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Assessing Implicit Redistribution within Social Security Systems: The Case of Argentina

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Assessing Implicit Redistribution within Social Security Systems: the case of Argentina

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Abstract

We assess redistribution in the Argentinean pension and unemployment insurance programs on a lifetime basis. Using household surveys, we simulate lifetime declared labor income and flows of contributions and benefits, and compute the expected present values of income and net flows. We find that the PAYG-DB system in Argentina appears to be regressive, specially in the case of women working in the private sector. Under an alternative scenario that assume a weak enforcement of the law and different discount rates, the results change and the system becomes less regressive or even slightly progressive.

Keywords: social security, redistribution, Argentina.

JEL: H50, H55

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1. Introduction

In this document we assesses the implicit redistribution of the Argentinean pension and unemployment insurance programs on a lifetime basis. Using household surveys we simulate lifetime declared labor income and flows of contributions and benefits, and compute the expected present values of income and net flows. Standard distribution indexes are used to assess the distribution and redistribution implicit in these systems. The main finding is that the Argentinean system is regressive under an strict application of the law. This outcome changes under an alternative scenario that assume a weak enforcement of the system rules.

The paper is organized as follows. Section 2 presents the conceptual framework. A brief description of the old age pension and unemployment insurance programs is presented in section 3. Section 4 describes the data, while section 5 presents the methodology. The main results are discussed in section 6, while section 7 summarize the main findings.

2. Conceptual Framework[2]

Social Security (SS) programs are usually designed to redistribute income from the better to the worst off. Most benefit formulas include explicit redistributive ingredients, like minimum pensions and supplements to small pensions. Even individual accounts DC programs, which are based on the principle of actuarial neutrality, tend to incorporate non-actuarial redistributive components in the real world.

But SS programs also redistribute income through less explicit mechanisms. First, high mortality rates may reduce the returns low income workers get for their contributions in pension programs when unified mortality tables are used (Garrett 1995; Duggan *et al.* 1995; Beach and Davis 1998). Second, government transfers that contribute to finance SS in many countries favor the population that is covered by the programs, which in developing countries tends to be the better off (Rofman *et al.* 2008). Third, low densities of contribution may leave many workers ineligible for benefits. Low income workers have been shown to have particularly low densities of contribution (Forteza *et al.* 2009; Berstein *et al.* 2006). In present case I focus on this last channel, i.e. the redistribution stemming from the fact that low income workers tend to have systematically shorter contribution histories. It should be clear that the impact of different mortality rates and different coverage on implicit redistribution is not assessed.

Micro-simulations of lifetime income and SS contributions and benefits are used to assess SS redistribution. The focus is on intra-generational redistribution: one cohort, current pension rules. An alternative scenario will also be evaluated.

The individual is considered as the unit of analysis, but it should be noticed that redistribution in the SS system may look very different at the family level. Gustman and Steinmeier (2001) show that, when analyzed at the individual level, the U.S. social

[2] This section summarizes the proposal of Research Program developed with the support of the World Bank project "Assessing Implicit Redistribution within Social Insurance Systems", which included five case studies: Argentina and Mexico (Moncarz, 2011), Brazil (Zylberstajn, 2011), Chile (Fajnzylber, 2011) and Uruguay (Forteza and Mussio, 2011).

security looks very redistributive, favoring low income workers, but it looks much less so at the family level (see also Lambert 1993, p 14).

Ideally, the assessment of the redistributive impact of social security programs should be based on the comparison of income distribution with and without social security. This is not the same as comparing pre- and post-social security income (i.e. income minus contributions plus benefits), because social security is likely to induce changes in work hours, savings, wages and interest rates. One possible drawback of these models is the assumption of full rationality, something that has been subject to much controversy, especially regarding long run decisions like those involved in social security. After all, the most appealed rationale for pension programs is individuals' myopia (Diamond, 2005, chap. 4). In turn, much of fiscal incidence analysis is done on the non-behavioral type of assumption. It is usually performed under the assumption that pre-tax income is not affected by the tax system. The approach here proposed is closer to the literature pioneered by Gruber and Wise (1999, 2004), who designed and computed a series of indicators of SS incentives to retire assuming no explicit behavioral responses.

The optimization models have the obvious advantage of incorporating behavioral responses, so not only the direct effects of policies are considered, but also the indirect effects that go through behavioral changes. However, in order to keep things manageable, these theoretically ambitious models necessarily make highly stylized assumptions regarding not only individual preferences and constraints, but also social security programs. Given the goals of the proposed research, this is a serious drawback. Non-behavioral micro-simulations are based on exogenously given work histories and geared to providing insights on the social security transfers that emerge from those histories. Thanks to their relative simplicity, non behavioral models allow for a much more detailed specification of the policy rules and work histories than intertemporal optimization models. An additional advantage of micro-simulations is that the effects are straightforward, so no black-box issues arise. At the very least, it can be expected to capture the first-order impact effects of social security on income distribution. The micro-simulation modeling can thus be seen as a first step in a more ambitious research program that incorporates behavioral responses in a more advanced phase.

3. The Argentinean pension and unemployment programs

The system is regulated by the Law 24241 and is organized as a PAYG-DB scheme.

The conditions salaried workers must meet in order to be entitled to a retirement benefit are the following:[3]

- 30 years of contributions
- 65 years for men and 60 for women. Women, if they choose to, can continue working until reaching 65 years.

[3] We exclude from the analysis people working under any other regime than salaried workers, such as self-employed.

- People that do not comply with the minimum length of contribution can compensate each year of missing contributions with two additional years counted after reaching the minimum retirement age.

People who do not meet the previous conditions can access an old-retirement pension if:

- They are 70 years old.
- Have a minimum of 10 years of contributions.
- Have 5 years of contributions in the 8-year period previous to retirement.

The Health and Social Security System is founded by contributions made by workers and employers. Workers contribute an 11% of the gross salary, while employers contribute a 16%. In June 2011 the maximum gross salary to calculate both contributions was A$ 16213.72 (US$ 3925.85), while the minimum wage was $A 498.89 (US$ 120.79). Workers also contribute a 6% for health insurance, and 1% in case they choose to affiliate to a trade union. Employers contribute a 8% for health insurance.[4]

With respect to the benefits, the monthly payment is divided into two parts:

- A flat payment known as Universal Basic Pension (PBU). In June 2011 the PBU was A$ 667.92 (US$ 161.72). If the person retired under the old-age pension scheme the PBU is 70% of the full amount.
- A compensatory payment (PC) that is equal to 1.5% for each year of contribution, or fraction above six months (with a maximum of 35 years) of the average real gross salary[5] (including the worker contributions to the Social Security System but excluding the employer contributions) over the last 10 years previous retirement. In order to calculate the average gross salary, periods in which the person was not working are excluded. In despite of the legal norm makes reference to the 10 years previous retirement, it is customary to consider the last 120 positive remunerations previous retirement. In June 2011, the maximum amount a person was entitled to receive under the PC was A$ 10507.90 (US$ 2544.28).
- In June 2011, the System guarantied a minimum pension of A$ 1434.29 (US$ 347.28).

With regards to the unemployment insurance, this covers only private-sector workers and is funded with a 1.5% of the firms wage bill paid by the employer, employees make no contribution. Unemployed workers are entitled to a monthly payment that is equal to a half of the maximum wage earned in the six-month period previous to become unemployed, with a maximum of $A 400 (US$ 96.85) and a minimum of A$ 250 (US$ 60.53). The unemployment benefit is paid for up to twelve months depending on the length of contributions before unemployment (there is a minimum of 6 months contributions during the previous 3 years before unemployment), for the first four

[4] Employees' contributions to health insurance is 3% for their own coverage and another 3% to finance health insurance for those already retired. Employers' contributions are divided, but in this case 6% is for the employee health insurance, while the remaining 2% is for those already retired.

[5] The Social Security Secretary of the Labor Ministry is in charge of establishing the mechanism to calculate the average salary. In our case we use real wages deflated by the manufacturing wage index with base second quarter of 2011.

months the benefit is a 100%, between months 5 and 8 is an 85%, and from months 9 to 12 is a 75%. The first benefit is paid after 60 days of becoming unemployed.

4. Data

The data source is the Encuesta Permanente de Hogares (EPH) for the period 1995 to 2003.[6] The EPH is a household survey carried out twice a year, usually in the months of April/May and October. Each household, and each individual who resides in it, is surveyed four consecutive times after which they are dropped from the survey.

The sample we work with includes only individuals that have been observed the four times and that at least in one occasion have declared themselves as employed or unemployed. The variable that identifies the contributing status to the social security system (SS) is available only for salaried employees. Thus, the sample will not include people that have declared a different employment status than salaried employees, when employed or in their previous job when unemployed, in any of the four opportunities they were surveyed.

Because of the potential differences in the coverage of the System across types of workers the public and the private sectors will be considered separately, as well as men and women. We include in the sample only individuals that when employed have not changed sectors, and aged between 18 and 69 years old the four times they were surveyed. In the Tables below we present some descriptive statistics.

Sample size

		Sector	
		Public	**Private**
Gender	**Female**	5,784	11,069
	Male	5,417	12,445

Source: own based on EPH.

Distribution of samples depending on having contributed at least in one out of the four possible occasions

		Public		Private	
		Female	**Male**	**Female**	**Male**
Contributed at least one time	**No**	13.8	5.7	61.9	26.8
	Yes	86.2	94.3	38.1	73.2

Source: own based on EPH.

[6] From the second half of 2003 the EPH was subject to an important methodological change that impedes us to extend the period of analysis, also because of the timing households are survey under the new EPH this is less suitable for the purposes of the present study.

Sample working status (%)

	Public		Private	
	Female	**Male**	**Female**	**Male**
Not Working	12.8	5.7	41.3	17.8
Working	87.2	94.3	58.7	82.2

Sample contributing status (%)

a) All sample

	Public		Private	
	Female	**Male**	**Female**	**Male**
Not contribute	20.5	10.9	72.3	41.1
Contribute	79.5	89.1	27.7	58.9

b) Conditional on working

	Public		Private	
	Female	**Male**	**Female**	**Male**
Not contribute	8.8	5.5	52.7	28.3
Contribute	91.2	94.5	47.3	71.7

Source: own based on EPH.

5. Methodology

5.1. Estimation of contribution status

As it is clear from the sample description, there is an important percentage of cases in which the individual is working but it does not contributes. This behavior is more evident for those working in the private sector, specially for women. Because of this characteristic that emerges from our sample, and under the assumption that those individuals that contribute are not a random draw of the working population, we use the Heckman Selection Model in order to control for the bias that would emerge if the contribution status were estimated without controlling for the probability that an individual could have a job but does not contribute to the Social Security System. In particular, we estimate de following model:

$$L_{it} = x'_{it}\beta^L + \eta_i^L + \varepsilon_{it}^L \qquad (1.a)$$

$$C_{it} = y'_{it}\beta^C + \eta_i^C + \varepsilon_{it}^C \qquad (1.b)$$

where:

L_{it}: a dummy variable equal to 1 if individual i is working and zero otherwise;

C_{it}: a dummy variable equal to 1 if, conditional on working (L_{it}=1), individual i contributes and zero otherwise;

x_{it}: is a set of variables that explain the probability of individual i working;

y_{it}: is a set of variables that explain the probability of individual i contributing;

t: stands for a semester.

Under the assumptions of the Heckman Selection Model, ε_{it}^{L} and ε_{it}^{C} are correlated with each other, such that the estimation of equation (1.b) without taking consideration of (1.a) would render a biased estimation of vector β^{C}.

As just said, equations (1.a) and (1.b) are estimated using the Heckman selection estimator, so the individual effects η_i^{L} and η_i^{C} are recovered as follows:

$$\hat{\eta}_i^{L} = \frac{\sum_{t=1}^{T_i}\left(L_{it} - x'_{it}\hat{\beta}^{L}\right)}{T_i}$$

$$\hat{\eta}_i^{C} = \frac{\sum_{t=1}^{T_i}\left(C_{it} - y'_{it}\hat{\beta}^{C} - \gamma IMR\right)}{T_i}$$

where IMR are the inverse Mills Ratio which are defined as $IMR_{it} = \frac{\phi\left(x'_{it}\hat{\beta}^{L}\right)}{\Phi\left(x'_{it}\hat{\beta}^{L}\right)}$, where ϕ and Φ stand for the normal pdf and cdf respectively.

In sample simulations

The probability of individual *i*, with individual effect $\hat{\eta}_i^{C}$ and conditional on being working, contributing in time *t* is calculated as follows:

$$\tilde{P}_{it}^{C} = y'_{it}\hat{\beta}^{C} + \hat{\gamma} IMR_{it} + \hat{\eta}_i^{C}$$

Then, conditional on $\tilde{L}_{it} = 1$, the contribution status for individual *i* in time *t* is defined as:

$\tilde{C}_{it} = 1$ if $\tilde{P}_{it}^{C} > draw_{it}^{C}$; and 0 otherwise.

where $draw_{it}^{C}$ is a realization from a uniform (0,1) distribution for each period *t*; $\tilde{L}_{it}$ is the simulated working status (equal to 1 if working and to 0 if not working).[7]

Out of sample simulations:

Since in this case the individual effects η_i^{L} and η_i^{C} are not directly observed, they are generated as follows:

$$\tilde{\eta}_i^{L} = \hat{\sigma}_{\eta^{L}}\tilde{z}_i^{L}$$

[7] The probability of individual *i* working at moment *t* is calculated as $\tilde{P}_{it}^{L} = x'_{it}\hat{\beta}^{L} + \hat{\eta}_i^{L}$. Then, the simulated working status is defined as $\tilde{L}_{it} = 1$ if $\tilde{P}_{it}^{L} > draw_{it}^{L}$ and 0 otherwise, where $draw_{it}^{L}$ is a realization from a uniform (0,1) distribution for each period *t*.

$\tilde{\eta}_i^C = \hat{\sigma}_{\eta^C} \tilde{z}_i^C$

where $\hat{\sigma}_{\eta^L}$ and $\hat{\sigma}_{\eta^C}$ are the standard deviations of the individual effects η_i^L and η_i^C respectively, and $\tilde{z}_i^L$ and $\tilde{z}_i^C$ are both pseudo-random draws from a Standard Normal distribution.

Then, the probability of contributing is calculated as:

$$\tilde{P}_{it}^C = y'_{it}\hat{\beta}^C + \hat{\gamma} IMR_{it} + \tilde{\eta}_i^C$$

where t now stands for a month.

Then, conditional on $\tilde{L}_{it} = 1$, the contribution status for individual i in month t is defined as:

$\tilde{C}_{it} = 1$ if $\tilde{P}_{it}^C > draw_{it}^C$; and 0 otherwise

where $draw_{it}^C$ is a realization from a uniform (0,1) distribution for each period t; $\tilde{L}_{it}$ is the simulated working status (equal to 1 if working and to 0 if not working).[8]

5.2. Projection of labor income

We estimate two static random effect models, one for when individual i is working and contributing, and a second one for when individual i is working but does not contribute. In the first case we refer as to formal labor, while in the second case as to informal labor. Given that our main goal is to project income, we are particularly interested in exploring the impact on wages of time invariant and deterministic covariates, like age and education. More specifically, wages are assumed to be governed by the following stochastic processes:

$$\ln w_{it} = x_{it}^{'}\beta^0 + v_i^0 + e_{it}^0 \qquad \text{if } L_{it} = 1 \text{ and } C_{it} = 1 \qquad (2.a)$$

$$\ln w_{it} = x_{it}^{'}\beta^1 + v_i^1 + e_{it}^1 \qquad \text{if } L_{it} = 1 \text{ and } C_{it} = 0 \qquad (2.b)$$

where w_{it} is the real wage[9] received by person i in time t (semester); x_{it} is a set of regressors of personal characteristics, age and education; and the unemployment rate; v_i^0 and v_i^1 are time invariant unobservable characteristics of individual i, and e_{it}^0 and e_{it}^1 are

[8] The out of sample working status are calculated as in Footnote 7, but using $\tilde{\eta}_i^L$ instead of $\hat{\eta}_i^L$.

[9] Wages are deflated using the Wage Index of Manufactures.

both error terms. As long as we expect w_{it} to be stationary we do not introduce any deterministic time trend in the equation.[10]

Predictions according to equation (2) can only be computed for the individuals in the sample, i.e. individuals for which we can compute the individual effects. But the model is used to predict the labor income flow of "newborn" individuals. In this case, we simulate the individual effects:[11]

$$\tilde{v}_i^0 = \hat{\sigma}_{v^0}\tilde{z}_i^0$$

$$\tilde{v}_i^1 = \hat{\sigma}_{v^1}\tilde{z}_i^1$$

where $\hat{\sigma}_{v^0}$ and $\hat{\sigma}_{v^1}$ are the standard deviations of the individual effects $\hat{v}_i^0$ and $\hat{v}_i^1$, respectively, in equation (2). $\tilde{z}_i^0$ and $\tilde{z}_i^1$ are pseudo-random draws from a Standard Normal distribution. Thus, the labor income stream of the newborn individuals is computed as follows:

$$\ln \tilde{w}_{it} = x_{it}^{'}\hat{\beta}^0 + \tilde{v}_i^0 \qquad \text{if } \tilde{L}_{it} = 1 \text{ and } \tilde{C}_{it} = 1$$

$$\ln \tilde{w}_{it} = x_{it}^{'}\hat{\beta}^1 + \tilde{v}_i^1 \qquad \text{if } \tilde{L}_{it} = 1 \text{ and } \tilde{C}_{it} = 0$$

5.3. Computation of SS contributions and benefits

Based on the simulated work histories we compute social contributions and benefits according to the existing laws as described in Section 3. We include the unemployment insurance program together with the retirement program. Working this way we are implicitly assuming that individuals leave no survivors and suffer no sickness or disability. We assume that all individuals claim their retirement benefits as soon as they are eligible to do so. We work with an alternative scenario under the assumption of a weak enforcement of the law, in particular vesting periods.

5.4. Computation of pre- and post-social-security lifetime income, and distribution indexes

The expected pre-SS lifetime labor income is the present value of the expected simulated labor income:

[10] In previous drafts we estimated equation (2) by OLS including an autoregressive component for the second and following periods of a working spell and an static equation for the first period. However, since our panel has a small T, the results would suffer from a serious bias because of the inclusion on the RHS of the lagged dependent variable.

[11] The implicit assumption here is that the distribution of the individual effects does not vary with age or cohort.

$$\bar{W}(r) = \sum_{a=0}^{a=r-1} p(a) W(a) (1+\rho)^{-a}$$

where:
r is age at retirement;
$p(a)$ is the probability of worker's survival at age a;
$W(a)$ is total labor cost (including employee and employer contributions to SS, health and unemployment insurance, and for trade unions membership) at age a;
ρ is the discount rate (we use a 3% rate).

We compute the lifetime Social Security Wealth (SSW) as an indicator of SS transfers. Social Security Wealth is the present value of expected net transfers to SS. It can be obtained as the sum of the discounted expected flows of old-age pensions (PB) and unemployment benefits (UB) net of contributions (SSC).

$$SSW = PB + UB - SSC$$

$$PB = \sum_{a=r}^{a=\max\ age} p(a) B(a,r)(1+\rho)^{-a}$$

$$UB = \sum_{a=0}^{a=r-1} p(a) UB(a)(1+\rho)^{-a}$$

$$SSC = \sum_{a=0}^{a=r-1} p(a) C(a)(1+\rho)^{-a}$$

where:
$\max age$ is maximum potential age;
$B(a,r)$ is the amount of retirement benefits at age a conditional on retirement at age r;
$UB(a)$ is the unemployment benefit collected at age a;
$C(a)$ is the amount of contribution at age a to social security;

Finally, the expected post-SS lifetime labor income is defined as $\bar{W}(r) + SSW$.

Two alternatives of pre- and post-SS life time labor incomes are calculated. Firstly only considering labor income subject to contributions ($\tilde{L}_{it} = 1$ and $\tilde{C}_{it} = 1$), and secondly including also labor income from which the person does not contribute ($\tilde{L}_{it} = 1$ and $\tilde{C}_{it} = 0$).

6. Results

To assess the redistributive impact of social security we use some descriptive statistics of pre-SS lifetime income, social security wealth, and social security wealth to pre-SS income ratio. We also calculate two progressiveness measures, the Lorenz curve of pre-SS lifetime income and its associated concentration curve for the post-SS lifetime income (ranked by the pre-SS lifetime income). Finally two additional indexes are calculated, the Gini Coefficient (for pre- and post-SS lifetime income) and the Reynolds-Smolensky-type index of net redistributive effect (Lambert, 1993, p 256).

This index assesses the redistributive impact of a program computing the area between the Lorenz pre-program income and the concentration post-program income. A positive (negative) value indicates that the program reduces (increases) inequality.[12]

For each population group we work with a simulated population of 10000 individuals, starting at an age of 18 years old. Each individual potentially work until she/he is 69 years old (inclusive) if she/he does not retire earlier. The maximum age an individual lives is 100 years old. In equations (1) and (2) two dummies are included to control for the level of education (see Tables A.1 and A.3 for a definition of these variables). These dummies are assigned following the proportion in the samples used for the estimation of equation (1). Even when some education levels are completed at an age older than 18, we assume that the proportion of population with such level of education has it from the beginning of the simulated period. In the case of the selection equation we also include a dummy variable equal to one if the individual is male/female and 65/60 years old or more.

Table A.1 in the Appendix reports the results for the working and contribution status equations. In results do not reported here we obtained that for women in the private sector the IMR was not statistically significant, also the selection model generates too low simulated contribution densities when comparing with observed ones. Thus, for women in the private sector we estimate equations (1.a) and (1.b) without assuming the two error terms are correlated between them.

For the most of the variables we obtain the expected signs. In the case of the age effect, the interpretation is more difficult since this variable enter the regression through a cubic polynomial, a better picture is given by Figure A.1 that shows the observed and out-of-sample simulated densities. The goodness of fit is quite high when measured by the proportion of correct predictions for the in-sample simulations (see Table A.2).

With regards to the income equation, the results are reported in Table A.3. As expected the education dummies are positive and increasing in the level of education, they are always statistically significant. However is not clear if they have a higher marginal effect when the individual is working and contributing, this appears to be the case for men in the private sector, but surprisingly not for the other three groups, specially for the highest level of education (complete tertiary-university). For the age coefficients these are mostly also significant. Using Schaffer and Stillman (2010) test of overidentifying restrictions we have that in all cases but women in the public sector when not contributing, we do not reject the hypothesis that there is no systematic difference between the fixed and random estimates.

Table A.4 to A.6 show some statistics about the simulated populations in relation to the history of contribution and access to a retirement benefit. Here we assume that each individual retires as soon as she/he meets the required conditions, thus is no surprise that the average age of retirement for those that access to a retirement benefit is almost equal to the minimum required age, 60 for women and 65 for men (see Table A.4). With respect to the proportion of the simulated populations, excluding those that never contributed, that access to a retirement benefit, these are higher for public workers. A higher proportion of men access to a benefit than what happens with women,

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[12] The Gini coefficients and the Reynolds-Somelinsky index were estimated using DASP (Araar and Duclos, 2009).

independently of the sector they work in, but this difference is very much important in the case of the private sector, which does not come as a surprise since for women in the private sector our sample shows only a 27.7% of cases with a declared contribution status (this percentage goes up to 47.3% when the reference group are those that declare a working status), while for men the percentage is 58.9% (71.7%). Finally, in Table A.6 we report the average years of contributions of the simulated populations. The average length of contributions is longer in the public than in the private sector (considering all individuals, regardless of whether they accessed a retirement benefit). This outcome is surely a reflection of the higher labor stability enjoyed by public workers relative to private ones. Because of men need to contribute until they are as least as 65 years old while for women the minimum age is 60 years, men contribute more than women. When we restrict the analysis only to individuals that access to a pension benefit the years of contributions are in all cases above the minimum requirement.

Moving our attention to the redistributive effects of the social security system, in Table 1 we present some descriptive statistics for the simulated populations for the pre-SS lifetime income, social security wealth, and social security wealth to pre-SS lifetime income ratio.

When only considering formal labor income, for which people contribute to social security, average expected pre-SS lifetime income goes between 88.8 thousand for women in the private sector to 253.2 thousand for men in the public sector. In the case of men the difference between public and private sector is quite less important than for the case of women, 25% in the case of mean against a 103% for women. Men, on average, have a higher pre-SS lifetime income than women, specially in the private sector with an average value 129% higher than for women, while in the public sector the difference is 40%. This important difference against women in the private sector is a reflection of their much lower probability of contribution.

If we now include income form jobs for which there was no contribution, informal income, the pattern between public and private sectors, and women and men is more or less much the same, with a slight improvement in the relative position of people working in the private sector relative to those in the public sector, and for women relative to men. These changes are explained because it is in the private sector, specially for women, where the is a higher percentage of people that have a job but do not contribute.

The simulated populations show a large degree of income dispersion given by the ratio between the average income of the 99 and 1 percentile. These differences are much important in the private sector, and for women than for men. As expected, the distributions are skewed to the right, with the median pre-SS lifetime income consistently lower than the mean values.

Average Social Security Wealth (SSW) is never positive, it ranges from -39.8 thousand (men in the public sector) to -14.4 thousand (women in the private sector).[13] SSW is considerably more negative for men than for women, with a 2.1 to 1 relation in the public sector and 2.5 to 1 in the private sector. The differences between public and private sectors are less important in the case of men, but not for women. Measured by

[13] When including income from informal jobs, SSW is equal to zero for everyone that never hold a formal job.

the difference between percentiles 1 and 99, within each category, SSW shows a higher dispersion among men, specially in the private sector, than among women.

On average, the SSW to pre-SS lifetime income ratio ranges from -19.9% among women in the private sector to -12.2% among women in the public sector. Ranked by this ratio, there is an important dispersion, as for percentile 1 the ratio is about -22%, while for percentile 99 its range is between -15.2% and -7.1%. The figures are not much affected if we consider also the income from not contributing jobs, however women and private sector workers show an improvement relative to men and public workers respectively. The reason for this is the higher probability of the former having an informal job.

The results just summarized show that social security redistributes wealth in the case of Argentina. We now move to look in what direction this redistribution goes.

Figure 1.a shows the relationship between pre-SS lifetime income and Social Security Wealth. The negative slope would suggest that the redistribution is progressive. However, there is a clear distinction when including income from jobs that do not contribute. In this second case we have that those who derived some of their income from informal jobs increase their pre-SS lifetime income while SSW does not change, and also we are including individuals that never contributed so their SSW is zero, while they have a positive pre-SS lifetime income. As we can appreciate from Figures 1.a and 1.b, these individuals are low earners having, in average, a low pre-SS lifetime income.

In Figure 2 we plot the Lorenz curves for pre-SS lifetime income and their corresponding concentration curves for post-SS lifetime income. With the exception of women in the private sector the two curves are very close to each other. The differences are even less important when including income from informal labor. These patterns are reflected in the Gini coefficients for the pre-SS and post- lifetime incomes (see Table 2). When only income form contributing jobs are considered, the system is regressive for men in the private sector and women in the public sector (in both cases the Gini increases a 1.5%, approximately 0.6 ppt.), while not surprisingly there is a considerable regressiveness for women in the private sector (the Gini increases a 3.5%, 1.9 ppt.). For men in the public sector the system is slightly progressive (the Gini falls 0.4%, 0.13 ppt.). The same pattern emerges when looking at the Reynolds-Smolensky-type index, which are negative for the first three groups, specially for women in the private sector, while it is positive for men in the public sector. It is also possible to observe that, in absolute values, the system have a greater impact in the case of the private than the public sector

The results change quite importantly when we also include income from informal employment, over which there is no contribution. Now the system is progressive for men, either in the private or public sector, and it has almost no impact for women in the public sector, while still is regressive for women in the private sector, but now with an increase in the Gini of just 0.08 ppt., just a 4% of the previous 1.9 ppt. These changes are also reflected in the Reynolds-Smolensky-type index.

The failure of the Argentinean social security program to reducing inequality represents a puzzle. The vesting period condition might help explain it. A possible explanation for our results is that as Forteza *et al.* (2009) show, large segments of the population have a low probability of having contributed thirty or more years when they reach retirement ages, and this probability is particularly low among low income individuals (see Figure 3 and 4). Forteza and Ourens (2011) show that the implicit rate of return on contributions paid to these programs is very low when individuals have short contribution histories. Hence, low income individuals might be getting a bad deal from social security because they have short histories of contribution. Figure 3 shows the kernel densities for the average gross wage per year of contribution distinguishing between people that contributed to the system and do not get a retirement benefit and those who do. Figure 4 shows the average wage per year of employment for each of the two groups when including income from informal jobs. It is very clear from the simulated data that low wage earners have a much lower chance of fulfilling with the conditions the system requires to obtain a pension at the age of retirement.[14]

Another *de facto* progressive component, maybe the most important, is the weak enforcement of the law when deciding if a person fulfills the minimum requirements to access a retirement benefit. To account for the *de facto* application of the law we run a very extreme alternative scenario under a weak enforcement of the conditions to access to a benefit:

Scenario A: strict application of the SS rules (benchmark case already presented above).
Scenario B: everyone that having worked are 70 years old and do not access to a retirement benefit is granted the minimum pension.[15]

Also, we run the simulations using two alternative discount rates, 1% and 2%.

As reported in Tables 4 and 5, for both scenarios, and when including only income form formal jobs, the lower the discount rate the system becomes more regressive when the system is indeed regressive, or more progressive when the system is indeed progressive. If income form informal jobs are included there is no clear pattern, with the outcomes varying depending on the scenario and the population group we look at.

Not surprisingly, an scenario with an extreme weak enforcement of the system rules makes it progressive for all population groups whatever the discount rate we work with. This improvement is more important for the private than for the public sector (with the exception of men when only formal income is considered), and for women (men) than for men (women) in the private (public) sector. These results are mainly driven by the lower probability that people in the private sector, and particularly women, have of fulfilling the conditions for a retirement benefit. It emerges clearly, and once again without being a surprise, the case of women in the private sector, which as shown

[14] A very parsimonious linear probability model such as $R_i = \delta_1 \tilde{\eta}_i^C + \delta_2 \ln\left(\overline{w}_i\right) + u_i$, where $R_i = 1$ if the person get a retirement benefit, and zero otherwise, $\tilde{\eta}_i^C$ is the simulated individual fixed effect obtained from equation (1), and $\overline{w}_i$ is the average gross wage (including employer and employee contributions) per year of contribution, explains a large proportion of the probability of getting a pension, with a 1% increase in the average wage increasing the probability of getting a pension between 0.08-0.30% depending on the type of worker and the sector, if we exclude women in the private sector the effect ranges between 0.20-030%.

[15] A less extreme scenario would to assume that those who do not fulfill the conditions for retirement benefit are paid only the PBU.

before have a much lower probability of obtaining a retirement benefit if the law is strictly enforced. These patterns emerge independently of the inclusion or not of informal labor income.

7. Concluding remarks

Argentina Social Security System, based on a PAYG-DB scheme, appears to be regressive, specially for women working in the private sector. This result is somehow reduced when we include into the inequality measures incomes derived from jobs people do not make a contribution to the system. The first result constitutes, a priori, a puzzle, that might find explanation in the lower probability that low-income earners have of accessing to a retirement benefit as reported in Forteza *et al.* (2009). This effect is much more important in the case of the private sector, specially for women. However, under a very extreme scenario with a weak enforcement of the social security law, the system becomes progressive. These changes are more likely for women than for men, and in the private than in the public sector. Both cases could be explained because of the lower probability women and those working in the private sector have of fulfilling the conditions to have access to a retirement benefit. Using different discount rates have different effects depending on the population group and the scenario we work with.

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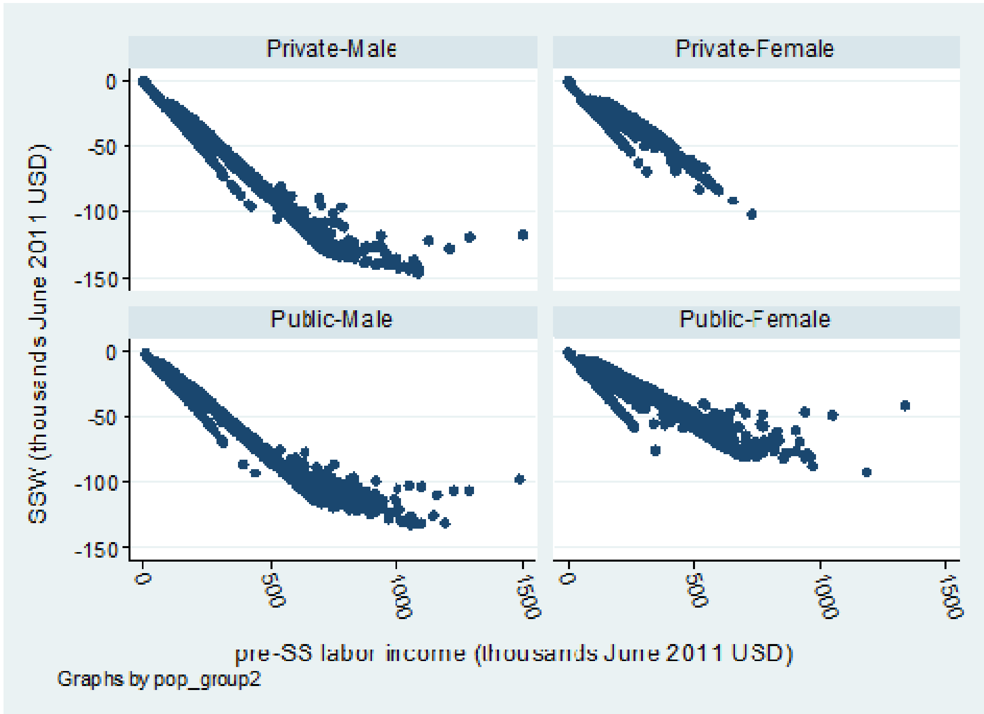
Table 1
Pre-social security lifetime labor income and social security wealth
(in thousands of June 2011 US dollars)

		Excluding Informal Jobs			Including Informal Jobs		
		Pre-SS Income	SSW	SSW / Pre-SS Income	Pre-SS Income	SSW (*)	SSW / Pre-SS Income (*)
Private-Male	Mean	203.4	-36.2	-19.1	233.1	-35.6	-14.2
	P1	3.5	-119.0	-22.7	44.1	-118.9	-22.5
	Median	171.9	-29.2	-17.7	202.5	-28.7	-15.6
	P99	686.1	-0.8	-15.2	685.3	0.0	0.0
	Skewness	1.3	-1.2	-0.3	1.6	-1.1	1.2
Private-Female	Mean	88.8	-14.4	-19.9	106.9	-12.1	-10.8
	P1	0.4	-54.8	-22.7	1.1	-53.1	-22.6
	Median	56.6	-12.7	-22.6	84.4	-8.9	-11.3
	P99	407.8	-0.1	-10.4	397.6	0.0	0.0
	Skewness	1.7	-1.4	1.2	1.4	-1.4	0.1
Public-Male	Mean	253.2	-39.8	-15.8	269.2	-39.8	-14.2
	P1	36.1	-111.9	-21.8	67.9	-111.9	-21.0
	Median	222.7	-34.5	-15.7	237.8	-34.5	-15.1
	P99	773.0	-7.8	-12.8	773.0	-7.8	-6.1
	Skewness	1.5	-1.0	-1.7	1.6	-1.0	0.9
Public-Female	Mean	180.3	-18.7	-12.2	203.3	-18.7	-9.7
	P1	7.3	-65.5	-21.8	18.0	-65.5	-21.8
	Median	148.8	-13.6	-9.9	181.2	-13.6	-8.8
	P99	607.6	-1.6	-7.1	607.6	-1.5	-2.6
	Skewness	1.4	-1.6	-1.2	1.5	-1.6	-1.4

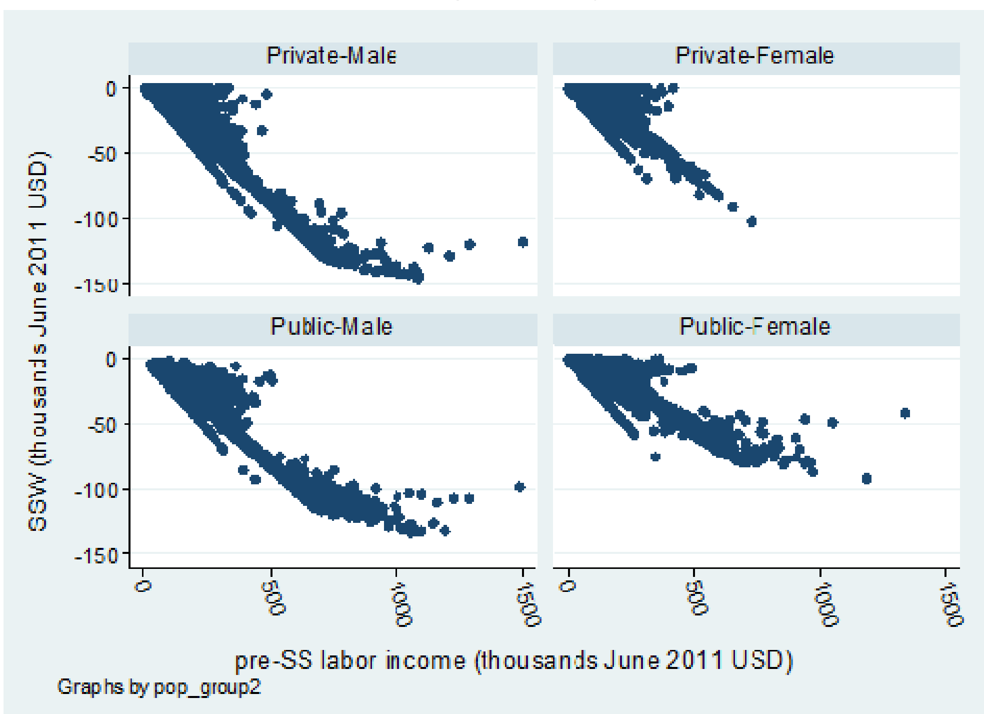
(*) SSW is zero for all those who derived their income from informal employment.

Figure 1
Social security wealth and life time income

a) Excluding informal jobs



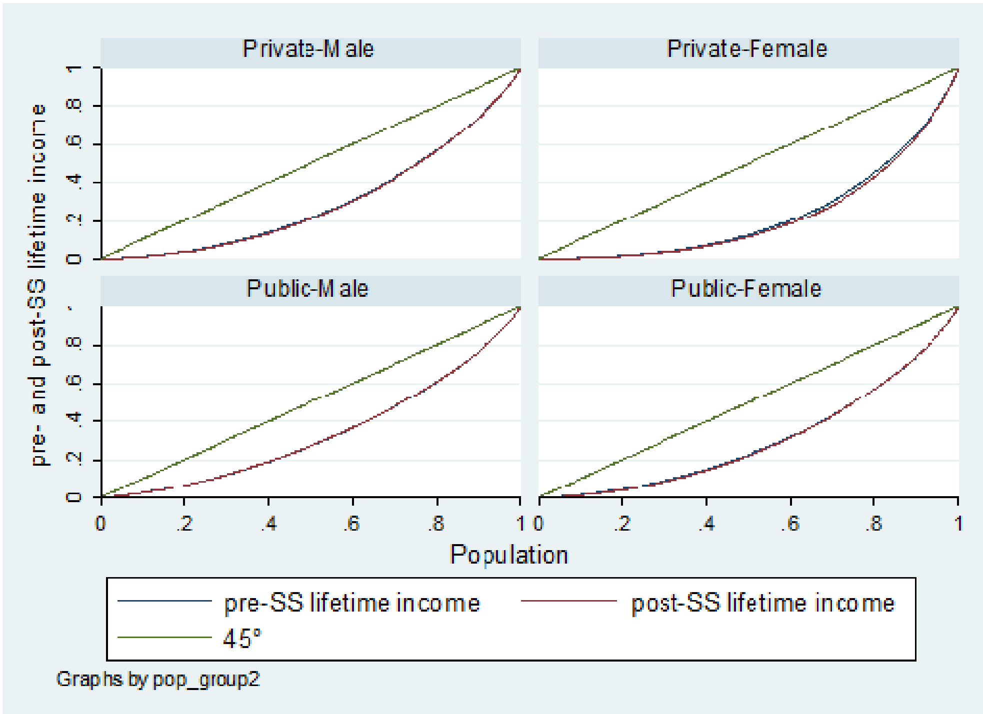
b) Including informal jobs (*)



(*) SSW is zero for all those who derived their income from informal employment.

Figure 2
Pre Social Security life time labor income Lorenz curve
and Post Social Security life time income concentration curve

a) Excluding informal jobs



b) Including informal jobs

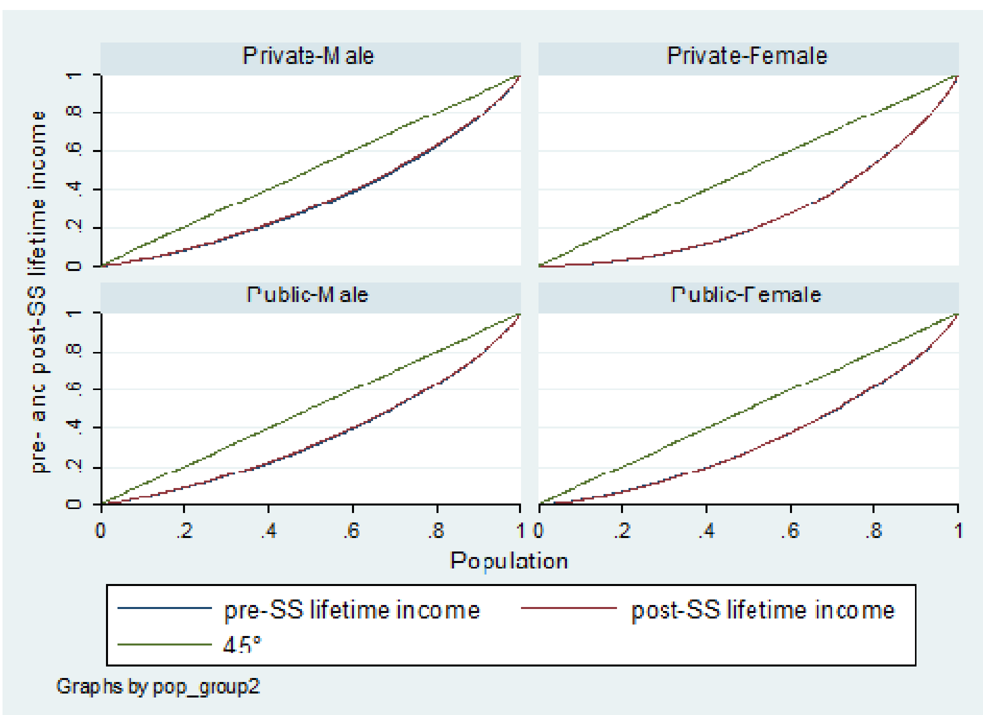


Table 2
Gini coefficients of life time labor income before and after social security

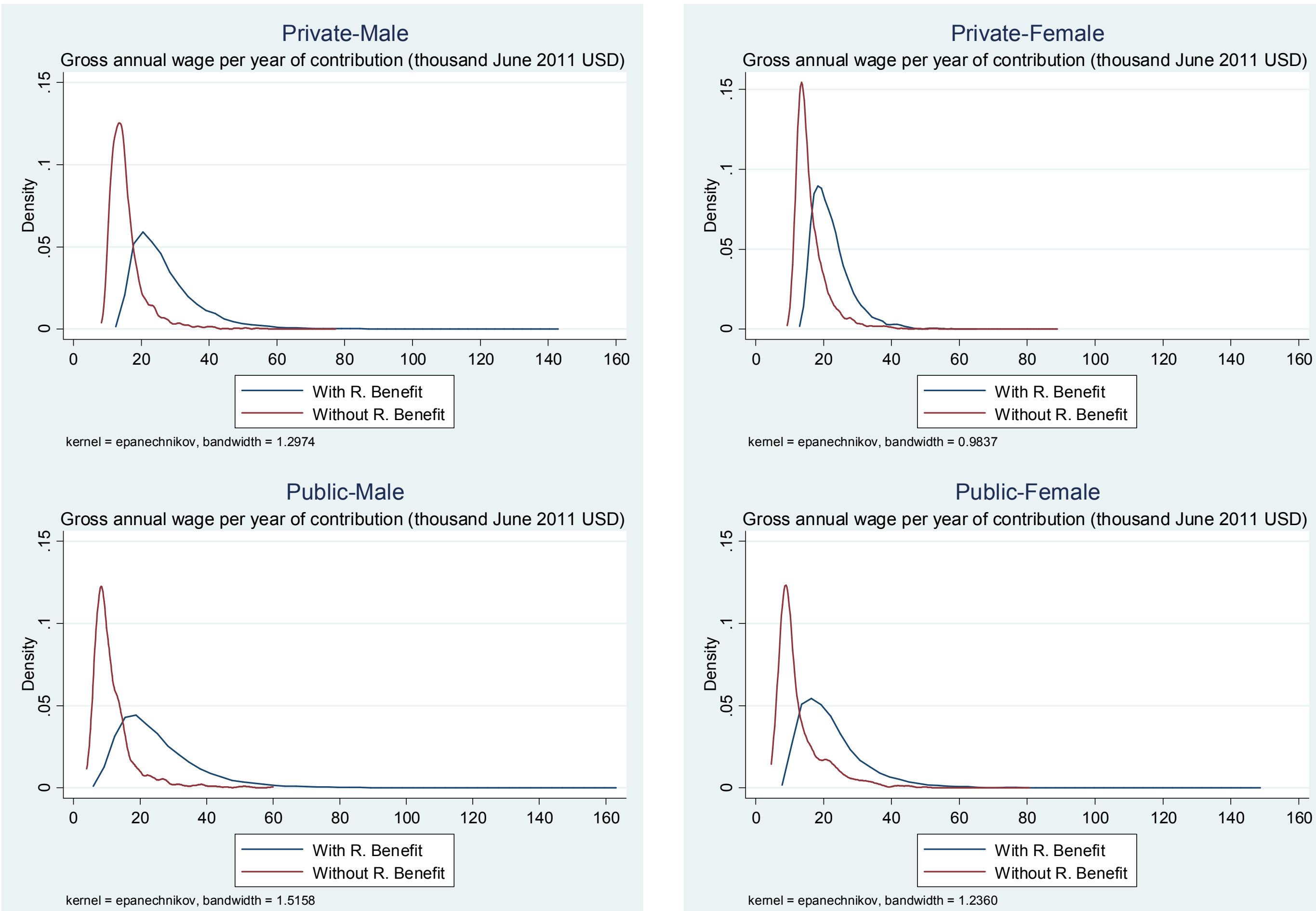
		Excluding informal job income			Including informal job income		
		Estimate	**LB (95%)**	**UB (95%)**	**Estimate**	**LB (95%)**	**UB (95%)**
Private Female	pre-SS	0.5366	0.5305	0.5427	0.4475	0.4422	0.4529
	post-SS	0.5556	0.5496	0.5615	0.4483	0.4431	0.4536
Private Male	pre-SS	0.4031	0.3979	0.4083	0.3007	0.2964	0.3049
	post-SS	0.4091	0.4038	0.4144	0.2896	0.2854	0.2939
Public Female	pre-SS	0.3879	0.3830	0.3928	0.3171	0.3126	0.3217
	post-SS	0.3939	0.3888	0.3990	0.3176	0.3129	0.3223
Public Male	pre-SS	0.3282	0.3238	0.3326	0.2860	0.2820	0.2901
	post-SS	0.3269	0.3223	0.3314	0.2790	0.2749	0.2832

Table 3
Index of redistribution (Reynolds-Smolensky index of effective progression)

	(*)	(**)
Private Female	-1.8770	0.0618
Private Male	-0.5873	1.1880
Public Female	-0.5751	-0.0051
Public Male	0.1357	0.7280

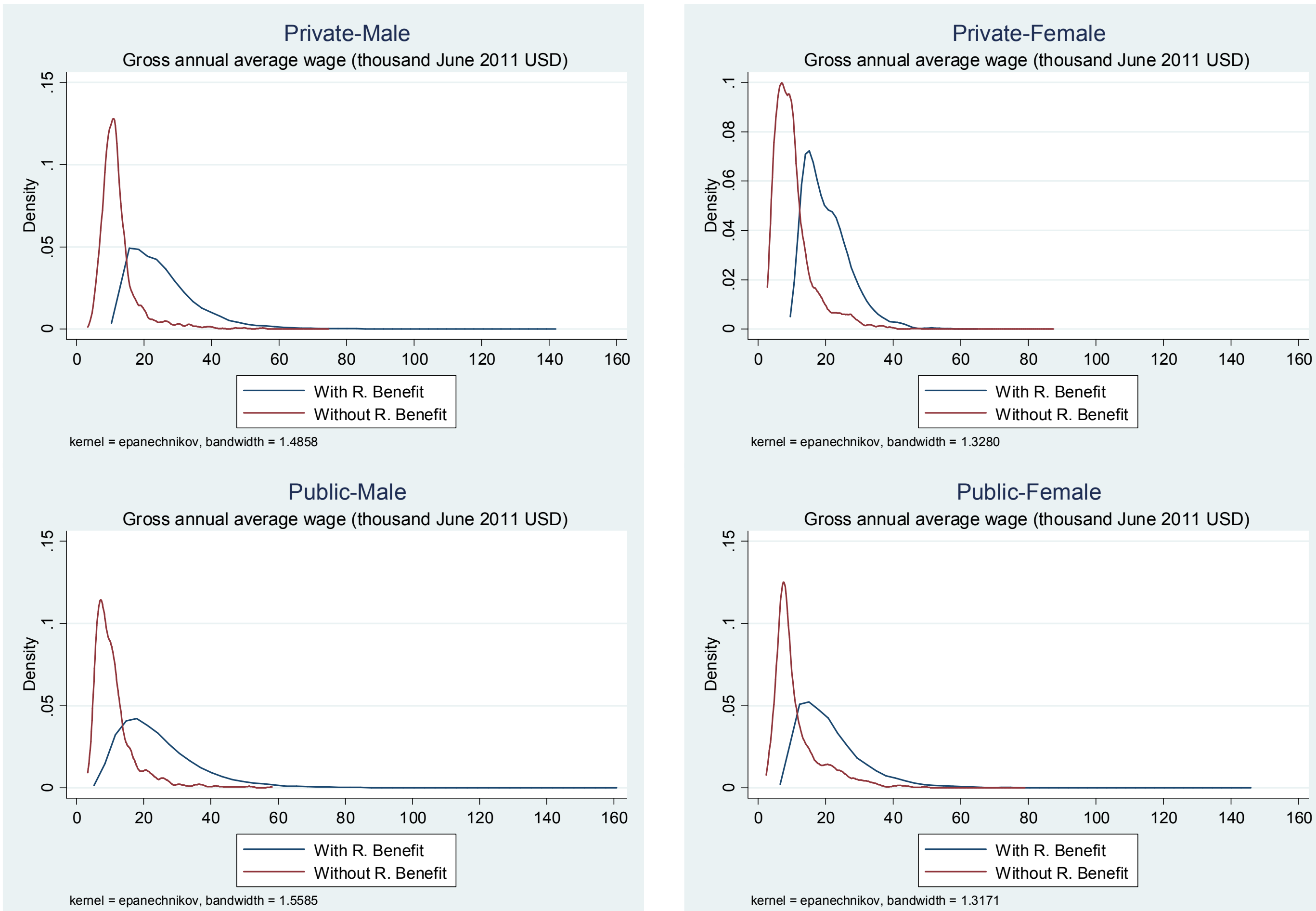
(*) Excluding informal jobs
(**) Including informal jobs

Figure 3
Argentina: average gross wage per year of contribution



Note: excluding informal jobs.

Figure 4
Argentina: average gross wage per year of employment



Note: including informal jobs.

Table 4
Gini coefficients of life time labor income before and after social security
Scenario under weak law enforcement and discount rates

a) Excluding informal jobs

Discount rate		Scenario A				Scenario B			
		Private-Female	Private-Male	Public-Female	Public-Male	Private-Female	Private-Male	Public-Female	Public-Male
1%	pre-SS	0.5224	0.3966	0.3746	0.3256	0.5224	0.3966	0.3746	0.3256
	post-SS	0.5581	0.4076	0.3856	0.3222	0.4860	0.3934	0.3716	0.3196
2%	pre-SS	0.5297	0.3997	0.3813	0.3268	0.5297	0.3997	0.3813	0.3268
	post-SS	0.5559	0.4078	0.3894	0.3246	0.5033	0.3977	0.3791	0.3227
3%	pre-SS	0.5366	0.4031	0.3879	0.3282	0.5366	0.4031	0.3879	0.3282
	post-SS	0.5556	0.4091	0.3939	0.3269	0.5180	0.4019	0.3864	0.3255

b) Including informal jobs

Discount rate		Scenario A				Scenario B			
		Private-Female	Private-Male	Public-Female	Public-Male	Private-Female	Private-Male	Public-Female	Public-Male
1%	pre-SS	0.4378	0.2986	0.3046	0.2842	0.4378	0.2986	0.3046	0.2842
	post-SS	0.4552	0.2966	0.3146	0.2773	0.4042	0.2860	0.3033	0.2751
2%	pre-SS	0.4429	0.2995	0.3109	0.2850	0.4429	0.2995	0.3109	0.2850
	post-SS	0.4508	0.2924	0.3155	0.2781	0.4145	0.2849	0.3073	0.2766
3%	pre-SS	0.4475	0.3007	0.3171	0.2860	0.4475	0.3007	0.3171	0.2860
	post-SS	0.4483	0.2896	0.3176	0.2790	0.4230	0.2844	0.3117	0.2779

Note: Scenario B: everyone that having worked are 70 years old and do not access to a retirement benefit is granted the minimum pension.

Table 5
Index of redistribution (Reynolds-Smolensky index of effective progression)
Scenario under weak law enforcement and discount rates

a) Excluding informal jobs

	Scenario A			Scenario B		
	Discount rate			Discount rate		
	1%	2%	3%	1%	2%	3%
Private Female	-3.4928	-2.5788	-1.8770	3.6747	2.6557	1.8662
Private Male	-1.0591	-0.7903	-0.5873	0.3348	0.2167	0.1305
Public Female	-1.0223	-0.7694	-0.5751	0.3389	0.2391	0.1596
Public Male	0.3547	0.2313	0.1357	0.6039	0.4132	0.2666

b) Including informal jobs

	Scenario A			Scenario B		
	Discount rate			Discount rate		
	1%	2%	3%	1%	2%	3%
Private Female	-1.5967	-0.6537	0.0618	3.4896	2.9755	2.6022
Private Male	0.2733	0.7895	1.1880	1.3279	1.5398	1.7148
Public Female	-0.9256	-0.4087	-0.0051	0.1759	0.3972	0.5744
Public Male	0.7100	0.7191	0.7280	0.9213	0.8727	0.8380

Note: Scenario B: everyone that having worked are 70 years old and do not access to a retirement benefit is granted the minimum pension.

Appendix

Table A.1
Results Equation (1)

	Private Sector				Public Sector			
	Male		Female (*)		Male		Female	
	Contribution	Working	Contribution	Working	Contribution	Working	Contribution	Working
Age	-0.0110	0.3991***	0.0755***	0.0427***	-0.0071	0.7288***	-0.0364	0.3281***
	(0.020)	(0.017)	(0.007)	(0.007)	(0.018)	(0.041)	(0.041)	(0.037)
Age2	0.2004	-7.5029***	-1.4818***	-0.7821***	0.1480	-15.0138***	0.4328	-5.8119***
	(0.403)	(0.466)	(0.183)	(0.179)	(0.381)	(1.043)	(0.864)	(0.969)
Age3	0.0059	4.0525***	0.9212***	0.4363***	-0.0520	9.5028***	0.0323	3.0991***
	(0.257)	(0.391)	(0.150)	(0.155)	(0.263)	(0.836)	(0.598)	(0.817)
Education 2 (+)	0.1169***	-0.0706***	0.3260***	0.0734***	0.0426***	-0.2042***	0.0210	0.3428***
	(0.008)	(0.015)	(0.006)	(0.005)	(0.008)	(0.035)	(0.034)	(0.027)
Education 3 (++)	0.1155***	0.0866***	0.4909***	0.2277***	0.0314***	0.0415	-0.0578	0.7419***
	(0.015)	(0.032)	(0.008)	(0.007)	(0.009)	(0.045)	(0.055)	(0.028)
Unemployment	0.0063***	-0.0417***	0.0063***	-0.0047***	-0.0001	-0.0145**	0.0093**	-0.0141**
	(0.002)	(0.003)	(0.001)	(0.001)	(0.001)	(0.006)	(0.004)	(0.006)
Elderly (+++)		-0.1426**		-0.0484**		-0.2581**		-0.1213
		(0.072)		(0.024)		(0.115)		(0.102)
IMR	-0.7907***				-0.4630***		-1.0536***	
	(0.111)				(0.083)		(0.216)	
Constant	0.9004***	-4.4216***	-0.9925***	-0.0657	1.0414***	-8.7631***	1.6982**	-4.5652***
	(0.301)	(0.204)	(0.089)	(0.079)	(0.262)	(0.510)	(0.689)	(0.460)
Observations	49,780		25,980	44,276	21,668		23,136	
Censored	8866				1242		2972	
Uncensored	40914				20426		20164	

(*) Working and Contribution equations were estimated independently of each other. (+) Complete high school/incomplete tertiary-university. (++) Complete tertiary-university. (+++) Dummy equal to one if the individual is 65 years old or more for men, and 60 or more form women. Robust standard errors in brackets.
* significant at 10%; ** significant at 5%; *** significant at 1%

Table A.2
In sample simulations: Right predictions (*)

a) Working Status

	Private Sector		Public Sector	
	Male	Female	Male	Female
Not working	66.1	76.6	71.3	72.1
Working	90.6	83.0	96.7	94.0
Total	86.3	80.4	95.2	91.2

b) Contribution Status

	Private Sector		Public Sector	
	Male	Female	Male	Female
Not contributes	82.7	93.3	76.2	83.3
Contributes	88.5	85.8	95.9	94.3
Total	86.1	91.3	93.7	92.1

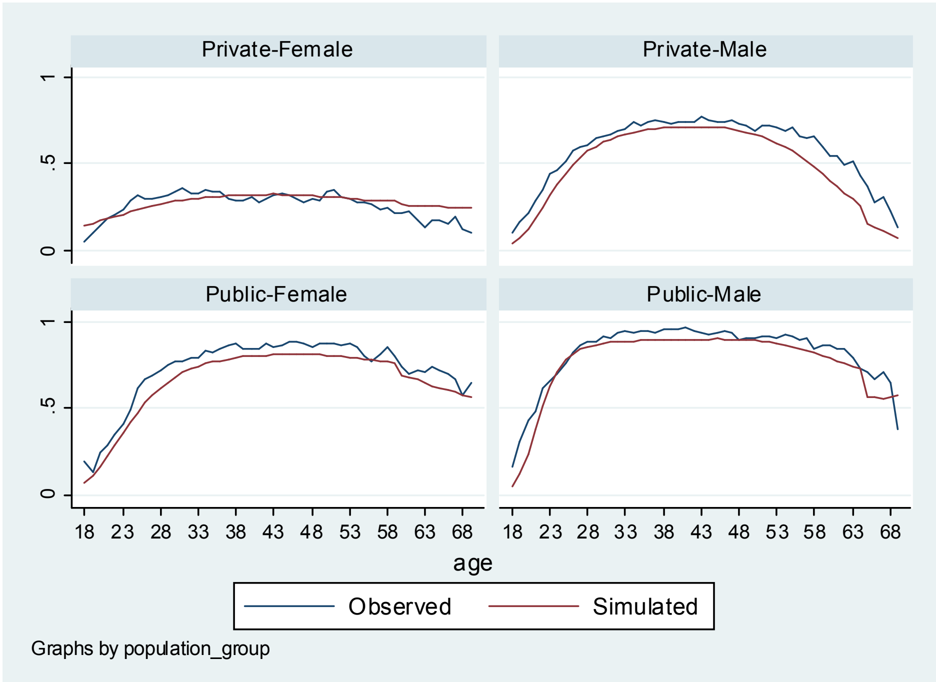
c) Contribution Status (conditional on working)

	Private Sector		Public Sector	
	Male	Female	Male	Female
Not contributes	82.6	92.5	73.7	81.9
Contributes	88.5	85.8	95.9	94.3
Total	86.8	89.3	94.6	93.2

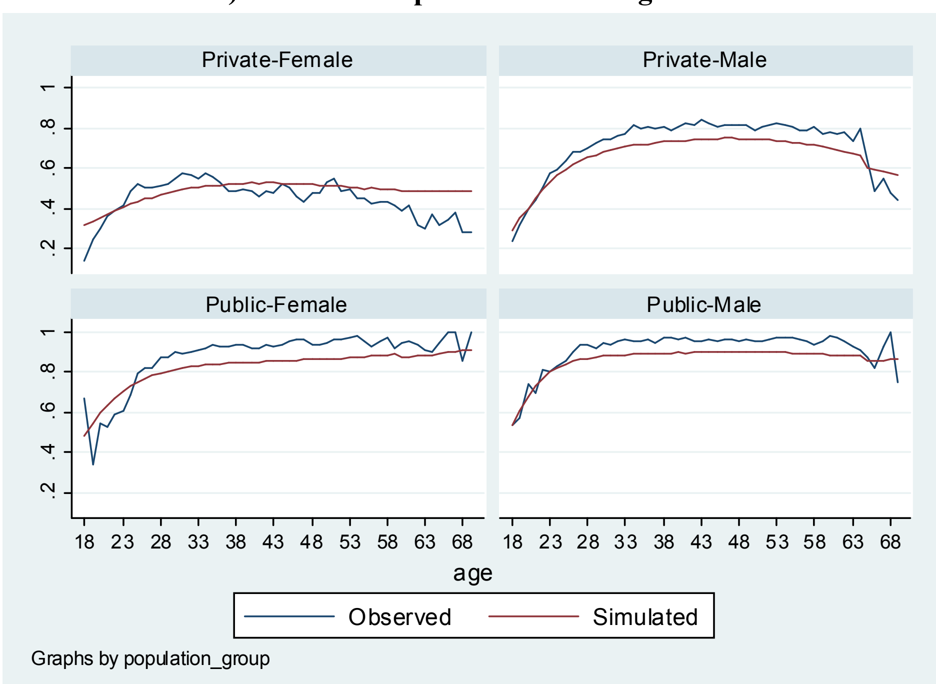
(*) The simulated status matches the observed status.
Source: own

Figure A.1
Observed and out-of-sample simulated contribution densities by age

a) Share of overall sample



b) Share of sample with a working status



Note: The unemployment rates used for the simulated densities are 15.3 for men and 17.4 for women. These figures are the average rates for the period covered by the country sample used in equation (1).

Table A.3
Results Equation (2)

	Private Sector				Public Sector			
	Male		Female		Male		Female	
	Contributes	Not Contributes	Contributes	Not Contributes	Contributes	Not Contributes	Contributes	Not Contributes
Age	0.1125***	0.1382***	0.1033***	0.0445**	0.0956***	0.0109	0.1190***	0.0798
	(0.012)	(0.018)	(0.018)	(0.020)	(0.019)	(0.057)	(0.025)	(0.051)
Age2	-1.8051***	-2.4211***	-2.1220***	-0.6881	-1.3021***	1.0005	-1.9874***	-1.6317
	(0.312)	(0.480)	(0.471)	(0.514)	(0.469)	(1.463)	(0.602)	(1.360)
Age3	0.8285***	1.2125***	1.4036***	0.2300	0.4371	-1.4582	1.0378**	1.1755
	(0.258)	(0.397)	(0.391)	(0.418)	(0.366)	(1.177)	(0.471)	(1.155)
Education 2 (+)	0.2558***	0.1350***	0.2699***	0.2654***	0.2770***	0.4137***	0.2765***	0.3729***
	(0.011)	(0.018)	(0.016)	(0.021)	(0.015)	(0.055)	(0.020)	(0.044)
Education 3 (++)	0.6531***	0.5785***	0.4037***	0.6122***	0.5769***	0.9846***	0.4320***	0.9780***
	(0.024)	(0.052)	(0.021)	(0.037)	(0.019)	(0.088)	(0.019)	(0.053)
Constant	6.2062***	5.5182***	6.3129***	6.3670***	6.3136***	6.6330***	5.8227***	5.9078***
	(0.144)	(0.213)	(0.217)	(0.240)	(0.251)	(0.693)	(0.332)	(0.598)
Observations	27,757	10,471	11,379	12,835	18,365	1,064	17,514	1,670
Individuals	8,864	5,033	4,046	6,101	5,025	572	4,905	939
Sargan-Hansen Test of Overriding restrictions (P. value) (++)	0.256	0.093	0.492	0.467	0.433	0.099	0.999	0.000

(+) Complete high school/incomplete tertiary-university. (++) Complete tertiary-university. (+++) Fixed vs. Random effects. Robust standard errors in brackets. * significant at 10%; ** significant at 5%; *** significant at 1%

Table A.4
Average retirement age of simulated populations

Group	Years
Private-Female	63.2
Private-Male	65.3
Public-Female	61.8
Public-Male	65.2

Notes: (i) Unemployment rate used in simulations: 8%;
(ii) people retire as soon as they meet the required conditions.

Table A.5
Proportion of simulated populations that access to a retirement benefit

Group	(*)	(**)
Private-Female	22.1	26.3
Private-Male	60.3	61.2
Public-Female	78.0	78.1
Public-Male	92.6	92.6

(*) Includes people that did not contributed while working.
(**) Excludes people that did not contributed while working
Note: (i) Unemployment rate used in simulations: 8%.

Table A.6
Average number of years of contribution of simulated populations

Group	(*)	(**)	(***)
Private-Female	12.9	15.4	31.2
Private-Male	29.1	29.5	37.5
Public-Female	29.1	29.1	32.8
Public-Male	37.6	37.6	38.8

(*) Includes people that do not access to a retirement benefit, independently of the contribution status while working. (**) Includes people that do not access to a retirement benefit, only with a contributing status while working. (***) Includes only people who access to a retirement benefit.
Note: (i) Unemployment rate used in simulations: 8%;
(ii) people retire as soon as they meet the required conditions.