

Demographic Dynamics of Poverty and Income Inequality in Brazil^{*}

Jerônimo Oliveira Muniz[†]

Abstract

There is a common belief that higher reproduction rates among the poor will increase average poverty levels, drive inequality up, prevent economic development and reduce upward mobility. To test this hypothesis we use 1980, 1991 and 2000 Brazilian Census data. We first present rates of demographic growth among subpopulations with different levels of income (poor, middle and rich classes) and then 1) evaluate the impact of differential demographic rates on the future size, composition and growth of income classes and on the distribution of income through population projections, and 2) conduct stable population analysis, which demonstrate the long-term implications of maintaining or changing current demographic patterns to the composition of poverty and inequality.

Keywords: poverty; inequality; reproduction; fertility

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BACKGROUND AND SIGNIFICANCE.

Previous literature has sought to understand how differences in reproductive rates impact population growth and the distribution of traits in the long-run (Preston and Campbell 1993). In a seminal paper published in 1986, David Lam called attention to the impact that differential demographic rates and population composition could have on the distribution of income. Using Brazil as an empirical example, he concluded that differential fertility and mobility have distinct effects on income distribution depending on which inequality measure is used (i.e. coefficient of variation or log variance of income). Lam's article sheds light on the "ambiguous" effects of differential fertility and population composition on inequality measures, and subsequent studies have demonstrated the same (e.g., Chu and Jiang 1997; Cowell and Jenkins 1995; Croix and Doepke 2003; Jenkins 1995; Shorrocks and Wan 2005).

The lesson to be learned from these articles is that in order to understand how inequality is created and maintained over time, one must address the relationship between income distribution and the reproduction behavior of particular income groups. One must examine the process by which a socioeconomically differentiated population reproduces itself (Chu and Koo 1990; Mare 1997). This is important for two reasons.

First, because it has been argued that income inequalities in developing countries are caused by high population growth and that high population growth rates in most developing areas are due to the high reproductive rate of the poor (Brockenhoff and Brennan 1998; Chu and Koo 1990: 1135; Kremer and Chen 2002: 228). The mechanisms through which differential population growth translates into income inequality is a result of the allocation of fewer resources to classes with higher reproduction. Where reproduction and income is low, individuals will receive a smaller share of resources than in classes where there are fewer people but relatively more income. Inequality results from this differential allocation of income, where many people get few and few people get many. As a corollary, as class specific reproductive rates converge, inequality should decline. This reasoning supports family planning programs that might help to alleviate poverty and reduce inequality.

Second, analyzing how different socioeconomic groups reproduce over time indicates their potential for future growth and elucidates how individual income classes combine to generate inequality in the total population. This type of analysis is relevant to evaluate the impact that distinct mortality and fertility regimes may have on the composition of poverty and income inequality. Although it is not surprising that the poor have higher birth rates than the middle and rich classes, this pattern does not necessarily imply in greater rates of growth since the poor are also subject to higher mortality rates. Thus, it is important to account for fertility and mortality rates corresponding to different levels of income in order to determine population growth.

To my knowledge, only two studies have done this exercise using empirical evidence from Brazil. Wood and Carvalho (1988) and Camarano and Beltrão (1995) estimated fertility, mortality, natural and intrinsic growth rates by household income in Brazil between 1960 and 1980. This chapter uses these as a point of reference to build knowledge, but it differs from them in two aspects. First, it provides more recent descriptive estimates of income-specific fertility and mortality rates for Brazil in the last three censuses. Second, it offers side by side comparisons of mortality and fertility rates by income using alternative demographic methods that use the same data source. In particular, it estimates fertility using two different methods: Brass indirect method of fertility (e.g. P/F method) and the own children method (Cho, Retherford and Choe 1986) for estimating age-specific fertility rates. Mortality is estimated

by combining three indirect techniques: Brass indirect method of childhood mortality (Brass et al 1968), a variation of his method to adult mortality (Hill and Trussell 1977), and the Brass (1971) relational model based upon a logit transformation of Brazilian standard life tables.

This article advances our understanding on the reproduction of inequality by providing current estimates of Brazilian reproductive rates from 1980 to 2000, and by offering comparative estimates that rely on alternative and robust indirect demographic methods.

DATA AND METHODS.

Data.

The variables required for the analysis are: age, sex, children ever born, children surviving, year and month of the last birth, orphanhood status and family income per person. The working dataset includes special tabulations of these variables for the 1980, 1991 and 2000 Brazilian Censuses produced by the *Instituto Brasileiro de Geografia e Estatística* (IBGE). The Brazilian censuses are publicly available at IPUMS International website (Ruggles et al 2004). Unlike the vital registration system, census data contains a wide range of information about individuals such as their income, educational attainment, family organization and composition, place of residence, number of children ever born and number of children who were alive at the date of the census. Individual-level data can thus be used to generate demographic rates-specific to different socioeconomic groups of the population (Wood and Carvalho 1988: 9).

Mortality and fertility rates are estimated for three groups: poor, middle and rich classes. The poor class corresponds to 33 percent of the population in the bottom of the income¹ distribution of 1980, the one percent of the population at the top of the income distribution represents the richest, and the middle class is the remaining population in between. The poverty line is thus defined by the value separating 33 percent of the population with lowest per capita family income². This value is low enough to avoid any controversies about who is poor and is compatible with the popular perception of what represents an “insufficient” income to survive. Using data from the Northeast and Southeast regions of Brazil, Medeiros (2005: 120) reports that 83 percent of the population considers the estimated poverty line of R\$80.42 per capita³ as “insufficient to cover the living expenses (85%) and the purchase of food (49%) for the family.

In sum, because of its methodological simplicity, the three income classes are defined as:

- Poor class: 33 percent of the population at the bottom of the family per capita income distribution. The value R\$80.42 is the upper limit of the poor class;
- Middle class: population between the 33rd and 99th percentiles of the income

¹ We use per capita family income, which takes into account all the sources of income within the family, the number of people and the role of the family as a solidary unit of consumption and earnings (Rocha 2000). Family per capita income “corrects” for family size as the total income is shared equally among all the family members (Datta and Meerman 1980). A similar measure, per capita household income, has also been utilized in other studies of inequality (Ferreira and Barros 1999; Fiorio 2006; Firpo, Gonzaga and Narita 2003; Pero and Szerman 2005) and provides similar results. Gross monthly family income per capita is measured in January 2002 Brazilian *Reals*. The Brazilian INPC and IGP official consumer price index are used to convert current incomes into real ones (Corseuil and Foguel 2002).

² Official poverty lines do not exist in Brazil. Studies have not agreed on the best methodological procedures of measuring poverty (Rocha 2000; Ferreira, Lanjouw and Neri 2000; Neri 2000). Some studies suggest that a poverty line should not even be implemented in Brazil because it would create an inflexible yardstick to implement compensatory policies (e.g. Schwartzman 2002).

³ This value was equal to \$44.5 per month on October 2007.

distribution;

- Rich class: one percent of the population at the top of the family per capita income distribution. Individuals with per capita family income higher than R\$2,374 are considered rich.

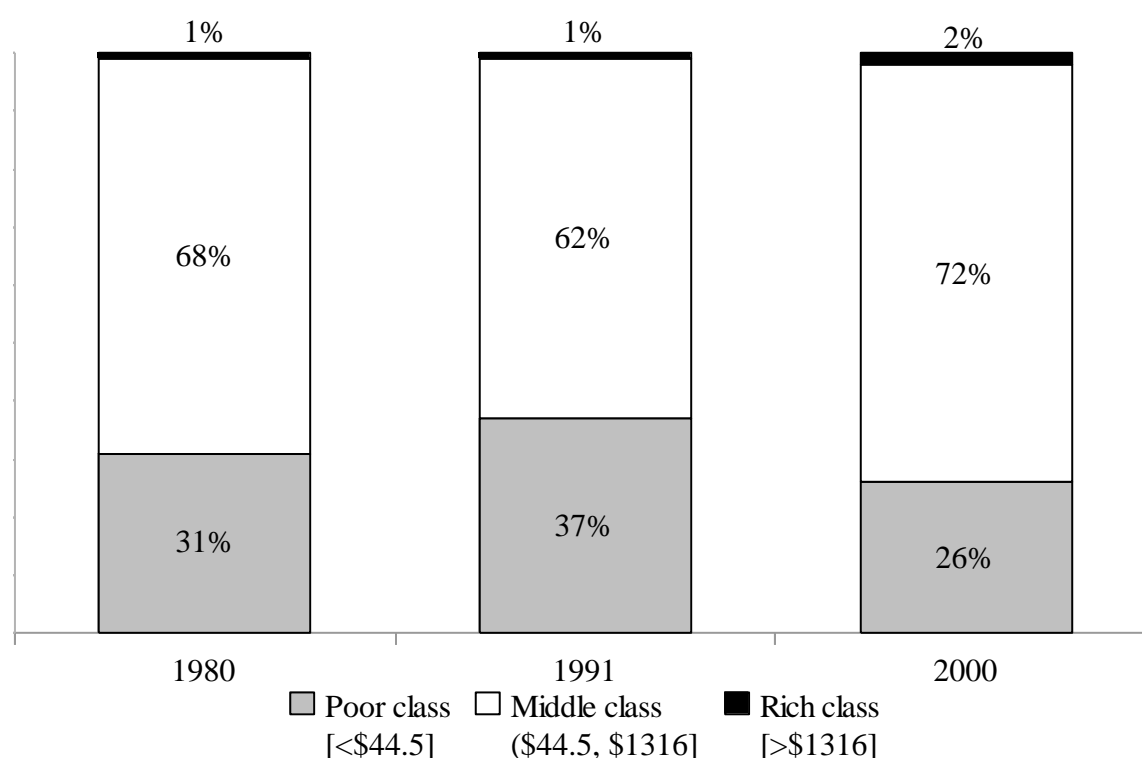
The main function of imaginary lines defining the poor and the rich is to discriminate broad but relatively homogeneous social groups to allow the study of their characteristics rather than to generate a criterion to implement and execute distributive public policies of any kind. In the absence of official and consensual definitions for what “economic classes” mean, it seems reasonable to avoid a series of contestable presuppositions and to understand the definition of class as a simple instrument required to an analytical end. It is preferable to adopt a criterion that is at the same time easy to implement, relevant to the object of study and compatible with previous studies than to struggle with alternative class schemes whose validity is debatable and at best conditioned on the goal of analysis.

In sum, my definition of “social/economic class” follows a sociological agreement according to which social classes should characterize homogeneous groups, be meaningful for analytical purposes and relatively comparable over time (Grusky and Sorensen 1998; Hauser and Warren 1997; Sorensen 1991; Wright 1997, 2005). My definition of class fulfills these requirements and does not change over time. It does not change between 1980, 1991 and 2000. Once I define the poor as 33 percent of the population at the bottom of the income distribution in 1980, I use the absolute value separating this same 33 percent in 1980 to define the poor in 1991 and in 2000 as well. Example: In 1980, R\$80.42 (about \$44.5) defines the poverty line. In 1991 and in 2000, R\$80.42 per capita is the same value used to define the poverty threshold. As a result, the size of the population in the poor class changes over time, but the definition of who is poor remains the same. The same logic follows for the rich and middle classes. Thus, the cutting points used to identify social classes do not change over time, but the share of population in each one of the “classes” does. This change is exactly what I want to analyze in order to infer demographic fluctuations in the size of the three classes. Needless to say, all income values are real, not current, and hence comparable over time.

After excluding missing and zero income values⁴, the final distribution of people in each social class and year looks as follows:

⁴ Missing and zero income values accounted for 3.5% of the total sample in 1980, 3.35% in 1991, and 6.54% in the 2000 Brazilian Census.

Figure 1. Population distribution by income class in Brazil, 1980-2000



Source: 1980, 1991 and 2000 Brazilian Censuses

Figure 1 shows that the proportion of people living below poverty was 31 percent in 1980, increased to 37 percent in 1991 and then declined to 26 percent in 2000. The rich population remained relatively stable, while the middle class declined to 62 percent and then increased to 72 percent in 2000.

Estimating fertility rates.

Income-specific fertility rates are calculated using indirect methods developed by Brass et al (1968) and the “own-children method” of fertility developed by Cho et al (1986). The indirect method requires two types of information: (i) the number of children born in the last twelve months, which is a measure of current fertility, and (ii) the number of children ever born, or parity, which is retrospective information less subject to memory error. The current fertility rates of women 15-49 years old provide the age pattern of childbearing. But because of the effects of reference period error – women may not respond with the correct time span in mind when asked about the children born in the last twelve months – an adjustment must be made by a factor equal to P/F , where P is parity to women 20-29 years old and F is the sum of age-specific fertility rates for women of the same age. The rates represent, therefore, the childbearing experience of women 20-29 years of age who had a given level of per capita income on the census date.

The alternative to estimate income-specific fertility rates is the own-children method. The advantage of this method is that it (i) provides detailed age-specific estimates by single years of age and any socioeconomic characteristic (i.e. income); (ii) only one census is required to generate estimates to even fifteen years prior to the census; (iii) the population does not have to be closed to migration, and (iv) the method is relatively insensitive to recall errors (Feeney 1975). The logic of the method consists in estimating the number of women

(denominator) and births (numerator) by age and age of mother in each year who were living in the same family and who had a mother-child tie. Age-specific fertility rates can then be estimated by the division of the number of births by the mean number of women at each single year of age for each year preceding the census (Cho et al 1986). Miranda-Ribeiro (2007) applied the own-children method to estimate fertility rates in Brazil and its states in 1980, 1991 and 2000. She did not look at fertility differentials by income, but her results for the entire country are reassuring because they are similar to the ones reported in this article.

After cross validating the fertility estimates using these two methods, final estimates of class-specific fertility will be obtained by averaging the rates in 1980, 1991 and 2000. Age specific fertility rates are estimated for inter-censal periods (1985 and 1995) by linearly interpolating age-class-specific fertility rates between two census periods.

Estimating mortality rates.

The estimation of income-specific life expectancies requires the calculation of life tables for each income category (poor, middle, rich). To retrieve these tables I combine estimates of infant and adult mortality using the logit relational system suggested by Brass (1971). The relational model consists in combining income specific mortality estimates by age with a previously defined general mortality standard describing the mortality experience of that population at every age. In this analysis I use Brazilian standards of mortality in combination with indirect estimates of adult and child mortality to retrieve five-year life tables for each income class.

Brass' method of indirect child mortality estimation is based on the number of children ever born and the number of children surviving by age of mother (Brass et al 1968). "The proportion of children surviving among children ever born to women aged 20-24, 25-29 and 30-34, when multiplied by the proper correction factors, yield estimates of the probability of death at exact ages 2, 3 and 5. These values correspond to the ${}_xq_0$ life table function (in this case ${}_2q_0$, ${}_3q_0$, ${}_5q_0$)" (Wood and Carvalho 1988: 263). Infant mortality estimates represent the first component towards the estimation of a full income specific life table.

The other component used to retrieve a full life table is an estimate of how mortality will look at older age cohorts. The logic of the method is similar to the one used in childhood mortality estimates but consists in converting proportions non-orphaned into conventional probabilities of surviving. The details of the method are provided by Hill and Trussell (1977) and summarized by Preston, Heuveline and Guillot (2001: 233-237).

Estimated values of child and adult mortality are representative indicators of mortality levels for different ages (i.e. different cohorts born in different years) and are associated with a full life table that can be obtained in combination with a pre-defined mortality pattern for both sexes. The selected mortality pattern reflects the mortality experience in the general Brazilian population, but the final specific mortality standard reflects the mortality experience of each income class since it is adjusted by estimated levels of child and adult mortality calculated through indirect methods. So even if the income specific mortality pattern departs from the Brazilian one, this would not invalidate the primary focus of analysis, which is on relative differences between income groups rather than on absolute levels of mortality. The combination of child and adult mortality estimates with the general Brazilian standards guarantees that differences in mortality levels will exist even when the standard employed to combine these estimates is the same.

The main caution about using mortality estimates by income classes is that survival probabilities can be distorted if mobility took place from one level of income to another. A woman may have been recorded as belonging to income class (i+1) in 1990, but if she was upwardly mobile in the last ten years or so, the mortality of her children could correspond in reality to income level (i) (given the retrospective nature of the child mortality measure). This

bias, however, is minimized with fewer income categories. The use of only three income categories (poor, middle and rich) decreases the susceptibility of mortality estimates to this mobility bias. More disaggregated estimates of mortality are more likely to be influenced by the mobility bias, and should be interpreted with this caveat in mind.

Population projections by age and income class.

The projection of the poor, middle and rich classes will use the set of fertility and mortality rates estimated for these same classes. The projections are divided by five year age groups and income class, but they are not separated by sex. They also assume that each income class is closed to international migration and to internal migration, that is, the mobility of individuals between classes is not taken into account in the projection models. Since the economic status of individuals is likely to change over their life cycle, I do not expect to obtain projections that are compatible with what is actually reported in the end of the projection period. The goal of this exercise is to show how population would look “if only” fertility and mortality were influencing population dynamics. Projecting the size of income classes with only fertility and mortality rates is a valid exercise to inform and highlight the separate roles of social mobility and differential fertility and mortality in affecting future population growth. Therefore, only differential fertility and mortality rates are considered in the dynamics of growth and distribution of the poor, middle and rich classes. Comparing projected and reported populations will show how much social mobility influences the size of specific income classes.

I use the cohort component method to project income subgroups with specific fertility and mortality changes over time in each class. The parameters of the cohort component method are expressed in compact Leslie matrix form (Leslie 1945, 1948). To illustrate how fertility and mortality of specific income classes can be expressed in matrix form I provide an example for a single population and then I show how it can also be used to combine the three subpopulations of interest.

For a single population, the general model surviving an age distribution forward through time may be expressed by a summation of matrices multiplication according to the equation below:

$$\mathbf{W}^t = \mathbf{S} \mathbf{W}^{t-1} + \mathbf{M} \mathbf{W}^{t-1} \quad (1)$$

Where:

$$\mathbf{S} = \begin{bmatrix} 0 & b_1 & b_2 & \dots & b_n & 0 & 0 \\ d_{1+1} & 0 & 0 & \dots & \dots & \dots & 0 \\ 0 & d_{2+2} & 0 & \dots & \dots & \dots & 0 \\ 0 & 0 & d_{3+2} & \dots & \dots & \dots & 0 \\ \vdots & \vdots & \vdots & \ddots & \ddots & \ddots & \vdots \\ 0 & \dots & \dots & \dots & d_{n-1} & 0 \end{bmatrix}, \quad \mathbf{W}^t = \begin{bmatrix} W_1^t \\ W_2^t \\ W_3^t \\ \vdots \\ W_{n-1}^t \\ W_n^t \end{bmatrix}, \quad \mathbf{M} = \begin{bmatrix} 0 & 0 & \dots & \dots & 0 \\ m_1 & 0 & \dots & \dots & 0 \\ 0 & m_2 & \ddots & \ddots & \vdots \\ \vdots & \vdots & \ddots & \ddots & \vdots \\ 0 & \dots & \dots & m_{n-1} & 0 \end{bmatrix}$$

w_r^t = population in the r th age group at time t ;

b_r = number of births surviving to the $t+1$ in the r th childbearing age group;

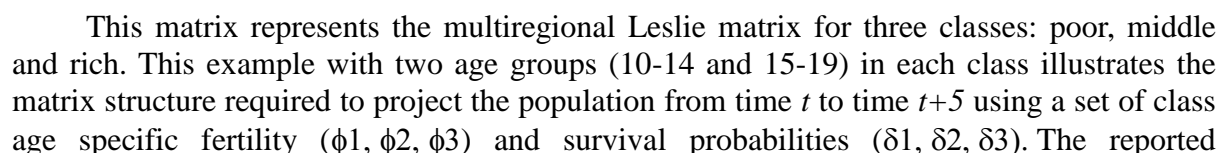
d_r = proportion of people who “survived” between ages r and $r+1$ between t and $t+1$.

m_i = net migration/mobility rate for the i th age group.

Survivorship ratios are stored in the lower diagonal while the average fertility rate for each age group required to survive resulting births are expressed in the first row.

$$\begin{array}{|c|c|c|c|} \hline \text{POOR} & \text{O} & \text{RICH} & \text{O} \\ \hline \text{MIDDLE} & \text{O} & \text{MIDDLE} & \text{O} \\ \hline \text{RICH} & \text{O} & \text{RICH} & \text{O} \\ \hline \end{array} \quad (2)$$

Figure 2. Projection scheme of population dynamics with fertility and mortality



population in time $t+5$ differs from what is projected because at this stage net mobility between classes has not been incorporated into the projection matrix yet.

RESULTS.

This section presents three sets of results. The first set describes class-specific fertility and mortality estimates for 1980, 1991 and 2000 using the methods suggested above. The second set introduces class specific net reproduction (NRR) and stable growth rates. The third set of results compares class specific projected and recorded populations between 1980 and 1990, and between 1990 and 2000 under realistic scenarios of decline in total fertility and mortality rates. Each class specific projection assumes that total fertility has linearly declined over the decade. I average class specific life tables of 1980 and 1991 for the projection between 1980 and 1990. Similarly, the projection between 1990 and 2000 assumes that mortality has remained constant and is represented by the average life table of 1990 and 2000.

Age-specific fertility rates by year and income class.

The sum of age-specific fertility rates multiplied by the size of the age group interval provide a synthetic measure that represents “the average number of children a woman would bear if she survived through the end of the reproductive age span and experienced at each age a particular set of age-specific fertility rates” (Preston et al 2001: 94). Total fertility rates (TFR) are a useful measure because they remove the influence of differences in sex and age structures between different populations.

The fertility estimates using Brass’ indirect method in each year provides estimates very similar to the own-children method. The figure below depicts age specific fertility rates for women at reproductive ages in 1980, 1991 and 2000 by income class and in the total population. The dotted line represents the Brazilian standard of fertility, the traced line corresponds to a third estimate of fertility using Mortara (1949)’s method, and the line marked by little circles corresponds to the average fertility of Brass’s indirect method and the own children method. The estimates using Mortara’s methods are not considered in the calculation of the average fertility because they are not compatible or close to the other results.

Figure 3. Age-specific fertility rates by income class, Brazil, 1980-2000

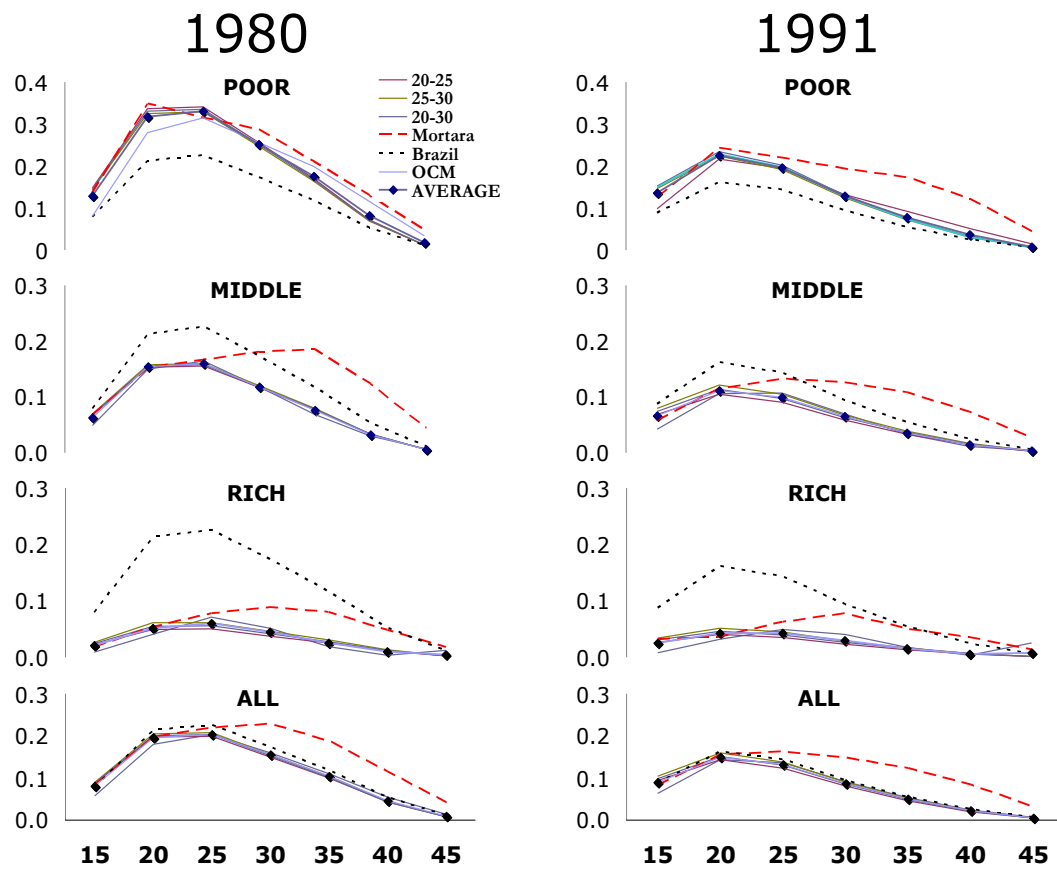
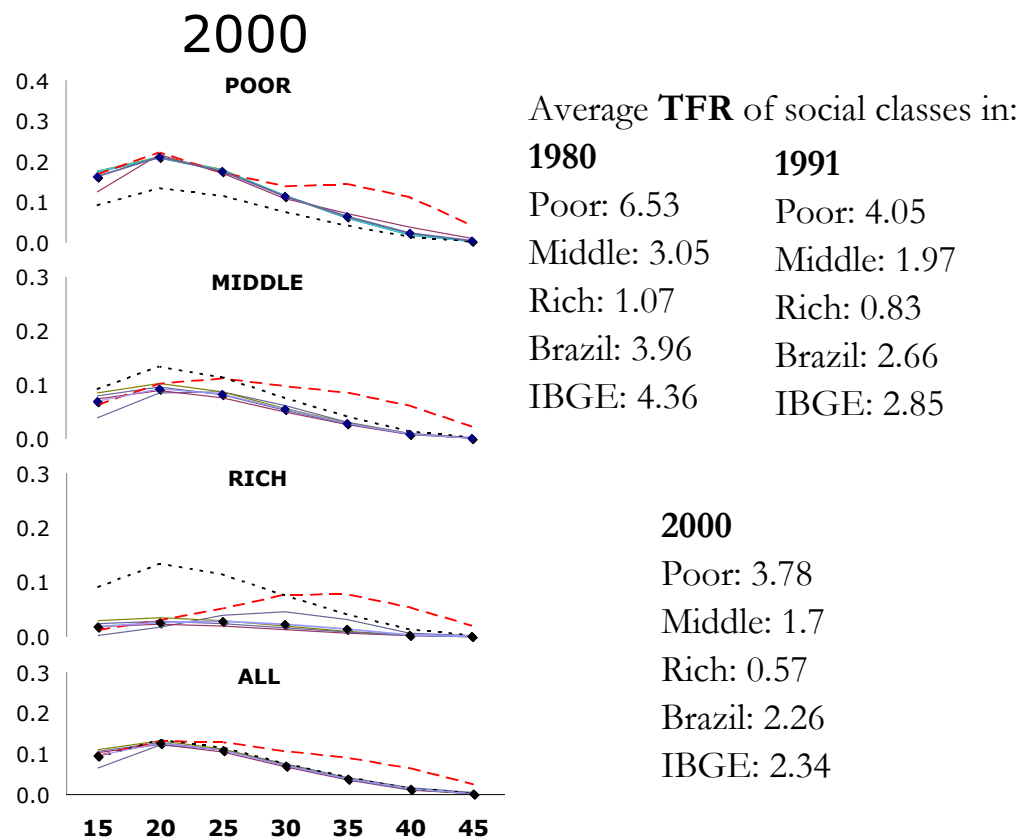


Figure 5. Cont'd.



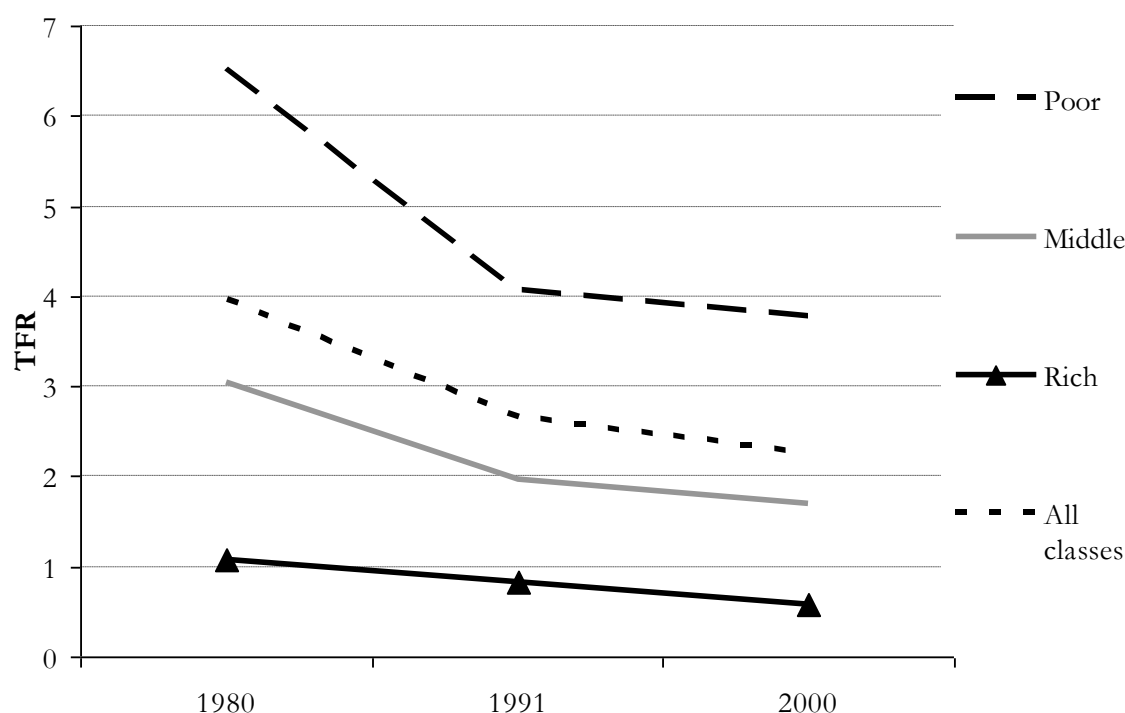
Source: Appendix A

Figure 3 shows two reassuring results. First, the fertility of the poor is above the average Brazilian standard while the fertility of the rich is way below it. In 1980, the average number of children born to women in the poor class was more than two times the total fertility of the middle class, while the fertility of the rich was almost one third of the middle class's fertility. Second, the fertility estimates for the entire country are close to the Brazilian census estimates (e.g. IBGE) and also similar to the estimates by Miranda-Ribeiro (2007), who estimated total fertility rates equal to 4 children in 1980; 2.71 in 1991; and 2.21 children in 2000. The fact that my sample of the censuses used in the estimates considers only individuals who had valid values of income might explain the small differences between their estimates and mine⁵.

The other picture emerging from these estimates shows the speed at which fertility fell in each income class between 1980 and 2000. Graph 1 clarifies that the speed of decline was much faster between 1980 and 1991 than between 1991 and 2000. This decline is particularly evident in the case of the poor class, where total fertility shifted from 6.53 to 3.78 children for every poor woman. In the rich class the decline also happened despite the fact that this class already had levels of fertility below replacement in 1980. Average fertility in the rich class declined from 1.07 to 0.57 between 1980 and 2000.

⁵ Age-specific fertility rates for each income class and for Brazil as a whole are in Appendix A.

Graph 1. Decline of total fertility rates by income class and year



Source: Appendix A

Age-specific mortality by year and income class.

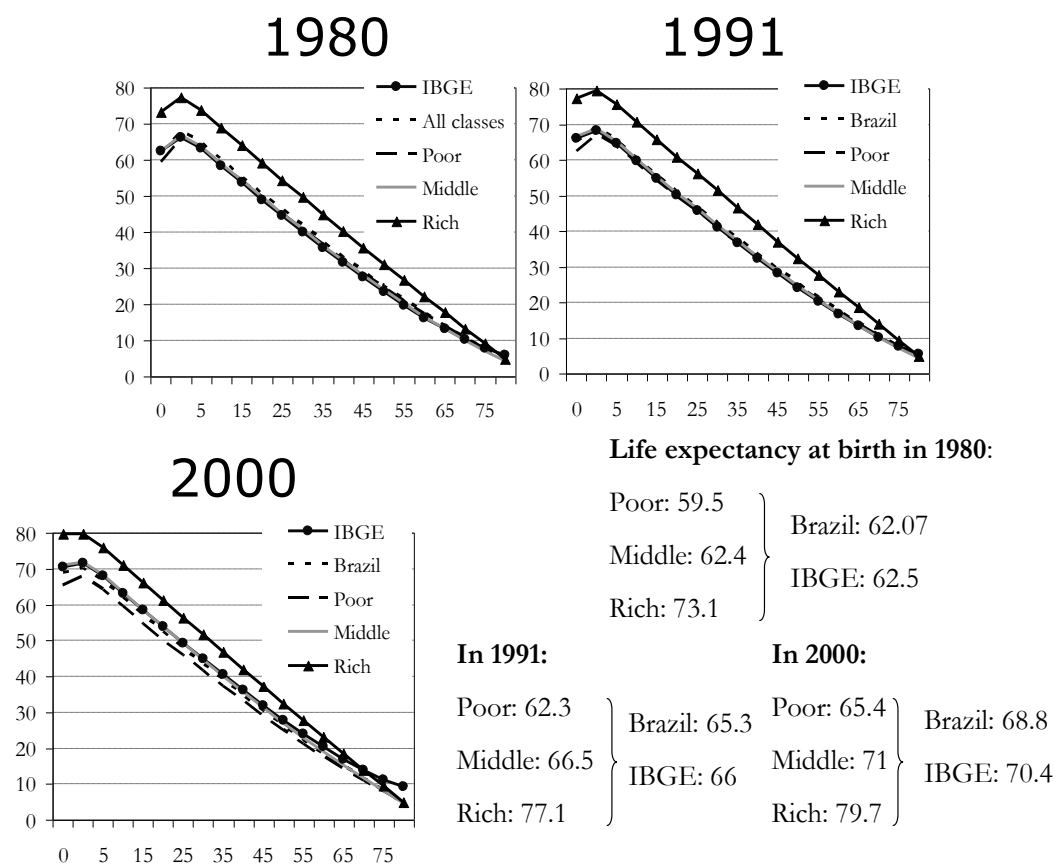
Crude mortality rates are affected by changes in the population age structure, but life tables provide mortality indicators that are not influenced by the age structure and easy to read. It summarizes a population cohort's mortality experience. The most used column of a life table is the expectation of life at age x , which refers to "the average number of *additional* years that a survivor at age x will live beyond that age" (Preston, Heuveline and Guillot 2001: 39).

Life expectancies at birth in Brazil were equal to 62 years in 1980 and increased to 66 ten years later. In 2000 life expectancy at birth increased even more, shifting to 70.4 years according to IBGE official estimates. Overall, life expectancies over the life cycle were very similar for middle and poor classes. In contrast, the rich class had much lower mortality in all age groups, although there is some noticeable convergence at older ages. Only in 2000, the difference between life expectancies became more evident as the gap between poor and rich classes has increased and the gap between middle and rich classes decreased. This result is visually noticeable in

Figure 4⁶.

⁶ Life expectancies and other parameters of period life table by income class and for Brazil as a whole are available in Appendixes B and B1.

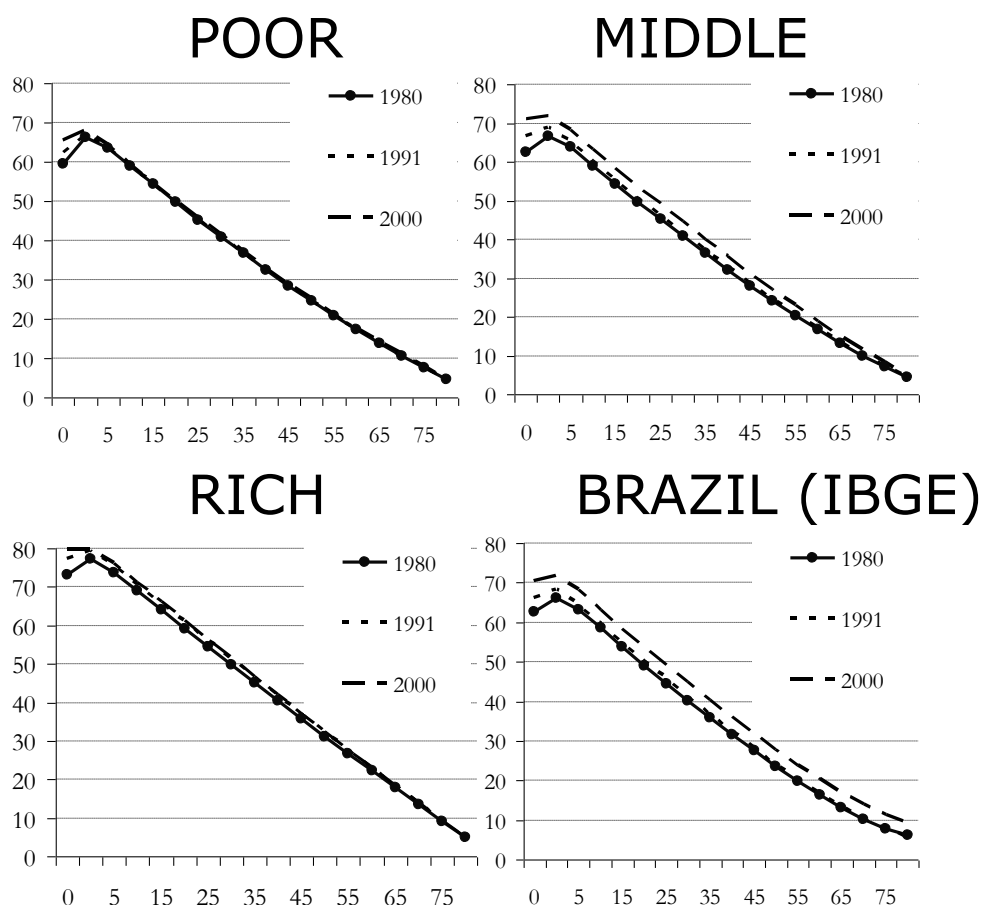
Figure 4. Age-specific life expectancies by income class, Brazil, 1980-2000



Source: Appendix B

The mortality gap in life expectancies at birth between poor and rich classes, which was already large in 1980 – 13.6 years – increased even more in 2000, shifting to 14.3 years. This increase is due to the fact that mortality decreased more among the rich than the poor class during this period. While the life expectancy at birth of the poor increased 5.9 years between 1980 and 2000, the life expectancy of the rich increased 6.6 years. Most of these gains in survivorship happened in the first year of life, regardless of social class. The mortality of children below one year of age fell from 135 deaths in 1950, to 63 in 1980, 42.5 in 1990 and 34 deaths for every thousand children born alive in 2000 (United Nations 2008). Gains in life expectancy in other ages were more significant for the middle class in 2000 (Figure 5).

Figure 5. Increase of life expectancies by socioeconomic class and year



Source: Appendix B

Net reproduction and intrinsic growth rates by year and income class.

This section introduces reproduction measures and the intrinsic growth rate of groups belonging to different income classes in 1980, 1991 and 2000. The first term, “reproduction”, refers to “the process by which new members of a population replace outgoing members, a process that may comprise mortality as well as fertility” (Preston et al 2001: 92). The most important demographic measure of reproduction is the net reproduction rate (NRR). Net reproduction rates take mortality into account to indicate how successive generations replace themselves. It is “the average number of daughters that female members of a birth cohort would bear during their reproductive life span if they were subject to the observed age-specific maternity and mortality rates throughout their lifetimes” (Preston et al 2001). These net rates indicate whether the female population is reproducing or replacing itself, and is usually a good indicator of how fertility and mortality combine to define population dynamics.

Net reproduction rates greater than one mean that a cohort of girl babies will give birth to a generation of daughters larger than their own. In this case the population more than replaces itself from natural increase across consecutive generations. A NRR of one implies that a female population is replacing itself, and a NRR below one indicates that the female population will shrink in size over time if fertility and mortality remain stable over time.

The second term introduced in this section is the intrinsic or stable growth rate. The intrinsic growth rate measures how much population would grow if current fertility and

mortality patterns were to prevail in the future. It represents the annual growth rate that will eventually apply if fertility and mortality remain constant over time. Table 1 shows intrinsic growth rates, crude rates of natural increase, and net reproduction rates for the poor, middle and rich classes in 1980, 1991 and 2000:

Table 1. Comparison between observed and stable-equivalent population parameters

<i>Year, Social Class</i>	NRR	Intrinsic rates			Crude rates		
		<i>r</i>	<i>b</i>	<i>d</i>	<i>CRNI</i>	<i>CBR</i>	<i>CDR</i>
1980							
Poor	2.7583	0.0366	0.0462	0.0096	0.0283	0.0385	0.0102
Middle	1.3476	0.0107	0.0223	0.0116	0.0179	0.0266	0.0087
Rich	0.4973	-0.0239	0.0042	0.0281	0.0050	0.0102	0.0053
1990							
Poor	1.7729	0.0217	0.0310	0.0093	0.0202	0.0288	0.0086
Middle	0.9035	-0.0038	0.0126	0.0163	0.0101	0.0180	0.0079
Rich	0.3863	-0.0329	0.0024	0.0353	0.0015	0.0078	0.0063
2000							
Poor	1.6951	0.0207	0.0295	0.0088	0.0246	0.0304	0.0058
Middle	0.7930	-0.0088	0.0098	0.0186	0.0074	0.0152	0.0078
Rich	0.2784	-0.0446	0.0011	0.0457	0.0011	0.0047	0.0035

Table 1 indicates that the 1990s is the year when the Brazilian middle class would have made a transition to replacement if only fertility and mortality were contributing to the growth of this socioeconomic class (e.g. without considering social mobility between income classes). In 1990 the NRR of the middle class was equal to .903 daughters per woman. The rich class continued to decline, with NRR much lower than 1 (.386). In contrast, the poor was the only class that was more than replacing itself between 1980 and 2000, although this rhythm of replacement has substantially declined from 2.76 in 1980 to 1.69 in 2000, representing a decline of 39 percent.

The discrepancy between intrinsic and crude rates of natural increase indicates how close these populations are from stability. Large disparities between these rates mean that large changes in fertility and/or mortality have occurred in the histories of these populations. If the difference between natural and intrinsic growth is smaller, then past changes in mortality and fertility have not destabilized these population structures. Overall, all income classes have had positive growth since the 1980s, but if mortality and fertility remain stable, rich and middle classes will eventually decline. Table 1 shows that the difference between intrinsic (*r*) and crude rates of natural increase (*CRNI*) is larger for the richest share of the population, which indicates that past changes in fertility and mortality have been more important in affecting the age structure of the rich than of other social classes. The table also shows that the rate of natural increase would eventually fall and become negative for the rich and middle classes if mortality and fertility conditions of 1990 and 2000 were maintained in the future.⁷ In other words, if current demographic rates were to prevail as observed in 1990

⁷ This result confirms the analytical connection between NRR and *r*, according to which NRR lower than 1 also imply in negative intrinsic growth rates. Alfred Lotka demonstrated the relation between intrinsic growth and net reproduction rates in the following way: $NRR = e^{rT}$, where T is the mean length of generation (Preston et al 2001: 152). It is, therefore, not surprising to notice that NRR and intrinsic growth rates have both declined over time.

or 2000, the mortality component would dominate the growth dynamics of the middle and rich classes, and as a result these subpopulations would decrease and eventually head to extinction.

In sum, stable population scenarios such as the ones described in this section are an important tool to evaluate how populations will change if fertility and mortality remain constant over a long time period – about 100 years. For more immediate scenarios, it is perhaps more useful to examine how the population would look had fertility or mortality changed or remained constant for a shorter period of time. Projections offer an alternative to validate demographic estimates and infer the impact of fertility and mortality in a given period of time according to certain assumptions. The next section introduces demographic projections to demonstrate how the poor, middle and rich classes would grow if mortality and fertility were the only forces acting in the population dynamics.

Demographic projections by income class.

Projections are useful to analyze the effects of a set of demographic parameters for population size, composition, and growth. Population projections illustrate the implications of certain demographic characteristics – assumptions about the future course of fertility and mortality – on future population development and parameters over time. The goal of this section is to establish an empirical link between fertility, mortality and reproduction to show how class specific populations would have grown if only mortality and fertility estimated between 1980 and 2000 were dictating the growth dynamics of the poor, middle and rich classes.

The first things to consider in demographic projections are the assumptions of fertility and mortality for the projection period. The level and structure of mortality adopted in the projections reflect the average life table of each period. For the projection from 1980 to 1990, I use the average life table of these years, and for the projection period between 1990 and 2000 I average the life tables of 1990 and 2000. The assumption behind these estimates is that mortality will hold constant and equal to the average life table over each one of these decades. In the case of fertility, I allow a gradual and linear decline for each projection period of five years. Fertility and mortality for the poor, middle, and rich classes are reported in Table 2, where I also show the assumptions for the projection of the total population. These values are the same values reported in Figure 3 and

Figure 4.

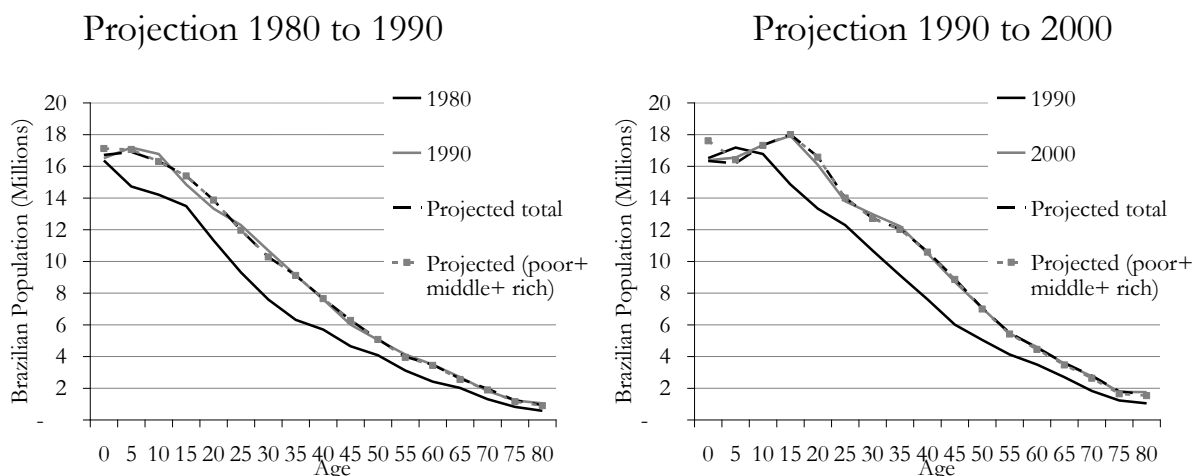
Table 2. Fertility and mortality assumptions by income class, Brazil, 1980-2000

	1980	1985	1990	1995	2000
TFR					
Poor	6.53	5.40	4.05	3.91	3.78
Middle	3.05	2.56	1.97	1.83	1.70
Rich	1.07	0.96	0.83	0.70	0.57
All Classes	3.96	3.37	2.66	2.46	2.26
e^x_0					
Poor	60.93		63.88		65.43
Middle	64.46		68.76		71.01
Rich	75.14		78.43		79.71
All Classes	63.71		67.04		68.76

The first projection period, from 1980 to 1985 assumes total fertility rate equal to 6.53

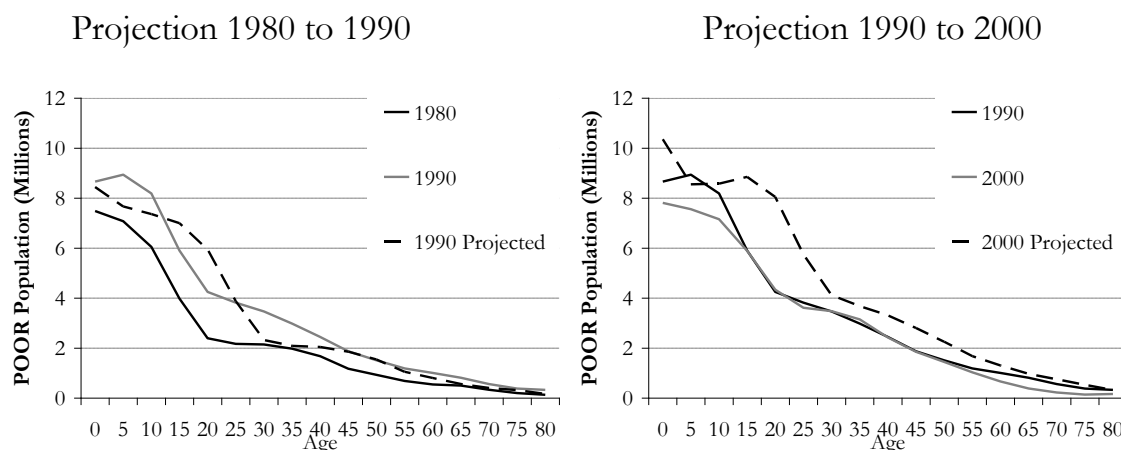
children per women and life expectancy at birth equal to 60.93 years for the poor class. In the subsequent projection period, from 1985 to 1990, the mortality assumption remains the same, but total fertility rate declines to 5.40 children. This decline accommodates a more realistic scenario for the decade than assuming constant fertility over time. The resultant projections for the total population and for subpopulation by income class are in the graphs below.

Graph 2. Projection of total population, Brazil, 1980- 2000

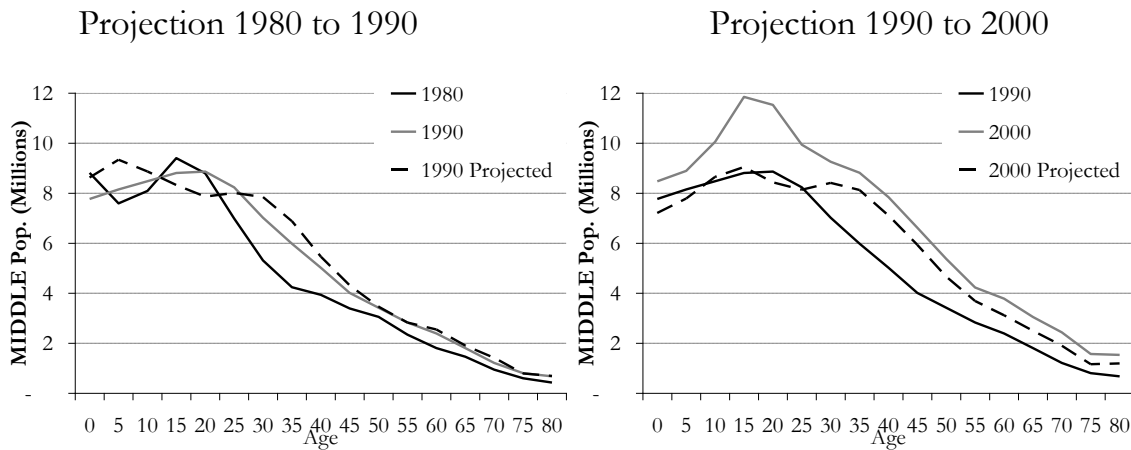


Graph 2 is reassuring for two reasons. First because it shows that the total projected population and the projection resulting from the sum of individual income class projections are very similar. Second because these two projections overlap with the observed populations in almost all age groups. The projections for the total population are accurate and in fact have a smaller error than the official projections conducted by IBGE (IBGE 2004). The small differences between projected and observed populations are due to international migration.

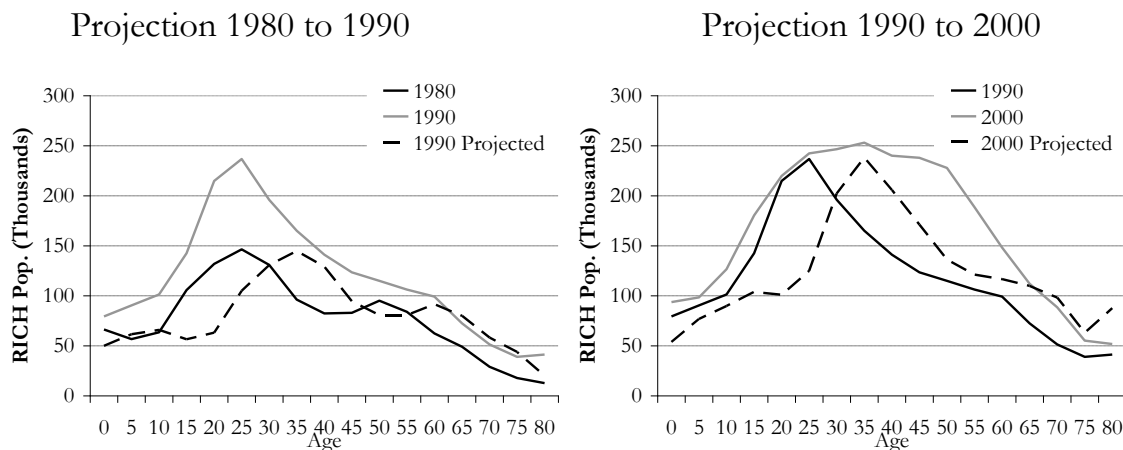
Graph 3. Projection of poor class, Brazil, 1980- 2000



Graph 4. Projection of middle class, Brazil, 1980- 2000



Graph 5. Projection of rich class, Brazil, 1980- 2000



By looking at class specific projections (Graph 3 to Graph 5) the following conclusions emerge:

- 1) Overall, the projections by income class are not as accurate as the projection for the total population;
- 2) The projection of the middle class is the closest to what was observed because this class also represents the largest share of the total population. In contrast, the projection of the rich class deviates from what was observed because it accounts for only one percent of the total population. As a result, the projection of the rich class has a larger margin of error than the projection of the poor and middle classes;
- 3) The discrepancy between projected and observed populations is mostly due to social mobility between income classes. Because migration between classes (e.g. social mobility) is not considered in the projection models, projected and observed populations by class differ. So comparing observed and projected populations allows one to anticipate

what was the contribution of social mobility to the growth of income specific social classes;

- 4) The projection of the poor class underestimates the growth of this class during the 1980s because a significant share of the population was moving into this class as a result of unfavorable economic circumstances. During the 1990s, the size of the poor class is overestimated in the projections because a significant share of the population left the “state of poverty” mainly as a result of multiple anti-inflationary plans and the modernization of the economy.
- 5) The projections overestimated the growth of the middle class in the 1980s and underestimated it in the 1990s. During the Brazilian “lost decade” many people moved from the middle to the poor class, and these moves are not captured or reflected by the fertility or mortality assumptions of the projection model. As a result, the projected middle class is larger than it actually was in 1990. In contrast, the projection of this class was underestimated in the 1990s. The share of the middle class in the total population expanded from 62 percent in 1990 to 72 percent in 2000, but this increase was not fully captured by the projection assumptions. The improvement in the economic condition of the poor class in the 1990s is not reflected in the population projections of the middle class;
- 6) The rich class was underestimated in both projection periods. The size of the rich class is larger than the predicted for two reasons: first, because unfavorable inflationary shocks affecting the vast majority of the population in the 1980s did not have the same effect on the richest one percent share of the Brazilian population. Because of their easier access to financial and physical investments, the rich were less vulnerable to adverse economic shocks than those at the bottom of the income distribution. Second, because the rich class represents only one percent of the population, the fertility and mortality assumptions adopted in the projections are more vulnerable to changes over the period than in classes where the share of the population is larger and consequently more stable over time. The lesson is simple and well known to demographers: small populations, and populations of small areas, are hard to project with only fertility and mortality because they usually are very exposed to migration flows. This is exactly what the rich class represents in the projection context: a small share of the population that is heavily affected by the entrance of individuals from middle and poor classes who have faced upward mobility and who became part of the rich class during the 1980s and 1990s.

THE IMPACT OF DEMOGRAPHY ON POVERTY AND INEQUALITY

One strategy to measure the impact of differential demographic rates over the size, composition and growth of specific income classes consists of comparing projected and observed populations in 1990 and 2000. The table below shows how much the poor population would increase under the assumptions of fertility and mortality adopted in the previous projections (e.g. Table 2):

Table 3. Comparison between projected and observed poor populations

	1990		2000	
	Projected	Observed	Projected	Observed
Size				
Count	53,462,077	56,326,296	71,859,742	51,336,620
(Poor/ Total) ^a	0.37	0.39	0.42	0.30
Poor/ Poor _{baseline}	1.35	1.43	1.28	0.91
Keyfitz's $\Delta_{baseline}$ ^b	0.11	0.06	0.08	0.04

^a The proportion of poor in the total population includes individuals whose income was missing or equal to zero.

^b Compares the age structure of projected and observed populations to the age structure of the baseline population. Maximum value is 1 and minimum is 0 when the vectors are identical.

The second column of Table 3 shows that the poor population would increase by 35 percent between 1980 and 1990 and account for 37 percent of the total population if fertility and mortality were the only factors influencing the growth dynamics of the poor. Overall, the projection underestimates the censal population by five percent. If social mobility to and from the poor class had been taken into account, the projection of the poor population would have the same size as the censal poor population, described in column 3. In contrast, the projection of the 1990 poor population is overestimated by 40 percent. If upward mobility had not been so intense in the 1990s, the poor population would have increased by 28 percent and would account for about 42 percent of the total population.

The last row of Table 3 reports Keyfitz's Δ , which is a standard measure of the distance between probability vectors representing the proportion of the population in different ages⁸. It indicates how different the age structures of projected and observed censal populations are in relation to the projection baseline. Overall, the age structure at the baseline is more similar to the age structure of the observed than to the projected populations. The internal structure of the population is less similar to the age structure observed ten years earlier when social mobility is absent of the model. This result is also confirmed by Graph 3, which shows a more detailed comparison between observed and projected populations by age.

Population impact on income inequality.

The impact of differential demographic growth on inequality is more complicated because it involves two variables: income and population. Thus, the effect of demographic growth on inequality requires assumptions of independence between population and income and the establishment of rules dictating a behavior for the relationship between income and population. Since income inequality is not only a function of population, but also a function of how incomes are distributed among its members, in order to calculate income inequality and evaluate the role of demography I assume two counterfactual scenarios for income: in the

⁸ Keyfitz (1968: 47) proposed a measure equivalent to $\Delta = \frac{1}{2} \sum_i |x_i - w_i|$, where x_i is the proportion of the poor population in the baseline; w_i is the proportion of the population in the projected or observed population ten years after the baseline, and i subscribes five-year age groups between 0 and 80.

first scenario the level of income remains the same as in the baseline of the projection. In the second scenario, the level of income is assumed to be the same as in the observed censual population in the end of the projection period. In both scenarios I use the projected population share in each income class to build the inequality counterfactuals. The results of these simulations are in the table below:

Table 4. Simulated income inequality due to differential population increase

Inequality inputs:		GE(0)		
Population share	Income	Within ^a	Between	Total
1990 projected	1980	0.2609	0.5700	0.8308
1990 projected	1991	0.2697	0.5170	0.7866
1990 observed	1991	0.2645	0.5477	0.8122
1991 observed ^b	1991	0.2687	0.5222	0.7909
2000 projected	1991	0.2591	0.6115	0.8706
2000 projected	2000	0.2668	0.8291	1.0959
2000 Full sample	2000	0.2915	0.5730	0.8645
2000 observed ^b	2000	0.3009	0.4777	0.7786

^a Within income inequality of poor, middle and rich classes is kept constant and equal to the values reported in table 1 for a given income year.

^b Excludes observations with missing or equal to zero income values. These are the same results reported in the previous chapter.

Table 4 demonstrates how GE(0), the mean log deviation of income, would change under different combinations of population and income. The first row, for instance, indicates that if the projected population in 1990 was combined with the income level of 1980, total inequality would be five percent higher (.83) than in 1991 (.786). However, when the mean level of income in 1991 is used in the simulation, inequality is only .54 percent lower than in 1991 (.786 and .7909, respectively). *Ceteris paribus*, this result suggests that income inequality should have been slightly lower in 1991 if mortality and fertility were the only components dictating the population dynamics of the period. The simulated level of inequality (.78) would still be higher than in 1980 (.72), but it would be lower than the inequality generated by mortality, fertility and mobility in 1991 (.79).

In 2000, the counterfactual scenarios show the opposite of what was observed ten years earlier. Depending on the level of income and within inequality assumed in the simulation (e.g. 1991 or 2000) the projected population in 2000 provides inequality levels between 13 (.87) and 40 (1.09) percent higher than what was estimated in 2000 (.7786). Thus, if there was no mobility between social classes during the 1990s, income inequality would have been higher than it actually was.

The evidence in Table 4 suggests that income inequality moves in the same direction as the size of the poor population. In 1991, simulated income inequality and the projected poor population are lower than what was observed. In 2000, the opposite happened: the projected poor population was overestimated and so was inequality. These results suggest that the poor population accounts for most income inequality. The social mobility happening in the 1980s, mostly from the middle to the poor class, helped to increase income inequality in 1990, from .78 to .79. In the 1990s, there was a shift in this trend since there were more people moving out of the poor class than into it. As a result of upward mobility, income inequality decreased by 29 percent (from 1.09 to .77). Overall, the impact of net social mobility on inequality was stronger in the 1990s than in the 1980s.

SUMMARY AND CONCLUSION.

This article sought to answer the following questions: 1) what are the fertility and mortality rates of socially distinct economic groups? 2) How much would the poor, middle and rich classes grow under the demographic conditions of the 1980s and 1990s? 3) How would poverty and income inequality change under these demographic circumstances?

The evidence answering the first question shows that the fertility gap between the poor and rich classes was 3.2 children in 2000, despite the rapid decline of fertility in the poor class during the 1980s. The total fertility rate of the poor shifted from 6.53 to 3.78 children between 1980 and 2000, while in the rich class it shifted from 1.07 to 0.57 during the same period. Mortality also declined in all classes and contributed to increase life expectancy. The gains in life expectancy at birth were more evident in the middle class, where one could expect to live 62.4 in 1980 and 71 years in 2000 – a gain of almost 9 years. The rich had a gain of 6.6 years during this same period (73.1 to 79.7 years), and the poor had a gain of about 6 years in life expectancy at birth between 1980 and 2000 (from 59.5 to 65.4 years). This differential increase in life expectancy at birth contributed to increase the mortality gap between poor and rich classes from 13.6 to 14.3 expected years of life.

Combining fertility and mortality produces net reproduction rates for each income class. These rates indicate that most population growth is due to the reproduction of the poor class, where the NRR was equal to 2.76 in 1980 and 1.69 in 2000. In the middle class it has been below replacement since 1990 and in the rich since before 1980 (Table 1). The rich class is also the one with most unstable growth. Since the difference between intrinsic and crude rates of natural increase is larger for the richest share of the population, past changes in fertility and mortality have been more important in affecting the age structure of the rich than of the middle and poor classes.

The answer to the second question derives from demographic projections. The multi- and single-state projections of the total population provide similar results. The projection of class specific populations, however, differs from what was expected because the cohort-component projection method does not take into account the mobility of individuals between income classes and international migration. While the effect of international migration has little effect on the projections, the entrance of individuals into the poor class (e.g. downward social mobility) in the 1980s contributed to increase the size of the poor population. Because this mobility is not considered in the projections, the size of the poor population is underestimated in 1990. By this same logic, the projected poor population is overestimated in 2000 because of the intense exit (e.g. upward mobility) of people from the poor class in the 1990s, a period marked by intense anti-inflationary plans and industrialization. Most of these population exchanges occurred between middle and poor classes since the rich group accounted for only a small share of the total population (roughly one percent). Because of its small participation in the total population, the rich is the most unstable group and the hardest to project. The rich population was underestimated in both projection periods because thousands of individuals moved into the rich class in the 1980s and 1990s.

The projection exercise also answers the third question. If the fertility and mortality values estimated in 1980 and 1990 were the only forces contributing to the demographic dynamics of the period, the poor population would have increased by 35 percent instead of 43 percent, which was the real growth between 1980 and 1990. Between 1990 and 2000 the poor would have increased by 28 percent due to demographic forces. However, because this was also a period of intense upward social mobility from the poor to other classes, the poor class shrank. The actual size of poor group in 2000 was 91 percent of the observed ten years earlier (Table 3).

The projection approach also allows the construction of counterfactual scenarios to measure how income inequality would change if the projected populations were used in the calculation of GE (0) (Table 4). *Ceteris paribus*, income inequality would be slightly lower (.78 versus .79) in 1991 if the population had grown only according to mortality and fertility. In contrast, income inequality in 2000 would have been higher than what was actually observed in the census count if the population had followed the path defined by the demographic assumptions of the model (1.09 versus .77). This evidence corroborates the following conclusions about the role of social mobility: a) in the 1980s, downward mobility to the poor class helped to increase the level of income inequality in 1990 from .78 to .79; b) in the 1990s, upward mobility, especially from the poor to the middle class, helped to alleviate income inequality, from 1.09 to .77. In sum, the impact of social mobility on income inequality was more intense in the 1990s than in the 1980s. These conclusions, however, are valid only to the extent that the mortality and fertility estimates from which they derive are precise. Since class-specific projections are a direct result of the estimates of fertility and mortality obtained through indirect demographic methods, the validity of the conclusions described here are also conditioned on the accuracy and robustness of the methods. The impact of these estimates on the net mobility is that, if class-specific fertility was underestimated, the level of mobility to that class, in the first age-groups, will be exaggerated. And if class-specific mortality is underestimated, social mobility into that class will look smaller than it actually was if mortality had been accurately measured.

Unfortunately, in the absence of alternative methods, comparable and better data to validate the estimates, it is impossible to precise the size of bias included in the estimates of fertility and mortality. All the information available in the Brazilian censuses was used to generate and validate the demographic parameters of class-specific fertility and mortality. Moreover, the indirect methods employed in the analysis are well known and recognized among demographers as the best option to measure fertility and mortality rates in the absence of directly observable data. The total estimates of fertility and mortality for Brazil as a whole are similar to those provided by IBGE and close to the ones in the literature (Miranda-Ribeiro 2007). Despite the intrinsic uncertainties of the method, I have confidence that the estimates are as good as they could get given the current tools of Demography.

All the results and conclusions presented in this chapter assume that fertility and mortality are the only forces affecting the dynamics of growth of income specific classes. This restrained analysis is useful because it portrays population growth in the absence of social mobility. Future research, however, should take a closer look at the influence of mobility on population growth and calculate how the poor, middle and rich classes have changed their sizes when they are allowed to move between these three groups. In particular, it would be interesting to know the value of NRR, life expectancies and stable growth rates when mobility becomes an explicit component of the demographic dynamics.

REFERENCES:

- Brass, W., A. J. Coale, P. Demeny, Donald F. Heisel, Frank Lorimer, Anatole Romaniuk, and Etienne Van de Walle. 1968. *The Demography of tropical Africa*. Princeton, N.J.: Princeton University Press.
- Brass, W. 1971. "On the Scale of Mortality," pp.69-110 in W. Brass, ed., *Biological Aspects of Demography*. London: Taylor and Francis Ltd; New York: Barnes & Noble Inc.
- Brocknerhoff, M. and E. Brennan. 1998. "The poverty of cities in developing regions." *Population and Development Review* 24(1):75-114.
- Camarano, A.A. and K.I. Beltrao. 1995. "Dinamica Demografica por Nivel de Renda." *Revista Brasileira de Estudos Populacionais* 12(1/2).
- Cho, L.-J., R.D. Retherford, and M.K. Choe. 1986. *The own-children method of fertility estimation*. Honolulu, HI: Population Institute.
- Chu, C.Y.C. and L. Jiang. 1997. "Demographic transition, family structure, and income inequality." *Review of Economics and Statistics* 79(4):665-669.
- Chu, C.Y.C. and H.W. Koo. 1990. "Intergenerational Income-Group Mobility and Differential Fertility." *American Economic Review* 80(5):1125-1138.
- Corseuil, C.H. and M.N. Foguel. 2002. "Uma sugestão de deflatores para rendas obtidas a partir de algumas pesquisas domiciliares do IBGE." *Texto de discussão do IPEA* 897:1-13.
- Cowell, F.A. and S.P. Jenkins. 1995. "How Much Inequality Can We Explain - a Methodology and an Application to the United-States." *Economic Journal* 105(429):421-430.
- Datta, G. and J. Meerman. 1980. "Household Income or Household Income per Capita in Welfare Comparisons." *Review of Income and Wealth* 26(4):401-418.
- de la Croix, D. and M. Doepke. 2003. "Inequality and growth: Why differential fertility matters." *American Economic Review* 93(4):1091-1113.
- Feeney, G. 1975. "The Own-Children Method of Estimating Age-Specific Fertility Rates." in *Demographic Analysis and Data Evaluation Workshop*. Department of Statistics, Kuala Lumpur.
- Ferreira, F.H.G., R.P.d. Barros, and World Bank. Poverty Reduction and Economic Management. Poverty Division. 1999. *The slippery slope: explaining the increase in poverty in urban Brazil, 1976-1996*. Washington, DC: World Bank Poverty Reduction and Economic Management Network Poverty Division.
- Ferreira, F.H.G., P. Lanjouw, and M.C. Neri. 2000. "A new poverty profile for Brazil using PPV, PNAD and census data." *Pontificia Universidade Catolica Do Rio De Janeiro. Departamento De Economia. Texto Para Discussao* No. 418:1-66.
- Fiorio, C.V. 2006. "Understanding Inequality Trends: Microsimulation Decomposition for

- Italy." in *STICERD DARP* 78. London: London School of Economics.
- Firpo, S.P., G. Gonzaga, and R. Narita. 2003. "Decomposição da Evolução da Desigualdade de Renda no Brasil em Efeitos Idade, Período e Coorte." *Pesquisa e Planejamento Econômico* 33(2):211-252.
- Grusky, D. and J. Sorensen. 1998. "Can class analysis be salvaged?" *American Journal of Sociology* 103(5):1187-1234.
- Hauser, R. and J. Warren. 1997. "Socioeconomic indexes for occupations: A review, update, and critique." *Sociological Methodology* 27:177-298.
- Hill, K. And J. Trussell. 1977. "Further Developments in Indirect Mortality Estimation." *Population Studies* 31(2): 313-34.
- IBGE, J.d.C. Oliveira, F.R.P.d.C.e. Albuquerque, and I.B. Lins. 2004. "Projeção da População do Brasil por Sexo e Idade para o Período 1980-2050: Revisão 2004 Metodologia e Resultados; Estimativas Anuais e Mensais da População do Brasil e das Unidades da Federação: 1980 - 2020 Metodologia; Estimativas das Populações Municipais: Metodologia." Pp. 1-82. Rio de Janeiro: IBGE.
- Jenkins, S.P. 1995. "Accounting for Inequality Trends - Decomposition Analyses for the UK, 1971-86." *Economica* 62(245):29-63.
- Keyfitz, Nathan. 1968. *Introduction to the mathematics of population*. Reading, Mass.: Addison-Wesley Pub. Co.
- Kremer, M. and D.L. Chen. 2002. "Income distribution dynamics with endogenous fertility." *Journal of Economic Growth* 7(3):227-258.
- Lam, D. 1986. "The Dynamics of Population-Growth, Differential Fertility, and Inequality." *American Economic Review* 76(5):1103-1116.
- Leslie, P.H. 1945. "On the Use of Matrices in Certain Population Mathematics." *Biometrika* 33(3):183-212.
- . 1948. "Some Further Notes on the Use of Matrices in Population Mathematics." *Biometrika* 35(3/4):213-245.
- Mare, R.D. 1997. "Differential fertility, intergenerational educational mobility, and racial inequality." *Social Science Research* 26(3):263-291.
- Medeiros, M. 2005. *O que faz os ricos ricos: o outro lado da desigualdade brasileira*. São Paulo: Hucitec.
- Miranda-Ribeiro, A.d. 2007. "Reconstrução de Histórias de Nascimentos a partir de Dados Censitários: aspectos teóricos e evidências empíricas." Doctoral dissertation, Centro de Desenvolvimento e Planejamento Regional, Faculdade de Ciências Econômicas, UFMG.
- Mortara, G. 1949. "Methods of Using Census Statistics for the Calculation of Life Tables and Other Demographic Measures." Pp. 40-60 in *United Nations Publication, Sales no.*

- Neri, M.C. 2000. "Assets, markets and poverty in Brazil." *Escola de Pós-Graduação em Economia da Fundação Getúlio Vargas. Ensaios Econômicos* No. 374:1-41.
- Pero, V. and D. Szerman. 2005. "Mobilidade Intergeracional de Renda no Brasil." in *Anais do XXXIII Encontro Nacional de Economia [Proceedings of the 33th Brazilian Economics Meeting]* 146: ANPEC - Associação Nacional dos Centros de Pósgraduação em Economia [Brazilian Association of Graduate Programs in Economics].
- Preston, S.H. and C. Campbell. 1993. "Symposium on Intergenerational Transmission - Differential Fertility and the Distribution of Traits - the Case of IQ." *American Journal of Sociology* 98(5):997-1019.
- Preston, S.H., P. Heuveline, and M. Guillot. 2001. *Demography: measuring and modeling population processes*. Oxford; Malden, Mass.: Blackwell Publishers.
- Rocha, S. 2000. "Estimação de linhas de indigência e de pobreza: opções metodológicas no Brasil." Pp. 109-127 in *Desigualdade e pobreza no Brasil*, edited by R. Henriques and A.R. Barros. Rio de Janeiro: IPEA.
- Ruggles et al., 2004 Ruggles, S., Sobek, M., Alexander, T., Fitch, C., Goeken, R., Hall, P., King, M., & Ronnander, C. (2004). Integrated public use microdata series: Version 3.0 (machine-readable database). Minneapolis, MN, Minnesota Population Center. Available: left angle bracket<http://www.ipums.org>right-pointing angle bracket.
- Schwartzman, S. 2002. "Vantagens e desvantagens das linhas de pobreza." 2005(11/05). Available at http://www.iets.org.br/article.php3?id_article=266&var_recherche=pobreza
- Shorrocks, A.F. and G. Wan. 2005. "Spatial Decomposition of Inequality." *Journal of Economic Geography* 5(1):59-81.
- Sorensen, A. 1991. "On the Usefulness of Class Analysis in Research on Social-Mobility and Socioeconomic Inequality." *Acta Sociologica* 34(2):71-87.
- United Nations. Population Division of the Department of Economic and Social Affairs. 2008. "World Population Prospects: The 2006 Revision and World Urbanization Prospects: The 2005 Revision." United Nations.
- Wood, C.H. and J.A.M.d. Carvalho. 1988. *The demography of inequality in Brazil*. Cambridge [Cambridgeshire]; New York: Cambridge University Press.
- Wright, E.O. 1997. *Class counts: comparative studies in class analysis*. Cambridge; New York; Paris: Cambridge University Press; Maison des sciences de l'homme.
- . 2005. *Approaches to class analysis*. Cambridge, UK; New York: Cambridge University Press.