Demographic Change and the Living Arrangements of the Elderly: The Case of Brazil

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Abstract:

The demographic transition Brazil has been through in the 1960s and 1970s resulted in unprecedented increases of cohorts of older adults and smaller family sizes. As population ages and family size declines, it becomes crucial to understand how families adjust to their changing social and demographic environment. In particular, the well-being of older persons is a growing policy concern worldwide. Yet, the consequences of these demographic shifts for the elderly often are not well understood, especially in developing countries. In this paper, we take advantage of unique nationally representative data collected yearly over a period of three decades to employ a cohort analysis in which the living arrangements of several cohorts of elderly are traced. This study's cohorts were of childbearing ages prior to, during, and after Brazil's rapid fertility decline. Smaller families mean fewer children for support and exchange later in life, which may result in fewer intergenerational households.

1. Introduction

As a result of dramatic demographic transition, Brazil has a rapidly aging population. In 1970, the proportion of Brazil's population that was 60 and older was 5%; in 2030, it is projected to be 20%. As the population ages and family size declines, it becomes increasingly crucial to understand how families adjust to their changing social and demographic environment. In particular, the well-being of older persons is a growing policy concern worldwide. Yet, the consequences of these demographic shifts for the elderly often are not well understood, especially in developing countries. In this paper, we take advantage of unique nationally representative data collected yearly over a period of approximately three decades to employ a cohort analysis in which the living arrangements of several cohorts of elderly are traced. Living arrangements constitute one of the most basic and essential determinants of the well-being of older adults. The investigation of elderly co-residence merits particular attention in countries where alternative non-familial arrangements are largely lacking, such as Brazil.

This paper goes beyond previous analyses of living arrangements of the elderly in two key ways: 1. By studying the same cohorts at different points in time, as well as same age groups across different cohorts; and 2.By adding to our understanding of how each generation benefits from co-residence and how economic independent the elderly are, by conducting a detailed examination of intergenerational households where elderly and adult children co-reside.

We will examine the living arrangements of elderly cohorts born from the 1910s to the 1940s in Brazil. These cohorts were of childbearing ages prior to, during, and after Brazil's rapid fertility decline. Smaller families mean fewer children for support and exchange later in life, which may result in fewer intergenerational households. In addition, some of the children of this group of elderly have more fragile earnings histories, as they went through their initial economic active years during the so-called lost decade. With few exceptions, literature on living arrangements of the elderly implies that co-residence with adult children is a result of older parents' need for assistance, and therefore signifies transfers from children to parents. However, the proposed investigation of income provision within intergenerational families hypothesizes that these arrangements may convey benefits to the adult children, to the elderly parents, or to both generations. For these adult children, co-residence with elderly parents may be a strategy for family well-being.

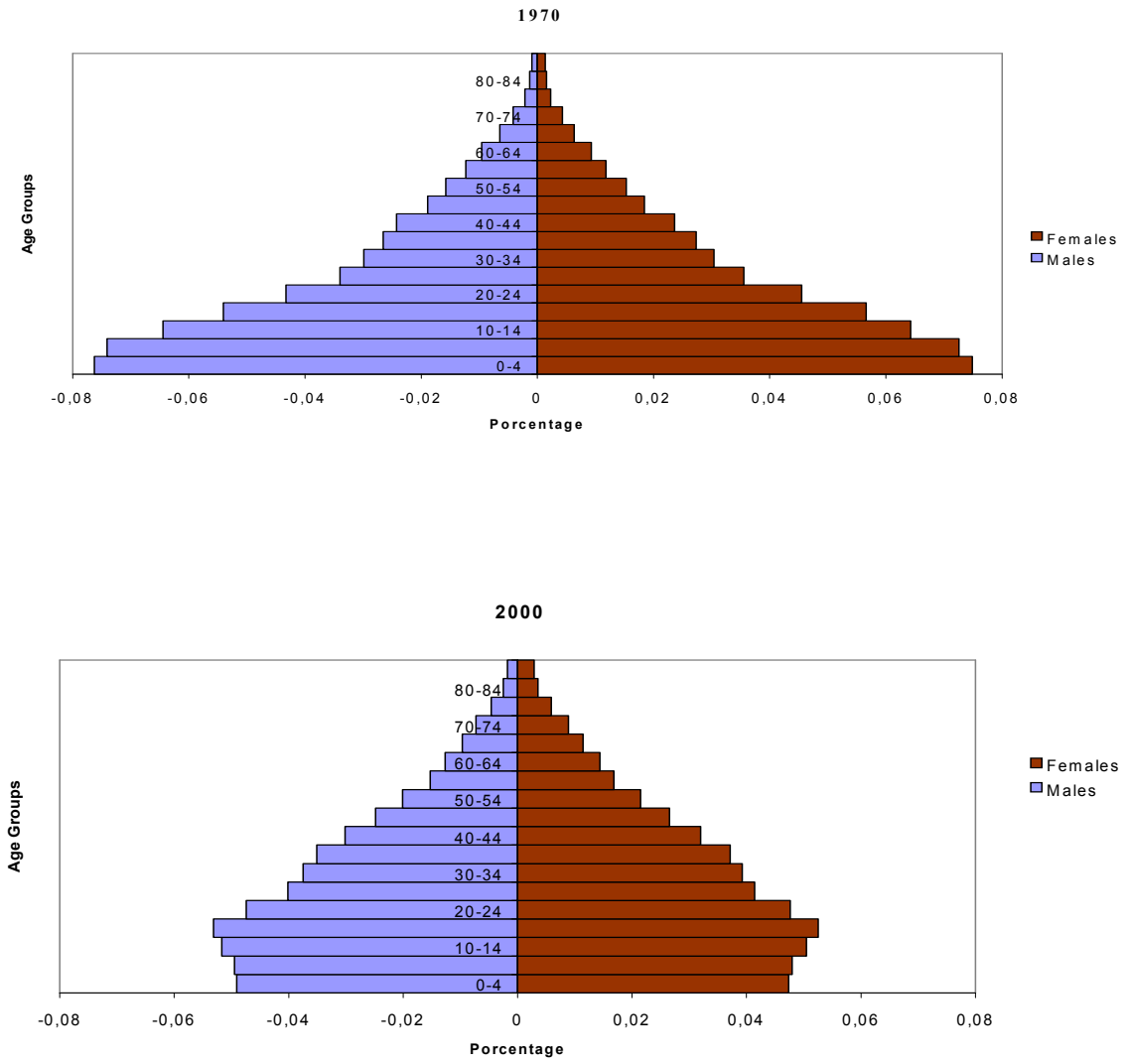
The paper will pool unique nationally representative household survey data collected yearly from 1976 to 2003. The extensive period covered by the data allows for tracking Brazilian elderly within and across cohorts with the following specific aims:

1. Examine how and why intergenerational living arrangements of the elderly have changed across their life course within the same cohorts. We will look at elderly cohorts at different points in their life course to study the factors associated with changes in intergenerational arrangements across ages, particularly family size.
2. Within the same age groups, we examine whether and why the elderly are more or less likely to co-reside with their children in earlier than in later cohorts, and the factors associated with that, including family size. We will be able to infer social change by addressing how societies have been accommodating the needs of cohorts of elderly, their living arrangements in particular.
3. Examine whether adult children benefit from co-residence with elderly parents as much or even more than the elderly. We address whether the probability that the contribution of elderly income is higher than that of their child in intergenerational households, and whether this is associated with poor employment conditions of the younger generation and high rates of labor market participation among Brazilian elderly.

2. Background

Demographic transition occurred in Brazil in the 1960s and 1970s and is responsible for the subsequent rapid and concentrated changes in the age structure: increasing cohorts of young people and decreasing family sizes, subsequent decreasing population and family cohorts of youth, and increasing cohorts of the elderly.

Figure 1



Age Pyramids, Brazil 1970 and 2000

Source: Brazil 1970, 2000 Census.

Figure 1 shows the 1970 and 2000 age pyramids for Brazil. The large differences in the two pyramids are typical of countries that have experienced rapid fertility decline. The 1970 pyramid clearly shows the effects of exponential population growth during previous decades with a large concentration of the population under age 20. In 2000, the largest five-year age group was 15-19 which illustrates that fertility decline had eventually overtaken population momentum in reducing the size of birth cohorts. Population aging is also rapidly taking place. In 1970, 5.2% of the population was 60 and over; in 2000 that proportion increased to 8.6%; and by 2030 it is projected to reach 18% – more than doubling in three decades (U.S. Census Bureau 2001). The rapid demographic changes underway in Brazil clamor for extensive research on its consequences for the well-being of the elderly.

The aging process in Brazil, as in other developing countries, has been happening much faster than in developed countries, which brings the consequences of population aging at the societal and family levels to the forefront of social policy. At the societal level, population aging changes the proportion of workers, consumers and beneficiaries of public sector transfers. At the family level, population aging modifies the proportion of individuals who receive and provide intergenerational transfers. There are three main types of intergenerational flow of support between elderly and their children: money, time and space (co-residence) (Lee 1994). In this paper, I will focus on living arrangements as a type of intergenerational transfer. Co-residence is very important as it is likely to involve transfers in all three currencies (time, money and space) where co-residents also transfer time and money (Soldo and Hill 1995).

How families respond to the rapid changing demographic conditions is a pressing research issue, particularly as these responses concern the elderly. For the elderly, family relationships are generally the major source of social connectedness and support. Increases in the elderly life span and in the proportion of elderly in the population, combined with smaller cohorts of adult children, create a significantly greater demand on families, particularly in societies such as Brazil where the family is the primary care provider for the elderly.

Analyses of elderly living arrangements have emphasized costs and benefits associated with different arrangements (Da Vanzo and Chan 1994; Knodel and Ofstedal 2002), pointing out the apparent interplay of constraints and preferences (Casterline et al 1991). Elderly living arrangements often result from a series of decisions taken by a number of people over a considerable period of time that are heavily influenced by factors such as marital status, employment, family composition, and health. Research in Asian countries, for example, has shown that kinship size and gender composition affect several outcomes later in life, including living arrangements (Hermalin 1993; Hermalin 2002; Knodel and Ofstedal 2002).

Intergenerational living arrangements reflect a central link between the elderly and younger generations that has played a central role in the traditional familial support system in developing countries. In Brazil, co-residence with family members has been common, particularly in the absence of alternative non-familial arrangements.

Some of the children of this study's cohorts of elderly were at the age of entering the labor market during the 1980s, a period of severe economic crisis in Brazil. For these adult children, co-residence with elderly parents may have been a strategy for family well-being. With few exceptions, literature on living arrangements of the elderly implies that co-residence with adult children is a result of old-age parents needing assistance, and therefore signifies transfers from children to parents. However, this investigation of income provision within intergenerational families hypothesizes that these arrangements may in fact convey

benefits to the adult children, to the elderly parents, or to both generations. Knodel and Ofstedal (2002) found that elderly parents with higher socio-economic status were more likely to co-reside with adult children in the Philippines, suggesting that parents provide assistance to their children.

We will further investigate intergenerational households in terms of economic intra-household support. The proportion of total family income attributed to the elderly will be a measure of the proportion of financial resources provided by the elderly to the household and a proxy of the direction in which benefits flow.

There are several compelling reasons for studying living arrangements of cohorts of elderly who were of childbearing years throughout the demographic transition in Brazil. First, the changes in the age structure of the Brazilian population and family are happening much faster than in developed countries and they are happening under more difficult social and economic conditions. Population aging is taking place before the social and economic conditions that facilitate and secure transfers of wealth to the elderly have consolidated. These large and rapid demographic changes combined with persistent high levels of social and economic inequality provide an important and interesting case for examining elderly living arrangements.

Second, Brazil is a unique context for the study of the impact of demographic change on elderly living arrangements as the country's fertility decline occurred during a period of a far-reaching social change that included periods of both rapid economic growth and economic crisis (Lam and Duryea 1999; Martine 1996; Wood and Carvalho 1988). Third, the Brazilian experience is of wide interest as the effects of rapid demographic change on the well-being of the elderly are salient in all developing and transitional economies. Lastly, the combination of economic environment, policy changes, and nationally representative data availability across time provides unique opportunities for analysis of the impact of demographic change on elderly living arrangements and the circumstances under which older people and their adult children have co-resided in a developing country.

3. Preliminary Studies and Background Information

Recent work by Marteleto, and Lam and Marteleto has investigated the impact of demographic change on the well-being of children, the other extreme of the age distribution (children's school enrollment in Lam and Marteleto forthcoming; children's years of schooling and school enrollment in Marteleto 2001b, 2002a, 2002b).

Lam and Marteleto (2005) recently examined the consequences for children of dramatic changes in the population age structure, as presented in Table 1. This trend is associated with the large changes in the size of cohorts of elderly that motivate this paper. Table 1 shows the absolute and relative sizes of children and elderly for five-year intervals from 1950 to 2000, and projected to 2050. In 1960, only 4.9 percent of the Brazilian population was composed by persons age 60 and older, reaching 7.8 percent in 2000. In 2010,

the group 60 and over will correspond to 9.7 percent of the population and to 23.6 percent of the population in 2050. Table 1 demonstrates how the relative and absolute sizes of the elderly population are increasing.

Table 1. Relative and Absolute Sizes of Children and Elderly Groups, Brazil 1950-2050

	Ages 0-14		Age 60 and over	
	Absolute	Percentage of the	Absolute	Percentage of the
1950	22 432	41.6	2 627	4.9
1955	26 446	42.1	3 170	5.0
1960	31 478	43.3	3 871	5.3
1965	36 839	43.7	4 576	5.4
1970	40 674	42.4	5 471	5.7
1975	43 589	40.3	6 498	6.0
1980	46 318	38.1	7 531	6.2
1985	49 477	36.6	8 502	6.3
1990	51 353	34.7	9 898	6.7
1995	50 646	31.8	11 336	7.1
2000	49 077	28.8	13 321	7.8
2005	48 207	26.6	15 461	8.5
2010	48 371	25.3	18 494	9.7
2015	48 841	24.3	22 607	11.2
2020	48 990	23.3	27 531	13.1
2025	48 851	22.3	33 360	15.2
2030	48 645	21.5	38 647	17.1
2035	48 658	20.9	43 652	18.7
2040	48 851	20.5	49 204	20.6
2045	49 053	20.2	54 350	22.3
2050	49 175	19.9	58 390	23.6

Source: United Nations.

These changes in proportions of youth and elderly have effects on a range of outcomes, such as children's schooling and elderly living arrangements. This paper was in fact motivated by prior research by Lam and Marteleto that demonstrates the impact of family size on improvements in school enrollment (forthcoming), using Brazil's large household surveys that will also be used in this paper. We estimate significant effects of family size on enrollment, with the number of siblings age 0-6 and 7-17 both having a negative effect on enrollment. Using regression coefficients, we changed family size to simulate different situations. These simulated counterfactuals suggest that declining family size was one of the factors contributing to the rising school enrollment rates of the 1990s. These findings have motivated the present paper to extend the analysis of the effects of smaller family sizes on elderly living arrangements.

Previous work has also significantly motivated this proposal and provides considerable evidence for this research's significance that is worth reviewing (Marteleto 2001b, 2002a, 2002b). Brazilian families have become smaller in ways that are similar to trends observed in other developing countries. I examined the role that recent family and demographic changes have played on schooling and school enrollment, and on the intergenerational transmission of education for cohorts of children in Brazil. Indeed, regression models from Marteleto (2002b) provide evidence that the demographic transition has benefited children's schooling through smaller number of siblings. The decline in family size has explained a substantial proportion of the cohort gap in children's schooling. These findings support the notion that children born post-demographic transition have higher levels of schooling than children born pre-demographic transition.

Although using a broad preliminary conceptualization of intergenerational living arrangements, preliminary results show unprecedented declines in intergenerational co-residence. In 1977, 72.0 percent of older adults lived in a household with at least one person younger than 40 years of age that was not a spouse, a proportion that declined to 64.0 percent in 1990 and to 39.3 percent in 2002.

4. Theoretical Background

The Demographic Transition and the Living Arrangements of the Elderly

Population aging and its consequences seem to be poised to replace population growth as the major demographic issue of public, political and scientific concern in the twenty-first century (Lutz 1994; Lutz et al 2004; Paloni 2002 for Latin America). Indeed, Knodel and Debavalya (1997) warn that this is likely to be the case for several developing countries where declining fertility rates are rapidly approaching or have already reached replacement level, such as Brazil.

Living arrangements constitute one of the most basic and essential determinants of the well-being of older adults. The investigation of elderly co-residence merits particular attention in such countries where alternative non-familial arrangements are largely lacking. The concept of elderly living arrangements has been defined in several ways depending on the research question (DeVos 2003; Knodel and Ofstedal 2002; Zimmer 2003). In this paper, we start with a simple notion of living arrangements by considering elderly who live with at least one adult married or unmarried child. We then extend De Vos' multi-level scheme of living arrangements to include co-resident's age (De Vos 2003). This is appropriate as our main interest is on the types of intergenerational arrangements, particularly co-residence with children. We will therefore examine four types of living arrangements: living with at least one married or unmarried adult child; living with at least one other adult relative or nonkin and no own children; living alone; or living only with a spouse and/or with young child.

The theoretical framework that guides these proposal analyses considers that living arrangements are influenced by: 1) availability of kin with whom to co-reside, particularly children, and 2) preferences, needs and resources of all parties involved regarding shared or independent living arrangements (Knodel and Ofstedal 2002; Da Vanzo and Chen 1994). The main constraint on the choice of living arrangements is size and characteristics of one's kinship network, particularly children (Knodel and Ofstedal 2002). Indeed, past research has shown a strong association between number of living children and co-residence with children in Asia (Casterline et al. 1991). Declining fertility rates have significantly reduced the availability of children eligible to co-reside with parents. Despite the rapid population aging and fertility decline in the region, to my

knowledge no research on living arrangements of the elderly in Brazil or in other Latin American countries focuses on changing family sizes across cohorts.

A second set of factors that constrain living arrangements are those related to preferences and resources. To operate on their living arrangement preferences, individuals must have the necessary economic and physical resources. Many studies have found a positive relationship between economic resources and independent living; suggesting thatwhenever possible the elderly prefer to purchase goods and services that otherwise live-in children may provide. We will examine whether elderly socio-economic and demographic characteristics are related to living in intergenerational households.

Decisions on whether elderly parents and children co-reside can also be based on children's preferences. A shortcoming of most research on elderly living arrangements using nationally representative data in developing countries, including that proposed here, is the lack of information on characteristics of non-resident children. However, we do have information on number and gender composition of living and ever born children to address the availability of children across cohorts of elderly before and after fertility decline. Moreover, to examine the impact of Brazil's severe economic crisis on children's ability to provide financial resources in intergenerational arrangements, we have extensive information on each household member, which will be discussed with detail in the data section.

An important concept of this paper is that adult children may benefit from co-residence at least as much as the elderly. Brazil's current and past economic conditions create a complicated environment for families making decisions about living arrangements. A portion of the children of the elderly cohorts analyzed in this study were in their early economically active ages during Brazil's social and economic crisis of the 1980s – a characteristic that may have hurt their ability to financially support nuclear independent households.

The overall performance of standard macroeconomic indicators was so poor in Brazil in the 1980s that the period has been widely referred to as "the lost decade." Brazil ended the decade with levels of per capita income lower than they had in 1980, a stark contrast to the healthy annual rates of economic growth experienced during the 1970s. The severe recessions that began around 1980 were often associated with "structural adjustment"' programs to deal with severe external debt problems. As Brazil experienced large declines in per capita income, it has been argued that the sharp economic downturns set off serious short- and long-run negative consequences on indicators of social and economic welfare.

In focusing on co-residence with children, we will look at how household economic support is determined. We will examine the proportion of total household income that comes from older persons' income in intergenerational families to test the hypothesis that the contribution of elderly income to total household income is higher among those whose children were in their early economically active years in the 1980s. The elderly have participated in the labor market at higher rates in Brazil than in other countries. We will

examine the family composition factors associated with this high labor market participation to provide a comprehensive portrait of the conditions under which the elderly have been living in intergenerational households.

5. Data Sources

The paper will take advantage of excellent nationally representative household surveys that have been collected in Brazil from 1976 to 2003 to trace cohort changes over time. The Pesquisa Nacional por Amostra de Domicílios (PNAD) is a sample of households collected annually by the Instituto Brasileiro de Geografia e Estatística (IBGE), the Brazilian Statistical Bureau. The PNAD contains standard demographic, social and economic variables for all members of the household. There PNAD was not conducted in 1980, 1991 or 2000 because of the censuses, nor in 1994.

The PNAD's strengths are numerous – a significant strength is its consistent questionnaires over a long period. The repeated cross-sections and comparability of the questionnaires provide consistent measures of family composition, schooling, labor market, earnings and total income for each household member for a period of almost three decades. The core data contains the same items in each round, with additional sections each year. The data also contain detailed information on childbearing for each individual, including number of children ever born and living, separately for males and females.

Another strength of PNAD data is the study's large sample sizes. For example, the 1977 PNAD contains information on 498,679 individuals, the 1989 PNAD contains information on 301,312 individuals, and the 1999 PNAD contains information on 374,088 individuals. It is interesting to note that, in 1999 data were obtained for 37,600 persons age 60 and over, which corresponded to approximately 10 percent of the total population, while in 1977 they corresponded to 6 percent of the population. PNAD data also allows us to construct measures that relate all household members. For example, the data permit tracking of each household member's employment, earnings, and receipt of pension or other sources of income, as well as total household income. This will allow us to determine the relationships among elderly income, the income of co-resident children, and total household income.

Although the PNAD is an extremely rich resource that is almost without parallel in developing countries, it suffers from the usual problems of large national surveys, such as age heaping and various kinds of measurement error. We developed two tests to determine the quality and reliability of the PNAD data. First, we run distributions of birth year for people 60 and over in each survey to determine the extent to which heaping is severe. We found, for example, that the proportion of individuals in the 1979 survey that reported 1909 as their birth year is 7.91, 7.58 in 1910 and 7.22 in 1911. In the 1989 survey, this proportion is 6.35, 7.12, and 6.50. There seems to be no heaping in the first example. In the second example however, the

proportion of individuals reporting 1910 as their birth year is higher than both 1910 and 1911. Although the second example shows that there seems to be some heaping in reports of birth year, it also demonstrates that it is not a severe problem. Another indicator of data quality is the extent to which we can confidently follow cohorts over time. We show that we can reliably follow cohorts by providing mean years of schooling for the 1917 cohort in different surveys. We are aware that, at old ages, the distribution of most variables in a cohort will inevitably change over time due to differential mortality, but there are no characteristics that are not subject to this problem. We find that 60 year-olds in 1977 had on average 2.84 years of schooling in Brazil. Following the same 1917 birth cohort we find that 64 year-olds in 1982 had on average 2.85 years of schooling; 69 year-olds in 1987 had 2.61; 74 year-olds in 1992 had 2.67; 79 year-olds in 1997 had 2.69; 84 year-olds in 2002 had 2.72. This test shows that the average schooling does not change a great deal. We therefore are confident we can follow cohorts over time. We believe that our tests reiterate that the PNAD is a data source of extremely good quality that is almost without parallel in developing countries.

6. Analytical Strategy

The major analytical strategy to be employed in this paper are a cohort analysis in which several birth cohorts of elderly are traced across surveys. The long time series allow us to study how and why living arrangements have changed within and across cohorts. We will carry out the first and second specific aims of this proposal through two steps:

1. We will describe living arrangements according to two definitions discussed earlier and by socio-economic and demographic variables of the elderly such as sex, age, education, marital status, number of children ever had and living, work status, income and cohort.

2. We will address whether and why living arrangements have changed within and across cohorts and the role of family size, by employing equations 1, 2 and 3, simulations and decompositions.

Equation (1) is a logistic regression that takes the following form:

$$\log\left[\frac{\Pr(y=1)}{1-\Pr(y=1)}\right] = \sum_{K=0}^{K} Cohortb_{ijt} + Child\,\alpha_{ijt} + Ses\,\rho_{ijt} + Year\,\lambda_{ijt} + Cohort * Child\,\rho_{ijt} + M_{jt} \quad (1)$$

The term Pr(y=1) is the probability of living with unmarried or married adult children for elderly i in cohort j in year t for 60-64 year-olds, for example. This series of models are implemented separately for each age group because of the identification problem of age, period and cohort (Firebaugh 1997).The term $Cohortb_{ijt}$ represents cohort dummy variables. The term ($Child\alpha_{ijt}$) represents family size. The term ($SesD\rho_{ijt}$) is a vector of socio-economic and demographic factors such as elderly log income, work status, sex, education and marital status. The term $Year\lambda_{ijt}$ represents year dummies. We use an interaction term ($Cohort*Child\rho_{ijt}$)

to capture changes in the effect of family size on living arrangements across cohorts. We will vary the interaction term to include year to capture the changing effect of family size on living arrangements across the lost decade. The term (m_{jt}) is the estimate of the error. Using coefficients from these models we test how much of the change in living arrangements is due to entry and exit of different cohorts with differing arrangements (between-cohort change) and how much is due to the changing arrangements of the same cohorts as they age (within-cohort change),following regression decomposition techniques (Firebaugh 1997).

Equation (2) has a highly flexible treatment of cohort effects. We have swept away (and therefore cannot estimate) the effects of overall economic conditions that vary over time. We are not using the information on the relationship between the changes in family size and in living arrangements as in equation (1). However, the model is more parsimonious and allows for exploring the role of additional independent variables, such as children's sex composition. Equation (2) has the following form:

$$\log\left[\frac{\Pr(y=1)}{1-\Pr(y=1)}\right] = \sum_{K=0}^{K} Child\ \alpha_{ij} + SesD\ \rho_{ij} + M_j \quad (2)$$

Pr(y=1) is the probability of living with adult children for elderly i in cohort j. The term (Childα_{ij}) represents number and sex composition of children. The term (SesDρ_{ij}) is a vector of socio-economic and demographic factors such as elderly log income, work status, sex, education, marital status, age and cohort. The third term (m_j) is the estimate of the error for the equations.

Results will be shown on figures of predicted probabilities and counterfactuals of co-residing with adult children. To address the extent to which the variables in our regressions can explain the trends in living arrangements, it is useful to simulate living arrangements under various counterfactual assumptions. We will take the coefficients from Regressions 1 and 2 and combine them with the actual values for the independent variables. We will implement two series of counterfactuals that are substantively relevant for our research: holding cohort constant and altering age (first specific aim represented in dark grey in Table 2) and holding age constant and varying cohort (second specific aim represented in light gray in Table 2).

Table 2. Analytical Strategy: Birth Cohorts by Age Group and Survey Year, PNADs 1976-2003*

	Elderly Age Groups				
Survey	60-64	65-69	70-74	75-79	80 or more
1976	1912 to 1916	1907 to 1911	1902 to 1906	1897 to 1901	1892 to 1896
1977	1913 to 1917	1908 to 1912	1903 to 1907	1898 to 1903	1893 to 1897
1978	1914 to 1918	1909 to 1913	1904 to 1908	1899 to 1903	1894 to 1898
1979	1915 to 1919	1910 to 1914	1905 to 1909	1900 to 1904	1895 to 1899
1981	1917 to 1921	1912 to 1916	1907 to 1911	1902 to 1906	1897 to 1901
1982	1918 to 1922	1913 to 1917	1908 to 1912	1903 to 1907	1898 to 1902
1983	1919 to 1923	1914 to 1918	1909 to 1913	1904 to 1908	1899 to 1903
1984	1920 to 1924	1915 to 1919	1910 to 1914	1905 to 1909	1900 to 1904
1985	1921 to 1925	1916 to 1920	1911 to 1915	1906 to 1910	1901 to 1905
1986	1922 to 1926	1917 to 1921	1912 to 1916	1907 to 1911	1902 to 1906
1987	1923 to 1927	1918 to 1922	1913 to 1917	1908 to 1912	1903 to 1907

1988	1924 to 1928	1919 to 1923	1914 to 1918	1909 to 1913	1904 to 1908
1989	1925 to 1929	1920 to 1924	1915 to 1919	1910 to 1914	1905 to 1909
1990	1926 to 1930	1922 to 1926	1917 to 1921	1912 to 1916	1906 to 1910
1992	1928 to 1932	1923 to 1927	1918 to 1922	1913 to 1917	1908 to 1912
1993	1929 to 1933	1924 to 1928	1919 to 1923	1914 to 1918	1909 to 1913
1995	1931 to 1935	1926 to 1930	1921 to 1925	1916 to 1920	1911 to 1915
1996	1932 to 1936	1927 to 1931	1922 to 1926	1917 to 1921	1912 to 1916
1997	1933 to 1937	1928 to 1932	1923 to 1927	1918 to 1922	1913 to 1917
1998	1934 to 1938	1929 to 1933	1924 to 1928	1919 to 1923	1914 to 1918
1999	1935 to 1939	1930 to 1934	1925 to 1929	1920 to 1924	1915 to 1919
2001	1937 to 1941	1932 to 1936	1927 to 1931	1922 to 1926	1917 to 1921
2002	1938 to 1942	1933 to 1937	1928 to 1932	1923 to 1927	1918 to 1922
2003	1939 to 1943	1934 to 1938	1929 to 1933	1924 to 1928	1919 to 1923

*There was no PNAD in 1980, 1991, 1994 and 2000.

We follow the same cohort to answer whether and why living arrangements change with age (dark gray in Table 2).Coefficients will be used to predict, for example, the probability of living in an intergenerational household for elderly born in 1916 for each age when they are seen in the data. Similarly, the coefficients are used to predict the probability of living in an intergenerational household for a 60 year-old for every cohort from 1916 to 1943 (light grey in Table 2), for example. Calibrating living arrangements to the actual 1916 cohort level for age 60, the living arrangement in each subsequent cohort is simulated using counterfactual assumptions, particularly for family size. Several alternative specifications will be implemented as scientific discovery is an iterative process.

Multinomial logistic regression is appropriate to handle the case of dependent variables with more than two categories (Powers and Xie 2000). Equation (3) is a multinomial logistic regression model of living arrangements using the four-category concept described earlier:

$$\log\left(\frac{P(M_{ij}=k)}{P(M_{ij}=1)}\right) = Xb_{ijk} + Child\alpha_{ijk} + SesD\rho_{ijk} + M_j \qquad (3)$$

The dependent variable is the log odds that an elderly person i in cohort j lives with other adult relative or nonkin, or lives alone, or lives only with a spouse and/or with young child (k) relative to living with married or unmarried adult children (l). The vector of variables is similar to the ones in equation (2). An advantage of employing both sets of models is that while equations (1) and (2) focus solely on co-residence with adult children, equation (3) provides more detail on an array of living arrangements.

In the third specific aim we examine whether adult children have benefited economically from co-residence with elderly parents. We focus on households where the elderly co-reside with adult children. Non-independence of observations is not a severe issue in the pooled data as only 6 percent of elderly co-reside with more than one adult child, but we will pay close attention to that. The economic shocks of the 1980s will be operationalized through dummy variables of whether children spent most, some, or none of their initial labor force exposure during the 1980s. We consider the ages of entry into labor force as15 to 25, given the high levels of child labor in Brazil. The substantive focus on elderly work status is motivated by the

fact that Brazilian elderly have been in the labor force at unusually high rates and a potential explanation is the poor employment conditions of the younger generation.

We describe the extent to which the elderly provides more to family income than their child, according to socio-economic and demographic variables of the elderly and child. Equation (4) is a logistic regression of the probability that elderly i in cohort j provide a larger portion of total family income than their child:

$$\log\left[\frac{\Pr(y=1)}{1-\Pr(y=1)}\right] = ChildD_{ij} + Eld\rho_{ij} + ChSESM_{ij} + M_j \qquad (4)$$

The term ($ChildD_{ii}$) represents a vector of childbearing characteristics such as number and sex composition of living children. The term ($Eld\rho_{ij}$) represents socio-economic and demographic variables of the elderly such as sex, marital status, and work status. The term ($ChSESM_{ji}$) is a vector of variables from children such as work status, occupation, if in informal sector, demographic characteristics, and dummy variables indicating whether or not the children were of labor market entry age during the 1980s.Our results will indicate, for example, the extent to which adults who co-reside with elderly parents and spent most of their initial labor force ages in the 1980s are more or less likely to have a higher proportionate income provision by elderly parents than adults who spent none of their initial labor force ages in the 1980s, controlling for other children and elderly variables.

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