holding everything else constant, would reduce the Gini coefficient by 0.0061. However, other forces have buffered the favorable pure demographic effect. For example, when we varied only the income levels, the inequality got worse by 0,0053. In addition, all other unexplained sources of variation, including the effects of interaction between income and demographic changes, increased the Gini coefficient by 0,0043.

In the following decade (1995-2005), the pure demographic effect pushes down the inequality level even further, by 0,0049; 15% of the total reduction in the Gini coefficient over this period. Contrary to the previous decade, however, varying income alone, while holding everything else constant, produced the largest negative effect on inequality: about 103% of the total decline of the Gini coefficient. All other factors acted in the same way as in 1985-95 by making the income distribution worse.

The simulation results can be interpreted easier by plotting the proportional changes in adults and in mean income levels by income groups. Figure 1 shows the proportion of adults by income deciles, from 1985 to 2005. Although the relative number of adults increased for all income groups, the proportional change was largest among the poorest, which is consistent with the results from our micro-simulations. Between 1985 and 1995, for example, the proportion of adults increased by 8% in the two lowest deciles compared to only 4.5% among the two highest.

Figure 2 confirms that the role played by income changes varied from a regressive pattern in 1985/1995 to a strongly progressively pattern in 1995/2005. In the first decade, for example, the increase in the mean income of the poorest decile was only half as large as the one for the higher deciles. In 1995/2005, on the other hand, the development of social policies based on conditional cash transfers directed to the poor, changed the picture completely: the poorest had positive income gains of about 20%, while the wealthiest saw their income stay stagnant or even reduce.

As mentioned earlier, having only two age groups (children and adults) makes the demographic dimension too crude. Therefore, in the second simulation, we increased the number of age groups, from two to four (children, young adults, adults and elderly) in order to control for additional age compositional effects. Not surprisingly, the new simulation revealed lower effects for the pure demographic changes on income inequality when compared to the first one. Holding everything else constant and varying only the proportion of adults, the favorable effect of the demographic transition estimated in the first simulation, became 57% and 67% lower, respectively, for 1985/1995 and 1995/2005. Differences in the stages of the demographic transition among population subgroups explain these results. As Figures 3 to 5 depicts, during the 1985-2005 period, much of the relative change in the proportion of adults among the poor was due to increases in the proportion of people ages between 15 and 29 years old, who are the ones with the lowest average income among adults. At the same time, the proportion of elderly was increasing much faster among the wealthiest. Thus, the higher support ratios among the poorest families did not represent, at least until

2005, significantly higher economic support. It is reasonable to expect, however, a convergence in the results from the two simulations in the years to come, as the poorer families advance in the demographic transition.

We ran the same simulations to disentangle the effects on extreme poverty. According to Table 2, the proportion of the Brazilian population living below the extreme poverty line was reduced dramatically, from 9.167 to 4.827, between 1985 and 2005. During the first decade (1985-1995), all the simulated effects acted in the same direction by reducing the poverty rate. However, the first simulation (with two age groups) predicted that changes in the proportion of adults were responsible for almost the entire decline (95%), while income changes and other factors explained, respectively, only 4% and 1% of the variation. As expected, in the following decade, because of the redistributive policies that were implemented in Brazil, the effect of income changes increased substantially and accounted for about 60% of the total decline. Yet, the pure demographic effect remained important, being responsible for another 60% of the observed negative variation.

The decomposition of the proportion of adults by age groups (simulation 2) did not change the results significantly. Yet, in both decades, the increasing proportion of younger adults among poorer families, made the demographic effect to be less strong than in the first simulation: 40% of the decline in the 1985/95 period, and 18% in 1995/2005. However, it should be noted that the loss of impact of the demographic changes was not much significant for the poverty measure than it was in the case of the Gini coefficient. For extreme poverty measures, only the first deciles of the income distribution matter, which explains these findings.

Discussion

The proportion of adults per household started to increase in Brazil in the 1970s, with the steady decline in birth rates. In the last decades, other demographic forces, such as higher longevity, larger proportion of divorces and the higher economic dependency of the youth as well the increasing financial autonomy of the elderly have reinforced this compositional change. The decline of dependency ratios has been more pronounced within poorer families, reducing inequality and poverty levels.

As we showed in our simulations, proportional changes in the number of adults have reduced significantly the poverty rates between 1985 and 1995. At the same time, while it has also contributed for the improvement in income distribution it was not able to buffer the faster increase of income among the wealthiest families. In the following decade (1995-2005), the demographic effects were even stronger, since the ongoing population aging process changed the composition of adults among the poorer families, from younger to older individuals, who have higher income. Over this period, however, the role of the demographic change lost relative importance to the effects of social policies that promoted progressive income transfers.

Our findings have at least one important policy implication. The population aging process currently in progress in Brazil, combined with the strong social protection mechanisms available for the elderly will result in even better income distribution and poverty alleviation in the future. This is true particularly if we consider that there is more room left for population aging among the poorer than the wealthier. However this result depends on two main challenges: to keep the current flows of public transfers to the elderly, even under the strong fiscal pressure coming from the population aging, and guarantee that old people reallocate resources within families. The tendency of elderly people living alone may compromise the private transfers to younger members of the family.

Our results have several limitations, however. Many demographic factors were excluded from our simulations and should be included in future analysis. For example, differences in the composition of households by gender play an important role to poverty rates and income distribution since single mother and widow households usually have lower income than the average household; the number of these two types of households is growing in Brazil. In addition, there are large wage differences by educational attainment. Thus, given the recently significant changes in the educational profile of the Brazilian population, one should examine how it has affected income distribution.

With regard to the methodological limitations, one should note that our counterfactual simulations measure only the first order effects of demographic variables and adult income. Income and demographic composition, however, are known to be correlated. There is considerable literature examining the effects that changes in income, including non-labor income, exert on the decisions regarding the union and dissolution of families. Also, changes in income affect both mortality and fertility rates, which are other closely-related determinants of household composition. On the other hand, changes in the number of offspring, life expectancy and household mobility are not neutral regarding the choice between leisure and work, and the supply of labor, affecting the available income for the families. There are also institutional aspects, such as development of social security programs, which may simultaneously affect demographic composition and adult income. Our simulations do not, therefore, take into consideration any inter-relations among demographic variables or between them and income of adults.

From a methodological point of view, however, our results demonstrate the usefulness of micro-simulations in studies that combine demographic and economic variables to examine changes in socioeconomic differences among individuals or families in a population. Compared to the usual macro-simulations, the micro approach is much less limited in measuring the variations in the distribution of attributes across the population. Also, the use of counterfactual simulations is simple and instructive, measuring each effect individually in complex and multifactorial events.

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Table 1 – Demographic and Income Effects on Inequality in Brazil, 1985-2005

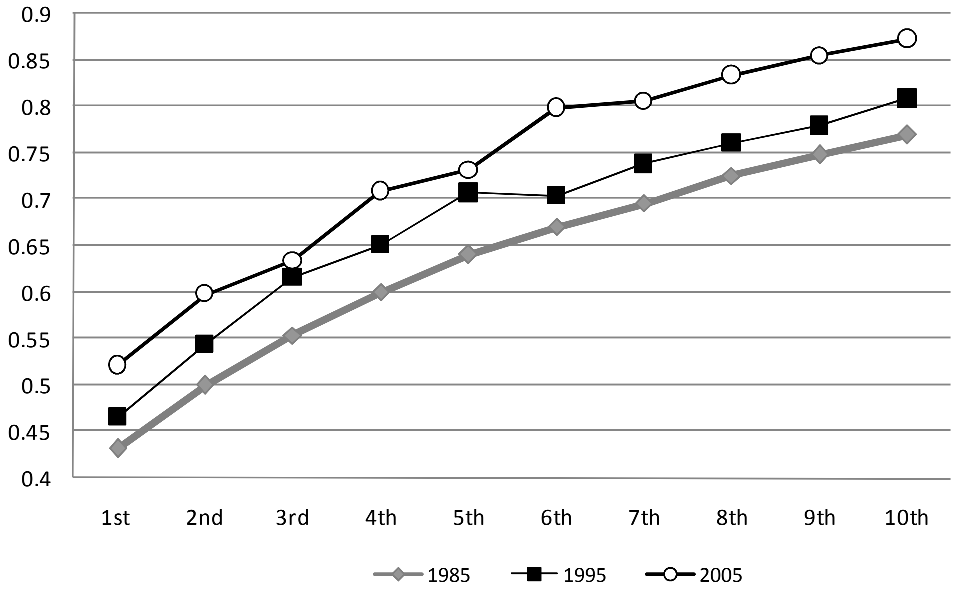
	Simulation 1 (two age groups)		
	1985-1995	**1995-2005**	**1985-2005**
Gini at the start of the observation period	0,5955	0,5990	0,5955
First order effect of demographic changes	-0,0061	-0,0049	-0,0103
First order effect of changes in income levels	0,0053	-0,0339	-0,0284
Higher order effects plus other sources of unexplained variation	0,0043	0,0060	0,0095
Gini at the end of the observation period	0,5990	0,5662	0,5662

	Simulation 2 (four age groups)		
	1985-1995	**1995-2005**	**1985-2005**
Gini at the start of the observation period	0,5955	0,5990	0,5955
First order effect of demographic changes	-0,0004	-0,0007	0,0003
First order effect of changes in income levels	0,0001	-0,0397	-0,0362
Higher order effects plus other sources of unexplained variation	0,0039	0,0076	0,0067
Gini at the end of the observation period	0,5990	0,5662	0,5662

Table 2 – Demographic and Income Effects on Extreme Poverty in Brazil, 1985-2005

	Simulation 1 (two age groups)		
	1985-1995	**1995-2005**	**1985-2005**
% extreme poor at the start of the observation period	9,167	7,269	9,167
First order effect of demographic changes	-1,809	-1,369	-3,143
First order effect of changes in income levels	-0,073	-1,458	-1,423
Higher order effects plus other sources of unexplained variation	-0,016	0,385	0,225
% extreme poor at the end of the observation period	7,269	4,827	4,827
	Simulation 2 (four age groups)		
	1985-1995	**1995-2005**	**1985-2005**
% extreme poor at the start of the observation period	9,167	7,269	9,167
First order effect of demographic changes	-0,760	-0,451	-1,014
First order effect of changes in income levels	-0,356	-1,935	-2,192
Higher order effects plus other sources of unexplained variation	-0,782	-0,057	-1,134
% extreme poor at the end of the observation period	7,269	4,827	4,827

Figure 1 - Proportion of adults by income deciles, Brazil, 1985-2005



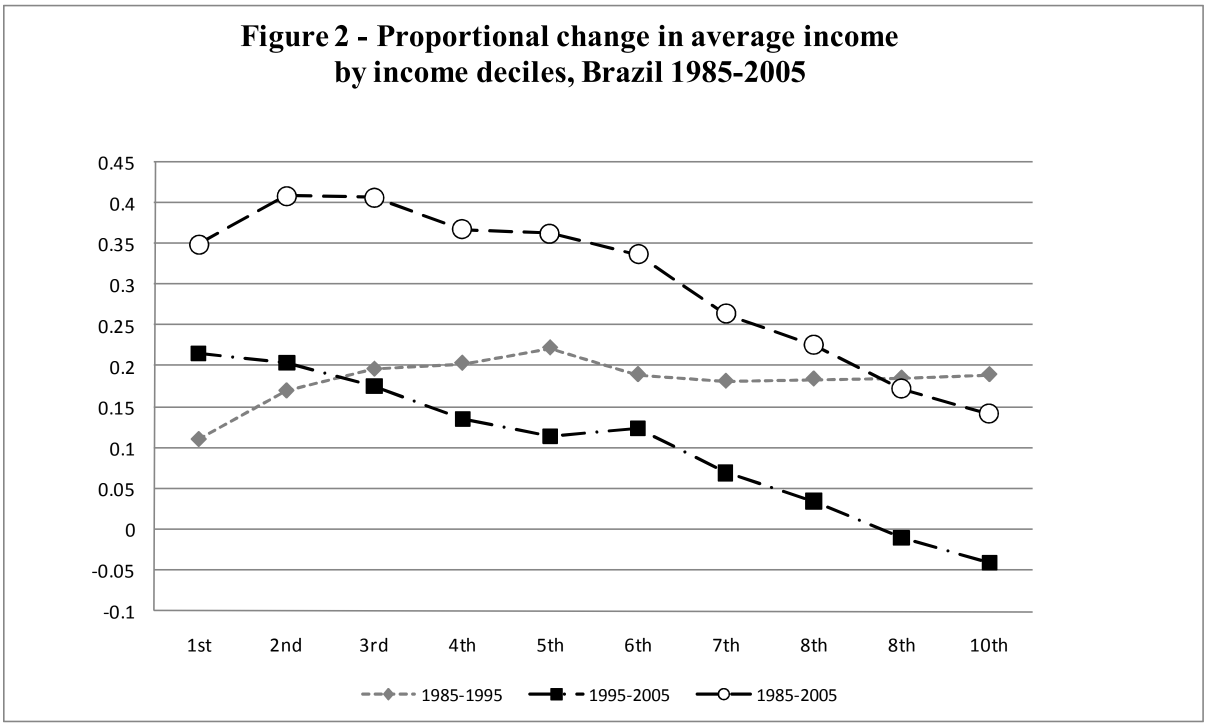


Figure 2 - Proportional change in average income
by income deciles, Brazil 1985-2005
0.45
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
-0.05
-0.1
1st
2nd
3rd
4th
5th
6th
7th
8th
8th
10th
1985-1995
1995-2005
1985-2005

Figure 3 - Proportion of 15-29 years old adults by income deciles, Brazil 1985-2005

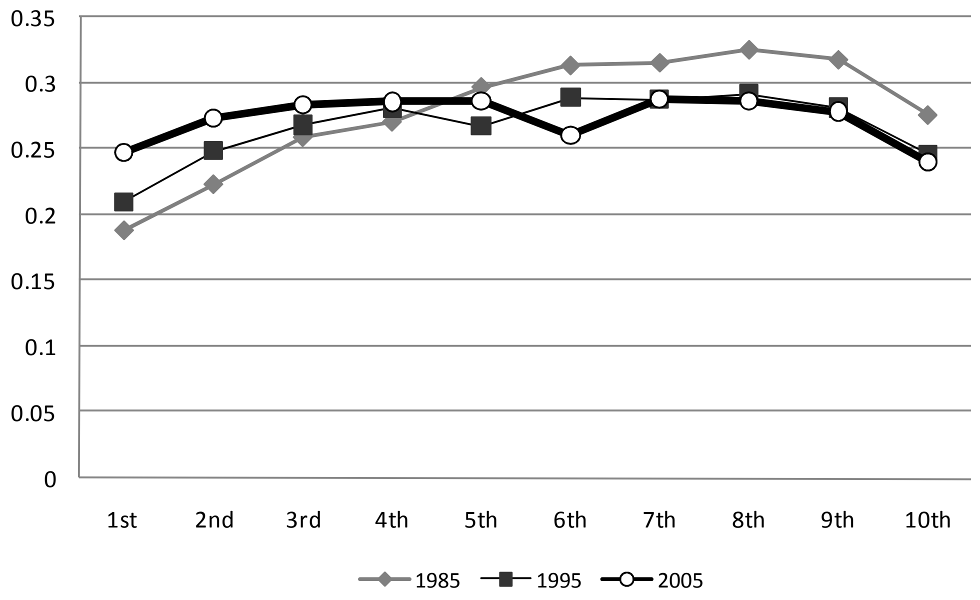
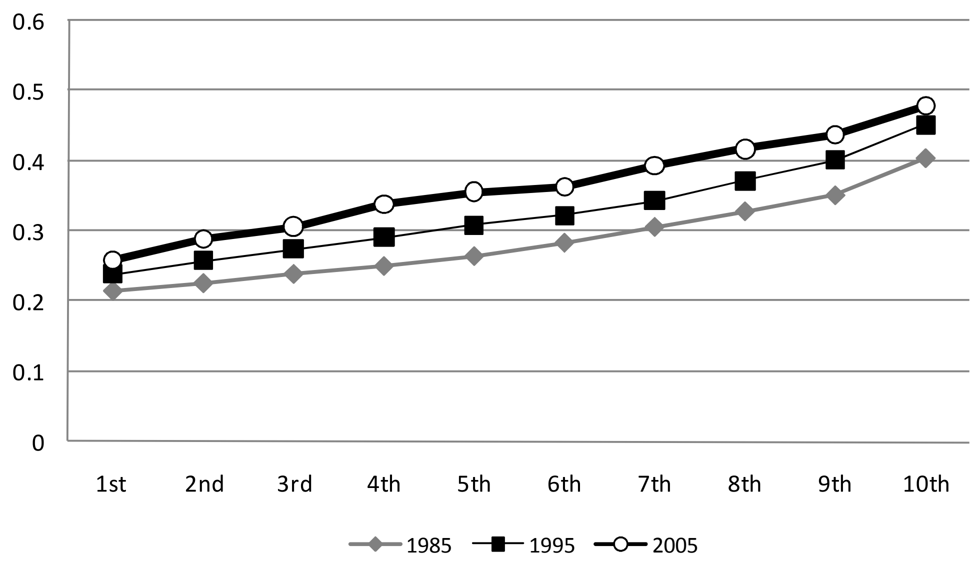


Figure 4 - Proportion of 30-59 years old adults by income deciles, Brazil 1985-2005



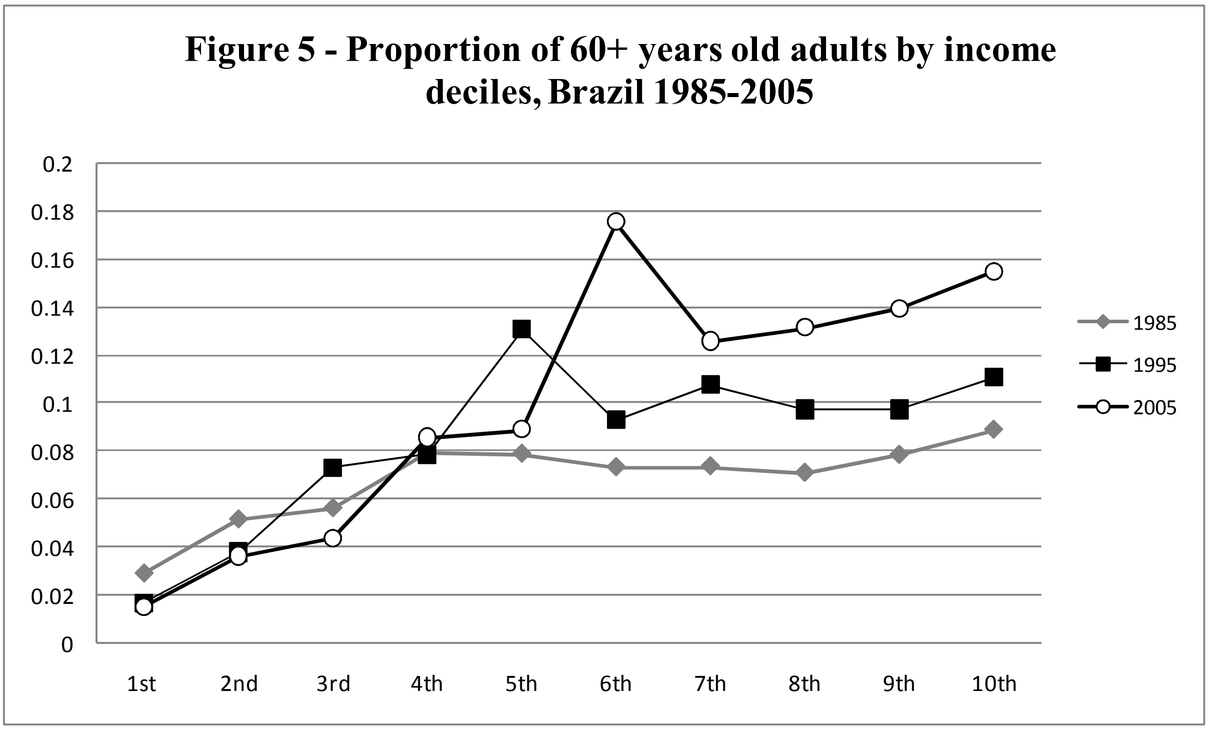


Figure 5 - Proportion of 60+ years old adults by income deciles, Brazil 1985-2005
0.2
0.18
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
1st
2nd
3rd
4th
5th
6th
7th
8th
9th
10th
1985
1995
2005