The Impacts of Social Security Changes on Rural Workers Labor Supply: a regression discontinuity approach

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Paper presented at the Annual Meeting of the Population Association of America
New Orleans 2008

Prelimary Draft

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1 - Introduction

The effects of public transfer systems on the labor supply are widely studied. There is a large literature on how social security systems around the world, both in developed and developing countries create incentives to early retirement (Gruber & Wise, 1999; Wise, 2004; Burtless & Quinn, 2001; Queiroz, 2005). Research on the impacts of other welfare programs in the United States and Europe are also common, and such studies also investigate negative impacts of the programs on the labor supply of the recipients. In recent years, negative effects on the labor supply of individuals justified policy changes on a series of welfare programs (Moffit, 2002).

The discussion about the effects of social security programs on the labor force participation of older workers in developed countries is common. Empirical evidence shows a decline in labor force participation of older workers since 1920. There are several studies trying to estimate the impacts of social security programs, both private and public, on individual's retirement decision. Gruber & Wise (1999, 2004) argue that the emergency of public pension programs had a significative impact on the decline of older workers labor force participation. Costa (1998) shows that the decline started before programs existed because of better socioeconomic conditions, economic development and leisure opportunities for the elderly. However, Costa (1998) acknowledges that public pension programs had a important impact on the decline of older workers labor force participation rates.

The discussion about the effects of public pension systems in developing countries is less developed (Legrand, 1995; Carvalho-Filho, 1999; Lam et. al., 2005; Queiroz, 2005; Queiroz, 2007). Rapid population aging in less developed countries brings a lot of concerns about the well-being of the elderly, especially when economic development has reduced the role of families in supporting the elderly and public pension system are not yet universal.

Public pension systems, on one hand, are very important because they can play a role in improving one's well-being, on the other hand they can have indirect effects on other measures of the economic life such as labor force participation and living arrangements. Public pension systems can create a distortion in the labor market, diminishing the labor force participation of older workers.

In this paper, we investigate the effects of a law change in 1988 that affect rural workers in Brazil. In 1988, the new constitution reduced the minimum retirement age for rural workers in 5 years, raised the minimum benefit to one (1) minimum wage from ½ minimum wage, and allowed more than one member of the

household to receive the benefit. Carvalho-Filho (1999) and Assuncao & Feres (2007) use this policy change to investigate labor supply and poverty levels changes using a difference-in-difference model. The program structure, with a clear break in the policy for those aged 60 and 55, for men and women respctively, allows me to implement a regression discontinuity (RDD) analysis of the impact of social security regulations on labor market behavior of Brazilian workers.

The regression discontinuity approach is a useful method for investigating whether the introduction of the new law was positive or not. The break in the policy gives us several advantages in relation to the other papers which analyzed this change. It is not necessary to investigate the policy itself (new constitution), we can focus on the discontinuity present in the policy. The advantages of this approach are: a) we assign individuals to a treatment or comparison group on the basis of a cutoff point, thus we do not need to make assumptions about treatment and control goups; b) we do not need to worry how other policies and situation might affect our results; c) the reduction in the minimum age and the change in the pension value are large enough to allow us to observe changes in people's behavior. We will discuss the methods below and make clear the advantages of this approach later in the paper.

The main objective of the paper is to study the impacts of the 1988 social security reform for rural workers on their labor supply decision. We investigate the period near the reform, around 1988, and again a few years later to check which impact the legislation change had.

I first provide some details about the 1988 social security reform in Brazil. Then I describe the data and the empirical strategy based on the regression discontinuity approach. Next, I present descriptive statistics that provide preliminary evidence of the effect of the policy. Finally, I present the regression results and conclude the paper.

2. THE BRAZILIAN PENSION SYSTEM AND THE RURAL WORKERS PENSION REFORM

The pension system in Brazil consists of three main segments: the general system (workers in private sector), the civil servants system, and other general private funded systems. Most of pension system is based on the PAYGO scheme (Bonturi 2002). The country has also a large non-contributory system with means-tested eligibility that provides benefits for low-income elderly[1].

[1] Public expenditures on social security benefits and other forms of elderly support amount to 12% of GDP (Brazil 2003).

The Social Security system for workers in the private sector (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 for postal workers and employees of the national press. In the following years, retirement benefits were extended to railroad workers, employees of the Ministry of Finances, the Mint and the armed forces. In 1923, the Lei Eloi Chaves (legislation) was approved to regulate social security for both civil servants and private sector workers. This law decentralized the pension system, as each company became responsible for its own employees. The first reform happened in 1933 when the pension funds became structured by professional categories (Leite 1983). The general pension system was centralized only in 1996, 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 PAYGO (Leite 1983). 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 are large, reaching 4.7% of the GDP in 2002. The program is a complex chain of federal, state and local systems, including special programs to different civil servants categories. Benefits are more generous in the civil servant program: replacement rates are higher and time of contribution to receive full benefits is shorter (Medici 2002) [2]..

The last major reform occurred with the 1988 Constitution, which extended mandatory social security coverage to most of the previously excluded groups, including rural workers, without requiring equivalent increases in revenue from contributions. Other measures also 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 minimum retirement age (Stephanes 1998). In 1988, the new constitution reduced the minimum retirement age for rural workers in 5 years, raised the minimum benefit to one (1) minimum wage from ½ minimum wage, and allowed more than one member of the household to receive the benefit.

Until 1998, full pension benefits were granted to all workers who had contributed for a minimum of 10 years to the system, have reached normalretirement 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

[2] In recent years, the system has been facing budget shortfalls, which have gradually increased after new regulations were implemented in the early 1990s. In 1996, the deficit was equal to 0.1% but increased to 1.7% in 2004. The implicit debt, a long term measure of the system's financial adequacy, is also large and amounts to about 350% of the GDP (Bravo and Uthoff 1998).

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 work (Brasil 2002). The level of benefits is relatively high, old-age benefits recipients receive, on average, 3 times the minimum wage, and the length of service benefits is 2.5 times higher than the old-age benefits (Queiroz, 2005).

In 1998, after long political debate, a new methodology to calculate benefits was put in place. The new formula takes into account acturial rules and is quite similar to the Swedish notional defined benefit program. The pension benefit is now calculated considering individual´s earnings history, life expectancy at retirement age and an adjustment factor for early retirement. Nevertheless, a minumum retirement age was not approved for workers in the general system (Brasil, 2002).

One important feature of the Brazilian pension system that might affect workers´s decision to retire is the inexistence of any mechanism creating incentives for workers to withdraw from the labor market after retirement, especially for rural workers. For the rural sector, workers can become eligible to receive benefits without a means tested mechanism. In addition to that, it is not necessary to quit the current job to start receiving pension benefits. Thus, it is important to consider labor supply and work intensity
in the analysis. In this paper, I measure work intensity using hours worked per week.

3. DATA AND METHODS

3.1. DATA OVERVIEW AND SAMPLE SELECTION

We use two different data sets to perform our analysis: Brazilian Population Census and Household Survey (PNAD). The brazilian censuses are public avalible in the Integrated Public Use Microdata Sample (IPUMS). In this paper, we use the 1991 and 2000 censuses. The PNAD is a annually household survey collected by the Brazilian Census Bureau and it is very similar to the US CPS. The PNAD contains a comprehensive set of information on demographic and socioeconomic variables.

The main limitation of using those two data is the definition of social security tax payers and beneficiaries. Although either dataset contains information on who pays social security tax and who receives pension benefits, it does not include information on sector (rural and urban) and type of benefit (age or length of service). In this paper, we assume that individuals living in rural areas are under rural workers social security rules. The problem of making this assumption is that workers can receive benefits in any part of the country, thus it is possible that

someone paid into the urban public pension scheme and it is receiving benefits in a rural area, and a rural worker is living in an urban area and receives rural pension benefits. Therefore, it is possible that we are not considering part of the workers affect by the legislation change in our analysis.

We believe that our final results will not be severely affected by this limitation. Other papers used the same methodology to classify urban and rural workers in Brazil and they got significant results. Also, we checked some of our data withg administrative data and aggregated numbers are quite comparable (results not shown).

3.2. REGRESSION DISCONTINUITY DESIGN

The regression discontinuity design is a useful method for investigating whether the new law had its expected impact. The regression discontinuity design is a pretest-posttest comparison group strategy mostly used in the context of student scores and outcomes. Regression discontinuity differs from the traditional comparison group strategy by not requiring a randomized experiment. In this approach, individuals are assigned to a treatment or comparison group on the basis of a cutoff point. For example, Martorel (2005) investigates the effects of failing high school exit exam on students outcomes. The cutoff criterion is the sharp break between failing and almost failing students.

In summary, the regression discontinuity design is an experimental design in which the chances of being in the treatment group changes discontinuously as a function of one variable. In my analysis, age is the cutoff point. The new law affects those aged sixty (fifty-five) and over. Basically, I only compare the difference between the outcome for those younger than 60(55) years old versus the ones older than sixty (fifity-five). I estimate the following model:

$$Y_{ia} = \beta_0 + \beta_1 TREAT_{ia} + \delta(a) + \varepsilon_{ia},$$

In the model above, Y is the outcome of interest, labor force participation and intensity of work, for person I aged a. TREAT is a dummy variable that captures the effects of being a pension recipient after some age. The most important assumption is that *d(a)* is a continuous function. This means that all observed characteristics trend smoothly through the cutoff point. This means that the change in the law is the only source of discontinuity in outcome around age 60 for men and 55 for women. We estimate the equation with polynomials of different order and check whether the results are robust to having higher order polynomials. In the case the new law has its desired effects; the probability of retirement will increase at the cutoff point.

Treat = 0 if age < 60(55); TREAT = 1 if age >= 60(55)

In summary, the chance of being a pension beneficiary (being treated) changes discontinually with age or other variables. In the RDD, treatment and control are determinated based on the cutoff point, and in our case, the social security system gives us this point (age). In other words, the chance of receving the treatment (social security benefit) changes discontinuously as a function of one (age) or more variables. Thus, I do not need to make any assumptions about treatment and controls as researchers have to do in other approaches, such as difference-in-differences. This research design allows us to obtain better estimates and make better inferences about public policy incentives.

4. THE EVOLUTION OF RURAL WORKERS BENEFITS

In this paper, I investigate the effects of a law change in 1988 that affect rural workers in Brazil. In 1988, the new constitution reduced the minimum retirement age for rural workers in 5 years, raised the minimum benefit to one (1) minimum wage from ½ minimum wage, and allowed more than one member of the household to receive the benefit. It is important to clarify that even though the reform took place in 1988, the new law was only set in place in 1993. The changes were also different for males and females. For male workers, the main difference was the reduction of minimum retirement age while for females it was the possibility of non household heads to receive benefits and the increase in the minimum benefit (see box 1 for details).

Figure 1 shows the evolution of rural male's pension beneficiaries, by type of benefit, from 1980 to 2003. It is clear the impressive increase in the number of beneficiaries in 1993 and 1994, after that the flow of retirees goes back to the levels observed before the reform. Most of the changes observed in that period are restricted to rural workers, the number and the flow of urban beneficiaries are not different during the period studied. Figure 2 shows that the main change is for workers who retire under the minimum age programs, there are very few retirements under length of contribution and/or disability for rural workers.

Table 1 and Figures 3 and 4 show the evolution of the stock of retirees since the late 1980s. Table 2 shows average values of benefits by type of benefit (minimum age, length of contribution and disability). The average benefit for rural workers was around ½ minimum wage until 1991, after that the average benefit increases to 1 minimum wage. Overall, rural benefits are lower than urban worker benefits for all types of retirement programs, this is explained by different levels of labor income over the life cycle.

Table 1 shows a big jump in the number of rural benefits by age, the emergence of length of contribution benefits and a reduction in the number of disability benefits. The number of length of contribution benefits is small because rural workers are not always able to produce proper documents necessary to obtain

this type of benefit. The rapid raise in age benefits and reduction in disability benefits might indicate that these benefits are substitutes for the rural workers affect by the 1988 reform (Carvalho-Filho, 1999).

5. PRELIMINARY EVIDENCE

Before turning to formal statistical analysis, I present graphical evidence that illustrates the chances in labor force participation and retirement behavior for rural workers in Brazil by age and over time. Labor force participation rates (LFPR) are calculated following the International Labor Organization (ILO) methodology. The LFPR is tha ratio between the active population and total population above age 10. The active population is defined as the population that is employed and the population that is looking for a job during the period of reference.

The trend in labor force participation for Brazilian workers shows significat changes in the last decades (Figure 2). It is clear that the length of working life shrank over time. Labor force participation rates for young individuals have declined because of the increase in educational attainment (Queiroz, 2005; 2007). The rates have also declined for older workers. In 1950 almost 90% of the population aged sixty to sixty-four were in the labor force, and this number declined to 65% in 2000 (Queiroz, 2007). The same rate of decline is observed for younger older workers. The fall in economic participation in even greater for those aged sixty-five and above: 30% of them were in the labor force in 2000 compared to 60% in 1950 (results not shown). The trend for females are very different than what is observed for males. The main change is the rapid increase in the labor force participation of prime-age women, those who are in their reproductive age (20-49). For old and young women, I do not observe the same changes I showed for males. One point, however, deserves attention. Labor force participation rates for women aged 50 and over are increasing overtime and reaches its highest level in 2000.

I now turn to the preliminary evidence of a change in the labor supply of rural workers in the past few decades. It is very important to verify if the raw data confirms my basic hypothesis that there was a break in the labor supply of rural workers on the cutoff point (age 60 and 65), before and after the implementation of the new legislation.

Figure 10 shows labor force participation rates for urban workers from 1960 to 2000 for males aged 45 to 70. Figure 11 shows the same information for males in the rural areas. The first difference between rural and urbans workers is that labor force participation in the rural areas are always greater than in the urban areas. In addition to that, we observe that workers receiving pension benefits and still working are also higher in the rural areas (results not shown). This phenomenon might suggest two things: first, velue of rural benefits are very low

not allowing workers to completely withdraw from the labor market; second, it might indicate that retirement age is too low and individuals are going to stay in the labor force whether they receive or not a pension benefit.

The main result, however, is the change is the slope of the labor force participation rates for rural workers between 1991 and 2000. Figure 11 shows that rural workers leave the labor market as soon as they become eligible to receive pension benefits. In 1991, the break in the labor force was observed around age 65, while in 2000 the break is observed for males age 60.

The results presented before show how labor force participation of older men has declined rapidly in Brazil. A more useful way to focus on timing of retirement and its changes is to calculate retirement pseudo-hazard rates. I estimate those rates for males using census data from 1960 to 2000.

Figure 4.4 plots retirement hazard rates for the census years 1960, 1970, 1980, 1991 and 2000 for all male workers in Brazil age fifty to seventy-five. In general, the hazard increases smoothly with age and shows peaks at ages of sixty and sixty-five corresponding to early and normal retirement ages in Brazil. However, the hazards vary substantially over time. Between 1960 and 1970 the retirement hazard rates rose steadily with age, but hazard rates were never greater than 10%. In 1980, 1991 and 2000, a more pronounced peak is observed at age 65 (about 15%), and hazard rates are higher at younger ages when compared to 1960 and 1970.

The hazard rates can be compared to the rates estimated in OECD countries by Costa (1998) and Gruber & Wise (1999). In most of the OECD countries retirement hazards are very high at ages when pension benefits are available. For example, in the United States Costa (1998) estimates rates of 15% and 25% at age 65, in 1940-60 and 1970-90 respectively. The Brazilian rates at age 65 are much lower than the ones observed in Europe. Gruber & Wise (1999) show hazard rates of over 60% in France and Spain. However, whereas for most countries hazard rates before age 60 are virtually zero, in Brazil I estimate rates ranging from 5 to 10%.

The rise in retirement hazard rates, especially the observed age peaks, matches the changes in the pension system since its establishment. In the 1960s, most urban employees were covered by the system, and coverage was being expanded to all urban employees and self-employed workers. In the 1970s, the system expanded to cover the entirely elderly population, including rural workers. From 1970 on the system kept growing rapidly. Data from the Brazil Social Security Administration show that the number of elderly receiving pensions benefits increased five-fold from 1970 to 1990, from 19% to 70%.

Figure 4.5 and Figure 4.6 show retirement hazard rates for urban and rural males workers separately, from 1960 to 2000. For rural workers the effect of the 1988

reform that reduced normal retirement age is clear. There is a single peak of retirement at age 60 whereas for 1980 and 1991 the peak is at age 65. Retirement hazard rates for urban workers increase continuously with age with peaks at ages 60 and 65 probably because of the availability of old-age retirement pension benefits. Another striking fact is that hazard rates at younger ages are much higher for urban workers than rural workers in all years, which is a clear effect of the existence of length of service pension benefit for urban workers. The differences in retirement hazard rates for urban and rural workers appear due to differences in pension regimes. For urban workers social security provides two types retirement: by age and by length of service. Rural workers do not have access to the length of service retirement benefit. The normal retirement age for rural workers was reduced from 65 to 60, for urban workers, the normal retirement age remained 65 after the 1988 reform.

In this paper, I concentrated on the analysis of labor market behavior. There is a large literature on how discontinuities in policy rules might affect individual behavior in the areas such as living arrangements, health and general well-being.

6 - ECONOMTRIC ANALYSYS

In this section, I parametrize individual retirement probabilities, using a regression discontinuity approach, aiming to observe the possible effects of retirement rules changes. I estimate models for three different dependent variables: labor supply, hours worked per week and benefit take-up rates (results not shown). I only use census data, for 1991 and 2000, in this section instead of using both Demographic Census and PNAD. I choose census over other surveys because the sample size for rural areas is large enough to estimate the effects for rural workers and because the census covers the whole country while PNAD is concentrated in some parts of the country. One main limitation of using census data is the time distance from the year when the policy change occurred. The last round of census happened in 2000 while the policy was put in place in 1993. I expect the magnitude of the effects to be smaller than it would be observed if I was using a dataset closer in time to the policy change.

I also concentrate the analysis on the results for males. Female labor force participation and retirement behavior are harder to explain. I show elsewhere that labor force participation of older women (65 and above) seems to be stable over time (Queiroz, 2006). The rapid increase in the labor force participation of younger women is impressive. As these women reach old age, they will have a much longer working history and job attainment, which might have significant impacts on retirement and the labor force participation of older women. The impacts of increasing female labor force participation on demographic variables are an active area of research. Moreover, exploring how those changes impact the labor participation of their spouses, and consequent

impacts to social security system is an area of research that deserves more attention.

6.1. Preliminary Analysis

First, I investigate the stock of rural workers retirees and labor force participation in rural areas in 1991 and 2000 using a simple logistic regression model. The dependent variables are: a) receiving a retirement pension benefit, and b) participating in the labor force. In this preliminary analysis, I restrict my sample to males aged 45 to 70, in 1991 and 2000, for all rural areas in Brazil. I include several explanatory variables: age, years of formal schooling, state of residence, and household composition.

The results, not shown in this paper, indicate that stock of retirees rises with age, as expected, and older individuals are 9 times more likely to be retired than the average. The probability of being retired increases monotonically with age. The direction and magnitude of the coefficients are the ones expected, older men are more likely to be out of the labor force than younger men. The reasons for that are eligibility for social security, decline in labor strength, and others.

The likelihood of being retired also increases with education; men with more than 12 years of schooling appear to have lower labor force participation than men with fewer years of schooling. This can be indicating several aspects of the Brazilian labor market: income effect is stronger than substitution effect, that is, more educated workers have higher ability to afford retirement and also more access to social security benefits.

The most important results for the following analysis are the abrupt change in the probability of being retired at some specific ages. The probability of being retired, and receiving a pension benefit, increases over 50% between ages 64 and 65 in 1991 and between ages 59 and 60 in 2000. Queiroz (2007) studied urban workers in the main metropolitan areas from in the 1980s and 1990s and he does not observed similar pattern. The results from rural workers indicate that the changes in retirement rules, and the rules itself, are important determinants of work behavior in rural Brazil.

The effects of education in the probability of being in the labor force are very different from the ones observed by Queiroz (2007) in the metropolitan areas. In the rural areas, more educated workers have more chances of being out of the labor force than their less educated counterparts. Queiroz (2007) showed an inverted U-shaped probability of retirement in relation to education for urban workers.

6.2. Regression Discontinuity Results

We know turn our attention to the regression discontinuity results. The program structure, with a clear break in the policy for those aged 60 and 55, for men and women respectively, allows me to implement a regression discontinuity (RDD) analysis of the impact of social security regulations on labor market behavior of Brazilian workers. The main advantage is that I do not need to study the effect of the new law itself, 1988 Constitution, but the discontinuity present in the policy.

Table 6 and Table 7, for 1991 and 2000 respectively, contain the estimated probit model for all variables included in the best and more parsimonious models. I estimate the equation with polynomials of different order and check whether the results are robust to having higher order polynomials. In the case the new law has its desired effects; the probability of retirement will increase at the cutoff point. The dependent variable is a binary outcome constructed based on the labor force status of the individual in each survey year (1991 and 2000). The models contain several functions for age, and regional and education controls.

The results indicate a clear discontinuity in labor supply in the ages when benefits are first available. The results are robust for all four (4) specifications. It is also interesting to observe that there is clear change in the age when the discontinuity in policy happens. In 1991, the discontinuity happened at age 65 while in 2000 it is observed at age 60.

In addition to the analysis of labor supply, it is also important to investigate whether the law generates any change in the labor intensity of rural workers. Since, rural retirement benefits are granted without any type of mean test, and it is not necessary to quit the current job to start receiving the benefits. It is possible that individuals start to receive benefits, stay in the labor force but adjust their hours of work per week. In other words, individuals might be adjusting their allocation of time between leisure and labor after starting to receive the extra income.

Table 8 and Table 9 show similar models as before with a different dependent variable, in this case number of hours worked per week. I transform the variable hours worked into a categorical variable, I considered individuals who worked more than 29 hours per week as strong labor intensity, and those who worked less than 29 hours as weak labor intensity.

The results indicate a clear impact of the legislation in the labor intensity, for both 1991 and 2000. There is a clear break in the intensity in the age when benefits become available to workers (65 in 1991 and 60 in 2000). The magnitude of the coefficients are very similar for both years, the only difference is the age when it happens. As before, the results are robust to all specification of the function on age.

The results show that the possibility of receiving pension benefits creates incentives to reduce the amount of time allocated to work in rural areas, and this phenomenon is also evident for younger workers. This fact is also evident when one analyses the percentage of workers in the rural sector who receive pension benefits and stay in the labor market. Wajnman (2004) showed that the proportion in the rural areas is almost twice the proportion observed in the urban areas. This evidence suggests that the value of the benefits is not enough to support a family in the rural areas, but also that individuals start to receive benefits and stay in the labor force because they consider themselves too young to complete withdraw from the labor market.

7. CONCLUSION

This paper used a characteristic and a policy change of the rural pension Brazilian program to study labor market behavior in recent decades. There is a large literature on this topic in developed countries, but research is still incipient in the developing world. In Brazil, most of the research concerning the rural sector involves the impacts of the program in improving individual well-being and reducing inequality. However, little is know about the incentives created by the programs and how it might affect overall socioeconomic conditions.

The main result of the paper is that the rural pension program creates clear incentives for workers to leave the labor force and/or reduce their labor intensity, and the new law made it easier to withdraw from the labor force at younger ages. This paper, using different methodology and datasets, reaches similar results achieve by other authors. The results also contribute to a larger literature on how social welfare programs might affect economic behavior, more specifically labor force participation. Research on this topic is relevant, because social policy should affect the equilibrium of the labor market and/or other variables.

The results presented here are limited by an amount of factors. First, it is not possible to correctly identify individuals who receive rural pension benefits and it is not feasible to obtain information about one's whole work and earning histories. Second, even though census data have several advantages in relation to other household surveys, the time distance from the year when the legislation was effective might final results. Last, our results are more robust for males than for females (results for female not shown). This might be explained by the lower female labor force participation in rural areas and the disruption in the female working life cycle.

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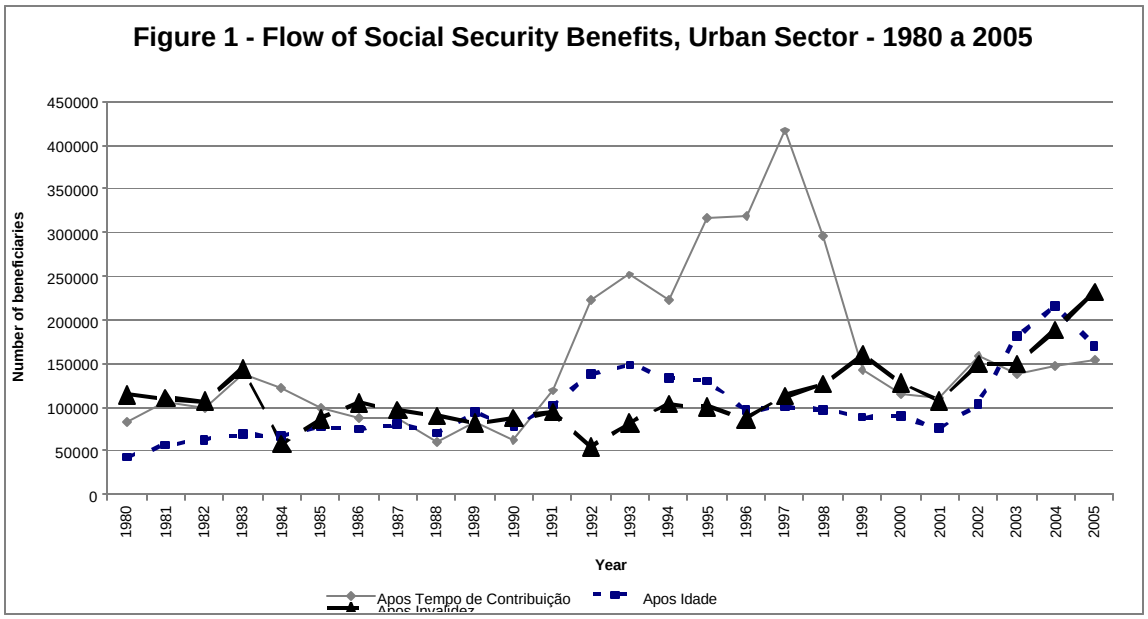
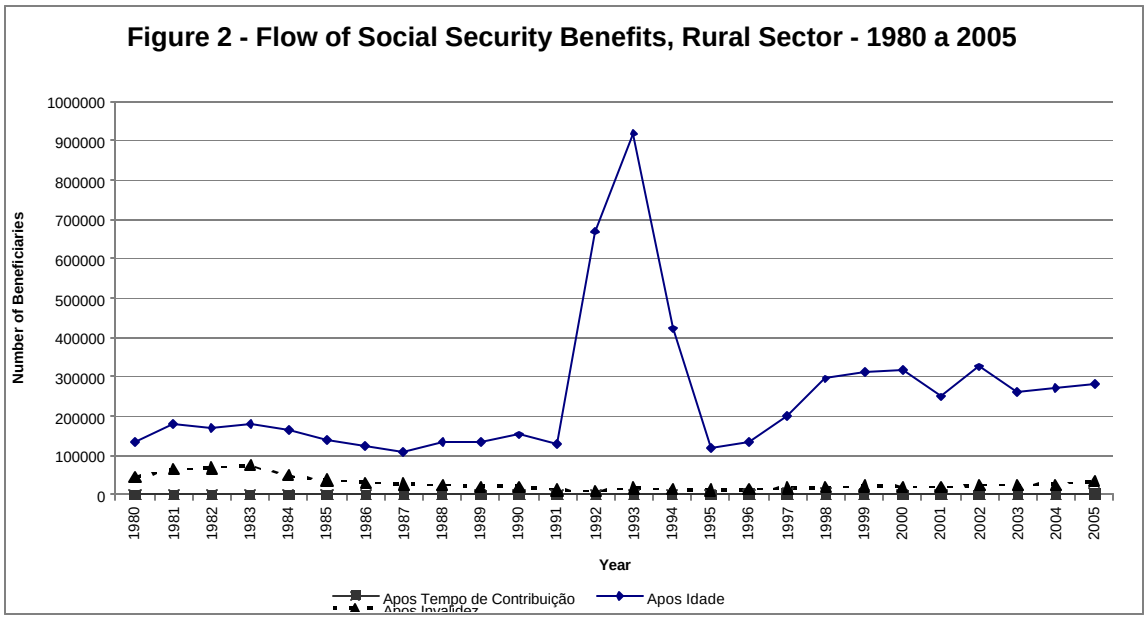
Figures and Tables





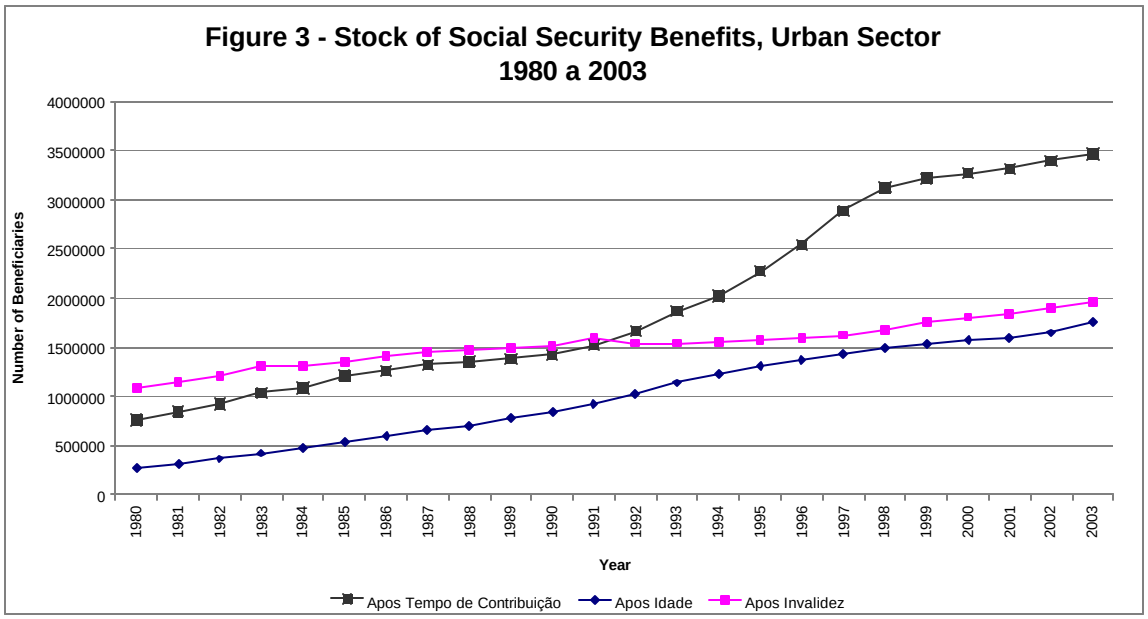


Figure 3 - Stock of Social Security Benefits, Urban Sector
1980 a 2003
Number of Beneficiaries
4000000
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003
Year
Apos Tempo de Contribuição
Apos Idade
Apos Invalidez

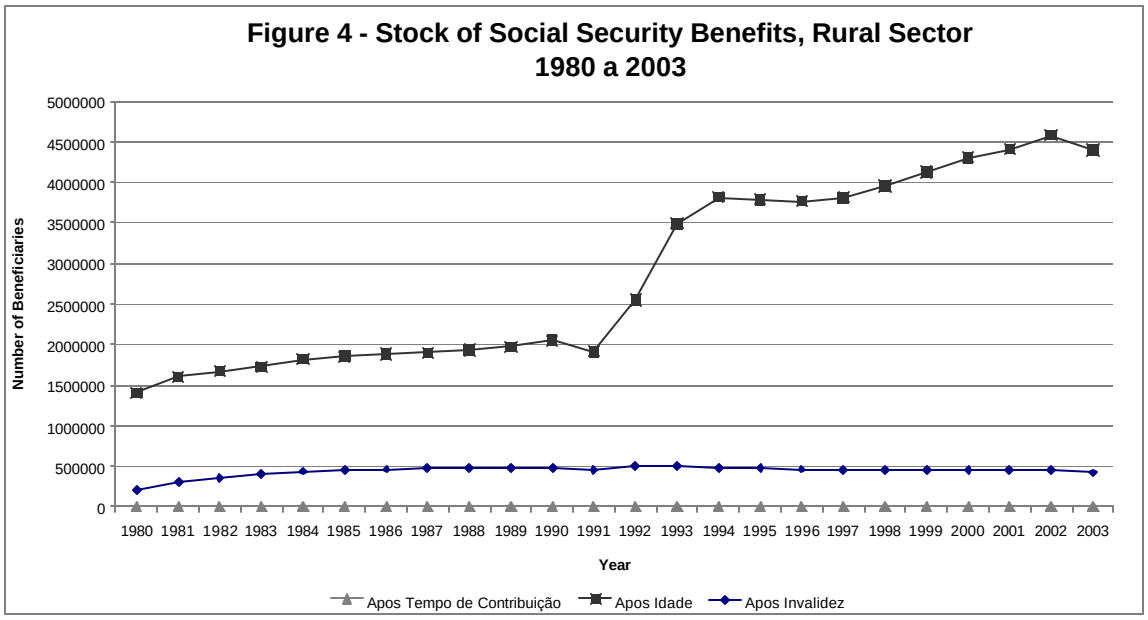


Figure 4 - Stock of Social Security Benefits, Rural Sector
1980 a 2003
Number of Beneficiaries
5000000
4500000
4000000
3500000
3000000
2500000
2000000
1500000
1000000
500000
0
1980 1981 1982 1983 1984 1985 1986 1987 1988 1989 1990 1991 1992 1993 1994 1995 1996 1997 1998 1999 2000 2001 2002 2003
Year
Apos Tempo de Contribuição
Apos Idade
Apos Invalidez

Figure 5 - Labor Force Participation Rates, Males, Brazil, 1950-2000

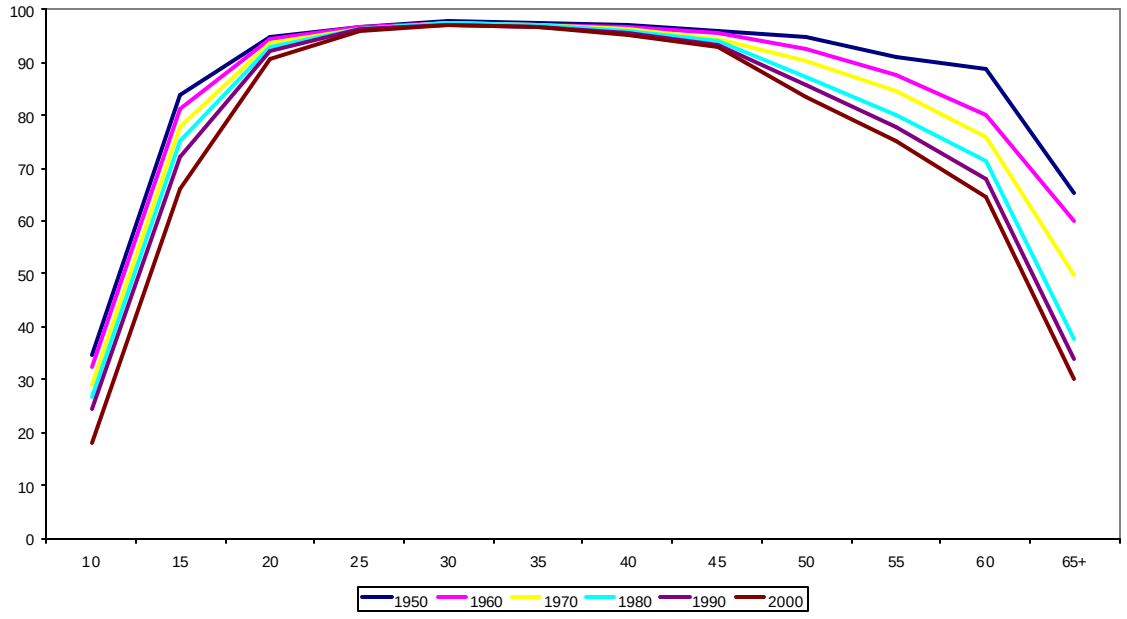
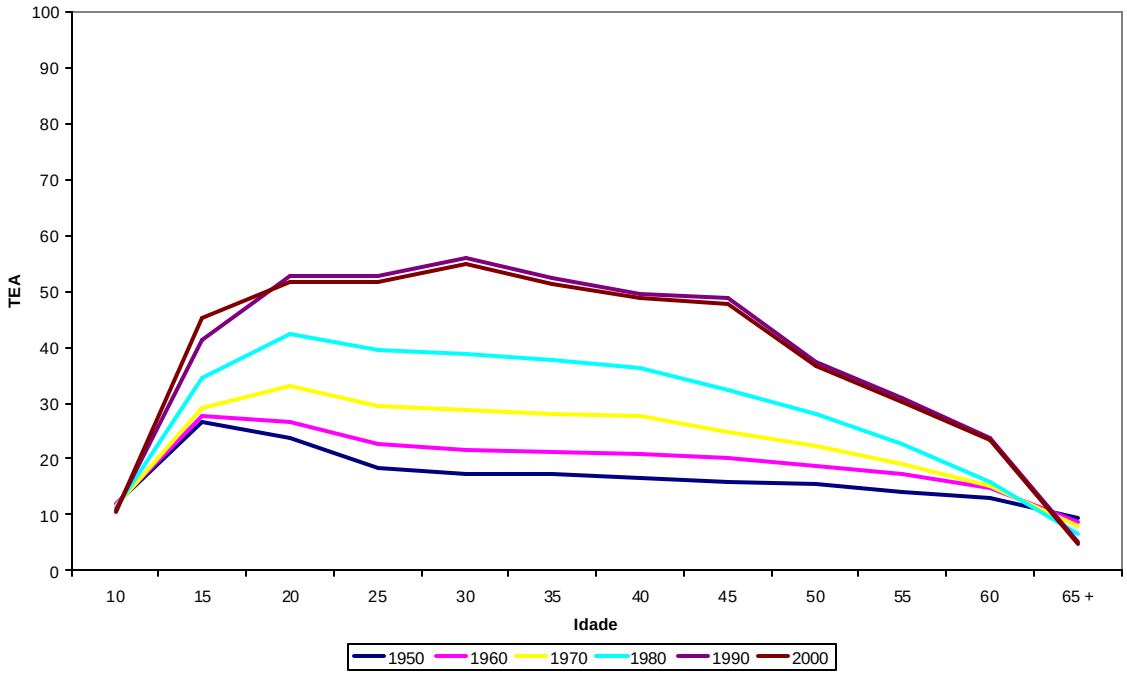


Figure 6 - Labor Force Participation Rates, Females, Brazil, 1950-2000



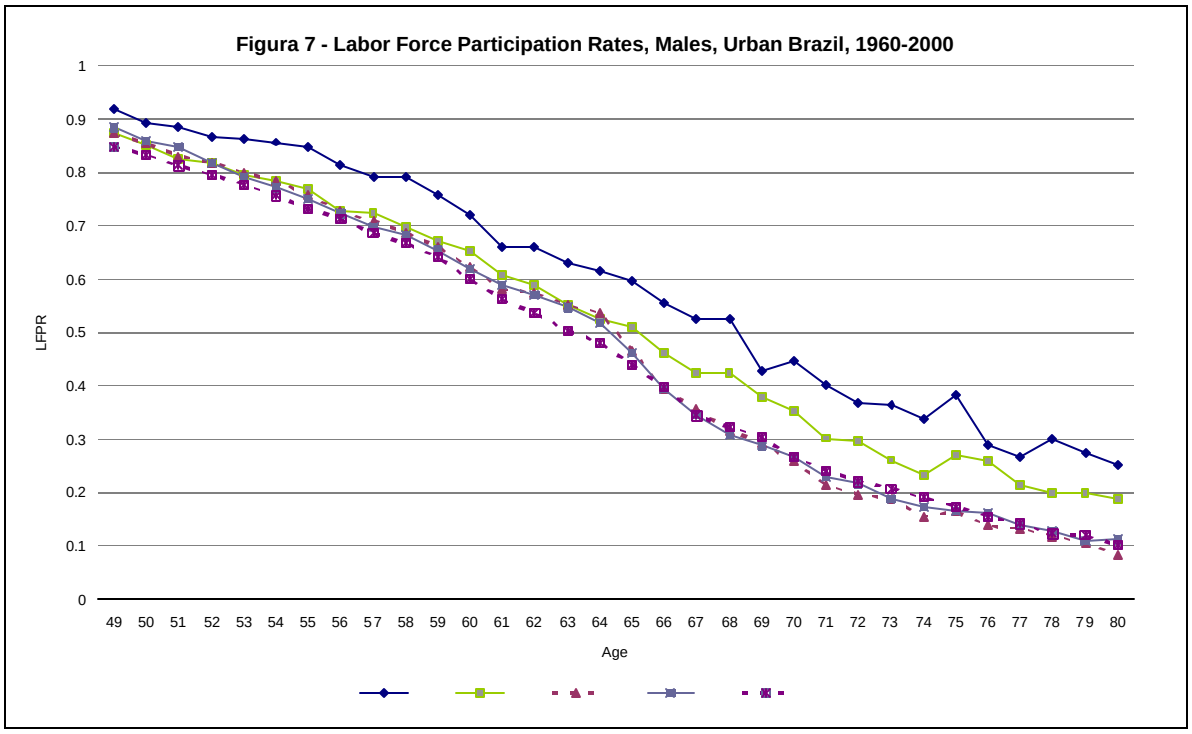


Figura 7 - Labor Force Participation Rates, Males, Urban Brazil, 1960-2000
LFPR
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
0.1
0
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
Age

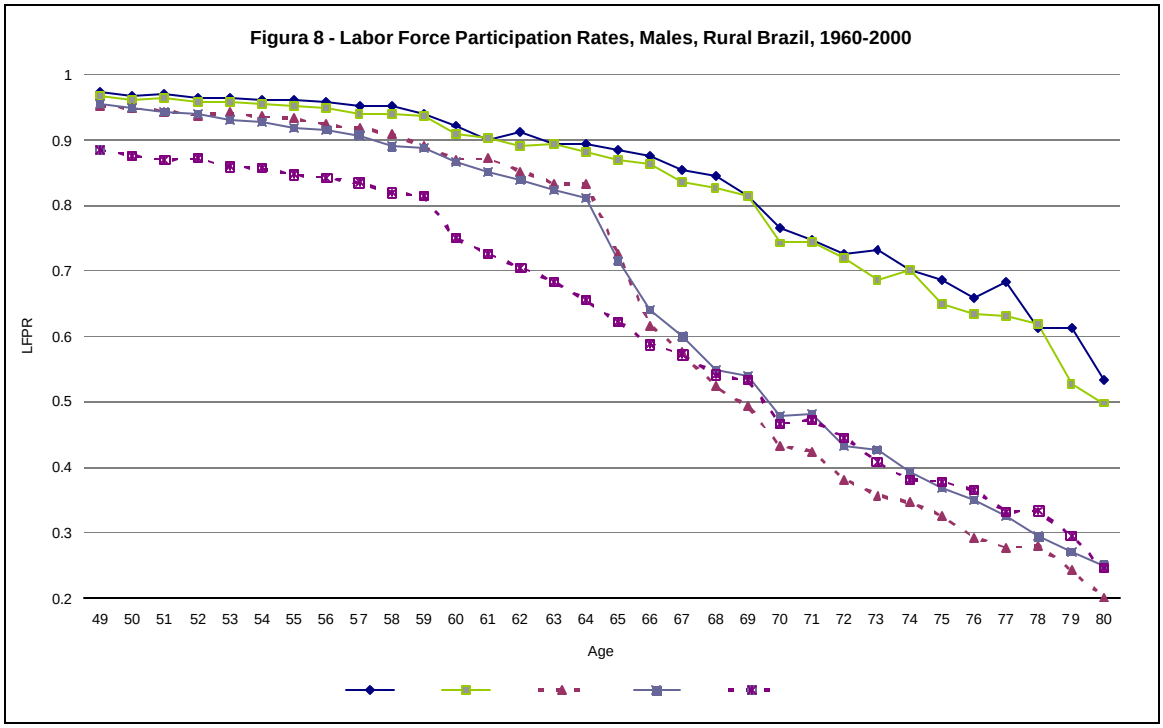


Figura 8 - Labor Force Participation Rates, Males, Rural Brazil, 1960-2000
LFPR
1
0.9
0.8
0.7
0.6
0.5
0.4
0.3
0.2
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80
Age

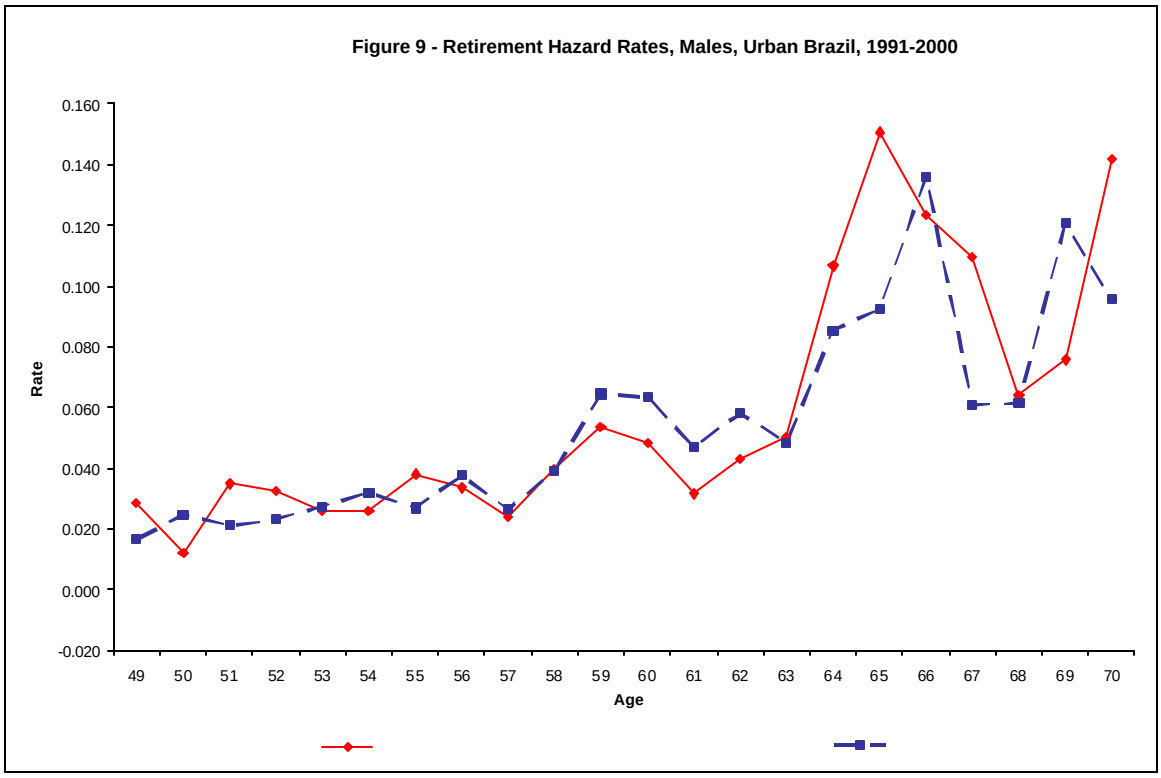


Figure 9 - Retirement Hazard Rates, Males, Urban Brazil, 1991-2000
Rate
0.160
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
-0.020
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
Age

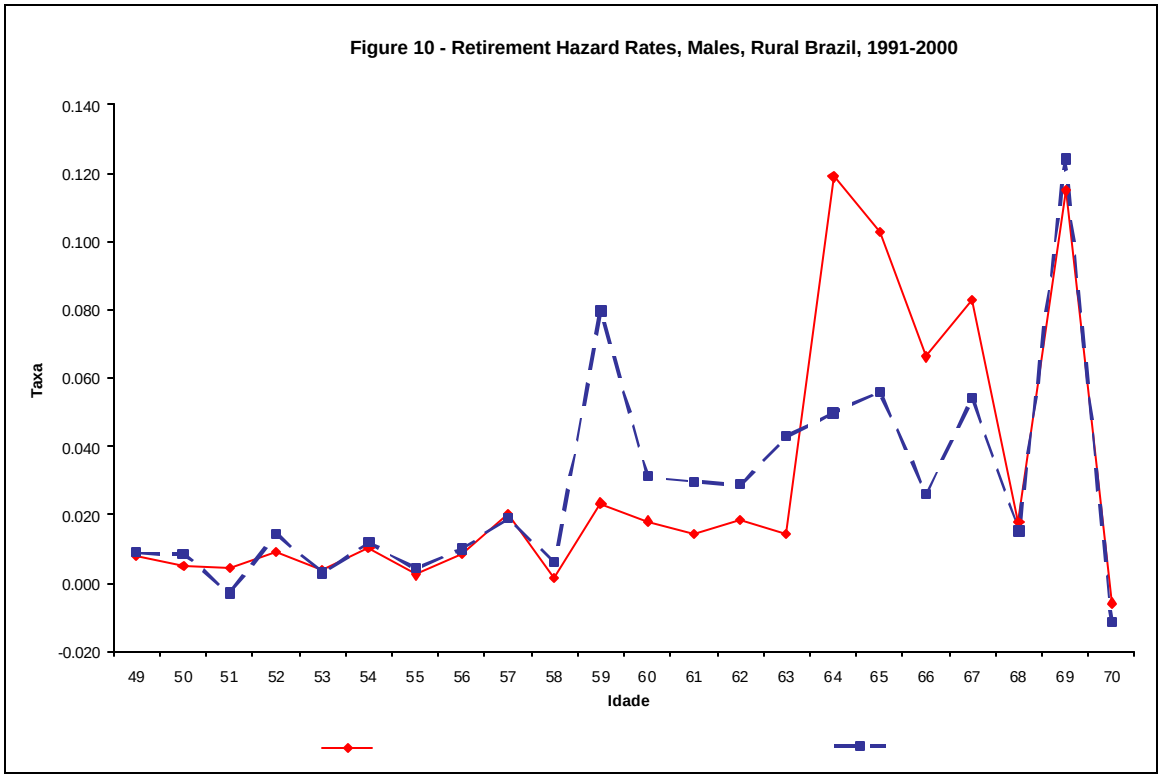


Figure 10 - Retirement Hazard Rates, Males, Rural Brazil, 1991-2000
Taxa
0.140
0.120
0.100
0.080
0.060
0.040
0.020
0.000
-0.020
49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70
Idade

Table 1 – Social Security Benefits and Rules in Brazil

Type of Benefit	Regulation	Minimum Contribution	Value of the Benefit
Age	Urban Males: 65 Females: 60 Rural Males: 60 Females: 55	90 months	70% of the contribution based wage + 1% for every 12 months of contribution up to 100%
Length of Contribution	Males: 35 years of work Females: 30 years of work	90 months	70% of the contribution based wage + 6% for each other years of work
Special Retirement	15, 20 or 25 years according to the legislation	90 months	100% of the contribution based wage
Disability	Medical Exam consider individual disable to perform activities	12 months	100% of the contribution based wage
Pension due to Spouse Death	To the dependents of a contributors	No minimum number of contributions	100% of the contribution based wage
Temporary Health Problem	Individual who is unable to work for more than 15 days	12 months	91% of the contribution wage based
Accident	Accidents that do not permit individual to work or reduces its work capacity	No minimum contribution period	50% of the wage
Maternity	Women who gave birth	No minimum contribution period if she's working at the time	Full Wage, Contribution Wage Based and Minimum Wage (depending on the work category)

TABLE 2 - SOCIAL SECURITY RURAL BENEFITS: STOCK AND AVERAGE BENEFIT

	Number				Average Benefit Value			
YEAR	**Total**	**Lenght of Contr.**	**Age**	**Disabi**	**Total**	**Lenght of Contr.**	**Age**	**Disabi**
1988	2413869	0	1933745	480124	233.85	0.00	235.54	227.05
1989	2456103	0	1977720	478383	287.21	0.00	290.33	274.30
1990	2542240	0	2052339	489901	158.76	0.00	160.39	151.93
1991	2371737	0	1916038	455699	254.96	0.00	255.27	253.63
1992	3051005	83	2548282	502640	255.35	675.88	255.65	253.74
1993	3989298	280	3491626	497392	367.18	759.47	358.21	356.17
1994	4307202	547	3817606	489049	228.32	456.33	228.41	227.36
1995	4263917	1128	3787195	475594	283.51	622.57	283.54	282.46
1996	4237401	2026	3769648	465727	292.97	726.39	292.85	292.04
1997	4274747	3113	3810846	460788	291.86	763.16	291.52	291.55
1998	4416224	4229	3954100	457895	311.28	813.22	310.69	311.79
1999	4590973	5026	4126872	459075	272.24	705.95	271.50	274.08
2000	4769911	5625	4305040	459246	273.15	679.51	272.30	276.14
2001	4871103	6031	4408080	456992	291.36	657.35	290.50	294.81
2002	5043993	6528	4578678	458787	262.48	580.66	261.61	266.69
2003	4825517	6881	4399563	419073	286.76	632.71	285.60	293.19

Fonte: Anuário Estatístico Ministério da Previdência Social

Table 3
Regression Discontinuity Estimates
Effects of Legislation Change on Labor Supply
Males, Rural Brazil, 19991

Variales	Model 1	Model 2	Model 3	Model 4
Age				
Linear	-.0128927 ***			
	(.0042581)			
Quadratic		.0092044***		
		(.0042028)		
Cubic			-.0109509***	-.0112023***
			(.0042611)	(.0042762)
Education	no	no	no	yes
Region	no	no	no	yes

Source: Population Census, 1991
Note: Dummy for age 60
*** Sig. at 5%

Table 4
Regression Discontinuity Estimates
Effects of Legislation Change on Labor Supply
Males, Rural Brazil, 2000

Variables	Model 1	Model 2	Model 3	Model 4
Age				
Linear	0.0246***			
	(.0041291)			
Quadratic		-0.0118***		
		(.0041764)		
Cubic			-0.01336***	-0.0112572 ***
			(.0042672)	(.0043158)
Education	não	não	não	sim
Region	não	não	não	sim

Source: Population Census, 2000
Note: Dummy for age 65
*** Sig. at 5%

Table 5
Regression Discontinuity Estimates
Effects of Legislation Change on Labor Intensity
Males, Rural Brazil, 1991

Variables	Model 1	Model 2	Model 3	Model 4
Age				
Linear	-.0239871			
	(.0286954)			
Quadratic		-.0392196		
		(.0287346)		
Cubic			-.0881274	-.0904844***
			(.0295715)	(.0299859)
Education	não	não	não	sim
Region	não	não	não	sim

Source: Population Census, 1991
Note: Dummy for age 60
*** Sig. at 5%

Table 6
Regression Discontinuity Estimates
Effects of Legislation Change on Labor Intensity
Males, Rural Brazil, 2000

Variáveis	Modelo 1	Modelo 2	Modelo 3	Modelo 4
Age				
Linear	.083538			
	(.0225478)			
Quadratic		-.0688678		
		(.02307)		
Cubic			-.064195	-.0493789
			(.0234566)	(.0239347)
Education	não	não	não	sim
Region	não	não	não	sim

Source: Population Census, 2000
Note: Dummy for age 65
*** Sig. at 5%