

THE *EX-ANTE* EFFECTS OF NON-CONTRIBUTORY PENSIONS IN COLOMBIA AND PERU

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Abstract: This paper studies the *ex-ante* effects of the implementation of a non-contributory pension (NCP) programme in Colombia and Peru. Relying on household survey data, we simulate the transfer's potential impact on poverty, inequality, fiscal cost and the probability of affiliation to contributory pensions. Our results show that an NCP reduces poverty and inequality among the elderly, particularly in rural areas, at an arguably limited fiscal cost. Regarding behavioural effects, there is not a large impact on the probability of affiliation to contributory pensions when the programme is targeted to the poor, with the exception of Peruvian women. Finally, we also compute some potential effects on the recipient's labour supply. Copyright © 2014 John Wiley & Sons, Ltd.

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1 INTRODUCTION

Old-age poverty in Latin America has been recently studied by Gasparini *et al.* (2010), Dethier, Pestieau, and Ali (2011) and Barrientos (2003, 2005). These studies emphasise that poverty roughly follows a U-form relationship with age. Rofman and Oliveri (2011) showed low levels of pension coverage in Latin American countries, both during labour life and retirement. In their sample of 18 Latin American countries, 60 per cent of the elderly (65 years and older) receive a pension, but this figure hides large country differences. In one third of the countries, less than 19 per cent of the elderly are recipient of any type of pension (Honduras, Dominican Republic, El Salvador, Guatemala, Paraguay and Nicaragua). Another group of seven countries exhibits pension coverage between 22 per cent and 60 per cent. In Colombia and Peru, only 23 per cent and 25 per cent of the elderly receive a pension. In spite of major

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pension reforms across Latin America during the 1990s, aimed at replacing the public systems by private individual capitalization schemes, there is not an improvement in this indicator. Therefore, governments must look for other alternatives to reduce old-age poverty.

It is in this framework that some non-contributory pension (NCP) schemes have become popular in Latin America. Distinctive examples are the programmes in Brazil (*Benefício de Prestação Continuada*) and Mexico (*70 y más*). The *Renta Dignidad* (previously known as *Bonosol*) from Bolivia and the *Pensión Básica Solidaria* (ex PASIS) from Chile are also well-known social pension programmes. In the case of Chile, the social pension is an innovation on their individual capitalisation pension system reformed in 2008. In general, these transfers are targeted to the elderly poor who are not pensioners, and include requisites like age, residence, citizenship and means-test. Although transfer generosity, coverage and access requisites vary widely in the region, we are witnessing a major shift in the strategy to deal with social protection and old-age poverty. Table A1 in the Appendix reports a list and distinctive features of these programmes.

One of the immediate effects of these programmes is reducing old-age poverty and easing the path into retirement with a secure income for the elderly poor. Other effects are related to the positive impacts on life satisfaction and health of the recipients, not to mention the positive outcomes on the rest of the family. In this respect, Galiani and Gertler (2010) offered a comprehensive impact evaluation of the Mexican programme *70 y más*. For the Brazilian programme, the studies by Kassouf, Rodríguez, and Maria de Aquino (2011), Barrientos (2005), Carvalho Filho (2008, 2010) and Reis and Camargo (2007) found that NCP is associated with poverty reduction, reductions in elderly labour supply and child labour, and increases in the school attendance of girls living with a pension recipient.¹

The aim of this paper is to study the *ex-ante* effects of the implementation of an NCP programme in Colombia and Peru. Relying on household survey data from both countries, we simulate the transfer's potential impact on (i) poverty levels, (ii) inequality, (iii) fiscal cost, (iv) the probability of affiliation to the contributory pension system and (v) the recipients' labour supply. The potential decline of the labour force's likelihood of affiliation to contributory pensions is perhaps the most direct behavioural effect one can expect from the implementation of an NCP. For some individuals, and depending on the generosity of the transfer, the expectation of having an NCP will be a good substitute of pension savings. We estimate a nested logit model (NLM) to analyse potential changes in the individuals' probability of affiliation to the pension system. We consider two types of programme transfers: universal and targeted. In the first case, the beneficiaries are all individuals who have reached the retirement legal age and have no pension. In the second case, besides the previous requirements, the transfer is targeted to the poor.

Our results show that an NCP in Colombia and Peru contributes to the reduction of poverty and inequality among the elderly, particularly in rural areas. The annual cost is about 2.60 per cent to 2.98 per cent of total tax revenues with the universal transfer and 0.81 per cent to 1.02 per cent with the targeted one. Furthermore, the impact on the probability of affiliation to contributory pensions when the programme is targeted to the poor (and extreme poor) is not large, with the exception of Peruvian women for whom there is a sizeable reduction on their probability of affiliation. Finally, we also compute the transfer potential effects on the retirement decision of recipients, who in general work until advanced ages or as long as health permits. We expect that the retirement rate increases about 7–11 percentage points in Peru

¹See Duflo (2000, 2003), Bertrand, Mullainathan, and Miller (2003), Ardington, Case, and Hosegood (2009), Edmonds, Mammen, and Miller (2005) and Edmonds (2006) for literature in this respect.

after the transfer. The effect in Colombia is smaller, between 2 and 5 percentage points. Notice that the baseline retirement probability is much higher in Colombia than in Peru (72.4 per cent and 30.4 per cent).

Studies analysing the behavioural impacts of social pensions, in particular about the effects on the affiliation to contributory pensions, are scarce. This paper contributes to the empirical literature on old-age poverty and pension evaluation in Latin America.

The paper is organised as follows. In the next section, we present the background of Colombia and Peru. Section 3 presents the methodology to estimate the effects of the NCP on affiliation to contributory pensions. Section 4 describes the data. Section 5 reports the effects on poverty, inequality, fiscal costs, affiliation to contributory pensions and elderly's retirement decision. Finally, Section 6 concludes.

2 COUNTRY BACKGROUND

In our year of reference, 2010, the relative size of the 65 years and older population is 7.0 per cent (3.07 million) and 5.9 per cent (1.73 million) in Colombia and Peru. Although the elderly share of the population is not high, we should keep in mind that this participation will rapidly increase in the future because of demographic transition (lower fertility rates and higher life expectancy). For instance, by 2050, the previous figures will increase to 17.5 per cent and 16.1 per cent in Colombia and Peru. Certainly, this evolution will have a direct impact on the cost of any NCP scheme.

The poverty rate of the 65 years and older population is 25.2 per cent and 27.3 per cent in Colombia and Peru. This is lower than the national average, which is 33.5 per cent and 31.3 per cent, respectively. There are notable differences between urban and rural areas. For instance, in Peru, the total poverty rate is 19.1 per cent in urban areas, while this jumps to 54.2 per cent in rural areas. In the case of the elderly, the poverty rate is 14.6 per cent in urban areas and 48.5 per cent in the rural areas (Table 1).

The poor work until advanced age because of the absence of regular income during old age, which in turn posits a risk to their health and physical integrity. This sort of *ceaseless toil*—as noted by Benjamin, Brandt, and Fan (2003) when analysing the elderly labour supply in rural China—is common in developing countries, particularly in rural areas. According to Kassouf *et al.* (2011), the elderly poor from Brazil would never be able to retire from the labour market

Table 1. Poverty rate by age group and region in 2010 (%)

	Colombia			Peru		
	Urban	Rural	Total	Urban	Rural	Total
<i>Poverty</i>						
<65 years	32.9	37.9	34.1	19.5	54.8	31.7
65 years and older	21.9	36.7	25.2	14.6	48.5	27.3
Total	32.1	37.8	33.5	19.1	54.2	31.3
<i>Extreme poverty</i>						
<65 years	9.8	19.2	12.0	2.6	23.3	9.7
65 years and older	8.6	17.5	10.5	2.2	22.9	9.9
Total	9.7	19.1	11.9	2.5	23.3	9.8

Source: Authors' elaboration with *Encuesta de Calidad de Vida-2010* and *Encuesta Nacional de Hogares-2010*.

had the social pension not been implemented. In Peru and Colombia, the occupation rate of the men who are poor and aged 65 years and older is high, being disproportionately larger in rural areas. The occupation rate for the elderly poor men is 35.3 per cent and 74.8 per cent in Colombia and Peru at national levels, but these figures increase to 47.2 per cent and 87.0 per cent in rural areas.

Colombia and Peru are part of the Latin American countries that implemented structural reforms in their pension systems during the 1990s. Under this wave of reforms, many countries created defined contribution pension systems based on individual capitalisation accounts and gave a prominent role to the private sector to manage pension funds. Some countries dismantled completely their old public defined benefit systems, while others kept the public scheme to be a complement to the private scheme in an integrated system. Different from this practice, only Colombia and Peru maintained both public and private pension systems as two competing schemes.² This means that workers in both countries can freely choose either the public or the private pension system.

The retirement ages are 55 and 60 years for women and men, respectively (57 and 62 from 2014), in the Colombian public pension system. People must contribute at least 1225 weeks (1300 weeks since 2015). In contrast, an individual can retire at any age in the private system, as long as his or her savings are sufficient to finance a monthly pension higher than 1.1 minimum wages (US\$319 approximately); otherwise, the legal retirement age is 57 and 62 years for women and men, respectively. In case the individual asks for a guaranteed minimum pension, besides the legal retirement age, he or she must prove a record of at least 1300 weeks of contributions. The contribution rate is 16 per cent of salary in both pension systems. The employer pays 75 per cent of this contribution, while the employee pays the remaining 25 per cent. There are 6.5 million people registered in the public pension system (in 2011), but only 31 per cent are regular contributors. The private system is composed of 10.2 million affiliates, with 42 per cent effectively contributing. Overall, this means that only 28 per cent of the Colombian labour force is actually contributing to pensions.

In Peru, the retirement age is 65 years in any pension system. Early retirement is possible in both systems under stringent conditions. The public system offers a minimum pension at the legal retirement age only if the individual proves a record of 20 years of contributions. In contrast, the private system only offers a minimum pension to individuals who were born before 1945 and prove a record of 20 contributed years to any pension system. The final pension amount earned in the public system depends on pension rules that vary according to the amount of contributions and birth cohort, whereas in the private system, it depends on both the accrued funds and returns in the individual account up to retirement. The contribution rate is 13 per cent and 10 per cent of wages in the public and private regimes, respectively. In the private scheme, the pension fund administrators charge a fee of about 3 per cent of the wage. The population affiliated to the public and private pension system in 2011 is 2.9 and 4.9 million, that is, a total of 7.8 million, which is equivalent to 49 per cent of the labour force. However, considering only those individuals who are actively contributing, we observe that only 22 per cent of the Peruvian labour force is actually contributing to pensions.

The number of elderly receiving a pension is low and biased towards richer groups in both countries. According to Rofman and Oliveri (2011), 23 per cent and 25.1 per cent of individuals aged 65 years and older received a pension in 2009 in Colombia and Peru, respectively. Furthermore, only 4.1 per cent and 1.8 per cent of the elderly from the poorest

²The interested reader on these structural reforms is referred to Arenas de Mesa and Mesa-Lago (2006).

income quintile received a pension in Colombia and Peru. In contrast, these figures rise to 31.8 per cent and 58.4 per cent for the richest quintile.

3 METHODOLOGY

We estimate the expected effects of an NCP relying on data from well-established and representative household surveys in Colombia and Peru. First, we simulate variations in poverty and inequality measures when an NCP is introduced. Second, we estimate the individuals' probability of affiliation to the pension system by using an NLN. To complement the analysis, we compute the fiscal cost of introducing an NCP scheme and estimate the potential effects of the NCP on the elderly retirement decision. Similar to Dethier *et al.* (2011) and Gasparini *et al.* (2010), we consider two types of transfers, one being universal and the other means-tested. In the first case, the NCP is received by all individuals upon reaching the legal retirement age and who are not receiving (or have the right to) a contributory pension. In the second case, in addition to the previous requirements, the transfer is targeted to the poor. The universal transfer requires more fiscal resources; however, it is easier to implement because there are no targeting costs.

3.1 Impact on Poverty and Inequality

We compute poverty and inequality indicators before and after the implementation of the NCP scheme. We use the headcount ratio to measure poverty, classifying the poor according to the official poverty lines of each country in order to make our results comparable to official figures within each country and be informative for policy-makers. Colombia constructs poverty lines based on total household income per capita, while Peru defines poverty lines based on total household expenditures per capita. Therefore, in Colombia, we will add the NCP to the total household income and divide over the total number of household members. This new income per capita is compared with the corresponding poverty line. In Peru, we add the NCP to the total household expenditure and divide over the total number of household members.³ For inequality, we estimate the Gini coefficient with the corresponding variable in each country.

3.2 Variations in the Probability of Affiliation to the Pension System

For some individuals, the prospect of receiving an NCP in the future might be a good substitute to pension savings, in which case we will expect a fall in the probability of pension affiliation. An important concept to be used in our estimation is the individual net pension wealth. This is the stream of future pension payments in present value net of costs, taking into account mortality prospects. In Colombia and Peru, the individual has three options: (i) affiliation to the private system; (ii) affiliation to the public system; and (iii) no affiliation. Each option involves a different level of net pension wealth as these differ in benefit levels, contribution rates and pension rules, among other aspects. Moreover, net pension wealth is different for each individual because its value depends on personal circumstances

³Note that neither of the two countries uses equivalence scales to measure poverty officially.

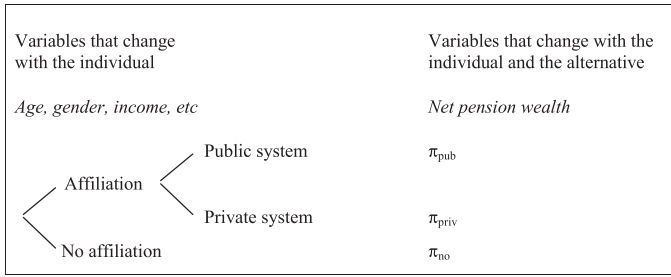


Figure 1. Nested decisions

(gender, income, age etc.). The value of net pension wealth for an individual i who chooses alternative j is represented by $\pi_{i,j}$ and will be the basis for the individual in choosing one of the alternatives. Because net pension wealth changes with the individual and alternative, the appropriate estimation model is an NLM.⁴ Graphically, the nested model is shown in Figure 1.

In the first nest, the individual decides to affiliate or not to the pension system. If affiliation is chosen, a second nest opens and the individual must choose between the public and the private system.

3.3 Net Pension Wealth

Net pension wealth is the value of all pensions that an individual of age x (today) will receive between retirement age and death, net of costs (contributions and administrative fees). As pensions and costs are generated in different moments of time, it is necessary to use a discount factor to express all variables in present value. The net pension wealth in the private system is computed as follows:

$$\pi_{x,priv} = (P_{priv} \times cru_z) \delta^{x-z} - (a_{priv} + c) \sum_{t=x}^z (e_t w_t) \delta^{x-t} \tag{1}$$

$$P_{priv} = [a_{priv} \sum_{t=x}^z (e_t w_t) \beta^{z-t} + CIC_x \beta^{z-x} + RB] / cru_z \tag{2}$$

$$cru_z = 12 \left(\sum_{t=0}^{M-z} \frac{P_{z,z+t}}{(1 + \hat{r})^t} \right) \tag{3}$$

$$cru_{z,y} = cru_z + 12 \theta_{priv} \left(\sum_{t=0}^{M-y} \frac{q_{y,y+t} (1 - P_{z,z+t})}{(1 + \hat{r})^t} \right) \tag{4}$$

$$\delta = 1 + d = 1 + \hat{r}; \quad \beta = 1 + r \tag{5}$$

where z is the retirement age, $\pi_{x,priv}$ is the present value of the net pension wealth (at current age x), P_{priv} is the pension in the private system, a_{priv} is the contribution rate to the pension fund (% of wage), c are the administrative fees and insurance premium (% of wage), e_t is the probability of being employed at the age t , w_t is the wage at the age t , d is the discount rate, r is the pension fund return rate, \hat{r} is the annuity discount rate, RB is the recognition bond of

⁴The advantage of this model is that, contrary to the case of a Multinomial Logit, we do not need to assume that the errors are independent and identically distributed (Creedy & Kalb, 2006).

the contributions made in the public system, CIC_x is the balance in the individual account of capitalisation at current age x , cru_z is the annuity price at retirement age z , θ_{priv} is the percentage of the pension received by the widow, M is the maximum survival age according to official mortality, $p_{z,z+t}$ is the probability of survival of pensioner from age z to $z+t$ according to official mortality and $q_{y,y+t}$ is the probability of survival of the pensioner's spouse from age y (when the pensioner reaches the retirement age z) to $y+t$ according to official mortality.

The first term in the right side of Equation (1) is the value of the future pension and the second term corresponds to the cost, that is, pension contributions (a_{priv}) and administrative fees (c). When replacing Equation (2) into Equation (1), the discounted pension wealth is equivalent to the final balance of the capitalisation account plus previous contributions made to the public system (RB). The term $e_t w_t$ denotes expected income, as it takes into account the probability e_t of being employed at age t and earning a wage equal to w_t . The annuity price cru_z is defined as the discounted capital needed to finance a unity of life pension. Equations (3) and (4) denote the annuity price for a single and a married affiliated, respectively. Note that the fraction θ_{priv} indicates the percentage of pension that a spouse will receive upon the death of the pensioner.⁵

The pension wealth generated in the public system ($\pi_{x, pub}$) is as follows:

$$\pi_{x, pub} = \left(P_{pub}^{z-h} \times cru_z \right) \delta^{x-z} - a_{pub} \sum_{t=x}^z (e_t w_t) \delta^{x-t} \tag{6}$$

The public pension P_{pub}^{z-h} depends on the wage and number of years contributed between the affiliation (h) and retirement age (z). The minimum number of years required to receive a minimum pension is 20 in Peru and 25 in Colombia. Obviously, in the case of no affiliation, the net pension wealth is zero:

$$\pi_{x, no} = 0 \tag{7}$$

Finally, the computation of the pension wealth must take into account the possibilities of changing the system, staying in the same system, and exiting from any system. For the interested reader, the detailed equations to compute the net pension wealth for each possible transition are placed in the Appendix. Furthermore, the parameter values needed to compute net pension wealth are also reported in the Appendix.

3.4 Estimation of Labour Income

We compute the individual stream of future expected incomes (w_t) and employment likelihood (e_t) by plugging the corresponding coefficients—from an estimated Heckman equation model—into the vector of individual characteristics of each individual in the sample. The estimation of this model is made separately by country and sex, and the results are presented in the Appendix. The advantage of this model is that we can obtain the coefficients from the first step (probability of being employed) and second step (expected income).

For those individuals affiliated to the private system, it is also necessary to estimate their pension balances up to actual age x . For this, we also use the Heckman regression estimates

⁵In our computations of pension wealth for married individuals, we use the default percentages established in each country, which are 100 per cent in Colombia and 42 per cent in the Peruvian private pension system. In the case of the public pension system of Peru, this percentage is 50 per cent, but we assume 42 per cent—like in the private system—in the computation of the annuity price in order to keep comparisons simple.

Table 2. Poverty lines in Colombia and Peru in 2010

Region	In national currency		In current US dollars		NCP as % of poverty lines	
	Poverty	Extreme poverty	Poverty	Extreme poverty	Poverty	Extreme poverty
Colombia						
Urban	193 701	83 741	98	43	31	72
Rural	115 703	69 134	59	35	52	87
Total	174 753	80 197	89	41	34	75
Peru						
Urban	293	155	104	55	43	81
Rural	208	137	74	49	60	91
Total	264	149	94	53	47	84

The non-contributory pensions (NCP) in Colombia and Peru are 60 000 pesos and S/125.

for each individual and the past average yearly pension fund rates of each country in order to compute the pension balances. This procedure is carried out backwards until 1994 (Colombia) and 1993 (Peru), as those are the starting years of the private pension systems. For each—old enough—individual, we also compute her corresponding RB with the rules of each country and the estimates from the Heckman estimations. Finally, we use a similar procedure to estimate past contributions of individuals affiliated to the public system. In both cases (public or private affiliation), we assume that individuals started contributing at the age of 25 years.

4 DATA

We use the main household surveys that are representative at national, regional and urban/rural levels in both countries for year 2010: *Encuesta de Calidad de Vida* and *Encuesta Nacional de Hogares* in Colombia and Peru, respectively. Both surveys are widely used to study poverty and living conditions. When the expansion of data is required, we use the sample weights of each survey and must adjust these levels with the most updated population projections [DANE (<http://www.dane.gov.co/>) for Colombia and INEI (2009) for Peru]. This is particularly important to count the number of elderly who will receive a social pension.

Table 2 presents the official monthly poverty lines in Colombia and Peru. This information is needed to find the effects of the NCP on poverty. The amount assumed for this pension will be 60 000 pesos (US\$31) in Colombia, which corresponds to the average old-age transfer that the Government grants to poor elderly in a social programme with limited coverage.⁶ In Peru, the amount will be 125 Nuevos Soles (US\$44), which is equal to the NCP recently implemented (*Pensión 65*) and still limited to some districts. The last column of Table 2 shows the relative importance of the NCP with respect to the poverty lines in different areas. The NCP is relatively more important in rural areas; therefore, we should expect a larger effect on poverty in these areas.

⁶This programme is called 'Colombia Mayor' and constitutes the bottom of minimum protection for the elderly in the country. The Government is promoting the extension of the programme to all people older than 65 years who have no pension and belong to the two lowest levels of socioeconomic classification.

Table 3. Effects of a non-contributory pension (NCP) on poverty

	Colombia			Peru		
	Urban	Rural	National	Urban	Rural	National
I. Effects on poverty						
Total population						
Before	32.1	37.8	33.5	19.1	54.2	31.3
After	31.7	36.4	32.8	18.0	50.6	29.3
Population 65 years and older						
Before	22.0	36.7	25.2	14.6	48.5	27.3
After	19.3	24.6	20.5	8.9	23.7	14.4
II. Effects on extreme poverty						
Total population						
Before	9.7	19.1	11.9	2.5	23.3	9.8
After	9.1	17.9	11.2	2.2	20.2	8.5
Population 65 years and older						
Before	8.6	17.5	10.5	2.2	22.9	9.9
After	4.8	7.0	5.3	0.6	5.9	2.6
III. Number of recipients						
Total pop. 65 years and older	2 392 212	682 611	3 074 830	1 083 222	645 537	1 728 759
Number of beneficiaries						
With universal	1 759 755	650 008	2 409 763	671 151	609 412	1 280 562
With targeted	504 707	248 843	753 550	133 305	305 170	438 475
% of pop. 65 years and older						
With universal	73.6	95.2	78.4	62.0	94.4	74.1
With targeted	21.1	36.5	24.5	12.3	47.3	25.4

Source: Authors' estimations. The NCP, if targeted, is targeted to the poor.

5 RESULTS

In this section, we present the effects of an NCP when this is granted either universally or as a transfer targeted at the poor. A requisite in both cases is that the NCP is granted at legal retirement ages and only if the individual is not already receiving a contributory pension. The advantage of this universal pension is that there are no targeting costs, although the fiscal cost is larger. In addition, the universal pension is associated with less stigmatisation of low income people.⁷

5.1 Poverty and Inequality

The first two panels of Table 3 report the effects of the implementation of an NCP on poverty and extreme poverty rates in each country.⁸ There are no differences on the effects of poverty or extreme poverty rates if the transfer is targeted or universal, because the individuals who achieve passing any poverty line are the same under both schemes. The

⁷These advantages are similar to the ones suggested in the literature on universal basic income (see Van Parijs, 1997).

⁸Recall that we evaluate the condition of being poor and extreme poor—before and after the transfer—with the total household income per capita in Colombia and the total household expenditure per capita in Peru. This follows the official methodology to estimate poverty in each country.

effects on the reduction of overall poverty at national level are modest: between 0.8 and 2 percentage points in Colombia and Peru, respectively. As expected, the reduction of poverty is larger for the group of 65 years and older. At the national level, this reduction is 5 percentage points in Colombia and 13 percentage points in Peru. Disaggregating by area, the effects of an NCP are more potent for the elderly living in rural areas. An NCP can reduce the poverty rate of the rural elderly of Colombia by 12 percentage points, while in Peru, this reduction is about 25 percentage points. In this last case, the NCP significantly reduces the poverty rate of the old and rural Peruvians, from 48.5 per cent to 23.7 per cent. These results are similar in the case of extreme poverty rates. Extreme poverty falls by a bigger margin for the 65 years and older people and in rural areas. As indicated before, an NCP has a stronger effect in Peru in reducing extreme poverty for the elderly. For example, extreme poverty falls from 22.9 per cent to 5.9 per cent for the Peruvian elderly of rural areas.

The number of potential recipients of the NCP is considerable in both countries (see bottom panel of Table 3). If the programme is targeted, there are 753 550 recipients in Colombia and 438 475 in Peru, which are equivalent to approximately one fourth of the elderly population in each country. Obviously, the number of recipients is much larger if the programme is universal, being 78.4 per cent of the elderly in Colombia and 74.1 per cent in Peru. Moreover, the proportion of elderly people receiving an NCP is higher in the rural area under any type of programme. We observe that the targeted programme is mainly composed of rural recipients, while the universal programme presents a mixture of urban and rural individuals. For example, in Peru, three of four recipients are from the rural area in the targeted programme, while with the universal programme, this relationship is approximately 1 to 1.

It is also important to highlight the household composition of the elderly living in poverty and how an NCP can report different results according to this composition. The first panel of Table 4 shows the distribution of the targeted transfer recipients by household size. We detect that 28 per cent and 40 per cent of the total of recipients in Colombia and Peru live alone or at most with another individual and that these figures increase when examining rural areas. For an elderly person who is poor, living alone or in a small household can represent more vulnerability because of the lack of immediate support and help with ageing-related mobility problems. Therefore, it is positive to find a sizeable quantity of individuals living alone or in two-person household among the total recipients, in particular within rural areas. The bottom panel of Table 4 reports the poverty rates before and after the targeted transfer by recipient household size. There are important differences on poverty reduction among households of different sizes and by area. In the Peruvian urban areas, there are no noteworthy differences in poverty reduction by household size, but in the rural area, we find that poverty is much more reduced for one-person or two-person households. For example, elderly poverty declines by 35 per cent in a two-person household in rural Peru, but only by 11 per cent in a household with five or more members.

Before implementing the NCP, we note that inequality is higher in urban areas in both countries (Table 5).⁹ We observe that the effects of the NCP in reducing overall inequality are modest in each country and not statistically significant with the exception of a universal NCP in Peru for the elderly population. In contrast, the strongest effects are observed in the

⁹A possible explanation why Ginis are much larger in Colombia than those of Peru is because we use household incomes in Colombia and expenditures in Peru. It is well known that income data presents more volatility and dispersion than expenditure data. Furthermore, it appears that there is more inequality in Colombia than in Peru in year 2010. According to the World Development Indicators of the World Bank, the Gini index estimated with incomes in both countries are 55.9 in Colombia and 48.1 in Peru.

Table 4. Effects of a targeted non-contributory pension (NCP) on elderly poverty by household size (%)

# of members in household	Colombia			Peru		
	Urban	Rural	Total	Urban	Rural	Total
I. Distribution of the recipients						
1	9.7	12.0	10.4	5.6	13.2	10.9
2	16.0	22.2	17.9	18.8	35.1	30.1
3	14.5	17.5	15.4	15.6	14.4	14.8
4	15.3	12.6	14.5	14.4	9.7	11.1
5 or more	44.6	35.7	41.9	45.6	27.6	33.1
Total	100.0	100.0	100.0	100.0	100.0	100.0
II. Effects on elderly poverty						
Before NCP						
1	20.9	32.5	23.8	7.0	33.2	20.5
2	15.1	31.5	18.7	11.6	47.7	29.0
3	14.2	30.1	17.4	12.0	48.6	23.9
4	20.9	29.3	22.6	13.2	50.1	22.9
5 or more	35.2	41.8	36.6	21.3	62.1	32.8
Total	22.2	34.0	24.8	14.6	48.5	27.3
After NCP						
1	15.2	14.6	15.1	1.6	5.1	3.4
2	12.6	15.4	13.2	4.9	12.8	8.7
3	10.9	16.4	12.9	7.6	24.2	13.0
4	18.9	24.3	19.9	6.8	37.1	14.8
5 or more	32.8	33.1	32.8	15.7	51.5	25.9
Total	19.4	21.9	19.9	8.9	23.7	14.4

Source: Authors' estimations. The NCP is targeted to the poor.

Table 5. Effects of a non-contributory pension (NCP) on Gini coefficients

	Colombia			Peru		
	Urban	Rural	National	Urban	Rural	National
Before NCP						
Total pop.	0.569	0.515	0.580	0.337	0.308	0.388
Pop. 65 years and older	0.562	0.541	0.582	0.348	0.329	0.400
With NCP universal						
Total pop.	0.565	0.504	0.575	0.333	0.304	0.381
Pop. 65 years and older	0.547	0.494	0.562	0.332	0.286 ^a	0.365 ^a
With NCP targeted						
Total pop.	0.566	0.505 ^a	0.577	0.334	0.296	0.382
Pop. 65 years and older	0.553	0.503 ^a	0.570	0.338	0.260 ^a	0.372

Source: Authors' estimations. The NCP, if targeted, is targeted to the poor.

^aDifferent from the corresponding Gini estimated before the NCP (at 95 per cent).

reduction of inequality within the rural elderly. In Colombia, a targeted transfer reduces the Gini of the rural elderly from 0.541 to 0.503, while in Peru, this declines from 0.329 to 0.260. These figures represent a sizeable effect of the transfer, and it corresponds to previous estimated achievements in the reduction of rural poverty. If the transfer is universal, the

Ginifor the rural elderly falls up to 0.494 in Colombia and 0.286 in Peru, but this result is only statistically significant for the elderly Peruvian. Focusing on the rural elderly, we observe that a targeted transfer accomplishes more equalisation than a universal transfer in Peru. In Colombia, there are no notable differences between the types of transfers in reducing inequality.

5.2 Affiliation to Contributory Pensions

In measuring the effects of an NCP on the probability of affiliation to contributory pensions, we restrict the sample of individuals to whom the simulation exercise is relevant. We also exclude permanently disabled individuals; pensioners; affiliates to special schemes like the army, police and judges; unpaid family workers; and full-time students. In addition, the sample is restricted to individuals between 25 and 65 years old in Peru. In Colombia, the sample is restricted to individuals between 25 and 45 years old; otherwise, the estimation will be unnecessarily more complex because of the different legal ages of retirement by gender. Following the methodology described in Sections 3.2 to 3.4, we estimate an NLM for the probability of being affiliated to the private or public pension system, and use the event of no affiliation as the base outcome. Other control variables apart from pension wealth are disposable labour income (income net of taxes), age, squared age, marital status, education, region dummies and non-labour income.

As expected, pension wealth positively and significantly affects the probability of affiliation to any pension system. This effect is larger for women in Peru but larger for men in Colombia. The goal of Table 6's estimates is to compute changes in the probability of affiliation to each pension system when an NCP scheme is introduced. First, we need to verify that the individual complies with the requisites to receive an NCP, and then we compute his or her corresponding pension wealth with Equation (8). This equation is similar to previous equations that compute pension wealth of other pension systems, although the main difference is that there are no costs for the individual (contributions and fees). Second, the NCP wealth ($\pi_{x,\text{nep}}$) replaces the value of zero that is associated with the outcome of no affiliation for those individuals in the sample who satisfies the requisites of the NCP scheme. This last step allows us to predict the new probabilities of affiliation with the estimated coefficients of the NLM.

$$\pi_{x,\text{nep}} = (\text{NCP} \times \text{cru}_z) \delta^{x-z} \quad (8)$$

Table 7 reports the results of the previously described exercise. In addition to the universal and targeted (to the poor) programme, we consider a third programme, even more narrowly targeted to the extreme poor. In both countries, a universal programme will notably reduce the probability of affiliation, particularly in Peru.¹⁰ For example, Peruvian women have a probability of affiliation of 28.8 per cent before a universal NCP is introduced, but this falls to 10.6 per cent after the transfer. This sizeable effect is related to the overwhelming number of women without social security coverage. In contrast, the impact of the universal transfer on the probability of affiliation for Peruvian men is lower and decreases from 36.2 per cent to 28.4 per cent. In Colombia, the probability of affiliation decreases 5.7 per cent for women and 4.5 per cent for men.

¹⁰A possible explanation for this differenced effect by country is that the relative value of the transfer is larger in Peru than in Colombia. In Colombia, this represents 34 per cent of the poverty line, while in Peru, this is 47 per cent.

Table 6. Nested logit estimates for the probability of affiliation to the contributory pension system

Variables	Colombia				Peru			
	Women		Men		Women		Men	
	Private	Public	Private	Public	Private	Public	Private	Public
Net labour income 000's	0.00003	-0.00007***	-0.00007***	-0.00003***	0.009843***	-0.007458***	0.006545***	-0.001905***
Age	0.138087	-0.071362	-0.217124	-0.053059	-0.395868***	-0.254078***	-0.207654***	-0.164957***
Age square	-0.032873	0.074714	0.448352*	0.022213	0.531053***	0.251618***	0.338887***	0.172325***
Married	0.7262***	-0.153894	-0.994325***	-0.169116*	-0.063509	0.215711***	-0.372398***	-0.424342***
Edu: no level (reference)								
Edu: primary	0.371359	-0.872978***	0.366932	-0.530986***	0.412785	-0.773304***	-0.292589*	-1.027473***
Edu: secondary	0.303425	-1.52582***	0.952308***	-1.013935***	0.275127	-2.389207***	-0.369795**	-1.979864***
Edu: tertiary no university	0.261899	-1.771828***	1.258698***	-1.151909***	0.083346	-3.706092***	-0.416786**	-2.87574***
Edu: tertiary university	-0.297043	-0.139852	0.646696	-0.450287**	0.202522	-4.376607***	-0.276754	-3.366085***
Edu: postgraduate	-0.12704	-1.322652***	1.121538**	-0.938882***	0.268517	-5.263738***	-0.444012*	-4.626105***
No labour income 000's	0.000046***	0.000029**	-0.000167***	-0.000024	0.035444***	-0.05442***	-0.001112	-0.012295*
Constant	-6.651894	3.952576**	0.704176	3.727424***	5.187316***	10.16555***	1.102756*	6.395625***
Pension wealth	0.000093***		0.000105***		0.188754***		0.065064***	
Log likelihood	-1909.2665		-2619.0862		-5146.9816		-11494.022	

***Sig. at 1 per cent;

**5 per cent;

*10 per cent. Regressions include region fixed effects.

Table 7. Effects of a non-contributory pension on the probability of affiliation

Type of programme	Colombia					Peru				
	Private level	Public level	Both systems level	No affiliation level	var	Private level	Public level	Both systems level	No affiliation level	var
Women										
1. Baseline	26.22	6.00	32.22	67.78	22.35	6.44	28.79	71.21		
2. Universal	21.58	4.95	26.54	73.46	7.01	3.59	10.60	89.40	18.19	
3. Targeted to poor	25.56	5.84	31.40	68.60	12.63	5.70	18.33	81.67	10.46	
4. Targeted to ext. poor	26.10	5.97	32.07	67.93	13.15	5.91	19.06	80.94	9.74	
Men										
1. Baseline	23.15	5.23	28.38	71.62	26.71	9.51	36.23	63.77		
2. Universal	19.30	4.57	23.87	76.13	21.25	7.15	28.40	71.60	7.83	
3. Targeted to poor	22.42	5.05	27.47	72.53	25.49	8.99	34.48	65.52	1.75	
4. Targeted to ext. poor	22.98	5.18	28.16	71.84	26.42	9.38	35.80	64.20	0.43	

Source: Authors' estimations. The last column in each country shows the difference between the baseline and the corresponding programme.

Table 8. Probability of affiliation to the contributory system by quintiles

		Quintile 1	Quintile 2	Quintile 3	Quintile 4	Quintile 5	Total
Colombia							
Women	Baseline	11.09	18.95	33.73	49.66	68.72	32.22
	With universal NCP	7.60	13.62	26.37	41.83	62.44	26.54
	With targeted NCP (to poor)	9.59	17.83	33.08	49.48	68.72	31.40
	With targeted NCP (to extreme poor)	10.64	18.89	33.72	49.66	68.72	32.07
Men	Baseline	10.03	13.31	27.39	38.09	60.25	28.38
	With universal NCP	7.20	9.71	21.90	32.08	55.72	23.87
	With targeted NCP (to poor)	8.26	12.18	26.38	37.65	60.19	27.47
	With targeted NCP (to extreme poor)	9.21	13.14	27.32	38.05	60.24	28.16
Peru							
Women	Baseline	5.32	11.56	22.72	42.39	63.28	19.17
	With universal NCP	1.63	4.60	11.62	25.45	43.48	10.57
	With targeted NCP (to poor)	4.40	10.50	21.68	41.72	62.96	18.29
	With targeted NCP (to extreme poor)	5.07	11.42	22.65	42.36	63.27	19.02
Men	Baseline	17.49	21.04	29.87	42.11	58.76	36.28
	With universal NCP	11.63	14.48	22.25	33.34	49.53	28.43
	With targeted NCP (to poor)	14.73	18.34	27.81	40.75	58.23	34.53
	With targeted NCP (to extreme poor)	16.48	20.18	29.44	41.94	58.73	35.85

Source: Authors' estimations. NCP, non-contributory pension.

If the programme is targeted at the poor, there are sizeable effects only for Peruvian women, whose probability of affiliation is reduced by 10.5 per cent. In Colombia, the reduction of the probability of affiliation is less than 1 per cent for both genders. Similar results are observed when the programme is targeted at the extreme poor. With this narrow targeting, the reduction of the likelihood of affiliation is only marginal (about less than 0.5 per cent) except for Peruvian women. In the case of Peruvian women, the impact of a pension targeted at the extreme poor (a reduction of 9.7 per cent) is similar to the one targeted at the poor.

Women can be more responsive to the introduction of an NCP programme because the pension wealth associated with this transfer is larger than that of men. Recall that the pension wealth is the product between the annuity price that is affected negatively by mortality and the NCP amount, and that women show lower mortality than men; therefore, we should expect (all else being equal) a larger pension wealth for women. Moreover, the larger differences by gender found in the impact of the NCP in Peru reflect the larger differences of mortality profiles of the official tables used in Peru. In Colombia, these mortality differences are less pronounced.¹¹

Another interesting outcome of our simulation is the evaluation of changes in the probability of affiliation by income quintiles (Table 8). As expected, the variation in the probability of affiliation to the contributory systems decreases with the quintile. Furthermore, the targeted

¹¹In addition, the age of retirement of Colombian women is 5 years less than that of the men, and therefore, their pension wealth will be lower. This counter balances the favourable effect of woman's lower mortality on her pension wealth.

programmes do not practically affect the behaviour of individuals in the richer quintiles, particularly in Colombia where the transfer is relatively small.

In sum, the effects of an NCP on the probability of affiliation to the contributory pension system depend on the design of the scheme. A universal programme can cause large reductions on that probability, while the two targeted programmes considered in our exercise have moderate or low effects, except for Peruvian women.

5.3 Fiscal Costs

The fiscal cost of each type of scheme is computed by multiplying the transfer amount by the total number of qualified recipients. Table 9 reports the results for a universal NCP scheme and for a programme targeted at the poor.

The universal programme costs 2.60 per cent and 2.98 per cent of total tax revenues in Colombia and Peru, while the programme targeted at the poor sums up 0.81 per cent and 1.02 per cent, respectively. These amounts are not very high considering that social public expenditures were about 13.6 per cent and 10 per cent of GDP in Colombia and Peru in 2010. Furthermore, in comparing these results with other programmes in Latin America and being mindful of some salient differences in generosity and targeting, we observe that the cost of an NCP targeted at the poor in our countries of analysis will be below the median cost observed in the region (see Table A1 in the Appendix).

A quick inspection into the long run evolution of the elderly population in each country allows us to foresee how NCP's cost can evolve. Figure 2 shows the potential expenditures in NCP programmes for the period 2010–2050 based on the most recent UN population projections and assuming a conservative real GDP growth rate of 3 per cent. In both countries, fiscal costs related to NCP increase over the next 25 to 30 years, but later on (about year 2035), these costs decrease as the speed of the ageing process slows.

5.4 Retirement Decisions

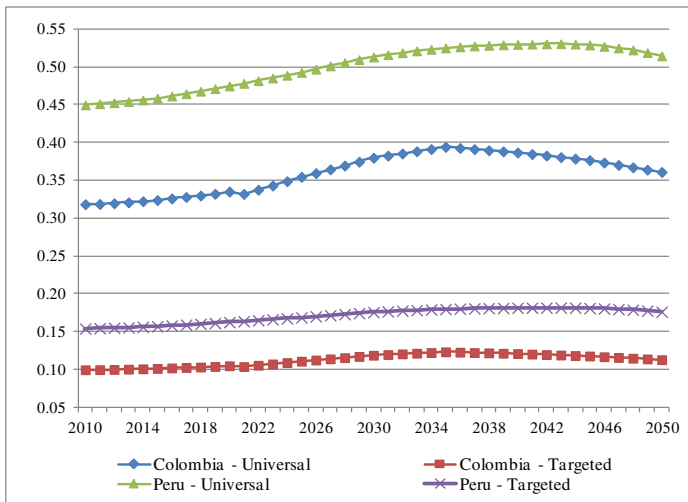
We can profit from our simulation strategy and outcomes to compute (at least statically) the potential *ex-ante* effects of an NCP on the elderly labour supply. Specifically, we will measure the change in the probability of retirement for the recipients once an NCP is implemented.

The literature on retirement decisions gives an important role to benefit generosity, taxation, pension rules and household composition (Gruber & Wise, 1998). Similarly, we expect that the size of the transfer and household income composition will affect the decision

Table 9. Cost of a non-contributory pension (NCP) programme

	Colombia		Peru	
	Universal	Targeted	Universal	Targeted
Number of recipients	2 409 763	753 550	1 280 562	438 475
US\$ millions	882	276	681	233
% GDP	0.32	0.10	0.45	0.15
% Total taxes revenues	2.60	0.81	2.98	1.02

Source: Authors' estimations. The NCP, if targeted, is targeted to the poor.



Source: Authors' estimations.

Figure 2. Expenditures in non-contributory pension (NCP) programmes (as % of GDP), 2010–2050. Source: Authors' estimations

to retire. For example, Carvalho Filho (2008) estimated that about 40 per cent of recipients fully retired from the labour market upon receiving a social pension in rural Brazil, although this sharp decline can be explained by the large amount of the rural social pension (331 dollar per month), equivalent to 33 per cent of GDP per capita in annual terms, while this proportion is 5 per cent and 9 per cent in Colombia and Peru. Ranchhod (2006) estimated that the South African NCP reduces the labour force of the elderly by 8.4 per cent and 12.6 per cent for men and women, and notes that these figures must be considered as lower bounds. Recently, Galiani, Gertler, and Bando (2014) estimated that the Mexican NCP '70 y mas' does not generate significant negative effects on the labour supply of recipients and their family. The elderly working for pay declines from 23 per cent to 18 per cent, but unpaid work rises from 13 per cent to 19 per cent, while the overall number of worked hours remains roughly the same.

Another concern with NCP is the so-called *crowding-out* effects on other transfers and income received by the recipient and other household members, meaning that private donors (like family members not living with the elderly) can adjust their transfers downward. Amuedo-Dorantes and Juarez (2013) found that the Mexican NCP crowds out private transfers by 37 per cent, so upon receipt of the pension, total elderly income increases by less than the value of the pension. Knowing the crowding-out size is an empirical enterprise, as transfers and household composition are very different among populations. For example, Juarez (2009) estimated a complete crowding-out (about –100 per cent) when she analyses an NCP implemented in Mexico City in 2001. We are aware of the limitations of our data; therefore, we will employ a simple model strategy to measure the probability of retirement for the NCP recipients. The studies mentioned previously investigated NCP with data collected specifically to make impact evaluation or census data so that they can show ex-post results.

On the basis of a linear probability model with robust variance, we will find the average effect of an NCP (targeted at the poor) on retirement. The sample is composed of individuals eligible to receive an NCP in each country; it includes individuals who are poor, without a

pension and are aged 65 years and older in Peru, and 57 (women) and 62 (men) years and older in Colombia. The dependent variable is a dummy indicating if the individual is retired, while the independent variables are age, gender, marital status, household size, total household income, individual labour and non-labour income, and regional fixed effects. The upper panel of Table 10 reports the linear probability model estimated coefficients, which will allow us to predict the probability of retirement if we change some of the variables of interest. As an NCP is non-labour income, it is evident that this transfer increases the probability of retirement.

Table 10's bottom panel reports the effects of the NCP on the probability of retirement under diverse scenarios. The baseline figure indicates the actual probability of retiring before the introduction of NCP, while the remaining rows show how this figure changes when an NCP is implemented. In the first scenario, we are assuming that the recipient does not adjust his or her labour incomes, meaning that an NCP is increasing individual non-labour income and total household income, with all the rest kept constant. Under this scenario, the share of recipients that retire increases 1.6 per cent and 9.6 per cent in Colombia and Peru. The second scenario considers that the recipient adjusts his or her labour income, which is perhaps more realistic. In this case, the retirement rises by 4.8 per cent and 11.1 per cent in Colombia and Peru. We cannot be certain about the crowding-out size of the NCP, neither do we know in which component of the income the crowding-out is taking place (other private transfers or other household members' income), but at least, we can compute the effect of the NCP under complete crowding-out as a way to set up a lower bound for our computations. We do this by assuming that total household income does not change after the NCP introduction. This exercise produces a lower increase in predicted retirement with respect to the baseline, 2.0 per cent and 7.0 per cent in Colombia and Peru. Summarising, the introduction of

Table 10. Effects of a non-contributory pension (NCP) on elderly retirement

Variables	Colombia		Peru	
	Coef.	SD	Coef.	SD
Age	0.0071***	0.0001	0.0132***	0.0018
Women	0.129***	0.0009	0.0774***	0.0268
Married	0.0056***	0.0008	-0.0192	0.0262
Household size	0.0137***	0.0002	0.0244***	0.0062
Labour income	-0.199***	0.0008	-0.0594***	0.0053
Non-labour income	0.0249***	0.0003	0.0553***	0.0206
Total household income	-0.0016***	0.0001	0.0060***	0.0019
Constant	0.1726***	0.0044	-0.7638***	0.1480
Observations	1144		1921	
R ²	0.413		0.330	
Effects on the probability of retirement				
0. Baseline	0.724		0.304	
1. The recipient does not adjust her labour income	0.741		0.400	
2. The recipient reduces her labour income by the same NCP amount	0.773		0.415	
3. Perfect crowding-out at the household level	0.744		0.373	

***Sig. at 1 per cent;

**5 per cent;

*10 per cent. Regressions include region fixed effects. Robust standard errors. The dependent variable is a dummy for retirement. Monetary units are in millions and thousands for Colombia and Peru.

an NCP can increase retirement among the recipients by a percentage between 1.6 per cent and 4.8 per cent in Colombia and between 7.0 per cent and 11.1 per cent in Peru.

5.5 Some Limitations and Caveats

The introduction of an NCP may have other effects on the individual and her family decisions apart from what we are currently examining. For example, there is recent evidence of positive impacts on mental health of the recipients (Galiani *et al.*, 2014), not to mention some positive outcomes on enhancing school attendance of girls living with a recipient (Duflo, 2000, 2003). These effects are interesting and relevant, but they go beyond the scope and data availability for our study. It is important to mention that our computations consider only static behavioural changes. For example, the existence of some anticipation effects is possible, meaning that potential recipients will reduce their labour force before receiving the transfer, but this can be implausible because this population is poor and face credit constraints. In analysing the Mexican NCP, Galiani *et al.* (2014) did not find evidence of this anticipation effect. Furthermore, as the NCP analysed in this study is means-tested, another possibility is that some individuals will adjust their incomes accordingly in order to qualify for the transfer. We cannot control for this, but the actual NCP implemented in some Latin American countries use complex targeting score systems based—beyond incomes—on multi-dimensional characteristics of the household that proxy living standards so that individuals adjusting incomes could be less significant. Finally, we are aware that the NCP considered is of a low amount so that we are confident that other behavioural effects on individuals living above poverty thresholds can be negligible.

6 CONCLUSIONS

The relevance of an NCP scheme stems from its potential to reduce poverty and inequality, particularly among the elderly. This transfer can possibly become a powerful tool for improving the quality of life of those individuals whose chances of escaping poverty are almost nil. Furthermore, a vast majority of elderly people in rural areas must keep working until very advanced ages (even till death) because they are unable to retire with a secure income stream.

Our results for Colombia and Peru show that the impacts of an NCP (universal or targeted at the poor) are notable for reducing poverty among the elderly, particularly in rural areas. In Peru, old-age rural poverty can be reduced from 48.5 per cent to 23.7 per cent with the introduction of an NCP, while in Colombia, this falls from 36.7 per cent to 24.6 per cent. The results are modest if one considers national poverty rates, although the effect is higher in rural areas than in urban areas. The impact of the transfer on inequality is rather modest in both countries when one considers the entire population. However, the reductions in inequality are more important and statistically significant among the elderly group living in rural areas. We also observe that there are no sizeable differences between a universal and targeted pension in reducing inequality for rural elderly Colombians. Contrary to this, the targeted pension in Peru is more important to equalise incomes than the universal pension.

Our estimations reveal that the cost of the NCP programmes in Colombia and Peru does not include any substantial crowding-out of contributory pensions and that their cost may be limited when targeted to the poor. In Colombia, the universal programme has an annual cost of 2.6 per cent of the total tax revenues, while the scheme targeted at the poor costs 0.81 per cent.

Similarly, in Peru, implementing a universal programme costs 2.98 per cent of total tax revenues, while the targeted programme sums up 1.02 per cent. According to the population projections and under conservative estimates of real GDP growth rate in both countries, these percentages can increase only slightly over the next 25 to 30 years.

As for the possible changes in the behaviour of individuals, we observe that a universal transfer can significantly decrease the probability of affiliation to the contributory pension system in both countries, although the effect is larger in Peru. In Colombia, this programme can reduce the probability of affiliation to contributory systems by about 5 per cent, and in Peru, this reduction is about 8 per cent for men and 18 per cent for women. In contrast, a targeted scheme only slightly reduces this probability, meaning the reduction is less than 1 per cent for both genders in Colombia and less than 2 per cent for Peruvian men. Peruvian women still show a large reduction on the probability of affiliation (10.5 per cent). We also assess the impact of a transfer targeted at the extreme poor and detect very small reductions (less than 0.5 per cent) in this probability for Peruvian men and both genders in Colombia. Finally, we find that about 2 per cent to 5 per cent and 7 per cent to 11 per cent of the recipients in Colombia and Peru will retire upon receiving the transfer. This effect is positive as one of the goals of NCPs is to ease the path to retirement for the elderly poor.

In summary, our results show that the implementation of the NCP in Colombia and Peru contributes to the reduction of poverty and inequality among the elderly, particularly in rural areas and importantly at limited fiscal costs. In addition, we do not expect a large impact on the probability of affiliation to contributory pensions of individuals when the programme is targeted.

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APPENDIX

Table A1. Non-contributory pension programmes in Latin America

Country	Name of scheme	Year of creation	Benefit (% GDP p. c.)	Age	Targeting	Number of recipients	% Pop 60 years and older covered	Cost (% GDP)
Argentina	<i>Pensiones Asistenciales</i>	1994	14.4	70	Means-tested	75,229	1.3	0.23
Bolivia	<i>Renia Dignidad</i>	2008	1.6	60	Universal	788,969	103.3	1.06
Brazil	<i>Previdencia Rural</i>	1991	32.6	60 (m)/55 (f)	Means-tested and for rural area	5,851,554	28.3	1.5
Brazil	<i>Beneficio de Prestacao Continuada</i>	n.d.	32.6	65	Means-tested	1,700,000	n.d.	0.3
Chile	<i>Pension Basica Solidaria de Vejez</i>	2008	13.6	65	Means-tested	403,144	16.7	0.9
Colombia	<i>Programa Colombia Mayor</i>	2003	5.1	57 (m)/52 (f)	Means-tested. Regional	214,480	6.4	0.02
Costa Rica	<i>Programa Regimen No Contributivo</i>	1974	20.2	65	Means-tested	83,438	19.7	0.18
Ecuador	<i>Pension para Adultos Mayores</i>	2003	11.8	65	Means-tested	583,817	39.2	0.31
El Salvador	<i>Pension Basica Universal</i>	2009	16.9	70	Means-tested	13,600	2.3	0.04
Guatemala	<i>Programa de aporte economico del Adulto Mayor</i>	2005	19.5	65	Means-tested	103,125	11.2	n.d.
Mexico	<i>65 y mas</i>	2007	0.4	65	Pensions-tested	2,200,000	22.4	0.11
Mexico	<i>Pension Alimentaria Ciudadana</i>	2003	8.5	68	In Mexico City (universal)	2,000,000	20.4	0.04
Mexico	<i>Amanecer</i>	2007	5.2	64	In Chiapas State (universal)	238,000	2.4	n.d.
Panama	<i>100 a los 70</i>	2009	14.1	70	Pensions-tested	86,392	22.5	n.d.
Peru	<i>Pension 65</i>	2011	9.3	65	Means-tested	126,787	n.d.	n.d.
Paraguay	<i>Pension alimentaria</i>	2009	30.7	65	Means-tested	31,454	5.9	0
Uruguay	<i>Programa de Pensiones No-Contributivas</i>	1995	27.8	70	Means-tested	31,577	5.1	0.62
Venezuela	<i>Gran Mision Amor Mayor</i>	2011	40.8	60 (m)/55 (f)	Means-tested	675,000	24.6	0.02

Source: <http://www.pension-watch.net>.

NET PENSION WEALTH (NPW) COMPUTATIONS

The computation of the pension wealth must take into account the possibilities of changing the system, staying in the same system, and exiting from any system. Figure A1 shows all possible combinations and the corresponding equation for each case.

		Future Situation		
		PRIV	PUB	NO
Current situation	PRIV	$v_{x,priv}^{priv}$	$v_{x,pub}^{priv}$	$v_{x,no}^{priv}$
	PUB	$v_{x,priv}^{pub}$	$v_{x,pub}^{pub}$	$v_{x,no}^{pub}$
	NO	$v_{x,priv}^{no}$	$v_{x,pub}^{no}$	$v_{x,no}^{no}$

Figure A1. Possibilities of net pension wealth

$v_{x,j}^{priv}$ indicates the net pension wealth of an individual of age x affiliated to the private pension who chooses the option j : staying in the private system ($v_{x,priv}^{priv}$), changing to the public system ($v_{x,pub}^{priv}$) or leaving the pension system ($v_{x,no}^{priv}$). The interpretation of wealth variables $v_{x,j}^{pub}$ and $v_{x,j}^{no}$ is similar. The detailed equations for each combination are as follows:

A. NPW for a person currently enrolled in the private system:

a. *Staying in the private regime:*

$$v_{x,priv}^{priv} = \pi_{x,priv} \tag{A1}$$

b. *Moving to the public system:*

$$v_{x,pub}^{priv} = \left(P_{pub}^{z-x} \times cru_z + CIC_x \beta^{z-x} + RB \right) \delta^{x-z} - a_{pub} \sum_{t=x}^z (e_t w_t) \delta^{x-t} \tag{A2}$$

c. *Leaving the pension system:*

$$v_{x,no}^{priv} = (CIC_x \beta^{z-x} + E) \delta^{x-z} \tag{A3}$$

In Equation (A1), an affiliated to the private system who remains in that system obtains a pension wealth equal to that of Equation (1) (in the main text). Equation (A2) indicates the pension wealth in the public regime if he or she moves there, plus the accrued balance in the individual account, minus costs. Equation (A3) indicates that the individual stops contributing so that his or her net pension wealth will be equal to his or her previous pension balance plus returns.

B. NPW for a person currently enrolled in the public system:

a. *Moving to the private system:*

$$v_{x,priv}^{pub} = \left[\left(P_{pub}^{x-h} \times cru_z \right) + a_{priv} \sum_{t=x}^z (e_t w_t) \beta^{z-t} \right] \delta^{x-z} - (a_{priv} + c) \sum_{t=x}^z (e_t w_t) \delta^{x-t} \tag{A4}$$

b. *Staying in the public system:*

$$v_{x,\text{pub}}^{\text{pub}} = \pi_{x,\text{pub}} \tag{A5}$$

c. *Leaving the pension system:*

$$v_{x,\text{no}}^{\text{pub}} = \left(P_{\text{pub}}^{x-h} \times \text{cru}_z \right) \delta^{x-z} \tag{A6}$$

Equation (A4) indicates the pension wealth an individual affiliated to the public system would obtain if he or she moves to the private regime. The very first term of the right-hand side indicates the potential pension wealth he or she will obtain from the public regime, only if he or she has enough years of contributions before moving to the private system. In Colombia, this first term corresponds to the RB. The second term of Equation (A4) indicates the capital accumulation in the private system, and the last term is the cost of such accumulation. In Equation (A5), an individual who remains in the public system will obtain a pension wealth equal to that of Equation (6) (in the main text). Equation (A6) indicates that the individual stops contributing so that his or her pension wealth will be only the pension capital accrued before leaving the system. Note that if the affiliated has not enough year-contributions, he or she will not receive a pension, and hence, the pension capital will be zero.

C. NPW for a person currently out of the pension system:

a. *Going to the private system:*

$$v_{x,\text{priv}}^{\text{no}} = \left[a_{\text{priv}} \sum_{t=x}^z (e_t w_t) \beta^{z-t} \right] \delta^{x-z} - (a_{\text{priv}} + c) \sum_{t=x}^z (e_t w_t) \delta^{x-t} \tag{A7}$$

b. *Going to the public system:*

$$v_{x,\text{pub}}^{\text{no}} = \left(P_{\text{pub}}^{z-x} \times \text{cru}_z \right) \delta^{x-z} - a_{\text{pub}} \sum_{t=x}^z (e_t w_t) \delta^{x-t} \tag{A8}$$

c. *Staying out of the system:*

$$v_{x,\text{no}}^{\text{no}} = 0 \tag{A9}$$

Next table reports the parameters used to compute net pension wealth variables.

Table A2. Parameters employed in pension wealth computations

Parameter	Colombia	Peru
Contribution rate to the pension fund (% of wage)	11.50%	10%
Contribution rate for solidarity (% of wage)	1%	–
Administrative fee and insurance premium (% of wage)	4.50%	3.07%
Pension fund return rate (yearly)	6%	6%
Discount rate (yearly)	4%	4.60%
Annuity discount rate (yearly)	4%	4.60%
Annuity price for single man (yearly)	13.396	11.671

(Continues)

Table A2. (Continued)

Parameter	Colombia	Peru
Annuity price for married man (yearly)	15.516	12.963
Annuity price for single woman (yearly)	13.974	13.118
Annuity price for married woman (yearly)	15.754	13.473
Age difference between spouses (man always older)	4	4
Percentage of pension for pensioner's widow	100%	42%
Minimum salary (yearly)	6.18 (mill. pesos)	S/.7200
Contribution rate to public pension system (% of wage)	16%	13%
Minimum pension in the public pension system (yearly) ^a	6.18 (mill. pesos)	S/.5810
Maximum pension in the public pension system (yearly) ^b	154.5 (mill. pesos)	S/.12 003

^aIn Colombia, the minimum pension is equal to one minimum salary.

^bIn Colombia, the maximum pension is equal to 25 minimum salaries.

Table A3. Heckman equation estimates

Variables	Colombia		Peru	
	Men	Women	Men	Women
Dep. variable: log of hourly wage				
Age	0.0272**	0.044518***	0.0506***	0.0519***
Age square	-0.0233**	-0.043907***	-0.0548***	-0.0566***
Edu: no level (reference)				
Edu: primary	0.2772***	0.285334***	0.3347***	0.3597***
Edu: secondary	0.5085***	0.616812***	0.7814***	0.815***
Edu: tertiary no university	0.8911***	1.115057***	1.0971***	1.4067***
Edu: tertiary university	1.7794***	2.052601***	1.5554***	1.9055***
Edu: postgraduate	0.9637***	1.305639***	2.0855***	2.3246***
Constant	7.0145***	6.160858***	-0.24	-0.8576***
Dep. variable: working dummy				
Age	0.0804***	0.148215***	0.0612***	0.1149***
Age square	-0.1054***	-0.178129***	-0.071***	-0.1334***
Edu: no level (reference)				
Edu: primary	-0.0864**	0.211579***	-0.0708	-0.1354***
Edu: secondary	-0.1492***	0.495814***	-0.2105***	-0.2346***
Edu: tertiary no university	0.0417	0.846187***	-0.2357***	-0.1247***
Edu: tertiary university	-0.0989	1.32462***	-0.3648***	0.0036
Edu: postgraduate	-0.056	1.122737***	-0.3439***	0.2175**
No labour income 000's	-0.00001***	-0.000009***	-0.0205***	-0.033***
Married	0.4093***	-0.658702***	0.2945***	-0.4706***
Constant	-0.3705	-2.477556***	0.2499	-1.3295***
Mills lambda	-0.60377	0.07112	-0.05620	0.12853
Rho	-0.73028	0.08438	-0.05479	0.10265
Sigma	0.82677	0.84287	1.02568	1.25208

***Sig. at 1 per cent;

**5 per cent;

*10 per cent. Regressions include region fixed effects.