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Before it's too late: Demographic Transition, Labor Supply, and Social Security Problems in Brazil

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A. INTRODUCTION

One of today's central debates about the demographic transition centers on the relationships that connect changes in population age structure to economic growth. Demographers and economists alike are interested in examining the extent to which interactions between population momentum and both fertility and mortality declines yield increases in aggregate income levels. This process usually called 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 and Feng, 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. 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). 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. Rigid regulations in the labor market, low investments in human capital, tax evasion, socioeconomic inequality, and lack of well-regulated capital markets are some examples of constraints that limit the ability of developing countries in benefiting from population changes. Despite consensus among scholars about most of these issues, however, additional research is needed on the linkages between policy environment and demographic transition.

Among critical policy areas, social security and other forms of elderly support based on pay-as-you-go schemes are essential components. Weaknesses in the governance and management of PAYGO pension programs lead to negative effects for the demographic dividends. For example, if greater tax evasion[1] or real increases in social security benefits offset increases in the share of working age population, the fiscal capability of governments to invest in human capital will be reduced. In turn, efficiency loss may lower the effect of the demographic transition on both future productivity and economic growth. At the same time, declining social security support ratios (i.e. ratio of social security tax payers to beneficiaries) can represent a fiscal burden for future working age populations, reducing the ability of workers to save for future consumption and thus, putting at risk the second demographic dividend.

Brazil is one example of an important context for elaborating linkages between demographic transition and public policies. In a recent analysis of the first demographic dividend, Rios-Neto (2004) uses income data from Brazilian municipalities to demonstrate that the association between working age population growth and income growth was positive and significant during the period 1991-2000. It remains unclear, however, how much greater the economic growth would be if Brazil had stronger institutions and more appropriate policies in place.

Brazil is distinct because a relatively large public sector and a rapidly aging population coexist, compared to other emerging economies. Public welfare support, across all government levels, reached about 21% of GDP in 2002 (Brasil, 2003), an amount that is comparable to social

expenditures 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 size of the public sector, and in particular the amount of transfers to the elderly, suggests that economic implications of demographic changes depend in great extent on how public policies are designed.

In an influential study published a decade ago, Carvalho and Wong (1995) pointed out the need for policymakers to respond ahead of time in order to boost the benefits of temporary increases in the working age population in Brazil. Also, in a more recent analysis, Turra and Rios-Neto (2001) combine several age schedules of public and family transfers with population forecasts to demonstrate that fiscal gains from demographic changes are transitory and may not last for more than ten years in that country**.** As the political arena has been slow to act upon this information, the debate on the dividend remains among social scientists. Despite the lack of appropriate economic policies, however, some improvements in public education have been made as a result of lower fertility rates. Literacy levels and measures of enrollment and educational attainment have significantly improved in the last decades (Saboia, 1998): literacy rates jumped from 60% in 1960 to 87% in 2000 (Pinto et al., 2000) and in the last five years almost all children 7 to 14 have been enrolled in school (Schwartzman, 2003). Unfortunately, public education suffers from competition for resources with public programs to the elderly (Turra and Queiroz, 2005). Budget constraints have limited the government's ability to improve quality of schooling, and reduce grade retention and school drop-out; issues that might reduce potential productivity growth.

In this article we provide empirical evidence to support our thesis that the absence of appropriate policies can mitigate temporary benefits of population changes, and aggravate adverse effects of population aging. By demonstrating that the Brazilian social security system works less efficiently than desired, we contribute to the debate on how critical policy areas may reduce the potential economic impact of demographic changes. Although we do not directly test for the effects of social security financial adequacy on economic growth, by using counterfactual projections of the social security support ratios we shed light on the roles played by demographic, policy and economic changes on social security problems and, in turn, on potential limits for the demographic dividends. We address several questions. First, we examine to what extent fertility and mortality declines have favored the social security system through temporary increases in the working age population. Next, by looking into the future, we put forth a second and related question that is often ignored in economic studies, namely how population momentum mitigates the adverse effects of population aging. We then look at how changes in labor supply, and both social security contributions and benefits have precluded or favored the effects of demographic changes. Because we want to demonstrate potential policy applications we also offer a snapshot of what the social security support ratios in Brazil would look like if U.S. social security rules were applied in that country.

B. THE SOCIAL SECURITY SYSTEM IN BRAZIL

The pension system in Brazil consists of three main segments: the general system (private workers), the civil servants system, and other several private funded systems; most pension systems are based on the PAYGO scheme. The country also has a large non-contributory system with means-tested eligibility that provides benefits for low-income elderly.

The social security system for private workers (general system) is an unfunded defined-benefit program. There is still debate regarding when it began. In 1888 some measures were taken to provide pension benefits to postal workers and employees of the national press. In the following years, retirement benefits were extended to railroad workers, employees of the Ministry of Finance and the Mint, and army forces. In 1923, the Lei Eloi Chaves (legislation) was approved to regulate social security for both civil servants and private workers. This law decentralized the pension system, as each company was responsible for its own employees. The first reform happened in 1933 when the pension funds became structured by professional category (Leite 1983). 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 (Leite 1983).

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 (Stephanes 1998).

Until 1998, full pension benefits were granted to all workers who have contributed for 10 years to the system, have reached normal retirement age through the Old-Age Pension Benefit (65 for men and 60 for women), or could prove that they have been working for a certain number of years with the Length of Service Pension Benefit (35 for men and 30 for women, but without requirement of contribution for the same period of time). 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 (Brasil, 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, 2005).

In 1998, after years of political debate, a significant reform was approved in order to help solve the program's 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, however (Brasil, 2002).

The general system was conceived when rapid population growth and low life expectancy combined to sustain the program. In recent years, however, the system has been facing budget shortfalls, which have gradually increased after the changes implemented in the early 1990s. In 1996, the deficit was equal to 0.1 percent of the GDP, but it increased to 1.7 percent in 2004 (Giambiagi et al., 2004). The implicit debt, a long term measure of the system's financial adequacy, is also large and amounts to about two times the GDP (Bravo, 2001).

Alongside the general pension system, civil servants have their own pension program, which is also an unfunded PAYGO defined benefit 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 (Medici, 2004). According to Medici, the program is a complex chain of federal, state and local systems, including special programs to different civil servant categories. Benefits are more generous in the civil servant system than in the general system: replacement rates are higher and time of contribution to receive full pension benefits is shorter. The program deficit is high and has been increasing over the past decade, having reached about 3.6 percent of the GDP in 2004 (Giambiagi el al., 2004).

C. METHODS

To estimate what the social security support ratios in Brazil would look like under different demographic and economic scenarios we projected the population of 1970 using the cohort component method of projection in five-year intervals of time and age (Shryock and Siegel 1973; Preston, Heuveline and Guillot 2000). We then calculated taxpayers and beneficiaries at the beginning of each five-year period by applying age- and sex-specific (1) labor force participation rates, (2) taxpayer rates, and (3) beneficiary rates. Here, taxpayer rates are defined as the proportion of workers in the labor force who pay social security taxes by age and sex; whereas beneficiary rates are defined as the proportion of individuals receiving any social security benefit from the general system by age and sex.

To capture the full effects of demographic transition on social security support ratios, we end the projection period in the year 2045. Actual demographic and economic rates are used from 1970 to 2000, whereas projected rates are applied in the period 2000-2045. For purposes of this exercise we assume that the population in Brazil is closed to migration during the period of analysis. In addition, we assume that demographic and economic rates are independent and therefore, do not affect each other. Such models that focus on first-order effects have been used in previous demographic analyses (e.g. White and Preston, 1996).

Our first question is how changes in fertility and mortality rates ("demographic effects") impact social security support ratios. This estimate is made by projecting forward the social security support ratios under the actual and projected fertility and mortality rates, but assuming that economic rates are fixed at 1970 levels. We present total demographic effects - mortality and fertility rates varying together – as well as separated effects for each demographic variable. To highlight the effects of population momentum on dependency ratios, we present an additional set of projections using the age distribution of stable-equivalent populations for each five-year interval.

Next, we examine the effects of changes in the labor force participation (LFP) rates on the support ratios. To do this, we project forward the social security support ratios under the actual and projected LFP rates but assume that demographic rates and the other economic rates are fixed at 1970 levels. Given the well-documented sex differentials in LFP rates, we disentangle the effects by sex. We then estimate what we call the "evasion effect", that is, the impact of changes in taxpayer rates on the support ratios. The estimate is made by projecting forward the social security support ratios under the actual and projected taxpayer rates, but assuming that demographic rates and the other economic rates are fixed at 1970 levels. Further, we estimate the impact of changes in beneficiary rates on the support ratios in a manner analogous to that described above for the other components. We call this the "generosity effect". Together, the "evasion" and the "generosity" effects reflect the rules that have governed the social security system in Brazil. In order to emphasize the idiosyncrasies of the system, we present a final scenario that uses the U.S. beneficiary rates of 2001 and assumes that 95% of the workforce

contributes to the system; but assumes actual and projected demographic rates and LFP rates for Brazil.

The hypothetical scenarios described above are compared to two main time series: one that uses actual and projected demographic and economic rates, and one that keeps all rates fixed at 1970 levels.

D. DATA

Mortality and fertility estimates (actual and projected) used in our counterfactual projections were prepared by the Population Division of the United Nations and the U.S. Census Bureau (UN, 2003; US, 2005). In addition, population figures for 1970 come from the 5% sample census data for Brazil available in the Integrated Public Use Microdata Sample (Sobek et al., 2002).

We use data from the *Pesquisa Nacional por Amostra de Domicilio* (IBGE, 2005) to estimate actual social security taxpayer rates and beneficiary rates. To estimate projected rates we assume rates remain fixed at 2002 levels. The PNAD is a nationally representative stratified random sample of the Brazilian population collectedly annually since the late 1970s. The PNAD contains a comprehensive and comparable set of demographic and socioeconomic variables, including detailed information on employment status, occupation, income, and education for all members of the household. The survey asks respondents whether they contribute or not to the social security system, and whether they receive social security benefits. Data limitations prevent us from examining different types of social security benefits. For example, we can only know if the respondent is receiving retirement or survival benefits. We do not know whether the retirement benefit is due to old age, length of service, disability, or social assistance. In addition, we do not know whether the respondent is enrolled in the general pension system or civil servants program. We do not believe that our conclusions are substantively affected by this limitation, however. A comparison of estimates with those based on official data from the Social Security Administration Office in Brazil show that the two sets of estimates produce the same conclusions regarding to levels and trends of social security support ratios.

We estimate labor force participation rates using both census (Sobeck et al, 2002) and household survey data (PNAD). In addition, we use projected labor force participation rates prepared by the International Labor Organization (ILO, 2005) and the Economic Commission for Latin America and Caribbean (ECLAC, 1999). Labor force participation rates are defined by ILO as the proportion of the population, usually between ages 16 to 65 years, who are able to work and is either working or actively seeking work.

E. TRENDS FOR VARIOUS PROJECTION COMPONENTS

1. Demographic variables

The panels of figure I display some of the main features of demographic changes that have occurred in Brazil over the last decades. Figure I 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 demographic changes (Wong and Carvalho, 2005). The total fertility rate has reduced by more than half since 1970 (from 5.3 to 2.13 in 2000), and life expectancy at birth has improved steadily: from 57.5 years in 1970 to 70.3 years in 2000. These trends have interacted to transform the population age structure. 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 16 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.

2. Labor supply

Figure II depicts some of the changes in the age- and sex-specific LFP rates since 1970. For men, it is clear that the length of working life has fallen over time, which is explained by both increases in educational attainment (younger workers) and changes in retirement behavior (older workers). In 1970 almost 76% of the population aged 60-64 years was in the labor force; this number has declined to 65% in 2000. The fall in economic participation is even greater for older workers (65 and over): 30% of them were in the labor force in 2000 compared to 60% in 1970. An interesting summary indicator of early retirement can be constructed using labor force participation rates. The average retirement age is defined as the age in which less than 50% of the population is out of the labor force. According to estimates by Queiroz (2005), the average retirement age for males declined from 69 years in 1960 to 63 years in 2000, an average decline of 1.5 years per decade[2].

Among women, the labor force participation shows a different trend. Over the last century, female labor force participation in Brazil seems to have followed a U-shaped relationship with economic development (Durand, 1975; Mammen and Paxson, 2000). In earlier stages of economic development, the female rates fell due to structural changes in the labor market, particularly the decline of traditional sectors such as agriculture. Later, the rates started to increase steadily as more women decided to work in modern and urban sectors. According to figure II, the main change in female labor force participation since 1970 is the rapid increase in the economic activity of females in their prime-age: those aged 20 to 60 years. Conversely, female LFP rates at the youngest and the oldest ages have stayed stable over the last three decades.

Another important aspect regarding the labor market in Brazil is the decline in the share of labor force in the formal sector (meaning formal documentation), which has declined from 70% in the mid-eighties to about 60% in 2000. During the 1980's the number of workers in the informal sector followed very closely the business cycle behavior. However, since 1990 the degree of "informalization" cannot be explained by the business cycle; if anything, it seems to have a counter-cyclical behavior (Soares, 2004).

The segmentation of the labor market is clear: a formal and an informal sector coexist, which is a feature of many developing countries. Only those employed in the formal market (registered workers) are covered by labor market regulations, including social security coverage. Workers in the informal sector work without formal labor contract, and normally do not pay taxes and are not covered by welfare regulations (Soares, 2004; Ulyssea, 2005). One important recent finding regarding the informal sector is that the rapid increase in female labor force participation has been highly concentrated in the informal sector, meaning that the impact of female labor force on social security finances will be smaller than one could expect[3] (Wajnman et al., 1998).

3. Social security participants

Social security benefits are the most important of income sources upon which elderly Brazilians rely. As discussed above the system has been characterized by generous benefits and low contribution rates. About 77% of the population aged 60 and older received some sort of pension benefits by 2002. Figure III reveals important trends over the last decades. On one hand, beneficiary rates have increased for all age groups. At age 50, for example, about 20% of the population received benefits in 2002 compared to 17% in the early 1980s, which corroborates the finding that the average age at retirement has declined. At the same time, taxpayer rates have declined for both men and women. Among men, only 50% of those in the labor market had made contributions in 2002 compared to 65% twenty years earlier. These results are also generally true for women, which as discussed above contrast with the recent increases in labor force participation.

F.RESULTS

1. Demographic effects on social security support ratios

Not surprisingly, if all economic and demographic rates had remained at the 1970 levels, social security support ratios would be roughly constant throughout the period of analysis, declining slightly from 3.3 in 1970 to 2.9 in 2045 because of the initial effects of the demographic transition (figure IV and table 1). If instead the demographic rates had varied, holding everything else constant, increases in the share of the working age population would initially produce a demographic bonus in the social security system that would last for about 20 years (1970-1990). Although the bonus looks small - ratios would be about 5 percent higher than the ratios estimated when demographic rates are held constant - it cannot be ignored given the size of the social security program in Brazil and the challenges that it will face in the future. Eventually, demographic changes would have a negative impact on the support ratios, which would decline to 2.8 in 2000 and reach 1.0 in 2045 because of fertility and mortality reductions. Our estimates based on stable-equivalent populations suggest, however, that the effect of these changes would be noted much earlier if the population momentum had not played a central role. Without the effects of population age structure, support ratios would reach 2045 levels (0.8 taxpayers for each beneficiary) around 2015. Not surprisingly, most of the demographic effects are due to changes in fertility. Table 1 shows that the effect of mortality declines on social security support ratios is minimum, suggesting that the proportionate impact of mortality improvements on the population age structure is fairly neutral during the period of analysis.

Figure IV also shows one important feature of the social security system: support ratios have been declining faster than expected based only on changes in the demographic rates. The reasons for this pattern will be revealed in the next sections.

2. Effects of changes in labor supply on support ratios

A comparison of the support ratios assuming a scenario that LFP rates had varied alone, holding everything else constant, with the two baseline models - all rates held constant; all rates vary – indicates the significance of increases in labor supply to the social security system. The results are shown in figure V. Changes in labor force participation rates would have increased the ratios by 5 percent in the first three decades (1980 to 2010), while it would have produced ratios 20 percent larger in the last decades of the analysis (2025 to 2045). Most of the effect comes from increases in female labor force participation, reflecting structural aspects of the labor market that were discussed above. Although increases in labor supply have favored social security by slightly

augmenting the demographic bonus (results not shown), as well as by mitigating the adverse effects of population aging, the magnitude of these effects is much lower compared to the demographic effects.

3. Effects of changes in tax payer and beneficiary rates on support ratios

Have public policies and institutions favored the social security financial adequacy over the last decades? Unfortunately, neither policies nor institutions benefited social security finances. Figure VI shows what the social security ratios would look like if only the taxpayer rates had varied, holding everything else constant. Following the growth of the informal sector, support ratios would decline steadily until 2000 due to the declining share of the population in labor force who pays social security taxes. The "evasion effect" would reduce support ratios significantly, about 30 percent, from 3.3 in 1970 to 2.4 in 2000. In addition, when changes in tax rates are projected together with demographic changes, the bonus is shortened by five years, ending in 1985 (results not shown). Because we assume that projected taxpayer rates will be fixed at 2000 levels, our counterfactual projections are not very informative for years thereafter. Yet, it is indisputable that tax evasion will play a key role in social security deficits over the next decades. Given the low levels of taxpayer rates, legislation to stimulate the formalization of the labor market could mitigate substantially the effects of population aging.

We have repeated the simulation described above, but this time varying only beneficiary rates and holding everything else constant. A comparison of the support ratios under this projection is informative in showing that the new regulations approved in the 1988 Brazilian Constitution have worsen the social security support ratios and consequently its fiscal balance. Figure VII shows that the "generosity effect" is very similar in magnitude to the "evasion effect": ratios would decline from 3.3 in 1970 to 2.5 in 2000. Together, the "evasion" and "generosity" effects would be responsible for reducing potential social security support ratios by about 50 percent since the late 1990s.

To the extent that the "evasion" and "generosity" effects were already high in 1970 compared to international standards, the results presented in the previous simulations will underestimate true effects. We thus prepare a final set of projections that compare social security support ratios in Brazil assuming that 95% of the work force pays social security taxes and the beneficiary rates for the U.S. in 2001. Figure VIII shows striking results. If both tax evasion and early retirement were eliminated in Brazil, social security ratios would change drastically. For example, in 2000 the ratio would be 3 times higher than the actual ratio. In addition, the ratios would remain larger than 2 until the year 2045, despite the negative effects from changes in demographic rates. Finally, the demographic bonus would have been two times larger had appropriate policies were in place in Brazil since 1970.

G. CONCLUDING REMARKS

A growing literature has examined the importance of changes in population age structure to economic growth. Although 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 this article we argue that some developing countries 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. In that sense, the case of Brazil is remarkable because of the historical low levels of educational attainment and the increasingly large pay-as-you-go pension systems. In 2004, the public pension systems

transferred about 12% of the GDP from the working age population to the elderly in Brazil, a significant amount for a country where only 6% of the population is above age 65.

Our analysis examines social security support ratios under several counterfactual scenarios to provide insights into how institutional and policy issues reduce the potential economic impact of population changes. 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. This myopic view has also buffered fiscal gains from increases in labor supply.

Two other findings in the present analysis should be interpreted as warning signs. First, the effects of age structure on the pace of population aging (i.e. population momentum) have provided extra time for social security; about 30 to 40 years until support ratios will reach levels that will be too low to avoid a financial crisis. Second, policy simulations suggest that increasing the minimum age at retirement and eliminating evasion could boost social security support ratios, help honor obligations, and create future conditions for economic growth by (1) producing surpluses to be invested on human capital and (2) relieving the burden facing future generations. Although implementing these changes does not seem to be an easy task in Brazil, these are necessary conditions to preserve old-age security for current and future retirees, without putting economic growth at risk.

ENDNOTES

[1] In this paper we use the definition of tax evasion by Manchester (1999). The term is broadly defined to include both tax evasion and tax avoidance by not working, working in the informal sector, or early retirement.

[2] Similar measure for females is not very informative because of different trends in labor force participation rates over the this period

[3] Despite the increase in tax evasion, however, low-income workers from the informal sector can still claim retirement benefits when they become old in Brazil.

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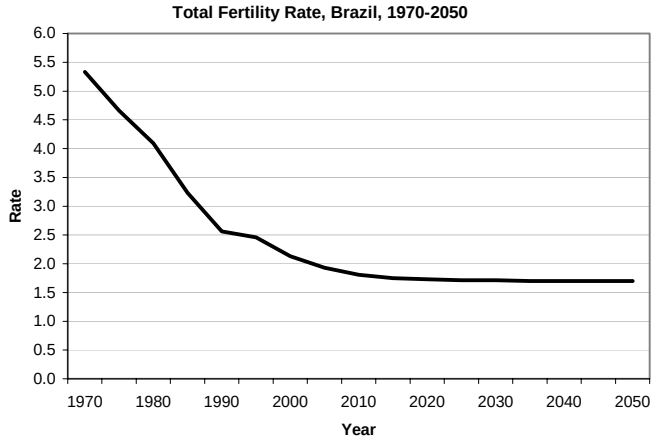
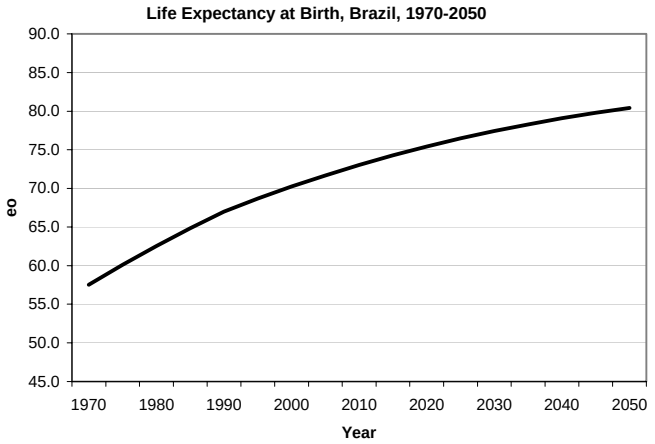
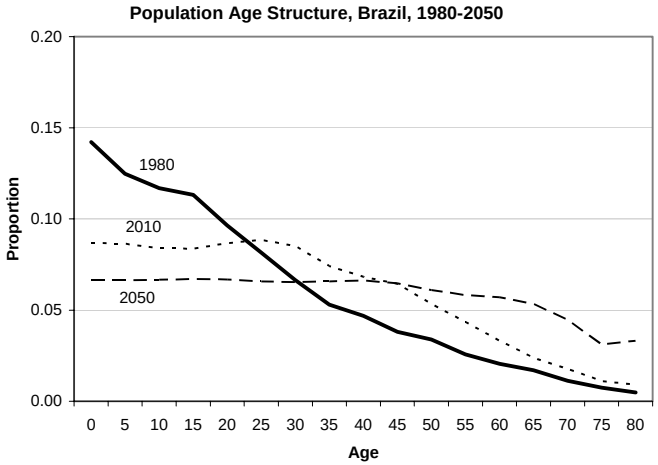
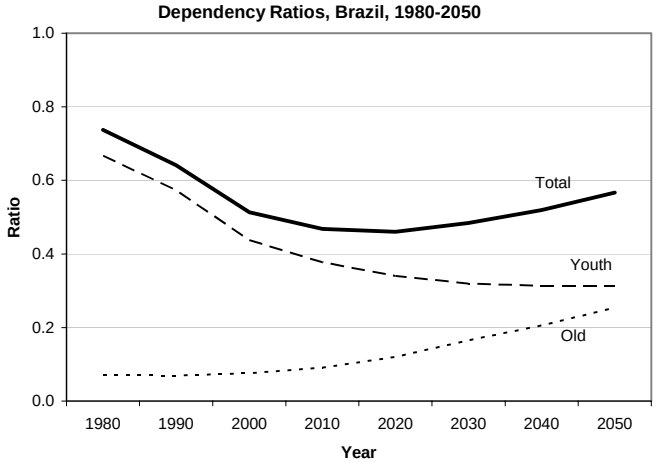
Figure I. Demographic Transition in Brazil, 1970-2050



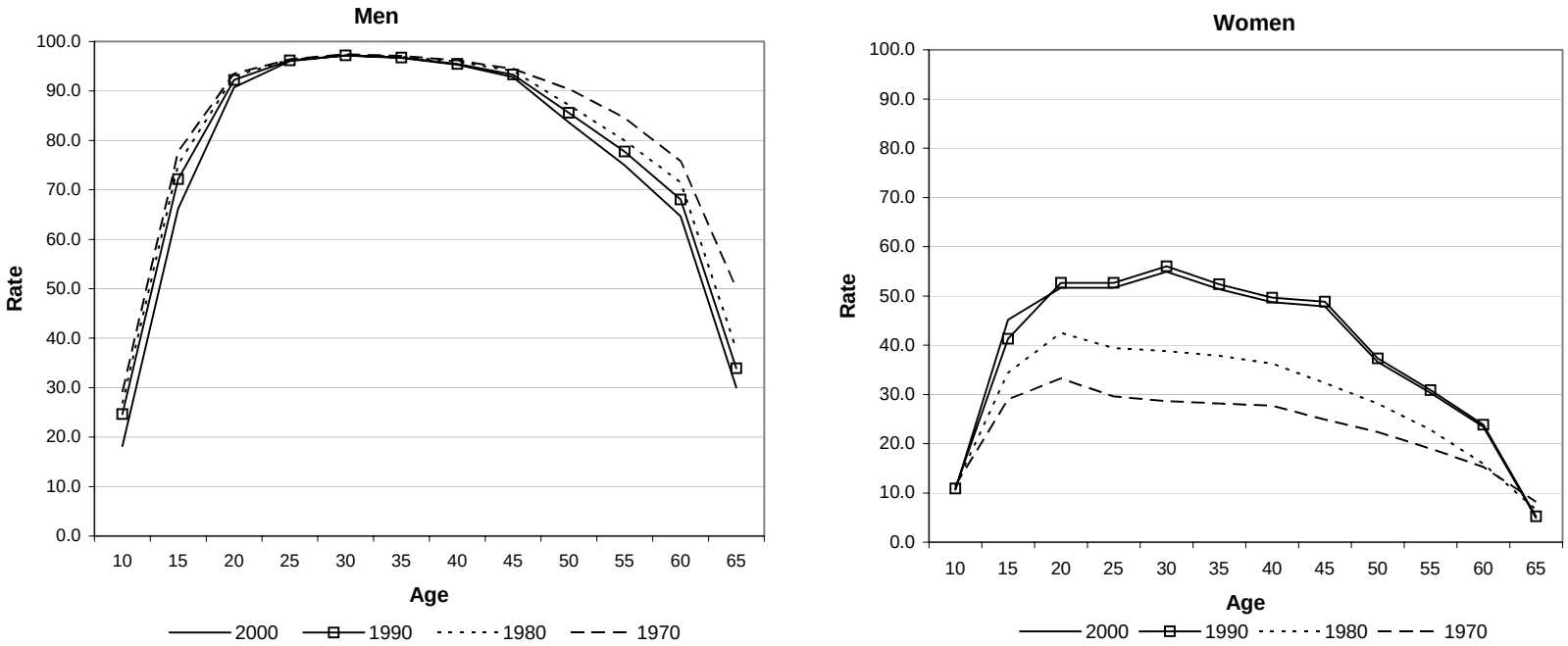






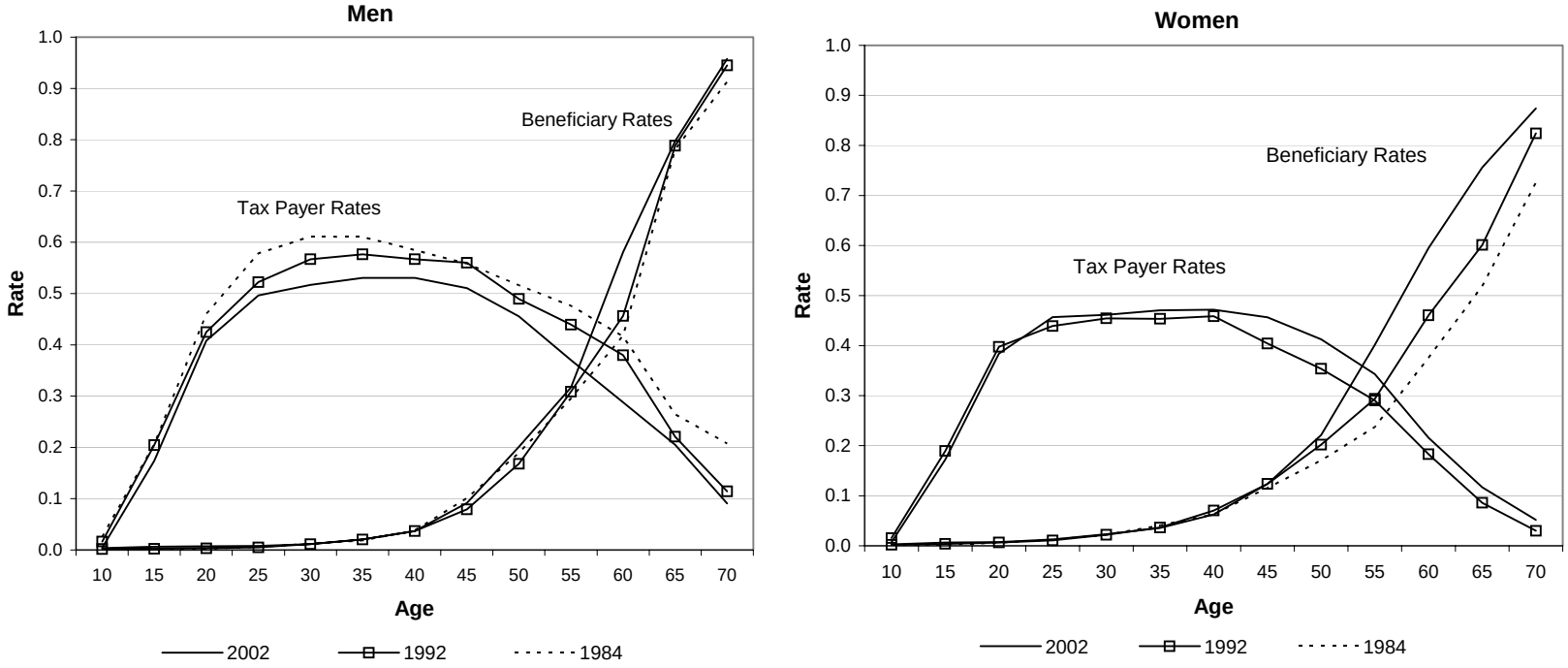
Source: *Pesquisa Nacional por Amostra de Domicilios (IBGE 2005)*

Figure II. Labor Force Participation Rates, Brazil, Selected Years



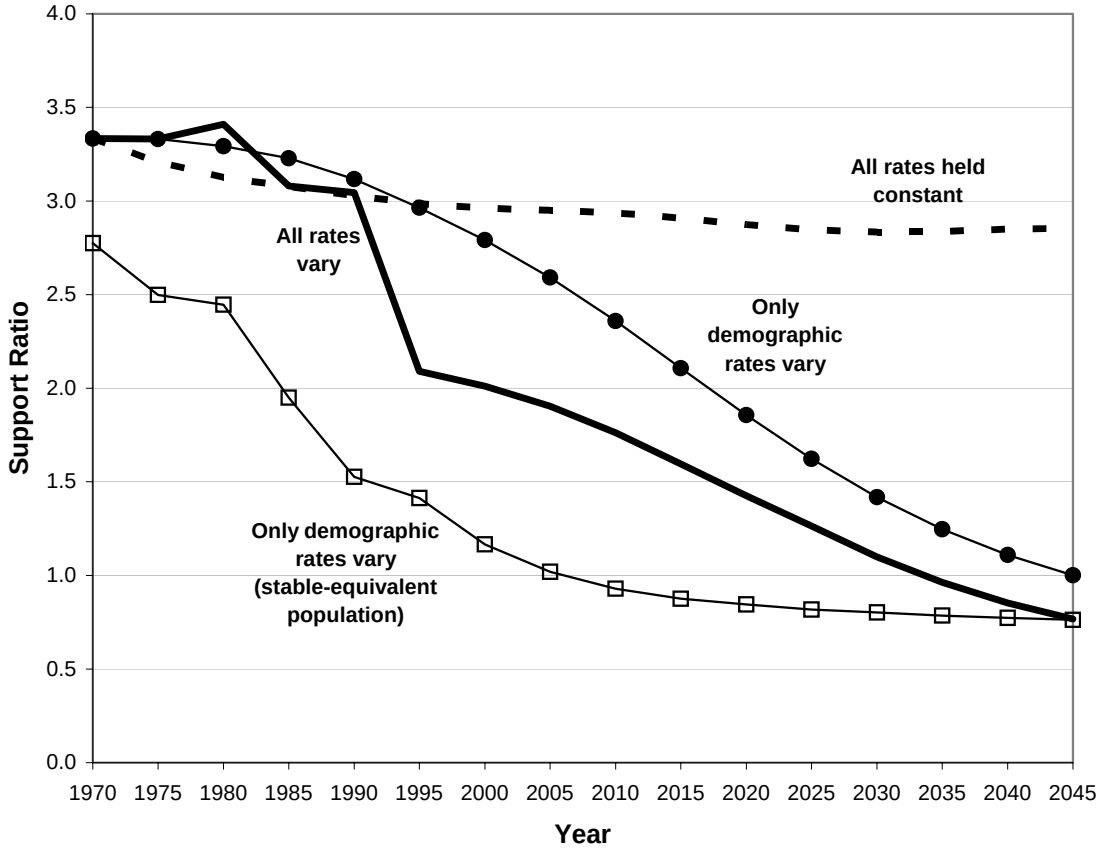
Source: Census Data (Sobek et al. 2002), *Pesquisa Nacional por Amostra de Domicilios (IBGE 2005)*

Figure III. Age- and Sex-Specific Tax Payer and Beneciary Rates, Brazil, Selected Years



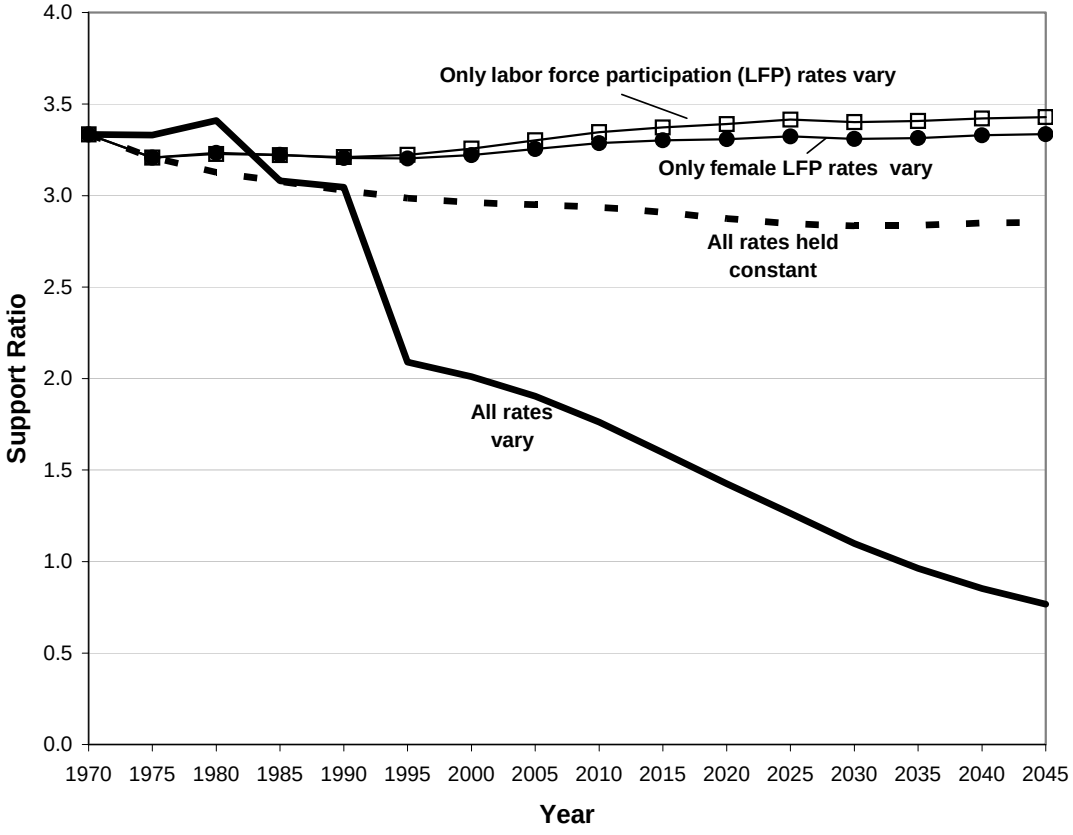
Source: *Pesquisa Nacional por Amostra de Domicilios (IBGE 2005)*

Figure IV. Social Security Support Ratio, Brazil, 1970-2045
(Demographic Effects)



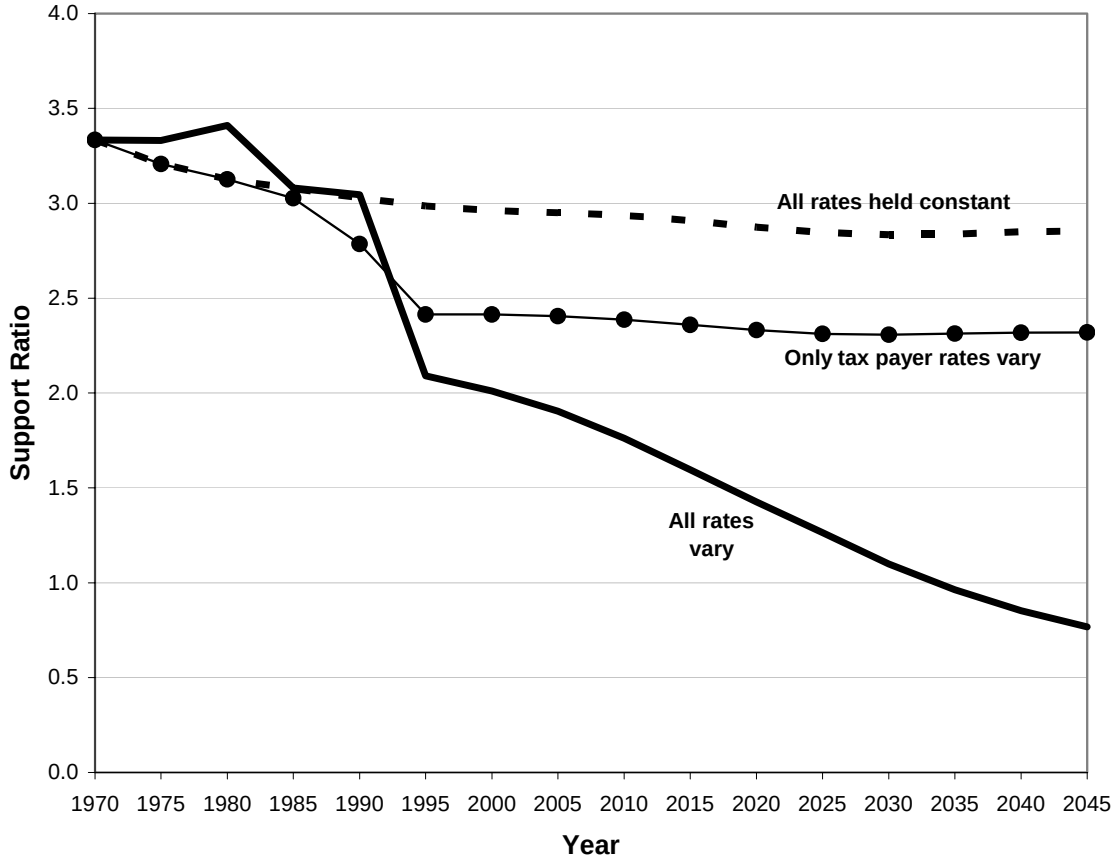
Note: The rates are:
Demographic: mortality and fertility rates
Economic: labor force participation rates, tax payer rates, and beneficiary rates

Figure V. Social Security Support Ratio, Brazil, 1970-2045
(Effect of Changes in Labor Supply)



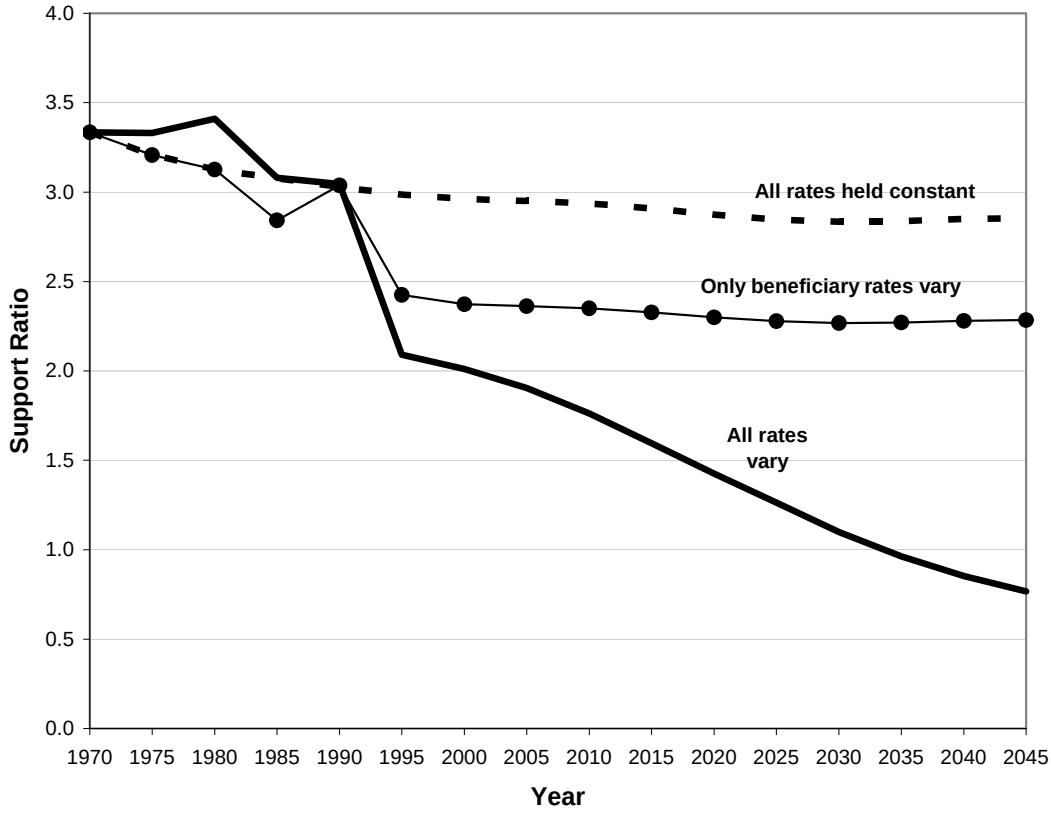
Note: The rates are:
Demographic: mortality and fertility rates
Economic: labor force participation rates, tax payer rates, and beneficiary rates

Figure VI. Social Security Support Ratio, Brazil, 1970-2045
(Change in Tax Payer Rates: "Evasion Effect")



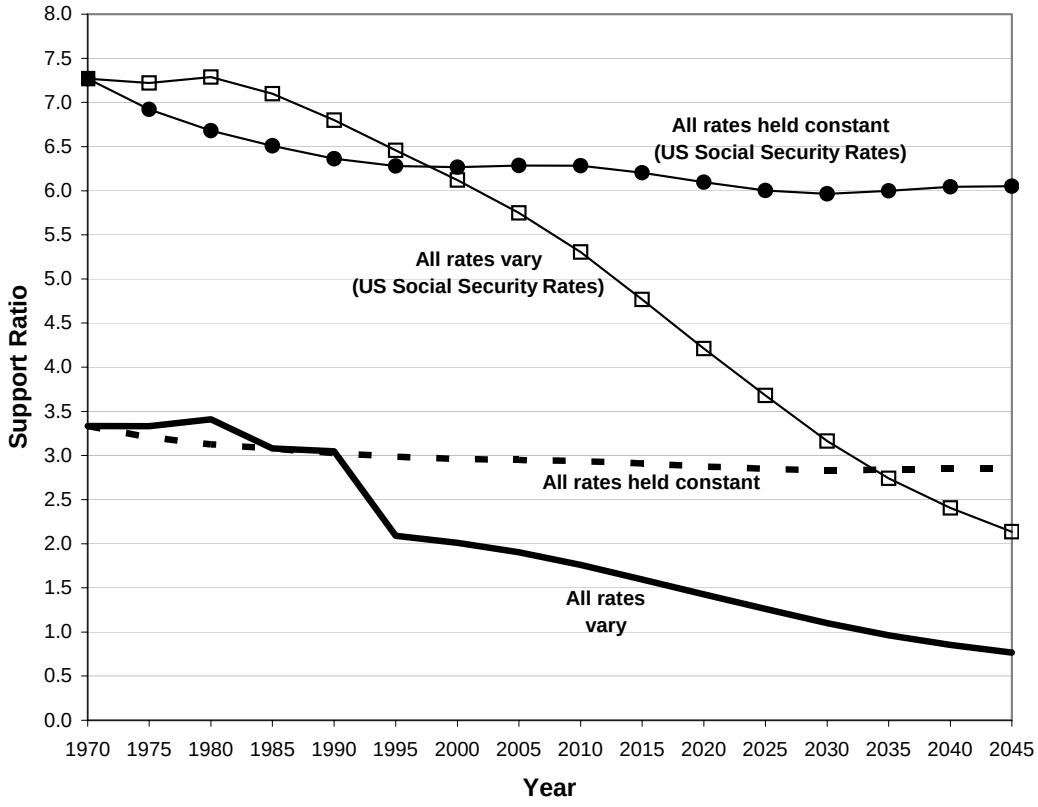
Note: The rates are:
Demographic: mortality and fertility rates
Economic: labor force participation rates, tax payer rates, and beneficiary rates

Figure VII. Social Security Support Ratio, Brazil, 1970-2045
(Change in Beneficiary Rates: "Generosity Effect")



Note: The rates are:
Demographic: mortality and fertility rates
Economic: labor force participation rates, tax payer rates, and beneficiary rates

Figure VIII Social Security Support Ratio, Brazil, 1970-2045
(Policy Simulations)



Note: The rates are:
Demographic: mortality and fertility rates
Economic: labor force participation rates, tax payer rates, and beneficiary rates

Table 1 Social Security Support Ratios Under Different Scenarios - Brazil, Selected Years

			Demographic Effects				Changes in Labor Supply		Institutional Effects		Policy Simulations (US Social Security Rates)	
	All rates vary	All rates held constant	Only fertility rates vary	Only mortality rates vary	Both rates vary	Both rates vary (stable equivalent)	LFP rates vary	Only female LFP rates vary	"Evasion" Effect	"Generosity" Effect	All rates vary	All rates held constant
1975	3.33	3.21	3.21	3.21	3.33	2.50	3.21	3.21	3.21	3.21	7.22	6.92
1980	3.41	3.13	3.13	3.12	3.29	2.45	3.23	3.23	3.13	3.13	7.29	6.68
1985	3.08	3.08	3.08	3.09	3.23	1.95	3.22	3.22	3.03	2.84	7.10	6.51
1990	3.05	3.03	3.03	3.04	3.12	1.53	3.21	3.21	2.78	3.04	6.80	6.36
1995	2.09	2.98	2.96	2.99	2.96	1.41	3.22	3.20	2.41	2.42	6.46	6.28
2000	2.01	2.96	2.86	2.97	2.79	1.17	3.26	3.22	2.41	2.37	6.12	6.27
2005	1.90	2.95	2.71	2.97	2.59	1.02	3.30	3.25	2.40	2.36	5.75	6.29
2010	1.76	2.94	2.51	2.97	2.36	0.93	3.35	3.29	2.39	2.35	5.30	6.28
2015	1.60	2.91	2.28	2.96	2.11	0.87	3.37	3.30	2.36	2.33	4.77	6.20
2020	1.43	2.87	2.04	2.94	1.86	0.84	3.39	3.31	2.33	2.30	4.21	6.10
2025	1.26	2.85	1.81	2.94	1.62	0.82	3.42	3.32	2.31	2.28	3.68	6.00
2030	1.10	2.83	1.60	2.94	1.42	0.80	3.40	3.31	2.31	2.27	3.16	5.97
2035	0.96	2.84	1.42	2.96	1.25	0.79	3.41	3.31	2.31	2.27	2.74	6.00
2040	0.85	2.85	1.28	2.99	1.11	0.77	3.42	3.33	2.32	2.28	2.41	6.04
2045	0.77	2.85	1.16	3.01	1.00	0.76	3.43	3.34	2.32	2.28	2.14	6.05