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Assessing Redistribution within Social Insurance Systems. The cases of Argentina, Brazil, Chile, Mexico and Uruguay

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Abstract

This paper summarizes the main findings in a series of coordinated studies conducted to assess the impact of social security programs on the distribution of lifetime labor income in Argentina, Brazil, Chile, Mexico and Uruguay. The country-case studies find varying degrees of redistribution, with PAYG-DB and mixed programs redistributing more than individual savings accounts programs. Notwithstanding, it is the Chilean individual savings accounts program, combined with the recently reformed solidarity pillar, the one that contributes more to reducing inequality in this group of countries.

Keywords: Redistribution, Social Security.

JEL Code: H55, J14, J26

Resumen

Este documento resume los principales resultados en una serie de estudios coordinados que evalúan el impacto de los programas de seguridad social en la distribución del ingreso laboral a lo largo de la vida en Argentina, Brasil, Chile, México y Uruguay. Los estudios a nivel país encuentran diferentes grados de redistribución, en particular, los programas PAYG-BD y mixtos redistribuyen más que los programas con cuentas de ahorro. A pesar de ello, es el programa chileno de cuentas de ahorro combinado con el pilar solidario recientemente reformado el que contribuye más a reducir la desigualdad dentro de este grupo de países.

Palabras Clave: Redistribución, Seguridad Social.

JEL Code: H55, J14, J26

1 Introduction

The present paper summarizes the main findings of five country-case studies conducted to analyze the impact of unemployment insurance and pension programs on the distribution of lifetime income in Latin America (Fajnzylber 2011, Forteza and Mussio 2011, Moncarz 2011 and Zylberstajn 2011). Based on longitudinal data, we estimate econometric models of contributions to social security and labor income and run Monte Carlo simulations of expected life time labor income and net transfers to social security. Using these estimations we then compute indicators of distribution and redistribution of income. We find that some programs perform much redistribution, but the programs that redistribute more are not necessarily the ones that make the greater contribution to reducing inequality.

The pension programs covered in our project range from the fully PAYG-DB Argentinean and Brazilian to the individual accounts DC Chilean and Mexican programs, and also include the Uruguayan mixed program. Unemployment insurance is based on savings accounts and common pool schemes in Brazil and Chile and on common pool PAYG financing in Argentina and Uruguay. Hence, our sample allows for a comparison of the redistributive impact of different social security designs.

Previous studies show that densities of contribution are low and very heterogeneous in Argentina, Chile and Uruguay (Forteza et al 2009). We do not have similar longitudinal studies for Brazil and Mexico, but social security coverage of the labor force in these two countries suggests that contribution densities cannot be much higher in Brazil and Mexico than in the other three countries. Therefore, we are assessing social security redistribution in the presence of low density and highly fragmented histories of contributions, considering five social security programs with substantial differences.

In the next section we briefly describe the programs to be analyzed. In section three we present the conceptual framework and discuss antecedents in the literature. We describe the data and methods in sections 4 and 5. Section 6 contains the results and section 7 concludes with some final remarks.

2   The old-age pension and unemployment insurance programs

In 1981, Chile pioneered a series of pension programs reforms that introduced mandatory individual savings accounts, phasing out the traditional PAYG-DB scheme. In the nineties, Mexico reformed its pension program along the same lines as Chile. Also in the mid nineties, Argentina and Uruguay introduced mandatory individual savings accounts, but without completely phasing out the PAYG-DB pillar. The result was a two pillar (or two tiers) mixed program. Brazil did a series of parametric reforms without introducing savings accounts in its pension program.

New reforms took place in the 2000s. The most radical of the new wave of reforms was the Argentinean abolition of the individual savings accounts. The current scheme is a partially funded DB program. Funds accumulated in the individual accounts were allocated to a collective pension fund. In 2008, Chile strengthened the redistributive component of its pension system, replacing the minimum pension and old-age assistance programs with a basic solidarity pension and a pension supplement. Also in 2008, Uruguay adjusted its program, loosening pension eligibility conditions.

We summarize in Table 1 the main parameters of these pension programs as they are today. These are the parameters used for the simulations in this study.

In addition, there is considerable variation in the design and scope of unemployment insurance programs in the set of countries included in this study. Argentina and Uruguay have traditional common pool PAYG programs, Brazil has parallel common pool and individual accounts programs, Chile has an integrated program that combines individual accounts with social insurance and Mexico does not have an explicit unemployment insurance program (Velásquez 2010).

The Argentinean program was enacted in 1992. It is financed out of employer contributions of 1.5% of wages on a PAYG common-pool basis and benefits are earnings related.[3] The first Brazilian unemployment program was founded in 1967 and consists of a compulsory contribution that employers have to deposit in an individual account, called

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[3] There is also a small unemployment insurance savings accounts program in Argentina for construction workers.

FGTS (*Fundo de Garantia do Tempo de Servico*). A second program was enacted in 1986, incorporated in the Constitution in 1988 and implemented and expanded during the nineties. This program has common pool financing and earnings-related benefits (Barreto de Oliveira and Beltrão 2002). Chile introduced a new unemployment insurance scheme in 2002. This program combines self and social insurance: workers and employers contribute to individual savings accounts and the government and employers contribute to a common pool called the "solidarity fund". Mexico does not have an unemployment insurance program, save for the advanced age unemployment insurance scheme (*seguro de cesantía en edad avanzada*) that covers individuals aged 60 and above (Ochoa 2005). With antecedents dating to the early twentieth century, the current Uruguayan unemployment insurance program was enacted in 1981 and expanded in 2001 (Amarante and Bucheli 2008). It is a traditional common pool earnings related program.

3   Conceptual framework

We assess redistribution within social insurance programs computing lifetime contributions and benefits. Our focus is on mostly contributory programs, but some non-contributory components cannot and should not be separated from the contributory ones. The Chilean solidarity supplement is an example of a well integrated non contributory component in a mostly contributory program. The financing that governments often provide in PAYG programs is also a "non contributory" component of social security. In some cases, this financing is incorporated in the design of the programs (for example, some points of the value added tax are earmarked for social security in Uruguay), but in most cases governments just pay what is needed to keep social security programs working.

Social Security programs are usually designed to redistribute income from the better to the worse off. Most benefit formulas include explicit redistributive components, such as 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 ingredients.

But social security 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; Brown et al. 2009).[4]

Second, government transfers that contribute to finance social security 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). But also these same groups are the ones that pay more taxes, so the net effect is not clear (Forteza and Rossi, 2009). Ideally, we should trace the origin of the funds governments spend financing social security and include those taxes in the individuals' cash flows.

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 this research project, we focused on this last channel, i.e. the redistribution stemming from the fact that low income workers tend to have systematically shorter contribution histories. We will not assess the impact of different mortality rates and different coverage on implicit redistribution.

Social Security redistribution is often assessed on an annual basis, analyzing taxes paid and benefits received by different groups of contributors. This type of analysis tends to show large transfers among groups which depend mostly on the ratio of beneficiaries to earners within each group. But most individuals transit from earning income and paying contributions to receiving pension benefits along their lifecycle. Therefore, redistribution performed through social security can be better assessed adopting a lifetime perspective (Liebman, 2001).

We run micro-simulations of lifetime income and social security contributions and benefits to assess redistribution, focusing on intra-generational redistribution: one cohort that lives with the current pension rules. It is worth noticing though that social security performs inter- as well as intra-generational redistribution and there is considerable evidence that inter-generational redistribution has been substantial, with early generations usually benefiting with high returns to contributions (Liebman 2001, Morató and Musto, 2010).

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[4] There is however contradicting evidence on the impact of differential mortality rates on social security progressiveness. Brown et al. (2009), for example, report very small effects on the measured progressivity of the US Social Security program of incorporating differential mortality rates by race and education.

The indicator used in this study to quantify transfers is the social security wealth, which is the net present value of the expected lifetime flows of contributions and benefits (Gruber and Wise, 1999, 2004; Coile and Gruber, 2001; Liebman, 2001, Brown et al. 2009). Also, we assess the progressivity of the system by comparing the distribution of the expected pre- and post-social security lifetime income. Pre-social security lifetime income is the present value of income before contributions to social security and without benefits from social security. Post-social security income is the present value of lifetime income net of contributions to social security and including benefits from social security. The comparison is performed based on standard Lorenz and concentration curves, Gini indexes and an index of net redistributive effect.

We consider the individual as the unit of analysis, but it should be noticed that redistribution in the social security 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 security looks very redistributive, favoring low income workers, but it looks much less so at the family level (see also Lambert 1993, p 14). In the words of Brown et al. (2009): "…much of the apparent redistribution from Social Security occurs within, rather than between, households."

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.[5] 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. In this line, Huggett and Ventura (2000) simulate a fully fledged OLG model of Social Security calibrated with US data. Forteza (2007) follows a similar approach to study the redistributive impact of a social security reform in Uruguay. In a similar vein, albeit not to study redistribution, Jiménez and Sánchez (2007) estimate a structural life cycle model to assess the incentives to retire in the Spanish Social

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[5] This is the equivalent to what Lambert (1993, p 266) suggests for the assessment of the impact of income taxes: "…the impact of an income tax can now be judged by comparing the "with-tax" income distribution with the distribution that would pertain in the tax's absence –the "no-tax" distribution rather than the "pre-tax" distribution." It is interesting to notice though, that ten of the eleven chapters of his classical book on distribution and redistribution of income are based on the assumption of invariant pre-tax income distribution.

Security System. Auerbach and Kotlikoff (1987) represents a key antecedent in this line of inquiry. 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 principle, a model with hyperbolic preferences could do the job, but solving and calibrating these models is even more difficult than the already demanding standard optimization, full rationality models.

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. Because of this, it is often interpreted as an analysis of the impact effect of the fiscal system (Lambert, 1993, pp 153, 162, chap 11). One such example is Euromod. Sutherland (2001) warns: "EUROMOD is better-suited to analysing some types of policy and policy change than others. Since it is a static model, designed to calculate the immediate, "morning after" effect of policy changes, it neither incorporates the effects of behavioural changes (i.e. behaviour does not change) nor the long-term effect of change. Thus it is not the appropriate tool for examining policy that is only designed to change behaviour, nor for policy that can only have its impact in the long term (e.g. some forms of pensions policy). It is best-suited to the analysis of policies that have an immediate effect and which depend only on current income and circumstance." For our analysis, we will be using life cycle models that are better suited to assess the redistributive impact of social security policies than the typical static short run models used in most microsimulations. However, following standard practice in microsimulations, we will not model behavioral responses. Our approach is closer to the literature pioneered by Gruber and Wise (1999, 2004), who designed and computed a series of indicators of social security incentives to retire assuming no explicit behavioral responses. Our study is also close to Liebman (2001) and Brown et al. (2009) who simulate lifetime income and compute redistribution in US Social Security using non-behavioral models.

In our view, these two approaches are largely complementary. 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 need to make highly stylized assumptions regarding not only individual preferences and constraints, but also social security programs. Given our goals, this is a serious drawback. We want to assess the lifetime implicit transfers in social security given the observed histories of contribution in Latin American countries. We are only beginning to characterize the very heterogeneous highly fragmented histories of contribution present in the region (Forteza et al. 2009) and quite far from having optimization models that can fit these patterns. Whether these histories of contribution are optimal responses to social security rules and various shocks is something we cannot answer yet. But given social security rules, it is pretty clear that these patterns of contribution seriously condition effective net transfers to social security. 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, we can expect 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 at a more advanced phase.[6]

4   Data
We use two sources of data: administrative records from Social Security (Uruguay and Chile) and surveys (Argentina, Brazil, and Mexico). In what follows, we provide brief descriptions of the databases.

4.1   Argentinean data
We used a household survey (the *Encuesta Permanente de Hogares* or EPH) for the period 1995-2003.[7] The EPH is carried out twice a year (May and October) covering only urban

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[6] An example of this strategy is the retirement research line followed by Jiménez and collaborators in the case of Spain (Boldrin et al. 1999, 2004; Jiménez and Sánchez, 2007).

[7] From the second half of 2003 the EPH suffered from an important methodological change that impede us to extend the period of analysis, also because of the timing households are surveyed under the new EPH this is less suitable for the purposes of the present study.

areas (around 61% of the country total population, and 70% of the country urban population). Each household included in the EPH, and all the individuals within it, is surveyed four consecutive times, with a replacement rate of 25% of the sample each survey. The EPH provides detailed information on the labor status, personal characteristics (age, gender, education, etc.) on each individual, as well as on characteristics of the household (number of members, living conditions, etc.).

4.2   Brazilian data

The *Pesquisa Mensal de Emprego* (PME), or Monthly Employment Survey, is a monthly rotating panel of dwellers in six major metropolitan areas in Brazil (São Paulo, Rio de Janeiro, Belo Horizonte, Salvador, Porto Alegre and Recife), compiled by IBGE. These six metropolitan areas cover approximately 25% of the country's population. The PME survey was redesigned in March, 2002. Currently, microdata is available since then until August, 2010.

The survey investigates schooling, labor force, demographic, and earnings characteristics of each resident aged 10 or more that lives on the interviewed households. This results in approximately 100,000 individuals from 35,000 households every month. One important feature is that there is no information on earnings not arising from labor.

The rotating scheme is as follows. Households are interviewed once per month during four consecutive months after which they stay out of the survey for an eight-month window. After this period, the household is interviewed again in four consecutive months. Once this last spell is finished, the household is permanently excluded from the sample. Households are divided into 4 rotating groups, in order to make sure that in two consecutive months 75% of the sample is the same.

The *PME* does not identify individuals directly, only their households. Thus, a matching process needs to take place. We match individuals within households over time using date of birth and gender, but a caveat of doing this is that there might be some attrition. In fact, according to Ribas and Soares (2010), on average 4% of the households sampled in the PME do not answer to the survey in the following month. In order to avoid (or at least minimize) a selection bias, the authors propose an algorithm and the inclusion of an 'answering probability estimator' in an estimation à la Heckman.

In order to build the database, we match individuals (using the algorithm proposed above) that were surveyed for two consecutive months and consider this matching as one observation. Characteristics such as income, gender, age, marital status and schooling are taken from the first interview (identified by t), together with labor status. The subsequent interview (identified by $t+1$) gives only the new labor status and income.

4.3 Chilean data

We have access to the *Base de Historias Previsionales de Afiliados Activos, Pensionados y Fallecidos* (Affiliates Pension Histories database, HPA), populated with individual contribution records from 1981 to 2009, for a sample of participants in the pension system.[8] The HPA includes the complete contribution history (in the pension system) for a sample of approximately 24,000 individuals, representative of the stock of affiliates of the system in July 2002.[9] In addition, the dataset also includes information on the recognition bonds held by the sampled individuals.

4.4 Mexican data

The data source is a household survey carried out by the *Instituto Nacional de Estadística y Geografía de Mexico*, more specifically we use the *Encuesta Nacional de Empleo* (ENE). The ENE is a continuous quarterly national survey representative of the whole population. The unit of analysis of the ENE is the household, but with a specific questionnaire for each individual living in it, which allows to control for personal characteristics. The replacement rate in the sample is 20% so each unit is surveyed during five consecutive quarters after which they are dropped from the survey. The period we work with runs form the third quarter of 2000 until the last quarter of 2004.[10]

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[8] The sample was originally drawn as the basis for the Social Protection Survey, a panel instrument that was taken in 2002, 2004 and 2006 for a large fraction of the individuals in the sample. The Social Protection Survey was inspired by the American Health and Retirement Survey. For more information on the Chilean version, see www.proteccionsocial.cl.

[9] Upon initial contribution, the individual is considered an "affiliate".

[10] A new nationwide survey, the *Encuesta Nacional de Empleo y Ocupación* (ENOE) started in the first quarter of 2005. However, because of the information we require to carry out the analysis we work with the ENE.

4.5 Uruguayan data

We used a random sample of the work history records of the main social security institution of Uruguay (BPS), collected in December 2004 by the Labor History Unit of the BPS (ATYR-BPS). Workers in the sample contributed at least one month between April 1996 and December 2004. The sample has close to 70,000 individuals.

The records are organized in five databases. One file gives personal information on individuals: date of birth, sex and country of birth. Another file reports about the job of each person, particularly the date of initiation of activity and the explicit end of the link between the worker and the firm. A third file reports monthly information about the contributions. In particular, we have information on wages and some characteristics of the job. A separate database contains information about benefits, including the date of retirement.

This database provides detailed information about monthly contributions to social security, gender, age, and sector of activity. Unfortunately, we do not have yet for Uruguay a survey of socio-economic characteristics of contributors to social security. Hence, we lack some important socio-economic characteristics like education and characteristics of the families.

5 Methods

The methodology is comprised of four steps. (i) Estimation and simulation of labor status and labor income models. (ii) Computation of social security contributions and pensions. (iii) Computation of pre- and post-social security lifetime income. (iv) Computation of income distribution measures.

5.1 Labor income and labor status models

We separately estimate models for labor income and working-contributing status. We model labor income to simulate strings of lifetime labor income, conditional on being working/contributing. We also model labor status, i.e. whether the individual is contributing or not, and simulate lifetime contributing status. Multiplying the simulated labor income and the contributing status, we generate the series of work histories on which we base our estimations of labor income distribution and social security redistribution.[11]

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[11] Some of the methods used in this project are based on Forteza et al. (2009).

Notice that we are simulating the labor income that is declared to social security (according to administrative records or the surveys, depending on the country case). This is the relevant series for the computation of social security benefits, but it may be very different from total labor income in Latin American countries.

In the case of administrative data (Chile and Uruguay), we have a relatively large number of observations for each individual, but relatively poor socioeconomic information to characterize individuals.[12] We take advantage of the relatively long panel to estimate unobserved individual effects that capture much of the variance in the population. In the case of the survey data (Argentina, Brazil, and Mexico) we have shorter panels, but better socioeconomic characterizations. We could then explicitly model heterogeneity using education and related variables. The details depend much on data specificities that vary from country to country. Because of this, we only provide general guidelines in this document.

5.1.1 Projection of labor income

We estimate two wage equations. Wages in the second and following months of a spell of contribution are modeled using a dynamic equation. Wages in the first month of a contribution spell are modeled with a static equation. 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 time trends.

Wages in the second and following months of the spell of contribution are assumed to be governed by the following stochastic process,

$$\ln w_{it} = \rho \ \ln w_{it-1} + \beta_1 \ln dur_{it} + \beta_2 a_{it} + \beta_3 a^2_{it} + \beta_4 x_{it} + \beta_5 \delta_t + v_i + e_{it}$$

(1)

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Where w_{it} is the real wage[13]; dur_{it} is the tenure in the current job; a_{it} is the age; x_{it} accounts for other control variables (like education); δ_t are month dummies; and v_i is a time invariant unobservable characteristic of individual i. The idiosyncratic shock e_{it} is assumed to be normally distributed with mean 0 and variance σ_{it}^2.

In the case of administrative data (Chile and Uruguay), we do not observe the education level of the individuals. Therefore, the term v_i will capture, at least in part, the cross section heterogeneity that comes from education jointly with other time invariant unobservable characteristics like ability. In the case of survey data, education indicators were included.

In Argentina, Mexico and Uruguay, this equation was estimated for male and female and public and private employees separately. In Brazil, two equations were estimated, one for men and the other for women, and only for private sector workers. In the case of Chile, only one equation was estimated using a gender dummy interacted with age and age squared.

We computed the individual effects as:

$$\hat{v}_i = \frac{1}{T_i} \sum_{t=1}^{T_i} \left(\ln w_{it} - \left(\hat{\rho} \ln w_{it-1} + \hat{\beta}_1 ldur_{it} + \hat{\beta}_2 a_{it} + \hat{\beta}_3 a_{it}^2 + \beta_4 x_{it} + \beta_5 \hat{\delta}_t \right) \right)$$

(2)

Once the econometric models were estimated, predicted values of labor income were calculated as follows:

$$\ln \tilde{w}_{is} = \hat{\rho} \ln \tilde{w}_{is-1} + \hat{\beta}_1 ld\tilde{u}r_{is} + \hat{\beta}_2 a_{is} + \hat{\beta}_3 a_{is}^2 + \hat{\beta}_4 x_{is} + \beta_5 \hat{\delta}_t + \hat{v}_i$$

(3)

Because of the number of periods observed, the estimates of the individual effects are less precise in the case of surveys than administrative data, but we are more interested in the distribution of these variables than on the individual values, so this should not be a serious

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[13] In the case of Uruguay, following Bosworth et al. (1999), we use the ratio of the nominal wage of individual i at period t respect to the nominal wage index of the economy at period t.

issue. What is really crucial for our purposes is to get a good characterization of the distribution of the observed and unobserved heterogeneity.

The second equation is applied to the initial month of the contribution spells. The equation to estimate is as follows:

$$\ln b_i = \alpha_1 + \alpha_2 a_i + \alpha_3 a^2_i + \alpha_4 \hat{v}_i + \varepsilon_i$$

(4)

Where b_i is the average real wage, a_i is the age and $\hat{v}_i$ is the individual effect estimated with equation (1). Since this is a cross-section estimation we do not include a time subindex. We use the OLS estimator with the White formula in order to obtain the standard errors.

We use equation (4) to predict the covered wage of the first month of a new spell of contribution provided the individual has previously stayed in a spell of non-contribution at least three months. Thus the prediction is given by:

$$\ln \widetilde{b}_i = \hat{\alpha}_1 + \hat{\alpha}_2 a_i + \hat{\alpha}_3 a^2_i + \hat{\alpha}_4 \hat{v}_i$$

(5)

5.1.2   Projection of the contribution status

Two types of models were used to project the contribution status. In the case of Chile, we modeled the duration of the spells of contribution and not contribution. In the other four countries we used linear probability models.

5.1.2.1   The linear probability models

A simple approach to estimating the probability of making contributions that directly exploits, for prediction purposes, the longitudinal nature of the data is to fit a fixed effect linear probability model. The main advantage of this type of models is that they allow using estimated individual fixed effects to make predictions for the entire lifetime. This is particularly relevant if the data does not allow including sufficiently rich control variables. A drawback of the linear probability model is that it does not rule out probabilities out of the 0-1 interval.

In the linear probability model, the dependent variable is equal to one if the individual makes a contribution during a particular month and zero otherwise $(C_{it} \in \{0,1\})$. We used

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two variants of the linear probability model: (A) a model with two equations, one for each contribution status in the previous month, and (B) a model with one equation and a dummy variable to capture the contribution status in the previous month. The models are as follows:

A) Two equations, one for each contribution status

$$C_{it} = x_{it}'\beta^0 + \eta_i^0 + \varepsilon_{it}^0 \quad if \quad C_{it-1} = 0$$
$$C_{it} = x_{it}'\beta^1 + \eta_i^1 + \varepsilon_{it}^1 \quad if \quad C_{it-1} = 1$$

(6)

In turn, the individual effects in the contribution status equations can be computed as:

$$\hat{\eta}_i^s = \frac{\sum_{t=2}^{T_i} \left(C_{it} - x_{it}'\hat{\beta}\right)\mathrm{I}(C_{it-1} = s)}{\sum_{t=2}^{T_i} \mathrm{I}(C_{it-1} = s)} \quad ; \quad s \in \{0,1\}$$

Where $\mathrm{I}(C_{it-1} = s) = 1$ if $C_{it-1} = s$; 0 otherwise .

A drawback of this specification is that we may lose many observations. Only when we observe two or more times the individual in state s can we compute the corresponding individual effect (η_i^s). In the case of databases with few periods per individual, there will be many individuals for which we cannot compute the individual effects for both states. Because of this issue, in the cases of Argentina, Brazil and Mexico we used the following model.

B) One equation for both contribution status

$$C_{it} = x_{it}'(1 - D_{it})\beta^0 + x_{it}'D_{it}\beta^1 + \eta_i + \varepsilon_{it}$$
$$D_{it} = 1 \; if \; C_{it-1} = 1 \; ; \; 0 \; otherwise$$

(7)

The individual effect can be computed as:

$$\tilde{\eta}_i = \sum_{t=2}^{T_i} \left(C_{it} - x_{it}'(1 - D_{it})\hat{\beta}^0 + x_{it}'D_{it}\hat{\beta}^1\right)/(T_i - 1)$$

Either with model A or B, we need an additional equation to project the contribution status in the first period of the simulated individuals. We assumed that individuals start contributing at 18 and estimate a static contribution-status equation at that age:

$$C_{it} = x_{it}'\alpha_1 + \hat{\eta}_i'\alpha_2 + e_{it}$$

<div align="right">**(8)**</div>

Where we are using the individual effects computed in the dynamic equations as an additional regressor.

The set of variables to be included as regressors depends on data availability (which varies from country to country), but in all cases the same variables used to capture the observed individual heterogeneity and the estimated individual effects $(\tilde{v}_i)$ in the labor income equations were included. These variables are essential to link labor income and contribution status in the simulations.

We simulate the contribution status of workers across their lifetime conditional on the individual not retiring or dying. Simulations start at the age of 18 with equation (8), and continue with equation (7). More specifically, we simulate the probability of contributing $\left(\tilde{P}_{it} = Pr(C_{it} = 1)\right)$, draw realizations from a uniform (0,1) distribution ($draw_{it}$) and set C_{it} as: $\tilde{C}_{it} = 1 \; if \; draw_{it} < \tilde{P}_{it} \; and \; 0 \; otherwise$.

We compute the percentage of correct predictions in the sample to assess the goodness of fit of the models.

5.1.2.2 Modeling duration

Taking advantage of the Chilean long panel (1981 to December 2009), Fajnzylber (2011) used the observed histories of contribution of a series of cohorts born between 1963 and 1967 and only complemented the observed with simulated histories for the years following 2009. To do that, he modeled the length of the spells (both contribution and non-contribution spells) as follows:

$$\ln(\text{Length}_{it}) = \alpha + \beta_1 \cdot \text{Age}_{it} + \beta_2 \cdot \text{Age}_{it}^2 + \beta_3 \cdot (\text{Age}_{it} \cdot \text{Female}_i) + \beta_4$$
$$\cdot \left(\text{Age}_{it}^2 \cdot \text{Female}_i\right) + \beta_5 \cdot t + \eta_i + \varepsilon_{it}$$

Where i indexes individuals, t indexes the spells of each individual and the variable Age is measured at the beginning of the corresponding spell. The variable η_i represents the individual fixed effects.

5.2   Computation of SS contributions and benefits

Once we had the simulated work histories, we computed social security contributions, unemployment benefits and pensions, according to the existing social security norms. This step involves programming the current social security rules. We considered both employee and employer contributions, as both eventually impact on net wages in the long run (Gruber, 1999, p 90; Brown et al. 2009, p 13; Hamermesh and Rees 1993, p 212).

We considered two social security programs, old-age pensions and unemployment insurance. Old-age, survival and disability (OASDI) benefits are usually integrated in a single program. Unemployment insurance is often an independent program, but with important contributions from the government. In the case of Uruguay, contributions to social security finance both OASDI and unemployment insurance. Because of this, Forteza and Mussio (2011) modeled the two programs together. Regarding OASDI benefits, we focused on old-age pensions, assuming the simulated individuals leave no survivors and suffer no disability.

Individuals are assumed to claim benefits as soon as they are eligible. In the cases of Argentina and Uruguay, a scenario in which vesting period conditions are not fully enforced was also simulated. In this alternative scenario, individuals who claim and receive pensions without having fulfilled the years of contribution legally required are assumed to receive minimum pensions. The aim of simulating this weak enforcement scenario is twofold. First, we want to assess the impact of vesting period conditions on social security progressiveness. Second, this scenario is a stylized representation of actual practices in two social security programs in which the testimony of witnesses to credit contributions is still common practice.

5.3   Computation of pre- and post-social-security lifetime income

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

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

Where r is age at retirement, $p(a)$ is the probability of worker's survival at age a, $W(a)$ is labor income at age a, and ρ is the discount rate.

We computed the lifetime social security wealth as an indicator of social security transfers. Social security wealth is the present value of expected net transfers to social security. It can be obtained as the sum of the discounted expected flow 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, and $C(a)$ is the amount of contribution to social security at age a.[14]

The formulas used in this study to compute social security wealth are adapted from the literature that studies incentives to retire (e.g. Blanchet and Pelé, 1999, p132). Similar expressions are used in the literature that analyzes lifetime redistribution in social security (e.g. Liebman, 2001).

Results are sensitive to the discount rate. Higher discount rates reduce social security wealth because benefits are mostly paid after contributions (particularly so in pensions). The progressivity of social security transfers measured through lifetime transfers is likely to be smaller the higher the discount rate, partly because of the social security wealth reduction it involves, but also because most social security programs perform redistribution

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[14] In the Chilean case, pension benefits include the possibility of paying off the balance in the account of a worker who dies before retirement to her survivors, as a survivorship pension or inheritance.

through benefit rather than contribution formulas (Brown et al. 2009 make this point for the US public social security program). We used a discount rate of 3 percent per annum (ppa), but Forteza and Mussio (2011) and Moncarz (2011) performed sensitivity analysis for Uruguay and Argentina respectively. For the US case, Brown et al. (2009) use 2 and 4 ppa. Liebman (2001) uses the internal rate of return of the cohort he analyzes -1.29 ppa- in order to focus only on intra-cohort redistribution.

Following our assumption of no behavioral responses, we assume that social security does not impact on the age at retirement, so we used the same value of r to compute the pre- and post-social security labor income. The only departure from this assumption is in the weak enforcement scenario, in which all individuals retired at the minimum retirement age. Also, we assumed that the interruptions in labor history are exogenously given, independent of the unemployment insurance program.

5.4   Computation of income distribution indexes

We first characterize the distribution of individuals (i) social security wealth and (ii) social security wealth to income ratios. These indicators provide a first assessment of how much redistribution is taking place within the social security system.

Second, we plot individual social security wealth versus pre-social security labor income. This is a first indicator of local progressiveness in social security redistribution. Liebman (2001) presents similar plots for the US.

Third, we compute the Lorenz curves of the expected pre-social security labor income and the associated concentration curves of the expected post-social security labor income (ranked by pre-social security income).

Fourth, we compute the Ginis of the pre- and post-social security labor income and 95% confidence intervals.

Finally, we compute 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.

The Lorenz and concentration curves, the Gini coefficients and the Reynolds-Somelinsky index were estimated using DASP (Araar and Duclos 2009).

6 Results

Estimations of the econometric models used to project labor income and contributions are not presented in this paper. Readers interested in these intermediate results should look at the background articles. The focus in this document is on the redistributive impact of the programs. To that we turn now.

We present in Table 2 some descriptive statistics of the simulated databases. Average expected life time income ranges from 64 thousand dollars in the Mexican to 199 thousand dollars in the Argentinean databases. In the five countries, the simulated databases exhibit much dispersion of income, which is crucial to effectively assess redistribution. There are some simulated individuals with very low income. The percentile one individual (P1) has almost no life time income in Brazil, partly due to small income when working but mostly due to very short histories of contribution. The other countries exhibit higher P1 incomes, but even in Argentina, which exhibits the highest P1 income, it is smaller than 4 thousand dollars. At the other end of the distribution, the percentile 99 individuals (P99) range from 260 thousand dollars in Mexico to more than 1,500 thousand dollars in Brazil. As expected, the distributions are skewed to the right, with median consistently lower than mean income.

Average social security wealth ranges from minus 27 thousand dollars in Argentina to 4.5 thousand dollars in Chile. Measured by the difference between percentiles 1 and 99 within each country, social security wealth exhibits more dispersion in Argentina, Brazil and Uruguay than in Chile and Mexico. This is an expected result, since the Chilean and Mexican pensions programs are based on individual accounts, while the Argentinean and Brazilian programs are PAYG-DB and the Uruguayan program is mixed, but with a large proportion of PAYG-DB. The Mexican social security system appears as almost actuarially neutral in these simulations. The Chilean system looks much less neutral: the P1 and P99 social security wealth are minus 3.3 and plus 9.4 thousand dollars, respectively.

Brazil is the country that exhibits the largest dispersion in social security wealth in our study. The P1 is as low as minus 258 thousand dollars. This large losses result from the lack of ceilings on employers' contributions combined with a maximum pension.

Therefore, there is no lower bound on social security wealth, since the higher the wage, the higher the implicit tax (and the implicit redistribution). Argentina and Uruguay show much higher P1. Unlike in Brazil, because of the existence of ceilings on insured wages, total contributions cannot be higher than certain thresholds and social security wealth has a lower bound.

The distribution of social security wealth looks skewed to the left in Argentina, Brazil, Chile and Uruguay and to the right in the Mexican system.

We also computed the expected social security wealth to life time income ratio for each simulated individual. This indicator exhibits much dispersion between and within countries. The average ratio ranges from − 17 percent in Argentina to + 28 percent in Chile. It is zero in Mexico, 6 percent in Brazil and 8 percent in Uruguay.[15]

The social security wealth to income ratio exhibits almost no dispersion in the simulated Mexican database. Therefore, according to these results, social security would not perform any significant redistribution in expected terms in Mexico. This is not surprising in an individual accounts program. Nevertheless, the other individual accounts program in our sample, Chile, exhibits much more dispersion. Sorting individuals by the social security wealth to lifetime income ratio, the P1 individual loses about 1 percent and the P99 individual gains 331 percent of their lifetime income in Chile. So, despite of being based on individual accounts, the Chilean system seems to have enough departure from actuarial neutrality as to perform significant redistribution. The Argentinean program shows less dispersion in the ratio than other programs covered in our study, apart from Mexico. However, the fact that the P1 individual losses is as much as 24 percent of his lifetime income through social security indicates that we cannot yet rule out significant redistribution from taking place within the Argentinean social security system. The Brazilian and Uruguayan programs show much more variation in the ratio, highlighting a potentially large redistribution.

According to our simulations, Argentina, Brazil, Chile and Uruguay exhibit considerable variation in social security wealth and social security wealth to lifetime income ratios

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[15] Liebman (2001) computed the same indicator for the United States. Using a discount rate of 3 percent per annum -the same rate used in the present study-, he finds the average ratio to be -6.6%.

across individuals, performing significant redistribution. This is not the case of Mexico. Whether this potential is actually realized and what sign it has depends on how these transfers are correlated to lifetime income. We turn now to this point.

Figure 1 plots social security wealth and pre social security lifetime labor income. To facilitate comparisons, we limited the range of values in the figure from the minimum P1 to the maximum P99 in the set of countries. It should be noticed that in the case of Brazil individuals with income above P99 would have social security wealth smaller than the highly negative value observed in the figure. Instead, in the cases of Argentina and Uruguay, higher income workers do not get more negative social security wealth, because as explained before they have already reached the lower bound.

The negative slope of the plots suggests that the PAYG Argentinean and Brazilian programs and the mixed Uruguayan program are progressive, while the flat plots of the individual accounts Chilean and Mexican programs suggest much more neutrality. Actually, there is redistribution at the lower end of the distribution in the Chilean and Mexican programs, but when the scale of the graphs is unified to facilitate cross-country comparisons as we did in this figure, the plots of the individual accounts programs look flat compared to the plots of the PAYG and mixed programs.

Figure 1 also shows considerable variability of social security wealth for each level of lifetime labor income in Argentina, Brazil and Uruguay. Therefore, there seems to be some redistribution that is not correlated to income levels in the PAYG and mixed programs covered in this study. Liebman (2001) reports a similar finding for the US.

These observations suggest that while the individual account programs perform less redistribution on average than the PAYG programs, they might be better targeted regarding redistribution. The net impact of the programs on the distribution of post-social security life time income is thus not a priori obvious.

Figure 2 presents the Lorenz curves of pre social security labor income and the concentration curves of post social security labor income. We do not observe large differences between the pre and post social security curves in these countries. Brazil and Chile are the only cases in which there seems to be an observable equalizing effect of social security.

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The Gini coefficients of the simulated pre social security life time labor income range from a minimum of 0.48 in Mexico to a maximum of 0.76 in Brazil (Table 3). According to this indicator, the distribution of the income measure considered in the present study is much more unequal than the distribution of current household per capita income reported to household surveys in Argentina, Brazil and Uruguay and more equal in Chile and Mexico.[16] Brazil is the most unequal in this group of countries according to both estimations, but the ranking regarding other countries differs considerably. We do not want to push the comparative perspective further, though, not only because the definition of income used in these studies is very different, but also because data sources used to compute life time income in the five countries covered in our project are also different (short panel surveys in Argentina, Brazil and Mexico and administrative records in Chile and Uruguay). More research on the distribution of life time labor income declared to social security is needed. With this caveat in mind, we turn now to our estimations of the impact of social security on inequality.

According to our estimations, Chile is the country in which social security causes the largest reduction in inequality (Table 3 and Table 4). The point estimation of the Gini coefficient is reduced by almost four points and the 95% confidence intervals do not overlap. The Reynolds-Smolenski index (RS) of effective progression is almost 4 percentage points and is significant at 1%.The second largest fall in the Gini coefficient due to social security in our study takes place in Brazil, where we see a two point fall, and the third in Uruguay, with a 1.8 point fall. The RS index is in the order of 2 percentage points and highly significant both in Brazil and Uruguay. Mexico shows almost no change in the Gini coefficients. The RS index is 0.02 percentage points. Finally, Argentina shows a 1.3 point increase in the Gini coefficient due to social security, with a small overlap of the 95% confidence intervals. The RS index is -1.3 percentage points and is significant at 1%.

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[16] CEDLAS and The World Bank (April 2011), for example, report Gini coefficients estimated on 2009 household per capita income of: 0.449 for Argentina, 0.537 for Brazil, 0.519 for Chile, 0.505 for Mexico and 0.44 for Uruguay. These indicators are not directly comparable to ours though. The Ginis reported in the present study refer to individual income as opposed to household per capita income, to labor as opposed to total income, to formal (in the sense of reported to social security) as opposed to formal plus informal income, and to simulated expected lifetime as opposed to reported current income. Also, in the case of Brazil, only private sector workers are included.

The reduction in income inequality that the Chilean social security system performs is remarkable. It is a system based on mostly actuarially neutral individual savings accounts, and as such produces much less redistribution than the PAYG and mixed programs analyzed in Argentina, Brazil and Uruguay. The difference between the P99 and P1 social security wealth is more than 90 thousand dollars in Argentina and Uruguay, and more than 260 thousand dollars in Brazil, but only 13 thousand dollars in Chile. And yet, the Chilean program is the one that shows the largest fall in income inequality in the countries studied. This result suggests that redistribution in the Chilean pension program is much better targeted than in the other four countries. The limited but well targeted redistribution in this social security system rests on the combination of a mostly actuarially neutral savings account and a relatively small but well targeted solidarity complement.

In addition, it is not surprising that the Mexican social security system does not impact on income distribution. Descriptive statistics of the social security wealth showed very small values, consistent with a mostly actuarially neutral program. Minimum pensions and government matching contributions represent departures from actuarial neutrality in the Mexican social security system, but the size of these deviations is not enough to significantly impact on income distribution.

The failure of the Argentinean and, to a lesser extent, the Uruguayan social security programs to reduce inequality represents a puzzle. Vesting period conditions might help explain the puzzle. In Argentina and Uruguay ordinary pensions can be claimed after thirty years of contribution, a condition that many contributors do not seem to be able to fulfill. Forteza et al. (2009) show that 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. In turn, 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.

In order to test this hypothesis, Moncarz (2011) and Forteza and Mussio (2011) simulated an additional scenario in which the vesting period condition is not required in practice. In this "weak enforcement" scenario, the social security administration does not control whether individuals have contributed the required thirty years to get an ordinary pension at

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the minimum retirement age. The assumption is that everybody can claim an ordinary pension at that age. Individuals who did not contribute thirty or more years at that age receive the minimum pension. This scenario is not only useful to see whether vesting period conditions could be behind the redistributive puzzle, but also to get closer to actual practice in weak institutional environments in which the testimony of witnesses to credit periods of contribution to social security is still common practice. The results of this scenario are summarized in Table 6, Table 7 and Figure 3.

Social security looks more progressive in the weak than in the strict enforcement scenario. In Uruguay, social security causes a 2.6 points fall in the Gini coefficient in the weak against 1.7 in the strict enforcement scenario. The RS is now 2.6 percentage points. An increase in the social security wealth of low income individuals seems to be behind the improvement (Figure 3). In Argentina, social security still fails to reduce inequality in the weak enforcement scenario. The Gini coefficient does not increase as much as in the base case scenario, but post-social security income still exhibits higher Gini than pre-social security income and the RS index is negative and significant at the usual levels.

Moncarz (2011) for Argentina and Forteza and Mussio (2011) for Uruguay run additional simulations with lower discount rates. Social security looks more redistributive when flows are discounted at lower interest rates, but the main results do not change qualitatively. In the case of Argentina, only in the scenario with weak enforcement and 1 percent interest rate (the lowest rate used) did social security significantly reduce inequality.

Fajnzylber (2011) assesses the separate impact of unemployment insurance and old age pension programs on the distribution of income in Chile. He finds that unemployment insurance is progressive. Most individuals have negative expected life time net transfers to this program, but individuals at the bottom of income distribution have positive net transfers due to the solidarity fund. Higher income individuals are less likely to benefit from this fund because (i) they are less exposed to unemployment and (ii) when unemployed they are less likely to be eligible for the solidarity funds benefits, because the balances in their individual accounts tend to exceed the maximum level to be eligible for these benefits.

Notwithstanding, the unemployment insurance program has a limited impact on income distribution. Fajnzylber (2011) reports a Reynolds-Smolenski index of redistributive effect

of 0.097 for this program, as opposed to 3.876 for the joint effect of unemployment insurance and old-age pensions. The main reason behind this is the relatively small size of the unemployment insurance program.

7   Concluding Remarks

The studies summarized in this document show that much redistribution is taking place through the social security systems in Argentina, Brazil, and Uruguay, very little in Mexico and something in between in Chile. Life time redistribution was measured simulating histories of contribution and computing benefits and individual expected life time net transfers to social security (i.e. the individuals' social security wealth). The amount of redistribution was assessed computing the dispersion of the social security wealth and the social security wealth to pre social security income ratios. The difference between the percentiles 99 and 1 of social security wealth is about 260 thousand dollars in Brazil, 90 to 100 thousand dollars in Argentina and Uruguay, 13 thousand in Chile and 0.5 thousand dollars in Mexico. As expected, the two individual accounts programs (Chile and Mexico) exhibit much less redistribution than the PAYG and mixed programs (Argentina, Brazil and Uruguay).

However, the net impact of social security on the distribution of income is not directly aligned to the size of total redistribution. Chile is the country in which the social security system makes the largest contribution to reducing inequality, despite of having the second smallest dispersion in social security wealth in our sample of countries. Fajnzylber (2011) reports an almost four points reduction in the Gini coefficient in Chile, as compared to about two points reduction in Brazil (Zylberstajn, 2011) and Uruguay (Forteza and Mussio, 2011), no changes in Mexico, and 1.3 points increase in Argentina (Moncarz, 2011).

The results summarized in this document suggest that the Chilean program has less but better targeted redistribution than the Argentinean, Brazilian and Uruguayan programs: with less total redistribution it performs a larger reduction in inequality. The Brazilian and Uruguayan programs look quite progressive, but not as much as the Chilean one and much of the redistribution they cause does not seem to be contributing to reducing inequality. The Mexican program does not seem to redistribute much. The Argentinean program is the most puzzling: it performs much redistribution, but it fails to reduce inequality, and it might even exacerbate it.

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Tables

Program	Contributions a/	Qualifying conditions	Benefits
Argentina (PAYG-DB)	Employee: 11.00% Employer: 16.00%	Men: $age \geq 65$ & $los \geq 30$ Women: $age \geq 60$ & $los \geq 30$	$PBU +$ "$Additional$" Minimum pension = 265 dollars (end of 2010) Where: $PBU = 125\ dollars\ (end\ of\ 2010)$ "$Additional$" $= 0.015 \times min(35, los) \times \bar{w}$
		$age \geq 70$ & $30 > los \geq 10$ (with at leat 5 years of contributions during the 8 years previous to retire)	$0.7 \times PBU +$ "$Additional$"
Brazil (PAYG-DB)	Employee: 8 to 11%. Employer: 20%.	a) "Length of service": Men: $los \geq 35$ Women: $los \geq 30$	$= \bar{w} *$ "$fator\ previdenciario$" Note: the "*fator previdenciario*" is a decreasing function of life expectancy at retirement.
		b) "Advanced age": Men: $age \geq 65$ & $los \geq 15$ Women: $age \geq 60$ & $los \geq 15$	$= 0.7(1 + 0.01los)\bar{w} \leq \bar{w}$

Program	Contributions a/	Qualifying conditions	Benefits
Chile (Individual accounts plus "solidarity" pillar)	Employee: 13.04% (10% individual account + 1.49% disability and insurance premium + 1.55% average administrative fee, as of April 2011) (Employers with more than 100 workers pay the 1.49% D&I premium)	$Men: age \geq 65$ $Women\ age\ \geq 60\ or$ $annuity \geq 0.7\overline{w}$ & $annuity \geq 1.5 \times Min.Pen.$	Annuity + "solidarity complement" Note: "solidarity complement" is reduced with the level of the annuity and becomes zero if $annuity \geq PMAS$, where PMAS is the Maximum Pension with Solidarity Complement
Mexico (Individual accounts plus minimum pension and government flat contributions)	Employee: 1.125% Employer: 5.15% Government: 0.225% + flat contribution for each day of contribution (decreasing in the wage rate)	$age \geq 65\ \&\ los \geq 25\ or$ $annuity \geq 1.3minpen$	$annuity \geq minpen$
Uruguay (Mixed program: (i) first tier: PAYG-DB; (ii) second tier: individual accounts)	Employee: 15% Employer: 7.5%	$age \geq 60\ \&\ los \geq 30$	$rr \times \overline{w}$ With: $0.45 \leq rr \leq 0.825$
		$age \geq 70\ \&\ los \geq 15$	$rr \times \overline{w}$ With: $0.5 \leq rr \leq 0.65$
		$age \geq 65\ or$ $age \geq 60\ \&\ los \geq 30$	Annuity

Notes: age = age when pension is claimed, in years; los = length of service when pension is claimed, in years; $\overline{w}$ = average wage (wages included in this average vary considerably between programs) ; $minpen$ = minimum pension.
a/ In most programs, contributions to old age, survivor and disability insurance (OASDI) cannot be separated into three distinct components. We report OASDI contributions in all cases. In Uruguay, contributions to old-age pensions and unemployment

Program	Contributions a/	Qualifying conditions	Benefits
insurance are bunched together.			
Source: Author's elaboration based on Forteza and Ourens (2011) .			

Table 2: Pre- social security lifetime labor income and social security wealth (in thousands of 2010 US dollars)

		Mean	P1	Median	P99	Skewness
Argentina	Income	201.1	4.0	115.4	1289.8	4.8
	SSW	-26.8	-102.1	-15.9	-1.0	-1.4
	SSW/Income	-17%	-24%	-17%	-6%	0.3
Brazil	Income	143.3	0.0	48.1	1533.5	22.3
	SSW	-19.8	-258.2	-2.4	4.2	-23.4
	SSW/Income	6%	-30%	-6%	196%	3.2
Chile	Income	95.2	2.1	62.9	440.8	1.9
	SSW	4.5	-3.3	4.4	9.4	-0.3
	SSW/Income	28%	-1%	8%	331%	7.8
Mexico	Income	63.8	0.6	48.5	259.9	1.7
	SSW	0.0	0.0	0.0	0.6	6.2
	SSW/Income	0%	0%	0%	2%	6.7
Uruguay	Income	175.1	1.3	89.3	1211.4	20.1
	SSW	-3.6	-77.3	-0.2	17.1	-2.9
	SSW/Income	8%	-13%	-1%	147%	13.5
Source: Fajnzylber (2011), Forteza and Mussio (2011), Moncarz (2011) and Zylberstajn (2011)						

Table 3: Gini coefficients of life time labor income before and after social security

		Gini before SS	Gini after SS
Argentina	Estimate	0.5504	0.5638
	Lower confidence bound (95%)	0.5426	0.5555
	Upper confidence bound (95%)	0.5582	0.5722
Brazil	Estimate	0.7630	0.7435
	Lower confidence bound (95%)	0.7412	0.7214
	Upper confidence bound (95%)	0.7848	0.7655
Chile	Estimate	0.4991	0.4606
	Lower confidence bound (95%)	0.4902	0.4521
	Upper confidence bound (95%)	0.5081	0.4691
Mexico	Estimate	0.4787	0.4786
	Lower confidence bound (95%)	0.4728	0.4726
	Upper confidence bound (95%)	0.4847	0.4845
Uruguay	Estimate	0.6004	0.5822
	Lower confidence bound (95%)	0.5889	0.5701
	Upper confidence bound (95%)	0.6119	0.5943
Source: Fajnzylber (2011), Forteza and Mussio (2011), Moncarz (2011) and Zylberstajn (2011)			

Table 4: Index of redistribution (Reynolds-Smolensky index of effective progression)

	Index	Standard Error
Argentina	-0.0132	0.00035
Brazil	0.0198	0.00028
Chile	0.0388	0.00079
México	0.0002	0.00001
Uruguay	0.0187	0.00045
Source: Fajnzylber (2011), Forteza and Mussio (2011), Moncarz (2011) and Zylberstajn (2011)		

Table 5: Pre social security lifetime labor income and social security wealth under weak enforcement of pension eligibility conditions (in thousands of 2010 US dollars). a/

		Mean	P1	Median	P99
Argentina	Income	200.4	4.1	114.9	1289.8
	SSW	-25.8	-102.1	-17.8	6.5
	SSW/Income	-7%	-20%	-13%	135%
Uruguay	Income	173.8	0.8	87.8	1211.4
	SSW	-3.3	-80.1	0.8	11.1
	SSW/Income	34%	-9%	1%	505%
a/ In this scenario, we dropped the vesting period conditions to access pensions. See text for the details.					
Source: Forteza and Mussio (2011) and Moncarz (2011)					

Table 6: Gini coefficients of life time labor income before and after social security under weak enforcement of pension eligibility conditions. a/

		Gini before SS	Gini after SS
Argentina	Estimate	0.554	0.557
	Lower confidence bound (95%)	0.546	0.549
	Upper confidence bound (95%)	0.562	0.565
Uruguay	Estimate	0.606	0.580
	Lower confidence bound (95%)	0.594	0.568
	Upper confidence bound (95%)	0.617	0.592
a/ In this scenario, we dropped the vesting period conditions to access pensions. See text for the details.			
Source: Forteza and Mussio (2011) and Moncarz (2011)			

Table 7: Index of redistribution under weak enforcement of pension eligibility conditions (Reynolds-Smolensky index of effective progression) a/

	Index	Standard Error
Argentina	-0.0029	.0005
Uruguay	0.0263	.0006
a/ In this scenario, we dropped the vesting period conditions to access pensions. See text for the details. Source: Forteza and Mussio (2011) and Moncarz (2011)		

Figures

Source: Fajnzylber (2011), Forteza and Mussio (2011), Moncarz (2011) and Zylberstajn (2011)

Figure 2: Pre Social Security life time labor income Lorenz curve and post Social Security life time income concentration curve
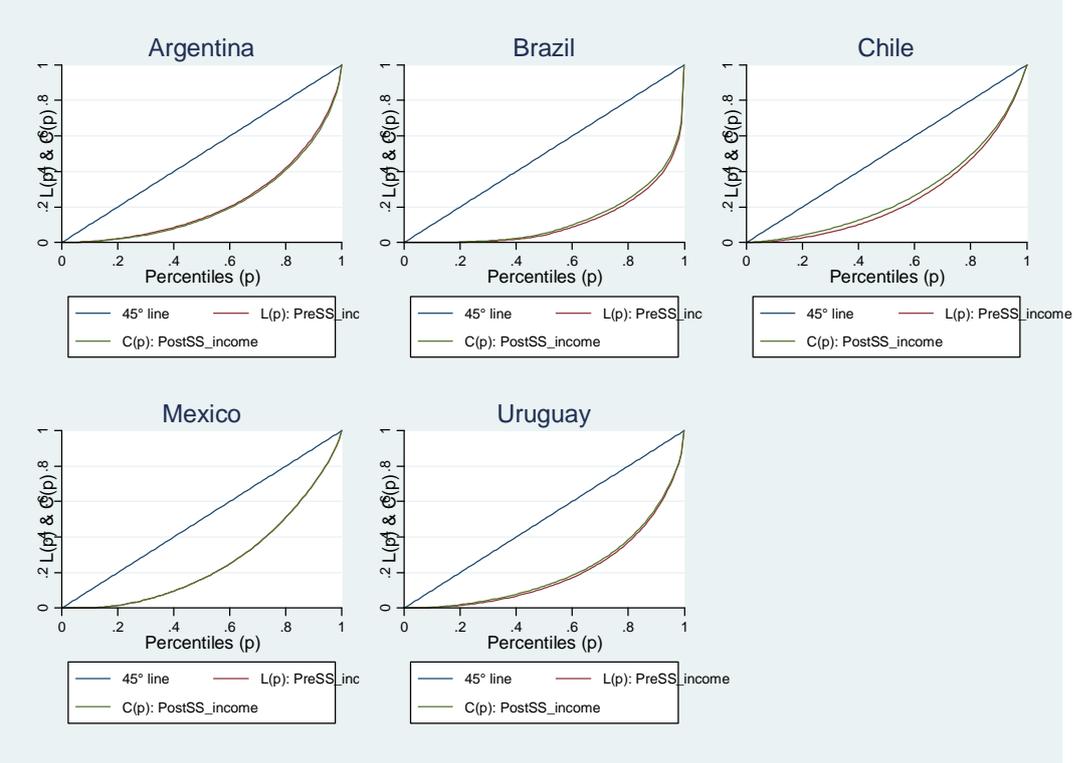
Source: Fajnzylber (2011), Forteza and Mussio (2011), Moncarz (2011) and Zylberstajn (2011)

Figure 3: Social security wealth and life time income under weak enforcement of pension eligibility conditions a/

Source: Forteza and Mussio (2011) and Moncarz (2011)