Window of Opportunity: socioeconomic consequences of demographic changes in Brazil.*

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Abstract

In the last few decades , Brazil has experienced major demographic changes. From a young age structure in the 1970, the population is gradually shifting to an older distribution. The transformation in the population age structure can have important impacts on economic growth. This paper estimates the demographic dividends in Brazil, and shows that demographic changes could have positive impacts on economic growth, but lack of investments in human capital and poor institution could lead to a slower growth than what could be expected from the population change. We also analyzed two components of the

first demographic dividend: private and public. We observe that high public transfers to the elderly reduces the magnitude and duration of the fiscal dividend and could also harm the realization of the second dividend.

1 Introduction

This paper analyzes the relationship between changes in population age structure and economic growth in Brazil between 1970 and 2050. This paper builds on previous analyzes Queiroz, Turra, and Perez (2006). This version includes new estimates of the life-cycle deficit following the NTA methodology and updated population projections. We were also able to estimate dividends for the public and private sector separately, and provide a brief analysis of the impact of population changes on the public pension system.

While we know some facts about population growth and economic development, we know little about the interactions between population age structure and changes in demographic variables on economic growth. The transformation in population age structure can have important impacts on the economic growth, a phenomenon called demographic dividends. The rise in the share of working age population and individual responses to population aging can lead to these dividends. We use income and consumption age profiles, in conjunction with population projections, to study the macroeconomic consequences of population changes in Brazil. We estimate the demographic dividends, analyzed the first and second dividend, provide an alternative view by looking at public and private dividends and discuss the gap between observed economic growth and potential growth given by the dividends.

The consequences of changes in population age structure have regained interest in recent years (Cutler, Poterba, Sheiner, Summers, and Akerlof 1990; Bloom, Canning, and Sevilla 2003; Lee 2003b). Demographers and economists alike are interested in examining the extent to which interactions between population age structure and both fertility and mortality declines yield economic development. First, several studies indicated the role of population dynamics (age structure) on economic growth. For example, Bloom and Williamson (1997) showed that part of the Asian economic miracle was explained because the working-age population grew at faster rates than the dependent population from 1960 to 1995. They find that changes in population age structure account to about one-third of the observed economic growth in Asia during that period. Second, the early 1990s brought a different issue to demographers and economists in developed countries. What would be the impacts of population aging in the developed world? Cutler, Poterba, Sheiner, Summers, and Akerlof (1990) investigated whether population aging is a challenge or an opportunity to economic development. They

showed that the changing age structure can bring benefits to the society for two reasons: lower dependency ratio means more resources to be invested in the economy; and increase longevity affects working age population savings behavior creating positive effects on the income level.

The demographic dividend or demographic bonus has been recently presented as a combination of two separate dividends (Mason and Lee Forthcoming). The first dividend is usually related to a temporary increase in the share of the population that is of working age and can be effectively measured by increases in the ratio of producers to consumers in the population (Mason 2005). The second dividend, which has gone virtually unnoticed among most scholars, comes in succession to the first dividend and is related to the creation of wealth that arises in response to population aging. The magnitude of this effect depends largely on how wealth is created (Mason 2005). Rapid capital accumulation or larger transfers from younger generations, private and public, can meet consumption demands of an increasing elderly population. Only in societies where capital-deepening prevails will the effects of population aging ultimately increase the output per effective consumer (Lee, Mason, and Miller 2003).

Unfortunately, the demographic dividends are not automatic and depend on institutions and policies to transform changes in population age structure into economic growth (Bloom and Canning 2001; Bloom and Canning 2004). For example, it is fundamental that the labor market creates enough opportunities for the growing working age population, and that a developed financial market exists to fulfill individual's willingness to save (Mason 2005). Therefore, it comes as no surprise that some emerging economies that could benefit substantially from the demographic transition are also the ones that are more likely to fail in taking advantage of this process (Mason 2005).

Despite unabated interest among researchers in issues pertaining to macroeconomic consequences of population aging in developed countries, little is known about these issues in emerging economies. Brazil is one example of an important context for elaborating linkages between economic and population changes that has not been fully examined yet. Brazil has been characterized by rapid demographic changes (de Carvalho and Wong 1999), such as rapid fertility decline and improvements in life expectancy (Figure 1). From a young quasi-stable age distribution in 1970, the distribution has been gradually shifting to an older one. This transition in age structure implies in rapid growth of the working age population until 2045, from which the first dividend arises (Wong and de Carvalho 2005). Indeed, in a recent

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analysis, Rios-Neto (2004), using income data from Brazilian municipalities, shows that the association between working age population growth and income growth was positive and significant during the period 1991-2000. Yet, we expect that income growth would be greater if Brazil had stronger institutions, macroeconomic stability and more appropriate policies in place. Unfortunately, there are strong forces promoting stagnation (Pritchett 1997).

Since 1980 the economy has been stagnant, with an annual growth rate of 2,17%, compared to a strong average annual rate of 7,5% in 1950-1980. Indeed, the years between 1980 and 1993 were characterized by macroeconomic instability and successive attempts to combat high inflation rates. It was only in 1994 that a successful economic plan consolidated price stability. In recent years, several other factors have jeopardized economic growth and put at risk the demographic dividends. First, the rising ratios of public debt as a share of GDP (56% in 2002) have reduced the fiscal capability of the public sector to invest in human capital. At the same time, large public transfers to the elderly that have been recently documented in Brazil (Turra and Rios-Neto 2001), may represent an extra burden for future working age populations, reducing the ability and willingness of workers to save for future consumption. Third, income inequality has been persistent over the past few decades. Brazil has a much higher Gini coefficient (0.56) than the average coefficient for Latin America (0.4), and despite some improvements in educational attainment, educational levels remain remarkably low. Finally, the labor market has not been able to absorb the growing working age population. During the last two decades unemployment and informality rates have increased (Table 1).

Despite the growing interest in this area, we are not aware of any study aiming to quantify the demographic dividends and to explain possible reasons for the inability to exploit the dividends in Brazil. In an influential study, de Carvalho and Wong (1999) pointed out the need for policy makers to respond ahead of time in order to benefit from increases in working age population. Turra and Rios-Neto (2001) demonstrate that fiscal gains from demographic changes are transitory and may not last long given current public policies. (Turra and Queiroz 2009) show how the absence of appropriate policies mitigate temporary benefits of population change, and aggravate adverse effects of population aging, in the case of the Brazilian social security system.

In this paper we show that almost 100% of the economic growth between 1970 and 2010 in Brazil could be explained by the demographic dividends.

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Our findings, however, suggest that most of this contribution was concentrated in the 1970s; in the last two decades the economy has not taken advantage of the demographic changes. We speculate that low investments in human capital and the lack of proper social and economic institutions are responsible for jeopardizing the demographic dividends in the country.

2   Demographic Dividends

The first dividend arises and dissipates as changes in age structure interact with the lifecycle of production and consumption (Mason 2005; Mason and Lee Forthcoming). The first dividend is related to a temporary increase in the share of the working age population and can be effectively measured by increases in the ratio of producers to consumers in the population. In this sense, it measures increases in income due to the growth of working age population. The first dividend is temporary and not always positive. As population ages and the share of the elderly grows faster than the working age group, output growth will be depressed.

The first dividend might generate positive impacts to the family and government. Families benefit from having more adults able to receive income and less individuals depending on transfers, and the government benefits from a increase in the pool of tax payers and smaller number of beneficiaries of public transfers. We follow (Bixby and Robles 2008) and estimate private and public dividends, as part of the first dividend. We also estimate separate dividends from public education and public pension systems [1]. The private (familial) first dividend is estimated by increases in the household support ratio, that is given by the variation in the rate of household producers less the variation in the beneficiaries of private inter-vivos transfers. The public dividend is given by the changes in the ratio between effective tax payers and effective beneficiaries from public transfers. We also estimate separate dividends from education and social security, as components of the total public first dividend.

The second dividend comes in succession to the first dividend and is related to the creation of wealth that arises in response to population aging (Mason and Lee Forthcoming; Mason 2005). With rising elderly population,

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[1]They are the most important public transfer programs in Brazil, have important impact of general well-being and are heavily affected by changes in population age structure. We discuss in more detail the characteristics of the public programs below.

consumption in the future can only be maintained by accumulating capital or transfer wealth (Lee 1994). The accumulation of capital also influences economic growth, whereas transfers do not. It is important to note, however, that accumulation of capital does not need to be as high as when working age population is growing at rapid rates. Since there are fewer number of effective producers, the amount of capital necessary to keep capital-labor ratio constant is reduced.

We follow Mason and Lee (Forthcoming) to formalize the demographic dividends. According to the authors, output per effective consumer can be expressed by Equation 1:

$$\frac{Y_t}{N_t} = \frac{L_t}{N_t} * \frac{Y_t}{L_t} \tag{1}$$

where Y_t is the total output, N_t is the effective number of producers, and L_t is the effective number of consumers. The effective number of producers is the population weighted by the age income profile, and the effective number of consumers is the population weighted by the age consumption profile (Cutler, Poterba, Sheiner, Summers, and Akerlof 1990; Mason 2005). The support ratio is given by the ratio of effective producers (N_t) to the number of effective consumers (L_t).

By taking the natural log of both sides of Equation 1 and deriving it in respect to time, Mason and Lee (Forthcoming) obtain rates of growth (Equation 2):

$$\dot{y}_t = \dot{L}_t - \dot{N}_t + \dot{y}_t^l \tag{2}$$

Therefore, the rate of growth in output per effective consumer is equal to the sum of two components. The first component, given by the difference between the growth in the number of effective producers and growth in the number of effective consumers (i.e. the rate of growth of the support ratio), is the first dividend. The second component - the rate of growth of productivity reflects increases in the ratio of capital-labor and therefore, represents the second dividend. Mason (2005) shows that the rate of growth of productivity is proportional to the ratio of capital to labor income when both capital and transfer wealth grow at the same rate (i.e. when there are no changes in intergenerational transfer policy). Given that the accumulation of wealth in year t for the cohort born in year b=t-a or earlier is defined by the difference between the present value of future lifetime consumption and future lifetime

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production (Equation 3):

$$W(<= b, t) = \dot{C}(t)PVC <= b, t) - \dot{Y}^l(t)PVL(<= b, t) \qquad (3)$$

the ratio of capital to labor income can be easily estimated by dividing the expression above by labor income and manipulating algebraically its terms, so that (Equation 4)(Mason 2005):

$$w(<= b, t) = [c(t)/y^l(t)]PVC(<= b, t)/L(t)ePVL(<= b, t)/L(t) \qquad (4)$$

The second dividend is different the first in one main point: it is not transitory since capital deepening has permanent effect on income. However, they share an important similarity: both depend on institutions and policies to be realized (Mason and Lee Forthcoming; Bloom and Canning 2001).

3   Data and Methods

Estimates of the demographic dividends require both income and consumption age profiles. The results in this paper are based on age profiles estimated using Brazilian data. We make extensive use of the Living and Standards Measurement Survey of Brazil (PPV) to estimate age schedules of economic flows. The PPV was carried out between 1996 and 1997 by the Brazilian census office in a joint project with the World Bank. With a sample size of 4940 households, the PPV is representative of 70 percent of the national population and 75 percent of GDP (Turra 2000). The survey contains a comprehensive and comparable set of demographic and economic variables, including detailed information on household budget and expenditures. We also make use of administrative records, which provide us with information on taxes and public spending on education, health care and social security in 1996. More information about the data can be found elsewhere (Turra 2000; Turra and Rios-Neto 2001).

We follow the methodology developed developed by the National Transfers Accounts project (www.ntaccounts.org) to perform the calculations. Briefly, to estimate age profiles of consumption we apply different rules depending on how data on expenditures were colleted in the survey (i.e. individual or household data). Out-of-pocket expenditures on education and health were reported for all respondents and thus, are drawn directly from the survey.

Expenditures on cigarettes are allocated proportionally among adults aged 15 and older in the household. Expenditures on children and adult apparel are distributed proportionally among persons between ages 0 and 15 and persons aged 15+, respectively. Following the Lee transfer framework, the age consumption profile also includes (1) the mean value of public consumption by age (e.g. public spending on education and health), and (2) the value of services provided by consumer durables and housing. All the age profiles estimated are then adjusted by aggregated values in the National Income and Product Accounts.

Information on labor earnings is collected for all individuals ages 10 and older who worked for pay during the survey's reference week. Labor earnings are self-reported and include income before taxes from all jobs held during the reference week as well as the value of fringe benefits. To estimate labor earnings we include both employment and self-employment income. For self-employed individuals, we assume that 2/3 of their earnings is labor income and 1/3 is return to capital (Lee and Mason 2004).

4   Demographic Transition in Brazil

The panels of Figure 1 display some of the main features of the demographic changes that have occurred in Brazil over the last decades. Figure 1 also depicts future demographic scenarios. The demographic transition started with mortality improvements in the 1930s, which were followed by fertility declines in the later 1960s. Despite the delayed onset, the demographic transition in Brazil has been characterized by rapid changes (de Carvalho and Wong 1999; de Carvalho 1997/1998). The total fertility rate has reduced by more than half since 1970 (5.3 to 2.12 in 2000) and life expectancy at birth has improved steadily: from 57.5 years in 1970 to 70.3 years in 2000. From a young quasi-stable age structure in 1970, the age distribution has gradually shifted to an older distribution. Until 2000, the most important changes were the decline in the share of the young and a rise in the share of the working age population. Significant increases in the elderly population are expected to occur only in the next decades. The projections indicate that by 2050, the population aged 65 and older will represent about 18 percent of the total population, compared to 3 percent in 1970. These shifts in the age structure can be seen in the dependency ratios, which follow a well documented pattern: the total dependency ratio will decline until 2010 following the decline in the

young dependency ratio. The trend will then shift upwards as increases in the old-age dependency ratio became more important.

5 Consumption and Income Age Profiles

In assessing the impacts of demographic change on the Brazilian economy, it is important to start by examining the broad features of economic dependency. Usually, youth and old-age dependency ratios are used to describe the trends in the economic lifecycle (Figure 1). However, income and consumption age profiles provide more detailed and richer information about the lifecycle and economic dependency. Figure 2 depicts income and consumption age profiles pattern in Brazil estimated by the Brazilian NTA team using the methodology developed by Lee and Mason, more details are available at www.ntacounts.org. The results show that the lifecycle pattern in Brazil is quite similar to patterns found in developed nations (Lee 2003a). As in most industrialized populations today (see Mason et al. 2009), the Brazilian economic lifecycle is characterized by three stages: two periods of economic dependency interrupted by a surplus stage. Like in most developed nations today, where retirement emerges as an important stage of the lifecycle, the old-age dependency starts around age 55 in Brazil. The Brazilian surplus stage lasts about 20 years, starting between ages 30 and 35 and ending between ages 50 and 55. As Mason (2005) points out, the age profiles imply a gradation of dependency. For example, those aged 70 and over are more economically dependent than those aged 60-69, and children age 0-9 are more dependent than those aged 10-19.

Figure **??** depicts public and private net transfers. Net public and net private transfers finance most consumption by children and the elderly. Among children, private transfers account for a large proportion of the consumptionÑbetween 66% and 88% depending on ageÑwhereas public transfers represent, on average, less than one quarter of the total consumed. On the other hand, net public transfers account for more than 90% of the consumption of people aged 65 and above in Brazil. Except for the very old, net private transfers are negative for the elderly. In other words, the elderly make private transfers to their adult children. The net flow of private transfers is small as compared with public transfers at older ages, but it is very large as compared with other NTA countries. Previous studies have suggested that this pattern represents transfers flowing downward from older parents

to adult offspring and that it may be an indirect effect of the substantial support that the elderly receive from the public sector in Brazil (Camarano 2003, Saad 2004).

In a recent article, Turra, Queiroz, and Rios-Neto (2010) showed that the elderly in Brazil receive much higher per capita public transfers than do children. The ratio of net per capita public transfers (i.e. public expenditures net of taxes paid) for the elderly (ages 65+) to net per capita public transfers for children (ages 015) in Brazil is between 2.5 and 8 times larger than the ratios estimated for the U.S, Japan and selected European and Latin American countries. Turra, Queiroz, and Rios-Neto (2010) show that at ages below 5, public health care is the largest source of consumption, accounting for about a quarter of all public transfers received. Between ages 5 and 15, public education becomes the largest age-related component, representing about 40% of public expenditures. As mentioned before, the lack of a minimum retirement age creates incentives to early retirement, resulting in pension benefits paid to both private workers and public servants begin to rise steeply around age 40 and reach their high plateau by age 75, when they represent 86% of the total public inflows.

More interestingly, Turra and Queiroz (2005) analyzed the Brazilian intergenerational transfer systems by educational level of the household head and observed different patterns of private and public transfers. They showed that private transfers are more important for wealthy children than for poorer one. Children from less well-off household rely heavily on public transfer (education). However, a completely different results is observed for the elderly. Regardless of socioeconomic level, elderly consumption depends on public transfers, mainly social security and health care.

6   Overview of Public Transfer System in Brazil

Over the last century, most industrialized countries and some developing nations have established universal social insurance programs. Social insurance programs provide public welfare support for the population through in-kind and cash transfers. These programs guarantee both the well-being of the elderly and the development of the young generations and can help reduce inequality and promote economic growth (Lee and Mason, 2004). In Brazil, public welfare support reached about 21% of GDP in 2002, considering all government levels (Brasil 2003), an amount that is comparable to social ex-

penditures in most developed countries. While social security benefits and other forms of elderly support represented about 12% of GDP, public expenditures on education and health amounted to 5.5% and 3.5% of GDP in 2002, respectively (Camargo, 2004).

The historical evolution of total expenditures on public education and pensions (general system and public servants) is shown in Figure 9. Since the 1940s, expenditures on pensions (currently around 10% of the GDP) have been by far larger than expenditures on public education (currently around 4%). One should note that these are crude measures and do not account for compositional effects. Thus, since the Brazilian population was very young during the XX century, the discrepancies are certainly mostly larger when controlling for age structure. The rise of public expenditures on education in Brazil started much later than in other nations. In Brazil, the consolidation of primary public education did not occur before most of the elderly population had begun receiving retirement benefits.

6.1 Social Security

In Brazil, most pension systems are based on the PAYGO system. The country has also a large non-contributory system, with means-tested eligibility. The pension system is divided in three segments: general system, civil servants system, and private funded system. The general pension system was centralized only in 1966, when the House of Representatives approved the Social Security Ordinary Law. The National Social Security Administration, INPS, incorporated all the revenues and expenditures from sector-specific programs as well as its assets and liabilities. Another major change during this time was in the scheme of the program, which changed from a capitalization system to a PAYGO. The last major change in regulation happened with the 1988 Constitution, which extended mandatory social security coverage to most of the excluded groups, including rural workers, without requiring equivalent increases in revenues from contributions. Other measures made the system more generous than before: establishing the minimum wage as the lowest benefit paid by the system, indexing all pensions to the minimum wage, and reducing the minimum age of retirement.

The general system was conceived when rapid population growth and low life expectancy combined to sustain the program. In recent decades, however, the ratio workers/retirees has declined. The ratio was 30:1 in 1940, declined to 5:1 in the 1960s, was 1.7:1 in 2000, and is projected to be 1:1 by 2013. In

2000, the PAYGO system had 27 million workers contributing and 16 million beneficiaries. About 77% of the population aged 60 and above receive some sort of pension benefit (Queiroz 2005). Until 1998, full pension benefits were granted to all workers who have contributed for 10 years to the system, have reached normal retirement age (65 for men and 60 for women - Old-Age Pension Benefit), or could prove that they have been working for a certain number of years (35 for men and 30 for women, but without requirement of contribution over that time - Length of Service Pension Benefit). In addition, special retirement schemes existed that granted proportional retirement benefits for individuals who had worked for 30 and 25 years, for men and women respectively. The benefits were computed based on the last 36 months of activity (Brazil 2002). The level of benefits is relatively high. Old-age benefits recipients receive, on average, 3 times the minimum wage, and length of service benefits is 2.5 times higher than old-age benefits (Queiroz, Turra, and Perez 2006). In 1998, after years of political debate a significant reform was approved in order to help solve the programÕs fiscal imbalance. The main change was the introduction of a new methodology to calculate pension benefits based on an actuarial rule. The new benefit computation is based on the Swedish Notional Defined Benefit Program and takes into account longer earnings history, the life expectancy at age of retirement, and a coefficient that creates disincentives to early retirement. A minimum retirement age has not yet been approved for workers in the private sector (Brazil 2003).

Alongside the general pension system, civil servants have their own pension program. Although smaller in absolute numbers when compared to the general program, expenditures with the civil servants program are not trivial, reaching 4.7% of GDP in 2002 (Queiroz 2005). The program is a complex chain of federal, state and local systems, including special programs to different civil servant categories. There are two main advantages in the civil servant system: higher replacement rates and shorter time of contribution to receive full pension benefits. The program deficit is high and has been increasing over the past decade. In addition the program has very high dependency ratio. That is, few active workers to retiree, which increases doubts about its future sustainability.

6.2 Public Education System

Education is certainly the most effective program to reduce inequality and improve the life standard of a population. The 1988 Constitution determined

that the Federal government should spend 18% of its budget on education, while the states and municipalities should spend 25%. In general, primary education is provided by the municipalities (3.6% of GDP), while state level government is responsible for secondary education (0.8% of GDP) and the central government funds most of the public higher education (0.5% of GDP) (Camargo 2004; Almeida 2001). Since 1971, 8 years of primary education has been mandatory. Since 2000, almost all children aged 7 to 14 have been enrolled in school, but many problems have persisted including grade retention and school drop-out after age 15.

Although the Brazilian government spends similar percentage of GDP on education than other countries, the pattern of expenditures per pupil is dramatically different. For example, while in Brazil per pupil expenditures on higher education are about 14 times larger than on primary education, in OECD countries the ratio is only 2.7, emphasizing the unequal distribution of public resources by level of education in Brazil (Almeida 2001).

In recent years some programs have been created to improve the quality and coverage of basic education. For example, the FUNDEF is an educational fund that was created to (1) increase investments on basic/primary education, (2) guarantee a minimum amount of expenditures per pupil in primary education, and (3) allocate resources from richer areas to poorer ones. In addition, the 'bolsa-escola', a means-tested conditional cash transfer, was implemented to incentive families to keep children aged 7 to 14 in school. Finally, the federal government has developed new curricular guidelines and established a system of performance evaluation for school and students (Schwartzman 2003).

7 The Demographic Dividends

7.1 The First Demographic Dividend

The first dividend is related to a temporary increase in the share of working age population and it is effectively measured by increases in the ratio of producers to consumers in the population. Estimates of the first demographic dividend use age profiles of income and consumption and population age distributions. The results presented here were estimated using Brazilian profiles for 1996 (Figure 2). We assume that this cross-sectional profile is constant during the period of analysis (1970-2050). This assumption ignores

how socioeconomic development might affect the patterns of income and consumption in the future. Also, we are assuming that demographic changes will not affect the arrangements of intergenerational transfers (Preston, Heuveline, and Guillot 2001), nor how the expansion of public programs might affect patterns of consumption (Becker and Murphy 1988). In this paper, we are mainly concerned on how demographic changes can have impacts on economic growth. On further research we are considering alternative scenarios.

Figure 3 presents the support ratio and the first dividend. The two vertical lines indicate when the growth rate of the support ratio turns negative (i.e. the first dividend equals to zero), in 2026. The support ratios (effective producers to effective consumers) in Brazil are unfavorable during the 1970s and 1980s. High fertility rates and declining infant and child mortality led to a larger proportion of children, about 50% of the population under age 20 during this period, causing the low support ratio.

From the late 1990s on the country experience a rapid rise in the support ratio lasting until 2040. These improvements in the support ratio are caused by the fertility decline since 1970s and the consequent increase in working age population (Figure 1). The trend in the Brazilian support ratio shares some similarities with the Indian experience, shown in Mason (2005). They both have only one peak contrary to the US experience, and the rise in the support ratio starts later in these two countries compared to the United States and Japan. However, the rate of growth of the support ratio is faster in Brazil than in Indian because fertility decline in India was much slower than in Brazil. BrazilianÕs support ratio peaks in 2010 while support ratio in India will not peak until 2040 ((Mason 2005).

The first dividend, the rate of growth of the support ratio, is shown in Figure 3. Brazil has one clear period of demographic dividend, starting in 1975 and lasting until 2025. The dividend is strongly positive during those decades. In this period the economy should have grown at about 0.6% per year on average due to the first dividend only. The effects of population aging are already observed after 2005, when the first dividend starts to decline, but they are more evident after 2025 when it turns negative. The first demographic dividend after 2025 will be a drag to economic growth.

Figure 4 compares the duration of the first dividend in Brazil with other countries. The first dividend in Brazil will last longer than what is observed in industrialized countries. The first dividend in Brazil is about 20 years longer than the developed world experience. Mason (2005) shows that the first dividend last for 30 years in both Japan and the USA, and it is already being

a drag to economic growth since 2000. The dividend in Brazil is shorter than other developing nations, more specifically Asian countries. For exemple, the first dividend in India started in 1975 and it is expected to last until 2040 (about 15 years longer than in Brazil).

Table 2 shows the potential impact of the first demographic dividend on actual economic growth. We follow Mason (2005) to analyze the contribution of the dividends on economic growth. The table reports the first dividend (growth rate of the support ratio), the growth rate of GDP per capital, growth rate of GDP per effective consumer, and the contribution of the first dividend to the observed economic growth rate. GDP per effective consumer is a better measure rather than GDP per capita because it incorporates the effects of demographic changes on population consumption and needs (Mason 2005).

The results presented in the table show some interesting patterns of the Brazilian economic growth from 1970 to 2000. During this period the decline in fertility rate and the consequent increase in working age population led to an increase in GDP per effective consumer of 0.6% per year on average. In the future the expected changes in the Brazilian population age structure will lead to a negative effect on economic growth. From 2020 to 2040 Brazil will experience a negative effect, 0.4% per year on average, on potential economic growth.

The first dividend contributed to almost 30% of the observed economic growth from 1970 to 2010. The first dividends contribution in Brazil is greater than the ones observed in Japan, India and the United States. Mason (2005) estimates the contribution of the growth rate of the support ratio in 20% for the United States and about 10% for India during the same period. However, Table 3 shows that Brazil failed to take better advantage of the process in recent years. Most of the contribution of the first dividend is from 1970 to 1980. In the 1980s and 1990s the growth rate of support ratio could have led to an increase of the GDP per effective consumer of 2.5% and 2.4% per year, respectively. However, the observed economic growth was smaller than the first dividend alone. The growth rate of GDP per effective consumer from 1980 to 1990 was negative 0.61% per year, and from 1990 to 2000 it was 0.08% per year.

7.2 First Dividend: public and private

Figure 5 presents the public (fiscal) and private (familial) components of the first dividend. The private dividend implies an improvement in living conditions because there are more effective producers that effective consumers in the household for a certain period of time. The fiscal dividend is related to the larger number of potential contributors in relation to beneficiaries of public transfers. The familial (private) dividend is greater and lasts longer than the fiscal dividend. In general, brazilian households can expect to improve its life conditions (well-being) by more than 0.5% per year from 1980 to 2020. After 2020, the familial dividend declines until it becomes negative in 2035. From 2035 on, brazilian household will observe a reduction in their well-being resulting from demographic changes. The fiscal dividend lasts much less than the familial dividend, it is estimated to be negative after 2005. During the window of opportunity, when effective producers increase faster than effective consumers, and could boost government revenues, we observe a very small and short period of gains. This happens because at the same time that public revenues increase, we also observe a rapid increase in government spending on public programs, especially for the elderly (Queiroz 2005; Camargo 2004; Brazil 2003).

This results is related with a large body of the literature that discuss the size of the Brazilian public transfer system (Camargo 2004; e Francisco Ferreira 2002; Turra, Queiroz, and Rios-Neto 2010; Saad, Miller, and Martinez 2009). (Araujo, Turra, and Queiroz 2010) show that the public sector has been generous to the current generations of elderly in Brazil, without receiving enough compensation in terms of life cycle taxes. Their results show that the current generation of adults (the demographic bonus) suffer from a double burden. They are responsible for paying for the large public pension system and are also contributing to the expansion of the public education program. This situation probably affects the ability of the public sector (and families) to invest properly on education, investing less than necessary in human capital of future workers, which might reduce even more productivity growth in Brazil (Schwartzman 2003; Bonelli and Fonseca 1998).

7.3 Brief Look at the Public Pension System

We follow the methodology developed by Bongaarts (2004) to investigate the impact of changes in population age structure to the social security system.

Bongaarts (2004) proposed the use of a more accurate measure to relate the weight of pensioners in a economy: the ratio of pensioners to workers (PWR). The PWR is directed related to the old-age dependency ratio and the pensioner ratio (number of pensioners to the population aged 65 and above), and it is indirectly related to the employment ratio (ratio of workers making contributions to the population aged 15 to 64). The data for population in Brazil were obtained from the National Statistics Office (IBGE). The data from pensioners and contributors were obtained from the Ministerio da Previdencia Social (MPAS). We considered only the benefits that were considered active by MPAS and contributions made by individuals.

PWR is much larger than the usual old-age dependency ratio for all countries, ranging from 0.27 in the United States to 0.71 in Italy. PWR in Brazil is affected by the high level of informality in the labor market, early retirement ages, and generosity of the public pension system. The number of pensioners per worker rises substantially with time, as it would be expected by the rapid process of population aging in Brazil (shown by the rise in old-age dependency ratio). In 2050, PWR is projected to reach 1.23, that is, 123 pensioners per 100 workers. The trend in Brazil is similar to what is projected for Italy where PWR is projected to be 1.55 in 2050. PWR in Brazil is project to be the second highest among the countries analyzed here (based on Bongaarts estimates). For instance, the ratio in the US is project to reach 0.46 in 2050 compared to 0.27 in 2000. The effects of age structure on the pace of population ageing (i.e. population momentum) have provided extra time for social security; about 25 years until pensioner per worker ratio reaches levels that will be unsustainable to the system and to the economy.

The findings reveal that Brazilian policy makers have made decisions that are poorly grounded on a technical basis and overlooked the temporary nature of the demographic transition. By granting new forms of benefits without requiring contribution (e.g., inclusion of rural workers in 1988) and by not approving reforms to encourage tax payments, policy makers have reduced the benefits of the demographic transition and aggravated financial issues from population aging.

7.4 The Second Demographic Dividend[2]

To estimate the second dividend we follow Mason (2005) and apply several simplifying assumptions. First, we measure the ratio of capital to labor income at ages 50 and older to represent the wealth accumulated over the individual life cycle. Second, although we assume that the age patterns of consumption and labor income do to not change over time, we do allow consumption and income levels to increase by 1.5% a year. To estimate the present values of consumption and labor income we further assume a rate of interest of 3% in order to keep our results consistent with previous applications of the model (Mason 2005). Finally, to translate changes in the ratio of capital to labor income into productive growth we assume that the elasticity of labor income with respect to capital is 0.5. As indicated above, on further research we are considering alternative scenarios.

The estimates of lifecycle wealth and the second demographic dividend are presented in Figure 6, which shows the estimates of the ratio wealth to output, and Figure 7, which shows estimates of the second dividend from 1970 to 2045.

Lifecycle wealth has been growing quite slowly until recently. According to our estimates the ratio of lifecycle wealth to output will reach 0.45 in 2050. Mason (2005) shows that the United States reached ratio equals to 1 in 1905, Japan in 1940, and India in 1985. In recent years we estimate more rapid grow to this ratio in Brazil because age structure is changing fast with the population getting older. We estimate wealth-output ratio growth rate in 2.65% per year from 2015 to 2050. Despite raising growth rates, the wealth-income ratio in Brazil is much lower than what it observed in other countries developed and developing (Mason 2005). The low levels of capital accumulation might have negative effects on future economic growth.

The increasing wealth translates in economic and productivity growth. Wealth accumulation and consequent capital deepening has direct effect on productivity and economic growth. Figure 7 depicts productivity growth rate from 1970 to 2045. Before 2010, capital deepening caused by population aging would have raised productivity level by 1.79% per year on average. The effects of population aging are clearly observed after 2015, when one-forth of the population is over 50 years old. From 2015 to 2045, the productivity effect would increase by 150%, jumping to 2.68% per year on average.

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[2]This estimates are very preliminary and needs further revision.

7.5 Combining the Dividends

Table 3 presents the contribution of the first and second demographic dividends to growth in GDP per effective consumer. The second dividend is greater than the first dividend for all periods but 2005-2010. This is also found by Mason (2005) observes for the USA, Japan and India, in these three countries the second dividend is greater than the first and the magnitudes are large. The combined effect of the first and second dividends contributed to 97% of the observed growth rate in GDP per effective consumer from 1970 to 2010. As with the first dividend, the Brazilian economy failed to take advantage of the second dividend. We show that for the two most recent decades the growth rate in GDP per effective consumer was lower than what the demographic dividends would predict. For example, from 2000 to 2005 GDP per effective consumer growth rate was one-half of what the demographic dividends would predict.

Population change seems to be favorable to economic growth in Brazil in the near future. From 2010 to 2045, the demographic dividends (first + second) could raise GDP growth per effective consumer by 2.48% per year on average (Figure 7). On the contrary, developed countries studied by Mason (2005) will have a small or even negative contribution from the demographic dividends to economic growth. Population change provides an window of opportunity that can either be used or not by countries.

There is evidence to support the view that the demographic transition leads to an income boost, the gains from this association depend on several conditions, including the ratio between producers and consumers, the degree of capital deepening, and the existence of appropriate institutions and economic policies. In Brazil, policy makers have been neglecting the opportunities that changes in population dynamics can bring to the economy by maintaining domestic policies that are less efficient than desired. The Brazilian case is remarkable because of the historical low levels of educational attainment and the increasingly large pay-as-you-go pension systems.

8 Conclusion

This paper has shown that demographic changes might favor economic growth when appropriate policies and institutions are in place. We also have contributed to extend and deepen the knowledge of how much demographic

changes in Brazil can impact on economic growth. More specifically, we now have some understanding that the country is failing to take advantage of the positive impacts of the demographic dividends. In the last few decades, the Brazilian economy grew at much slower rates than what the demographic dividends alone would predict, contrary to the experience of other developing countries (e.g. Asian countries).

One of the main findings of our work is that the demographic dividends explain 97% of GDP per effective consumer from 1970 to 2010. However, our results also indicate that the economy growth rate could have been greater if the country had taken advantage of the changes in population age structure. In addition to that, we find that most of the dividendsÕ contribution happened in the 1970s, the last two decades have observed economic growth rates much smaller than what demographic changes would predict. These findings reveal that Brazilian policy makers have not made decisions to transform changes in population age structure into economic growth. Moreover, if policies are not adopted future benefits of the dividends will also be lost.

The second important finding is that we show that the first demographic dividend can be dividend into the familial (private) and fiscal (public) dividends. The private dividend implies an improvement in living conditions because there are more effective producers that effective consumers in the household for a certain period of time. The fiscal dividend is related to the larger number of potential contributors in relation to beneficiaries of public transfers. As we show before, Brazil is characterized by large public transfers to the elderly resulting in a smaller dividend that lasts for a short period of time. In other words, giving the current structure of public transfer system in Brazil, the government will observe a faster growth in the number of beneficiaries than contributors, and it will enjoy for a very short period the benefits brought by the demographic transition.

In attempting to explore further benefits of demographic changes we also simulate future trends in the demographic dividends. Our results indicate that the Brazilian economy can still benefit from population dynamics and boost economic growth. On one hand, the possible advantages from the first dividend will last until 2025, thus, there is still some time to elaborate policies to benefit from this opportunity. On the other hand, the benefits from the second dividend are permanent but they will be realized only if capital deepening prevails. The experience of Asian economies should provide some insights on how to benefit from the demographic bonus. Investments in human capital and policies to incentive wealth accumulation should be top

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priority for current and future governments.

The second demographic dividend provides the country with a chance to sustain reasonable economic growth. However, the realization of the second dividend depends more heavily on proper policies than the first one. It is important that public policies in Brazil creates incentives to private savings and that institutions are reliable for investors. Making public pension systems large and generous might reduce the propensity to save, reducing the capacity to invest, affecting economic growth.

The rapid process of population aging will have huge impacts on the sustainability of the Brazilian public transfer system (and familial support network). The increase in the old age dependency ratio means a larger number of beneficiaries will depend on a smaller number of workers. The demographic problem is not the sole issue in this matter. Other research has shown that large public transfer systems provide incentives for individuals to leave the labor force earlier, thus increasing dependency ratio, and crowding-out of private investing, affecting even further the fiscal dividend. The rapid population aging, size and fiscal problems of public transfer systems in the developed world led researchers to devote considerable attention to this problem. However, developing countries are aging more rapidly than developed countries, and social welfare programs will be asked to provide more support than they might be able to give.

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Variable	1976	1981	1985	1996	2003	2006
GDP per Capita (U$ 2009)	5719	6252	6349	6792	6974	7616
Annual Inflation Rate (%)	46.2	95.20	235.13	9.33	7.66	3.79
Unemployment Rate(%)	1.82	4.26	3.38	9.95	5.24	9.2
Average Years Schooling	3.23	3.9	4.3	5.4	6.3	6.6
Formal Employment Rate (%)	57	41	39	55	58	52
Gini Index	0.62	0.58	0.59	0.60	0.58	0.56
Economic Growth (a.a.%)	10.26	-4.25	7.85	2.66	0.54 2.7	

Source: Ferreira and de Barros (1999) and Ipeadata, 2010

Table 1: General Economic Indicators, Brazil, 1976-2006 (selected years)

Period	Support Ratio	GDP per Capita	Effective Consumer	GDP per Consumer	Ratio
1970-1975	0.305	7.13	2.32	7.27	4.28
1975-1980	0.285	4.6	2.39	4.56	6.20
1980-1985	0.626	-1.03	1.87	-0.61	60.61
1985-1990	0.593	-0.09	1.94	-0.08	680.32
1990-1995	0.734	1.32	1.67	1.26	55.62
1995-2000	0.717	0.49	1.69	0.3	147.27
2000-2005	0.738	1.38	1.13	1.62	53.43
2005-2010	0.557	2.06	1.03	1.9	27.05
1970-2010	0.569	1.98	1.76	2.03	28.72

Source: Ipeadata, 2010 and Author's Estimates based on Brazilian PPV

Table 2: Growth Rates of the support ratio and GDP per effective consumer, Brazil, 1970-2010

Period	GDP per Consumer	First Dividend	Second Dividend	Total Dividend	Dividend/Actual
1970-1975	7.72	0.305	2.37	2.675	0.37
1975-1980	4.56	0.285	2.51	2.795	0.61
1980-1985	-0.61	0.626	1.96	2.586	
1985-1990	-0.08	0.593	1.85	2.443	
1990-1995	1.26	0.734	1.08	1.814	1.44
1995-2000	0.3	0.717	0.95	1.667	5.6
2000-2005	1.62	0.738	0.13	0.868	0.54
2005-2010	1.9	0.557	0.92	1.477	0.78
1970-2010	2.03	0.569	1.41	1.979	0.97

Source: Ipeadata, 2010 and Author's Estimates based on Brazilian PPV

Table 3: Estimates of First and Second Dividends, Brazil, 1970-2010

Figure 1: Demographic Transition in Brazil, 1950-2050
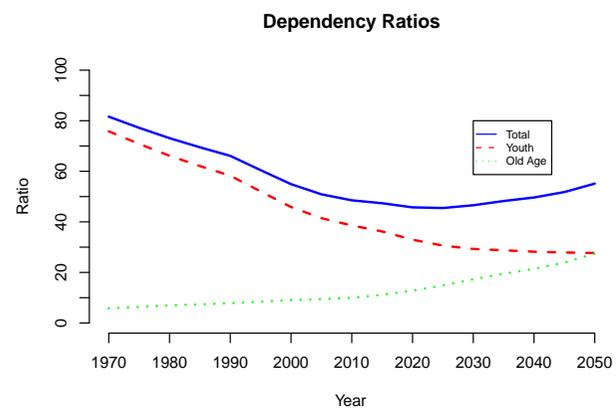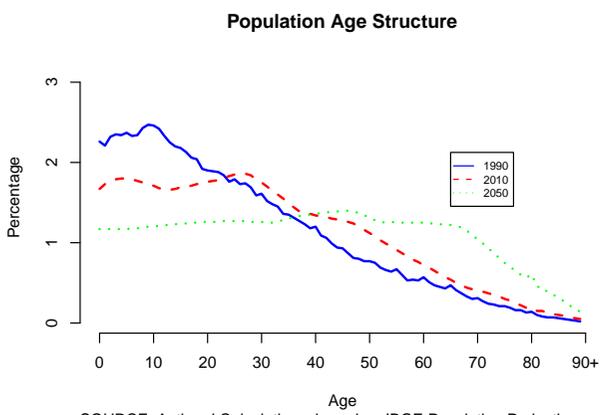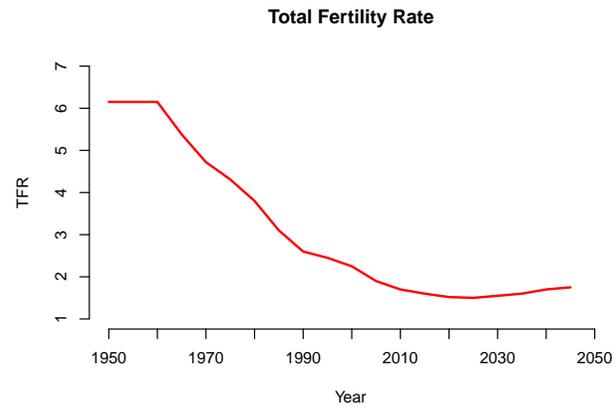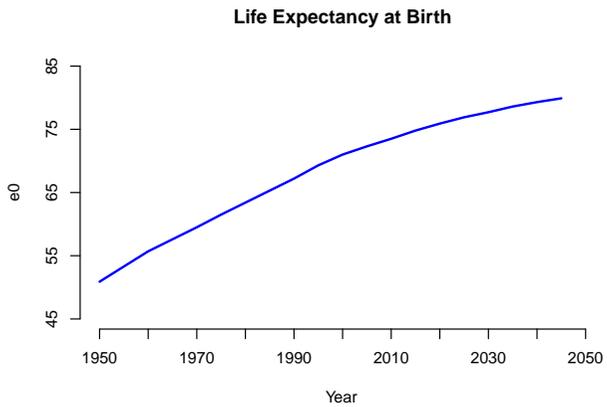
SOURCE: Authors' Calculations, based on IBGE Population Projections
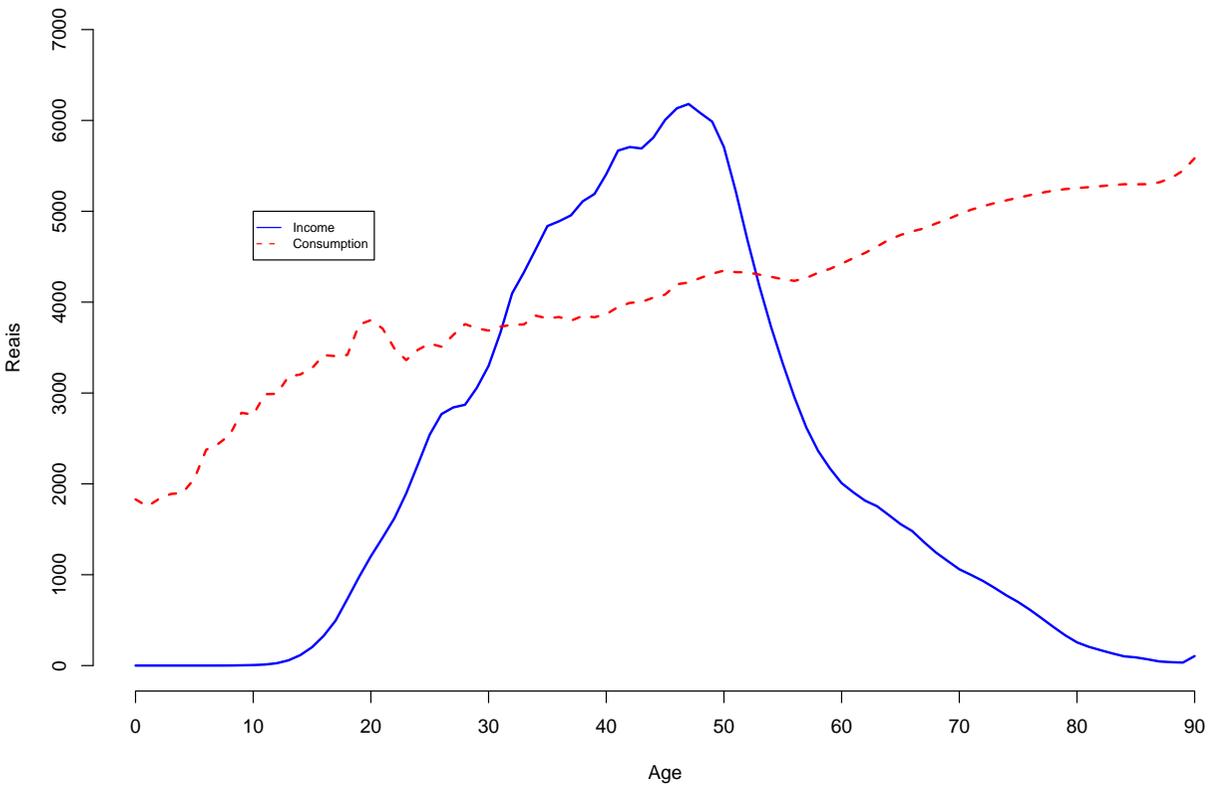
Figure 2: Income and Consumption Age Profiles, Brazil, 1996

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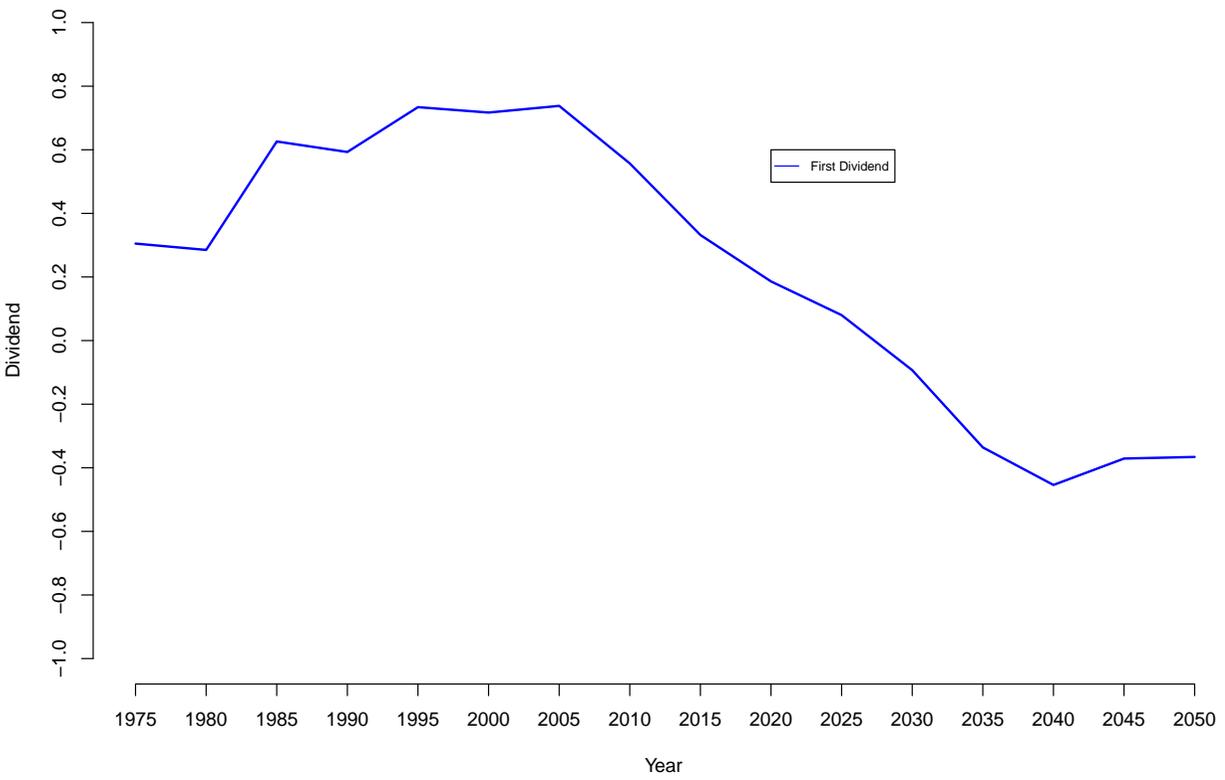
Figure 3: First Demographic Dividend, Brazil, 1970-2045
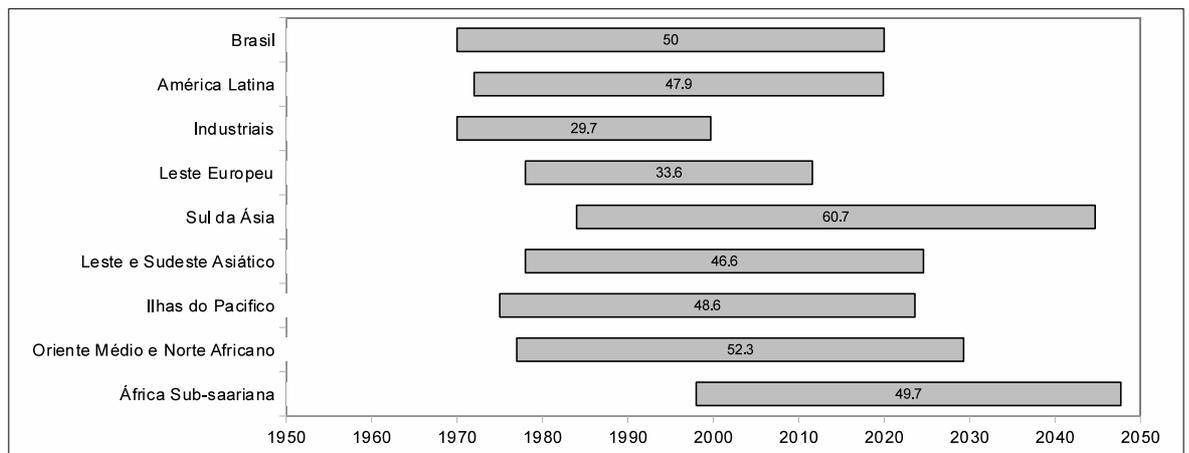
Figure 4: The Timing of the First Demographic Dividend: Brazil and Other Countries
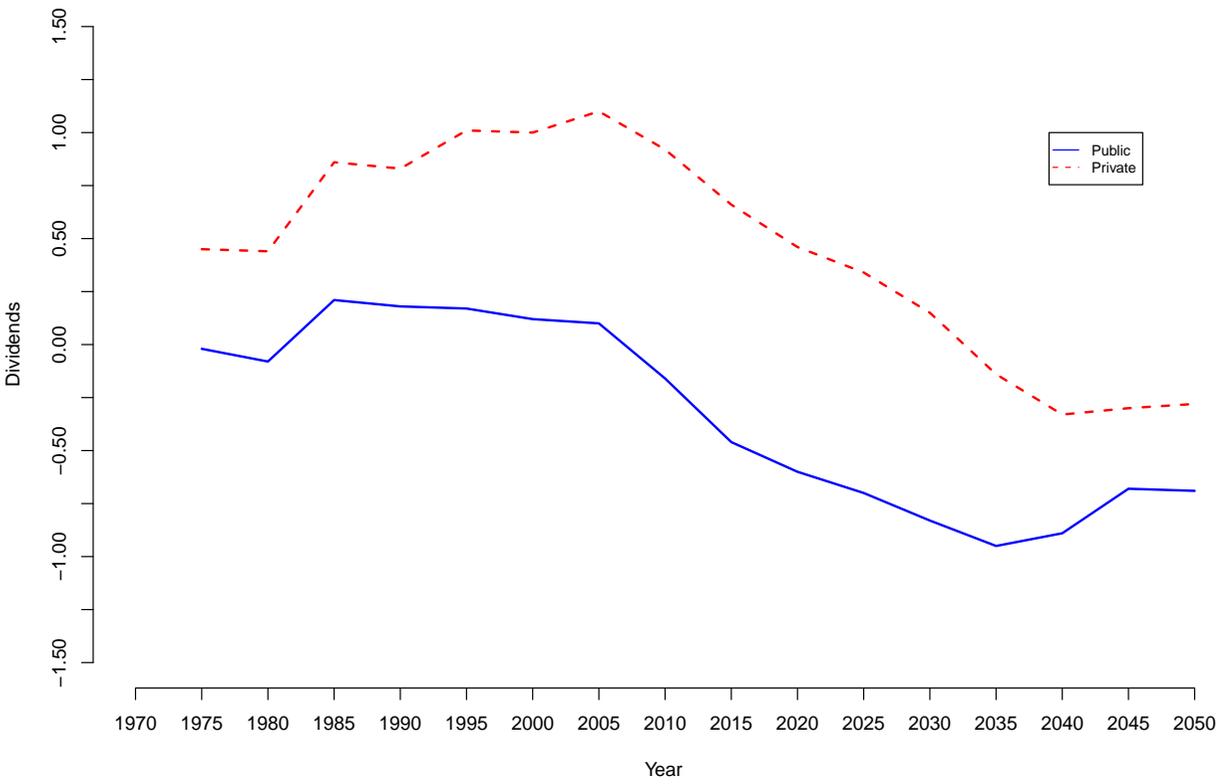
Figure 5: Public and Private First Demographic Dividend, Brazil, 1970-2045
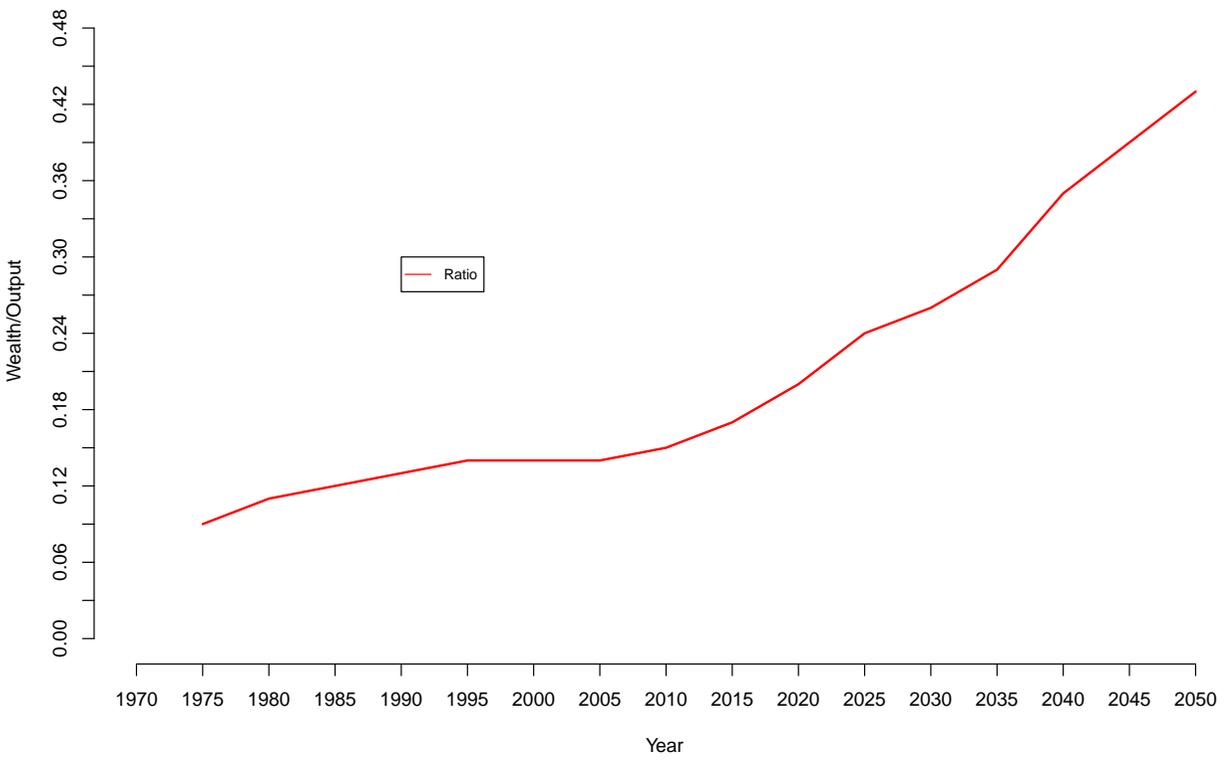
Figure 6: Estimates of Wealth (50+) to Total Output, Brazil, 1970-2045
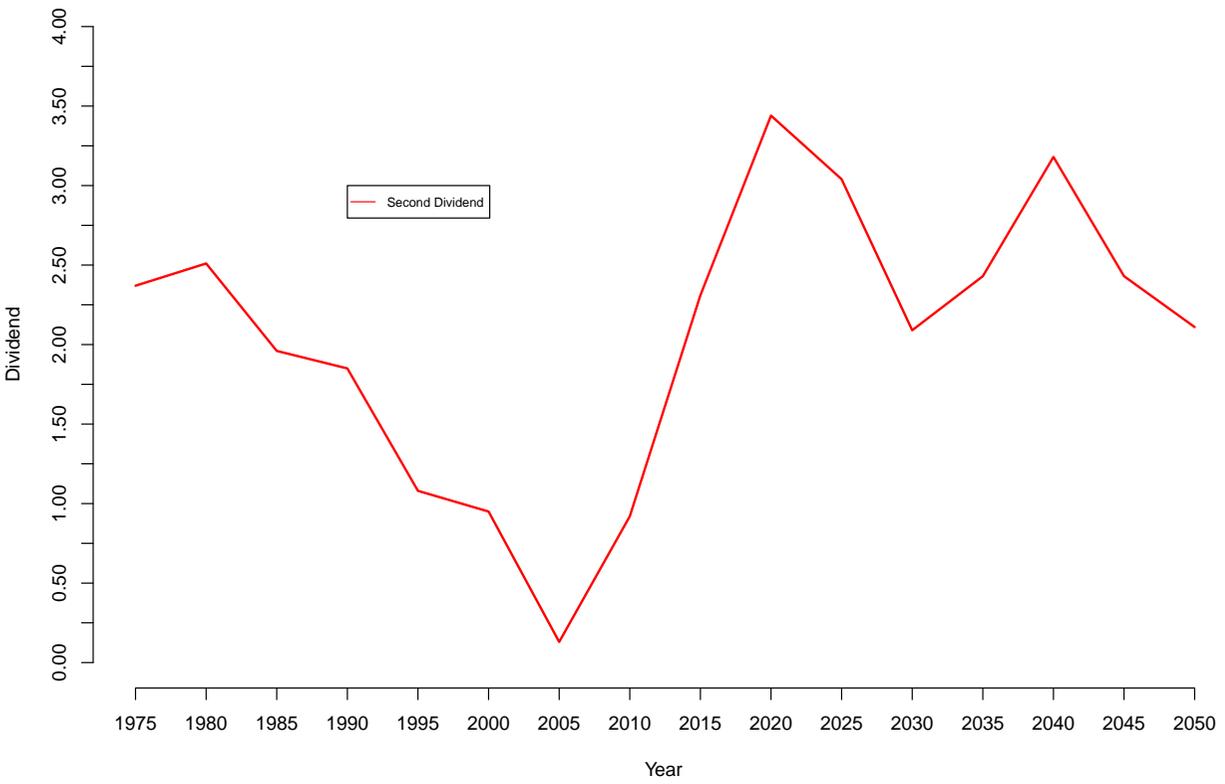
Figure 7: Second Demographic Dividend, Brazil, 1970-2045
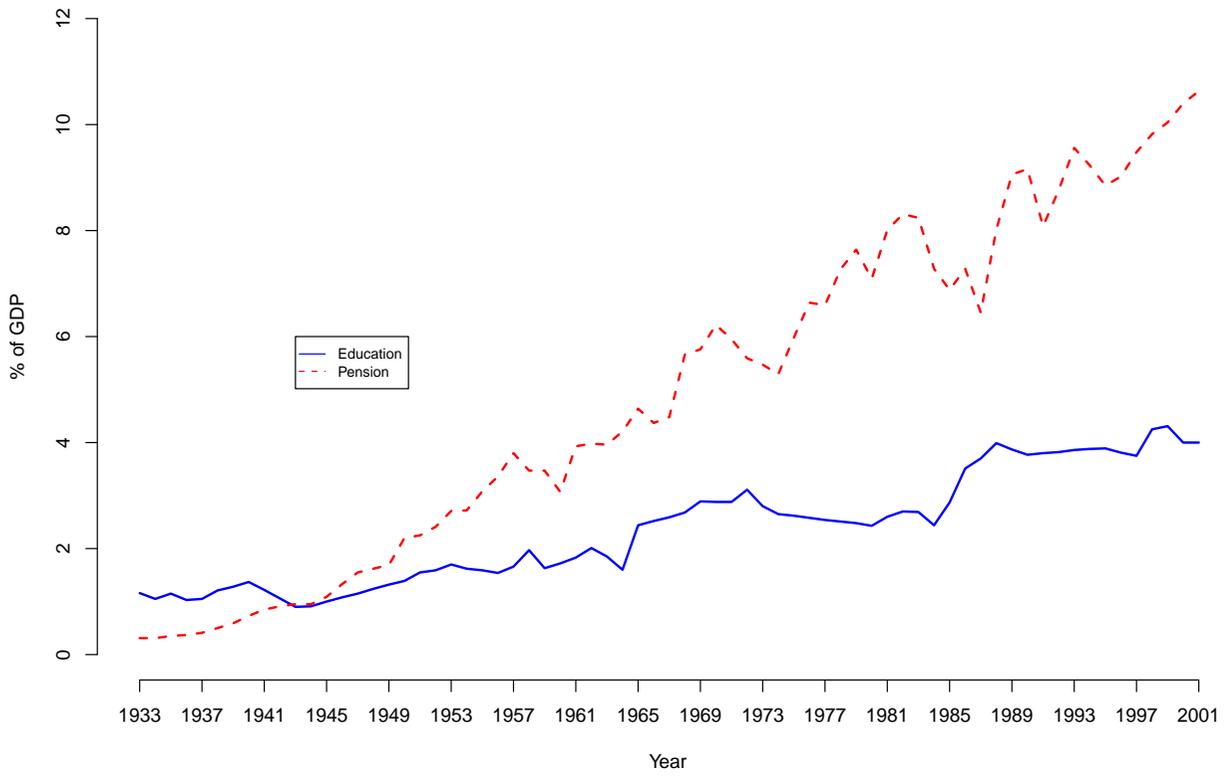
Figure 8: Public Expenditure on Pension and Education, as % of GDP, Brazil, 1933-2001
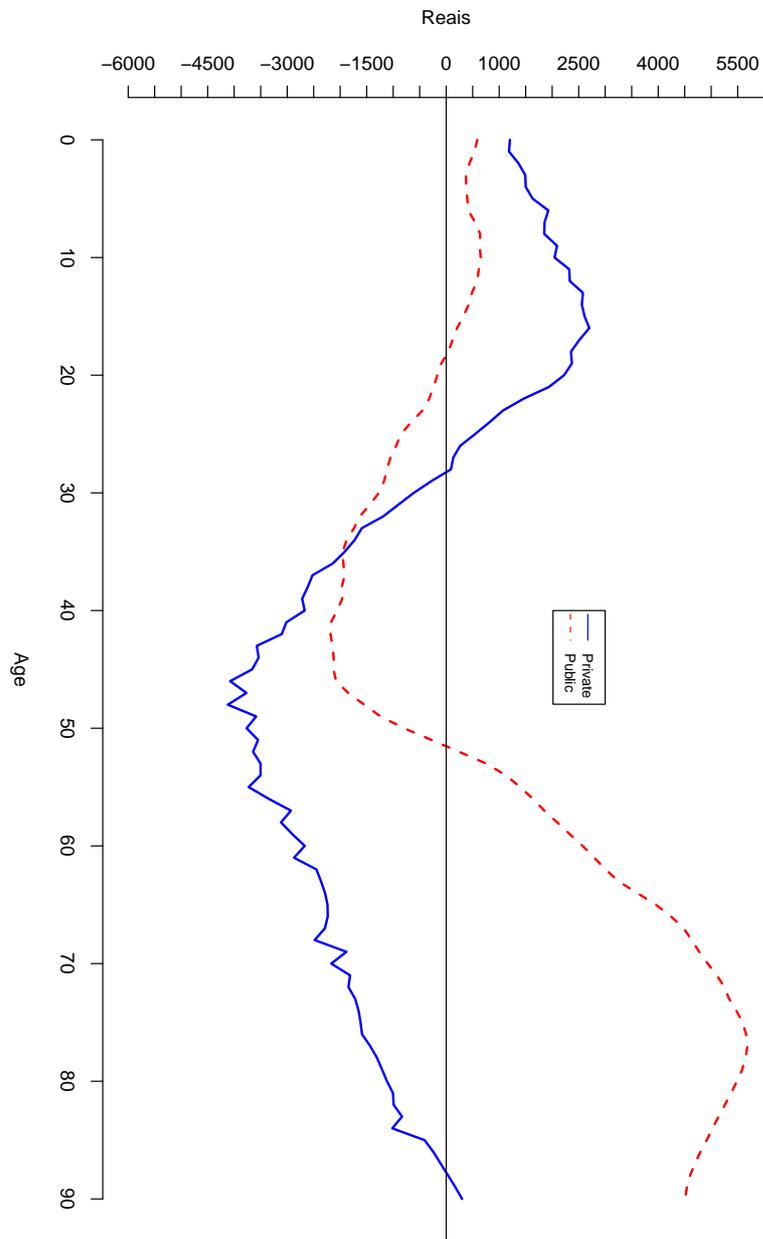
Figure 9: Public and Private Net Transfers by age, Brazil