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Calculating the redistributive impact of pension systems in LAC

Alvaro Altamirano, María Laura Oliveri, Mariano Bosch, and Waldo Tapia

Abstract: This paper examines the implicit subsidies within pension systems across Latin America and the Caribbean (LAC) region. We first calculate the theoretical benefits of pension for hypothetical workers in 25 countries in LAC. We show that, on average, LAC's pension systems are subsidized, as they provide pensions above what workers would have obtained by investing pension contributions in a safe asset. Similarly, pension systems are designed to be progressive by offering higher replacement rates (pensions relative to earnings) for low-income workers. Despite this progressivity, in some countries, absolute subsidies could be higher for high-income workers. This occurs because the cost of one percentage point of the replacement increases with the average pension. Second, using data from social protection surveys, we estimate the incidence of pension systems in five LAC countries. We show that, on average, all five systems provide important subsidies to those workers who obtain a pension. However, given the high levels of informal work, in some countries, those subsidies are highly concentrated among high-income workers. Variation is large across countries. The three highest labor income deciles concentrate 70-95% of all subsidies in defined benefit systems such as Paraguay and Colombia. In defined contribution systems, subsidies are much more progressive, but still, because low-income workers do not qualify for minimum pensions, between 50-60% of subsidies concentrate in the high-income deciles. Countries like Chile, with explicit subsidies targeted at the bottom of the income distribution, obtain a more progressive distribution of subsidies. Because of relatively low participation rates, women have a weaker link with the pension system. They are also less likely to benefit from implicit subsidies. Finally, we show that non-contributory pensions, if well-targeted, largely improve the redistributive properties of pension systems in LAC.

Keywords: Pensions, Subsidies, Taxes, Latin America

JEL codes : H55 ; J11; J14; J18; J26; J32

Introduction

The Latin America and Caribbean region is still relatively young. On average, 9% of the population is 65 and above compared to high-income countries in Europe (19.1%) or North America (16.8%). However, population aging is happening faster in Latin America and the Caribbean than anywhere else in the world. It took Europe 56 years for the share of the population older than 65 to grow from 10% to 20%. In Latin America and the Caribbean, this transition will happen in half that time (UNPD, 2019). This will increase pension expenditures in LAC from 3.9% of GDP in 2020 to 7.4% in 2050 (Aranco, et al 2022). By 2050, without reforms, as the LAC population ages, pensions are bound to absorb an important share of public spending, leaving little room for investment in other social priorities (Izquierdo, Pessino and Vuletin, 2018).

Despite being one of the main components of public expenditure in LAC there is relatively little systematic measurement of how pension spending distributes resources within generations across different income and population groups and across generations. Measuring the distributive properties of pension systems is challenging. Pension systems differ from other taxes levied on households insofar as participants perceive contributions as giving them a claim to future benefits. In general, the link between pension contributions and future pension rights depends on how closely benefits are related to contribution histories, 'actuarial fairness', and the implicit returns on pension contributions relative to an outside investment option in a safe asset. In simple terms, an actuarially fair program would match expected individual entitlements exactly to lifetime contributions.

This paper measures the within-generation tax component and redistribution in LAC. That is, how the pension system treats workers with different characteristics (income, history of contribution, gender, etc.), that belong to the same cohort. We present two exercises. First, we build on work from Altamirano et al. (2018) and update the theoretical distributional properties of pension systems in 25 LAC countries. We do this by calculating the difference between individual entitlements and lifetime contributions for hypothetical workers with full-contribution careers. It is useful to think of this exercise as what pension systems are designed to do for fully compliant workers. Second, to understand the actual incidence of pension systems in LAC we use data from social protection surveys and estimate the replacement rates (pensions relative to earnings) and implicit subsidies in five pension systems in LAC (Colombia, Chile, El Salvador, Paraguay, and Uruguay) for the generation retiring between approximately 2030 and 2040.

The main results of this paper are as follows. First, on average, most of LAC's pension systems are designed to provide pensions to workers above what they would have obtained by investing pension contributions in a safe asset. However, there are large differences across countries and types of systems. In defined benefit programs (define contribution programs), a worker that contributes his entire life from age 20 to the minimum age of retirement receives an average replacement rate of 63% (37%), 30pp (9pp) higher than an actuarially fair pension. Second, pension systems are designed to be progressive by offering higher replacement rates for low-income individuals. In defined benefit programs, workers earning 75% of the average wage obtain

a replacement rate 17pp higher than workers earning 3 average wages. Despite this progressivity, absolute subsidies could be higher for high-income workers in defined benefit systems. This occurs because subsidizing 1 pp of the replacement rate is substantially more costly for high-income workers. Third, the actual incidence of pension systems is far less progressive than its design implies. Given the levels and the patterns of informal work in LAC, a much higher share of high-income workers is eligible for pension benefits. This means that the incidence of built-in subsidies is highly concentrated in the upper part of the income distribution. For instance, in defined benefit systems such as Paraguay and Colombia, the three highest income deciles concentrate between 70-95% of all subsidies. In defined contribution systems, subsidies are less regressive, but still, because low-income workers do not qualify for minimum pensions, between 50-60% of subsidies concentrate in the high-income deciles. Countries like Chile with explicit subsidies targeted at the bottom part of the income distribution obtain a more progressive distribution of subsidies. Because working women have a weaker link with the pension system, they are also less likely to benefit from implicit subsidies. Finally, we show that non-contributory pensions, if well-targeted, largely improve the redistributive properties of pension systems in LAC.

This paper follows the literature that assesses the impacts of pension programs on redistribution. In the United States of America, several papers quantify redistribution of the social security program by calculating net present value of the expected lifetime flows of contributions (Gruber and Wise, 1999, 2004; Coile and Gruber, 2001; Liebman, 2001). In LAC, Forteza (2011) estimates the redistributive impacts of 5 pension systems Argentina, Brazil, Chile, Mexico, and Uruguay. The authors suggest calculating redistribution by comparing the distribution of the expected pre- and post-social security lifetime income. Finding varying degrees of redistribution, with defined benefit and mixed programs redistributing more than individual savings accounts programs. They also find that it is the Chilean individual savings accounts program, combined with the solidarity pillar, the one that contributes more to reducing inequality in this group of countries. More recently Grushka (2019) proposed a simplified way to think about redistribution by computing the difference of replacement rates by education levels (as a proxy of lifetime income). They find that in Argentina actual replacement rates of high school graduates are 10 points higher than college graduates.

Pension systems constitute one of the major social programs in LAC and absorb an important part of the budget in many countries. Given the aging process, an increasing share of public spending will be destined to pay for pensions. This paper shows that though most pension systems in the region are designed to be progressive, in many countries the implicit subsidies are highly concentrated among high-income workers. Pension systems can be designed to be more progressive through three design features. First, reduce or eliminate the minimum number of years required to access benefits, particularly in defined benefit systems. This would eliminate the implicit tax workers that do not qualify for pensions pay to the system. Second, increasing the link between contributions and benefits. This could reduce subsidies in the upper part of the income distribution and third, making subsidies explicit and targeted towards the lower part of the income distribution.

The paper is organized as follows. Section II describes the pension system in LAC. Section III defines the main indicators and methodology used in the paper. Section IV presents theoretical benefits for hypothetical workers in 25 countries in LAC. Section V shows the incidence of pension systems in five LAC countries. Section VI provides a brief discussion and concludes.

II A brief description of Pension systems in LAC

Broadly speaking, the main mandatory contributory pension systems in Latin America and the Caribbean can be classified into three categories depending on the way they provide pension benefits. Countries with traditional publicly funded defined benefit systems, countries with individual accounts defined contribution systems, and countries that use mix systems.[1]

In defined benefit systems, the pension is determined by a formula that normally includes the retirement age; the contributions made to the system (in number of years or weeks), the average salary from which the pension is calculated (generally the last few years worked); and the minimum number of contributions to be eligible for a pension. In many of these systems, individuals who contributed less than the minimum number of contributions receive nothing from the system. In rare cases, like in Colombia, they receive their contributions back adjusted for inflation.

In defined contribution systems, the pension is determined by the accumulated amount of the worker's contributions plus the returns on these contributions which is transformed into a pension in the form of a life annuity at the moment of retirement.[2] The accumulated amount depends on contribution rates, interest rates, and the worker's years of contribution. The age of retirement, demography, and the technical interest rate of annuities impact the level of the annuity. In some defined contribution systems, minimum pensions are established, regardless of the accumulated amount, if the worker has reached a minimum number of contributions (like the eligibility criteria of defined benefit systems). These minimum pensions are what give these systems redistributive qualities.

In some countries, there is a single contributory system (defined benefit or defined contribution) for most workers. In other countries, the total amount of the individual's pension depends on a combination of these types of system. For example, in Costa Rica, Panama, or Uruguay, one part of the pension is determined under a defined benefit system, and another, by a defined contribution system (mixed systems). In addition, non-contributory pillars have been implemented in 24 of the region's countries. Some countries, such as Bolivia or Chile, combine defined contribution systems with non-contributory pensions.

Table 1 summarizes the pension systems in LAC and key parameters such as contributory rates, minimum retirement ages for men and women, and the minimum required number of years to qualify for a pension or a minimum pension.

[1] See Appendix I for detailed description of terms.

[2] Most defined contribution systems allowed for other retirement products such lump-sum withdrawals or periodic withdrawals. These are not considered in this paper.

Table 1: Main pension programs in LAC, and key parameters.

	Type of system	Minimum retirement age		Contribution rates	Years required to qualify for a pension
Country		Men	Women	%	Years
Antigua & Barbuda	Defined Benefit	62	62	14.5%	12
Argentina	Defined Benefit	65	60	23.4%	30
Barbados	Defined Benefit	67	67	13.5%	10
Bahamas	Defined Benefit	65	65	9.8%	10
Belize	Defined Benefit	65	65	10%	10
Bolivia	Defined Contribution	55	50	10.0%	10, 15 (MP)
Brazil	Defined Benefit	65	62	28-34%	20 (M), 15 (W)
Chile	Defined Contribution	65	60	10.0%	-
Colombia	Defined Benefit	62	57	16.0%	26
Colombia	Defined Contribution	62	57	11.5%	23 (MP)
Costa Rica	DB+DC	65	65	15.4%	15, 15 (MP)
Ecuador*	Defined Benefit	60	60	11%	30
El Salvador	Defined Benefit	60	55	16%	25
El Salvador	Defined Contribution	60	55	16%	25 (MP)
Guatemala	Defined Benefit	60	60	5.5%	20
Guyana	Defined Benefit	60	60	14%	15
Haiti	Defined Benefit	55	55	12%	20
Honduras	Defined Benefit	65	60	3%	15
Jamaica	Defined Benefit	65	65	6%	10
Mexico	Defined Benefit	65	65	6.5%	10
Mexico	Defined Contribution	65	65	6.5%	15 (MP)
Nicaragua	Defined Benefit	60	60	17.3%	15
Panama	DB+DC	62	57	13.5%	20, 15 (15)
Paraguay	Defined Benefit	60	60	16.5%	25
Peru	Defined Benefit	65	65	13%	20
Peru	Defined Contribution	65	65	10%	20 (MP)
Suriname	Defined Benefit	60	60	10%	10
Trinidad & Tobago	Defined Benefit	60	60	13.2%	15
Uruguay	DB+DC	60	60	22.5%	30
Venezuela	Defined Benefit	60	55	15%	15

Note: * in Ecuador anyone can be retired with 40 years of contributions at any age.
Source: Prepared by the authors. Notes: DB = Defined Benefit; DC = Defined Contribution. * In defined contribution systems, it corresponds to the rate of capitalized contributions. ** (M) denotes

Men and (W) Women, (MP) Minimum Pension. Most DC systems do not require a minimum of years of contributions to grant pension benefits.

III Understanding the within-generation redistributive elements built into pension systems.

To understand distributional properties of pension systems we define two indicators. First, the replacement rate as the ratio of pension benefits with respect to the last salary (Equation 1). This indicator captures how the pension benefit compares to the worker's earnings; it represents the system's capacity to alleviate poverty and smooth consumption.

$$RR(P_t) = \frac{P_R}{S_{R-1}} \qquad \text{(Equation 1)}$$

Where P_R is the pension at the time of retirement and S_{R-1} is the worker's final wage in the period immediately before retiring.

Second, we define subsidies/taxes as pension benefits above (below) what would have been obtained relative to investing the mandatory contribution in a safe asset and obtaining a fair annuity. It is this difference that we exploit to infer the redistribution that occurs within pension systems. Several assumptions are needed to establish both the actual and the counterfactual benefit (see appendix I for details). One key parameter is the interest rate of this safe asset as it establishes the level of subsidies. As a benchmark scenario we follow the OECD and establish the safe asset return for LAC at 3.5% real (OECD/IDB/The World Bank, 2014)). The order of magnitude of this interest rate is based on several data points. For instance, the social security administration in the US calculates the internal rate of return of the social security system between 2.28% and 4.28% depending on the gender and the marital status of the beneficiary (SSA, 2022).[3] Similarly, the average rate of return for private pension savings in LAC between 2012 and 2022 was 4.07% (FIAP, 2023).

We can express these subsidies/taxes in two ways. First, the share of the pension (or replacement rate) that is subsidized; that is, the difference in percentage points between the replacement rate obtained and one resulting from a pure savings system investing in a safe asset. (Equation 2).

$$S_{RR} = RR(P_R) - RR[P_R^J(r_E)] \qquad \text{(Equation 2)}$$

Where S_{RR} is the subsidized replacement rate, $RR(P_R)$ is the replacement rate granted by the system, and $RR[P_R^J]$ is the replacement rate that would result from capitalizing the contributions made to the system at an equilibrium interest rate, r_E.

Similarly, these subsidies/taxes can also be expressed as the difference in PPP US$ between the capital necessary to finance the actual pension that workers obtain in a particular system and the capital that would have accumulated if the contributions had been capitalized in a safe asset (Equation 3).

$$\mathrm{S_{US}} = \mathrm{K}\left[\mathrm{P_R^J} = \mathrm{P_R}\right] - \sum_{t=0-(R-20)}^{t=-1} \frac{C_t}{(1+r_E)^t} \qquad \text{(Equation 3)}$$

[3] This corresponds to beneficiaries born in 1973 retiring in 2038 with average income.

Where S_{US} is the amount subsidized to the individual through the pension system, K is the capital necessary to purchase a life annuity equivalent to the pension that the system grants upon retirement and $\sum_{t=0-(R-20)}^{t=-1} \frac{C_t}{(1+r_E)^t}$ is the capital that would result from capitalizing the contributions at an equilibrium interest rate r_E upon retirement.

The progressivity of pension systems can be understood as providing higher replacement rates to lower-income workers (see Grushka, 2019). For a given interest rate and contribution history this implies that a larger proportion of the pension is subsidized for low-income workers (equation 2). However, even when replacement rates decrease with income, the total amount subsidized may not. The total amount subsidized is an important metric for at least two reasons. The total costs of subsidies in GDP terms depend on the total amount subsidized, not on the share of the pension that is subsidized. For example, a pension system that subsidizes 10 percentage points of the pension (according to equation 2) for all workers regardless of their income, would be spending substantially more on high-income workers because they have a higher salary. Second, countries that grant explicit subsidies through the pension system, do so in absolute (total amount) and not relative terms (in relation to the worker's salary). This is the case of defined benefit systems that establish subsidies as the gap between the accumulated savings at the capital necessary to finance a minimum pension, as well as in countries like Chile and Sweden, where the state complements the workers' savings with a subsidy using a formula that links the total amount of the subsidy with the total amount saved or contributed. Therefore, throughout the paper we put particular attention in the overall level of subsidies by income level.

Explicit and Implicit redistribution in pension systems.

Most pension systems include explicit redistributive features that aim at providing higher pensions (as a percentage of earnings) to workers with lower wages. Furthermore, pension systems will also generate some implicit redistribution as deviations from actuarially fair benefits, depending on a variety of factors, including differential contribution histories, gender, or longevity for different types of workers. These are implicit redistribution elements.

Explicit redistribution

Pension systems tend to have progressive elements in their design: the higher the income, the lower the replacement rates. There are three key features that are designed to contribute to that progressivity. First, the existence of minimum pensions ensures a minimum level of benefit for low-income workers. This is true for both defined benefit and defined contribution programs. For the latter, this tends to be the only redistributive feature. Second, defined benefit formulas tend to decrease in the level of income, providing higher replacement rates to low-income workers. And third, in some systems a maximum pension caps the benefit of high-income workers.

Given the lack of coverage of pension systems, non-contributory pension programs have proliferated in the region (Rofman et al., 2013, Bosch, Melguizo and Pagés, 2013). These pensions extend payments to people who have not made contributions or who do not fulfill the requirements for a contribution-based retirement pension. Currently, non-contributory pensions represent a third of the pension coverage in the region. In several countries, there are more people who receive non-

contributory pensions than a contribution-based retirement pension. Non-contributory pensions represent a direct explicit subsidy for individuals with sporadic or no contributions.

Implicit redistribution

Redistribution across income levels might happen for other factors even in the absence of explicit redistributed components. One of the most important redistributive features of pension systems is the requirement of a minimum number of contribution years to grant pension eligibility. This design element has clear implications for the relationship between contributions and benefits.

Figure 1 illustrates this relationship. The dotted line represents the relationship between the number of contributions as a percentage of working life (also known as "contribution density") and the pension obtained in a situation where contributions are made into an individual account, are capitalized with an interest rate "r", and from which, upon retirement, the subject obtains a fair annuity in accordance with the mortality tables at the time of retirement in the person's country. We call this scenario a "pure savings scenario". This is a baseline scenario for the exercise developed in this document since it represents a pension contract in which the state does not intervene and, therefore, does not offer any subsidy or tax. The individual's pension in this social contract is derived exclusively from his contributions, from their returns in the financial market, and from demographic trends. It, therefore, serves as a reference for comparisons with other pension contracts.

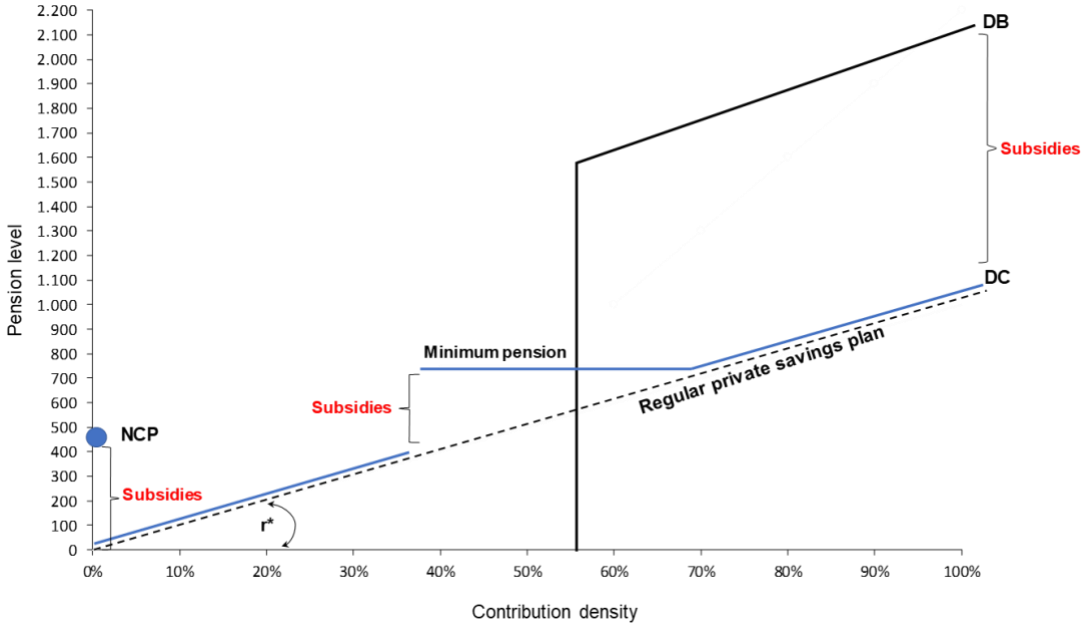
Defined contribution systems closely resemble this scenario. The pension depends on the individual's contributions to an individual account. However, most individual capitalization systems include a minimum pension that guarantees a level of benefit once a certain number of contributions has been reached (in the chart they are arbitrarily shown after a 35% contribution density). This minimum pension is represented by a horizontal line at the value of the replacement rate, consistent with this guaranteed minimum pension in figure 1 (capitalization with a minimum pension).

In defined benefit systems, on the other hand, there is a very different relationship between contribution and pension level since most of them do not offer any type of pension benefit beneath a minimum number of contributions. Once a certain level of contributions has been reached, a pension is granted based on a formula. Finally, non-contributory pensions are represented as a point on the vertical axis, since in principle there are no contributions for these and, therefore, there is no relationship between benefits and contributions. If the worker does not reach the threshold a pension is not granted. This implies that workers who are not eligible, but made contributions, receive a negative subsidy (tax) through the pension system. Table 1 shows the required year of contributions. The minimum number of contribution years rules generate a very characteristic pattern of benefits by density level. The differences between systems take place in the contribution density threshold, where benefits discontinuity occurs, and in the magnitude of taxes and benefits.

Other elements can generate implicit redistribution in defined benefit systems. For instance, replacement rates are calculated based on the last 5 or 10 years of contributions, which benefits workers that have steeper wage profiles, and tend to be high-income workers. Similarly, there

could be differential longevity for different income levels. We do not consider these elements in the analysis below.

Figure 1: Relationship between density of contributions and benefits



Source: Authors' elaboration.

Potential differences between men and women

Depending on the type of system (defined benefit versus defined contribution) and the relative position of women in the income distribution, these differences will manifest themselves as factors that increase or decrease the replacement rates. We have identified three factors that are decisive in understanding these differences.

First, women have lower wages. On average in the region, formally employed men have salaries that are 14.5% higher than those of formally employed women (SIMS, 2022). Although in every system this produces lower pensions for women, as seen in the previous section, for a given contribution density, in general lower wages imply higher replacement rates. This occurs because, in practice, there are minimum pensions in both the defined benefit and the defined contribution systems. In addition, in defined benefit systems, the benefit formula tends to be progressive even in the upper part of the income distribution, granting higher pensions to lower-income participants.

Second women tend to have less attachment with the labor market. The previous sections already documented how lower density rates dramatically affect pension levels, in some cases, leaving individuals who do not reach the minimum years of pension without any benefits. Women may suffer disproportionately from the consequences of this pension design.

Finally, in some countries, women have a lower minimum retirement age. This has two implications for this exercise. On the one hand, women contribute for fewer years. This reduces

women's replacement rates compared to those of men in all types of systems. On the other hand, women will have a longer retirement period. As can be seen below, this has important implications for defined contribution systems as, assuming gender specific mortality tables, this will yield lower pensions for women for the same number of contributions. Although, it generally does not affect pensions in defined benefit systems, it will impact the calculation of subsidies and taxes. Marriage, however, tends to close gender gaps because the life annuity of married men (normally to a younger woman) is more expensive than the life annuity of married women (normally to an older man).

III Theoretical results for pension systems.

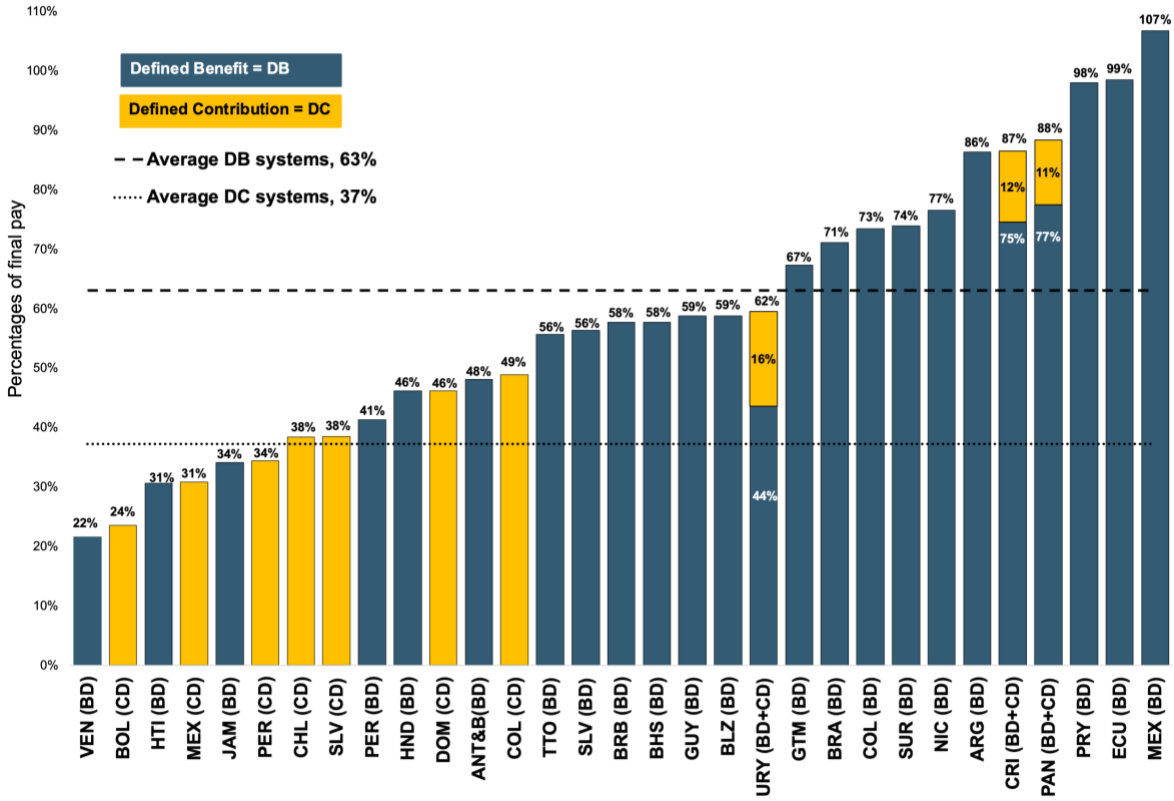
We begin by analyzing the benefits and subsidies that the pension systems are designed to grant to a hypothetical worker. This hypothetical worker corresponds to a married man or woman who contributes continuously from the age of 20 until the minimum retirement age in each country's pension system with a final salary equivalent to the average wage in the formal sector (see appendix I). Although the calculations are made separately for married men and women, the results presented below reflect country averages.

Figure 2 shows the main result of this exercise. The average replacement rate in defined benefit systems in Latin America and the Caribbean is 63%. That is, the average worker in the baseline scenario goes from a labor income of 100 to a pension income of 63 at retirement. However, there is considerable variation among the promises made by countries in their defined benefit systems. There is a group of countries that offer a replacement rate of more than 80% (Argentina, Ecuador, Paraguay, and Mexico). The vast majority offer replacement rates of between 50% and 80% (Trinidad and Tobago, Bahamas, Barbados, Brazil, Guatemala, Belize, Guyana, Honduras, Suriname, Colombia, El Salvador, and the defined benefit components of the mixed systems of Panama, Costa Rica, and Uruguay). Some countries offer less than 50% (, Haiti, Jamaica, Antigua and Barbuda, and Peru).

There are three countries with mixed systems in the region (Panama, Costa Rica, and Uruguay), which combine defined benefit and defined contribution components. The average replacement rate in these systems is 80%, with Panama offering a joint replacement rate of close to 90%. In mixed systems, most of the pension is determined by the defined benefit component (75% in Panama, 74% in Costa Rica, and 43% in Uruguay).

The average replacement rate in defined contribution systems in Latin America and the Caribbean is 37% (Figure 2). That is, the average worker in the baseline scenario goes from a labor income of 100 to a pension income of 37 when he or she retires. Variability is lower than in defined benefit schemes, but equally remarkable: from 24% in Bolivia to 49% in Colombia.

Figure 2. Average replacement rates of pension systems in Latin America and the Caribbean (contribution density of 100%)



Source: Updated from Altamirano et al. (2018). Note: DB = Defined Benefit; DC = Defined Contribution. The DC component of the mixed systems is excluded from the average of the defined contribution systems. ISO Standard 3166-1 alpha-3 nomenclature was used to denominate countries. The chart presents the baseline scenario as a percentage of the final wage: simple average between married men and women.

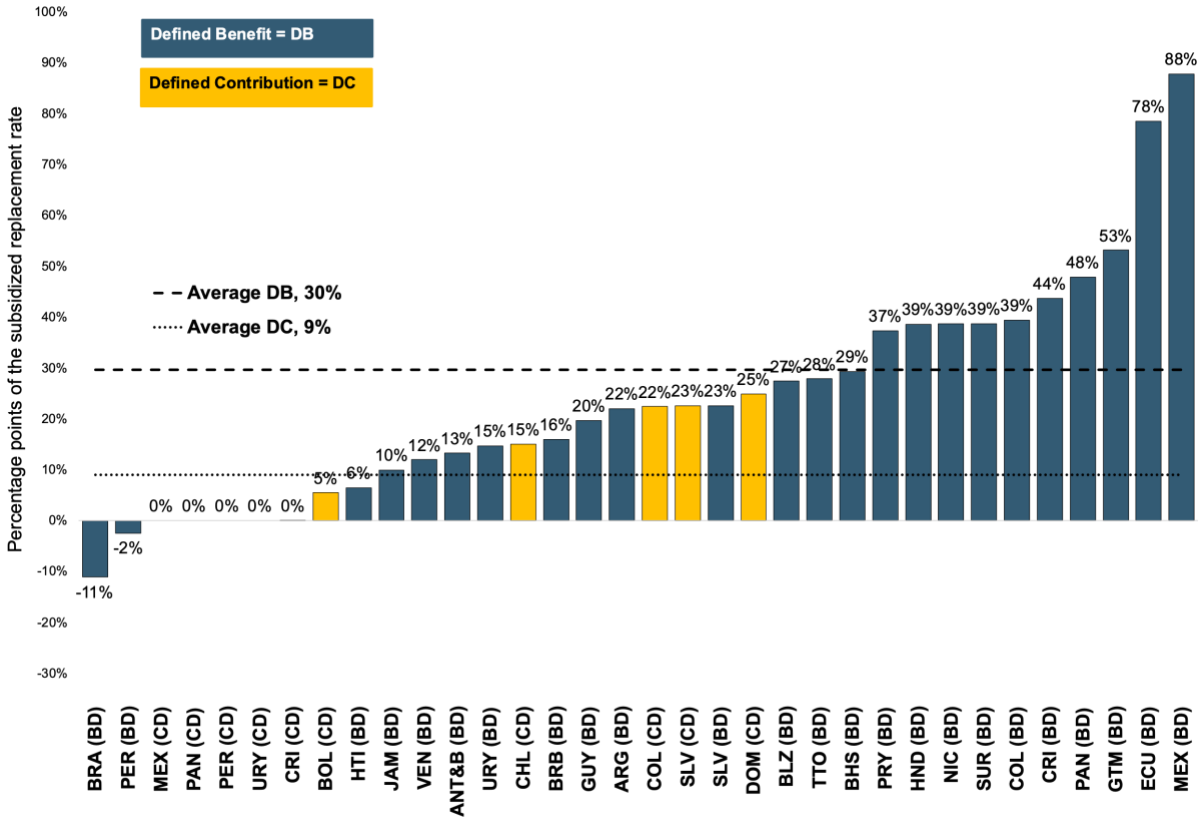
Implicit subsidies of pension systems in LAC.

Section II defines pension benefits above (below) what would have been obtained relative to investing the mandatory contribution in a safe asset and obtaining a fair annuity. As discussed above we establish the safe asset return at 3.5% real. At this interest rate most pension systems today offer benefits that subsidize workers who continuously participate in them. That is, the contributions of the average worker would not be able to finance the entire pension granted by the pension system. The definition of the outside option is crucial to establish the level of subsidies,

but relatively variations of the key parameters do not alter the main results in this section.[4] This subsidy can be expressed in two ways.

Figure 3 shows the subsidy expressed as percentage points subsidized in the replacement rate. The average worker in the region in defined benefit (defined contribution) systems receives a subsidy of 30 (9) percentage points in his or her replacement rate. That is, given the level of contributions, an actuarially fair pension in the region would be 33% of the final formal wage, instead, the average worker receives 63%. The implied subsidy in defined benefit systems is 30 percentage points, which is equivalent to 46% of his/her total pension. The defined benefit systems that provide the greatest subsidies are Mexico (88pp), Ecuador (78pp), Guatemala (53pp) and Panama (48pp).

Figure 3. Implicit subsidies/taxes of pension systems in Latin America and the Caribbean in percentage points of the replacement rate (contribution density of 100%)



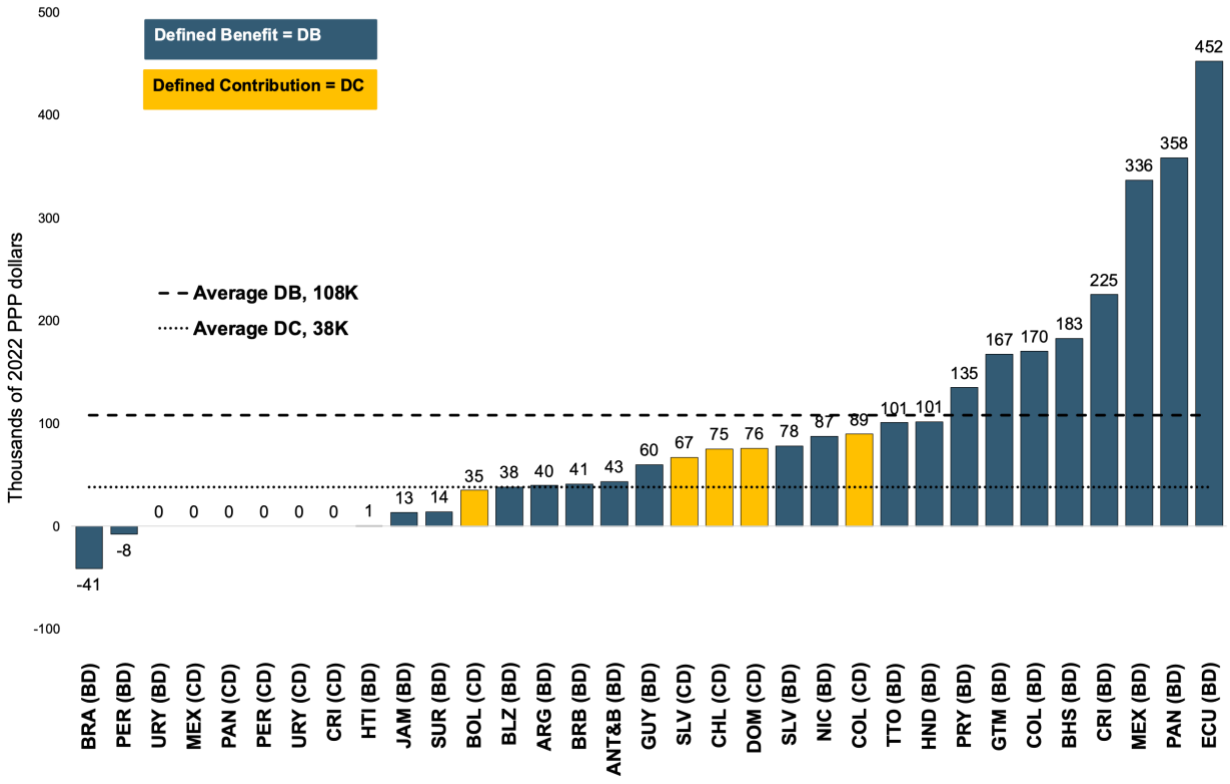
Source: Updated from Altamirano et al. (2018). Note: DB = Defined Benefit; DC = Defined Contribution. For mixed countries, the implicit subsidy for DB does not include

[4] For example, in the case of defined benefits, if the subsidies were established as all returns over 2%, all countries will subsidies. If the interest rate 5% instead of over 3.5%, 18 cases would present subsidies instead of 20, and 6, instead of 4, would present taxes. However, regional averages and pattern will be qualitative the same.

its DC component, which, in the absence of a minimum pension, equals 0 % (the two components of mixed systems are presented separately). ISO Standard 3166-1 alpha-3 nomenclature was used to denominate countries. The figure presents the baseline scenario for the average between married men and women.

Alternatively, the subsidy can be expressed in monetary terms. This captures the difference in monetary value, adjusted for purchasing power parity, between the capital needed to finance the pension promised by the defined benefit rule and the capital that the individual would have accumulated in the safe asset. The average subsidy in defined benefit systems the region is close to US$ 108,000 upon retirement (Figure 4). The countries with highest subsidies are Panama (DB), and Mexico (in the old DB system), and Ecuador, with subsidies of more than 60% over the replacement rate and with amounts of US$ PPP 358,000, US$ PPP 336,000, and US$ PPP 452,000 per year, respectively. The countries that least subsidize their contributors are, Brazil, and Barbados, with negative subsidies, which corresponds to a "tax" through the pension system.

Figure 4. Implicit subsidies/taxes of pension systems in Latin America and the Caribbean (contribution density of 100%)



Source: Updated from Altamirano et al (2018). Prepared by the authors. Note: DB = Defined Benefit; DC = Defined Contribution. For mixed countries, the implicit subsidy for DB does not include its DC component, which, in the absence of a minimum pension, equals US$ 0 (the two components of mixed systems are presented separately). ISO Standard 3166-1 alpha-3 nomenclature was used to denominate countries. The figure

presents the baseline scenario, in thousands of US$ PPP of 2022: simple average between married men and women. Regional averages exclude Venezuela estimates.

Note that there are also important subsidies in defined contribution systems. These subsidies are explicit and arise because of the existence of minimum pensions of explicit subsidies. Minimum pension guarantee fund finances the excess pension. These subsidies represent between US$ PPP 89,000 in the Colombia, US$ PPP 76,000 in Dominican Republic, US$ PPP 67,000 in El Salvador, and US$ PPP 35,000 in Bolivia. A special case is that of Chile, which has an explicit supplementary pension subsidy that decreases with the level of individual savings. In this case, the subsidy for the average worker is equivalent to US$ PPP 75,000.

The replacement rates and monetary subsidies vary sustainably by income level (Table 2). On average low-income workers exhibit relatively higher replacement rates (conditional on qualifying for pension benefits). Assuming a full contribution density, the average replacement rate in defined benefit systems for workers who earn 75% of the average wage is 69%, and 51% for workers who earn 3 average wages. Similarly in defined contribution systems in LAC the replacement rate falls from 46% to 24% (Table 2). An important point to make here is that, despite these progressive elements, monetary subsidies may increase with income in defined benefit systems. This occurs because the monetary subsidy necessary to finance a percentage point of replacement rate is higher for high-income workers. On average, workers who earn 75% of the average wage in DB systems receive an equivalent subsidy of 96,000 dollars compared to 246,000 that receive workers that earn 3 average wages. In DC systems, low-wage workers receive a subsidy of 43,000 dollars due to the minimum pension, while workers with 3 times the average wage receive a subsidy of 1,000 PPP dollars.

Variation across countries is large (see appendix II for country results). In most systems replacement rates fall with income.[5] However, in some countries replacements rates decline much faster than other. For example, in Brazil, Dominican Republic and Peru, replacement rates for workers who earn 75% of the average wage is 40 pp. higher than for workers who earn 3 average wages. But in countries like Colombia (RPM), Ecuador or Panama (BD), this difference is below 5 pp. In all, we observe that in countries where the replacement rates remain constant across income levels or experience only a gradual decline, there tends to be a greater provision of monetary subsidies for high-income workers. This phenomenon is present in 12 of the countries in our sample and drives the average results presented in table 2.

[5] Except for Ecuador, Mexico and Haiti, where replacement rates are constant across income levels.

Table 2: Theoretical replacement rates by income level: By country difference in the replacement rates between 75% of average wages wage and 3 average wages (in %)

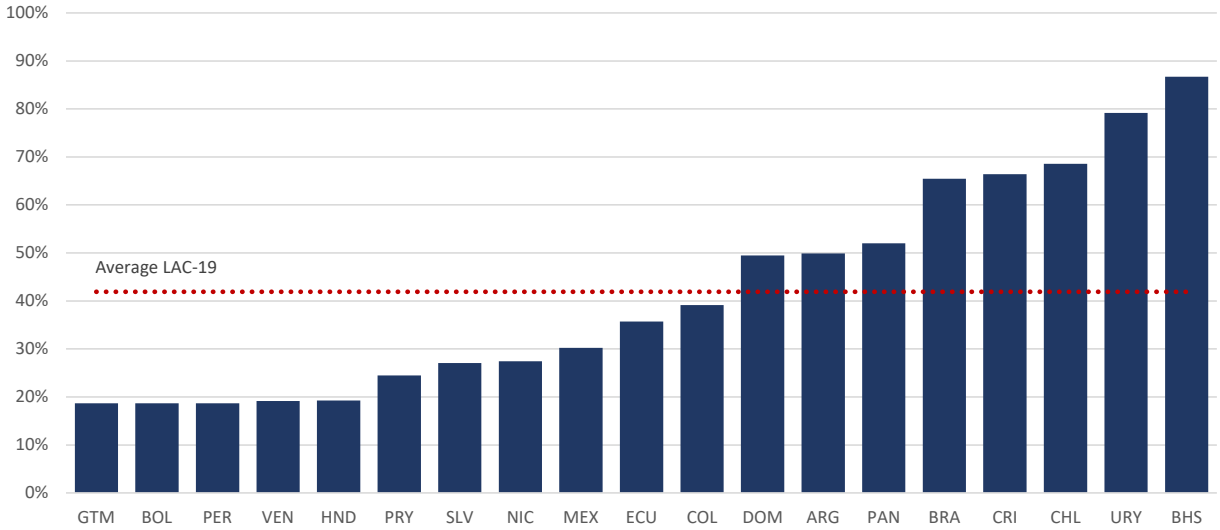
Replacement rates	**Times the average formal wages**				
Defined Benefit systems	**0.75**	**1**	**1.5**	**2**	**3**
Men	0.68	0.63	0.59	0.57	0.51
Women	0.69	0.63	0.59	0.57	0.51
Total	0.69	0.63	0.59	0.57	0.51
Defined Contribution Systems	**0.75**	**1**	**1.5**	**2**	**3**
Men	0.45	0.37	0.28	0.26	0.25
Women	0.47	0.38	0.29	0.24	0.22
Total	0.46	0.37	0.29	0.25	0.24
Monetary Subsidies					
Defined Benefit systems	**0.75**	**1**	**1.5**	**2**	**3**
Men	93,003	107,681	144,442	179,346	233,757
Women	100,919	118,029	157,848	197,519	259,989
Total	96,961	112,855	151,145	188,432	246,828
Defined Contribution Systems	**0.75**	**1**	**1.5**	**2**	**3**
Men	38,387	27,668	11,120	2.284	-
Women	49,328	40,748	23,587	11,063	3,011
Total	43,858	34,208	17,353	6,673	1,506

Source: Authors calculations based on Altamirano et al, 2018. These baseline estimates correspond to simple country averages for married men and women who contribute continuously to social security from age 20 until the minimum retirement age mandated by the respective legislation. See Appendix I for further definition of exogenous parameters and assumptions.

V Estimating the incidence of pension systems in five Latin American Countries.

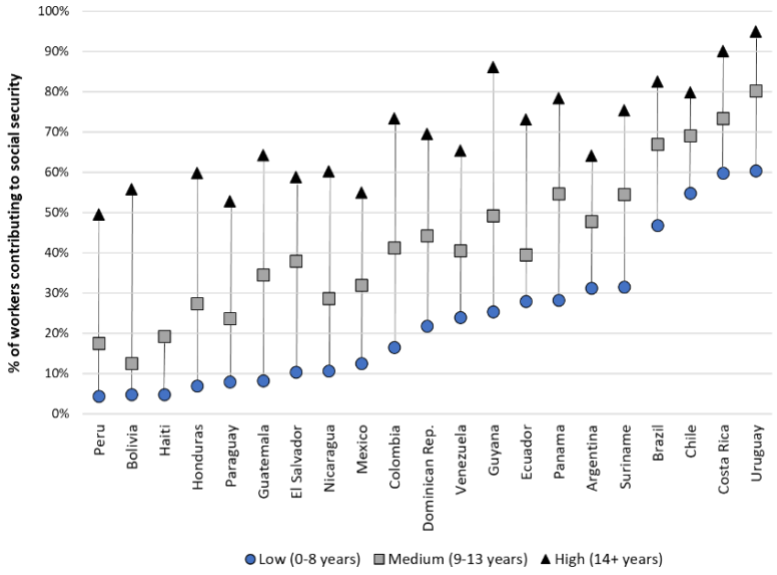
Most workers in Latin America and the Caribbean deviate from the stylized worker presented in the previous section. On average only 42% of workers contribute to pensions (Figure 5). There is a strong correlation between the level of education and the share of workers that contribute to pensions. Highly educated workers are between 20 and 50pp points more likely to contribute to pensions. In some countries, the share of low-educated workers who contribute to the system is below 10%. Therefore, the incidence of subsidies and taxes associated with the pension system will differ across individuals with different levels of education and income.

Figure 5 Formal jobs across countries, circa 2019



Note: Formality rates are calculated as the percentage of employed workers who contribute to the old-age social security national schemes.
Source: Labor Markets and Social Security Information System (SIMS).

Figure 1. Differences in formality rates across income levels and occupation, circa 2019



Note: Formality rates are calculated as the percentage of employed workers who contribute to the old-age social security national schemes. Schooling levels are estimated using a continuous years of schooling variable harmonized across countries.
Source: Labor Markets and Social Security Information System (SIMS).

We use the social protection surveys (SPS) of Chile, Colombia, El Salvador, Paraguay, and Uruguay to estimate the implicit subsides and taxes of the pension system for the generation retiring approximately between 2030 and 2040. SPS were conducted in Chile 2006, 2009, 2015 and 2022, Colombia, 2012, El Salvador, 2014, Uruguay 2012 and Paraguay 2015.

The SPS include useful information to estimate the effects of pension benefits and pre-retirement labor supply. The SPS contains data about labor force participation, employment in the formal and informal sectors, savings, and demographic information of households. Along with the demographic and labor market status variables it contains information of accumulated savings in pension funds and labor market history. These retrospective questions about past pension contributions make SPS better suited for this exercise than traditional household surveys. Table 3 shows the main descriptive statistics of the dataset for men and women separately.

Like the previous section, we estimate the pension benefit for individual workers and compare it to what would have been obtained in a hypothetical savings plan in a safe asset. In the case of Colombia, a traditional defined benefit system (Colombia-RPM) exists parallel to a defined contribution system (Colombia-RAIS) in which workers can migrate from one another. Therefore, this hypothetical exercise corresponds to the actual choice that workers must make as they near retirement.

To estimate pension entitlements, we proceed as follows. From each country we take all workers near retirement age, between 40 and 50 years of age with positive income at the moment of the survey (regardless of whether they are contributing to pensions or not).[6] Each worker reports years worked and years contributed to the pension system. For each worker we project the remaining years of contributions and potential wages until the country's gender-specific minimum retirement age. We assume that the remaining density of contributions (years contributed over total potential years contributed) to be equal to the past density of contributions. Similarly, we impute their wage forward and backward in time using the average age and education profile of the county by formal and informal status separately.

With the estimated history of contributions and wage profiles, we calculate the individual pension entitlements at the minimum retirement age for each worker. We then compare this pension with the pension that would have resulted from investing those contributions in a safe asset and converted into a fair annuity at the time of retirement. We set that rate of return to be 3.5%. We do this for men and women separately using gender specific mortality tables to estimate the fair annuity (see Altamirano, 2018 for details).

[6] We also run a model with all cohort individuals with very similar results.

Table 3: Descriptive Statistics.

Countries		Average Labor Participation rate	Average Formality rate	Average years of schooling	Average wages (2014 PPP dollars)	Average contribution density
All workers aged 25 to 60						
Chile		77.0%	69.8%	11.1	820	62.2%
Colombia		86.6%	40.0%	8.9	656	25.4%
Paraguay		77.0%	19.3%	10.2	867	16.7%
El Salvador		69.3%	31.3%	8.1	495	28.3%
Uruguay		82.2%	74.5%	10.6	778	84.0%
All workers aged 40 to 50						
Chile	Men	95.0%	70.6%	10.2	854	68.7%
	Women	61.4%	65.5%	10.9	669	49.1%
	Total	77.4%	67.9%	10.5	783	61.1%
	I quintile	79.7%	50.3%	8.1	318	44.2%
	V quintile	87.6%	82.9%	12.9	1,567	72.8%
Colombia	Men	95.1%	40.0%	8.5	705	25.7%
	Women	73.4%	37.7%	9.5	528	21.1%
	Total	88.2%	39.4%	8.7	658	24.5%
	I quintile	52.6%	31.9%	9.7	65	26.4%
	V quintile	96.2%	59.0%	12.0	1,213	38.1%
Paraguay	Men	96.3%	18.5%	9.2	988	47.5%
	Women	60.1%	20.9%	9.6	810	43.5%
	Total	77.8%	19.4%	9.3	920	19.2%
	I quintile	47.8%	0.0%	5.4	215	15.8%
	V quintile	95.3%	31.9%	12.2	1,353	52.5%
El Salvador	Men	92.5%	33.5%	7.8	578	30.3%
	Women	59.7%	27.4%	8.0	481	24.8%
	Total	72.7%	30.5%	7.9	530	27.6%
	I quintile	69.6%	0.0%	4.3	153	6.8%
	V quintile	86.3%	52.9%	11.4	911	45.9%
Uruguay	Men	93.9%	78.0%	9.8	978	85.2%
	Women	76.8%	73.6%	11.2	673	83.4%
	Total	85.1%	75.9%	10.5	840	84.4%
	I quintile	68.4%	41.2%	7.6	279	59.1%
	V quintile	94.2%	87.1%	12.7	1,359	93.3%

The set of tables in this section show the result of this exercise. In each table we report by income decile, the share of workers that qualify for a pension (because they contribute the minimum

number of years required to become eligible), the average replacement rate, and monetary subsidies for workers not eligible for a pension, workers eligible for a pension and all workers. We present the results together for men and women separately in Appendix III.

We present the results for Colombia-RPM and Paraguay in Tables 4 and 5, two countries with a traditional defined benefit system and with a relative low formality rate and high required number of years of contributions to qualify for a pension (26 and 25 years respectively). A few results merit attention. First, the share of workers that qualify for a pension is low and increases with income. Very few workers in the lower income deciles qualify for a pension. Less than 5% of income deciles 4 and lower achieve the required years of contributions to obtain a pension, but even for high-income workers it remains low. Only between 25-45% of workers in the highest two income deciles qualify for a pension. Second, conditional on a long history of contributions, replacement rates are larger for low-income workers in Colombia. A worker in the third income decile in Colombia receives a replacement rate of 100% of the pension vs 49.5% in the tenth income decile.[7] This is due to the existence of highly subsidized minimum pension and a benefit formula that is decreasing in income. However, replacement rates are relatively flat in Paraguay as the benefit formula does not change with income. In both countries, when we account for all workers that do not qualify for pension average replacement rates increase with income. Fourth, large monetary subsidies accrue for high-income workers in both countries. The subsidies necessary to finance a high-income pension can be more than 100,000 US dollars. Finally, for a large proportion of workers the pension system acts as a pure tax. The overall tax paid is increasing with income. These are workers who contributed for a substantial number of years but did not qualify for a pension. For, example, on average, a worker in Paraguay in the tenth decile who does not qualify for a pension pays a tax equivalent to 29,000 US dollars. An important difference between these two countries is that Colombia returns the contributions adjusted by inflation to the worker that does not reach the minimum years of contribution necessary to quality for a minimum pension (a rare exception in the region). The taxes computed here correspond to the interest rate not received on those contributions.

[7] The very high subsidized replacement rates in the first two deciles correspond to very few workers that report low wages.

Table 4: Replacement rates and implied monetary subsidies: Colombia-RPM

Labor Income Decile	Share of workers eligible for a pension (%)	Average replacement rate (% of final pay)			Average monetary subsidies (2014 PPP dollars)		
		Workers not eligible for a pension	Workers eligible for a pension	All Workers	Workers not eligible for a pension	Workers eligible for a pension	All Workers
1	3.8%	0.2%	100.0%	14.4%	-139	122,133	4,553
2	4.4%	0.2%	100.0%	7.2%	-259	111,809	4,693
3	3.6%	0.2%	100.0%	4.3%	-337	107,382	3,567
4	6.8%	0.5%	85.4%	6.3%	-869	104,238	6,315
5	21.1%	0.9%	77.1%	17.0%	-2,068	98,548	19,164
6	14.1%	0.7%	69.3%	10.3%	-1,716	94,977	11,874
7	15.6%	0.9%	55.5%	9.4%	-2,639	91,079	12,026
8	27.4%	0.9%	51.7%	14.9%	-3,479	94,173	23,317
9	29.4%	1.2%	51.0%	15.8%	-6,159	131,611	34,398
10	45.6%	1.4%	49.5%	23.3%	-14,906	242,347	102,330

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

Table 5: Replacement rates and implied monetary subsidies: Paraguay

Labor Income Decile	Share of workers eligible for a pension (%)	Average replacement rate (% of final pay)			Average monetary subsidies (2014 PPP dollars)		
		Workers not eligible for a pension	Workers eligible for a pension	All Workers	Workers not eligible for a pension	Workers eligible for a pension	All Workers
1	0.3%	0.0%	87.7%	0.3%	-1,601	51,624	-1,444
2	1.5%	0.0%	66.7%	1.0%	-2,441	80,755	-1,226
3	0.3%	0.0%	71.4%	0.2%	-2,407	91,889	-2,108
4	2.5%	0.0%	72.1%	1.8%	-3,657	107,702	-921
5	4.5%	0.0%	68.8%	3.1%	-4,543	123,913	1,218
6	5.9%	0.0%	71.5%	4.2%	-6,256	134,933	2,049
7	10.3%	0.0%	71.9%	7.4%	-7,620	153,689	8,979
8	17.6%	0.0%	73.4%	12.9%	-12,574	214,440	27,372
9	36.8%	0.0%	73.0%	26.9%	-19,560	276,243	89,241
10	25.6%	0.0%	71.6%	18.3%	-29,032	411,439	83,599

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

Table 6 shows the results for Uruguay[8]. Like Paraguay and Colombia Uruguay has a defined benefit pillar with similar redistribute components. However, Uruguay is substantially more formal, with around 70% of workers contributing to pensions at any given time. The Uruguayan case is comparable to Brazil and Argentina. Uruguay has a complementary defined contribution pillar, but this has no impact on redistribution, and we do not model it in this exercise. The replacement rates for those workers who qualify for a pension are relatively flat. The share of the subsidies/tax patterns are akin to Colombia and Paraguay, with low deciles of the income distribution receiving lower overall subsidies. However, given the higher levels of formality and contribution rates in Uruguay, the taxes for those that do not qualify are substantially higher. The average replacement rate of a worker that does not qualify for a pension in Uruguay in the fifth decile is 11,000 US dollars. Another important redistribute policy in the case of Uruguay is the maximum pensions which dramatically lowers subsidies for workers at the top of the income distribution. The average worker in the 10th decile of the income distribution pays a tax of around 19,000 US dollars.

Table 6: Replacement rates and implied monetary subsidies: Uruguay

Labor Income Decile	Share of workers eligible for a pension (%)	Average replacement rate (% of final pay)			Average monetary subsidies (2014 PPP dollars)		
		Workers not eligible for a pension	Workers eligible for a pension	All Workers	Workers not eligible for a pension	Workers eligible for a pension	All Workers
1	24.3%	0.0%	54.9%	13.3%	-1,916	17,636	2,832
2	25.5%	0.0%	54.8%	14.0%	-3,484	31,857	5,543
3	29.6%	0.0%	55.5%	16.5%	-6,945	41,889	7,527
4	39.8%	0.0%	55.8%	22.2%	-10,977	50,131	13,353
5	35.2%	0.0%	55.8%	19.7%	-11,138	51,005	10,765
6	48.1%	0.0%	55.9%	26.9%	-14,111	64,587	23,719
7	55.7%	0.0%	55.4%	30.8%	-18,443	75,412	33,842
8	59.9%	0.0%	55.6%	33.3%	-20,844	82,226	40,915
9	59.6%	0.0%	55.7%	33.2%	-29,068	102,085	49,110
10	71.4%	0.0%	29.0%	20.7%	-56,086	-4,941	-19,578

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

Tables 7 and 8, and 9 show the results for El Salvador, Colombia-RAIS, and Chile. These three countries have defined contribution systems. In principle, all workers retain all their capitalized savings, so there are no taxes associated with these systems. All three systems have some redistributive components built in. EL Salvador and Colombia have minimum pensions that are

[8] Uruguay's systems allows for different benefits depending on the retirement age, this exercise only captures subsidies and taxes that have accrued at normal retirement age.

obtained after 25 and 23 years of contributions, respectively. Chile offers a solidarity pension to those that have not contributed to the system (and are among the 60% poorest) and additional explicit subsidy to top up the capital accumulated in the individual accounts. Clear patterns emerge. Both subsidized replacement rates and monetary subsidies are decreasing in income (for those workers that qualify for a pension). In Colombia and El Salvador, a worker in the 4th decile receives a subsidy of 100,000 US dollars and 70/80 pp in the replacement rate. A worker in the 10^{th} deciles receives 30,000 and 60,000 in Colombia and El Salvador respectively. Like in defined benefit systems, a substantial number of workers do not qualify for a minimum pension, particularly in the low part of the income distribution.

Table 7: Replacement rates and implied monetary subsidies: El Salvador

Labor Income Decile	Share of workers eligible for a pension (%)	Average replacement rate (% of final pay)			Average monetary subsidies (2014 PPP dollars)		
		Workers not eligible for a pension	Workers eligible for a pension	All Workers	Workers not eligible for a pension	Workers eligible for a pension	All Workers
1	4.1%	0.1%	100.0%	12.8%	0	113,818	4,667
2	1.9%	0.3%	100.0%	2.7%	0	103,767	1,932
3	1.0%	0.2%	100.0%	0.2%	0	0	0
4	4.9%	0.4%	94.0%	5.0%	0	107,068	5,274
5	13.1%	0.6%	71.7%	9.9%	0	100,637	13,215
6	15.7%	1.1%	57.8%	10.0%	0	94,547	14,800
7	16.1%	1.1%	46.6%	8.4%	0	93,275	15,003
8	40.7%	1.0%	39.6%	16.7%	0	90,990	37,061
9	34.8%	1.3%	30.7%	11.5%	0	81,349	28,316
10	55.6%	1.9%	19.2%	11.5%	0	62,487	34,764

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

Table 8: Replacement rates and implied monetary subsidies: Colombia-RAIS

Labor Income Decile	Share of workers eligible for a pension (%)	Average replacement rate (% of final pay)			Average monetary subsidies (2014 PPP dollars)		
		Workers not eligible for a pension	Workers eligible for a pension	All Workers	Workers not eligible for a pension	Workers eligible for a pension	All Workers
1	5.0%	0.2%	100%	17.4%	-	122,789	6,085
2	5.0%	0.3%	100%	8.1%	-	112,917	5,643
3	3.9%	0.3%	100%	4.8%	-	108,496	4,257
4	8.3%	0.5%	86.5%	7.7%	-	105,943	8,832
5	23.5%	1.1%	77.2%	19.0%	-	100,302	23,606
6	15.7%	0.8%	69.6%	11.6%	-	96,672	15,187
7	17.7%	1.0%	55.7%	10.7%	-	92,871	16,459
8	30.3%	1.0%	47.1%	15.0%	-	83,760	25,412
9	34.3%	1.2%	33.1%	12.2%	-	65,362	22,449
10	51.2%	1.2%	20.2%	11.0%	-	31,732	16,254

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

At this point, it is important to compare Colombia's individual account system (Colombia-RAIS) with its defined benefit system (Colombia RPM) as they operate in parallel, with different benefit rules, and workers can transfer between systems up 10 years before of the minimum retirement age. Two results merit attention. First, for every income decile the share of workers that qualify for a pension is higher in the individual account system as it requires 23 instead of 26 years of contributions. This also leads to a slightly higher subsidized system at the bottom part of the income distribution. Second, for high-income workers monetary subsidies can be up to 8 times more in the defined benefit system (240,000 vs 30,000 US$).

Chile (Table 9) is a special case. Chile is one of the few countries that fully integrates non-contributory and contributory pillars. The establishment of the solidarity pillar in 2008 granted a basic pension to the poorest 60% of the population. The design of the solidarity pillar deserves some attention. People with no contributions to the system (and belonging to the poorest 60% of the populations) will receive a solidarity basic pension. People who did accumulate pension savings but for whom the base pension lies below a particular level are eligible for an explicit subsidy (See Bosch, Melguizo and Pages, 2013 for details). The magnitude of this subsidy declines with the level of savings. In 2022 this pillar has been expanded to increase up to 90% of the population. For illustration, we choose to model de previous design setting and assume that the 6 first deciles of the workers in our distribution will be beneficiaries of the subsidized pension, but it is important to acknowledge that this targeting could be imperfect. Several facts merit attention. In this case, by construction, all the subsidies are in the lower part of the income distribution. Replacement rates are substantially higher for low-income workers. Workers in the first decile of the income distribution present a replacement rate of 94.6% compared to 14.4% for workers in the

10th decile of the income distribution. Additionally, since the subsidy formula is such that the subsidy amount declines with the accumulated savings, the dollar amount of subsidies also declines with income. Workers in the first decile of the income distribution receive on average a subsidy equivalent to 56,000 US$ compared to 40,000 US$ for a worker in the 6th decile of the income distribution.

Table 9: Replacement rates and implied monetary subsidies: Chile

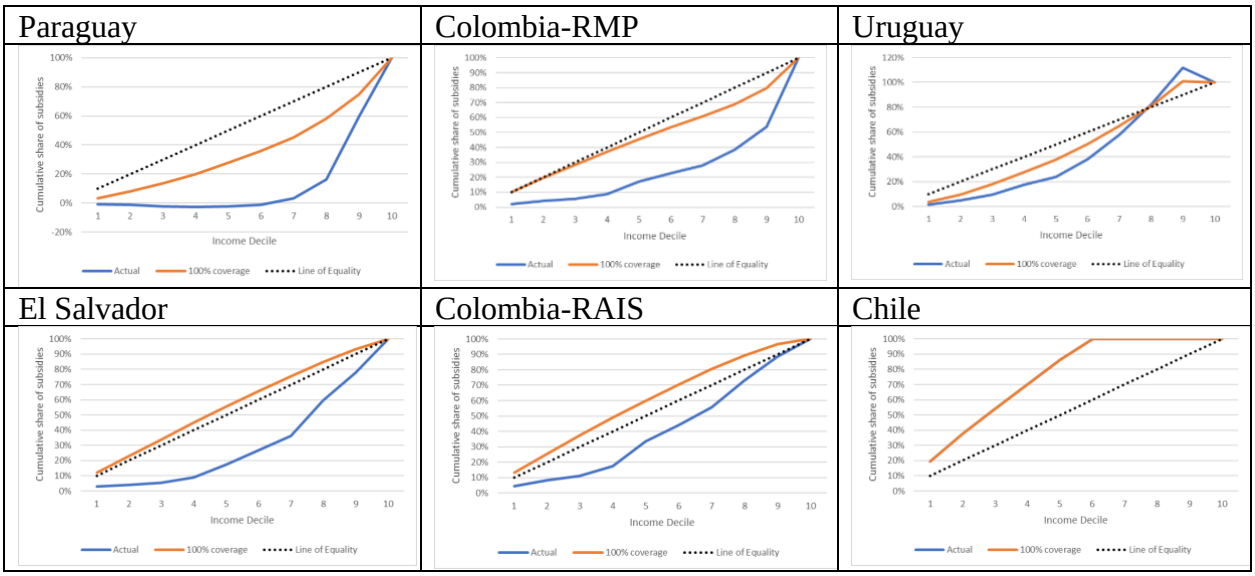
Labor Income Decile	Share of workers eligible for a pension (%)	Average replacement rate (% of final pay)			Average monetary subsidies (2014 PPP dollars)		
		Workers not eligible for a pension	Workers eligible for a pension	All Workers	Workers not eligible for a pension	Workers eligible for a pension	All Workers
1	100.0%	0.0%	94.6%	94.6%	-	56,377	56,377
2	100.0%	0.0%	42.2%	42.2%	-	52,922	52,922
3	100.0%	0.0%	36.7%	36.7%	-	48,208	48,208
4	100.0%	0.0%	34.1%	34.1%	-	46,977	46,977
5	100.0%	0.0%	29.7%	29.7%	-	47,000	47,000
6	100.0%	0.0%	26.3%	26.3%	-	40,232	40,232
7	100.0%	0.0%	12.7%	12.7%	-	0	0
8	100.0%	0.0%	13.8%	13.8%	-	0	0
9	100.0%	0.0%	13.3%	13.3%	-	0	0
10	100.0%	0.0%	14.4%	14.4%	-	0	0

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

In all, except for the case of Chile, the systems analyzed in this paper present redistributive properties that are very different from their intended design. To illustrate this, figures 7 to 10 present the accumulated share of subsidies by income decile for the countries above analyzed. We present two scenarios. First, what would be the cumulative distribution of subsidies if all the workers in each decile behaved like the average worker who is eligible for a pension in that income decile (100% coverage). And second, what "actual" distribution of subsidies is. Several facts merit attention. First, all systems except for Chile are much less progressive than their design will imply. In all systems, the distribution of subsidies if all workers had qualified for a pension is much closer to (or above) the equality line than the actual distribution of subsidies. Second, in defined benefit systems such as Paraguay and Colombia, the three highest labor income deciles concentrate between 70-95% of all subsidies. Had all the workers qualified for a pension the subsidies for the 3 highest deciles would have been between 40% and 50% of the total subsidies. Third, in defined contribution systems, if all the workers qualified for pensions low-income workers would have received a larger share of the subsidies, since they would be the main recipients of minimum pensions. However, because low-income workers present a low density of contributions they do not qualify for minimum pensions, between 50-60% of subsidies concentrate in the high-income deciles. In Chile, since every worker among the 60% of poorest households receives subsidies

regardless of their history of contributions and we assume perfect targeting, both lines lie above the equality line.

Figure 7: Distribution of monetary subsidies across income deciles



Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

The role of non-Contributory pensions.

The results presented above constitute the redistribution that occurs within the contributory systems. However, all countries studied here have established non-contributory pillars to mitigate the lack of coverage on their contributory systems (Rofman et al., 2013, Bosch, Melguizo y Pagés, 2013). These non-contributory pillars constitute pure transfers and depending on their generosity and targeting they can substantially change the distribution of subsidies presented in previous section. Table 10 shows the level of non-contributory pensions and the coverage of the five countries circa 2020.

We perform two exercises to illustrate the potential impact of NCP on the distribution of subsidies. We cannot identify in our data who would be recipient of the non-contributory pension. We compute two additional scenarios where for each country we provide the existing non-contributory benefit to workers in the first 3 or 6 deciles of the income distribution that are not eligible for a contributory pension. Figure 8 shows the main results of these calculations.

As expected, the share of subsidies that accrue to the first three deciles declines with the expansion of non-contributory pensions in all counties. For instance, in Paraguay, in the absence of non-contributory pensions 97% of subsidies are received by the top three deciles of the income distribution. If non-contributory pensions are implemented for the bottom three (six) deciles of the income distribution, this number falls to 82% (71%). Qualitatively, similar results are found for

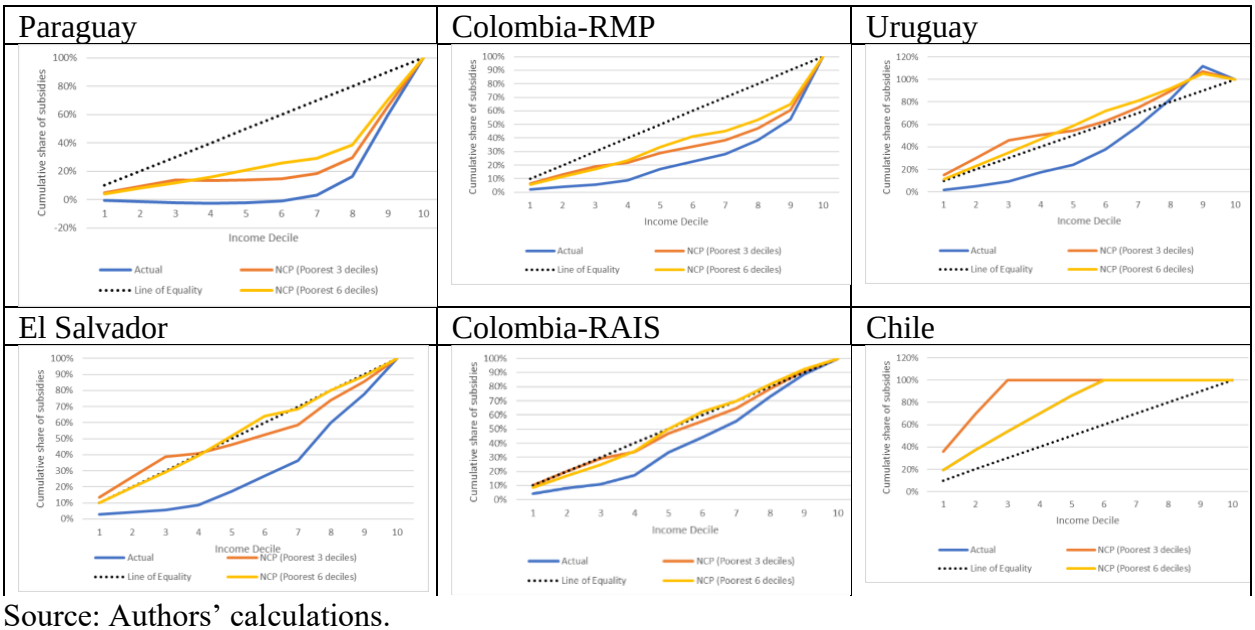
other countries. However, the ultimate impact of non-contributory pensions depends on its generosity and the previous distribution of subsidies. In countries with defined contribution systems where contributory pensions are relatively low, there are only minor changes in the distribution of subsidies.

Table 10: Non-contributory pension (NCP) and semi-contributory programs (Chile's APS), key parameters (circa 2020).

Country	**Age requirement**	**Share of adults 65+ receiving NCP ***	**Average monthly grant amount (LCU, circa 2020) ***	**Average lifetime annuity from non-contributory pensions (2014 PPP dollars)**
Chile	65	28.1%	148,766	59,576
Colombia	59 (M), 54 (W)	29.1%	89,447	12,819
El Salvador	70	5.1%	50	29,031
Paraguay	65	46.5%	515,432	47,316
Uruguay	70	4.4%	6,170	51,294

Source: Prepared by the authors based on national legislations. * Data from the Labor Markets and Social Security Information System (SIMS). M denotes Men; W denotes Women.

Figure 8: Distribution of subsidies in the presence of Non-Contributory Pensions.



Source: Authors' calculations.

Notes: The Actual or Baseline Scenario does not grant non-contributory pensions. A set of two additional scenarios targets non-contributory pensions to workers who are not eligible for a minimum pension and are in the first three and first six income deciles respectively.

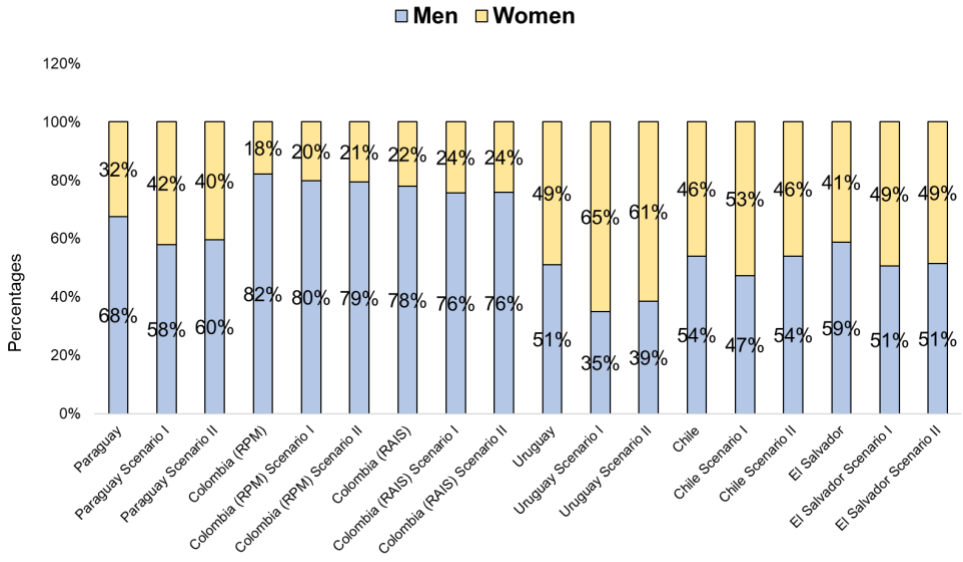
Differences between men and women.

There are two main differences between men and women in this exercise that are common in all five counties. First, women represent a lower share of workers between 40-50 years old in our sample. On average they represent 38% of all workers. And second, women are overrepresented among low-income deciles, with relatively lower contribution densities. However, conditional on income decile, we do not observe systematic differences between the share of women who are eligible for a pension, the replacement rates, or the average subsidy received (see tables in Appendix II).

Because women have a weaker link with the pension system, they are also less likely to benefit from implicit subsidies (see Figure 9). Women receive 49%, 46%, 41%, 32%, 22%, and 18% of the subsidies in Uruguay, Chile, El Salvador, Paraguay, Colombia RPM, and Colombia RAIS.

Similarly, because women are concentrated in the lower income deciles, the expansion of non-contributory pillars is bound to have a gender-equalizing effect in the distribution of subsidies. For instance, a non-contributory pension focused on the first three deciles will increase the share of subsidies accrued to women in 16, 10, 8, 7, and 2 percentage points in Uruguay, Paraguay, El Salvador, Chile, and Colombia (both private and public systems). It is important to note that these are the subsidies received by the sample of working individuals. Women are more likely to be outside the labor force and would benefit even more from non-contributory pillars. Hence, this is a lower bound estimate of the effects of noncontributory pensions on the share of subsidies received by women.

Figure 9. Percentage of total subsidies accrued to men and women with and without non-contributory pillars.



Source: Authors' calculations.

Note: The Baseline Scenario does not grant non-contributory pensions. Scenario I target non-contributory pensions to workers who are not eligible for a minimum pension and

are in the first three income deciles, and Scenario II grants non-contributory pensions to the first six income deciles.

VI. Discussion and Conclusions

Pension systems are social contracts whose main objective is to reduce poverty and smooth consumption in old age. These are complex contracts to interpret for several reasons. First, there are very long-term contracts in which, for several decades, citizens contribute to the system and, for another two or three decades, receive benefits from the system. Second, individuals with different characteristics and work histories will obtain very different benefits (which are not necessarily related to their proportional participation in the program). Third, there is no single transparent way to measure the relationship between entitlements and contributions. This makes establishing measures of equity or financial redistribution challenging.

Pensions constitute one of the major social programs in LAC and absorb an important part of the budget in many countries. Given the aging process, an increasing share of public spending will be devoted to pay for pensions. This paper shows that though most pension systems in the region are designed to be progressive in the sense of providing higher replacement rates to low-income workers, in many countries the implicit subsidies are highly concentrated among high-income workers. This is more acute in defined-benefit systems, which are generous to those who obtain a pension and impose a tax on those who do not. Given the level and pattern of informality in labor markets of the region, this result is a highly inequitable distribution of subsidies. But it also occurs in defined contribution systems, where very few low-income workers become eligible for minimum pensions.

This exercise has some caveats. First, key to define the level of subsidies in pension systems is the need to define a counter-factual scenario. Establishing what is a fair annuity that workers should receive given the level of contributions is a central question that countries should clearly establish. However, this rarely happens, and assumptions need to be made. Second, we focus on the redistribution impact that occurs within the main contributory pension systems. To fully assesses the distributional impact of pension programs from a lifetime perspective requires longitudinal data, which not only tracks individuals over the entirety of their adult lives but also includes all the necessary information for computing individuals' other tax liabilities and for determining their eligibility for different transfers as well as other sources of financing of pension systems. Even in the few countries where sufficiently long-running administrative or longitudinal survey data are available, not all include all the information needed. Third, the exercises proposed here do not consider the behavioral responses of workers to the incentive provided by the parameters in the systems. For instance, we do not allow individuals to work after the minimum retirement age, even though some workers do to qualify or obtain a higher pension. Fourth, there are redistributive elements that have not been considered in this analysis, such as the impacts of differential mortality across income groups. In developed countries there has been increasing awareness of the large differences in mortality by socioeconomic status (Chetty et al., 2016), which can give rise to additional redistribution of pension wealth. Finally, it is important to note that while the focus of this paper is on within-generation redistribution and there is considerable evidence that inter-

generational redistribution of pension systems has been substantial, with early generations usually benefiting with high returns to contributions (Liebman 2001, Morató and Musto, 2010).

Pension systems can be designed to be more progressive. First, countries can reduce or eliminate the minimum number of years required to access benefits and provide a proportional benefit, this would eliminate the implicit tax workers who do not become eligible for pension because of their reduced number of contributions. These tend to be low-income workers. Second, countries can establish a more direct link between contributions and benefits. For instance, determining benefits that are the result of a notional equilibrium return that is linked to a sustainability formula. This would reduce the overall subsidies that the systems provide, but particularly in the upper part of the income distribution. Finally, direct subsidies through the pension system could be made explicit and targeted towards the lower part of the income distribution. One way of doing this is through well targeted non-contributory pensions or subsidies to the contribution of low-income workers. As this paper shows, current levels of non-contributory pensions can make important improvements in the redistribution properties of pension systems in the region if subsidies are directed to the poorest individuals. One of the key implications is that countries could devise methodologies to gain a better understanding of how their pension systems affect income or wealth distribution. This knowledge can be valuable for policymakers in assessing the fairness and effectiveness of their pension programs and making informed decisions about potential reforms, given a desired level of redistribution.

Without reforms, aging implies complex dynamics for redistribution. In defined benefit systems, longer life expectancies imply increasing level of subsidies and given the current distribution of subsidies in many countries, increasing inequities. For individual capitalization systems, longer lives imply a reduction in replacement rates (as with the same level of capital accumulated annuities will be lower). This will be an unpopular outcome and will call into question their social sustainability. In the absence of changes, this could also lead to more subsidies since it will be more difficult to achieve the necessary capital to attain a minimum pension. In this context, inaction is not an option for public policymakers in the face of the challenges presented by pension systems.

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Appendix I: Baseline scenario, hypothetical workers and key terms

To estimate the indicators proposed in this document, assumptions need to be made about hypothetical workers. We start from a baseline scenario with two hypothetical employees: man and woman, both married. In both cases, the man is 3 years older than the woman. Both have contributed throughout their working lives since the age of 20. Both retire at the minimum retirement age between approximately 2030 and 2040 under the rules in force in their country[9], with an average salary of the formal worker that has been growing in real terms by 2%.[10] Table A1 summarizes the characteristics of these two individuals.

Although in regulatory terms some countries do use unisex mortality tables, in all our calculations we use gender differentiated mortality tables. In the case of defined benefit systems, the difference in life expectancy does not necessarily affect the replacement rate (the level of the pension), but it does affect the system's implicit rate of return and implicit subsidies. For a fixed replacement rate, a longer life expectancy involves greater internal rates of return (and subsidies). Similarly, the differences between single and married men and women stem from the fact that, for married women and men, benefits do not terminate with the death of one spouse, but with the death of both. This fact, which does not affect replacement rates, greatly impacts the internal rates of return and subsidies, given that the average time of receipt of the pension increases.[11]

Table A1: Characteristics of hypothetical workers in the baseline scenario

Indicator	Married man	Married woman
Year of retirement	2030-2040	2030-2040
Spouse's age	Three years younger	Three years older
Age of beginning of working life	20	20
Age of retirement	Minimum retirement age established for men (R_M)	Minimum retirement age established for women (R_W)
Years contributed/Density of contribution	100%	100%
Salary at the time of retirement	Average formal salary	Average formal salary
Real salary increase	2%	2%
Survival benefits	Yes	Yes
Real interest rate	3.5%	3.5%
Annuity rate	2%	2%

[9] This is an important simplifying assumption because many social security systems include early/late retirement schemes, or schemes that are specific to certain economic activities (in addition to gender considerations), which impede a regional comparative analysis.
[10] Harmonized household surveys in the Labor Markets and Social Security Information System (SIMS for its acronym in Spanish) show that the real income growth of formal workers was 1.7% between 1990 and 2016.
[11] The distribution of marital status for people over the age of 65 indicates that high rates of marital union and widowhood remain among older adults in the region. Considering both formal and consensual unions as marital unions, 52.7% of people aged 65 or older declared being married, while 29.9% declared they were widowers (SIMS, 2015).

Key Terms

Defined Benefit (DB). In these systems, pensions are determined based on the worker's contribution history. Benefits can be established based on the last salary or on a longer period (for example, the last five or ten years of contributions).

Defined Contribution (DC). In these systems, the pension is determined based on assets accumulated by an individual during his working life. Benefits can be withdrawn all at once, through scheduled withdrawals, or through an annuity that provides a monthly income until the end of the individual's life.

Non-contributory pensions (NCP) These pension benefits do not depend on any type of contribution by the individual. They can be granted universally, as in Bolivia, or be focused, for example on the condition of a certain level of income or excluding contributory pensions (normally, the State establishes a pension and determines its adjustment over time).

Contribution density. Represents the percentage of effective contributions made by the worker to social security in relation to the contributions that would have been made in an ideal scenario where the worker contributes every month of his/her active labor life. In our baseline scenario, a density of 100% is assumed in all cases.

Rate of return. It is the rate used to capitalize workers' contributions towards the system during their active working life to determine the present value of pension benefits. In the case of defined contribution pension systems, it is relevant for the calculation of adequacy indicators, although it has also been used to evaluate the implicit rate of return of defined benefit schemes (for comparative purposes).

Longevity risk. In defined benefit systems and in the case of annuities in defined contribution systems, pension providers commit to making payments to their insured for as long as they live. The longevity risk occurs when the provision of capital made by the pension provider is not consistent with the costs associated with unexpected life expectancy. In other words, it arises when the insured outlive their life expectancy.

Mortality rate. The probability that an individual, upon reaching age x, dies during the course of the year that begins on that date. The set of these probabilities is known as "mortality tables" and expresses group or national survival probabilities by age.

Financial risk. Derives from the dependency that pension savings have on the profitability that is obtained from their investment in financial markets, where volatility can produce rates that can even be negative.

Annuity rate. Implicitly represents the cost of annuities when used to calculate the present value of a projected series of benefit payments. Increasing the annuity rate makes the provision of annuities more expensive since it implies greater precautions against the longevity risk; reducing it implies the opposite.

Annuity Factor (AF). The capital that the affiliate needs to finance a monetary unit of pension, from the moment of retirement until a certain time, based on the life expectancy of the affiliate (and of his/her dependents) and the profitability expectations of the pension administrator.

Life annuity. A type of pension or contract that grants its beneficiary a fixed periodic payment (pension) during his/her lifetime.

Programmed withdrawal. A pension modality in which capital saved by the worker is distributed in periodic payments, which are calculated each year based on the balance of the retirement fund, the profitability of the funds, and the annuity rate, among other criteria. It does not offer pension benefits until the pensioner's death, and the amount of the pension tends to decrease over time.

Minimum and maximum contribution base. It refers to the wage base upon which the contributions are calculated. If the salary is lower than the minimum base (usually associated with the minimum wage), the worker has no obligation to contribute; on the other hand, if it is greater than the maximum, the contribution rate is only applied up to said limit. These parameters are considered invariant throughout the worker's active life.

Minimum and maximum pension. In most systems, a minimum pension is established when the age and contribution density requirements are met, and some also establish a maximum amount. In many cases, the minimum pension matches the minimum wage.

Spouse survivor's benefit. In the event of the insured's death, some systems/countries allow the spouse and/or his/her dependents to continue receiving the benefits under some conditions. In some of the region's countries, the beneficiary spouse receives 100% of the deceased individual's pension, although that percentage is usually much lower (40% -70%) and includes restrictions depending on the age and socioeconomic level of the surviving dependent.

Appendix II: Additional results by Country and Gender

Table A2: Country-level replacement rates by income level

Replacement rates (%)	**Times the average formal wages**				
Country (system)	**0.75**	**1**	**1.5**	**2**	**3**
Antigua & Barbuda (DB)	0.481	0.481	0.481	0.481	0.453
Argentina (DB)	0.956	0.863	0.771	0.724	0.678
Barbados (DB)	0.577	0.577	0.577	0.562	0.386
Bahamas (DB)	0.577	0.577	0.577	0.577	0.577
Belize (DB)	0.588	0.588	0.588	0.530	0.353
Bolivia (DC)	0.314	0.236	0.182	0.181	0.181
Brazil (DB)	0.878	0.711	0.545	0.461	0.378
Chile (DC)	0.458	0.384	0.310	0.273	0.244
Colombia (DB)	0.735	0.735	0.732	0.730	0.726
Colombia (DC)	0.652	0.489	0.326	0.270	0.265
Costa Rica (DB)	0.745	0.745	0.731	0.716	0.685
Costa Rica (DB+DC)	0.865	0.865	0.851	0.835	0.805
Ecuador (DB)	0.999	0.985	0.971	0.965	0.958
El Salvador (DB)	0.751	0.564	0.505	0.505	0.505
El Salvador (DC)	0.513	0.385	0.256	0.208	0.190
Guatemala (DB)	0.673	0.673	0.673	0.622	0.414
Guyana (DB)	0.588	0.588	0.588	0.550	0.367
Haiti (DB)	0.306	0.306	0.306	0.306	0.306
Honduras (DB)	0.615	0.461	0.307	0.231	0.154
Jamaica (DB)	0.448	0.341	0.234	0.180	0.124
Mexico (DB)	1.068	1.068	1.068	1.068	1.068
Mexico (DC)	0.348	0.308	0.269	0.249	0.230
Nicaragua (DB)	0.962	0.765	0.765	0.765	0.765
Panama (DB)	0.775	0.775	0.775	0.775	0.753
Panama (DB+DC)	0.841	0.884	0.926	0.865	0.656
Paraguay (DB)	0.981	0.981	0.981	0.981	0.981
Peru (DB)	0.551	0.414	0.276	0.207	0.138
Peru (DC)	0.344	0.344	0.344	0.344	0.344
Surinam (DB)	0.739	0.739	0.739	0.739	0.739
Trinidad & Tobago (DB)	0.743	0.557	0.387	0.381	0.298
Uruguay (DB)	0.491	0.491	0.491	0.440	0.389
Uruguay (DB+DC)	0.649	0.649	0.649	0.583	0.518
Dominican Republic (DC)	0.615	0.461	0.038	0.231	0.213

Source: Authors calculations based on Altamirano et al., 2018, updated.

Table A3: Country-level monetary subsidies by income level

Implicit subsidies (2022 PPP US$)	**Times the average formal wages**				
Country (system)	**0.75**	**1**	**1.5**	**2**	**3**
Antigua & Barbuda (DB)	32,597	43,462	65,193	86,924	102,979
Argentina (DB)	42,268	39,561	34,148	28,735	17,908
Barbados (DB)	30,784	41,046	61,569	73,915	-25,468
Bahamas (DB)	137,108	182,811	274,217	365,622	548,433
Belize (DB)	28,540	38,053	57,080	59,812	16,195
Bolivia (DC)	63,684	34,776	1,415	0	0
Brazil (DB)	28,615	-41,494	-160,996	-273,063	-269,814
Chile (DC)	84,151	75,088	56,963	38,838	15,055
Colombia (DB)	127,717	170,289	253,921	318,259	471,336
Colombia (DC)	115,731	89,447	36,877	4,162	0
Costa Rica (DB)	168,897	225,196	326,635	419,642	581,849
Costa Rica (DB+DC)	197,356	263,142	388,129	508,142	734,124
Ecuador (DB)	345,254	452,469	666,901	881,333	1,310,196
El Salvador (DB)	106,540	78,094	87,081	116,108	174,162
El Salvador (DC)	82,956	66,956	34,954	12,898	0
Guatemala (DB)	125,366	167,154	250,731	301,341	256,786
Guyana (DB)	44,944	59,925	89,887	95,536	-23,474
Haiti (DB)	381	508	762	1,015	1,523
Honduras (DB)	106,356	101,484	91,742	81,999	62,513
Jamaica (DB)	20,607	13,248	-1,469	-16,187	-33,935
Mexico (DB)	252,369	336,492	504,737	672,983	1,009,475
Mexico (DC)	0	0	0	0	0
Nicaragua (DB)	98,940	87,430	131,146	174,861	262,291
Panama (DB)	268,860	358,480	537,720	716,961	1,030,063
Panama (DC)	0	0	0	0	0
Paraguay (DB)	101,054	134,738	202,107	269,476	404,215
Peru (DB)	26,145	-8,033	-76,391	-144,749	-281,464
Peru (DC)	0	0	0	0	0
Surinam (DB)	10,507	14,010	21,014	28,019	42,029
Trinidad & Tobago (DB)	126,256	100,739	58,606	75,402	19,236
Uruguay (DB)	-9,820	-13,093	-19,640	-75,445	-281,468
Uruguay (DC)	0	0	0	0	0
Dominican Republic (DC)	92,054	75,811	43,323	10,836	0

Source: Authors calculations based on Altamirano et al., 2018, updated.

Table A4: Replacement rates and implied monetary subsidies by sex: Paraguay

Labor Income Decile	Share of Men per Decile	Share of workers eligible for a contributory pension (%)			Average replacement rate for workers eligible for a contributory pension (% of final pay)			Average monetary subsidies for workers eligible for a contributory pension (2014 PPP dollars)		
		Women	Men	All	Women	Men	All	Women	Men	All
1	52.3%	0.6%	0.0%	0.3%	87.7%	.	87.7%	51,624	-	51,624
2	45.7%	2.7%	0.0%	1.5%	66.7%	.	66.7%	80,755	-	80,755
3	25.4%	0.0%	1.2%	0.3%	.	71.4%	71.4%	-	91,889	91,889
4	39.1%	2.5%	2.4%	2.5%	70.3%	74.9%	72.1%	101,575	117,339	107,702
5	85.7%	4.9%	4.4%	4.5%	75.2%	67.6%	68.8%	131,886	122,436	123,913
6	74.9%	12.1%	3.8%	5.9%	71.7%	71.2%	71.5%	130,602	139,577	134,933
7	72.4%	9.0%	10.8%	10.3%	69.5%	72.6%	71.9%	146,509	155,989	153,689
8	70.3%	15.2%	18.6%	17.6%	72.2%	73.7%	73.4%	209,956	215,984	214,440
9	73.1%	41.0%	35.2%	36.8%	72.8%	73.1%	73.0%	277,791	275,582	276,243
10	68.7%	35.7%	21.0%	25.6%	74.2%	69.5%	71.6%	358,165	452,792	411,439

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

Table A5: Replacement rates and implied monetary subsidies by sex: Colombia (RPM)

Labor Income Decile	Share of Men per Decile	Share of workers eligible for a contributory pension (%)			Average replacement rate for workers eligible for a contributory pension (% of final pay)			Average monetary subsidies for workers eligible for a contributory pension (2014 PPP dollars)		
		Women	Men	All	Women	Men	All	Women	Men	All
1	53.3%	0.7%	6.6%	3.8%	>100%	>100%	>100%	114,189	122,835	122,133
2	61.9%	4.9%	4.1%	4.4%	>100%	>100%	>100%	107,331	115,079	111,809
3	70.3%	5.7%	2.7%	3.6%	>100%	>100%	>100%	104,513	109,931	107,382
4	76.0%	5.6%	7.2%	6.8%	84.6%	85.6%	85.4%	98,903	105,554	104,238
5	73.9%	17.8%	22.3%	21.1%	76.9%	77.1%	77.1%	92,918	100,143	98,548
6	75.0%	10.0%	15.4%	14.1%	70.3%	69.1%	69.3%	85,246	97,078	94,977
7	83.7%	11.4%	16.5%	15.6%	61.7%	54.7%	55.5%	87,588	91,551	91,079
8	79.6%	35.6%	25.4%	27.4%	48.7%	52.8%	51.7%	89,770	95,750	94,173
9	78.2%	41.0%	26.2%	29.4%	51.0%	51.0%	51.0%	119,720	136,799	131,611
10	82.3%	37.6%	47.3%	45.6%	48.3%	49.7%	49.5%	206,007	248,562	242,347

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

Table A6: Replacement rates and implied monetary subsidies by sex: Colombia (RAIS)

Labor Income Decile	Share of Men per Decile	Share of workers eligible for a contributory pension (%)			Average replacement rate for workers eligible for a contributory pension (% of final pay)			Average monetary subsidies for workers eligible for a contributory pension (2014 PPP dollars)		
		Women	Men	All	Women	Men	All	Women	Men	All
1	53.3%	0.7%	8.7%	5.0%	>100%	>100%	>100%	114,189	123,366	122,789
2	61.9%	4.9%	5.1%	5.0%	>100%	>100%	>100%	107,331	116,242	112,917
3	70.3%	5.7%	3.2%	3.9%	>100%	>100%	>100%	104,513	111,559	108,496
4	76.0%	8.8%	8.2%	8.3%	89.0%	85.6%	86.5%	102,778	107,016	105,943
5	73.9%	19.1%	25.1%	23.5%	76.8%	77.3%	77.2%	93,877	102,034	100,302
6	75.0%	13.1%	16.6%	15.7%	71.3%	69.2%	69.6%	90,208	98,366	96,672
7	83.7%	15.3%	18.2%	17.7%	60.9%	54.9%	55.7%	91,528	93,091	92,871
8	79.6%	38.6%	28.2%	30.3%	45.5%	47.7%	47.1%	82,415	84,231	83,760
9	78.2%	46.5%	30.9%	34.3%	34.5%	32.6%	33.1%	63,817	66,012	65,362
10	82.3%	48.2%	51.9%	51.2%	21.4%	20.0%	20.2%	38,420	30,396	31,732

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

Table A7: Replacement rates and implied monetary subsidies by sex: Uruguay

Labor Income Decile	Share of Men per Decile	Share of workers eligible for a contributory pension (%)			Average replacement rate for workers eligible for a contributory pension (% of final pay)			Average monetary subsidies for workers eligible for a contributory pension (2014 PPP dollars)		
		Women	Men	All	Women	Men	All	Women	Men	All
1	19.6%	20.4%	40.4%	24.3%	55.6%	53.5%	55.0%	14,091	10,157	12,813
2	27.6%	18.2%	44.8%	25.5%	55.4%	54.4%	54.9%	28,875	15,928	22,618
3	41.3%	25.6%	35.4%	29.6%	56.8%	54.2%	55.5%	37,178	21,073	29,242
4	41.4%	35.1%	46.4%	39.8%	56.5%	55.0%	55.8%	45,753	23,318	34,924
5	66.2%	34.1%	35.8%	35.2%	57.2%	55.1%	55.8%	48,124	26,338	33,463
6	54.3%	46.6%	49.3%	48.1%	56.8%	55.1%	55.9%	59,550	31,283	43,809
7	54.1%	50.4%	60.2%	55.7%	55.6%	55.3%	55.4%	72,941	35,770	51,213
8	69.9%	54.2%	62.4%	59.9%	56.6%	55.3%	55.6%	85,836	41,152	53,302
9	77.4%	54.4%	61.1%	59.6%	56.9%	55.4%	55.7%	105,373	53,562	64,237
10	69.3%	70.4%	71.8%	71.4%	33.6%	27.0%	29.0%	16,924	-58,993	-35,987

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

Table A8: Replacement rates and implied monetary subsidies by sex: Chile

Labor Income Decile	Share of Men per Decile	Share of workers eligible for a contributory pension (%)			Average replacement rate for workers eligible for a contributory pension (% of final pay)			Average monetary subsidies for workers eligible for a contributory pension (2014 PPP dollars)		
		Women	Men	All	Women	Men	All	Women	Men	All
1	37.6%	100%	100%	100%	99%	88%	95%	53,222	61,593	56,371
2	45.2%	100%	100%	100%	44%	40%	42%	51,384	54,709	52,886
3	58.4%	100%	100%	100%	37%	36%	37%	49,048	47,609	48,208
4	52.8%	100%	100%	100%	35%	33%	34%	45,951	47,895	46,977
5	67.4%	100%	100%	100%	31%	29%	30%	44,593	48,134	46,980
6	62.3%	100%	100%	100%	27%	26%	26%	40,266	40,278	40,274
7	78.0%	100%	100%	100%	12%	13%	13%	0	0	0
8	71.5%	100%	100%	100%	11%	15%	14%	0	0	0
9	72.7%	100%	100%	100%	14%	13%	13%	0	0	0
10	70.6%	100%	100%	100%	13%	15%	14%	0	0	0

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.

Table A9: Replacement rates and implied monetary subsidies by sex: El Salvador

Labor Income Decile	Share of Men per Decile	Share of workers eligible for a contributory pension (%)			Average replacement rate for workers eligible for a contributory pension (% of final pay)			Average monetary subsidies for workers eligible for a contributory pension (2014 PPP dollars)		
		Women	Men	All	Women	Men	All	Women	Men	All
1	27.5%	4.1%	4.2%	4.1%	>100%	>100%	>100%	116,716	106,372	113,818
2	44.2%	0.0%	4.2%	1.9%	.	>100%	>100%	-	103,767	103,767
3	40.7%	0.0%	0.0%	0.0%	.	.	.	-	-	-
4	44.9%	4.6%	5.3%	4.9%	91%	97%	94%	111,728	102,064	107,068
5	49.0%	9.7%	16.7%	13.1%	77%	68%	72%	107,711	96,358	100,637
6	63.1%	7.4%	20.5%	15.7%	61%	57%	58%	102,903	92,771	94,547
7	60.6%	9.6%	20.3%	16.1%	50%	45%	47%	102,978	90,279	93,275
8	56.9%	46.5%	36.4%	40.7%	40%	39%	40%	96,841	85,318	90,990
9	68.9%	22.8%	40.2%	34.8%	32%	30%	31%	89,709	78,959	81,155
10	49.0%	58.2%	52.9%	55.6%	20%	18%	19%	70,823	52,930	62,487

Source: Authors' calculations.
Notes: Estimates represent the average per labor income decile resulting from applying each system's pension rules at the time of the survey.