Essays in Development Economics

by

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Abstract

In 1991, a reform was passed changing the rules for social security for rural workers in Brazil. The reform consisted of a reduction in the minimum eligibility age for old-age benefits, an extension of benefit eligibility to workers who are not the heads of their households, and an increase in the minimum value for benefits.

As a consequence, elderly rural workers and their households found a substantive increase in their non-labor incomes. Because old-age benefits for rural workers are not means or retirement tested, this reform may be a very useful natural experiment for studying pure income effects.

I use information from surveys administered before and after the reform is implemented to identify the effects of the reform on the actual receipt of benefits by the elderly.

The first chapter studies the labor supply of elderly rural males in response to the reform. I find that elasticities of labor supply with respect to benefits generosity among rural men age 60 to 64 are greater than those estimated from developed country data. I find that benefit take-up rates are greatest among the better educated, but that least-schooled workers have the largest elasticities of labor supply. I also find that husbands respond to wives' benefits by increasing their labor supply, perhaps because of bargaining considerations within the household. Last but not the least, I find that anticipated benefits do not affect the labor supply of workers close to the minimum eligibility age.

The second chapter studies the choice of living arrangements of unmarried elderly females, that is never married, divorced or widowed females. The main finding is that living arrangements are responsive to benefits income: Brazilian rural elderly females value their privacy and independence, choosing not to coreside with their adult children if they can afford to do so. This result suggests that substituting the extended family for formal transfer programs by means of severe filial responsibility laws and scaling back of social security may be a very costly measure for the elderly in Brazil. Because the estimates of this paper are based on the behavioral response of unmarried elderly females

in the rural areas, one may reasonably argue that those effects are underestimates of the effects for the whole sample of elderly, males and females, married or unmarried, residing in rural or urban areas.

The final chapter studies the effects of increases in non-labor income at the household level on children's outcomes, particularly labor participation and school enrollment. In this chapter I study the impact of this increase in non-labor income on children of ages 10-14 living in the same household as old-age beneficiaries. Counterfactual analysis based on reduced form estimates implies that little less than 20% of the gap between 100% enrollment and counterfactual enrollment rates was closed for girls living with at least an elderly who benefited from the reform, with a smaller effect for boys. Labor force participation of boys also seem to have been effected by the reform, with a reduction in participation rate around one-tenth of counterfactual participation rates. Those results may be underestimates of the effects of overall income growth because economy-wide increases in income are likely to be associated with shifts in social norms and attitudes towards children's labor participation and schooling.

Thesis Supervisor: Abhijit Banerjee
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To my wife, Maria Paula, and son, Lucas,
whom I love with all my heart

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Chapter 1

Old-Age Benefits and the Labor Supply of Rural Elderly in Brazil

The elasticity of elderly labor supply with respect to social security generosity is a key parameter of interest for the management of Social Security systems. From the point of view of a policymaker setting the rules governing a country's Social Security system, that elasticity is an important determinant of the total revenue generated by payroll, output or income taxes commonly used to finance benefits payments. The labor supply elasticity is also an important determinant of the total amount of benefits paid out when benefits are subject to retirement, earnings or means tests. Last but not the least, labor supply elasticities are central to the policy debate on poverty alleviation and transfers programs.

Little is known about the impact of social security in developing countries.[1] This paper estimates the elasticity of elderly labor supply in Brazil by studying the effect of a reform in the rules governing social security for rural workers in Brazil[2], contributing to the understanding of this important behavioral parameter. The number of elderly in developing countries is growing and many countries have instituted social security systems where there was none (World Bank (1994)). The challenge for policymakers is to design systems that do not create excessive burden on workers and employers, particularly social security systems that do not generate too large an impact on the labor supply of the elderly and dependency ratios. But, because developing countries differ from developed countries in a variety of ways it is not clear that we can use the many studies based upon data from the developed world to understand retirement in a developing country context.[3]

Sources of differences between developed and developing countries include the difference in income levels, in the stringency of credit constraints, in the relative importance of non-market activities, in the capital intensity in production, and in workers' life expectancy, and in the importance of the informal, undocumented sector

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[1] Case and Deaton (1998) show how a means tested program achieves the redistributive goal in South Africa.
[2] The legal definition of rural workers includes workers directly involved in agriculture, ranching, forestry, fishing and small-scale mining.
[3] Meyer (1995), citing Cook and Campbell (1979), calls this problem "interaction of setting and treatment".

Evidence from developed countries suggests that income effects for low-income are larger than income effects for high-income workers (Hausman 1985). Evidence from developed countries also suggests that relatively few workers retire before they become eligible for social security (Kahn 1988; Johnson 1999), perhaps because of liquidity constraints. Because consumers in developing countries are more likely to be liquidity constrained because development of the financial sector is positively correlated with income levels (Levine 1997), the timing and current availability of benefits become more important variables than social security wealth. Therefore, one may expect larger labor supply responses to current receipt of benefits in developing countries. Labor supply response to benefits may also be larger in developing countries because the marginal trade-off between market and non-market activities may be changing much more quickly in favor of such non-market activities as working the family property. Because capital-labor ratios are smaller in developing countries, workers may be required to perform more arduous tasks, disproportionately more burdensome for elderly workers, making retirement more desirable for a given level of benefits. This effect may be exacerbated by poorer health condition on the average in developing countries. On the other hand, because the majority of the rural elderly is poor, leisure may be a luxury, which reduces the labor supply response for a given level of benefits.[4] Finally, when such vital events as births may be poorly documented and when a large share of the labor force is involved in informal work workers may not easily qualify for benefits. If there is a positive correlation between formal relationships and unobserved variables correlated with preferences for work, such as ability, OLS estimates of the effects of benefits on labor supply will be biased downwards.

The Brazilian social security reform of 1991 provides a unique opportunity to study the effect of pensions on elderly labor supply. This reform reduced the minimum eligibility age for rural old-age benefits for men from 65 to 60, increased the minimum benefit paid to rural old-age beneficiaries from 50% to 100% of the minimum wage, extended old-age benefits to female rural workers who were not heads of households, and reduced the age at which women qualified for benefits from 65 to 55. Brazilian rural beneficiaries are not subject to either an earnings test or retirement requirement. When a rural worker reaches the minimum eligibility age for old-age benefits, he just has to file a request for his benefits, and once he is able to formally make the case for his eligibility, there are no strings attached. There is therefore little room for strategic timing of filing claims for old-age benefits and thus no need to model a dynamically optimizing view of retirement incentives (e.g. Stock and Wise (1990)).

[4] In 1990, television sets were present in 40% of Brazilian rural households headed by an elderly. In 1997, the figure was 58%.

I am able to use changes in rules governing eligibility and benefit values in the old-age program for rural workers to identify the effect of own, spouse's, and family-level benefits on male elderly labor supply. These changes in rules and benefit values provide me with an exogenous source of variation in benefits that is not correlated with a worker's idiosyncratic preferences for work. I use several econometric approaches. I first use a simple differences-in-differences approach in which I compare rural and urban workers of the same age group and also rural workers of different age groups. I then control for rural-urban trends by using a differences-in-differences-in-differences approach in which I use different cohorts of workers.

Then, I move to structural estimation of the parameter of interest. The gradual build-up of benefit take-up rates, the change in the minimum eligibility age, the differential increase in benefits for rural workers, and the rule changes affecting female workers all provide me with a set of instrumental variables capturing exogenous variation in social security benefits. The structural model also allows me to test whether benefits received by husbands and wives generate different effects, providing an interesting test for the unitary model of household labor supply. In addition, because benefit take-up rates may be correlated with factors that enhance labor market performance, such as ability or education, I analyze the differences in take-up rates and labor supply responses across education groups.

Finally, I examine the possibility of workers reducing their labor supply in anticipation to future benefits. The structure of the rules governing old-age benefits allows a reduced form test that solves the problem of identification of the effects of proximity to the minimum eligibility age when there are also age effects.

I find that elasticities of labor supply with respect to benefit generosity among rural males age 60 to 64 are greater than those estimated from developed country data. Differences-in-differences estimates imply an elasticity of labor force non-participation equal to 0.28. An increase in benefits with a dollar equivalent to US$100 increases the proportion of workers who "did not worked in the reference week" in 34 percentage points. Structural estimates controlling for individual characteristics imply an elasticity of labor force non-participation equal to 0.79, which is a very large number compared to the evidence from developed countries.

I find that benefit take-up rates are greatest among the better educated, but that least-schooled workers have the largest elasticities of labor supply. I also find that husbands respond to wives' benefits by increasing their labor supply, perhaps because of bargaining considerations within the household. Finally, I find that workers do not anticipate benefits to be received in the near future when making their current labor supply decisions. Those findings have implications not only for social security policy in developing countries, but also for poverty reduction programs in developing countries, for theories of family decision making, and for the role of anticipated wealth in current retirement decisions.

Section 1 discusses the data, our outcomes of interest and sample selection choices. Section 2 summarizes the reform. Section 3 presents the identification strategy and presents graphs that summarize the evidence on the first-stage relationship. Section 4 presents results based on differences-in-differences estimates using age and time variation. Section 5 presents results based on difference-in-difference-in-differences estimates using age, time and rural-urban variation. Section 6 presents structural estimates of the effect of one's own benefits on one's labor supply. Section 7 discusses further results, such as implications for the theory of the household decision-making, estimates the extent of anticipatory behavior in the labor supply of workers close to the minimum eligibility age for benefits and examines differential effects across educational groups. Section 8 concludes discussing how the estimates relate to the previous literature and then implications for policy.

1. Data and Rural Workers' Labor Supply Measurement

1.1. Source of Data

I use the *Pesquisa Nacional por Amostra de Domicílios* (PNAD) to estimate the impact of the extension of social security benefits on labor supply. The PNAD is a yearly household survey, with sample size equal to 1/500 of the Brazilian population (about 100,000 households) and is designed to produce a picture of the living conditions and economic life of the Brazilian population, rural and urban. For every individual I observe characteristics such as age, race, education, school enrollment, income from different sources, housing and living arrangements, family structure, work, fertility, migration and other topics. I observe various measures of labor supply, including hours of work, labor force non-participation and earnings.

1.2. Outcome Variables

The labor supply measures that I use should capture different features of rural work in the population of interest. To explore the differences between remunerated and non-remunerated work, I use monthly earnings. To explore the intensity of work, I use total hours per week. To measure labor force non-participation, I use "did not work in the week of reference", which I call "did not work last week" for the sake of brevity.

I use two continuous measures of labor supply because *aposentadorias rurais* (rural pensions) contain no incentives for total withdrawal from the labor force. There is no earnings test and, unlike their urban counterparts, rural workers do not have to quit their jobs to become eligible for benefits[5]. Therefore, examining only discrete measures of labor supply (as is the practice in studies of US labor markets) may miss the adjustment in the intensity margin, captured by total earnings.

Unfortunately, the data do not allow me to determine the type of social security benefits paid to each beneficiary. The PNAD groups social security benefits into somewhat broad categories. It only differentiates between *aposentadorias* (disability, old age and length of service benefits) and *pensões* (military and survivors' income maintenance benefits). *Pensões* are mostly received by widows whose husbands were covered by social security benefits.

I will identify rural and urban workers based on their occupations. I observe every worker's current occupation and I observe past occupation up to a four years recall. Therefore, my estimates are conditional on a worker not having retired in the last four years.[6]

I can also identify the rural/urban situation of a worker's household. Living in a rural area is a very good predictor for having a rural occupation, but I am concerned about bias coming from the possibility of rural elderly moving to urban areas upon retirement. Therefore, I emphasize results based on the occupation classification.[7]

1.3. Sample Choice

In the econometric analysis of this paper, I restrict myself to male workers age 50-69. The compulsory retirement age for public sector workers in Brazil was 70 in the period of the study. Because very few (<0.5%) rural workers had 12 years of schooling or more – equivalent to high school completion or more - while the same figures for urban workers are 9%, I restrict both the rural and urban samples to workers who had less than 12 years of schooling.

[5] A beneficiary is required to stop working altogether only upon the receipt of disability benefits. Public sector workers are required to quit their jobs in order to receive benefits, and that is likely to have a stronger test than a private sector worker having to quit his job, for the specificity of work in the public sector.

[6] Unemployed and labor force non-participants are asked which occupation and at which industry they worked in the last year. In case they have not worked in the last year, they are asked to recall up to the last 4 years. Eligibility for rural old-age benefits requires that the worker had had rural occupations in 2 out of the last 3 years. Therefore, the questionnaire allows me to identify any worker potentially eligible to rural old-age benefits.

[7] There are no major changes in results when I use location of residence as a proxy for occupation for those workers whose occupation is undefined.

I chose not to analyze female labor supply because labor force participation rates for elderly female rural dwellers are much smaller than the figures for males. In 1990, for the 60-64 age group in rural areas, the labor force participation rate was 20% for females and 85% for males.

2. The 1991 Reform in the Brazilian Social Security System

The promulgation of the Constitution of 1988 was a watershed in the Brazilian social security system (see Table 1). It established the guidelines for a reform in the Social Security system, requiring among other things that rural workers' old-age benefits be extended to women who were not household heads; that length-of-service eligibility be extended to rural workers; that occupational discrimination against rural workers be ended; that no benefit be smaller than one minimum wage; and that the minimum age of old-age social security eligibility for rural workers be reduced.

The reform of Social Security entitlements proposed by the Constitution of 1988 did not go into effect before approval of Ordinary Law regulating its implementation. The Ordinary Law was only passed in July 24, 1991 (Lei #8212/8213). After this approval, actual increase in the value of outstanding benefits went automatically into effect, but actual extension of benefits to newly eligible workers took a few months to be processed for a variety of reasons (administrative delay, distance to the nearest post office, lack of information about entitlements and others).

This is the timing of events: In 1988, the Constitutional change was passed and more informed workers became aware of their new entitlements. In July 1991, the necessary ordinary law was passed, with benefit payments to rural beneficiaries of old-age pensions increasing automatically from 50 to in general 100 percent of the minimum wage and newly eligible rural workers (60 to 64 year olds) beginning to apply for benefits. In September 1992, the month of reference of the 1992 household survey that I will use in estimation, take-up of new benefits was still incomplete, either for bureaucratic reasons or because of delays in the spread of information. Finally, by September 1993, the month of reference of the 1993 survey, almost all of the take-up process was completed and newly eligible workers were already receiving their benefits. Administrative data from the Anuário Estatístico da Previdência (1997) confirms this pattern of sluggish take-up: by the end of 1992, 129,953 newly eligible males aged 60-64 were receiving rural old age benefits; by the end of 1993, 326,158; by the end of 1994, 358,761.

The latest year before the Constitutional change was passed for which the survey data is available is 1987. Data is available also for 1988 and 1989. The latest year before the actual implementation of the reform for which data is available is 1990. There is no data for 1991. In

1992, old-age benefits have already increased and take-up of new benefits is still partial, which allows us to take advantage of additional time variation in take-up rates. In 1993, the take-up process is almost "complete". There is no data for 1994. The earliest year after the take-up process has been "completed" for which data is available is 1995. By 1995, however, the Federal Government started to react against pressures on the long-term solvency of the social security system passing a series of rule changes with the goal of tightening restrictions on new benefits. The data on granted benefits shows a slow-down starting in 1995, consistent with the change in government policy mentioned above.

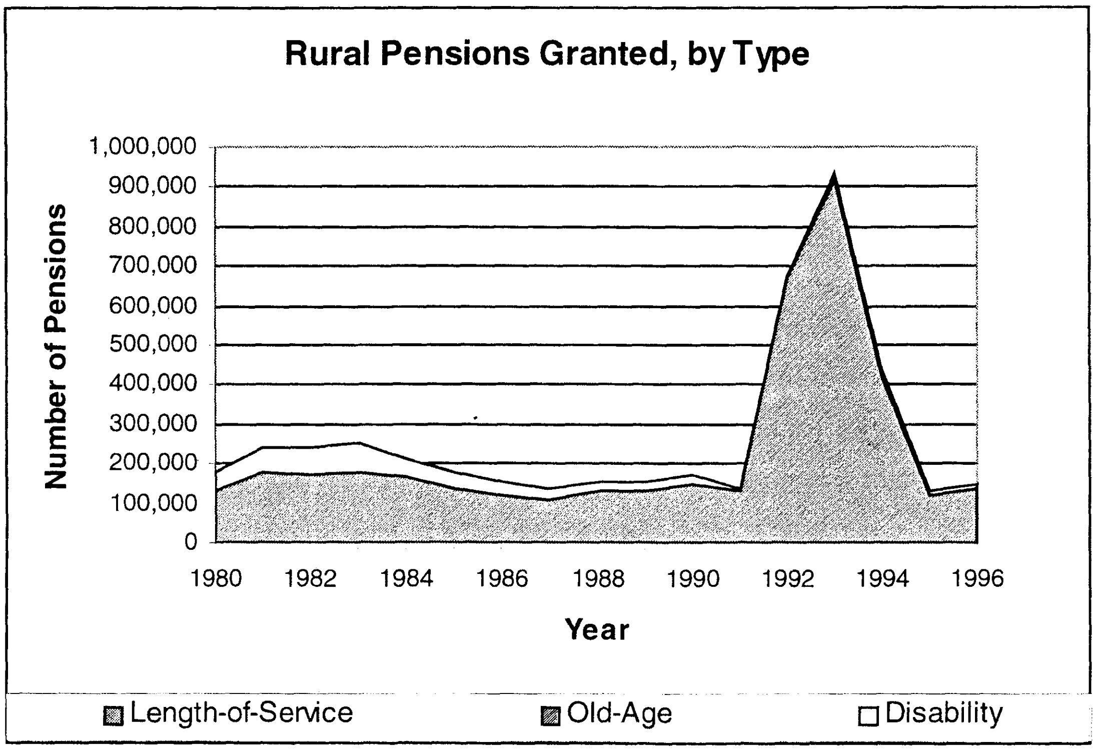


Figure 1: The figure above presents the flow of rural pensions granted for each year between 1980 and 1996. Notice that the spike starts in 1992 and lasts until 1994. The series displayed above aggregates data for males and females. Source: Anuário Estatístico da Previdência (1997).

The reform described above provides exogenous variation in social security benefits, which will be used to estimate the effect of those benefits on labor supply.

Figure 1 above shows the time series of the flow of new pension benefits. Although the change in the law happened in July 1991, there does not seem be any increase in the flow of granted benefits per year before 1992. The spike in the number of granted old-age benefits lasted until 1994 (Anuário Estatístico da Previdência (1998)). The yearly amount of new disability benefits shrinks after the reform implementation, suggesting that disability and old-age benefits are substitutes for the age group affected by the reform. The number of granted rural length-of-service benefits is so insignificant that it can hardly be seen at the picture. Therefore, the impact of the extension of access to length-of-service pensions is likely to be small or negligible. Even today the stock of length of service pensions among rural workers is still extremely small - less than 1/1000 of the number of rural old-age pensions.[8]

To a first approximation, social security for rural workers has a flat benefit schedule. Before the reform, rural old-age benefits were flat and equal to 50% of the minimum wage. Therefore, rural workers had no incentive to postpone their application to benefits. Since the reform, the same formula for calculation of urban workers' benefits applies, which is a function of documented past earnings. However, because the vast majority of rural workers do not have a long history of documented earnings, nearly 100% of rural beneficiaries are at the corner, receiving exactly the minimum benefit equal to 100% of the minimum wage. (Appendix Table 2 shows that the average old-age benefit in 1997 was R$121.37, while the minimum wage was R$120).

Male rural workers were affected by: (1) a reduction in the minimum eligibility age from 65 to 60; (2) an increase in benefits from 50% to 100% of a minimum wage; and, (3) extension of access to length-of-service benefits (see Table 1).

Female rural workers were affected by: (1) a reduction in the minimum eligibility age from 65 to 55; and, (2) the end of the one person-per-household restriction, which allowed married females to take-up benefits too.

3. Identification Overview

I identify the effects of the reform on labor supply by using variation over time in benefits availability, take-up rates and benefit values. Male rural workers age 60-64 became eligible to old-age benefits as consequence of the reform. The same happened for married female rural workers age 55 or older. Finally, benefits paid out to male rural workers 65 or older doubled with the reform.

[8] This fact is also illustrated in Appendix Table 1, which shows the number of beneficiaries for the rural old age and length-of-service benefits by age groups, gender and year. The number of rural length-of-service pensioners is insignificant, representing less than 1/200 of the number of old-age beneficiaries in the group of males aged 60-64. This outcome is not surprising, because length-of-service benefits require documented

3.1. Basic Differences-in-Differences

The most basic way to identify the effects of the reduction in eligibility age on rural workers' labor supply consists of comparing the behavior of the group that became eligible (*treated group*) with a group (*control group*) that was not affected by the eligibility change, before and after the reform. That is the idea underlying the difference-in-differences estimates I present in section 4. From now on, subscripts T, C, A and B denote respectively treated group, control group, after and before. The change in the labor supply of the treated group is ΔL_T or ($L_{T,A}$ - $L_{T,B}$). This change may be due to the changes in the social security rules those workers are facing, but also for other time specific factors that may be acting also on the control group. If I assume that those time specific factors are additive, they can be "differenced away" with the subtraction of the change in the labor supply of the control group, ΔL_C, from ΔL_T. Therefore, the differences-in-differences estimate for the impact of the reform will be ($\Delta L_T - \Delta L_C$). In other words, differences in differences estimates identify the impact of the reform on the outcomes of interest by controlling for systematic shocks to the labor outcomes of the treatment group (males aged 60-64) that are correlated with, but not due to, the law change.

In the differences-in-differences estimation, I use variation in occupation and time for identification. I compare the changes in the variables of interest for rural and urban workers age 60-64, before and after the reform. The idea is to use the trend for the control group to construct a counterfactual to the reform for the treated group. The identification condition is that there is no shock to the relative labor market outcomes of the treatment and control groups contemporaneous to the reform. That may be a strong identification assumption, after all, there are observable and unobservable differences between the treated and the control group that may account for relative shifts in the outcomes of interest.

I use two other control groups to increase the confidence on the results based on comparisons between rural and urban workers. Rural workers ages 55-59 and 65-69 are likely to be similar to rural workers 60-64 in all characteristics but their ages. The former ones received a positive shock to their social security wealth with the reduction in the minimum eligibility age for old-age benefits. The latter ones saw an increase in their current benefits from 50% to 100% of the minimum wage.

work for 30 years, and workers in rural occupations did not have the incentives to document their work before it became a pre-requisite for pension eligibility.

Differences-in-differences estimates can be given a regression interpretation. The differences-in-differences estimates for the outcomes of interest are equivalent to estimates of the coefficient β_Y in the regression below:

$$Y = \alpha_0 + \alpha_1 AFTER + \alpha_2 RURAL + \beta_Y (AFTER \times RURAL) + v \qquad (1)$$

The differences-in-differences estimates of the effect of the reform on benefit take-up rates or benefit values can be interpreted as the first-stage regression in a two-stage least squares estimate of the effect of benefits on the outcome of interest. The first-stage relationship, where Z denotes the endogenous variable measuring benefits, is:

$$Z = \alpha_0^Z + \alpha_1^Z AFTER + \alpha_2^Z RURAL + \beta_Z (AFTER \times RURAL) + v \qquad (2)$$

Instrumental variables estimates of causal relationships can be generated by taking the ratio between the differences-in-differences estimate of the reduced form effect on the outcome of interest and the differences-in-differences for the first-stage relationship (effect of the reform on the endogenous variable). When (AFTER*RURAL) is used as an instrument for the endogenous regressor Z, the coefficient δ in the equation below is numerically equivalent to the ratio of the estimates β_Y/β_Z from equations (1) and (2).

$$Y = \gamma_0 + \gamma_1 AFTER + \gamma_2 RURAL + Z\delta + \varepsilon \qquad (3)$$

3.2. Differences-in-Differences-in-Differences

One can control for different relative shocks that might have affected rural and urban workers of all ages by moving to a triple-differences framework. This strategy consists of using a "non-affected" pair of "treated" and "control" groups, with characteristics similar to the relevant treated and control group in the "affected" pair, but for which the treatment did not take place. The key to this approach is in the similarities in the "affected" and "non-affected" pairs. The groups in the "non-affected" pair are going to be used to difference away any relative trend in the treated and control groups correlated with unobservable variables, but not due to the intervention.

The triple-differences estimates are obtained from the subtraction of the differences-in-differences estimates based on the "non-affected" pair from the differences-in-differences estimates based on the "affected" pair.

In the estimation below I therefore control for: year effects, to capture any trend in labor supply decisions of both rural and urban workers; for occupation effects (rural/urban), to control for any fixed difference in labor supply behavior of rural and urban workers; for age effects, to control for any fixed difference in labor supply decisions across age groups; for year-occupation effects, to control for any shock affecting all workers regardless of age in a given occupation; for year-age effects, to control for any shock affecting all workers regardless of occupation in a given age group; and for occupation-age effects, to control for any fixed difference in labor supply decisions across age groups in a given occupation.

I investigate the reform not only on labor supply, but also on receipt of benefits (the first-stage) and average benefits received because availability of disability benefits could be a substitute for old age benefits for the treatment group before the reform. Triple-differences estimates can also be motivated in a regression framework:

$$\begin{aligned} Z = \alpha_0^Z + \alpha_1^Z AFTER + \alpha_2^Z RURAL + \alpha_3^Z TREAT + \beta_1^Z (TREAT \times RURAL) \\ + \beta_2^Z (AFTER \times TREAT) + \beta_3^Z (RURAL \times AFTER) \\ + \beta_Z (AFTER \times RURAL \times TREAT) + v \end{aligned} \tag{4}$$

$$\begin{aligned} Y = \alpha_0 + \alpha_1 AFTER + \alpha_2 RURAL + \alpha_3 TREAT + \beta_1 (TREAT \times RURAL) \\ + \beta_2 (AFTER \times TREAT) + \beta_3 (RURAL \times AFTER) \\ + \beta_Y (AFTER \times RURAL \times TREAT) + v \end{aligned} \tag{5}$$

In equation (4), Z is receipt of social security benefits. In equation (5), Y is the labor supply outcome of interest. In both equations, $RURAL$ is a fixed occupation effect, $AFTER$ is a fixed year effect, and $TREAT$ is a dummy for the age group that was treated by the program change (1 if treatment group, 0 if control group). The coefficient β_1 controls for secular differences between rural and urban male workers in the treated age group. The coefficient β_2 controls for the time trend specific to the age group (aged 60-64) affected by the reform. The coefficient β_3 controls for the time trend specific to all rural workers. The coefficient β_Z (β_Y) on the interaction of age, location, and year is the triple difference estimate and identifies the impact of the reform on benefit receipt (labor supply). The triple difference estimator has the interpretation of a reduced form estimate, capturing the effect of the rule change on the group means of the outcome variable. Moreover, the ratio β_Y/β_Z is the instrumental variables estimate of the effect of benefit receipt on labor supply when I use the triple interaction term as the instrument for the benefit variable.

Equation (5) above can also be written in an useful abbreviated form:

$$Y = \alpha_0 + \phi_1(\text{age, occupation, time}) + \beta_Y(AFTER \times RURAL \times TREAT) + v \text{ , where:} \qquad (6)$$

$$\phi_1(\text{age, occupation, time}) = \alpha_1 AFTER + \alpha_2 RURAL + \alpha_3 TREAT + \beta_1(TREAT \times RURAL) + \beta_2(AFTER \times TREAT) + \beta_3(RURAL \times TREAT)$$

Figure 2, below, provides a visual interpretation of the identification strategy. It displays the age benefit take-up profiles for males in rural and urban areas in five different years: 1984, long before the reform was thought of; 1987, right before the Constitutional change; 1990, right before the passing of the ordinary law implementing the changes; 1992, right after the program starts; and 1993, when the reform is likely to have full effects.

For rural area males, there is a remarkable increase in benefit take-up rates in 1992 and 1993 for the cohorts age 61 to 64, that can be observed in the top left diagram of Figure 2. Notice that the age benefit take-up profiles for all years before 1992 have a very similar shape, with a sizeable increase by age 65, the pre-reform eligibility age for rural old-age benefits, and take-up rates approaching 100% for the older old. The implementation of the reforms shifted the age at which a 50% male benefit take-up rate is achieved in the rural area from 65-66 to 61. For urban area males, age benefit take-up profiles show a smooth increase in take-up rates with age, which can be explained by a large proportion of urban workers receiving length-of-service benefits. The absence of a noticeable spike in the distribution of ages at which urban workers take up benefits can be explained by accumulation of years of documented work at different rates, due to different unemployment and informal work spells and different ages of first entry at the labor force. More importantly for our identification strategy, there does not seem to be any remarkable change in the age benefit take-up profiles of urban workers.

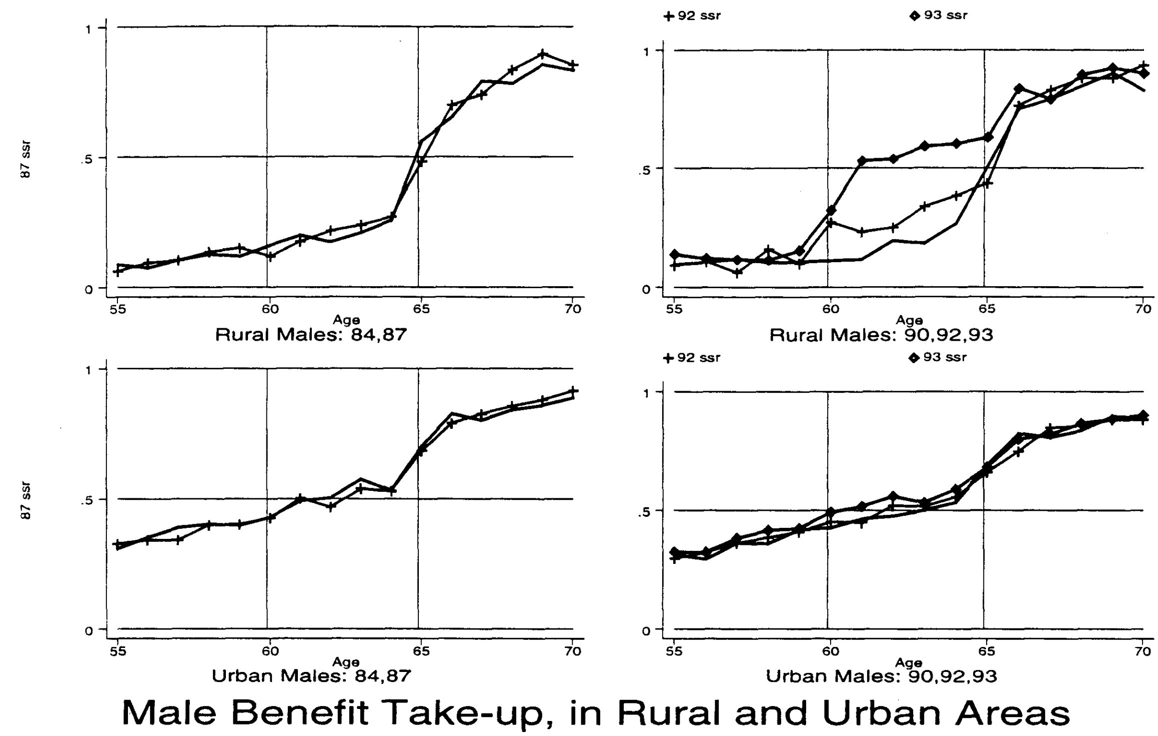


Figure 2. The above figures show age-benefit take-up profile for male rural and urban dwellers in the PNAD surveys of 1984, 1987, 1990, 1992 and 1993. The two diagrams to the left show that there is no trend in the profiles using data from 1984 and 1987, previous to the reform. The diagram in the upper right shows the gradual increase in benefit take-up rates between 1990 and 1993 for males age 60-64 living in the rural area. The diagram in the lower right shows that little changed for urban dwellers.

A similar pattern arises for females, as shown in Figure 3 below. Unlike males, there was only a noticeable change in take-up rates for females in 1993. The increase in take-up rates occurred for females at all ages above 55, suggesting that both the reduction in the minimum eligibility age from 65 to 55 and the end of the "one-per-household" rule played important roles in the increase in female benefit take-up rates. The implementation of the reforms shifted the age at which a 50% female benefit take-up rate is achieved in the rural area from about 70 to 61.

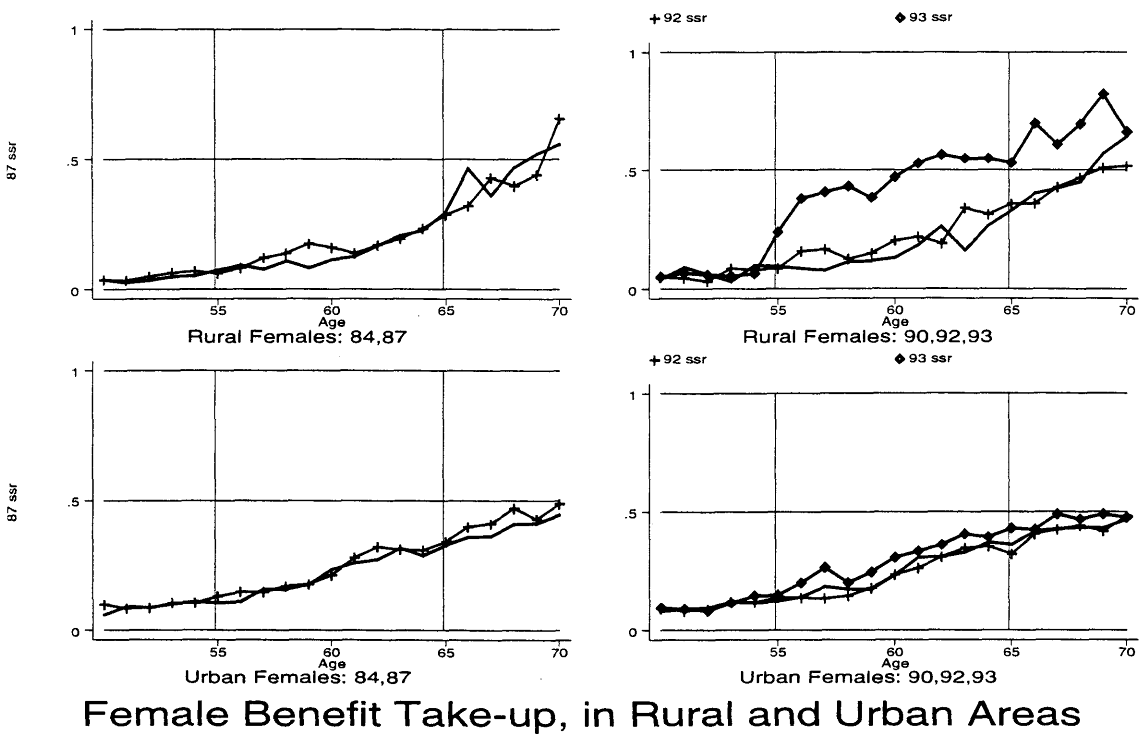


Figure 3. The above figures show age-benefit take-up profile for female rural and urban dwellers in the PNAD surveys of 1984, 1987, 1990, 1992 and 1993. The two diagrams to the left show that there is no trend in the profiles using data from 1984 and 1987, previous to the reform. The diagram in the upper right shows a remarkable increase in benefit take-up rates between 1992 and 1993 for females age 55 and older living in the rural area. Unlike the case for males (Figure 2), there is little difference in take-up rates between 1990 and 1992, suggesting that the concession of benefits to newly-eligible females took a longer time to occur than for males. The diagram in the lower right shows that little changed for urban dwellers.

Figure 4, below, shows the age average benefit receipts profiles for rural and urban dwellers, before and after the reform. It presents a noticeable increase in average benefit receipt for rural dwellers age 60 and older in 1992 and especially 1993. All other movements in the age benefits profiles are parallel in the sense of affecting either all age groups or both rural and urban workers. To better interpret the identification of the exogenous change in benefits values, it helps to directly examine the reduced form regressions presented in Table 9. It presents the coefficient on the interaction between rural occupation, after the reform and affected age in a regression where I control for age, rural/urban and year effects and all second level interactions between those variables. The reduced form estimates present evidence of a statistically significant relative increase of R$50.77 (result in the column (1) of Table 9) in average benefits received by rural workers age 60-64 after the reform.

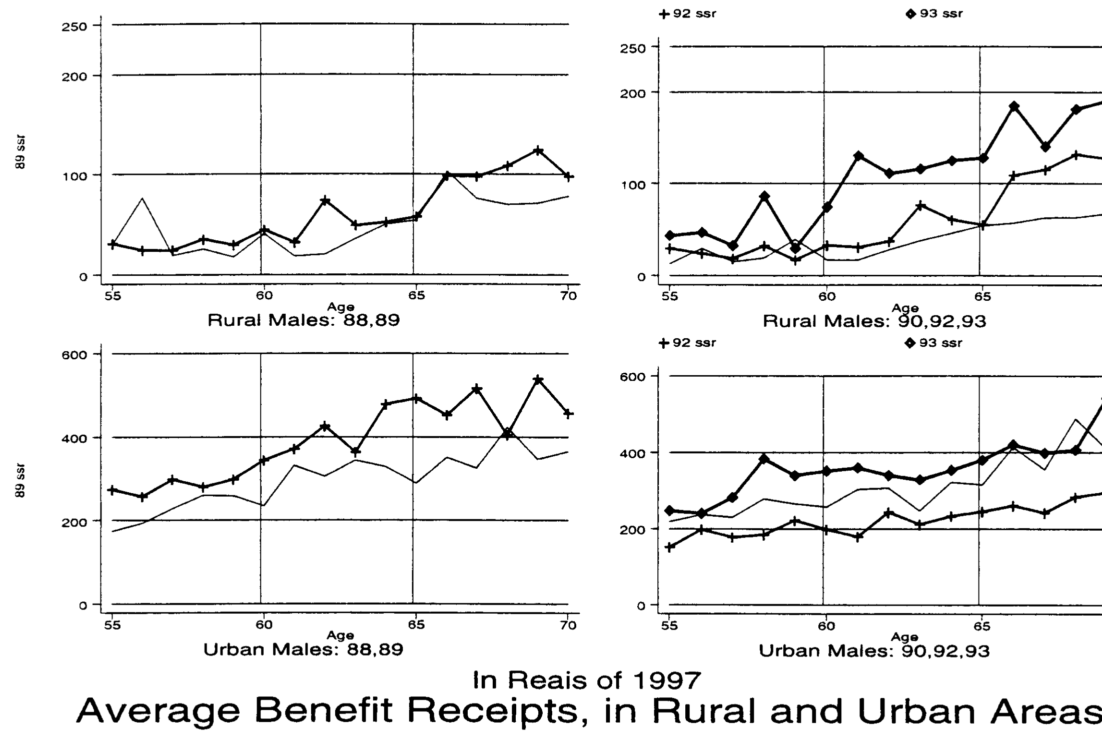


Figure 4. The above figure shows age-average benefit receipts profiles for rural and urban dwellers in the PNAD survey of 1988, 1989, 1990, 1992 and 1993 in Reais of 1997. To construct the series above I purged the data from observations greater than the 99th percentile of positive benefit receipts. In an attempt to purge the data from parallel shifts in the profiles due to lags and leads in price indexation, I adjusted the series as discussed in the Data Appendix. Notice the increase in average benefit receipt for rural dwellers age 60 and older in 1992 and especially 1993. Notice also the parallel character of other shifts in the age profiles found in the figures.

To complete the description of the program, I discuss some other possible problems with interpreting its effects: reliability of the benefit flow and volatility of benefits' real value.

Delgado et alli (1999) present evidence that the timeliness of the benefits flow is quite reliable. Their survey of 3,000 rural beneficiaries in the Southern region shows that 98.3% of beneficiaries have never experienced delays in the receipt of their benefits. Therefore, concerns about the reliability of this transfer program should be dismissed.

The direct link between benefits and the minimum wage in a certain sense pins down the real value of benefits. It certainly minimizes the uncertainty about the present discounted value of benefits due to the chronic high inflation in Brazil during that period.

4. Basic Differences in Differences: Results

Table 3 reports the differences-in-differences for the variables directly affected by the reform: benefit take-up rates and benefit values. This is not an irrelevant exercise because the availability of disability benefits could be a substitute for old-age benefits for that group before the reduction in the minimum eligibility age. That is the reduced form first-stage relationship, linking the rules changed by the reform to direct consequences on benefits take-up rates and average benefit values.

Because there were changes occurring to female entitlements at the same time, I restrict myself to single males and males whose spouses are not older than 50. For this restricted sample, I find that benefit take-up rates for rural workers 60-64 increased 31 percentage points from 11% to 42% between 1990 and 1993. The figures for urban workers 60-64 increased 7 percentage points from 22% to 29%. Consequently, the difference-in-differences estimate is 31 percentage points. In the lower panel of Table 3, one can see that benefit values for rural workers 60-64 did not significantly increase in absolute terms more than for urban workers in the same age group. However, in terms of growth rates, the increase is substantial. Average benefits for rural workers 60-64 increased almost 700%, from R$13 to R$89, while for urban workers they increased only 61%, from R$91 to R$152.[9] To make sure that those estimates are driven by the reform, not some over-the-board relative increase in entitlements for rural workers of all ages, I use two other comparison groups. Rural workers age 55-59 had neither their eligibility affected by the reform nor their average benefits affected by the reform, and I find that both benefits take-up rates and average benefits for rural workers age 60-64 increased relative to that comparison group. On the other hand, rural workers age 65-69 did not have their eligibility status changed but had their benefits increased from ½ to 1 minimum wage[10], and I find that benefit take-up rates for rural workers 60-64 increased relative to 65-69 ones but average benefits decreased relative to that group.

Table 4 reports the differences-in-differences estimates for the outcomes of interest. For the outcome *"did not work last week"*, the reduced form evidence shows statistically significant relative decreases in labor supply of rural workers 60-64 compared to both urban workers 60-64 and rural workers 55-59. Estimates using rural workers 65-69 as a comparison group are not statistically significant. The ratio of the differences-in-differences percentage change in the

[9] All monetary values are expressed in Reais of 1997. During that year, R$1 was roughly equal to US$1.
[10] To be more rigorous, a 65 year-old in 1993 had been eligible for old-age benefits since 1991, when benefits were extended to the 60-64 age group, while a 65 year-old in 1990 just became eligible.

outcome variable to the percentage change in average benefit is an estimate of the elasticity of the outcome with respect to benefits income. The leftmost column at Table 4 reports elasticities ranging from 0.15 to 0.42 for the *"did not work last week"* variable.

In the lower panels of Table 4, I report the differences-in-differences estimates for average total hours of work per week and monthly earnings. Elasticities of hours per week range from negative 0.04 to negative 0.05. Results on monthly earnings show that social security benefits displace earned income on an almost one for one basis. In the comparison against urban workers 60-64, monthly earnings of rural workers of that age group decreased R$71, while their average benefits increased R$61 as consequence of the reform.

Instrumental variables estimates of causal relationships can be generated by taking the ratio between the differences-in-differences estimate of the reduced form effect on the outcome of interest and the differences-in-differences for the first-stage relationship (effect of the reform on the endogenous variable). With urban workers 60-64 as the comparison group, I find coefficients that imply that an increase in benefits of R$100 affects rural workers age 60-64 by: increasing *"did not work in reference week"* in 34 percentage points, reducing average hours per week in 24 hours and reducing average monthly earnings in R$250.

5. Triple Differences: Results

5.1. The First-Stage

Table 5 shows the difference-in-difference-in-differences estimates of the effect of the social security eligibility extension on benefits take-up rates by the group targeted by the law (rural workers age 60-64). Here I compare workers with rural and urban occupations, which means that the results are conditional on a reported work in the last four years. I restrict my sample to workers with less than 12 years of schooling and who are either single or with spouses younger than 50, because I do not want the omission of spouse's benefits to affect my estimates.[11] The top panel compares the change in receipt of benefits for 60-64-year-old workers with rural occupations to the ones with urban occupations. Each cell contains the proportion of respondents who received any kind of social security benefits for the relevant group represented in the axes, along with standard errors of the means.

The point estimates in Table 5 show that the triple differences in the *aposentadorias* benefit take-up rates of by the targeted group increased about 25 (17) percentage points, when I use 55-

59 (65-69) year-olds as the "non-affected" group. The difference-in-differences estimate using the 55-59 age group is insignificant statistically and small in absolute value. But the same cannot be said about the difference-in-differences using the 65-69 age group: I found a large (6%) and statistically significant change over time. However, that is not at all surprising. The 65-69 group in 1993 has lived a different eligibility story as the same age group in 1990. A sixty-five year old rural worker in 1990 has just become eligible for old-age benefits under pre-reform rules. A sixty-five year old rural worker in 1993 has been eligible since 1991, when the reform occurred.

Table 6 presents the reduced form triple differences estimates of the impact of the reform on the average benefit receipts by different age groups of rural and urban workers in Brazil. Rural males age 60-64 became eligible for old-age benefits with the reform. Between 1990 and 1993, their average benefits increased from R$12.72 to R$101.57 (in Reais of September of 1997). For the same age group, but with urban occupations, average benefits increased from R$91.00 to R$ 151.98, yielding a time and occupation difference-in-differences equal to R$27.87, not statistically different from zero. In the same calculation applied to the 55-59 age group, whose eligibility status did not change, the difference-in-differences is negative R$25.13, statistically insignificant. The 55-59 age group allows me to control for trends over time in benefits differentials between rural and urban areas. The difference between the two difference-in-differences estimates is the triple differences estimate equal to R$53.60, with a t-statistic of 1.59.

In the bottom panel of Table 6, I report that the time and occupation difference-in-differences in average benefits for males age 65-69 is R$59.40, with a t-statistic of 1.61. Remember that the eligibility status of males age 65-69 did not change with the reform, but their old-age benefits, originally set equal to ½ minimum wage, increased to one minimum wage. The implied triple difference estimates by comparing the 60-64 and 65-69 age groups is negative R$31.53, not statistically distinguishable from zero.

5.2. The Second-Stage

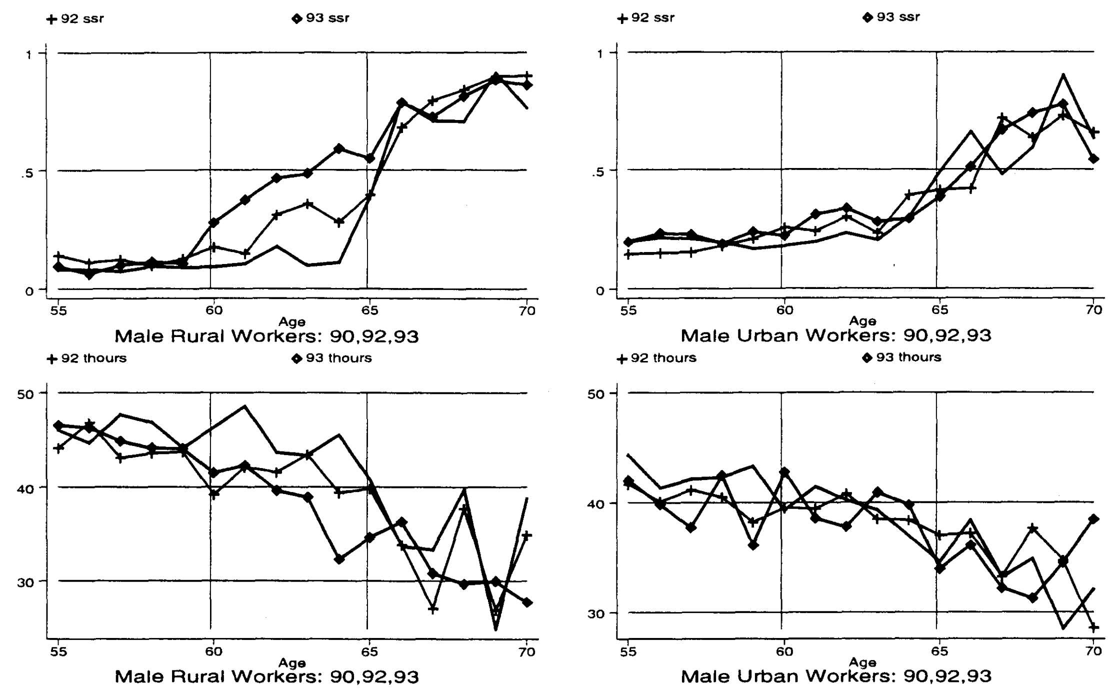
Figure 5 below presents the reduced form effect of the reform on one of the labor outcomes of interest: the variable *"average hours of work per week"*. As expected, the age profile for this variable slopes down in the 55-70 age range as older workers either withdraw from labor force participation or reduce their workweek given a greater cost of effort or other economic incentives. The reduced form effect of the reform is seen in the lower left diagram, where one can see that, for each age between 60 and 65, male rural workers worked on average less hours in 1993 than in

[11] I do not restrict it only to single males because it would reduce sample size too much.

1990 or 1992. To strengthen the case in favor of a causal effect of the reform and to control for age specific shocks hitting the whole economy, no pattern emerges from the observation of urban workers' profiles.

The results for *"did not work last week"*, in Table 7, are typical of all labor supply outcomes, which I do not report for brevity. They show a significant absolute increase of 9% in the proportion of "non-workers last week" for the 60-64 year-old group in rural relative to urban areas, and statistically insignificant changes of –1.28% and 2.88% respectively for the 55-59 and 65-69 year-old. Taking the difference between the figure for the 60-64 group and each of the control groups, I find that both triple-differences estimates of the reduced form impact on "worked in the week of reference" are statistically significant. The figures are in the 6.5%-11% range, depending on the choice of the "non-affected" group. Those numbers are consistent with an IV estimate of the marginal effect of benefit take-up rates on *"worked in the week of reference"* in the 30-40% neighborhood.

Triple-differences reduced form estimates can be calculated for all outcomes. The top panel of Table 8 provides a summary of the triple difference results on labor supply outcomes and monthly earnings. I use 1990 as the base period for comparisons with the next two periods for which data is available, 1992 and 1993. The estimates in columns (1)-(2) show statistically significant reductions for *"did not work last week"* and total hours per week. Results for monthly earnings are not statistically significant, presenting large standard errors, which are due to both fundamental variability in the data and also plausibly for measurement errors in monthly earnings variables, especially for self-employed workers.



Top: Take-up Rates; Bottom: Average Hours Per Week

Figure 5. The above figures show the age profile average hours per week worked. The upper left diagram shows the increase in benefit take-up rates due to the reform studied in this paper. The lower left panel shows that for ages between 60 and 65 inclusive, there is a decrease in the average hours per week worked. For other age groups, no obvious pattern of differences between 1993 and the previous 3 years emerges. Age profiles for urban males show no obvious change with the same timing as the reform either.

5.3. Additional Discussion on the Identification Assumption

There is still the possibility that these results are driven by previous or continuing trends in the variables of interest. One way to put the results under stress is to perform the same exercise but assuming that the reform occurred in another date or affected another age group. In the bottom panel of Table 8, I try to falsify the results, looking for trends in time and age in the outcomes of interest.

Columns (5) and (6) ask the following question: was the increase in take-up rates a feature of the period right after the reform (post-1991) or part of an ongoing trend? I calculated triple-differences estimates of changes in take-up rates and outcomes of interest, pretending that the reform occurred at another date. That is a pre-program test, proposed by Heckman and Hotz (1989). In column (5), I use 1988 as the base period and 1990 as the after period. In column (6), I use 1995 as the base year and 1997 as the after period. For both combinations of before and after periods mentioned above, my identification hypothesis claims that those triple differences estimates should be statistically insignificant, for there was no major reform in the economic environment between those periods.[12] Indeed, none of the point estimates is statistically significant. The labor supply outcomes in general do not show significant changes. None of the 6 labor supply outcomes that are reported in columns (5)-(6) of Table 8 is statistically significant. If there was anticipation of the reform implementation, with changes in labor supply occurring after the Constitution promulgation (1988) and before the reform implementation (1991), the effect was small and statistically insignificant.

Columns (7)-(8) in the bottom panel of Table 8 ask the following question: was the increase in take-up rates specific to the age groups affected by the reform or did the slope of the age benefit take-up profile increased for earlier ages too? That is an important question because the usage of the rural males 55-59 as a control relies on the hypothesis that they do not change their behavior in anticipation of their eligibility at age 60. I calculated triple-differences estimates of changes in the outcomes of interest using males age 55-59 as the treated group and males age 50-54 as the control group. I perform the calculation for two different combinations of before and after periods. Only 1 out of 6 estimates of changes in labor supply in the falsified experiment is statistically significant but at the 10% level. In summary, the comparison between age groups 55-59 and 50-54 brings support for the usage of the 55-59 age group as a control for the 60-64 year old. The next section moves on to structural estimates, using the changes induced by the reform as instruments for benefits received.

6. Structural Estimates and Results

6.1. The Model

So far we have estimated reduced form equations. However, some of the questions I want to address require a structural model. The structural model I want to estimate is:

$$Y = \beta_{own}\,\text{OwnBenefits} + \beta_{spouse}\,\text{SpouseBenefits} \qquad (7)$$
$$+\ \phi_1(\text{age, occupation, time}) + \phi_2(\text{spouse's age, spouse's occupation, time})$$
$$+\ X\,\delta + \upsilon$$

[12] I also calculated triple-differences for the first-stage relationships involving benefit take-up rates and average benefit values, finding no change, as expected. These results are available at request.

In the equation above, ϕ_1 denotes a full set of age, occupation, time, age-occupation, age-time and occupation-time effects, ϕ_2 is its counterpart for spouse specific variables and X is a set of other control variables.

The existence of correlation between υ and the benefit variables, i.e., between the heterogeneity in preferences towards labor force participation and the benefit variables, causes OLS estimates to be biased.

One source of this bias may be differences in the actual access to benefits across workers with different levels of ability. To receive benefits, a worker has to establish his eligibility through a bureaucratic process that requires proofs of age, occupation and in some cases past contributions to the Social Security system. More able or more educated workers may have an advantage because they are more likely to work in the formal sector or more able to understand the rules of the game. In this case, if ability is positively correlated with preferences for work, then OLS estimates of the effect of benefits on labor supply will be biased downwards.

If workers with less attachment to their labor force participation are the ones more involved in gathering information about benefits entitlements (or preemptively organizing the necessary documents), then it will be the case they will be the first ones in the queue for receiving newly granted benefits. In this case, the OLS bias will go in the opposite direction: it would generate an upward bias (in absolute terms) in the parameter that measures the effect of the benefit.

Measurement errors in benefit values may be yet another source of bias in the OLS estimates. The Brazilian economy suffered from very high inflation rates during the period studied in this paper and this could have created confusion about the nominal values of benefits (readjusted monthly through part of this period) in a survey using self-reported benefits income.

The solution for this problem is the use of instrumental variables. A valid instrument for benefit receipt is a variable that will have no effect on the outcome of interest but for its effect on the benefit measure. Benefit values are determined by either the minimum wage or complicated functions of a worker's past earnings. Eligibility for benefits is a function of observed variables like occupation and age and variables not observed by the econometrician such as health status.

I constructed instruments for benefit values, which incorporate variation in age, time and occupation. The interaction between rural workers, age 60-64 and after-period will instrument for the increases in benefits accruing to the 60-64 rural males who became eligible to old-age benefits with the reform. To take into account the gradual character of the changes caused by the reform, this instrument can be interacted with an indicator for both years after the reform: 1992 and 1993. The interaction between rural workers, age 65 and up and after period will instrument for the increases in the value of old-age benefits from 50% to 100% of the minimum wage occurred in 1991 affecting old-age beneficiaries already in the benefit payroll. The interaction between rural occupation for the spouse, spouse's age 55 and up and after period will instrument for spouse's old age benefits. This instrument can also be interacted with years 1992 and 1993, to capture the gradual increase in benefit take-up rates.

6.2. Own Benefits' Effects on Labor Supply

To isolate the effects of spouse's benefits, I estimate (7) with the sample restricted to single males and married males whose spouses are not older than 50. Table 10 reports the coefficients of the benefit variables when the dependent variable is "*did not work in the reference week*". Tables 11-12 report results for respectively hours per week and monthly earnings. Columns (1), (4) and (5) report the results for this restricted sample of males who are in general the only benefit receiver in their families.

I find that OLS estimates are in general smaller in absolute value than IV estimates for all dependent variables. Two explanations may account for that: measurement error in the benefit variables and correlation between benefit values and preferences for work. Elasticities *of "did not work in reference week*" with respect to benefits, derived from IV estimates are in the 0.75-0.80 range. Controlling for observed characteristics such as education, region of residence does not change results substantively.

Table 11 reports elasticities of hours with respect to own benefits in the –0.12 to –0.14 range. Table 12 reports that own benefits on average replace an amount of earnings 2.5 to 3 times greater than their size (the elasticity of monthly earnings with respect to benefits is in the –0.4 to –0.5 range). This large response in the earnings margin can be explained by the possibility that subsistence agriculture, unpaid work at relatives' properties or self-employment activities are substituting for wage earning.

7. Further Results

7.1. Own and Spouse's Benefits and Labor Supply Responses

The unitary model of family (or household) decision postulates that the family behaves as a single decision making unit, maximizing an utility function that depends on each family member's leisure and the family total consumption (for reviews, see Killingsworth and Heckman (1986) or Strauss and Thomas (1995)). Family level consumption is constrained by the sum of all family members' earnings plus unearned income. Because all resources are pooled together within the family resource constraint, the identity of the receiver of unearned income does not matter. In particular, the income effects of own and spouse unearned income on male labor supply should be the same, if there are no means testing or retirement requirement, after controlling for differences in life expectancy that affect a benefit stream's present discounted value.[13]

Thomas (1990) explored this insight, studying health and nutrition outcomes for urban Brazilian children, finding evidence that mothers' unearned income has larger effects on the health outcomes of daughters than fathers' unearned income. That is a violation of the unitary model of household decision.

I estimate the effect of wife's benefits on husbands' labor supply. This parameter is interesting on its own, but it is also useful for bringing a better understanding of family-level decision making.

Tables 10-12 report results for the unrestricted version of equation (7) in columns (2) and (6). For the three outcomes, wives' benefits increase labor supply, while own benefits reduce it. An increase in the wife's benefits of R$100 is found to increase the husband's hours in 8 hours per week. However, the coefficient on spouse's benefits is not statistically significant, in spite of its large magnitude. Tests for equality of coefficients on own and spouse's benefits are rejected at the 1% level for all specifications.

This result suggests that research on family decision-making using developing countries data and accounting for the endogeneity in unearned income may generate interesting falsifications of the unitary model of the family. The result above looks consistent with models of the same class as the Nash-bargaining model by McElroy and Horney (1981): receipt of portable benefits by wives strengthens their threat points, maybe compelling husbands to increase their labor supply and earnings in order to maintain the marriage. However, Bourguignon and Chiappori (1992) argue that empirical evidence against properties of the unitary model, such as income pooling, falsifies that model, but do not support any alternative model in particular. The only way to support a specific model is to derive and test falsifiable conditions under the model in consideration.

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[13] Non-existence of means testing or retirement requirement is crucial for this implication. Otherwise, the earnings of the beneficiary will be taxed by the means test.

Last but not the least, this result is not in contrast with the evidence for the US,[14] which shows that couples seem to coordinate their retirement, because it is a relationship between husband's labor supply and wife's benefits, not wife's labor supply.

7.2. Anticipatory Responses to Future Benefits

An important issue of contention in the debate about retirement trends in developed countries is the role played by the minimum eligibility age for old-age benefits. Johnson (1999) uses panel data for thirteen countries, finding that reductions in the minimum eligibility age lag increases in retirement rates for the age group just made eligible. He concludes "men retire earlier when OAI benefits exist for their age group, but not do so in anticipation of benefits at higher ages".[15] This section tests if benefits at higher ages produce anticipation effects.

Rural males younger than 60 did not have their current eligibility status changed by the reform. However, their social security wealth was increased with the implementation of the reform because it increased the probability that they would be able to receive benefits as early as their sixtieth birthday (instead of sixty-fifth).

With cross-sectional data, I cannot separately identify the effect of proximity to the minimum eligibility age and pure age effects. However, identification is possible if I have more than one cross-section of observations and I observe a reduction in the minimum eligibility age. It helps to make an analogy with triple-differences identification schemes. That empirical strategy defines the treatment group by the interaction of three dummy variables and controls for all first-level interactions between any pair of those variables. Identification comes from the assumption that all second-order effects but the treatment effect are zero. The reform allows me to identify the effect of proximity to the minimum eligibility age because when one observes time periods with different minimum eligibility ages, time until eligibility and time since eligibility are triple interactions between age, occupation and time.

The regression I estimate will include main effects and first-level interactions of age, occupation and year effects, plus the triple interactions relative to the groups affected by the reform and functions of time until eligibility and time since eligibility.

That is the exercise reported in Table 13, which reports results only for the "did not work in reference week" variable. I run the following regression:

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[14] Gustman and Steinmeyer (1994), Coile (1999).

[15] Johnson (1999), page 2.

$$Y_{ijt} = \alpha + \phi_2(ANTIC) + \phi_2(POSTIC) + \sum_{m \in M} \beta_{Ym} I_m + \beta_t AFT + \beta_l RUR + \beta_k AGE_k + \beta_{2k}(AGE_k \times RUR) + \beta_{3k}(AFT \times AGE_k) + \beta_4(RUR \times AFT) + \vartheta \tag{8}$$

where ANTIC denotes time until eligibility and enters the equation as either categorical or continuous variable, POSTIC denotes time since eligibility, ϕ_1 and ϕ_2 are generic functions and I add three triple interaction dummy variables capturing the effects of the reform. The first column at Table 13 excludes ANTIC and POSTIC variables from the regression. In the second column, I add a dummy for one year until eligibility, finding a reduction in the proportion that did not work in the reference week, which has the opposite signal as expected if retirement increases with proximity of the minimum eligibility age. In the third column, I add dummies indicating one to five years until retirement, statistically rejecting each one of those regressors. In the fourth and fifth columns, I enter ANTIC and POSTIC as quadratic functions, rejecting each one of them at the usual levels.

Results for monthly earnings and hours per week are similar. Therefore, I find no evidence of reduction in labor supply for workers close to the minimum eligibility age, due to the minimum eligibility age. Recall that I also use continuous measures of labor supply, which can be adjusted easily, especially for the large share of self-employed in the sample, yet not causing any change in future benefits, which makes these results stronger than if I had only studied categorical variables.

7.3. The Role of Schooling in the Take-up Process and Labor Supply Responses

Estimation of the equations of interest for different sub-samples helps us assess heterogeneity in behavior across diverse groups. Heterogeneity across education groups is especially of interest.

Differential effects across educational groups can arise for a variety of reasons. More educated workers may have easier access to information and become aware about the eligibility opportunities at a shorter span of time. More educated workers may also have more ease in putting together the documents necessary for applying to the pension. Education is also correlated with labor market outcomes - more educated workers, even in rural occupations may have a richer past history of earnings, and maybe greater accumulated assets, being in a more comfortable position for reducing hours of work. More educated workers may also have access to more capital, which can make their tasks at work less physically demanding. And finally, for a given flat benefit, more educated workers will have lower replacement rates because they have greater earning potential.

In Table 14, I report the triple-difference estimates for 1992 and 1993 as after-periods for 1990 and the falsification experiment using 1988 and 1990 for two sub-samples based on broad educational groups: no schooling and some schooling.

It is remarkable how much faster is the growth in take-up rates for the group with some schooling relative to the group with no schooling. In 1992, the triple difference estimates are 0.158 and 0.065 respectively for the groups with some and no schooling. In 1993, the figures are 0.273 and 0.396. These differences in take-up rates indicate an important role of education in increasing workers' ability to process information and adapt to the economic opportunities they face.

However, a different pattern emerges for the labor supply outcomes. As an example, triple differences for the positive earnings are –0.0668 and –0.1399 for the group with no schooling and –0.0267 and –0.1134 for the group with some schooling. Using the triple difference estimates with 1993 as after period, I can calculate the IV estimate of the effect of benefit receipt on average number of hours per week by taking the ratio between the reduced form effect on hours to the first-stage on benefit take-up. For workers with some schooling, the IV estimate is -0.287 (-0.113/0.396). For workers with no schooling, the IV estimate is -0.513 (-0.140/0.273). Therefore, the supply of workers with no schooling contracts more than the supply of workers with some schooling.

I attribute part of the differences in take-up rates across education groups to differences in their abilities to turn potential benefits into granted benefits, which requires some simple formal procedures to establish proof of occupation and age and some knowledge and information about the rules governing the Social Security system.

8. Conclusions

The reform in the Brazilian social security system in 1991 provides an opportunity to learn about labor supply responses to exogenous changes in social security benefits and anticipation of benefits at higher ages; models of family labor decision making; and the biases that bureaucratic formalism introduces into social programs for the poor in developing countries.

This paper shows that the labor supply of elderly rural workers in developing countries is more responsive to unearned income than that of workers in developed countries. The point estimate of Brazilian rural workers' elasticity of "did not work in the reference week" with respect to benefits is 0.78. The elasticity of hours per week is –0.14 and R$1 in benefits displaces on average R$3 in earnings. The large estimate for the effect of current benefits on earnings can be explained by substitution of non-remunerated activities, such as subsistence agriculture, unpaid work and leisure, for wage earning and remunerated activities.[16]

The labor supply response to old-age benefits is concentrated on current beneficiaries, with little or no anticipated response by workers close to the minimum eligibility age.

The elasticity of labor supply I estimate is a pure income effect. The vast majority of the existing literature has estimated total effects that are the sum of an income and a substitution effect, the latter due to means, income, earnings or retirement tests. In the standard case of leisure as a normal good, the income and substitution effects of means tested unearned income point to the same direction. All else being equal, one should expect smaller total effects in the program analyzed in this paper than if means testing were in place.

The main message from the estimated labor supply elasticities is that governments should proceed with caution in the implementation of social security programs or other distributive policies, taking into account the possibility of substantial output losses. Of course, this recommendation includes neither efficiency nor equity judgements, but only an observation about the costs likely to be incurred with the implementation of such programs, which policy-makers should take into account. Furthermore, if labor markets are characterized by high unemployment or non-participation rates of the youths and those non-employed fill the vacancies open by the retired elderly, output losses due to retirement may be minimized.

This paper also shows that the identity of the benefit receiver may be of crucial importance in the determination of the labor supply response. For all labor supply variables, there is some

[16] In a preliminary version of this paper, I reported a substantial shift from wage earning to self-employment. However, it may have been due to changes in the survey questionnaire with the same timing as the reform under study. Therefore, I do not emphasize those results.

evidence that wives' benefits are correlated with increased labor supply by husbands. These results do not favor the unitary view of the household and are suggestive that improvements in wives' outside options change the incentives faced by their husbands.

This paper also shows that more educated workers are more likely to take advantage of social programs, probably because either they are more able to understand the formal rules of the game or because they are better informed in general. Given that this program of rural pensions is widely viewed as a program very successful in targeting the poor (Filgueiras (1998)), this result suggests that governments in developing countries should put more effort into making their social programs as universal as possible. Otherwise, scarce resources will be spent, without really achieving the most basic equity goal: reaching for the destitute.

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Chapter 2

Income Effects on Living Arrangements and Relative Well Being of Unmarried Elderly Women in Brazil

Will the extension and increase of social security benefits displace the extended family as a mechanism of insurance for the elderly in less developed countries? Can less developed countries do without implementing costly social security systems because they are able to rely on the extended family as the protector of the elderly? Will the elderly in developing countries follow the steps of their Western counterparts? Or are culture and preferences different – and the demand for privacy significantly smaller?

Opposing views about the wellbeing of the elderly are generally associated to Western industrialized countries and less developed countries. In the richer Western world, the elderly are little likely to coreside with their adult children and a lot likely to rely on transfer programs such as old age benefits or Social Security in general. In the "Western view", the elderly prefer to live separated from their adult children because they value their privacy and independence, and they will do so if they can afford it (Costa 1998, 1999). In contrast to this view, particularly in less developed and Far-Eastern Asian countries, the extended family is seen as provider of insurance for old age and sickness and also an environment where the elderly are useful and respected. In this view, the displacement of the extended family by impersonal transfer programs strips the old of claims to respect, power, and independence.[17]

The behavior of the elderly in less developed countries after an extension of social security benefits can help us understand the merits of both views. If increases in incomes are followed by increases in independent living arrangements among the beneficiaries of the benefits extension, then one can argue that the extended family is only an imperfect substitute for social insurance, maybe because the elderly in less developed countries value privacy and independence. If no changes in living arrangements occur after benefits extensions, then one may have a more favorable judgement for the extended family method of protection for the elderly.

In this paper I explore the Brazilian experience as a means to learn about those questions. In the period from 1970 until the second half of the 1990s, the availability of social security benefits for elderly females in Brazil has increased significantly, after two major reforms: the introduction of old age benefits for rural workers in 1971, and the reform in social security in 1991. Survey data for the period from 1981 to 1995 shows increase in benefit take-up rates of old age, length-of-service and survivors' benefits among elderly females age 60-89, from 53.2% in 1981 to 73.0% in 1995, as shown in Table 15. Average benefits received by elderly females have also increased over-the-board: for every 5 years age group between 45 and 89, there were increases in average benefits over time. This increase was due not only to changes in social security rules but also to higher lifetime incomes for younger cohorts combined with benefits based on past earnings.

One specific set of changes is of interest for this paper. Changes in benefits due to the social security reform in 1991 are likely to have exogenously affected elderly females' budget constraints and provide the opportunity to investigate the effects of social security benefits in shaping their choice of living arrangements. Because those reforms only affected elderly females of a given age and occupation, the interaction between those characteristics and an indicator for after the reform can be used as an instrument for benefits in an equation for the determination of living arrangements of the elderly.

Understanding behavioral responses to increases in income will help us predict trends in living arrangements for the future. In Brazil, the process of demographic transition has accelerated and demographic forecasts show that by 2020 13.6% of the Brazilian population will be older than 60, whilst current numbers show 7.1% and in 1960 elderly people accounted for 4.1% of the population.

This paper focuses on unmarried elderly females, that is never married, divorced or widowed females.[18] This group is often viewed as needy and therefore one that ought to be targeted by poverty alleviating or insurance providing programs. Therefore it is also interesting to analyze the effectiveness in alleviating poverty of the measures introduced by the reform in 1991. This question is particularly interesting because rural old age benefits are much smaller than other benefits received by Brazilian elderly, such as length-of-service benefits paid to urban formal sector workers and retirement benefits paid to public sector workers. Given that Brazil faces fiscal difficulties, one may want to know how low benefits can become without throwing a large share of the elderly into poverty. The answer to this question depends, among other things, on the household arrangements of the elderly, in particular, on how many people share their incomes.

Section 1 presents the source of data and the definition and description of variables used in this paper. Section 2 presents background information on elderly living arrangements and social security rules in Brazil. Section 3 presents the identification strategy. Section 4 presents the factors likely to affect the living arrangements of the elderly. In section 5, I find that the reform in

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[17] Treas and Logue (1986) present an interesting review of those arguments.

[18] An alternative denomination is "females without the presence of a spouse".

the Brazilian Social Security system passed in 1991 had strong poverty alleviating effects. In section 6, I present the results on the effects of benefits on the living arrangements of the elderly. Section 7 concludes.

1. Source of Data, Definition of Variables and Description

I use the *Pesquisa Nacional por Amostra de Domicílios* (PNAD) for the years of 1985 and 1995, and the *Censo Decenial* (CD) of 1970 to model the living arrangements of unmarried elderly females in Brazil. The PNAD is a yearly household survey, with sample size equal to 1/500 of the Brazilian population (about 100,000 households) and is designed to produce a picture of the living conditions and economic life of the Brazilian population, rural and urban. For the purposes of this paper, it has the desirable characteristic of recording information on social security benefits receipt separated from earnings income. The Census of 1970 is useful for measuring elderly living arrangements before the initial introduction of rural old-age benefits in 1971. However, it lacks a proper treatment of benefit income – there is only one income variable aggregating income from all sources.

The empirical exercise will use data for the years 1985 and 1995. Information about availability of living kin is not available for the years 1986-1990. There is no data available for 1991. The reform in social security that generated the exogenous variation in benefits occurred in 1991, with new benefits being granted most in the years 1992-1994. There are no data available for 1994. Because living arrangements are likely to respond with some lag to changes in income, my choice of year for the after reform period is 1995, in other words, four years after the reform was passed. For periods later than 1995, I do not have data for 1996, but 1997 and 1998 are available and my conclusions do not change by using a later year for the after period.

The measures of living arrangements of the elderly used in this paper's empirical analysis are *indep*, a dummy for independent living arrangements, to be defined shortly, *head*, a dummy for head of household status, and *alone*, a dummy for living in a one person household.

In this paper, an elderly female is in an independent living arrangement when she is either the head of the household or spouse to the head and there are no relatives or children around. In this definition, the presence of domestic employees does not determine "dependence".

The benefits variables used in this paper are:

1) *ssr*, a dummy variable for receipt of positive benefits, which include old age, disability and length of service benefits;
2) *psr*, a dummy variable for receipt of positive benefits including survivor's income;

3) *ssf*, a continuous variable measuring the real value of old age, disability and length of service benefits; [19]

4) *ss-surv*, which adds the real value of survivors' benefits to *ssf*.

2. Background Information

Elderly rural females first had access to formal social security programs in 1971, with the institution of the PRORURAL (Rural Worker's Assistance Program), which entitled females older than 65 to old age benefits. Benefits were equal to half of the minimum wage, but only one person per household could obtain a pension. Widows were entitled to survivor benefits if they were not already beneficiaries of the old-age program.

The Constitution of 1988 established the guidelines for a reform in the Social Security system, requiring among other things that:

a) Rural workers' old-age benefits be extended to women who were not household heads;
b) No benefit be smaller than one minimum wage;
c) Minimum eligibility age for old-age benefits for rural workers be reduced from 65 to 55 for females.

The reform of Social Security entitlements proposed by the Constitution of 1988 did not go into effect before approval of Ordinary Law regulating its implementation. The Ordinary Law was only passed in July 24, 1991 (Lei #8212/8213).[20]

Female rural workers were affected by:

(1) The reduction in the minimum eligibility age from 65 to 55;
(2) The end of the one person-per-household restriction, which allowed married females to receive benefits independently of their husbands.
(3) The increase in benefits for old age and survivors benefits for rural workers from one half to one minimum wage.

Maybe as a consequence of the initial introduction of social security benefits for rural workers in 1971, the decade of the seventies saw an increase in the prevalence of independent living arrangements for elderly unmarried females.[21] In the Census of 1970, about 12%-13% of unmarried females living in rural and urban locations age 60-75 had independent living arrangements. During the seventies, a period of fast income growth, the proportion of

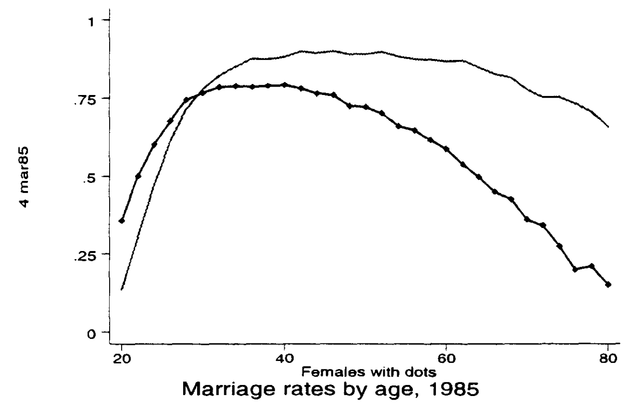
[19] All income measures are deflated temporally and spatially, as suggested in Ferreira and Paes de Barros (1999).

[20] For a longer and more detailed account of the reform, see the first chapter of this Thesis.

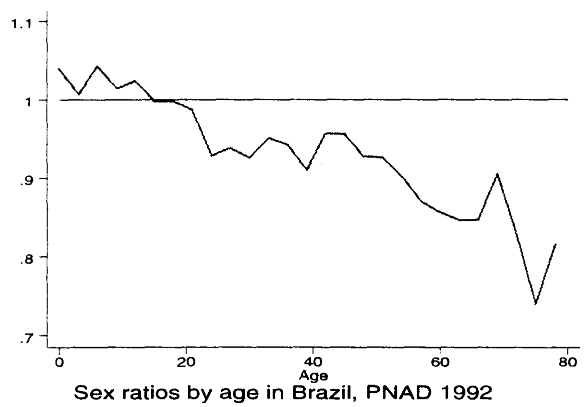
independent living unmarried elderly females increased to around 20%. In the second half of the eighties, the proportion of independent living among unmarried elderly females living in urban and rural areas diverged, with increases in urban and decreases in rural areas. In the nineties, the rural trend reverts, and the prevalence of independent living increases once again for rural females.

Panel A:

Panel B:



Panel C:



Panel D:

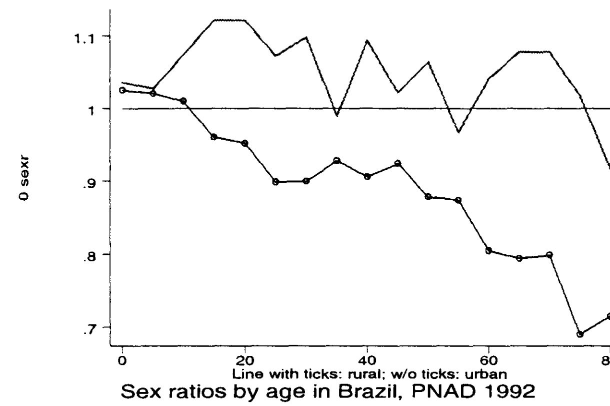


Figure 6. Panel A shows the evolution of the proportion of independent living arrangements among rural and urban females age 60-75. The line with dots represents urban females. The vertical line marks the 1991, the year of the reform in social security that increased old-age benefits for rural workers. Panel B presents the marriage age profile for Brazilian males and females. The line with dots represents females. Panel C shows the sex ratio age-profile in Brazil in 1992. Panel D decomposes the sex ratio age-profile into rural and urban components, showing lower male-female sex ratios in urban than in rural areas.

Panel B in Figure 6 shows that elderly females are more likely to be unmarried than elderly males. For all ages over 64, the proportion of unmarried females is greater than 50%, whereas for all ages between 30 and 75, the proportion of married males is greater than 75%. The mismatch in

[21] See Panel A in Figure 6.

marriage rates by age between males and females is likely due to the age pattern of marriage[22] and males' lower life expectancy.

Panel C in Figure 6 shows that the ratio of males to females in Brazil is lower than one for all ages over 20, and lower than 0.9 for ages over 50. This feature is common in the developed world and also in countries such as China and Thailand.[23] Panel D in Figure 1 shows the disaggregation between rural and urban locations with sex ratios even lower in urban locations than in the whole country. This is likely due to the higher rural-urban migration rates among females.

3. Identification strategy

This paper identifies the effects of non-labor income on the living arrangements of unmarried elderly females based on exogenous variation in old-age benefits due to a reform in the Brazilian social security passed in 1992. Among other things, this reform brought up a reduction in the minimum eligibility age for old-age benefits for female rural workers from 65 to 55, the end of a rule that determined that no more than one person per household would be eligible to receive old-age benefits for rural workers, and an increase in the size of benefits from half a minimum wage to one minimum wage.[24]

Because social security rules are based on age and rural-urban occupation, which are observable in the PNAD data, one can use those variables to model benefit take-up rates and receipts. Receipt of benefits may also be correlated with one's attitudes towards living arrangements for a variety of reasons. Elderly for whom the outlook of living with relatives looks more unpleasant are likely to choose jobs for which retirement benefits are higher or easier to qualify for – for instance, jobs in the formal sector. In this case, OLS would overestimate the effect of benefits on living arrangements. Another possibility is that disability benefits – which are lumped together with old-age benefits in the PNAD survey – are granted to workers with poorer health, who are the ones less likely to live independently. In this case, the effect of benefits on living arrangements will be underestimated by the OLS parameters.

From one single cross-section, one cannot identify the effects of old-age benefits on living arrangements from the effects of age and occupation. However, the reform provides variation in

[22] Table 16 shows that elderly males' spouses are on average more than 5 years younger than they are.
[23] Deaton and Paxson (1997).
[24] Before the reform, old-age benefits for rural workers were flat and equal to 50% of the minimum wage. After the reform, rural workers could opt for benefits based on past earnings, but the vast majority of rural old-age beneficiaries had benefits equal to the minimum benefit, fixed by the reform at one minimum wage.

benefits independent to the effects of age and occupation on the choice of living arrangements, allowing the identification of the effects of benefits on living arrangements.

The reduced form first-stage equation below sheds light on the specification I estimate.

$$
\begin{aligned}
Z = \alpha_0^Z &+ \alpha_1^Z AFTER + \alpha_2^Z RURAL + \alpha_3^Z AGE + \beta_1^Z (AGE \times RURAL) \\
&+ \beta_2^Z (AFTER \times AGE) + \beta_3^Z (RURAL \times AFTER) \\
&+ \beta_{Z1} (AFT \times RUR \times AGE5564) + \beta_{Z2} (AFT \times RUR \times AGE65OVER) \\
&+ W\theta_Z + v^Z
\end{aligned} \tag{9}
$$

$$
\begin{aligned}
Y = \alpha_0 &+ \alpha_1 AFTER + \alpha_2 RURAL + \alpha_3 AGE + \beta_1 (AGE \times RURAL) \\
&+ \beta_2 (AFTER \times AGE) + \beta_3 (RURAL \times AFTER) \\
&+ \beta_{Y1} (AFT \times RUR \times AGE5564) + \beta_{Y2} (AFT \times RUR \times AGE65OVER) \\
&+ W\theta + v
\end{aligned} \tag{10}
$$

In equation (9), Z is the receipt of social security benefits. In equation (10), Y is the variable for independent living arrangements of the elderly. In both equations, $RURAL$ (RUR) is a fixed location effect, $AFTER$ (AFT) is a fixed year effect, AGE is a collection of dummies for each age from 50 to 80, and W is the vector of exogenous control variables, discussed in section 4 below.

The coefficient β_1 controls for secular differences between rural and urban elderly females for each age group. The coefficient β_2 controls for the time trend specific to each age group. The coefficient β_3 controls for the time trend specific to all rural elderly females.

The coefficient β_{Z1} (β_{Y1}) on the interaction of rural residence, year after the reform and age 55 to 64 identifies the impact of the reform on benefit receipt (living arrangements) for rural females age 55 to 64 who became eligible for old-age benefits due to the reform. The coefficient β_{Z2} (β_{Y2}) on the interaction of rural residence, year after the reform and age 65 and over identifies the impact of the reform on benefit receipt (living arrangements) for rural females age 65 and over. Those females' level of benefits increased from being equal to half of the minimum wage to being equal to the full minimum wage.

Coefficients β_{Z1}, β_{Y1}, β_{Z2} and β_{Y2} are reduced form parameters. They measure the effect of the reform on benefits and living arrangements, but ultimately the goal of this paper is to estimate the structural form parameter linking benefits to living arrangements. The structural form equation below will be estimated in this paper via OLS and IV methods:

$$
\begin{aligned}
Y = \alpha_0 + Z\beta + \alpha_1 AFTER + \alpha_2 RURAL + \alpha_3 TREAT + \beta_1 (TREAT \times RURAL) \\
+ \beta_2 (AFTER \times TREAT) + \beta_3 (RURAL \times AFTER) \\
+ W\theta_Y + v
\end{aligned}
\tag{11}
$$

4. Factors affecting the living arrangements of the elderly

The previous literature has considered several factors as determinants of living arrangements of the elderly. A non-exhaustive list includes:

a) Elderly income: increases in elderly income make coresidence more attractive for adult children, but also they can make independent living more affordable for the elderly. Total income is observed in both the PNAD and the Census data, however the Census data does not distinguish earned from non-earned income.
b) Elderly health: poorer health may make the elderly more dependent on support from their adult children.
c) Availability of kin: the availability, the gender and the marital status of adult children are determinants of elderly living arrangements. The number of children ever born is observed in the PNAD of 1985 and 1995, which allows the use of this variable in the empirical exercise. The number of living children, by gender, which is available only for the PNAD from 1992 on, cannot be used for the empirical exercise that uses information from before and after the reform in old-age benefits. Marital status of living children is available only for children coresiding with the elderly person, therefore it cannot be used in the empirical exercise.
d) Social norms and externalities: the more prevalent are independent living arrangements for the elderly in a region or social group, the larger will be the supply of services for independent living elderly (for example, third age social clubs), making independent living arrangements more attractive.

5. Effects of the program on unmarried elderly females position in the income distribution

A simple way to assess the effects of the reform on poverty rates among the elderly consists in locating the elderly in the Brazilian income distribution, before and after the reform. I split the Brazilian household income distribution into five quintiles and I calculate the proportion of the elderly belonging to each one of those quintiles.

The relative standing of the elderly in the income distribution is an intuitive measure of poverty relative to the available resources in the Brazilian economy. It is also likely the relevant poverty measure for the debate on intergenerational fairness.

This method has the advantage of not requiring the adoption of specific poverty lines, such as 1 or 2 dollars per day. Comparisons based on generic poverty lines may not be informative about real income levels in a country where there are likely to be large differences in price levels across rural and urban areas, across richer and poorer regions, and across towns of different sizes.

For this exercise, I use measures of income based on different assumptions about the strength of economies of scale in consumption at the household level. Due to the high incidence of home ownership among the elderly, I impute rents based on estimated hedonic prices for housing characteristics. The hedonic model I estimate uses information about a wide variety of characteristics and has a R^2 as large as 0.4. The generic formula for the measures of income used in this paper is:

$$y_J^k = \sum_{i \in J} \frac{y_{iJ}}{(\# J)^k}$$

In the equation above, y^k_J is the income measure for household J when the economies of scale parameter is equal to k. When the economies of scale parameter, k, is equal to 1, the income measure y^1 for household J is simply the per capita income of the household. The case when k is less than one corresponds to positive economies of scale at the household level. In this paper I present results for k equal to 1 and 0.5. The latter value for k was chosen because that is the usual low end for k in most of applications in the literature that examine a broad range of values for k.[25]

[25] Deaton and Paxson (1997) discuss the measurement of poverty and suggest that children be counted as less than an adult in the calculation of household per capita income. Because the estimates in this paper do not incorporate this feature, the relative standing of the elderly (who are less likely to coreside with

If the income distribution for rural unmarried elderly females were just equal to the overall income distribution, equal proportions of them would belong to each quintile of the income distribution. In other words, the bar diagrams in Figure 7 would show flat profiles with 20% of the elderly belonging to each quintile of the income distribution. Hence one can say that the group under study is over/underrepresented in a quintile if the proportion of its members belonging to that quintile is more/less than 20%.

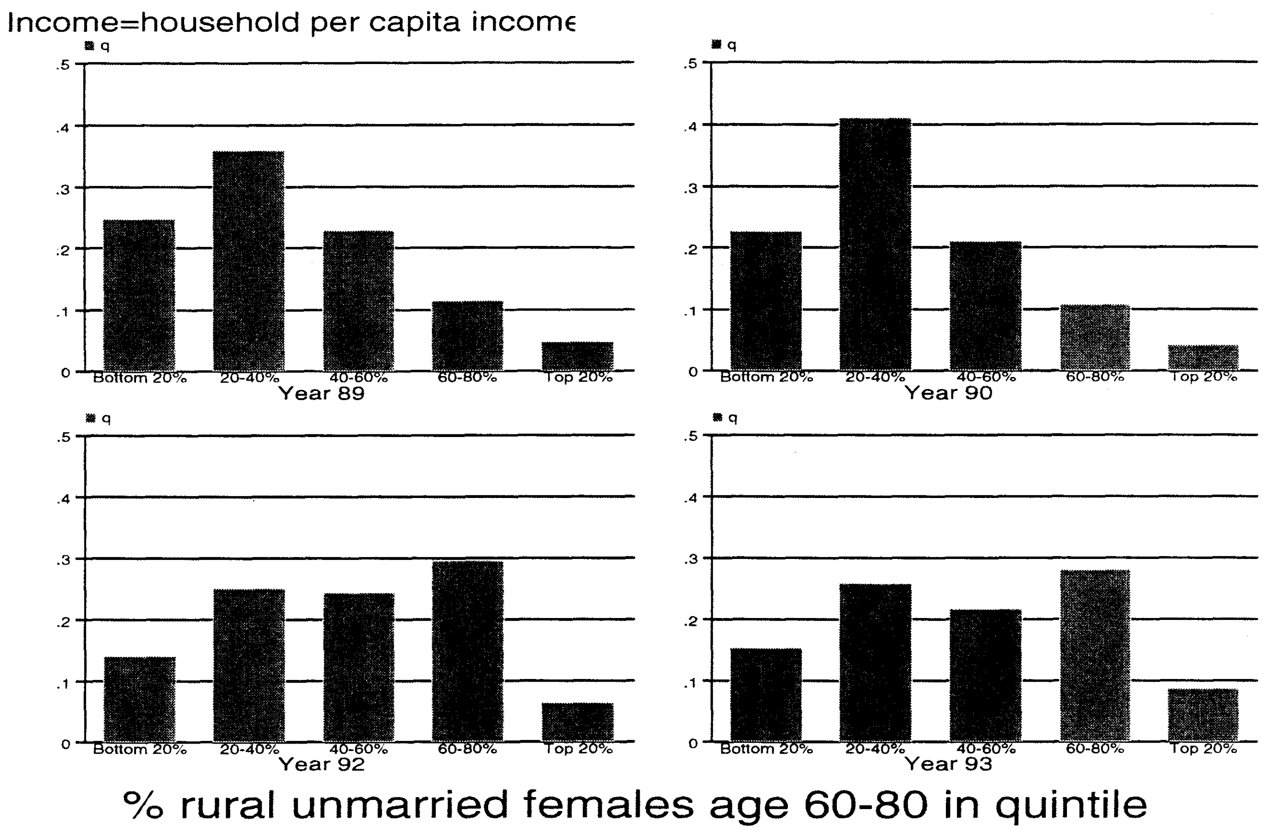


Figure 7. This figure presents the relative standing of rural unmarried females age 60-80 in the Brazilian income distribution for the years of 1989, 1990 (pre-reform), and 1992, 1993 (post-reform), when the income measure is per capita household income.

Figure 7 shows that rural elderly unmarried women shifted from being over-represented to underrepresented in the bottom 20% of the income distribution, where the income distribution is calculated assuming no economies of scale in household consumption. Before the reform, rural elderly unmarried women were over-represented in the three poorest quintiles. After the reform, they became over-represented in the three middle income quintiles: 20-40%, 40-60% and 60-80%.

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children than young adults or children) will be overstated if the cost of children is lower than the cost of an

The assumption of strong economies of scale (k=0.5) is adopted in Figure 8. As expected, accounting for possible economies of scale penalizes the elderly relatively to the rest of population, because they are more likely to live in smaller households. Under those assumptions, rural elderly unmarried women were over-represented in the two poorest quintiles before the reform. After the reform, they became over-represented in the second and third quintiles: 20-40% and 40-60%, with a strong concentration in the 20-40% quintile.

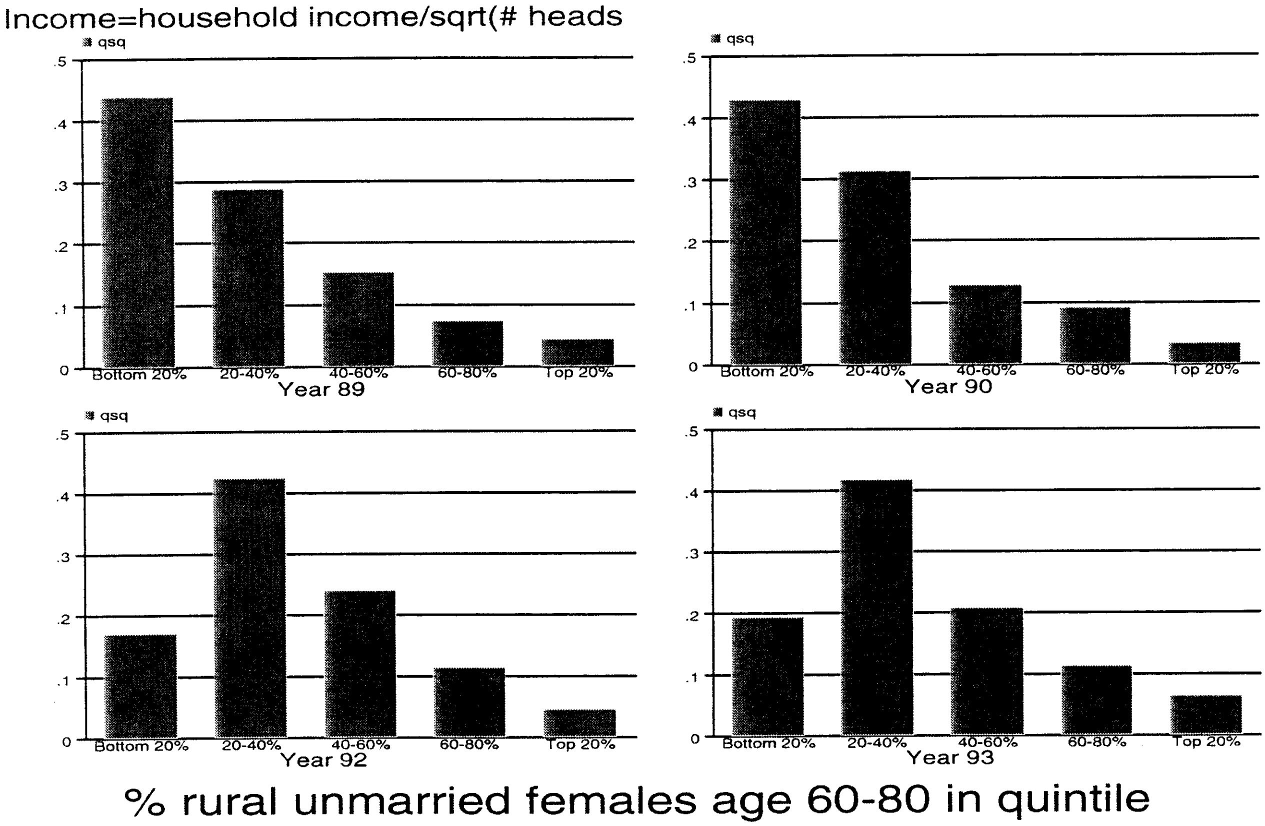

Figure 8. This figure presents the relative standing of rural unmarried females age 60-80 in the Brazilian income distribution for the years of 1989, 1990 (pre-reform), and 1992, 1993 (post-reform), when the income measure is household income divided by the square root of the number of people in the household.

Under both assumptions for economies of scale in household consumption, there were visible improvements in the relative standing of rural unmarried elderly females, with the same timing as the reforms in social security for rural workers. The next section will examine the effects of these improvements in income on their choice of living arrangements.

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adult.

6. Effects of the Program on Living Arrangements of Elderly Women

6.1. First Stage Estimates

The first stage regression relates the endogenous variable, benefits receipt, to all variables that belong to the structural equation (11) plus the variables that will be excluded from that equation and used as instruments for the benefits variable.

The reported coefficients at the first two rows of Table 18 confirm that the identification strategy based on exposure to the effects of a reform in Social Security rules indeed may be fruitful.[26]

Females age 55-64 living in a rural location were one of the targets of the reform, gaining eligibility to old age benefits for rural workers if able to provide proof of age and past or current rural occupation. Estimates indicate that there were increases of 23 and 17 percentage points in benefit take-up rates of social security and social security or survivors benefits for this group.[27] Estimates for the effects on average benefits received are less precise but also carry the expected signal. Average social security benefits received by that group increased by R$57 (statistically significant) in Reais of September 1997.

Females older than 65 living in a rural location also benefited from the reform and its increase in benefits. Estimates indicate that their receipt of social security benefits increased by R$34 (statistically insignificant), while their social security benefit take-up rates increased by 9 percentage points. The increase in take-up rates is likely due to the fact that females slightly older than 65 had just become eligible to collect benefits in 1985, while they had been eligible to collect benefits for about three years (since the reform was implemented in 1992) in 1995.

6.2. Reduced Form Estimates

In the reduced form equations, the excluded instruments, which are interactions between time after the reform and indicators for belonging to groups affected by the reform, substitute for the benefits variables.

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[26] As already shown in the first chapter of this Thesis.

[27] The PNAD provides one variable for old age, disability and length-of-service benefits (social security benefits, or *aposentadorias*) and another for survivor benefits (*pensões*).

For the three living arrangement variables, reduced form estimates, reported in Table 19, suggest that increased access to benefits income makes elderly unmarried females more likely to choose an independent living arrangement.

Point estimates indicate that for rural females age 55 to 64, who were affected by the reduction in the minimum eligibility age for old age benefits, the incidence of independent living arrangements, of one person households and the headship rates increased by 5, 5, and 7 percentage points respectively. However, the coefficients are not statistically significant.

Point estimates indicate that for rural females older than 65, who were mostly affected by the increase in benefits from half to one minimum wage, the incidence of independent living arrangements, one person households and household headship increased by around 2 percentage points, which was a more modest effect.

6.3. Structural Estimates

Table 20 presents the OLS estimates for the parameter β of the structural form equation (11) when social security (old age, disability and length-of-service) benefit take-up rates are the endogenous variable. The reported coefficients imply that the receipt of social security benefits increases the likelihood of independent living arrangements by around 4 to 5 percentage points depending on the living arrangement variable that is used.

As discussed in section 3, OLS may not provide consistent estimates. The possibility that some sort of endogeneity drives the OLS results calls for the use of IV estimation. The instruments to be used are the triple interaction terms in equation (9) and (10).

Table 21 presents the IV estimates for the effect of receipt of social security benefits on living arrangements. For all three living arrangement variables the estimated effect is positive and larger than OLS estimates. The effect on headship rates is as large as 31 percentage points and borderline statistically significant. However standard errors are 30 times larger than standard errors for the OLS regressions reported in Table 20. In the fourth column I report the effects on labor participation as a means of evaluating the model I estimate, after all, most economists are likely to have strong priors about the effect of benefit receipt on female labor supply. Nevertheless, the estimated coefficient was positive (but statistically insignificant). I interpret this finding as a signal of inadequacy of the estimated model, maybe due to the exclusion of receipt of survivor benefits from the equation.

Table 22 presents the IV estimates for the variable that includes receipt of survivor benefits. Standard errors for these estimates are smaller than in Table 21. And so are the estimated coefficients. The larger effects are once again found on headship rates, with an increase by 25 percentage points. The coefficient on labor participation however changes signal to negative, borderline statistically significant 25 percentage points, which seem to be well in line with at least my priors.

Table 23 presents the IV estimates for the effects of total benefits (sum of length-of-service, old age, disability and survivor benefits) on the living arrangements of the elderly. The point estimates imply that receipt of benefits as large as R$100 increases the probability of independent living arrangements and one-person household, and headship rates by 5, 4 and 7 percentage points respectively. The effect on labor participation is negative as expected and well in line with my priors: a decrease by 11 percentage points.

7. Conclusion

This paper uses information about a reform in social security for rural workers to estimate the effect of income on unmarried elderly females in the Brazilian rural areas. The findings of this paper favor the Western view that elderly people place a value on privacy and independence, choosing not to coreside with their adult children if they can afford to do so.

This result suggests that substituting the extended family for formal transfer programs by means of severe filial responsibility laws and scaling back of social security may be a very costly measure for the elderly in Brazil.

Because the estimates of this paper are based on the behavioral response of unmarried elderly females in the rural areas, one may reasonably argue that those effects are underestimates of the effects for the whole sample of elderly, males and females, married or unmarried, residing in rural or urban areas. After all, unmarried elderly are likely to be the ones to demand the more company from their adult children, and rural people may well be the ones more reliant on more traditional roles for the extended family in Brazil.

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Chapter 3

Income Effects on Child Labor and School Enrollment in Brazil

Can rising income levels in less developed countries eradicate child labor? Will income growth in less developed countries improve their poorer children's education? Some policies adopted by rich countries seem to assume not. The Child Labor Deterrence Act of 1995 also known as the Harkin Bill, after Senator Tom Harkin (D-Iowa), is one example. This legislation bans the importation to the United States of goods produced abroad with child labor. If child labor is an inevitable manifestation of poverty, curable only by rising income levels, then forceful bans or interventions such as trade restrictions are likely to do more harms than benefit to children.

This paper explores exogenous variation in non-labor income at the household level caused by a reform of Social Security for rural workers in Brazil to estimate the impact of increased incomes on child labor and school enrollment.[28]

This natural experiment is particularly interesting because Brazil has high child labor participation rates relative to other Latin American countries and also because rural occupations are the most common among child laborers in Brazil. Moreover, about 15% of children 10-14 years old living in rural locations coreside with an elderly, which guarantees that statistically significant effects can be assessed, using a large sample survey such as the PNAD.

This natural experiment empirical strategy overcomes a setback in the previous literature: child labor and school enrollment may be correlated with household income because families with a greater discount rate will have adults with higher education levels and also higher income. In this case, the cross-section relationship at the household level between income levels and child labor is not informative of the likely effect of policies that increase incomes to families with children, because it overestimates the effects of income on child labor and school enrollment decisions. Because I have a plausibly valid instrument for non-labor income at the household level, the effect of income on child labor decisions can be estimated consistently and the estimated parameter will be causal in the sense of Angrist, Imbens and Rubin (1996).

This research strategy is akin to the papers by Duflo (1999) and Bertrand, Miller and Mullainathan (1999) that explored the effects of social pensions in South Africa on respectively

[28] The first chapter of this Thesis explores the effects of these reforms on elderly labor supply.

children health outcomes and labor force participation of prime-aged males coresiding with pensioners.

This paper uses microeconomic data – incomes are measured at the individual and household level – which is the most desirable approach for studying child labor, because macroeconomic growth may also be correlated with society-wide changes in attitudes towards child labor. Moreover, macroeconomic growth is not the most relevant variable for assessing the design of policies aiming child labor reduction (one cannot change macroeconomic aggregates in order to reduce child labor, but one can interfere with personal income distribution).

Counterfactual analysis based on reduced form estimates implies that little less than 20% of the gap between 100% enrollment and counterfactual enrollment rates was closed for girls living with at least an elderly who benefited from the reform, with a smaller effect for boys. Labor force participation of boys ("worked in reference week") also seem to have been effected by the reform, with a reduction in participation rate around one-tenth of counterfactual participation rates.

This paper also finds that non-labor income earned by males and females have different effects, with consequences for the design of transfer policies. Male benefits reduce boys' labor supply and increase boys' school enrollment more than they affect girls' outcomes. Female benefits exhibit the opposite pattern, reducing girls' labor supply and increasing girls' school enrollment more than they affect boys' outcomes. These results remind the findings by Duflo (1999) that in South Africa social pensions received by grandmothers benefits granddaughters relatively more than if received by grandfathers.

Section 1 discusses why child labor may be inefficient. Section 2 below discusses the previous empirical evidence. Section 3 presents background information about child labor in Brazil. Section 4 presents background information about living arrangements at which elderly and children coreside in Brazil. Section 5 describes the data used in the empirical sections. Section 6 presents the empirical strategy. Section 7 presents the regression results. Section 8 discusses possible caveats. Section 9 concludes.

1. Why child labor may be inefficient

The economic literature lacks a specific model for child labor supply to address efficiency questions. Therefore, the efficient level of child labor supply is in general thought as the counterpart to the efficient level of schooling investment.

There are several plausible sources of inefficiency that may distort the trade-off between a child's working and human capital accumulation activities. First, the decision of attending school instead of working may not take into account the social value of education due to education-related externalities (Acemoglu 1996, Moretti 1999, Acemoglu and Angrist 1999). Second, this decision may not take into account the private value of education because private gains of education may not accrue to the primary decision-makers, the children's parents, because children cannot commit to repay parents for past human capital investments they financed (Baland and Robinson 1998). Third, if parents are not allowed to borrow against their future income in order to smooth consumption, child labor may also be distorted because it may be used as a means of bringing income from future periods to the present.[29] And last but not the least, child labor may cause economy-wide costs due to trade restrictions or sanctions imposed by industrialized countries.

The economic literature also considers reductions in child labor desirable for the possibility of multiple equilibria due to substitutability between adult and child labor (Basu and Pham Van 1998).[30]

2. Previous Empirical Evidence

The most important open question in the empirical literature is about the relative role of increased incomes and government interventions in the eradication or reduction of child labor. The historical evidence provides some clues but identification of the effects of government regulations such as industry regulations is confounded due to the endogenous determination of regulations (if child labor loses its attractiveness for firms, the lobby against regulations banning child labor becomes weaker). The positive correlation between macroeconomic income levels and restrictive regulations on child labor is another complicating feature of this problem.

Despite an apparent lack of overwhelming evidence on the determinants of child labor, a recent survey paper argued that "the overall growth of an economy is by no means the only factor, nor for that matter the most important factor, in the mitigation of child labor" (Basu 1999a). Other candidates are quality and availability of schooling, existence of compulsory schooling laws, existence of industrial regulations setting labor standards, quality of schooling alternatives, social norms and customs, and credit market imperfections.

[29] Jacoby and Skoufias (1997) found that child labor helps smooth the incomes of rural Indian families, consistent with poorly developed credit and risk markets.

The empirical evidence in general explores information from two different periods, namely the nineteenth century and early twentieth century experience of developed countries such as United States and UK,[31] and more recent experience at developing countries.[32]

2.1. Evidence from the United States and UK

The evidence from the United States and UK downplays the historical importance of government interventions in reducing child labor. Nardinelli (1980) argues that the English Factory Acts, passed for the first time in 1833 and made more stringent in 1844 and 1874, do not seem to have been the central determinant of the reduction in children's importance in cotton factories during the nineteenth century. Technological change reducing the demand for child labor seems to have been crucial. Galbi (1997) argues that children had an advantage over adults in adapting to working conditions in Industrial Revolution's factories. The aging of the initial cohort of children who worked in factories would bring about a brand new adult workforce adapted to factory conditions, reducing future demand for child labor.

For the United States, Moehling (1999) fails to find an effect of state level labor regulations on the incidence of child labor, using data from the federal censuses of 1880, 1900 and 1910. Social reform legislation, in this case, would have followed and responded to social change instead of leading and triggering social change.

2.2. Evidence from contemporary developing countries

Despite the interest on this topic in policy-making and non-academic circles, child labor per se has not been a major research area in development economics.

The importance of technological factors instead of government intervention is illustrated in a developing country setting by Levy (1985), which argues that technological change in Egypt's agricultural sector had large effects on the demand for child labor and, consequently, on fertility rates. This result bears resemblance with the above mentioned evidence presented by Galbi and Nardinelli for developed countries.

The trade-off (if any) between child labor and school enrollment has also been examined in a series of papers based on contemporaneous experience in developing countries. Jacoby (1994) argues that borrowing constraints are an important factor determining withdrawal from school by Peruvian children. Also using Peruvian data, Patrinos and Psacharopoulos (1997) conclude that

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[30] However, there is no Pareto ranking between the equilibria with and without child labor in the model by Basu and Pham Van (1998).

[31] For example: Goldin (1979), Vincent (1981) and Moehling (1999).

[32] For example: Jacoby (1994), Jensen and Nielsen (1997), and Patrinos and Psacharopoulos (1997).

"without work many children may not be at school at all" – however, after controlling for parental background, family income does not affect children's labor force participation. Both papers mentioned above examine cross-sectional evidence, therefore are not revealing of the causal effect of an increase in incomes.

The extent at which labor supply and enrollment at school are substitutes was also questioned by the results in a paper studying a school enrollment subsidy in Bangladesh called "Food for Education". Ravallion and Wodon (1999) study the possible trade-off between child labor and school enrollment in Bangladesh by using exogenous variation in access to this school enrollment subsidy. They find that the subsidy was effective in increasing school enrollment but reductions in child labor were very small, suggesting children's other uses of time such as leisure and helping at household chores may have been reduced.

3. Background information about child labor in Brazil

Brazil has one of Latin America's highest rates of child labor force participation. In 1995, when participation rates for children 10-14 in Latin America & Caribbean (LAC) were 9.8%, figures for Brazil were as high as 16%.[33] This backwardness relative to LAC countries' aggregates has been consistent over the years: in 1950, participation rates were 19.4% and 23.5% for respectively LAC and Brazil.

Time series data on child labor in Brazil have shown a slow downward trend in labor force participation for boys and girls age 12-13 particularly in the nineties, and an apparently flat profile over time for children age 10 and 11.

[33] Source: ILO (1996), based on statistics organized by Ashagrie (1993), as quoted in Basu (1999a).

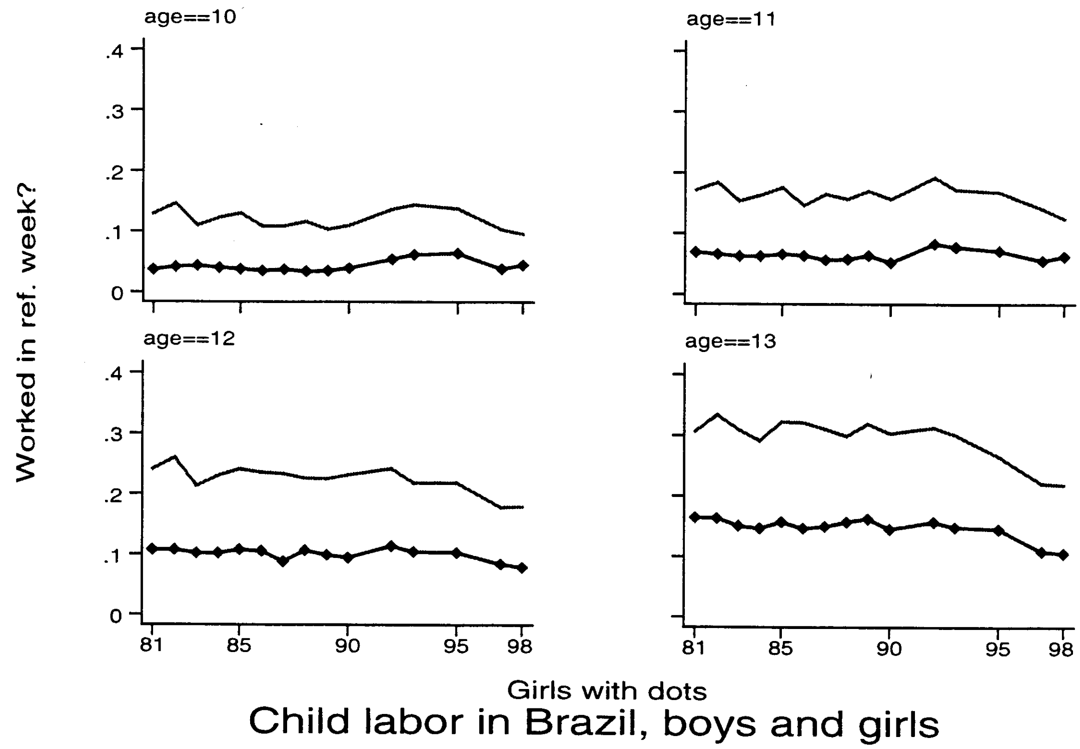

Figure 9. The figures above show the time series behavior of the proportion of boys and girls who "worked in the reference week" from the PNAD household survey. The line with dots represents the statistics for girls, the other for boys.

The majority of Brazilian child laborers work in agriculture activities.[34] While only 24% of youths 10-24 are employed in agriculture, 69% of the work force age 10-11 and 55% of the work force age 12-14 are in that sector (IBGE (1997)). Therefore, policies focused on banning or reducing child labor in Brazil are most likely to be policies changing the incentives faced by rural families.

The mirror image of Brazil's large participation rates of children is Brazil's dismal educational record. Much has been written about Brazil's problems in creating high-quality educational opportunities for children in rural areas or even poor urban areas (for a collection of papers on education and income inequality in Brazil, see Birdsall and Sabot (1996)). Behrman and Schneider (1996) ask the question "where does Brazil fit" in comparison to other low and middle-income countries in terms of schooling investments. They find that secondary school enrollment rates in Brazil are respectively 7.7% and 16.4% below their "expected values" for females and males after conditioning on income levels and measures of schooling cost.

[34] From now on, when I refer to children, I mean age 10-14.

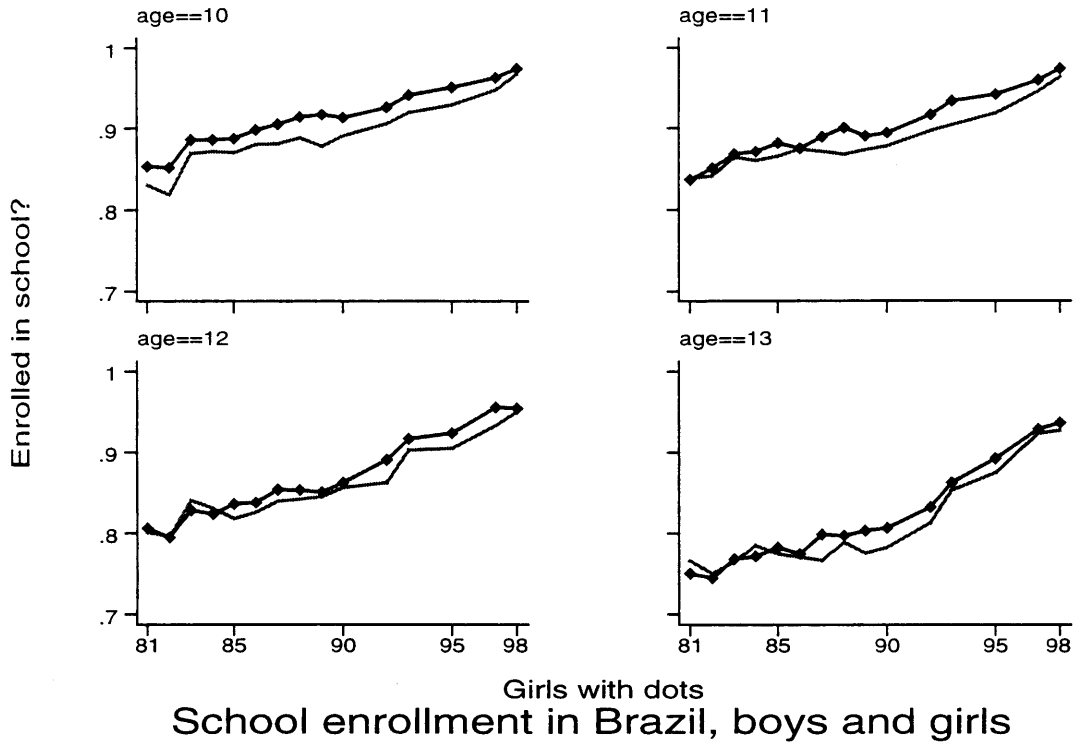

Figure 10. The figures above show the time series behavior of the proportion of boys and girls who are "enrolled in school" from the PNAD household survey. The line with dots represents the statistics for girls, the other for boys.

Indeed Figure 10 shows that girls are more likely to be enrolled in school than boys are in Brazil. It is also worthwhile to point out the sharp increase in school enrollment for the 12 and 13 age groups particularly during the nineties. The comparison between the trends for worked in the reference week and school enrollment for children age 12-13 suggests some degree of competition between those two activities for children's time. Table 26 shows that while there is little signal of a downward trend in the proportion of children working, there has been a gradual increase in children working and studying and also a reduction in the proportion of children idle (neither working nor studying). Among the around 18% children who were working in 1989, it is noteworthy that 46% of them were not enrolled in school while working and for about the same number of working children in 1993, 28% of them were not enrolled in school.

However, terrible child labor and school enrollment statistics are coupled with advanced laws in Brazil. Schooling is compulsory in Brazil up to age 14 or the eighth grade.[35] Public schools are

[35] However Krueger (1996) argues that compulsory schooling laws are usually not enforced in developing countries.

free and children are served food at public schools. Work is only allowed for children 14 and older, with apprenticeship available at age 12. Hazardous activities are only available for youths older than 18, and for some activities, older than 21.

The social acceptability of child labor in activities that do not represent hazards also deserves mention. Inspectors tend to ignore many of the more "tolerable" forms of child labor, in the belief that children are better off by working than on the streets (DOL 1999). An official report by the Brazilian Ministry of Labor stresses some cultural aspects of child labor: for many, going to school without working is considered detrimental to a children disciplinary development and an invitation for idleness (Ministério do Trabalho e Emprego do Brasil 199X).

Federal policy also seems to have chosen to target specific cases where abuse is evident and also costly in terms of possibility of trade retaliations.[36] In the most recent years, interventions against child labor, under the "Program on the Eradication of Child Labor", have also had a limited and localized character. High profile cases due to the sheer abuse or due to export-orientation of the industry involved such as charcoal mines, sisal plantations, shoe manufacturing and sugar cane harvesting have received federal funds and families with children at risk of working receive stipends as high as 134 dollars a month. However, coverage has been minimal: while some estimates count up to 4.3 million children as working, only 48,000 children have benefited from those interventions (United States Department of Labor 1998).

4. Background information about children and elderly in Brazil

The strategy of using exogenous changes in old-age benefits to make inferences about child labor only makes sense if there is a significantly large number of children coresiding with elderly people. Table 28, Panel A, shows that around 14% of children age 10-14 coreside with at least one person older than 60. Coresidence with elderly among those children living in rural areas has been also increasing from 13.5% in 1989, to 14.9% in 1990, 16.3% in 1992, while there does not seem to be any trends for the children living in urban locations. However, this trend is not clearly related to the reform I study, since the fraction of rural children coresiding with an elderly was 14.0% in 1981, 14.4% in 1985 and 14.7% in 1988, with differential increases in life expectancy in rural and urban areas as an alternative explanation.

[36] In the state of Mato Grosso do Sul, migrant families with children were found in indentured labor in the production of charcoal under horrible conditions. One of the final destinations of charcoal is the export-oriented steel industry, which already faces trigger-happy protectionist restrictions even without allegations of links to child labor. Apparently, child labor was eradicated in this industry (US Department of Labor 1998)

Table 28, Panel B, shows that around 18% of elderly (60 or older) in Brazil coreside with at least one child age 10-14. Patterns are different in rural and urban areas: around 17% of elderly in urban households and around 21-22% of elderly in rural households coreside with children 10-14. The average number of children 10-14 coresiding with each elderly in Brazil is about 0.24, with 0.21-0.22 and 0.30 as the averages for the urban and rural sub-samples.

5. Source of Data and Description

I use the *Pesquisa Nacional por Amostra de Domicílios* (PNAD) to model the labor supply – school enrollment decision of children aged 10-14. The PNAD is a yearly household survey, with sample size equal to 1/500 of the Brazilian population (about 100,000 households) and is designed to produce a picture of the living conditions and economic life of the Brazilian population, rural and urban. For every individual I observe characteristics such as age, race, education, school enrollment, income from different sources, housing and living arrangements, family structure, work, fertility, migration and other topics. I observe various measures of labor supply, including hours of work, labor force non-participation and earnings.

The earliest age at which work related questions are asked is 10. Therefore, the definition of child labor in this paper is restricted to children 10 or older. For the upper limit, I use 14 - in concordance with the ILO definition of child labor. Age 14 is also the earliest age at which youths are legally allowed to work in Brazil.

The empirical exercise will use data for the years 1989, 1990, 1992 and 1993. There is no data available for 1991. The exogenous variation in non-labor income due to the reform of social security for rural workers happened for the two latest years, 1992 and 1993. Data for years previous to 1989 may bring confounding factors because 1988 was a year of major changes in labor regulations due to the promulgation of the Constitution of 1988. There is no data available for 1994. From 1995 on, there seems to be a stronger concern by the federal government in eradicating child labor, so the institutional background may not have been the same.

The outcome variables I use in this paper were chosen in order to capture different dimensions of children's labor supply and school enrollment choice. "Enrolled in school" measures school enrollment. "Worked in reference week?" and "Worked in reference week for pay" are binary variables capturing children's labor force participation and also whether children are working for pay. The concept of work used at the PNAD comprises work for pay, unpaid work such as supporting another member of the household at his job and production for one's own consumption. "Total hours per week, all jobs" measures how time-intensive is children's labor. "Monthly earnings" measures earnings for those children who work for pay.

6. Empirical strategy

The identification of the effects of non-labor income at the household level on child labor is based on exogenous variation in old-age benefits due to a reform in the Brazilian social security occurred in 1992.[37] This reform brought up a reduction in the minimum eligibility age for old-age benefits for rural workers from 65 to 60 for males and 55 for females, the end of a rule that determined that no more than one person per household would be eligible to receive old-age benefits for rural workers, and an increase in the size of benefits from half a minimum wage to one minimum wage.[38]

I explore the differences between children who coreside with elderly people who are eligible to benefit from the reform and children who do not, before and after the reform. The cross-sectional pattern of children's labor participation and school enrollment before the reform identifies the effect of coresidence with an elderly. The comparison between the cross-sectional patterns of children's outcomes before and after the reform identifies the effect of the reform.

From one single cross-section, one cannot identify the effects of non-labor income coming from old-age benefits from the effects of the presence of an elderly person that are not related to the benefits elderly receive. Children who coreside with an elderly person may differ from other children for several reasons. Elderly people may testify for the importance of patience and investment in human capital, or children from older parents may be raised in a different manner than otherwise, or presence of an elderly may be correlated with other unobserved characteristics.

The use of an exogenous reform in social security, however, allows us to separate the effects of benefits from the effects related to the presence of an elderly person.[39]

The reduced form first-stage equation below sheds light on the specification I estimate.

$$Z = (X_E \times after)\beta_E + X_E\gamma_E + X_H\gamma_H + (year_j \times rural)\theta_{jr} + (state_i \times rural)\theta_{ir} + u \qquad (12$$

[37] For a longer and more detailed account of the reform, see the first chapter of this Thesis and Table 1.

[38] Before the reform, old-age benefits for rural workers were flat and equal to 50% of the minimum wage. After the reform, rural workers could opt for benefits based on past earnings, but the vast majority of rural old-age beneficiaries had benefits equal to the minimum benefit, fixed by the reform at one minimum wage.

[39] It is crucial that there be no changes in living arrangements for this empirical strategy to provide consistent estimates. In Section 8 I argue that endogeneity of living arrangements and selection problems does not seem to be a major problem.

In the equation above, Z is the household receipt of social security benefits, X_H are household and personal characteristics such as number of children age 0-4, education attainment of the head of household, number of household members at different age groups, race, only son/daughter and others; X_E are household characteristics capturing the household exposure to the effects of the social security reform. X_E enters the equation as a main effect and interacted with a dummy denoting post-reform years. Year dummies interacted with rural area dummies control for time trends in rural child labor that are not due to increases in incomes for households where an elderly is present. State dummies interacted with rural area dummies control for fixed effects reflecting the historical differences in child labor within states across rural and urban areas.

The variables in the first term of the right hand side of equation (12), i.e., the interaction between variables X_E and *after* are the excluded variables from the structural form equations I estimate:

$$Y = Z\ \beta + X_H \hat{\gamma}_H + (year_j \times rural)\ \hat{\theta}_{jr} + (state_i \times rural)\hat{\theta}_{ir} + v \tag{13}$$

In other words, I identify β, or the effect of income on the outcome variable Y, using interactions between post-reform dummies with variables measuring the exposure of a household to the effects of the reform. Therefore, the key to our identification strategy is constancy in the effects of household structure and personal characteristics not related to social security rules across the time period under study.

The reduced form equation can also be used for counterfactual analysis. Under the assumptions used for IV estimation, counterfactual outcomes can be constructed from the reduced form equation for the outcome variables, disregarding the term with the variables that are excluded from the structural form equation:

$$\hat{Y}_{counterfactual} = X_E \hat{\gamma}_E^Y + X_H \hat{\gamma}_H^Y + (year_j \times rural)\hat{\theta}_{jr}^Y + (state_i \times rural)\hat{\theta}_{ir}^Y \tag{14}$$

6.3. The determinants of children's schooling and labor

The determinants of child labor can be classified in different categories: children's characteristics, siblings' availability and their characteristics, parent characteristics, and household characteristics.

Children's age and gender are expected to affect their labor supply. Above a certain age, the older the child, the more likely she works. Gender interacts with cultural background determining schooling and working choices. Girls often substitute for their mothers in household chores and child care activities, particularly when the mother supplies work in the market. Therefore, girls' labor at unpaid activities is likely to be reduced in response to non-earned income received by their mothers insofar as it reduces their mothers' labor market activities. Important to notice, childcare and household chores are not counted as work for the PNAD survey. As a consequence, effects on girls are likely to be more visible in the school enrollment margin.

Presence of younger siblings increases the demand for childcare services, probably imposing a burden on girls' school attainment and enrollment. On the other hand, evidence from Botswana (Chernichovsky (1995)) shows that families with a larger number of children have higher average schooling among their children as a consequence of specialization among the children. Therefore effects of sibling availability - as well as gender effects - are likely to be culture-specific, depending on social norms, and probably on whom falls the burden of caring for the parents when they are elderly.[40]

Several variables attempt to control for the effects of family composition. The number of children in the household ages 0-4 and 5-9 proxies for the demand for childcare services. Dummies for oldest child of all genders, oldest daughter and oldest son capture older child effects – oldest daughters may carry a disproportionately large burden in household chores, oldest sons may be picked by fathers to follow their tracks by learning their jobs as apprentices. Dummies for second and third oldest children account for differences between those and other children further below in the birth order. Dummies for the youngest child, for only children, and the number of children in the family control for other family characteristics and birth order characteristics.

Parents' education also affects child labor and school enrollment through several channels. The education of parents affects their wage rates positively, proxies for their attitudes towards

[40] For the living arrangements of unmarried elderly women in Brazil and how daughters are more likely to care for their elderly parents than sons, see the first chapter of this Thesis. Interestingly, the gender gap in education is wider in Asian societies where sons (and consequently daughters-in-law) are relatively more likely to care for their parents than daughters than in Brazil where caring for elderly parents is more of a daughter activity.

education, and also may be an input on their children's human capital production function, possibly complementary to schooling. All those factors suggest that higher parent education increases school enrollment and reduces child labor.

The number of adults (age at least 20) in the household is a measure of a household potential income. The number of adults working at rural jobs is a measure of the household's engagement in rural activities, which seem to be the preferential field for child labor.

Cost and quality of schooling also affect children's time use. Direct pecuniary costs of schooling are likely to be negligible since education up to the high school level is for free in Brazil. However, indirect costs such as foregone income and non-pecuniary costs such as travel time from home to school are likely to be important factors. Because primary education is mostly funded at the state level, and because non-pecuniary costs, indirect costs of schooling and school quality are likely to vary within each state in the rural and urban dimension, I use interactions of state and rural location to control for those effects.

Other controls are "black" and "brown" race dummies,[41] dummies for female-headed household, presence of the head's spouse and metropolitan area.

[41] The classification follows the survey instrument. "Browns" correspond to the "Pardos" category in Portuguese.

7. Results

7.1. First Stage Estimates

The first stage regression relates the endogenous variable, benefits in the household, to all variables that belong to the structural equation (13) plus the variables that will be excluded from that equation and used as instruments for the benefits variable.

The coefficients for the first four variables in Table 29 confirm that the excluded variables based on characteristics of the reform in social security benefits are strong predictors of benefits.[42]

Households located in the rural area, with one female age 55-64 receive monthly benefits R$84 higher in 1992-93 than in 1989-90. Households with one male rural worker age 60-64 receive monthly benefits R$82 higher in the after period reform. Those variables capture the effect of increased eligibility due to reductions in the minimum eligibility age for old-age benefits for workers of both genders.

Households located in the rural area, with one unmarried female age 65 or older receive monthly benefits R$109 higher in 1992-93 than in 1989-90. Households with one male rural worker age 65 or older receive monthly benefits R$139 higher in the after reform period. Those variables capture the effect of the increase in benefits from ½ minimum wage to 1 minimum wage. However, those magnitudes seem exaggerated when compared to the size of the increment of ½ minimum wage determined by the reform.

The first stage regressions for gender-signed benefits also conform to the expectations based on the reform rules.

7.2. Reduced Form Estimates

In the reduced form equations, the excluded instruments, which are interactions between time after the reform and indicators for belonging to groups affected by the reform, substitute for the benefits variables. Reduced form estimates are reported in **Table 30**.

Estimates for school enrollment are reported in columns (1)-(2). School enrollment is 9.0% and 4.3% lower for boys and girls living in rural locations. Skin colors black or brown have statistically significant negative effects. The presence of one child age 0-4 reduces boys' and girls' school enrollment 4.6% and 5.9% respectively. Oldest boys in the family have 2% greater school enrollment, while no significant effect is seen for oldest girls in the household. Number of

[42] As already shown in the first chapter of this Thesis.

children in the family has a small but statistically significant effect just as in Chernichovsky (1995), for boys and girls. The marginal effect of adult presence is large – 2% and 1.7% for boys and girls – and statistically significant. Somewhat surprisingly, female-headed household has a large and positive significant effect on school enrollment. And last but not least, the education of the head and the head's spouse have a large and significant effect: the effect of living in a household whose head has more than 4 years of schooling (instead of no schooling) is 12.5% and 7.3% for boys and girls respectively. Similarly large effects are found for the education level of the head's spouse.

Estimates for "worked in the week of reference" are reported in columns (5)-(6). Labor force participation is 6.0% and 5.4% greater for boys and girls living in rural locations. Skin color black increases participation for girls in 1.9% but has insignificant effects for boys, such as skin color: brown. The presence of one child age 0-4 increases boys' and girls' participation 2.5% and 1.8% (both significant) respectively. The marginal effect of children 5-9 in the household is 1.7% and 1.3% (both significant) for boys and girls respectively. Number of children in the family has no effect for boys' and marginally reduces girls' participation –0.3% (significant). The marginal effect of present adults is large: -2.4% and -1.5% (both significant) for boys and girls respectively. Girls' labor participation is 1.9% smaller they are the oldest daughter in the family, and is 2.7% smaller (significant) when they are also the oldest children in the family. An opposite pattern is found for boys, which confirms the prior that older girls may substitute for their mothers in household tasks. As a mirror image of the results for school enrollment, the number of present adults and more educated adults reduce significantly labor force participation of boys and girls.

The results for the other labor outcomes are mostly similar to the results for "worked in the week of reference?" reported above.

7.3. Counterfactual Analysis

From the reduced form estimates, one can construct a counterfactual in order to evaluate the impact of the reform on the outcomes of interest for the sub-population that was affected by the reform. The effect of the reform can be evaluated from the difference between the actual outcomes for the sub-population of interest and the predicted outcome if no reform had occurred. This counterfactual can be obtained by subtracting the effect of the excluded variables (interactions between post-reform dummies and characteristics of the elderly in the household) from the fitted values from the reduced form equation.

The counterfactual analysis finds that the reform had significant effects on school enrollment for boys and girls, with a particularly large effect for girls. In the girls' sub-sample there was an increase of 5.1% in school enrollment from a counterfactual value of 73.7% to an actual value of 78.8% - a little less than one-fifth of the difference between counterfactual and 100% enrollments. The effect of the reform for boys was more modest: an increase of 1.4%, a small fraction of the gap between counterfactual and full enrollment rates.

The "worked in reference week" variable measures a decrease of 5.0%, from 54.8% to 49.8%, for boys and a decrease of –1.2%, from 25.3% to 24.1%, for girls. Similar but smaller results are obtained for "worked in reference week for pay". The monthly earnings variable shows a statistically significant effect on girls' outcomes and no effect on boys. The "total hours per week" variable presents a statistically significant average reduction of 1.29 hours for boys and no significant effect for girls. This response implies a little less than 10% decrease in hours of work for the treated population.

7.4. Structural Estimates

Table 32 and Table 33 present respectively the OLS and the IV estimates for the parameter β of the structural form equation (13). Because I divided the benefit amounts by 100, the coefficients are to be interpreted as the effect of an increase of R$100 in benefits, where monetary values are expressed in Reais of 1997.

For many equations, instrumental variables estimates are orders of magnitude larger than OLS estimates. This finding can be explained by a large degree of measurement error in benefit amounts. If the evidence form OLS estimates is taken at face value, the effect of R$100 of female benefits on girls' school enrollment is 0.2% - against 8.0% implied by IV estimates.

Estimates for the effects on school enrollment show differential responses for boys and girls. An increase in benefits of R$100 increases girls' school enrollment statistically and economically significant 4.5% and has insignificant 0.9% effect on boys. Moreover, the gender of the benefits recipient also matters: the coefficient on female benefits is 8.0% (significant) for girls' and –3.1% (insignificant) for boys' school enrollment, while the coefficient on male benefits is 2.2% and 3.5% (both insignificant) for girls and boys. These results are in line with previous evidence on violations of the unitary model of the household found in Brazilian data (Thomas (1990), the first chapter of this Thesis).

Estimates for the effect on "worked in the reference week" imply that an increase of R$100 in benefits at the household level is –3.9%, statistically and economically significantly, for boys and –0.9%, insignificant, for girls. Again, the gender of the benefit recipient matters: the coefficient on female benefits is –2.0% (insignificant) and –6.9% (significant) for respectively boys and girls, while on male benefits is –5.1% (significant) and 3.0% (insignificant) for respectively boys and girls.

Estimates for the effect on "worked in reference week for pay" imply that a large part of the reduction of girls' participation due to benefits earned by females is made up of a decrease in girls' participation in the remunerated labor force. No significant effect can be seen for boys.

The outcome "total hours per week, all jobs" again shows the gender differentials with boys and girls reducing hours only in response to benefits received respectively by males and females. Results on the outcome "monthly earnings" are all statistically insignificant, probably due to the large variance of this variable.

8. Possible Caveats

8.1. Selection problems

In section 6, the empirical strategy assumes that the selection of children into households with elderly – or vice versa, the selection of elderly in the households with children – is random, once differences in observables are controlled for.[43] That is unlikely to be the case.[44] However, the evidence from aggregate means shows little evidence of changes in living arrangement patterns during the limited period of time studied in this paper.

Table 27, Panel A, shows no change in the relationship of children with the family head: in 1989, 93.51% of children age 10-14 were sons or daughters of the head of their families. The number for 1993 was 93.38%, suggesting that there does not seem to be any evidence of children being sent to elderly relatives homes (say, grandparents). Table 27, Panel B, shows a small decrease in the proportion of children who are not sons or daughters of the head of their household. In 1989, the number for this statistic was 91.44%; in 1993, it was 90.85%. At the same time, a greater proportion of children has "other relative" as the head of their household. It suggests two non-exclusive hypothesis may be true: more elderly living with their adult sons and grandsons may have the position of head of household due to the reform in benefits; some adults may have moved with their children to their elderly parents' household. Table 27, Panel C, confirms these results by showing that there was a small decrease in the proportion of children belonging to the primary family of their household. From the point of view of the elderly (age greater or equal to 60), the upper panel of Table 28 shows that there was no statistically significant change in the mean number of children 10-14 living with each elderly after the reform. There were also no statistically significant changes in the proportion of elderly coresiding with children age 10-14.

[43] Bertrand, Miller and Mullainathan (1999) face the same problem, with the additional difficulty of not having information about living arrangements prior to the introduction of social pensions in South Africa.
[44] In another project currently in its preliminary stages, I examine the living arrangement choices of elderly unmarried women affected by the same reform of social security for rural workers in Brazil.

8.2. Functional form assumptions

The choice of total benefits at the household level as the benefits measure is arbitrary. Other alternative measures of non-labor income or functions of benefits amount could have been used. The linear specification I adopted carries the hidden assumption that a dollar of benefits has the same effects on children's use of time regardless of other factors that may be important, to name a few, the number of adults and the age of the children.

Table 33 reports IV estimates for the effect of total benefits on girls' and boys' school enrollment that imply that an increase in benefits of R$100 is associated with an increase in school enrollment of 4.5% for girls and 0.9% for boys.

Table 34 reports results for the same statistic for different sub-samples, based on the children's age and also the number of adults (persons older than 20) in the household. In Panel A, column (3), one can see that for the girls' equation, the coefficient on total benefits is stable across different counts of adults in the household, with the exception of households with only one household, for which point estimates and standard errors are higher. From Panels B and C, one can infer that most of the marginal action in girls' school enrollment patterns happens for girls age 12-14. Estimates reported in Panel C are precise and slightly greater than estimates from Panel A whereas estimates in Panel B are statistically insignificant and shift from positive to negative with changes in the number of adults in the household.

9. Conclusions

This paper used variation in old-age benefits received by rural workers due to a reform in social security benefits to identify the effect of income on labor outcomes and school enrollment of children of ages 10-14 in Brazil. This empirical strategy based on exogenous variation in old-age benefits is adopted because cross-sectional comparisons between income levels and children's outcomes are not able to identify the effect of non-labor income from other characteristics that are correlated with income.

Because IV estimates in this paper are based on exogenous variation in benefits, they are informative of the likely effect of policies that redistribute cash to families with children in Brazil. Local governments such as the City of Belo Horizonte and the City of Vitória have recently pursued cash redistribution policies to families with children.

The results in this paper imply that old-age benefits have the effect of increasing school enrollment of children coresiding with old-age beneficiaries, particularly girls aged 12-14. Parallel results are found for boys' labor participation. IV estimates imply that R$100 of old-age benefits received by household members increases school enrollment rates of girls in 4.5%, with smaller effects for boys. Counterfactual analysis based on reduced form estimates implies that little less than 20% of the gap between 100% enrollment and counterfactual enrollment rates was closed for girls living with at least an elderly who benefited from the reform, with a smaller effect for boys.

It is noteworthy that results in this paper differ from the U.S. evidence, particularly Mayer (1997). In her study of the effects of income on children's outcomes in the United States, Mayer forcefully argues that at the margin money can't buy better outcomes for children, once their basic material needs are met. This is not surprising: many children in Brazil do not have their basic material needs met.

Because child labor participation is so much higher than the desired levels in Brazil, a successful program of cash benefits that would reduce child labor to insignificant levels seem to be very costly: R$100 monthly only reduced boys' labor participation in four percentage points. The same remark is valid for school enrollment outcomes. Therefore, measures such as conditioning the receipt of cash benefits to school attendance or improvements in labor inspection are called for as complements to plain cash redistribution.

The variation in income used in this paper is not correlated with economy-wide income variation. Therefore, the effects of income I estimate do not take into account any change in attitudes or social norms towards schooling and child labor due to rising income levels. As a consequence, the effects I find are likely to be underestimates of the changes in child labor and school enrollment that occur as the overall incomes of LDC countries rise.

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Table 1

Characteristics of the Brazilian Social Security System Before and After the Reform

Occupations	Programs	The System Before the Reform	Changes with the Reform
Rural Workers	Old-Age	Eligibility at age 65+, rural work documented for 1 of past 3 years. Only 1 person per household is eligible. Benefit is flat and equal to 50% of the minimum wage. No restriction on gainful work. No bonus for deferment of pension receipt. No need to quit the current job to apply for benefits. No earnings/retirement test after that	Minimum age for eligibility reduced to 60 for males and 55 for females. No restriction in the number of receivers in a household. Benefit is 70% of earnings-based benefit plus 1% for each 12 past payment of the payroll tax, up to 100%. Minimum benefit is increased to 100% of the minimum wage.
	Length-of-Service	Not available for rural workers.	Same rules as urban workers.
	Disability	Available at any age. Needs to stop working altogether. Benefit is flat and equal to 50% of the minimum wage	Benefit is 80% of earnings-based benefit plus 1% for each 12 past payment of the payroll tax, up to 100%. Minimum benefit is increased to 100% of the minimum wage.
Urban Workers	Old-Age	Eligibility at age 70. Benefit is 90% of minimum wage. Needs to quit the current job to apply for benefits. No earnings/retirement test after that	Benefit is 70% of earnings-based benefit plus 1% for each 12 past payment of the payroll tax, up to 100%. Minimum benefit increased to 100% of the minimum wage.
	Length-of-Service	Eligibility after 30 years of declared documented work. Full benefits after 35 years of documented work. Fewer years for some types of work. No minimum age requirement. Benefits determined by years of documented work and recent labor earnings. Generous benefits for public sector work. Minimum benefit is 90% of the minimum wage Bonus for continued work beyond maximum eligibility period. Needs to quit the current job to apply for benefits. No earnings/retirement test after that.	Minimum eligibility for females reduced to 25 years of service. Benefit is 70% of earnings-based benefit at the minimum eligibility age plus 6% for each additional year of service beyond it, up to 100%. Minimum benefit increased to 100% of the minimum wage.
	Disability	Available at any age. Needs to stop working altogether. Benefit is 90% of minimum wage.	Benefit is 80% of earnings-based benefit plus 1% for each 12 past payment of the payroll tax, up to 100%. Benefits are no less than 100% of the minimum wage.

Notes: The reform in the Social Security was prompted by the specification of entitlements in the Constitution promulgated in 1988. The actual implementation of the reform was delayed until ordinary Law was approved in July of 1991. Benefit increases were implemented automatically; however granting of new benefits to newly-entitled beneficiaries in general took a few months to happen, due to administrative delays in the application and grant process.

Table 2

TABLE OF MEANS, ALL MALES AGED 55-64

AGE	55-59			60-64			65-69		
OCCUPATION	URBAN	RURAL	UNDEF	URBAN	RURAL	UNDEF	URBAN	RURAL	UNDEF
1988									
Benefit Take-up	0.198	0.089	0.821	0.282	0.129	0.837	0.539	0.564	0.936
Benefit Values	100.90	20.94	531.03	185.42	31.76	477.27	224.87	71.99	392.55
Worked Last Week	0.929	0.942	0.000	0.922	0.935	0.000	0.935	0.908	0.000
Total Hours / Week	46.39	49.00	0.000	45.24	47.22	0.000	42.06	43.58	0.000
Monthly Earnings	793.69	373.95	0.000	690.61	283.80	0.000	581.44	284.20	0.000
Rural Location	0.087	0.695	0.104	0.096	0.710	0.122	0.113	0.705	0.173
1990									
Benefit Take-up	0.163	0.047	0.845	0.319	0.112	0.890	0.667	0.711	0.936
Benefit Values	170.36	13.16	507.31	206.07	29.71	427.65	282.04	57.09	426.33
Worked Last Week	0.841	0.932	0.000	0.795	0.915	0.000	0.704	0.767	0.000
Total Hours / Week	40.87	47.10	0.000	38.05	45.89	0.000	32.65	35.44	0.000
Monthly Earnings	641.32	361.07	0.000	565.34	309.29	0.000	400.40	218.23	0.000
Rural Location	0.098	0.703	0.098	0.099	0.700	0.091	0.129	0.698	0.140
1992									
Benefit Take-up	0.236	0.114	0.868	0.338	0.301	0.879	0.659	0.745	0.953
Benefit Values	125.52	28.67	409.63	152.05	61.482	347.93	195.20	112.66	364.16
Worked Last Week	0.835	0.895	0.000	0.807	0.829	0.000	0.725	0.729	0.000
Total Hours / Week	40.04	45.70	0.000	39.30	42.06	0.000	33.95	34.11	0.000
Monthly Earnings	560.91	281.02	0.000	501.03	202.42	0.000	386.49	173.09	0.000
Rural Location	0.060	0.631	0.056	0.065	0.634	0.063	0.066	0.592	0.091
1993									
Benefit Take-up	0.276	0.134	0.869	0.345	0.526	0.896	0.672	0.811	0.933
Benefit Values	234.58	48.60	589.36	240.40	115.31	579.52	341.66	178.96	533.32
Worked Last Week	0.803	0.887	0.000	0.822	0.824	0.000	0.658	0.728	0.000
Total Hours / Week	38.59	45.06	0.000	38.92	39.39	0.000	30.50	33.48	0.000
Monthly Earnings	698.68	315.03	0.000	633.01	299.88	0.000	511.37	253.53	0.000
Rural Location	0.063	0.637	0.060	0.064	0.604	0.076	0.056	0.616	0.082

Notes: Urban and rural occupations are only defined for workers who had a job in the last four years before the survey. All other respondents are labeled as undefined.

Table 3

DIFFERENCES-IN-DIFFERENCES ESTIMATES

	Before reform: 1990	After reform: 1993	Change: (1993-1990)	Differences in Differences
Benefit Take-up Rates				
Rural 60-64	0.1130	0.4213	0.3083	
	(0.0189)	(0.0260)	(0.0321) [273%]	
Urban 60-64	0.2163	0.2887	0.0724	0.2359
	(0.0192)	(0.0206)	(0.0282) [33%]	(0.0427) [179%]
Rural 55-59	0.0827	0.0930	0.0103	0.2980
	(0.0128)	(0.0128)	(0.0181) [12%]	(0.0369) [232%]
Rural 65-69	0.6655	0.7247	0.0592	0.2491
	(0.0349)	(0.0279)	(0.0447) [9%]	(0.0550) [242%]
SS Benefits				
Rural 60-64	12.72	101.57	88.85	
	(3.56)	(11.42)	(11.96) [699%]	
Urban 60-64	91.00	151.98	60.98	27.87
	(18.01)	(17.16)	(24.88) [67%]	(27.60) [378%]
Rural 55-59	14.41	26.09	11.68	77.17
	(4.76)	(4.57)	(6.60) [81%]	(13.66) [341%]
Rural 65-69	47.17	151.22	104.05	-15.20
	(3.58)	(11.23)	(11.79) [221%]	(16.79) [149%]

Notes: Sample of males with less than 12 years of schooling who have worked at least some time in the last four years. Numbers in parenthesis are standard errors; numbers in square brackets are percentage changes.

Table 4

DIFFERENCES-IN-DIFFERENCES ESTIMATES AND IMPLIED ELASTICITIES

	Before reform: 1990	After reform: 1993	Change: (1993-1990)	Differences in Differences	Elasticities
Did Not Work Last Week					
Rural 60-64	0.0898	0.1781	0.0883		
	(0.0172)	(0.0203)	(0.0266) [98%]		
Urban 60-64	0.1751	0.1686	-0.0065	0.0948	0.28
	(0.0179)	(0.0172)	(0.0248) [-4%]	(0.0364) [106%]	
Rural 55-59	0.0822	0.1072	0.0250	0.0633	0.15
	(0.0133)	(0.0138)	(0.0192) [30%]	(0.0328) [52%]	
Rural 65-69	0.2265	0.2765	0.0500	0.0383	0.42
	(0.0310)	(0.0277)	(0.0416) [22%]	(0.0494) [62%]	
Total Hours per Week					
Rural 60-64	45.65	39.32	-6.33		
	(1.00)	(1.06)	(1.46) [-14%]		
Urban 60-64	39.51	39.98	0.47	-6.80	-0.04
	(0.91)	(0.98)	(1.34) [1%]	(1.98) [-15%]	
Rural 55-59	45.88	45.37	-0.51	-5.82	-0.04
	(0.77)	(0.75)	(1.07) [-1%]	(1.81) [-13%]	
Rural 65-69	35.33	32.64	-2.69	-3.64	-0.05
	(1.61)	(1.31)	(2.08) [-8%]	(2.54) [-7%]	
Monthly Earnings					
Rural 60-64	224.07	216.65	-7.42		
	(28.41)	(25.34)	(38.07) [-3%]		
Urban 60-64	401.08	464.12	63.04	-70.46	-0.04
	(30.15)	(47.14)	(55.96) [16%]	(67.68) [-16%]	
Rural 55-59	283.78	253.97	-29.81	22.39	0.02
	(22.31)	(18.76)	(29.15) [-11%]	(47.95) [8%]	
Rural 65-69	174.53	197.95	23.42	-30.84	-0.10
	(33.73)	(41.67)	(53.61) [13%]	(65.75) [-15%]	

Notes: Sample of males with less than 12 years of schooling who have worked at least some time in the last four years. Numbers in parenthesis are standard errors; numbers in square brackets are percentage changes. Elasticities are the ratio of the difference-in-differences in percentage changes in the outcome of interest to the differences-in-differences in percentage form in SS benefits, reported in Table 3.

Table 5

TRIPLE DIFFERENCES ESTIMATES: Benefits Take-Up Rates

Location/year	Before law change: 1990	After law change: 1993	Time difference for occupation
A. *Treatment Individuals: Males, 60-64 Years Old*:			
Rural Occupation	0.1130 (0.0189)	0.4213 (0.0260)	0.3083 (0.0321)
Urban Occupation	0.2163 (0.0192)	0.2887 (0.0206)	0.0724 (0.0282)
Occupation difference at a point in time:	-0.1033 (0.0270)	0.1326 (0.0332)	
Difference-in-difference:	0.2359 (0.0428)		
B: *Control Group: Males, 55-59 Years Old:*			
Rural Occupation	0.0827 (0.0128)	0.0930 (0.0128)	0.0103 (0.0181)
Urban Occupation	0.1963 (0.0137)	0.2157 (0.0134)	0.0194 (0.0192)
Occupation difference at a point in time:	-0.1135 (0.0187)	-0.1227 (0.0185)	
Difference-in-difference:	-0.0091 (0.0264)		
DDD	**0.2450** **(0.0503)**		
C: *Control Group: Males, 65-69 Years Old:*			
Rural Occupation	0.6655 (0.0349)	0.7247 (0.0279)	0.0592 (0.0447)
Urban Occupation	0.5898 (0.0354)	0.5864 (0.0325)	-0.0034 (0.0481)
Occupation difference at a point in time:	0.0757 (0.0498)	-0.1383 (0.0429)	
Difference-in-difference:	0.0627 (0.0657)		
DDD	**0.1732** **(0.0783)**		

Notes: Cells contain the ***aposentadoria* (disability, old-age and length-of-service benefits) benefit take-up rates** for the group identified. Standard errors are given in parentheses. Difference-in-difference-in-difference (DDD) is the difference-in-difference from the upper panel minus that in the lower panel. Occupation is measured by current occupation or in the case of workers without a current occupation, on latest occupation using in a recall period no longer than 4 years. Sample consists of males with less than 12 years of education, either single or with spouses 50 or younger.

Table 6

TRIPLE DIFFERENCES ESTIMATES: Average Benefit Receipts

Location/year	Before law change: 1990	After law change: 1993	Time difference for occupation
A. *Treatment Individuals: Males, 60-64 Years Old*:			
Rural Occupation	12.72	101.57	88.85
	(3.58)	(11.42)	(11.97)
Urban Occupation	91.00	151.98	60.98
	(18.01)	(17.16)	(24.88)
Occupation difference at a point in time:	-78.27	-50.40	
	(18.36)	(20.62)	
Difference-in-difference:	27.87		
	(27.61)		
B: *Control Group: Males, 55-59 Years Old:*			
Rural Occupation	14.41	26.09	11.68
	(4.76)	(4.57)	(6.60)
Urban Occupation	99.55	136.95	37.41
	(13.49)	(12.33)	(18.28)
Occupation difference at a point in time:	-85.13	-110.86	
	(14.31)	(13.15)	
Difference-in-difference:	-25.73		
	(19.43)		
DDD	**53.60**		
	(33.77)		
C: *Control Group: Males, 65-69 Years Old:*			
Rural Occupation	47.17	151.22	104.05
	(3.58)	(11.23)	(11.79)
Urban Occupation	150.15	194.80	44.65
	(28.93)	(19.54)	(34.91)
Occupation difference at a point in time:	-102.97	-43.57	
	(29.15)	(22.54)	
Difference-in-difference:	59.40		
	(36.85)		
DDD	**-31.53**		
	(46.03)		

Notes: Cells contain the **average benefit receipts** for the group identified. Standard errors are given in parentheses. Difference-in-difference-in-difference (DDD) is the difference-in-difference from the upper panel minus that in the lower panel. Occupation is measured by current occupation or in the case of workers without a current occupation, on latest occupation using in a recall period no longer than 4 years. Sample consists of males with less than 12 years of education, either single or with spouses 50 or younger.

Table 7

TRIPLE DIFFERENCES ESTIMATES: Did not Work in the Week of Reference

Occupation/year	Before law change: 1990	After law change: 1993	Time difference for occupation
A. *Treatment Individuals: Males, 60-64 Years Old*:			
Rural Occupation	0.0898 (0.0172)	0.1781 (0.0203)	0.0883 (0.0266)
Urban Occupation	0.1751 (0.0179)	0.1686 (0.0172)	-0.0065 (0.0249)
Occupation difference at a point in time:	-0.0853 (0.0249)	0.0095 (0.0266)	
Difference-in-difference:	0.0948 (0.0364)		
B: *Control Group: Males, 55-59 Years Old:*			
Rural Occupation	0.0822 (0.0133)	0.1072 (0.0138)	0.0251 (0.0192)
Urban Occupation	0.1314 (0.0114)	0.1693 (0.0120)	0.0379 (0.0165)
Occupation difference at a point in time:	-0.0493 (0.0175)	-0.0620 (0.0183)	
Difference-in-difference:	-0.0128 (0.0253)		
DDD	**0.1076** **(0.0443)**		
C: *Control Group: Males, 65-69 Years Old:*			
Rural Occupation	0.2265 (0.0310)	0.2765 (0.0278)	0.0500 (0.0416)
Urban Occupation	0.2784 (0.0324)	0.2996 (0.0302)	0.0212 (0.0443)
Occupation difference at a point in time:	-0.0518 (0.0448)	-0.0230 (0.0411)	
Difference-in-difference:	0.0288 (0.0608)		
DDD	**0.0660** **(0.0709)**		

Notes: Cells contain the share of respondents who **worked in the week of reference** for the group identified. Standard errors are given in parentheses; sample sizes are given in square brackets. Difference-in-difference-in-difference (DDD) is the difference-in-difference from the upper panel minus that in the lower panel. Occupation is measured by current occupation or in the case of workers without a current occupation, on latest occupation using in a recall period no longer than 4 years. Sample consists of males with less than 12 years of education, either single or with spouses 50 or younger.

Table 8

REDUCED FORM ESTIMATES OF OUTCOMES OF INTEREST: COEFFICIENT REPORTED IN THIS TABLE: β_Z

$$Z = \alpha + \beta_t AFT + \beta_l RUR + \beta_1 TREAT + \beta_2 (TREAT \times RUR) + \beta_3 (AFT \times TREAT) + \beta_4 (RUR \times AFT) + \beta_Z (AFT \times RUR \times TREAT)$$

	(1)	(2)	(3)	(4)
	Before=90, After=92	Before=90, After=93	Before=90, After=92	Before=90, After=93
Treated Age group	60-64	60-64	60-64	60-64
Non-Treated Age group	55-59	55-59	65-69	65-69
Worked Last Week	-0.0662	-0.1122	-0.0382	-0.1262
	(0.0275)	(0.0275)	(0.0386)	(0.0389)
Total Hours per Week	-4.56	-7.67	-2.57	-7.68
	(1.52)	(1.51)	(2.01)	(2.02)
Monthly Earnings	-46.83	22.41	-14.88	-4.95
	(78.72)	(83.91)	(85.14)	(136.98)
N:	12768	13006	9120	9259

FALSIFICATION EXPERIMENT

	(5)	(6)	(7)	(8)
	Before=88, After=90	**Before=95, After=97**	Before=90, After=92	Before=90, After=93
Treated Age group	60-64	60-64	**55-59**	**55-59**
Non-Treated Age group	55-59	55-59	**50-54**	**50-54**
Worked Last Week	0.0287	-0.0163	0.0107	-0.0287
	(0.0246)	(0.0274)	(0.0211)	(0.0215)
Total Hours per Week	2.15	2.17	0.43	1.56
	(1.48)	(1.49)	(1.24)	(1.25)
Monthly Earnings	-14.12	-44.45	-173.11	-91.31
	(91.36)	(87.43)	(96.36)	(74.89)
N:	11683	14772	17125	17477

Sample: all males who have worked in any of the 4 years before the observation. **Notes:** All regressions control for year, rural occupation and age group fixed effects and all interactions between any pair of these variables. Occupation is measured by current occupation or in the case of workers without a current occupation, on latest occupation using in a recall period no longer than 4 years.**Notes 2:** Bold letters denote the dimension at which the regressions is falsified. For example, at column (5), I use the wrong pair of years: both 1988 and 1990 are anterior to the reform.

Table 9

FIRST-STAGE REDUCED FORM ESTIMATES OF MONTHLY BENEFIT VALUES

$\text{Benefits} = \Sigma\ treat_i\ \beta_i + X\ \delta + \phi_1(\text{age, occupation, time}) + \phi_2(\text{spouse's age, spouse's occupation, time}) + \upsilon$

Dependent Variables	Own Benefits		Wife's Benefits		Couple's Benefits	
Independent Variables	(1)	(2)	(3)	(4)	(5)	(6)
age60-64*year92*rural	2.24	9.15			26.77	35.26
	(20.16)	(19.97)			(16.21)	(15.82)
age60-64*year93*rural	50.77	53.57			82.10	88.37
	(26.78)	(26.33)			(19.29)	(18.84)
age65up*after*rural	62.91	59.97			50.98	52.96
	(25.74)	(25.42)			(17.06)	(16.58)
spouse55up*year92*rural			6.80	6.76	-8.71	-14.58
			(4.32)	(4.31)	(12.50)	(12.39)
spouse55up*year93*rural			37.10	38.00	47.77	43.97
			(5.86)	(5.83)	(15.36)	(15.14)
Wife's Controls	excluded	excluded	included	included	included	included
Additional Controls	No	Yes	No	Yes	No	Yes
Sample	restricted	restricted	full	full	full	full
R^2	0.03	0.05	0.04	0.05	0.05	0.09
N:	26858	26858	49782	49760	49782	49760

Controls: ϕ_1 contains all year, age, occupation, year-age,, year-occupation and age-occupation effects where the observed unit is a male. ϕ_2 contains all spouse's age, spouse's occupation, spouse's occupation-year and spouse's occupation-spouse's age effects, where the unit of observation is a male.
Additional Controls: dummy for married, a quadratic polynomial on spouse's age, dummy for literacy, number of people in the household, and it ssquare, dummy for head of household, rural location and education and region effects.
Sample: Years 89, 90, 92, 93. Sample of males 50 to 70, with less than 12 years of schooling and who are currently working or have been working for the last 4 years. Restricted sample consists of male observations which are either single or married to a spouse younger than 50.
Notes: Social security benefits are measured in Reais of September of 1997. I measure the permanent portion of social security benefits using information on their adjustments to inflation and the level of inflation in a 12 months window around the month of reference as discussed in the Data Appendix.

Table 10

STRUCTURAL ESTIMATES OF THE EFFECT OF BENEFITS ON LABOR SUPPLY

DEPENDENT VARIABLE: ***DID NOT WORK IN REFERENCE WEEK***

$$Y = \beta_{own}\ \text{OwnBenefits} + \beta_{spouse}\ \text{SpouseBenefits} + \phi_1(\text{age, occupation, time}) + \phi_2(\text{spouse's age, spouse's occupation, time}) + X\,\delta + \upsilon$$

	OLS			IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Own Benefits/100	0.027 (0.002)	0.022 (0.015)		0.138 (0.059)	0.145 (0.061)	0.182 (0.054)	
Spouse's Benefits/100		-0.000 (0.001)				-0.174 (0.105)	
Own + Spouse's Benefits/100			0.022 (0.001)				0.084 (0.021)
Controls	ϕ_2=0, X=0	ϕ_2=0, X=0	ϕ_2=0, X=0	ϕ_2=0, X=0	ϕ_2=0, controls	ϕ_2=0, X=0	ϕ_2=0, X=0
Instruments (**)				set I	set I	set II	set II
Sample (***)	A	B	B	A	A	B	B
N:	26858	49790	49790	26858	26848	49782	49782
ELASTICITIES							
Own Benefits	0.148	0.137		0.746	0.785	1.118	
Spouse's Benefits		-0.001				-0.208	
Family Benefits			0.160				0.615

(**) **Instruments used:** set I denotes rural*age6064*year92, rural*age6064*year93 and rural*age65up*after. Set II consists of set I plus rural*spoage55up*year92, rural*spoage55up*year93. (***) **Sample used:** sample A denotes males 50-70, either single or with spouse not older than 50, with a defined occupation; sample B denotes all males 50-70 with a defined occupation. **Notes:** In column (2) and (6), coefficients for own benefits and spouse's benefits are statistically different at the 1% level.

Table 11

STRUCTURAL ESTIMATES OF THE EFFECT OF BENEFITS ON LABOR SUPPLY

DEPENDENT VARIABLE: ***HOURS PER WEEK***

$$Y = \beta_{own}\,\text{OwnBenefits} + \beta_{spouse}\,\text{SpouseBenefits} + \phi_1(\text{age, occupation, time}) + \phi_2(\text{spouse's age, spouse's occupation, time}) + X\,\delta + \upsilon$$

	OLS			IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Own Benefits/100	-1.48 (0.10)	-1.23 (0.08)		-7.49 (3.17)	-8.11 (3.31)	-9.72 (2.89)	
Spouse's Benefits/100		-0.10 (0.07)				8.27 (5.68)	
Own + Spouse's Benefits/100			-1.23 (0.05)				-4.78 (1.16)
Controls	ϕ_2=0, X=0	ϕ_2=0, X=0	ϕ_2=0, X=0	ϕ_2=0, X=0	ϕ_2=0, controls	ϕ_2=0, X=0	ϕ_2=0, X=0
Instruments (**)				set I	set I	set II	set II
Sample (***)	A	B	B	A	A	B	B
R-squared	0.0975	0.1070	0.1102				
N:	26834	49746	49746	26834	26825	49746	49746
ELASTICITIES							
Own Benefits	-0.025	-0.029		-0.129	-0.140	-.0.229	
Spouse's Benefits		-0.000				0.038	
Family Benefits			-0.035				-0.134

(**) **Instruments used:** set I denotes rural*age6064*year92, rural*age6064*year93 and rural*age65up*after. Set II consists of set I plus rural*spoage55up*year92, rural*spoage55up*year93. (***) **Sample used:** sample A denotes males 50-70, either single or with spouse not older than 50, with a defined occupation; sample B denotes all males 50-70 with a defined occupation.

Table 12

STRUCTURAL ESTIMATES OF THE EFFECT OF BENEFITS ON LABOR SUPPLY

DEPENDENT VARIABLE: ***MONTHLY EARNINGS***

$Y = \beta_{own}$ OwnBenefits + β_{spouse} SpouseBenefits + ϕ_1(age, occupation, time) + ϕ_2(spouse's age, spouse's occupation, time) + $X\,\delta + \upsilon$

	OLS			IV			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Own Benefits	-0.05 (0.02)	-0.002 (0.017)		-2.64 (1.19)	-3.06 (1.31)	-2.15 (1.23)	
Spouse's Benefits		0.379 (0.051)				2.75 (2.68)	
Own + Spouse's Benefits			0.038 (0.020)				-0.80 (0.535)
Controls	ϕ_2=0, X=0	ϕ_2=0, X=0	ϕ_2=0, X=0	ϕ_2=0, X=0	ϕ_2=0, controls	ϕ_2=0, X=0	ϕ_2=0, X=0
Instruments (**)				set I	set I	set II	set II
Sample (***)	A	B	B	A	A	B	B
R-squared	0.0201	0.0183	0.0236				
N:	26858	49782	49782	26848	26848	49782	49782
ELASTICITIES							
Own Benefits	-0.008	-0.000		-0.409	-0.475	-0.451	
Spouse's Benefits		0.015				0.118	
Family Benefits			0.010				-0.202

(**) **Instruments used:** set I denotes rural*age6064*year92, rural*age6064*year93 and rural*age65up*after. Set II consists of set I plus rural*spoage55up*year92, rural*spoage55up*year93. (***) **Sample used:** sample A denotes males 50-70, either single or with spouse not older than 50, with a defined occupation; sample B denotes all males 50-70 with a defined occupation.

Table 13

REDUCED FORM ESTIMATES OF THE IMPACT OF THE REFORM ON LABOR SUPPLY OUTCOMES

$$Y_{ijt} = \alpha + \phi_2(ANTIC) + \phi_2(POSTIC) + \sum_{m \in M} \beta_{Ym} I_m + \beta_t AFT + \beta_l RUR + \beta_k AGE_k + \beta_{2k}(AGE_k \times RUR) + \beta_{3k}(AFT \times AGE_k) + \beta_4(RUR \times AFT) + \vartheta$$

	Did not Work Ref Week				
	(1)	(2)	(3)	(4)	(5)
age6064*year92*rural	0.047	0.039	0.048	0.047	0.049
	(0.034)	(0.035)	(0.042)	(0.053)	(0.054)
age6064*year93*rural	0.102	0.094	0.105	0.102	0.103
	(0.033)	(0.034)	(0.042)	(0.052)	(0.052)
age65up*(year>91)*rural	0.066	0.065	0.067	0.063	0.040
	(0.039)	(0.039)	(0.040)	(0.100)	(0.115)
ANTIC=1		-0.039	-0.033		
		(0.040)	(0.042)		
ANTIC=2			0.044		
			(0.038)		
ANTIC=3			0.000		
			(0.035)		
ANTIC=4			0.005		
			(0.033)		
ANTIC=5			-0.007		
			(0.030)		
ANTIC				0.001	-0.007
				(0.018)	(0.007)
ANTIC squared/100				-0.003	-0.003
				(0.035)	(0.035)
POSTIC					0.005
					(0.016)
POSTIC squared /100					0.085
					(0.215)
P-value for ANTIC variables		0.3617	0.7998	0.9957	0.3734

Variables definitions: ANTIC denotes the number of years until becoming potentially eligible to old-age benefits. That is a function of age, occupation and time. POSTIC denotes the number of years since becoming potentially eligible to old-age benefits. That is a function of age, occupation and time.
Coefficients not reported: age, occupation, time, age-occupation, time-occupation, age-time effects; dummy for married, quadratic on spouse's age
Notes: Number of observations in each of the regressions is 29209. Standard errors in parenthesis. Sample includes males for which occupation is defined, aged 50-64, who are either single or whose spouses are not older than 50. Additional regressors not included in the table are main effects on age, occupation and time plus secondary effects on age-occupation, time-occupation and age-time.

Table 14

TRIPLE DIFFERENCES ESTIMATES FOR DIFFERENT EDUCATIONAL GROUPS

Education	No Schooling				Some Schooling			
Outcomes / Years	(1) Means 1990	(2) 1988-90	(3) 1990-92	(4) 1990-93	(5) Means 1990	(6) 1988-90	(7) 1990-92	(8) 1990-93
Benefit Take Up Rates	**0.1038**	**-0.0652**	**0.0650**	**0.2727**	**0.1329**	**0.0410**	**0.1577**	**0.3963**
	(0.0141)	**(0.0426)**	**(0.0453)**	**(0.0469)**	**(0.0201)**	**(0.0445)**	**(0.0464)**	**(0.0466)**
Monthly Benefit Value	**6.89**	**-4.48**	**8.29**	**27.51**	**65.67**	**74.47**	**39.87**	**83.73**
	(0.97)	**(10.27)**	**(10.36)**	**(12.85)**	**(24.90)**	**(52.13)**	**(46.39)**	**(50.42)**
Worked Last Week	0.8981	0.0566	-0.0636	-0.1554	0.9394	0.0060	-0.0790	-0.0909
	(0.0140)	(0.0388)	(0.0457)	(0.0450)	(0.0144)	(0.0334)	(0.0376)	(0.0375)
Total Hours Per Week	44.40	5.14	-3.27	-8.47	48.31	0.76	-5.50	-6.90
	(0.77)	(2.27)	(2.43)	(2.42)	(0.96)	(2.14)	(2.13)	(2.10)
Monthly Earnings	231.41	115.43	-100.65	-83.97	432.09	-73.07	42.64	145.55
	(60.64)	(77.14)	(70.81)	(72.77)	(41.09)	(138.20)	(110.79)	(117.22)
Number of observations		11695	12330	12457		20459	21779	22416

Notes: Sample consists of males 55-64, at the years reported above, who are currently working or have worked in the last 4 years. All regressions control for year, rural/urban occupation and cohort fixed effects and all secondary interactions those variables. Non-treated group is males aged 55-59, treated control group is males 60-64. Columns (1) and (5) refer to the means for the treated group (rural males, 60-64) in 1990. Standard errors of the estimates are reported in parenthesis. Monthly earnings and benefit values refer to values in Reais of 1997.

Table 15

PANEL A: FEMALES BENEFIT TAKE-UP RATES, BY AGE AND YEAR

Age	Year 81	Year 85	Year 90	Year 95
45-49	10.4	11.4	13.2	12.8
50-54	16.6	17.5	20.4	20.4
55-59	22.1	25.7	27.3	38.9
60-64	34.4	38.6	44.1	60.8
65-69	48.9	55.7	60.8	70.5
70-74	63.8	69.2	77.0	79.4
75-79	77.1	77.9	82.9	84.7
80-84	78.5	84.1	89.2	87.6
85-89	82.1	83.4	89.4	87.9
elderly: 60-89	**53.2**	**58.2**	**64.0**	**73.0**

PANEL B: FEMALES AVERAGE BENEFITS, BY AGE AND YEAR

Age	Year 81	Year 85	Year 90	Year 95
45-49	25.8	33.0	49.7	48.5
50-54	49.2	56.3	80.6	77.0
55-59	60.2	82.0	99.6	109.3
60-64	89.9	109.9	116.6	152.3
65-69	94.5	123.6	158.0	184.6
70-74	109.0	129.0	186.6	193.8
75-79	136.0	124.9	159.5	202.4
80-84	116.6	147.9	149.3	212.8
85-89	113.4	140.8	160.9	225.6
elderly: 60-89	108.8	128.8	165.2	196.1

Notes: Tabulation based on the PNAD several years.

Table 16
AGE GAP RELATIVE TO SPOUSE

	Males	Females
25-29	1.8	-4.6
30-34	3.0	-4.2
35-39	3.6	-4.2
40-44	4.4	-4.3
45-49	5.0	-4.0
50-54	5.7	-3.8
55-59	6.2	-3.6
60-64	6.9	-3.1
65-69	8.2	-2.6
70-74	9.3	-1.8
75-79	10.4	-0.9
80-84	11.4	0.4

Notes: Tabulation based on the PNAD of 1985

Table 17

TABLE OF MEANS

	1985					
	ALL		T1=0		T1=1	
	Mean	S.E.	Mean	S.E.	Mean	S.E.
SS BENEFITS	R$ 85.08	2.30	R$ 85.87	2.55	R$ 77.76	2.07
SS+SURVIVOR BENEFITS	R$ 163.86	3.37	R$ 171.91	3.72	R$ 89.86	2.01
SS TAKE-UP	0.400	0.004	0.101	0.003	0.762	0.013
SS+SURVIVOR TAKE-UP	0.675	0.004	0.655	0.005	0.865	0.010
AGE	63.464	0.077	62.580	0.079	71.585	0.132
RURAL	0.189	0.004	1.571	0.008	1.000	0.000
HEAD	0.650	0.004	0.656	0.005	0.596	0.015
ONE PERSON HHOLD	0.171	0.003	0.165	0.004	0.227	0.012
INDEPENDENT	0.179	0.003	0.173	0.004	0.229	0.012
NO SCHOOL.	0.501	0.005	0.466	0.005	0.822	0.011
SCHOOL.<4	0.335	0.004	0.355	0.005	0.153	0.011
SCHOOL 4 UP	0.164	0.003	0.179	0.004	0.025	0.005
WORKED REF WEEK	0.213	0.004	0.225	0.004	0.106	0.009
# CHILDREN EVER BORN	4.150	0.054	4.134	0.054	5.975	0.474
# LIVING CHILDREN	3.245	0.040	3.232	0.040	4.689	0.373
Observations	14652		13437		1215	

	1995							
	ALL		T2=0 & T3=0		T2=1		T3=1	
	Mean	S.E.	Mean	S.E.	Mean	S.E.	Mean	S.E.
SS BENEFITS	R$ 102.95	3.13	R$ 104.01	3.58	R$ 76.76	6.37	R$ 109.74	3.33
SS+SURVIVOR BENEFITS	R$ 215.00	4.39	R$ 225.22	5.02	R$ 135.18	7.23	R$ 157.03	3.65
SS TAKE-UP	0.398	0.005	0.363	0.005	0.490	0.022	0.725	0.016
SS+SURVIVOR TAKE-UP	0.735	0.005	0.717	0.005	0.758	0.019	0.923	0.010
AGE	63.654	0.087	63.159	0.094	59.629	0.129	72.117	0.168
RURAL	0.155	0.004	0.026	0.002	1.000	0.000	1.000	0.000
HEAD	0.725	0.005	0.729	0.005	0.731	0.019	0.677	0.017
ONE PERSON HHOLD	0.202	0.004	0.203	0.004	0.146	0.016	0.229	0.015
INDEPENDENT	0.207	0.004	0.208	0.004	0.148	0.016	0.231	0.015
NO SCHOOL.	0.420	0.005	0.377	0.005	0.622	0.021	0.761	0.016
SCHOOL.<4	0.371	0.005	0.388	0.005	0.315	0.020	0.210	0.015
SCHOOL 4 UP	0.209	0.004	0.235	0.005	0.063	0.011	0.028	0.006
WORKED REF WEEK	0.254	0.004	0.252	0.005	0.406	0.021	0.170	0.014
# CHILDREN EVER BORN	4.749	0.042	4.519	0.043	5.898	0.213	6.522	0.173
# LIVING CHILDREN	3.768	0.032	3.629	0.033	4.536	0.162	4.790	0.126
Observations	11419		10071		564		784	

ALL: AGE 55 UP
T1=1, RURAL, AGE 65 UP, YEAR 85
T2=1, RURAL, AGE 55-64, YEAR 95
T3=1, RURAL, AGE 65 UP, YEAR 95

Table 18

FIRST-STAGE REGRESSIONS, DATA FOR 85 & 95

	(1) SS RECEIVER	(2) SS+SURVIVOR'S RECEIVER	(3) SS BENEFITS / 100	(4) SS+SURVIVOR'S BENEFITS / 100
RURAL, AGE 55-64, AFTER	0.233	0.172	0.570	0.384
	(0.045)**	(0.042)**	(0.288)*	(0.399)
RURAL, AGE 65-OVER, AFTER	0.089	-0.042	0.344	-0.311
	(0.043)*	(0.040)	(0.274)	(0.380)
AFTER	0.207	0.224	0.538	-0.029
	(0.033)**	(0.031)**	(0.211)*	(0.292)
RURAL	0.169	0.046	0.541	0.023
	(0.039)**	(0.036)	(0.251)*	(0.348)
AFTER, RURAL	-0.139	0.027	-0.332	0.267
	(0.037)**	(0.035)	(0.240)	(0.332)
_nchever==1	-0.081	0.093	-0.701	0.069
	(0.013)**	(0.012)**	(0.085)**	(0.117)
_nchever==2	-0.114	0.107	-0.746	0.429
	(0.012)**	(0.011)**	(0.077)**	(0.107)**
_nchever==3	-0.141	0.114	-0.856	0.196
	(0.010)**	(0.010)**	(0.067)**	(0.093)*
_nchever==5	-0.149	0.108	-0.973	-0.118
	(0.011)**	(0.011)**	(0.073)**	(0.101)
_nchever==7	-0.095	0.135	-0.777	-0.069
	(0.009)**	(0.008)**	(0.057)**	(0.079)
Observations	26057	26057	26057	26057
R-squared	0.50	0.76	0.18	0.28

Notes: The PNAD data sets for 1985 and 1995 were used for the regressions above. AFTER denotes year of 1995. RURAL denotes rural household. Sample consists of unmarried females age 50-80. Omitted regressors are dummies for ages 51 to 80, interactions between age dummies and rural location, and interactions between age dummies and after period. Additional saturated controls consist dummies for each possible interaction of region of residence (South, Southeast, Northeast or Center-West), education (no education, 3 years or less, more than 3 years), and year.

Table 19

REDUCED FORM RESULTS, DATA FOR 85 & 95

	(1) INDEPENDENT LIVING ARRANGEMENT	(2) ONE PERSON HOUSEHOLD	(3) HEAD OF HOUSEHOLD
RURAL, AGE 55-64, AFTER	0.052	0.049	0.069
	(0.039)	(0.039)	(0.045)
RURAL, AGE 65-OVER, AFTER	0.019	0.018	0.020
	(0.037)	(0.037)	(0.043)
_nchever==1	-0.023	-0.019	0.206
	(0.011)*	(0.011)	(0.013)**
_nchever==2	-0.029	-0.026	0.275
	(0.010)**	(0.010)*	(0.012)**
_nchever==3	-0.070	-0.063	0.279
	(0.009)**	(0.009)**	(0.010)**
_nchever==5	-0.120	-0.112	0.295
	(0.010)**	(0.010)**	(0.011)**
_nchever==7	-0.122	-0.117	0.361
	(0.008)**	(0.008)**	(0.009)**
Observations	26057	26057	26057
R-squared	0.23	0.22	0.71

Notes: The PNAD data sets for 1985 and 1995 were used for the regressions above. AFTER denotes year of 1995. RURAL denotes rural household. Sample consists of unmarried females age 50-80. Omitted regressors are dummies for after, rural and after and rural, dummies for ages 51 to 80, interactions between age dummies and rural location, and interactions between age dummies and after period. Additional saturated controls consist dummies for each possible interaction of region of residence (South, Southeast, Northeast or Center-West), education (no education, 3 years or less, more than 3 years of education), and year.

Table 20

OLS RESULTS, DATA FOR 85 & 95

	(1) INDEPENDENT LIVING ARRANGEMENT	(2) ONE PERSON HOUSEHOLD	(3) HEAD OF HOUSEHOLD
SS RECEIVER	0.040	0.038	0.047
	(0.005)**	(0.005)**	(0.006)**
_nchever==1	-0.019	-0.016	0.210
	(0.011)	(0.011)	(0.013)**
_nchever==2	-0.025	-0.022	0.280
	(0.010)*	(0.010)*	(0.012)**
_nchever==3	-0.064	-0.058	0.286
	(0.009)**	(0.009)**	(0.010)**
_nchever==5	-0.114	-0.107	0.302
	(0.010)**	(0.010)**	(0.011)**
_nchever==7	-0.118	-0.114	0.366
	(0.008)**	(0.008)**	(0.009)**
Observations	26057	26057	26057
R-squared	0.23	0.23	0.71

Notes: The PNAD data sets for 1985 and 1995 were used for the regressions above. AFTER denotes year of 1995. RURAL denotes rural household. Sample consists of unmarried females age 50-80. Omitted regressors are dummies for after, rural and after and rural, dummies for ages 51 to 80, interactions between age dummies and rural location, and interactions between age dummies and after period. Additional saturated controls consist dummies for each possible interaction of region of residence (South, Southeast, Northeast or Center-West), education (no education, 3 years or less, more than 3 years of education), and year.

Table 21

SUMMARY RESULTS FOR IV REGRESSIONS USING 1985 & 1995 DATA
ENDOGENOUS REGRESSOR: SS RECEIVER

	(1) INDEPENDENT LIVING ARRANGEMENT	(2) ONE PERSON HOUSEHOLD	(3) HEAD OF HOUSEHOLD	(4) WORKED IN REFERENCE WEEK?
SS RECEIVER	0.224	0.212	0.314	0.070
	(0.156)	(0.154)	(0.182)	(0.157)
_nchever==1	-0.005	-0.002	0.232	0.060
	(0.017)	(0.017)	(0.020)**	(0.017)**
_nchever==2	-0.004	-0.002	0.311	0.037
	(0.021)	(0.020)	(0.024)**	(0.021)
_nchever==3	-0.038	-0.033	0.323	0.035
	(0.024)	(0.024)	(0.028)**	(0.024)
_nchever==5	-0.087	-0.081	0.342	0.037
	(0.025)**	(0.025)**	(0.029)**	(0.025)
_nchever==7	-0.101	-0.097	0.391	0.024
	(0.017)**	(0.016)**	(0.019)**	(0.017)
Observations	26057	26057	26057	26057

Notes: The PNAD data sets for 1985 and 1995 were used for the regressions above. AFTER denotes year of 1995. RURAL denotes rural household. Sample consists of unmarried females age 50-80. Omitted regressors are dummies for after, rural and after and rural, dummies for ages 51 to 80, interactions between age dummies and rural location, and interactions between age dummies and after period. Additional saturated controls consist dummies for each possible interaction of region of residence (South, Southeast, Northeast or Center-West), education (no education, 3 years or less, more than 3 years), and year.

Table 22

SUMMARY RESULTS FOR IV REGRESSIONS USING 1985 & 1995 DATA
ENDOGENOUS REGRESSOR: SS OR SURVIVOR RECEIVER

	(1) INDEPENDENT LIVING ARRANGEMENT	(2) ONE PERSON HOUSEHOLD	(3) HEAD OF HOUSEHOLD	(4) WORKED IN REFERENCE WEEK?
SS+SURVIVOR RECEIVER	0.169	0.161	0.251	-0.250
	(0.134)	(0.132)	(0.152)	(0.132)
_nchever==1	-0.038	-0.034	0.183	0.078
	(0.017)*	(0.017)*	(0.019)**	(0.017)**
_nchever==2	-0.047	-0.043	0.248	0.056
	(0.018)**	(0.017)*	(0.020)**	(0.017)**
_nchever==3	-0.089	-0.081	0.251	0.054
	(0.018)**	(0.018)**	(0.020)**	(0.018)**
_nchever==5	-0.138	-0.130	0.268	0.053
	(0.018)**	(0.017)**	(0.020)**	(0.017)**
_nchever==7	-0.144	-0.139	0.328	0.051
	(0.020)**	(0.019)**	(0.022)**	(0.019)**
Observations	26057	26057	26057	26057

Notes: The PNAD data sets for 1985 and 1995 were used for the regressions above. AFTER denotes year of 1995. RURAL denotes rural household. Sample consists of unmarried females age 50-80. Omitted regressors are dummies for after, rural and after and rural, dummies for ages 51 to 80, interactions between age dummies and rural location, and interactions between age dummies and after period. Additional saturated controls consist dummies for each possible interaction of region of residence (South, Southeast, Northeast or Center-West), education (no education, 3 years or less, more than 3 years), and year.

Table 23

SUMMARY RESULTS FOR IV REGRESSIONS USING 1985 & 1995 DATA
ENDOGENOUS REGRESSOR: SS OR SURVIVOR BENEFITS

	(1) INDEPENDENT LIVING ARRANGEMENT	(2) ONE PERSON HOUSEHOLD	(3) HEAD OF HOUSEHOLD	(4) WORKED IN REFERENCE WEEK?
SS+SURVIVOR'S BENEFITS/100	0.046	0.044	0.070	-0.111
	(0.045)	(0.045)	(0.054)	(0.059)
_nchever==1	-0.026	-0.022	0.202	0.062
	(0.013)*	(0.013)	(0.015)**	(0.017)**
_nchever==2	-0.049	-0.045	0.245	0.077
	(0.022)*	(0.022)*	(0.027)**	(0.029)**
_nchever==3	-0.078	-0.071	0.266	0.047
	(0.013)**	(0.013)**	(0.016)**	(0.017)**
_nchever==5	-0.114	-0.107	0.304	0.013
	(0.012)**	(0.012)**	(0.014)**	(0.016)
_nchever==7	-0.118	-0.114	0.367	0.010
	(0.009)**	(0.009)**	(0.011)**	(0.012)
Observations	26057	26057	26057	26057

Notes: The PNAD data sets for 1985 and 1995 were used for the regressions above. AFTER denotes year of 1995. RURAL denotes rural household. Sample consists of unmarried females age 50-80. Omitted regressors are dummies for after, rural and after and rural, dummies for ages 51 to 80, interactions between age dummies and rural location, and interactions between age dummies and after period. Additional saturated controls consist dummies for each possible interaction of region of residence (South, Southeast, Northeast or Center-West), education (no education, 3 years or less, more than 3 years), and year.

Table 24

TABLE OF MEANS: BOYS

	CONTROL				TREATMENT				DIFF-IN-DIFF		
	BEFORE		AFTER		BEFORE		AFTER				
	Mean	SE	Mean	SE	Mean	SE	Mean	SE	Mean	SE	
Total benefits in household	0.532	0.019	0.620	0.018	0.753	0.026	2.104	0.066	**1.262**	**0.076**	*
Female benefits in household	0.118	0.007	0.163	0.008	0.324	0.016	0.808	0.038	**0.439**	**0.043**	*
Male benefits in household	0.414	0.018	0.457	0.016	0.430	0.021	1.296	0.053	**0.823**	**0.062**	*
# Benefit receivers in household	0.126	0.002	0.118	0.002	0.648	0.017	0.790	0.017	**0.149**	**0.024**	*
# Female beneficiaries in household	0.045	0.001	0.045	0.001	0.291	0.012	0.322	0.012	**0.032**	**0.017**	
# Male beneficiaries in household	0.080	0.002	0.074	0.001	0.357	0.012	0.468	0.013	**0.117**	**0.018**	*
Enrolled in school	0.831	0.002	0.869	0.002	0.658	0.012	0.710	0.011	**0.014**	**0.017**	
Worked in reference week	0.231	0.002	0.233	0.002	0.467	0.013	0.496	0.012	**0.027**	**0.018**	
Worked in reference week for pay	0.119	0.002	0.088	0.002	0.150	0.009	0.104	0.007	**-0.014**	**0.012**	
Total hours per week>0	8.033	0.092	7.232	0.079	16.063	0.488	15.282	0.429	**0.020**	**0.660**	
Total hours per week	0.233	0.002	0.251	0.002	0.471	0.013	0.528	0.012	**0.039**	**0.018**	*
Monthly earnings	16.87	0.40	10.58	0.27	16.97	1.31	10.72	1.03	**0.048**	**1.733**	
Monthly earnings>0	140.76	2.49	119.68	2.25	112.59	5.36	102.21	6.53	**10.695**	**9.094**	
Earnings per hour	0.453	0.009	0.290	0.007	0.213	0.017	0.124	0.011	**0.073**	**0.023**	*
Rural location	0.290	0.003	0.226	0.002	0.867	0.009	0.790	0.010	**-0.013**	**0.014**	
# Females 65 or older	0.039	0.001	0.042	0.001	0.324	0.012	0.290	0.011	**-0.036**	**0.017**	
# Males 65 or older	0.031	0.001	0.030	0.001	0.374	0.012	0.390	0.012	**0.017**	**0.017**	
# Rural female workers older than 15	0.139	0.003	0.235	0.003	0.446	0.018	0.879	0.021	**0.338**	**0.028**	*
# Rural male workers older than 15	0.422	0.005	0.398	0.004	1.398	0.028	1.478	0.027	**0.104**	**0.039**	*
Metropolitan region	0.301	0.003	0.302	0.003	0.049	0.005	0.033	0.004	**-0.017**	**0.008**	*
Number of adults in household	2.331	0.005	2.300	0.005	2.942	0.031	2.938	0.030	**0.026**	**0.043**	
Female-headed household	0.137	0.002	0.151	0.002	0.122	0.008	0.128	0.008	**-0.008**	**0.012**	
# Children age 0-4	0.468	0.004	0.377	0.004	0.400	0.019	0.387	0.019	**0.078**	**0.027**	*
# Children age 5-9	0.848	0.005	0.726	0.005	0.696	0.023	0.669	0.022	**0.095**	**0.033**	*
Oldest daughter in family	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	**0.000**	
Oldest son in family	0.503	0.003	0.522	0.003	0.337	0.012	0.327	0.011	**-0.029**	**0.017**	
Oldest child in family	0.334	0.003	0.349	0.003	0.219	0.011	0.219	0.010	**-0.016**	**0.015**	
Child #2	0.278	0.003	0.287	0.002	0.191	0.010	0.197	0.010	**-0.003**	**0.014**	
Child #3	0.171	0.002	0.171	0.002	0.178	0.010	0.150	0.009	**-0.027**	**0.013**	*
Youngest child in family	0.250	0.002	0.293	0.002	0.307	0.012	0.318	0.011	**-0.032**	**0.017**	
Only child in family	0.050	0.001	0.061	0.001	0.078	0.007	0.084	0.007	**-0.006**	**0.010**	
# Children in family	3.873	0.012	3.517	0.011	3.503	0.062	3.206	0.057	**0.058**	**0.086**	
Head: 1-4 years of schooling	0.431	0.003	0.410	0.003	0.298	0.012	0.287	0.011	**0.011**	**0.017**	
Head: more than 4 years of schooling	0.284	0.003	0.333	0.003	0.049	0.005	0.049	0.005	**-0.049**	**0.008**	*
Head's spouse: no schooling	0.211	0.002	0.185	0.002	0.509	0.013	0.500	0.012	**0.017**	**0.018**	
Head's spouse: 1-4 years of schooling	0.388	0.003	0.359	0.003	0.295	0.012	0.270	0.011	**0.005**	**0.016**	
Head's spouse: more than 4 years	0.247	0.002	0.291	0.002	0.042	0.005	0.059	0.006	**-0.027**	**0.008**	*

Notes: TREATMENT stands for children living in a household with at least one member who benefited from the reform implemented in 1991. This status is based on the variables: # Females, rural, age 55-64; # Males, rural, age 60-64; # Males, rural, age 65 up; # Females, rural, unmarried, age 65 up, where TREATMENT status is determined for a positive number on any of those variables. CONTROL stands for children who were not treated. AFTER stands for observations for 1992 and 1993. BEFORE stands for 1989 and 1990. Asterisks indicate DIFF-IN-DIFF has a t-statistic greater than 2 in absolute value.

Table 25

TABLE OF MEANS: GIRLS

	CONTROL				TREATMENT				DIFF-IN-DIFF		
	BEFORE		AFTER		BEFORE		AFTER				
Total benefits in household	0.564	0.021	0.620	0.019	0.846	0.051	1.959	0.058	**1.056**	**0.082**	*
Female benefits in household	0.126	0.008	0.161	0.009	0.328	0.021	0.759	0.030	**0.396**	**0.038**	*
Male benefits in household	0.438	0.019	0.459	0.016	0.519	0.042	1.200	0.050	**0.660**	**0.070**	*
# Benefit receivers in household	0.129	0.002	0.116	0.002	0.654	0.017	0.754	0.017	**0.113**	**0.024**	*
# Female beneficiaries in household	0.047	0.001	0.043	0.001	0.290	0.012	0.317	0.012	**0.031**	**0.017**	
# Male beneficiaries in household	0.082	0.002	0.073	0.001	0.363	0.013	0.436	0.013	**0.082**	**0.018**	*
Enrolled in school	0.850	0.002	0.886	0.002	0.698	0.012	0.784	0.010	**0.050**	**0.016**	*
Worked in reference week	0.107	0.002	0.116	0.002	0.192	0.010	0.240	0.011	**0.038**	**0.015**	*
Worked in reference week for pay	0.068	0.001	0.052	0.001	0.087	0.007	0.058	0.006	**-0.013**	**0.010**	
Total hours per week>0	0.107	0.002	0.131	0.002	0.194	0.010	0.284	0.011	**0.066**	**0.015**	*
Total hours per week	3.934	0.071	3.716	0.063	6.495	0.379	7.118	0.338	**0.841**	**0.516**	
Monthly earnings	7.673	0.232	5.111	0.173	6.316	0.699	4.346	0.611	**0.593**	**0.972**	
Monthly earnings>0	111.859	2.483	97.662	2.423	72.573	5.440	75.083	7.313	**16.707**	**9.753**	
Earnings per hour	0.439	0.013	0.286	0.017	0.212	0.021	0.091	0.012	**0.032**	**0.033**	
Rural location	0.273	0.003	0.215	0.002	0.843	0.009	0.789	0.010	**0.005**	**0.014**	
# Females 65 or older	0.041	0.001	0.041	0.001	0.332	0.013	0.310	0.012	**-0.021**	**0.017**	
# Males 65 or older	0.032	0.001	0.029	0.001	0.364	0.013	0.382	0.012	**0.021**	**0.018**	
# Rural female workers older than 15	0.141	0.003	0.230	0.003	0.462	0.020	0.871	0.022	**0.319**	**0.030**	*
# Rural male workers older than 15	0.402	0.005	0.381	0.004	1.381	0.029	1.494	0.028	**0.134**	**0.041**	*
Metropolitan region	0.304	0.003	0.305	0.003	0.041	0.005	0.039	0.005	**-0.003**	**0.008**	
Number of adults in household	2.343	0.005	2.287	0.005	2.992	0.032	2.972	0.031	**0.036**	**0.046**	
Female-headed household	0.140	0.002	0.157	0.002	0.136	0.009	0.138	0.009	**-0.015**	**0.013**	
# Children age 0-4	0.473	0.004	0.392	0.004	0.423	0.020	0.400	0.018	**0.058**	**0.028**	*
# Children age 5-9	0.849	0.005	0.727	0.005	0.722	0.025	0.671	0.022	**0.070**	**0.034**	*
Oldest daughter in family	0.543	0.003	0.568	0.003	0.416	0.013	0.453	0.012	**0.013**	**0.018**	
Oldest son in family	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	**0.000**	**0.000**	
Oldest child in family	0.324	0.003	0.343	0.003	0.218	0.011	0.219	0.010	**-0.017**	**0.015**	
Child #2	0.271	0.003	0.285	0.002	0.195	0.010	0.202	0.010	**-0.008**	**0.015**	
Child #3	0.165	0.002	0.167	0.002	0.162	0.010	0.153	0.009	**-0.011**	**0.013**	
Youngest child in family	0.241	0.002	0.285	0.002	0.302	0.012	0.332	0.012	**-0.014**	**0.017**	
Only child in family	0.048	0.001	0.059	0.001	0.082	0.007	0.075	0.007	**-0.019**	**0.010**	
# Children in family	3.831	0.012	3.495	0.011	3.539	0.067	3.194	0.057	**-0.009**	**0.090**	
Head: 1-4 years of schooling	0.431	0.003	0.407	0.003	0.313	0.012	0.305	0.011	**0.016**	**0.017**	
Head: more than 4 years of schooling	0.293	0.003	0.346	0.003	0.045	0.005	0.049	0.005	**-0.049**	**0.008**	*
Head's spouse: no schooling	0.204	0.002	0.180	0.002	0.501	0.013	0.480	0.012	**0.003**	**0.018**	
Head's spouse: 1-4 years of schooling	0.382	0.003	0.354	0.003	0.285	0.012	0.283	0.011	**0.027**	**0.017**	
Head's spouse: more than 4 years	0.260	0.003	0.297	0.003	0.047	0.006	0.057	0.006	**-0.028**	**0.009**	*

Notes: TREATMENT stands for children living in a household with at least one member who benefited from the reform implemented in 1991. This status is based on the variables: # Females, rural, age 55-64; # Males, rural, age 60-64; # Males, rural, age 65 up; # Females, rural, unmarried, age 65 up, where TREATMENT status is determined for a positive number on any of those variables. CONTROL stands for children who were not treated. AFTER stands for observations for 1992 and 1993. BEFORE stands for 1989 and 1990. Asterisks indicate DIFF-IN-DIFF has a t-statistic greater than 2 in absolute value.

Table 26

The enrollment-participation statistics of 10-14 children in Brazil

Child 10-14 Status	89	90	92	93	Change 93-89
Idle	8.97	8.78	7.98	6.75	-2.22
Only Working	8.36	7.53	6.14	5.06	-3.30
Both	9.76	9.83	12.81	13.19	3.43
Only School	72.91	73.86	73.07	75.01	2.10

Boy 10-14 Status	89	90	92	93	Change 93-89
Idle	7.24	6.72	7.16	6.16	-1.08
Only Working	11.17	10.61	8.12	6.53	-4.64
Both	13.53	13.45	17.18	17.68	4.15
Only School	68.06	69.22	67.54	69.63	1.57

Girl 10-14 Status	89	90	92	93	Change 93-89
Idle	10.67	10.86	8.83	7.35	-3.32
Only Working	5.58	4.42	4.10	3.55	-2.03
Both	6.02	6.18	8.32	8.60	2.58
Only School	77.72	78.54	78.76	80.50	2.78

Notes: Source of data is the PNAD household survey for the years of 1989, 1990, 1992 and 1993.

Table 27

Panel A: Relationship with the family head for children 10-14 / Year

	89	90	92	93	Average
Head of family	0.00	0.00	0.08	0.06	0.04
Souse	0.22	0.23	0.18	0.21	0.21
Sons/daughters	93.51	93.54	93.12	93.38	93.39
Other relative	5.34	5.40	5.76	5.69	5.55
Aggregated	0.43	0.47	0.55	0.36	0.45
Boarder	0.01	0.02	0.01	0.01	0.01
Domestic employee	0.48	0.32	0.29	0.27	0.34
Relative of domestic employee	0.01	0.01	0.01	0.01	0.01

Panel B: Relationship with the household head for children 10-14 / Year

	89	90	92	93	Average
Head of household	0.00	0.00	0.04	0.03	0.02
Souse	0.13	0.14	0.10	0.11	0.12
Sons/daughters	91.44	91.31	90.73	90.85	91.08
Other relative	7.44	7.63	8.20	8.29	7.90
Aggregated	0.44	0.50	0.57	0.39	0.48
Boarder	0.03	0.06	0.03	0.02	0.03
Domestic employee	0.48	0.32	0.29	0.27	0.34
Relative of domestic employee	0.04	0.04	0.03	0.04	0.04

Panel C: Family characteristics for children 10-14 / Year

Family in the household	89	90	92	93	Average
primary family	97.72	97.57	97.37	97.15	97.45
secondary family	2.13	2.26	2.44	2.65	2.37
3rd family	0.14	0.13	0.18	0.19	0.16
4th family	0.01	0.04	0.01	0.01	0.01
5th family	0.00	0.01	0.00	0.00	0.00

Notes: Source of data is the PNAD household survey for the years of 1989, 1990, 1992 and 1993.

Table 28

Panel A

Living arrangements of the children (10-14 years old) in Brazil

	OVERALL		URBAN LOCATION		RURAL LOCATION	
# ELDERLY 60 AND UP CORESIDING	MEAN	S.E.	MEAN	S.E.	MEAN	S.E.
year 81	0.161	0.0026	0.160	0.0031	0.163	0.0049
year 85	0.155	0.0025	0.148	0.0029	0.171	0.0049
year 88	0.166	0.0034	0.161	0.0039	0.177	0.0066
year 89	0.157	0.0034	0.155	0.0040	0.162	0.0067
year 90	0.164	0.0034	0.157	0.0040	0.180	0.0067
year 92	0.161	0.0031	0.150	0.0035	0.194	0.0071
year 93	0.162	0.0032	0.154	0.0035	0.187	0.0069
ANY ELDERLY 60 AND UP CORESIDING?						
year 81	0.138	0.0022	0.137	0.0026	0.140	0.0040
year 85	0.132	0.0020	0.126	0.0023	0.144	0.0039
year 88	0.138	0.0027	0.147	0.0052	0.147	0.0052
year 89	0.131	0.0027	0.129	0.0032	0.135	0.0053
year 90	0.138	0.0028	0.132	0.0032	0.149	0.0053
year 92	0.134	0.0025	0.124	0.0027	0.163	0.0059
year 93	0.135	0.0025	0.127	0.0028	0.157	0.0057

Panel B

Living arrangements of the elderly (60 and up) in Brazil

	OVERALL		URBAN LOCATION		RURAL LOCATION	
# CHILDREN 10-14 CORESIDING	MEAN	S.E.	MEAN	S.E.	MEAN	S.E.
year 81	0.297	0.0048	0.275	0.0054	0.354	0.0102
year 85	0.257	0.0041	0.229	0.0044	0.334	0.0091
year 88	0.262	0.0053	0.238	0.0058	0.333	0.0120
year 89	0.239	0.0052	0.219	0.0056	0.300	0.0121
year 90	0.243	0.0051	0.216	0.0055	0.320	0.0117
year 92	0.234	0.0046	0.214	0.0049	0.296	0.0107
year 93	0.235	0.0045	0.217	0.0049	0.299	0.0108
ANY CHILDREN 10-14 CORESIDING?						
year 81	0.208	0.0030	0.194	0.0034	0.244	0.0063
year 85	0.187	0.0027	0.169	0.0030	0.236	0.0059
year 88	0.192	0.0036	0.176	0.0040	0.239	0.0079
year 89	0.180	0.0035	0.169	0.0040	0.210	0.0075
year 90	0.180	0.0034	0.163	0.0038	0.226	0.0074
year 92	0.180	0.0032	0.168	0.0036	0.217	0.0072
year 93	0.178	0.0032	0.167	0.0035	0.219	0.0073

Table 29

FIRST STAGE REGRESSIONS

	(1) TOTAL BENEFITS IN HOUSEHOLD / 100	(2) MALE BENEFITS IN HOUSEHOLD / 100	(3) FEMALE BENEFITS IN HOUSEHOLD / 100
# Females, rural, age 55-64 x AFTER	0.838	0.334	0.504
	(0.104)**	(0.082)**	(0.053)**
# Males, rural, age 60-64 x AFTER	0.815	0.761	0.054
	(0.122)**	(0.108)**	(0.038)
# Females, rural, unmar., age 65 up x AFTER	1.086	-0.041	1.127
	(0.150)**	(0.062)	(0.134)**
# Males, rural, age 65 up x AFTER	1.389	1.190	0.200
	(0.098)**	(0.088)**	(0.039)**
# Females, rural, age 55-64	-0.582	-0.500	-0.082
	(0.072)**	(0.058)**	(0.031)**
# Males, rural, age 60-64	0.155	0.149	0.006
	(0.076)*	(0.064)*	(0.025)
# Females, rural, unmarried, age 65 up	-0.753	-0.322	-0.431
	(0.117)**	(0.084)**	(0.070)**
# Males, rural, age 65 up	-2.317	-2.129	-0.188
	(0.147)**	(0.136)**	(0.045)**
# Females 65 or older	1.308	0.180	1.128
	(0.094)**	(0.072)*	(0.055)**
# Males 65 or older	2.952	2.895	0.057
	(0.150)**	(0.141)**	(0.042)
Rural location	0.254	0.178	0.076
	(0.071)**	(0.063)**	(0.032)*
Metropolitan area?	-0.027	-0.006	-0.020
	(0.039)	(0.036)	(0.014)
Number of adults in the household	0.280	0.230	0.050
	(0.019)**	(0.018)**	(0.007)**
Female-headed household	-0.254	-0.485	0.231
	(0.109)*	(0.088)**	(0.051)**
Household with head's spouse	0.066	0.032	0.034
	(0.074)	(0.046)	(0.057)
Head: 1-4 years of schooling	0.085	0.077	0.008
	(0.015)**	(0.013)**	(0.006)
Head: more than 4 years of schooling	0.547	0.449	0.098
	(0.039)**	(0.035)**	(0.017)**
Head's spouse: no schooling	-0.231	-0.248	0.017
	(0.107)*	(0.092)**	(0.044)
Head's spouse: 1-4 years of schooling	-0.134	-0.152	0.018
	(0.110)	(0.095)	(0.044)
Head's spouse: more than 4 years	0.036	-0.083	0.119
	(0.120)	(0.103)	(0.049)*
Observations	133206	133206	133206
R-squared	0.07	0.06	0.06

Notes: The PNAD data sets for 1989, 1990, 1992 and 1993 were used for the regressions above. AFTER denotes the years of 1992 and 1993. RURAL denotes rural household for females and rural occupation in the last 4 years for males. The sample consists of all children age 50-80, with the exception of the ones from the Northern states, whose rural households are not surveyed. Regressors omitted from the table are age dummies, dummies for interactions between rural location and year, interactions between rural location and state of residence, sibling availability and birth order variables, race dummies, and the number of male and female rural workers older than 15. Standard errors assume clustering at the household level.

Table 30

REDUCED FORM ESTIMATES

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
	ENROLLED IN SCHOOL		WORKED IN REF WEEK FOR PAY		WORKED IN REFERENCE WEEK?		MONTHLY EARNINGS, IN R$ 97		TOTAL HOURS PER WEEK, ALL JOBS	
	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
Elderly variables X AFTER										
# Females, rural, age 55-64 x AFTER	-0.024	0.045	0.024	-0.010	0.003	-0.066	7.194	0.470	1.199	-1.465
	(0.028)	(0.027)	(0.019)	(0.017)	(0.028)	(0.024)**	(2.841)*	(1.814)	(1.038)	(0.846)
# Males, rural, age 60-64 x AFTER	0.055	0.006	-0.062	0.026	-0.052	0.031	-7.068	3.351	-2.735	1.249
	(0.033)	(0.031)	(0.025)*	(0.018)	(0.034)	(0.027)	(3.831)	(1.804)	(1.306)*	(0.933)
# Females, rural, unmar., age 65 up x AFTER	-0.023	0.084	-0.022	-0.050	-0.042	-0.047	1.380	-2.433	-0.570	-1.918
	(0.038)	(0.035)*	(0.028)	(0.023)*	(0.038)	(0.035)	(3.444)	(2.184)	(1.508)	(1.236)
# Males, rural, age 65 up x AFTER	0.033	0.045	-0.008	-0.008	-0.085	0.043	-1.540	0.926	-2.525	1.130
	(0.030)	(0.030)	(0.021)	(0.019)	(0.030)**	(0.028)	(3.145)	(2.042)	(1.063)*	(0.958)
Elderly Variables, main effects										
# Females, rural, age 55-64	-0.014	-0.035	-0.005	0.014	-0.004	0.014	-4.603	-0.323	-0.318	0.419
	(0.020)	(0.020)	(0.014)	(0.013)	(0.020)	(0.017)	(2.198)*	(1.477)	(0.771)	(0.646)
# Males, rural, age 60-64	-0.040	0.035	0.042	-0.026	0.026	-0.041	5.331	-2.930	1.030	-1.759
	(0.026)	(0.025)	(0.020)*	(0.014)	(0.027)	(0.019)*	(3.041)	(1.256)*	(1.065)	(0.670)**
# Males, rural, age 65 up	-0.018	-0.019	-0.015	0.007	0.067	0.001	-3.274	-0.732	0.862	-0.303
	(0.024)	(0.025)	(0.018)	(0.017)	(0.024)**	(0.022)	(3.207)	(1.983)	(0.884)	(0.801)
# Females, rural, unmarried, age 65 up	-0.031	-0.079	0.055	0.044	0.056	0.055	4.010	2.297	2.537	2.283
	(0.028)	(0.027)**	(0.022)*	(0.020)*	(0.028)*	(0.024)*	(3.069)	(2.004)	(1.160)*	(0.969)*
# Females 65 or older	0.019	0.031	-0.021	-0.013	-0.007	-0.010	-5.222	-2.493	-0.451	-0.612
	(0.007)**	(0.006)**	(0.006)**	(0.005)*	(0.007)	(0.006)	(1.283)**	(0.769)**	(0.268)	(0.231)**
# Males 65 or older	-0.001	-0.001	0.019	0.005	-0.005	-0.001	3.586	0.789	-0.029	0.045
	(0.009)	(0.008)	(0.008)*	(0.006)	(0.009)	(0.007)	(1.757)*	(1.110)	(0.351)	(0.290)
Household location and occupation										
# Rural female workers older than 15	-0.029	-0.041	0.006	0.010	0.119	0.115	0.021	1.261	3.667	3.450
	(0.004)**	(0.004)**	(0.003)	(0.003)**	(0.004)**	(0.004)**	(0.591)	(0.388)**	(0.167)**	(0.151)**
# Rural male workers older than 15	-0.033	-0.030	-0.002	0.000	0.064	0.011	0.073	-0.455	2.332	0.342
	(0.003)**	(0.003)**	(0.002)	(0.002)	(0.003)**	(0.003)**	(0.436)	(0.270)	(0.115)**	(0.094)**
Rural location	-0.090	-0.043	-0.074	-0.016	0.060	0.054	-3.265	0.069	2.808	0.575
	(0.019)**	(0.018)*	(0.014)**	(0.013)	(0.022)**	(0.018)**	(2.009)	(1.122)	(0.778)**	(0.679)
Metropolitan area?	0.019	0.011	-0.043	-0.031	-0.053	-0.033	-3.728	-1.872	-1.663	-1.134
	(0.003)**	(0.003)**	(0.003)**	(0.003)**	(0.004)**	(0.003)**	(0.792)**	(0.535)**	(0.136)**	(0.118)**
Children's personal characteristics										
AGE==11	-0.007	-0.018	0.020	0.014	0.043	0.022	1.867	0.978	1.464	0.777
	(0.004)	(0.004)**	(0.003)**	(0.002)**	(0.004)**	(0.003)**	(0.311)**	(0.178)**	(0.132)**	(0.093)**
AGE==12	-0.032	-0.050	0.056	0.036	0.104	0.058	6.128	3.433	3.653	2.171
	(0.004)**	(0.004)**	(0.003)**	(0.002)**	(0.004)**	(0.003)**	(0.462)**	(0.311)**	(0.147)**	(0.116)**
AGE==13	-0.092	-0.106	0.112	0.077	0.178	0.110	15.990	7.956	6.927	4.337
	(0.004)**	(0.004)**	(0.004)**	(0.003)**	(0.005)**	(0.004)**	(0.753)**	(0.446)**	(0.173)**	(0.145)**
AGE==14	-0.157	-0.165	0.192	0.132	0.267	0.167	34.911	17.158	11.372	6.946
	(0.005)**	(0.005)**	(0.004)**	(0.004)**	(0.005)**	(0.004)**	(1.053)**	(0.646)**	(0.202)**	(0.174)**
Skin color: black	-0.051	-0.043	0.025	0.018	-0.004	0.019	0.913	0.951	0.335	0.957
	(0.008)**	(0.007)**	(0.007)**	(0.005)**	(0.008)	(0.007)**	(1.170)	(0.802)	(0.284)	(0.258)**
Skin color: brown, or native	-0.019	-0.018	0.010	0.008	-0.005	0.005	-0.549	0.400	-0.051	0.398
	(0.003)**	(0.003)**	(0.003)**	(0.002)**	(0.004)	(0.003)	(0.598)	(0.396)	(0.139)	(0.117)**

REDUCED FORM ESTIMATES (CONTINUATION)

	ENROLLED IN SCHOOL		WORKED IN REF WEEK FOR PAY		WORKED IN REFERENCE WEEK?		MONTHLY EARNINGS, IN R$ 97		TOTAL HOURS PER WEEK, ALL JOBS	
	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS	BOYS	GIRLS
Sibling availability and family composition										
# Children 0-4 in household	-0.046	-0.059	0.018	0.014	0.025	0.018	2.253	1.524	1.008	0.990
	(0.003)**	(0.003)**	(0.002)**	(0.002)**	(0.003)**	(0.002)**	(0.414)**	(0.286)**	(0.102)**	(0.095)**
# Children 5-9 in household	-0.014	-0.020	0.005	0.008	0.017	0.013	0.431	0.553	0.505	0.554
	(0.003)**	(0.002)**	(0.002)*	(0.002)**	(0.003)**	(0.002)**	(0.408)	(0.282)*	(0.099)**	(0.086)**
Oldest daughter in family	0.000	-0.004	0.000	-0.010	0.000	-0.019	0.000	-1.228	0.000	-0.717
	(0.000)	(0.004)	(0.000)	(0.003)**	(0.000)	(0.004)**	(0.000)	(0.474)**	(0.000)	(0.138)**
Oldest son in family	0.020	0.000	-0.006	0.000	-0.008	0.000	-0.145	0.000	-0.406	0.000
	(0.004)**	(0.000)	(0.004)	(0.000)	(0.005)	(0.000)	(0.794)	(0.000)	(0.174)*	(0.000)
Oldest child in family	0.010	0.093	0.004	-0.039	0.035	-0.027	-3.441	-3.917	1.066	-1.766
	(0.007)	(0.007)**	(0.006)	(0.005)**	(0.008)**	(0.006)**	(1.520)*	(0.833)**	(0.289)**	(0.243)**
Child #2	-0.006	0.053	0.012	-0.022	0.046	-0.006	-0.737	-1.985	1.709	-0.745
	(0.006)	(0.005)**	(0.005)*	(0.004)**	(0.006)**	(0.005)	(1.157)	(0.654)**	(0.222)**	(0.194)**
Child #3	-0.005	0.026	0.005	-0.012	0.027	-0.008	-1.324	-0.593	0.820	-0.576
	(0.005)	(0.005)**	(0.004)	(0.004)**	(0.006)**	(0.005)	(0.938)	(0.616)	(0.210)**	(0.184)**
Youngest child in family	0.001	0.017	-0.014	-0.019	-0.016	-0.015	-3.176	-2.027	-0.531	-0.653
	(0.004)	(0.004)**	(0.004)**	(0.003)**	(0.005)**	(0.004)**	(0.755)**	(0.493)**	(0.170)**	(0.142)**
Only child in family	-0.025	-0.016	0.005	0.014	0.009	0.013	2.085	1.422	0.391	0.658
	(0.007)**	(0.007)*	(0.006)	(0.005)**	(0.008)	(0.006)*	(1.330)	(0.812)	(0.291)	(0.222)**
# children in family	0.004	0.017	-0.001	-0.004	-0.001	-0.003	-0.537	-0.450	-0.047	-0.233
	(0.001)**	(0.001)**	(0.001)	(0.001)**	(0.001)	(0.001)**	(0.276)	(0.167)**	(0.054)	(0.047)**
Adults and household structure										
Number of adults in the household	0.020	0.017	-0.009	-0.008	-0.024	-0.015	-0.932	-0.429	-0.828	-0.538
	(0.002)**	(0.002)**	(0.002)**	(0.001)**	(0.002)**	(0.002)**	(0.351)**	(0.241)	(0.072)**	(0.060)**
Female-headed household	0.033	0.027	0.016	0.024	-0.024	0.014	-0.180	2.123	-1.014	0.494
	(0.010)**	(0.010)**	(0.009)	(0.007)**	(0.010)*	(0.008)	(2.473)	(1.668)	(0.400)*	(0.326)
Household with head's spouse	-0.023	0.000	0.004	0.016	0.006	0.015	2.822	2.201	-0.939	0.884
	(0.020)	(0.021)	(0.018)	(0.014)	(0.021)	(0.018)	(2.473)	(1.464)	(0.878)	(0.620)
Head: 1-4 years of schooling	0.079	0.051	-0.027	-0.011	-0.032	-0.015	-2.499	-0.259	-1.525	-0.608
	(0.005)**	(0.004)**	(0.004)**	(0.003)**	(0.005)**	(0.004)**	(0.696)**	(0.452)	(0.176)**	(0.149)**
Head: more than 4 years of schooling	0.125	0.073	-0.063	-0.029	-0.081	-0.031	-7.118	-2.748	-3.264	-1.198
	(0.005)**	(0.005)**	(0.004)**	(0.003)**	(0.005)**	(0.004)**	(0.901)**	(0.542)**	(0.191)**	(0.162)**
Head's spouse: no schooling	0.014	0.005	-0.004	0.016	-0.014	0.012	-3.803	0.901	-0.660	0.418
	(0.011)	(0.011)	(0.009)	(0.007)*	(0.011)	(0.009)	(2.395)	(1.746)	(0.417)	(0.342)
Head's spouse: 1-4 years of schooling	0.102	0.062	-0.029	0.005	-0.020	0.005	-5.499	0.048	-1.320	-0.081
	(0.010)**	(0.010)**	(0.009)**	(0.007)	(0.010)*	(0.008)	(2.432)*	(1.769)	(0.400)**	(0.327)
Head's spouse: more than 4 years	0.112	0.080	-0.049	0.002	-0.058	0.002	-7.921	-0.442	-2.636	-0.012
	(0.010)**	(0.010)**	(0.009)**	(0.007)	(0.010)**	(0.008)	(2.453)**	(1.743)	(0.397)**	(0.326)
Observations	66873	66333	66811	66263	66811	66263	66873	66333	66864	66327
R-squared	0.16	0.14	0.09	0.06	0.26	0.14	0.07	0.05	0.25	0.12

Notes: The PNAD data sets for 1989, 1990, 1992 and 1993 were used for the regressions above. AFTER denotes the years of 1992 and 1993. RURAL denotes rural household for females and rural occupation in the last 4 years for males. Sample consists of all children age 50-80, with the exception of the ones from the Northern states, whose rural households are not surveyed. Regressors omitted from this table are dummies for interactions between rural location and year, and interactions between rural location and state of residence.

Table 31

ACTUAL AND COUNTERFACTUAL VALUES FOR TREATED GROUP, AFTER THE REFORM

	BOYS			GIRLS		
	ACTUAL	COUNTER-FACTUAL	EFFECT OF REFORM	ACTUAL	COUNTER-FACTUAL	EFFECT OF REFORM
ENROLLED IN SCHOOL	0.714	0.700	**0.014**	0.788	0.737	**0.051**
	(0.003)	(0.003)	**(0.004)**	(0.003)	(0.003)	**(0.004)**
WORKED IN REFERENCE WEEK	0.498	0.548	**-0.050**	0.241	0.253	**-0.012**
	(0.005)	(0.005)	**(0.007)**	(0.004)	(0.004)	**(0.006)**
WORKED IN REF WEEK FOR PAY	0.104	0.118	**-0.014**	0.060	0.069	**-0.009**
	(0.002)	(0.002)	**(0.003)**	(0.001)	(0.002)	**(0.002)**
MONTHLY EARNINGS	11.06	10.56	**0.50**	4.66	3.72	**0.94**
	(0.38)	(0.39)	**(0.55)**	(0.18)	(0.18)	**(0.26)**
TOTAL HOURS PER WEEK, ALL JOBS	15.34	16.63	**-1.29**	7.27	7.47	**-0.20**
	(0.17)	(0.17)	**(0.24)**	(0.12)	(0.12)	**(0.17)**

Notes: The treated group consists of all children age 10-14 with at least one elderly affected by the reform in their household (for which not all excluded variables are equal to zero). Reduced form regression estimates, as reported in Table 30, are used to construct the actual and counterfactual values of the outcome variables. The actual values are the average predicted values from the reduced form regressions. The counterfactual is constructed by subtracting the effect of the excluded variables from the fitted values from the same regression. The effect of the reform is the average difference between the actual value and the counterfactual.

Table 32

STRUCTURAL ORDINARY LEAST SQUARES ESTIMATES

	(1)	(2)	(3)	(4)
	ENROLLED IN SCHOOL			
	BOYS		**GIRLS**	
Total benefits in household	0.001 (0.000)**		0.000 (0.000)	
Female benefits in household		0.001 (0.000)**		0.002 (0.001)**
Male benefits in household		0.000 (0.000)*		0.000 (0.000)
	WORKED IN REFERENCE WEEK?			
	BOYS		**GIRLS**	
Total benefits in household	-0.001 (0.000)**		-0.001 (0.000)**	
Female benefits in household		-0.002 (0.000)**		-0.001 (0.000)**
Male benefits in household		-0.001 (0.000)**		-0.001 (0.000)**
	WORKED IN REFERENCE WEEK FOR PAY			
	BOYS		**GIRLS**	
Total benefits in household	-0.001 (0.000)**		-0.001 (0.000)**	
Female benefits in household		-0.002 (0.000)**		-0.001 (0.000)*
Male benefits in household		-0.001 (0.000)**		-0.001 (0.000)**
	TOTAL HOURS PER WEEK, ALL JOBS			
	BOYS		**GIRLS**	
Total benefits in household	-0.052 (0.010)**		-0.029 (0.009)**	
Female benefits in household		-0.080 (0.018)**		-0.044 (0.021)*
Male benefits in household		-0.045 (0.011)**		-0.025 (0.011)*
	MONTHLY EARNINGS, IN REAIS OF 1997			
	BOYS		**GIRLS**	
Total benefits in household	-0.162 (0.070)*		-0.078 (0.027)**	
Female benefits in household		-0.396 (0.081)**		-0.126 (0.058)*
Male benefits in household		-0.105 (0.084)		-0.066 (0.033)*

Notes: The PNAD data sets for 1989, 1990, 1992 and 1993 were used for the regressions above. AFTER denotes the years of 1992 and 1993. RURAL denotes rural household for females and rural occupation in the last 4 years for males. Sample consists of all children age 50-80, with the exception of the ones from the Northern states, whose rural households are not surveyed. Regressors omitted from this table are dummies for interactions between rural location and year, and interactions between rural location and state of residence.

Table 33

STRUCTURAL INSTRUMENTAL VARIABLES ESTIMATES

	(1)	(2)	(3)	(4)
	ENROLLED IN SCHOOL			
	BOYS		**GIRLS**	
Total benefits in household	0.009		0.045	
	(0.013)		(0.014)**	
Female benefits in household		-0.031		0.080
		(0.029)		(0.029)**
Male benefits in household		0.035		0.022
		(0.021)		(0.021)
	WORKED IN REFERENCE WEEK?			
	BOYS		**GIRLS**	
Total benefits in household	-0.039		-0.009	
	(0.013)**		(0.013)	
Female benefits in household		-0.020		-0.069
		(0.029)		(0.029)*
Male benefits in household		-0.051		0.030
		(0.021)*		(0.020)
	WORKED IN REFERENCE WEEK FOR PAY			
	BOYS		**GIRLS**	
Total benefits in household	-0.009		-0.011	
	(0.009)		(0.009)	
Female benefits in household		-0.001		-0.043
		(0.020)		(0.019)*
Male benefits in household		-0.014		0.010
		(0.015)		(0.014)
	TOTAL HOURS PER WEEK, ALL JOBS			
	BOYS		**GIRLS**	
Total benefits in household	-0.947		-0.203	
	(0.482)*		(0.447)	
Female benefits in household		0.387		-2.220
		(1.128)		(1.029)*
Male benefits in household		-1.801		1.109
		(0.787)*		(0.698)
	MONTHLY EARNINGS, IN REAIS OF 1997			
	BOYS		**GIRLS**	
Total benefits in household	0.586		0.490	
	(1.366)		(0.921)	
Female benefits in household		4.209		-1.883
		(2.731)		(1.832)
Male benefits in household		-1.735		2.034
		(2.207)		(1.428)

Notes: The PNAD data sets for 1989, 1990, 1992 and 1993 were used for the regressions above. AFTER denotes the years of 1992 and 1993. RURAL denotes rural household for females and rural occupation in the last 4 years for males. Sample consists of all children age 50-80, with the exception of the ones from the Northern states, whose rural households are not surveyed. Regressors omitted from this table are dummies for interactions between rural location and year, and interactions between rural location and state of residence. Instruments for the benefit amount variables are # Females, rural, age 55-64 x AFTER; # Males, rural, age 60-64 x AFTER; # Females, rural, unmarried, age 65 up x AFTER; and # Males, rural, age 65 up x AFTER.

Table 34

STRUCTURAL INSTRUMENTAL VARIABLES ESTIMATES

	ENROLLED IN SCHOOL					
	BOYS			GIRLS		
SAMPLE	Total Benefits (1)	Male Benefits (2)	Female Benefits	Total Benefits (3)	Male Benefits (4)	Female Benefits
A) Age 10-14						
# Adults in the household = 1	0.265 (0.146)	-0.079 (0.936)	0.259 (0.145)	0.343 (0.195)	0.149 (0.246)	0.423 (0.225)
# Adults in the household = 2	0.003 (0.020)	0.044 (0.031)	-0.111 (0.072)	0.041 (0.021)	-0.047 (0.036)	0.206 (0.057)
# Adults in the household = 3	-0.005 (0.025)	0.053 (0.037)	-0.077 (0.045)	0.048 (0.028)	0.085 (0.039)	-0.009 (0.051)
# Adults in the household = 4 or more	0.042 (0.027)	0.078 (0.047)	-0.003 (0.056)	0.044 (0.028)	0.040 (0.040)	0.051 (0.048)
B) Age 10-11						
# Adults in the household = 1	0.399 (0.360)	0.444 (0.283)	0.329 (0.463)	-0.178 (0.171)	-0.547 (0.553)	-0.672 (0.146)
# Adults in the household = 2	-0.007 (0.029)	0.018 (0.042)	-0.110 (0.133)	-0.000 (0.030)	-0.009 (0.046)	0.021 (0.103)
# Adults in the household = 3	-0.011 (0.035)	0.006 (0.046)	-0.039 (0.054)	0.020 (0.032)	0.050 (0.041)	-0.039 (0.064)
# Adults in the household = 4 or more	0.042 (0.038)	0.130 (0.113)	-0.018 (0.068)	-0.030 (0.037)	-0.039 (0.073)	-0.021 (0.071)
C) Age 12-14						
# Adults in the household = 1	0.273 (0.149)	0.217 (0.322)	0.279 (0.156)	0.402 (0.252)	0.208 (0.283)	0.590 (0.358)
# Adults in the household = 2	0.004 (0.026)	0.062 (0.044)	-0.129 (0.084)	0.061 (0.026)	-0.055 (0.047)	0.251 (0.065)
# Adults in the household = 3	-0.008 (0.033)	0.109 (0.059)	-0.134 (0.072)	0.055 (0.040)	0.085 (0.055)	0.009 (0.073)
# Adults in the household = 4 or more	0.032 (0.033)	0.070 (0.055)	-0.029 (0.077)	0.065 (0.041)	0.056 (0.052)	0.084 (0.071)

Notes: This table reports the coefficients on total benefits, male benefits and female benefits in regression similar to the ones reported in Table 33. An adult is defined as a person older than 20. In the PNAD of 1993, the proportion of children 10-14 living in households with 1, 2, 3, and 4 or more adults is respectively 9.5%, 64.8%, 15.6% and 10.1%.

Appendix A. The model

A simple model can be used to understand some of the inefficiencies that may be related to child labor. The discussion below borrows from Baland and Robinson (1998). The setup of the model assumes that child labor and education compete for children's scarce time. That is a useful feature if we are to make statements about children's enrollment and labor supply responses.

The model has two periods, t=1,2 and there is no discounting to make things simpler. At the beginning of the period there are L_P parents, each with a predetermined number of children, n_i. Parents in the first period decide how to allocate their children's time between labor and education and supply their own labor inelastically. Parents' ability level is denoted by A_i, measured in efficiency units, normalized by the productivity of child labor.

In t=1, children's allocation of time between human capital accumulation and working is determined by their parents, who control all the household resources, including the proceeds from child labor and make the decisions about bequests and savings. Let λ_c denote the fraction of child time working, $1-\lambda_c$ the fraction in human capital accumulation. Investment in human capital accumulation pays off in t=2 in terms of a higher productivity level, determined by the education production function $h(1-\lambda_c, A_i)$, where the second argument of function h is parental productivity level.

Parents are endowed with a joint utility function defined over their consumption c_p in periods t=1,2 and the utility of their children. Assuming separability, we have:

$$W_p\left(c_p^1, c_p^2, W_c(c_c)\right) \equiv U\left(c_p^1\right) + U\left(c_p^2\right) + \delta_i W(c_c) \tag{15}$$

The parameter δ measures the extent of parents' altruism. U and W are both twice continuous differentiable, strictly increasing and strictly concave. Parents are not allowed to borrow and therefore their budget constraints are:

$$c_p^1 = A + \lambda_c - s \tag{16}$$

$$c_p^2 = A - b + s + f \tag{17}$$

$$c_c = h(1-\lambda_c, A) + b \tag{18}$$

The first-order conditions with respect to *b*, λ_c and *s* are:

$$\left\{ U'(c_p^2) - \delta W'(c_c) \right\} b = 0 \tag{19}$$

$$U'(c_p^1) = \delta\, W'(c_c)\, h'(1-\lambda_c, A) \tag{20}$$

$$\left\{ U'(c_p^1) - U'(c_p^2) \right\} s = 0 \tag{21}$$

The condition for efficiency in the level of human capital accumulation sets the marginal return to education equal to its opportunity cost in terms of child labor:

$$h'(1-\lambda_c, A) = 1 \tag{22}$$

From the efficiency condition in equation (22), one can conclude that there must be heterogeneity in the amount of time dedicated to human capital accumulation. The higher is the productivity of one's parents, the less time one will spend working as a child and more time at school. When savings and bequests are interior, child labor is only a function of parental ability A and the allocation is efficient.

When bequests are at a corner and savings are not, $U'(c_p^2) > \delta W'(c_c)$ and $h'(1-\lambda_c, A) > 1$. In this situation, child labor is too high.

Appendix B: Background information on the Brazilian Social Security system

As in other Latin American countries, the development of social security in Brazil occurred in piecemeal fashion (Mesa-Lago (1989), Malloy (1979)), with the more powerful and organized urban occupational groups[45] rewarded with earlier social security coverage than the typically less politically active rural workers. By the mid-sixties, practically all Brazilian urban workers were eligible to social security entitlements based on length-of-service, old age or disability.

The first nationwide introduction of the welfare state to Brazilian rural workers - defined as workers in occupations directly related to agriculture, ranching, forestry, fishing or small-scale mining, - happened in 1967 with the establishment of the FUNRURAL (Rural Workers' Assistance Fund). The FUNRURAL was set to work drawing up contracts with hospitals all over the country in order to obtain free medical care for rural workers, with the distinct feature of local management of the funds being responsibility of local peasant organizations.[46] In 1971, the institution of the PRORURAL (Rural Worker's Assistance Program) made rural workers eligible for social security benefits. Under the PRORURAL program, rural workers were entitled to disability and old age benefits only (unlike urban workers who also had access to length-of-service benefits). Despite the difficult access to many parts of the Brazilian hinterland, the PRORURAL program achieved high rates of benefit take-up, especially due to the pre-existent organizational structure laid out by the FUNRURAL (Chiarelli 1976).[47]

For the purposes of gaining access to rural old age benefits, the burden of proving the engagement in rural activities was not too heavy. The law provided for several valid sufficient proofs for past rural activity, namely: individual labor contract or the *Carteira de Trabalho e Previdência Social*;[48] sharecropping or another tenancy agreement; statement by the local rural workers union co-signed by relevant authorities of the Judiciary Power; statement by the Judiciary; a proof of enrollment at the INCRA[49] (Agrarian Reform and Colonization National Institute); documents produced by Social Security itself; and other means at the discretion of the social security administration.[50]

In the month of December of 1995, R$ 430 millions were paid out in rural benefits to 4,264,000 beneficiaries, with an average benefit value of R$100.76 (R$0.96=US$1.00). In this same month, R$1,329 millions were paid out in urban benefits to 5,159,000 beneficiaries, with an average benefit value of R$257.37.

Filgueiras (1998) cites numbers from the CONTAG (Brazilian Confederation of Workers in Agriculture) stating that in the Northeastern region approximately 500,000 age-eligible rural workers do not receive any benefit due to failure to produce the necessary documentation. This problem plagues especially the so-called *bóias-frias*, daily workers in seasonal jobs with little formalization in their labor relations. In this same region, there were then 2,680,000 beneficiaries, which suggests a rough estimate of benefit take-up rates on the order of 5 out of 6 age-eligible elderly. In 1995, there were 822,322 rural beneficiaries in the 60-64 age group, for a rural population of 862,613 at the same age. A naive comparison yields take-up rates in the order of 95%. However, rural residence is not a

[45] The first group to have their pressures rewarded were railroad workers, in 1923, with the Lei Elói Chaves.

[46] In this case, the means may justify the ends. Cynical observers place emphasis on the possibility of government control of peasant organizations as a motivation for the FUNRURAL's adopted organizational design.

[47] Other sources of historical information about Brazilian social security systems are Cardoso de Oliveira (1961) and Barroso Leite (1978).

[48] The *Carteira de Trabalho e Previdência Social* is an individual document where the holder's lifelong labor history should be registered. Every worker in the formal sector is supposed to have one.

[49] The Government institute responsible for agrarian reform and colonization of frontier lands.

[50] I do not have information about the most common documentation used by rural workers to apply for their old-age benefits, but anecdotal evidence suggests that rural workers unions supported the eligibility for the most destitute elderly, some of which did not even have birth certificates to prove their age.

perfect measure of rural occupation, much less of past rural occupation. In that same year, there were 888,729 rural beneficiaries in the 65-69 age group, for a rural population of 733,993 at the same age, yielding a take-up rate of 121%.

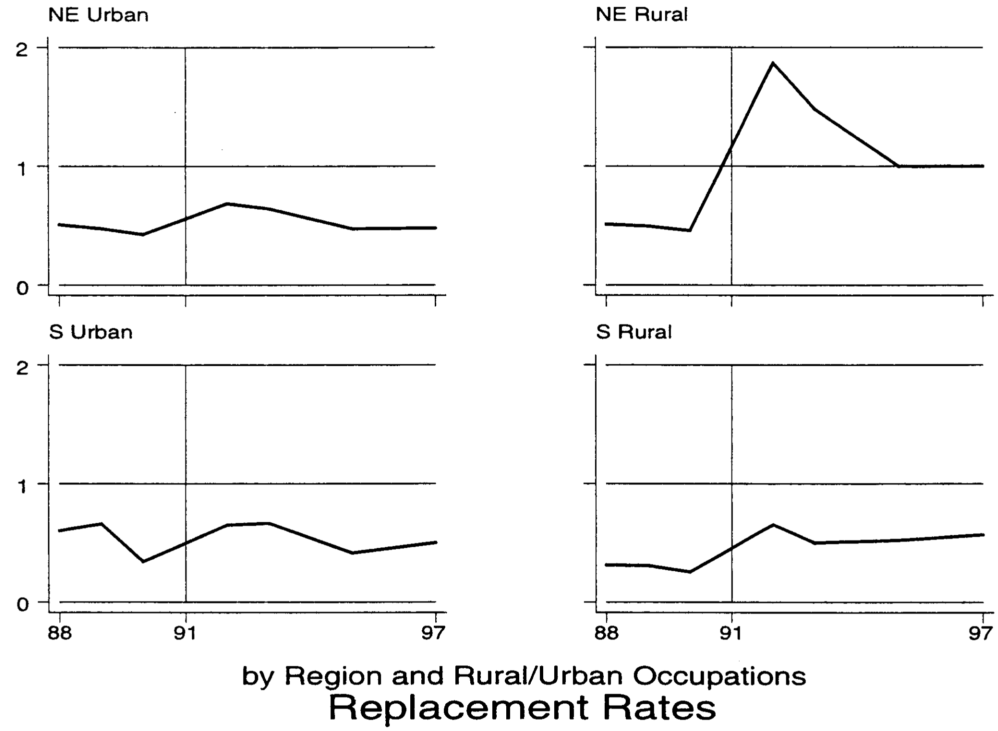

Figure 11: The above figures show the time series for a measure of replacement rates, by occupations and regions, using the data from the PNAD. I calculate replacement rates by dividing mean positive social security benefits received by males age 60-70 by the median earnings by males age 50-59, the oldest 5-year cohort not eligible to old-age benefits. The vertical line in 1991 marks the increase in minimum benefits from ½ to 1 minimum wage, binding for rural beneficiaries. The ratio of benefits to GDP per capita in Brazil is in the very high end of the cross-country distribution, 1.36 in 1989 (International Labor Organization).

These numbers can be explained by either rural workers leaving the rural areas upon retirement or outright fraud in the benefit granting process. Anecdotal evidence emphasizes the incidence of excessive leniency in the process of granting rural pensions in the early nineties. Delgado et alli (1999), in a survey of rural pension receivers in the Southern region, find that 51% of them live in urban areas. The decision of moving to the urban areas may be rationalized by, among other reasons: cities offering lower costs of goods consumed by the elderly (health care); better provision of public goods; savings in housing costs if the elderly move to houses of relatives or their children. As long as newly eligible workers, i.e. male rural workers age60-64, are more likely to be awarded benefits than non-eligible ones, which seems guaranteed, the possibility of fraud weakens my first-stage regressions but has no effect on the consistency of my instrumental variables estimates. The possibility that rural location is an endogenous variable damages any location-based identification strategy, therefore more emphasis will be out on using rural occupation instead of rural location in the empirical model. As shown below, indeed, the first-stage is weaker when rural location is used instead of rural occupation.

Adding up the information above, one can infer that take-up rates are high, probably greater than 3 out of 4 for the 60-64 age group and probably more than 90% for the oldest old.

Figure 11 above shows median replacement rates for rural and urban male workers for both the South, arguably the region with the best living conditions in rural areas and the Northeast, the region with the poorest rural area. Note the marked increase in replacement rates between 1989 and 1992 in rural areas in both regions. In contrast, replacement rates barely changed in urban areas, as expected. Although benefit values paid out to rural workers are low compared to benefits paid out to urban workers, it is important to emphasize the large replacement rates implied by the generalized rural poverty that characterizes some regions in Brazil. Downplaying the usual caveat about measurement errors in earning variables, replacement rates may have been as high as 180% for rural workers in the Northeastern region, where sub-minimum wages are not uncommon, at the aftermath of the increase in benefit values to one minimum wage.

Appendix C: Data Description

The PNAD asks all respondents over age 10 whether they "worked"[51] in the reference week. From this question I generate the labor supply measure *did not worked in the reference week*.

Respondents who did not work in the reference week are asked if they dedicated themselves to activities in agriculture, fishing or animal creation for the subsistence of the persons living in the household. Respondents who asked this question negatively as well are asked if they dedicated themselves to activities of home or well building for their own household. Those who answer this question negatively as well are asked if they had any paid work they did not do because of vacation, strike, disease, bad weather or other reason.

The respondents who answered yes to any of the four sequential questions above are then asked how many *trabalhos* (jobs or activities, meaning both employment, self-employment or even home production activities) they had in the week of reference. The "number of *trabalhos*" question is top-coded at three. For the "main", "secondary" and "other" jobs, the respondents are asked about their total hours of work and monthly earnings, in both money and produce.

Another labor supply measure I analyze is the monthly earnings. Elderly males in Brazilian rural areas may work in unpaid activities whether in family agriculture or household production as an alternative to paid labor. I expect the differences between the results on "did not work in reference week?" and monthly earnings to be due to the nature of work in rural occupations, where self-employment and unpaid work at establishments owned by relatives are common occurrences.

Appendix Table 3 summarizes the means of the main variables of interest for different combinations of the variables "received positive benefits?" and "did not work reference week?", for both rural workers and the whole sample of males age 50-70. Respondents who did not work in the reference week report substantial smaller monthly earnings that the ones who worked. They are also more likely to be single, and if married, their spouses are on average older than the spouses of respondents who worked in the reference week. The variable "total hours of work per week" is also substantially smaller for respondents who did not work in the reference week.

[51] In this sentence, a *trabalho* (work) means a job or activity, comprising both employment and self-employment activities.

Appendix Table 1

QUANTITY OF RURAL BENEFITS OUTSTANDING BY AGE GROUPS

Age	Years	Old Age				Length-of-Service			
		Total	**Males**	**Females**	**Ignored**	**Total**	**Males**	**Females**	**Ignored**
	1992	77,737	–	77,651	86	35	32	3	–
Up to 59	1993	321,969	–	321,907	62	161	139	22	–
	1994	390,590	–	390,545	45	316	290	26	–
	1995	329,434	–	329,395	39	715	681	34	–
	1996	269,323	–	269,295	28	1,311	1,241	70	–
	1997	247,767	–	247,739	28	2,101	1,992	109	–
	1992	207,739	**129,953**	77,560	226	21	20	1	–
60-64	1993	635,750	**326,158**	309,403	189	86	84	2	–
	1994	759,958	**358,761**	401,050	147	167	165	2	–
	1995	726,863	**303,424**	423,327	112	304	299	5	–
	1996	732,491	**273,095**	459,313	83	541	530	11	–
	1997	723,857	**251,349**	472,444	64	738	723	15	–
	1992	481,086	43,160	42,671	395,255	10	–	–	–
65-69	1993	656,280	180,417	196,941	278,922	15	1	1	–
	1994	717,319	277,086	274,982	165,251	47	2	2	–
	1995	747,754	360,973	320,682	66,099	88	2	2	–
	1996	763,566	414,121	346,437	3,008	151	4	4	–
	1997	811,452	433,553	377,730	169	242	5	5	–
	1992	2,134,767	2,604	14,951	2,117,212	15	3	3	2
70 +	1993	2,244,623	12,587	77,800	2,154,236	17	3	3	1
	1994	2,336,111	23,038	127,397	2,185,676	15	3	3	–
	1995	2,379,220	35,646	166,496	2,177,078	19	3	3	–
	1996	2,409,301	63,268	213,878	2,132,155	24	4	4	–
	1997	2,444,670	134,928	271,691	2,038,051	32	4	4	–

Notes: Before 1991, the sex of the rural benefit recipient was not recorded in the DATAPREV computers. Therefore, the sex information for beneficiaries who applied before the cited date is labeled as ignored. I could not get access to any administrative figure available for the year of 1991. Source: *Anuário Estatístico da Previdência*

Appendix Table 2

RURAL PENSIONS OUTSTANDING, QUANTITIES AND VALUES

	QUANTITIES			
YEAR	TOTAL	LOS	OLD AGE	DISABILITY
1995	4,263,917	1,128	3,787,195	475,594
1996	4,237,401	2,026	3,769,648	465,727
1997	3,932,128	3,148	3,513,582	415,398

	AVERAGE VALUES				
YEAR	TOTAL	LOS	OLD AGE	DISABILITY	MIN. WAGE
1995	R$116.48	R$226.24	R$114.40	R$133.09	
1996	R$112.61	R$283.43	R$112.56	R$112.19	R$112.00
1997	R$121.37	R$321.04	R$121.17	R$121.55	R$120.00

Notes: LOS = Length-of-Service; Source: Anuário Estatístico da Previdência (1998)

Appendix Table 3

TABLE OF MEANS

FOR RURAL WORKERS AGE 50-70:				
SS Receiver?	Not SS Receiver	Not SS Receiver	SS Receiver	SS Receiver
Worked Ref Week?	Did Not Work	Worked	Did Not Work	Worked
Proportion	4.30	68.46	8.17	19.07
Monthly Earnings	55.32	411.08	11.31	291.14
Own Benefits Values	0.00	0.00	201.73	191.68
Spouse' Benefit Values	17.23	18.33	51.41	65.33
Total Hours of Work Per Week	16.49	49.58	7.58	42.98
Single	0.21	0.13	0.19	0.14
Spouse's Age if Married	52.22	50.41	57.69	57.12
FOR ALL MALES AGE 50-70:				
Proportion	6.65	54.43	14.32	24.60
Monthly Earnings	130.25	696.07	5.24	670.80
Own Benefits Values	0.00	0.00	547.93	435.46
Spouse' Benefit Values	44.49	40.07	102.34	92.23
Total Hours of Work Per Week	12.14	48.25	1.16	43.33
Single	0.24	0.12	0.17	0.12
Spouse's Age if Married	51.59	49.66	55.95	54.96

Source: PNAD 1989, 1990,1 1992,1993