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Informality and the Challenge of Pension Adequacy: Outlook and Reform Options for Peru

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Abstract

Past reforms have put the Peruvian pension system on a largely fiscally sustainable path, but the system faces important challenges in providing adequate pension levels for a large share of the population. Using administrative microdata at the affiliate level, we project replacement rates in the defined benefit (DB) and defined contribution (DC) pillars over the next 30 years and simulate the impact of various reform scenarios on the average level and distribution of pensions. In the DB pillar, the regressive minimum contribution period should be re-thought, while in the DC pillar a broadening of the contribution base and/or an increase in contribution rates would help increase replacement rates relative to the baseline forecast of 25-33 percent. A higher net real rate of return than assumed in the baseline would also have a significant positive impact. In the medium-term, labor market reform to tackle informality, and a broad pension reform to restructure the system and avoid competition between the DB and DC pillars should be a priority. Given low pension coverage, having a strong non-contributory pillar will remain important for the foreseeable future.

JEL Classification Numbers: G23, H55, J2

Keywords: Pension System, Contribution Density, Replacement Rates, Peru

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I. INTRODUCTION[1]

Given high informality in Latin America, it has often proven difficult to devise pension systems which can provide adequate pensions to a wide share of the population without endangering fiscal sustainability. The search for solutions has led to a series of reform initiatives over the past decades, with many countries moving away from the traditional defined benefit systems to either fully transition to defined contribution systems (Chile, Mexico), adopt a mixed system (Uruguay) or having a public defined benefit and a private defined contribution pillar co-exist (Colombia, Peru). More recently, many countries have also added or expanded non-contributory pillars as an important measure to address the low coverage of contributory systems (OECD/IDB/TheWorld Bank, 2014).

In Peru, the structure of having two competing contributory pillars has created a highly complex system. And while in contrast to some other Latin American countries the overall system is largely fiscally sustainable (IMF, 2018a), low and inequitable pension coverage is a particularly acute problem. High labor informality means that only around 30 percent of the economically active population are contributing to statutory pension schemes and less than 10 percent of workers in the bottom income-quintile do. Labor informality also implies that even those workers who do contribute to the pension system only do so irregularly as they move between formal and informal employment. Low so-called "contribution densities" in turn negatively affect the level of future pensions.

In this paper, we assess the outlook for pension adequacy (the level of pensions) in Peru, complementing a larger literature which has focused on pension coverage and fiscal sustainability. From the point of view of the policy maker, having a good understanding of future pension levels is crucial to decide on potential parametric reforms. And from the point of view of the affiliate, having an estimate of likely pension levels is important for making informed financial and labor market decisions.

Specifically, we use detailed administrative contribution data to project (gross) empirical replacement rates for both the mandatory defined benefit and defined

[1] We would like to thank Hillman Farfan Ruiz (Oficina de Normalización Previsional - ONP) and Jorge Mogrovejo Gonzales and Elio Sánchez (Superintendencia de Banca, Seguros y AFP - SBS) for excellent collaboration throughout this project and for kindly sharing the administrative pension data with us. We would also like to acknowledge useful discussions and clarifications from Ravi Balakrishnan (IMF), Noelia Bernal (Universidad del Pacifico), Lorenzo Figliuoli (IMF), Asta Zviniene (World Bank), and seminar participants at the Central Bank of Peru and the IMF. Czaba Feher (IMF) and staff of the SBS, ONP, Central Bank and Ministry of Economy and Finance of Peru provided detailed written comments which significantly improved the paper. Adrian Robles provided excellent research assistance.

contribution systems.[2] By exploiting data at the affiliate level, we can recover the full distribution of future replacement rates. This allows us to draw conclusions on how equitable the system is and how potential reforms would impact different groups of affiliates.

The existing literature on pension replacement rate projections for Peru is still limited. Most studies quantify theoretical replacement rates for the case of a representative agent (e.g. Asociación de AFP 2014 or Berstein et al. 2017). Often these studies – based on hypothetical contribution careers – are carried out for cross-country comparisons of pension adequacy (e.g. Duran and Valverde 2011; OECD 2014 or Tuesta and Herrera 2014). Annex I presents the main results of a recent theoretical study (IMF, 2018a) for Latin American countries (incl. Peru).[3] A 2018 report by the pension fund association calculates replacement rates for current retirees but does not project the outlook (AAFP, 2018). To our knowledge, only two recent studies simulate empirical replacement rates for Peru (Alonso et al. 2014; Peruvian Social Protection Commission 2017). The aim of our report is, therefore, to partly bridge this gap and to project future pension levels based on actual contribution careers. Based on the projections, we then develop reform proposals.

Empirical contribution data show that affiliates in Peru on average only contribute for 4-5 months out of a possible 12 months over their working life, similar to private sector contribution densities in Mexico (IMF, 2018b) and somewhat below contribution densities in Chile (Benavides and Valdés, 2018). Partly due to these low contribution densities, replacement rates are projected to be relatively low on average, at 25-33 percent in the baseline projection for the private defined contribution system (SPP) and 25-31 percent in the public defined benefit one (SNP) when averaging across all affiliates and across the next 30 years. In the SNP, replacement rates are projected to decline quite strongly from roughly 45 percent in 2020 to 12-20 percent in 2047, largely due to past reforms which made the system more sustainable. The steepness of the decline depends on whether and how the minimum and maximum pension will be adjusted going forward. In the SPP, average replacement rates over the same period change from around 25-28 in 2020 to 23-34 percent in 2047, with the exact value within the range depending on a few key assumptions to be discussed below.

In the SNP, average replacement rates for those who reach the 20-year minimum contribution period, and who are thus eligible for a pension, are relatively high at roughly 60 percent. But about 60 percent of all affiliates, and roughly 50 percent of affiliates who contributed over the past five years, are likely not to reach the 20-year

[2] Replacement rates are a standard metric in pension system evaluation and capture the ratio of pension to labor income of an affiliate. We calculate gross replacement rates since calculating net rates would require additional assumptions and information on the tax system and its development.

[3] For a comprehensive review of Latin American pension systems see Altamirano et al. (2018).

threshold, leading to a replacement rate of zero. Given that affiliates from the bottom income quintile are three times less likely to reach the threshold than affiliates form the top quintile, this implies highly regressive redistribution.

Large differences in replacement rates between groups of affiliates also exist in the SPP. Affiliates with full contribution careers, generally high-income workers, are expected to have replacement rates around 40 percent even in one of our more conservative scenarios. On the other hand, workers with below average contribution densities (generally low-income workers) will have replacement rates substantially below 20 percent.

Comparing the empirical replacement rate projections developed in this paper for Peru with projections for other countries is not straightforward, but it is nevertheless clear from the literature that pension adequacy is a concern for many defined contribution systems in Latin America. Recent IMF projections for Mexico find that conditional on receiving a pension, average replacement rates will be between 40 and 47 percent. But about 64 percent of workers in the private sector and 27 percent of workers in the public sector will not contribute long enough to receive a pension, implying a lower average replacement rate for overall affiliates (IMF, 2018b). More generally, the literature projects empirical replacement rates somewhat below 40 percent in Chile and Mexico (Alonso et al., 2015 on Mexico and Mesa-Lago and Bertranou on Chile). Benavides and Valdéz (2018) report observed replacement rates for recent pensioners in Chile and find a replacement rate of 40 percent when including the solidarity pillar and a significantly lower replacement rate when excluding it. Appendix I has further information on cross-country comparisons within Latin America. Looking beyond Latin America, recent IMF projections for Central and Eastern Europe suggest that many countries there face similar challenges and will have average replacement rates below 40 percent in 2050 (IMF, forthcoming).

Precisely to tackle the issue of pension adequacy, in Chile a proposal to gradually increase contribution rates from 10 to 14 percent is currently being discussed. To address the issue of low replacement rates, many defined contribution systems in Latin America also have a government supported minimum pension, a matching contributions scheme or a fully integrated non-contributory pillar. These elements are either missing or could be further strengthened in Peru.

We discuss several parametric reforms to the existing system which could help raise replacement rates in Peru, but even then, replacement rates will remain significantly below levels occurring in advanced countries. In the SNP, shortening the minimum contribution period from 20 to 15 years would allow more people to obtain a pension and thus raise the average replacement rate at a relatively limited fiscal cost (we estimate a gross cost of 0.05 percent of GDP). In the SPP, broadening the contribution base to make pension contributions obligatory for the 13th and 14th monthly salaries would increase replacement

rates by close to 3 percentage points. An increase in contribution rates by 5 percentage points has the largest impact on replacement rates and might be unavoidable in the medium-term to guarantee adequate pensions but could adversely affect labor formalization.

Since 2016, lump-sum withdrawals of 95.5 percent of the value of the individual account are allowed at the point of retirement. And withdrawals of up to 25 percent are allowed prior to that for mortgage down payments and to pay down mortgage debt. These withdrawals have proven popular with affiliates but pose significant downward risks to replacement rate projections. This is especially true in the case of 95.5 percent lump sum withdrawals at retirement since those place the full financial longevity and capital market risks in the hands of the affiliate. In general, large withdrawals from individual pension savings accounts should not be allowed or strongly limited.

The real rate of return plays a key role for replacement rates in the SPP. An increase in the real rate of return of 0.5 percentage points relative to that assumed in the baseline simulations, would increase replacement rates by around 3 percentage points. Related to this, it is estimated that reducing asset-based pension fund fees by 0.5 percentage points would increase replacement rates by around 1 percentage point.[4]

A significant impact on replacement rates overall would be achieved by increasing contribution densities substantially, which essentially implies reducing labor informality. Of course, that is a difficult task, but labor market reforms, among others, can contribute to this.[5]

The remainder of the paper proceeds as follows. Section II presents an overview of the Peruvian pension system, including the institutional set-up and key parameters. Section III discusses the methodology and data used to project replacement rates and section IV presents the results. Section V concludes with a discussion of direct policy implications and broader reform considerations.

[4] The net real rate of return is the gross real rate of return adjusted for fees. There are two reasons that reducing asset-based fees does not have the same effect as increasing the gross real of return. First, a significant fraction of affiliates currently still operates under the contribution-based fee model and are thus not affected by changes in asset-based fees. Second, no asset-based fees are charged during retirement. If all affiliates paid asset-based fees and these were charged during both the accumulation phase and retirement, then a change in the gross real rate of return and a change in fees would be exactly equivalent and have the exact same impact on the net real rate of return.

[5] See David et al. (2019) for a recent overview of labor markets in Latin America.

II. Overview of the Peruvian Pension System

The Peruvian pension system consists of several contributory schemes as well as a de facto non-contributory pension (Pension 65). The contributory part of the system is made up of (i) a private fully-funded plan – Sistema Privado de Pensiones (SPP), (ii) a public defined benefit plan– Sistema Nacional de Pensiones (SNP) and (iii) a number of special regimes.[6] The two main special regimes are the so-called cedula viva, a preferential public pension scheme for certain categories of public employees which was closed for new entrants in 2004 due to the high fiscal cost, and the military and police pension scheme. The SNP operates largely as a pay-as-you-go system but since 1996 is also partly funded by the return of an investment fund.

The private and public contributory pillars operate as substitutes rather than complements. Affiliation with a contributory pillar is obligatory for formal, salaried workers and voluntary for independent workers. Workers must choose between the SNP and SPP upon entering the workforce. If no choice is made they are assigned to the SPP. Furthermore, workers can change from the SNP to the SPP later in their career but cannot change back. Four pension funds are active in the SPP, with current market shares of 39, 31, 25 and 5 percent, respectively, in terms of assets under management.

The legal retirement age is set at 65 in both pillars but there are some differences in contribution rates. Contributions are 13 percent of gross earnings in the SNP. In the SPP, contributions towards old age retirement savings are 10 percent of gross earnings. Including fees (used to be around 1.5 percent but falling now) and disability and life insurance (1.36 percent), total salary retention in the SPP is close to 13 percent.

Even for the same contribution rate, pensions benefits can potentially differ widely between the SNP and SPP. The SNP has both a minimum and a maximum pension and a vesting period (minimum contribution time) of 20 years.[7] The SPP is fully funded and only a specific group of older affiliates qualifies for the minimum pension.[8] Pension rights in the SNP are calculated as a function of average earnings over the last three to five years before retirement. The replacement rate depends on the length of contributions as well as the birth cohort of the beneficiary. Accumulated pension benefits in the SPP depend on a wide range

[6] The SNP is the oldest pension system in Peru having been created in 1972. SNP pensions are administered by the Oficina de Normalización Previsional (ONP). The SPP was created in 1992, following the Chilean model and is supervised by the Superintendencia de Banca, Seguros y AFP (SBS).

[7] The minimum pension is currently S/. 415 per payment and the maximum pension is S/. 857.36. The maximum and minimum pension amounts have occasionally been adjusted but there is no explicit indexation mechanism. As a reference point, the current legal minimum wage is S/ 930.

[8] Age, number of contributions, and birth cohort are among the criteria determining eligibility for a minimum pension in the SPP. The detailed criteria are set out in laws 27617 and 28991.

of factors, key among them the amount contributed and the net rate of return that was achieved.

There is no de jure non-contributory pension pillar, but Pension 65, a social transfer to the elderly poor, acts as support to some of those without a contributory pension. Everybody over 65 who lives in extreme poverty (as defined by the sistema de focalizacion de hogares – SISFOH) and does not receive a contributory pension or any other social transfer (with few exceptions) qualifies. Pension 65 currently pays S/ 125 per month to over 500,000 recipients (circa 25 percent of all people over 65). This amount has not been adjusted since the creation of the program and there is no explicit indexation mechanism. The transfers for Pension 65 currently cost slightly over 0.1 percent of GDP. Given that there is no explicit indexation rule, the de facto indexation mechanism is uncertain, but unless the transfers are indexed to wages, costs for the status quo arrangement are unlikely to exceed 0.2 percent of GDP per year over the long-term.

Key Numbers Peru (2017)

Population: 31.8 million, **Population 15-64:** 20.9 million, **Population 65 and over:** 2.3 million
Labor Force (2016): 16.9 million**, Employment (2016):** 16.2 million
SNP Affiliates: 4.5 million, **SPP Affiliates:** 6.6 million
SPP Assets under Management: 47.7 billion USD (ca. 22 percent of GDP)
SNP Expenditures: 1% of GDP, **SNP Contributions:** 0.5% of GDP
SNP State Budget Transfers: 0.2% of GDP, **SNP Other Revenues:** 0.3% of GDP
SNP Reserve Fund (FCR): 2.7% of GDP

GDP per capita (USD, current): 6,762
Poverty rate: 21.7%

Fiscal Sustainability

Reforms which made the SNP and especially the special regimes less generous over the years put the system in a sound fiscal position. The financing needed from the general budget to cover the pension deficit fell from around 3 percent of GDP in 2000 to 1.2 percent of GDP in 2012, and the deficit in the SNP was only around 0.2 percent of GDP in 2017.

Several studies simulate the fiscal outlook for the SNP and all project that the fiscal cost will increase again as the number of new affiliates will not keep up with the number of retirees. But given the sensitivity of such simulations, conclusions differ with respect to the estimated deficit (roughly between 0.1 and 2 percent of GDP by 2050, see Alonso et al. (2014), Bernal (2016), IMF (2018a) and Social Protection Commission (2017)).

Pension Coverage

A large share of the population is not covered by the contributory pillars. As of early 2018, 4.5 million people were affiliated with the SNP and 6.6 million people with the SPP. While this represents over 45 percent of the working age population, only 20 percent of the working age population contribute to their pension plan in any given month. As a percentage of economically active 20-64-year-olds, close to 70 percent did not contribute at all to a contributory pension plan during 2015 or 2016.

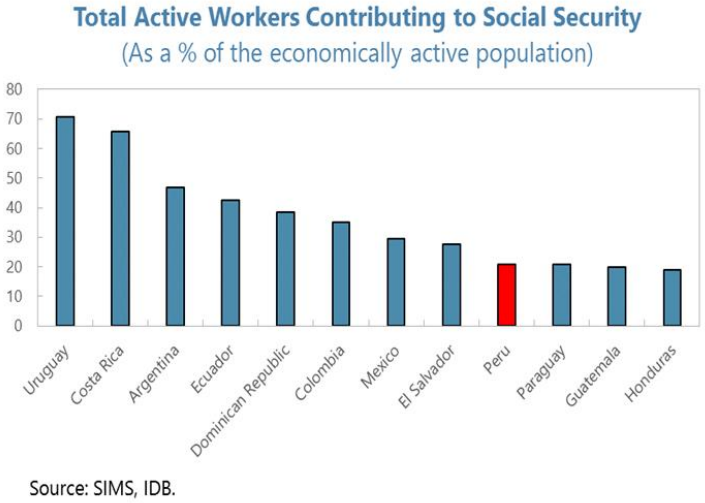
Higher income, higher educated, urban workers are significantly more likely to be covered. Only 7 percent of workers in rural locations contribute to a pension plan, versus 37 percent in urban areas. And while only 4 percent from the bottom income quintile contribute, 61 percent from the top income quintile do. By education level the contrast is particularly sharp, ranging from virtually 0 percent for the least educated groups to close to 100 percent for the highest education group.[9]

Coverage is low also from a regional perspective. Based on data from the Inter-American Development Bank's SIMS database, pension coverage in Peru ranks below the regional average and lags behind peer countries such as Colombia due to the high level of labor informality. Relative to its GDP per capita, Peru is one of the two regional underperformers, together with Mexico (Figure 1).[10]

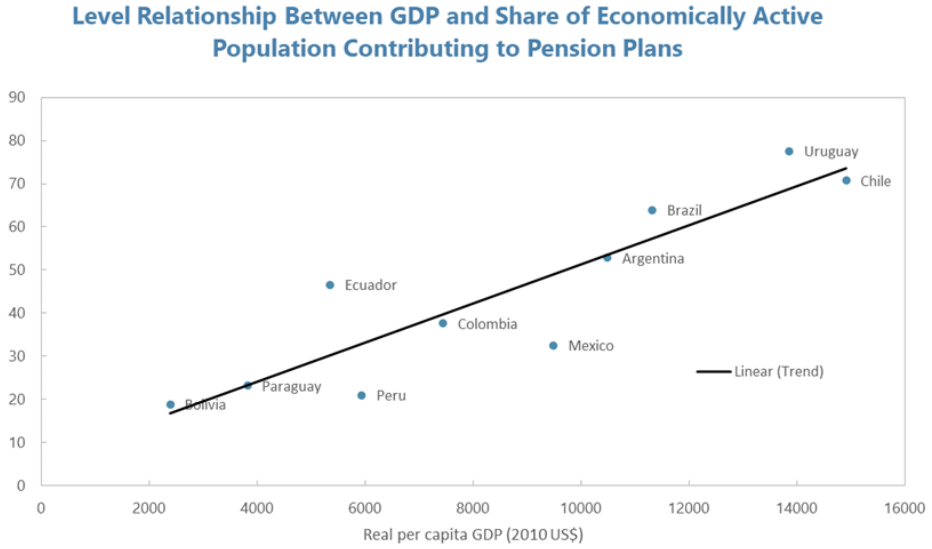
[9] Numbers are calculated based on the 2017 Peruvian household survey (ENAHO, INEI).

[10] The 2017 IMF Staff Report for Peru notes that labor market regulations are an important contributor to informality in Peru and "education levels, the tax regime, access to public services, and enforcement of laws have also played a role".

Figure 1: Coverage of Contributory Pension Systems in Latin America



Source: SIMS, IDB.



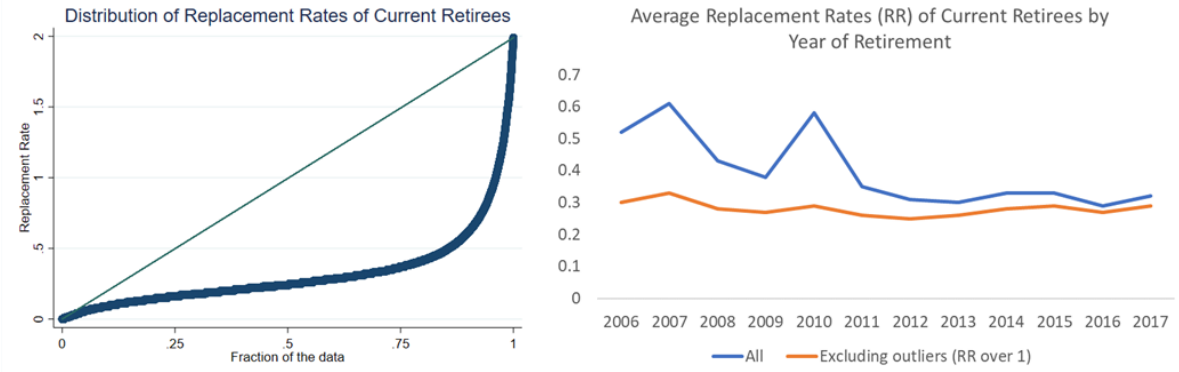
Source: SIMS IDB and WDI.
Note: Mexico uses 2014 values.

Pension Adequacy

Before later turning to simulations of what replacement rates will be over the next 30 years, we look at replacement rates of current retirees in Peru. Replacement rates of current retirees are around 40 percent in the SNP (Cruz-Saco and others, 2014), closely aligned with our short-term forecast (see section IV). For the SPP, we use administrative data for current retirees to retrieve the distribution of current replacement rates. Using information for all retirees since the data began being collected in a centralized manner (in 2006), shows

a mean replacement rate of 37 percent and a median rate of 25 percent.[11,12] As the left panel of Figure 2 shows, the mean is substantially higher than the median due to a tail of very high replacement rates over 1. These very high numbers occur for two specific types of retirement - early retirement and early retirement due to unemployment and might be inflated due to affiliates reporting low incomes to qualify for early retirement.[13] The right panel of Figure 1 shows that these outlier observations have decreased over the past years. Mean replacement rates, with and without outliers, have averaged 32 percent and 28 percent, respectively since 2012, close to our short-term forecast (see section IV).

Figure 2: Replacement Rates of Current SPP Retirees



Source: Authors' calculations.

In the remainder of this paper, we investigate the outlook for pension adequacy in detail by simulating replacement rates based on empirical contribution densities under a baseline and various reform scenarios over the next 30 years.

[11] Current replacement rates are defined as first pension over average income over the past decade while our simulations in the next section are for first pension over final income. In practice, this does not make a significant difference since we assume in our simulations that all affiliates have the same annual wage growth and thus remain in the relative average earnings position observed over the last years 2010-2017.

[12] Both the median and mean contribution density of current retirees was 0.38, very close to the 0.4 mean contribution density for current affiliates which will be discussed in section III.

[13] The SPP allows for early retirement if the individual savings account has sufficient resources to finance a pension which is higher than 40 percent of the average salary over the past 120 months. It has been observed that workers who do not satisfy this requirement start making contributions on a lower income level, thereby reducing average earnings and enabling them to satisfy the replacement rate criterion. A similar mechanism can be observed in the case of early retirement due to unemployment.

III. METHODOLOGY AND DATA

A. Overview of Methodology

Empirical replacement rates over the period 2018-2047 are simulated separately for the SNP and SPP based on representative samples of contribution histories (see below for details of the data used).

We measure contribution densities in two ways – contributions at the extensive margin (CEM) and contributions at the intensive margin (CIM). CEM measures whether an affiliate contributed in a given time period while CIM measures the frequency of contributions, i.e. the total months accrued / maximum possible months to be accrued. [14] For the below simulations, contribution densities refer to CIM. A further discussion of concepts of contribution densities used in the literature is provided in Annex II.

Replacement rates are defined as the ratio of an average monthly pension paid in the first year of retirement to the final monthly earnings prior to retirement. Projections are carried out for cohorts aged 35 and older in the base year of 2017 which are at a later, more stable path of their contribution career.

B. Data

The datasets underlying the analysis cover contribution information over the period 2012-16 for a representative sample of 65,382 SNP affiliates (about 1.5 percent of overall affiliates) and contribution information over 2007-17 for a representative sample of 2 percent of SPP affiliates, respectively. The format of the administrative contribution data differs slightly between the SPP and SNP. SPP data shows earnings data for December of each year in the period 2010-17 and the overall number of months contributed in a given year between 2007 and 2017. SNP data show contribution months and earnings for a given year in the period 2012 to 2016.[15]

[14] Alternatively, contribution densities could be measured only for the length of affiliation. For example, a worker aged 40 who enters the SPP for the first time in 2016 and contributes for the full 12 months has a contribution density of 20 percent over 2012-16 (=12 out of 60 potential months) using one methodology but a contribution density of 100 percent under the alternative methodology. Overall contribution densities are about 4 percentage points higher when using the alternative methodology.

[15] It is worth pointing out that average earnings of affiliates are higher in the SPP than in the SNP. The average monthly wage in the SPP was 2700 Soles in 2016 (age groups 20-64) while it was 1300 soles in the SNP. One likely explanation is that the maximum pension in the SNP leads higher earnings groups to join the SPP.

C. Contribution Densities

In the SNP, the mean contribution density is 34 percent, in other words workers contribute on average for roughly 4 months out of a possible 12 months per year over their working life. In the SPP the mean contribution density is about 40 percent, or 4.8 months.[16]

In both the SNP and SPP, contribution densities increase with income. Comparing the contribution density distributions for the bottom and top income quintiles reveals stark differences (Figure 3).[17] In the SNP, over 75 percent of bottom income affiliates have contribution densities below 50 percent and virtually nobody has uninterrupted contribution lengths (contributes in every month). On the other hand, the whole distribution for the top income quintile is shifted to the left (higher densities) and around 25 percent of the top income quintile have full contribution lengths. In the SPP, the picture is similar with the average contribution density in the top income quintile roughly double that for the bottom income quintile.

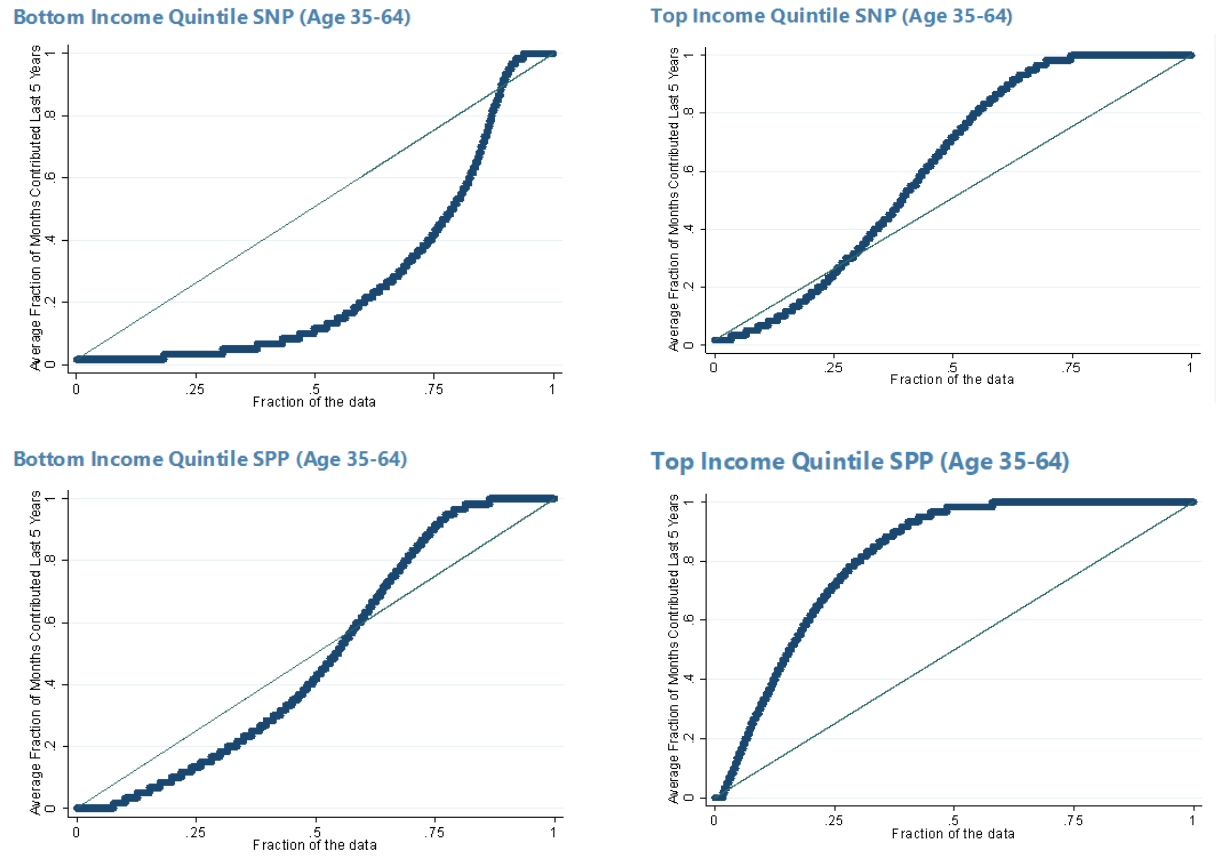
The 20-year vesting period combined with the above contribution densities implies that most SNP affiliates will not be eligible for a pension. Even when looking at only the sample of affiliates who contributed during 2012-16, close to 50 percent will not reach the 20-year minimum contribution period.[18] And due to their higher contribution densities, higher income affiliates are significantly more likely to reach the 20-year threshold (60 percent in top quintile versus 17 percent in bottom quintile – see Table 1).

[16] It should be noted that the relatively low contribution densities may to some extent be explained by the elimination of obligatory contributions for groups of self-employed.

[17] Since earnings data is not available for all affiliates, contribution density estimates for earnings quintiles are not strictly comparable to overall averages. The sample size used to calculate quintiles is smaller than the overall sample used for averages.

[18] This figure may underestimate the share of SNP affiliates who are unlikely to reach the 20-year threshold because it is based on contribution histories of only those affiliates who made at least one month of contribution in the period 2012-2016. In other words, fully inactive SNP affiliates (about 27 percent of the sample) are disregarded.

Figure 3: Contribution Densities by Income Quintile in SNP and SPP (2012-16)



Source: Authors' calculations.

Table 1: Probability of Reaching the 20-year Threshold in SNP by Earnings Quintile

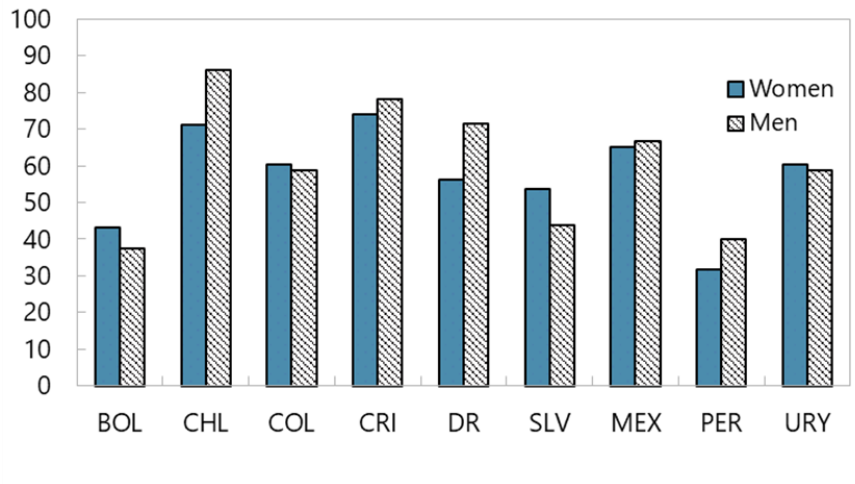
(Age group 30-59 in 2016)

Quintile	Probability
1st	17%
2nd	51%
3rd	55%
4th	54%
5th	60%

Source: Authors' calculations.

In both the SNP and SPP, contribution densities have increased over the past years. Contribution densities rose over the past 5 years (by around 10 percent or 4 percentage points) especially among younger cohorts, in line with an economy wide reduction in informality. Nevertheless, the 4-percentage points improvement still leaves contribution densities below regional averages if we use the 2010 data from Duran and Pena (2010) as a starting value (Figure 4).

Figure 4: Contribution Densities in Latin America around the Year 2010
(In percent)



Source: Duran and Pena (2011).

D. SNP Pension Projections: Methodology and Assumptions

SNP pensions are based on a defined benefit formula: the starting pension at age 65 reflects the product of the accrual rate and the average wages over the last three to five years. The accrual rate schedule differs by cohort, with less generous rules applied for younger birth years (see Alonso et al. (2014) for more details).

The accrual rate is estimated for each affiliate and is a function of total contribution years accrued over the individual working history. Information on individual contribution years can be observed for the period 2012-16. For years prior to 2012 and after 2016 it is assumed that pension affiliates show the same average individual contribution density as in 2012-16. In other words, a flat age profile of contribution densities is applied for age groups 30 and older which is closely in line with the empirical data.[19]

[19] In line with the data, contribution densities are assumed to rise between ages 20 and 30.

A similar assumption is applied for the future individual earnings path: Affiliates aged 35 and older in 2016 are assumed to remain in the relative earnings position observed in the period 2012-16.[20] In other words, individual future earnings grow only with general wage growth (as in the SPP simulation – see below, real wage growth and inflation are assumed to be 2 percent per year). There are no age specific changes in earnings (e.g. due to promotions). While not an ideal assumption, it is supported by the relatively flat earnings profile observed in the empirical data for 2012-16.[21]

To estimate the value of starting pensions in a future year, the simulated contribution densities and earnings paths are inserted in the defined benefit formula. Actual pensions are then calculated by taking into account the minimum and maximum pension. Note that the assumed adjustment of the minimum and maximum pension during the forecast horizon plays an important role for the results. For the baseline we assume either CPI indexation or no adjustment and in a robustness exercise we also show results for the case of wage indexation. We return to the role of the minimum and maximum pension when discussing the simulation results later in the paper.

In accordance with pension rules, the accrual rate is capped at 100 percent. Pensions are only calculated for affiliates with earnings records in the period 2012-16. The remaining scheme members who were inactive in those years – about 22 percent of birth years 1953-82 – are neglected, which may lead to an overestimation of future pension levels. Final replacement rates are estimated by dividing the average monthly pension paid in the first year of retirement by the final monthly earnings prior to retirement. Thereby, we take into account that SNP pensions are paid out 14 times per year.[22] For individuals with less than 20 contribution years accrued replacement rates are zero.

E. SPP Pension Projections: Methodology and Assumptions

SPP pensions are based on defined contribution (DC) principles: final pensions depend on contribution payments over the contribution career plus interest rates accrued. The value of pension entitlements earned until September 2017 can be observed in the sample data. It comprises individual DC accounts plus so called Bonos de Reconocimiento. The

[20] The earnings position is measured based on average earnings in 2012-16. Earnings prior to 2016 are indexed with general wage growth to 2016.

[21] Public sector employees who usually experience steep earnings careers are to a significant degree not captured by our data - given older age groups are affiliated with the now closed cedula viva special regime. This aspect likely contributes to the relatively flat earnings profile observed.

[22]It should be noted that SNP pensioners additionally receive some bonuses established by law which are neglected in our calculations. One of these bonuses is paid for advanced age, so called Bonificaciones de Edad Avanzada. They are granted to pensioners who are 80 years or older and equal 25 percent of the pension. Under a consideration of this additional SNP benefits the replacement rate in the SNP would be somewhat higher.

latter reflect unfunded pension rights accrued before the introduction of the SPP which are indexed with CPI until the point of retirement.

Pension entitlements accrued after 2017 until retirement are estimated based on simulations. Similar to the SNP calculations, it is assumed that pension affiliates will show the same mean individual contribution density as observed in 2012-17 during the projection horizon.[23] Likewise it is assumed that affiliates aged 35 and older will remain in the relative earnings position observed in the period 2010-2017.[24] Both these assumptions are again supported by the empirical data which show no significant changes in contribution densities and earnings by age (for age groups 35 and older).

Based on these assumptions, it is relatively straightforward to calculate contribution payments C in future years t by multiplying average earnings with contribution densities and the contribution rate. The latter rate remains constant in the base scenario and amounts to 10 percent after fees.[25]

Individual accounts are projected in line with equation 1. The value of the account of an individual i ($AC_{t,i}$) at the end of a given year t reflects the account value of the previous year ($AC_{t-1,i}$), revalued with rates of return rr_t^{DC} minus asset/return fees f_t, plus annual DC contributions (C_t^{DC}) in year t. Asset-based fees amount to 1.13 percent for mixed fee affiliates and to 0 percent for flow fee affiliates.[26] Gross rates of return are assumed to be time-invariant.

Eq. 1 $$AC_{t,i} = AC_{t-1,i} * \left(1 + rr_t - f_t\right) + C_{t,i}$$

For the estimation of the starting SPP pension, we first estimate the amount of resources needed to finance a monthly unit of pension, also called CRU (Capital Requerido Unitario), for a given year t at retirement age r (equation 2). This takes into account the contingent probability p to survive from retirement age r until a future age r+1+j (j$\leq M - r$).[27] The

[23] The contribution density applied for the projection is measured by dividing the total contribution months accrued in a given time span by the overall months in this time span. If an affiliate entered the SPP during the observation period, the denominator reflects the total months from the affiliation start date until the end of the observation period.

[24] A longer reference period is chosen here compared to SNP due to the fact that earnings information for SPP is sparser and provided only for one month in a given year.

[25] The simulations do not consider voluntary contributions.

[26] Assuming constant asset-based fees over the forecast horizon is a relatively conservative assumption given the recent downward trend.

[27] The contingent probability to survive from retirement age r in year t until a future age f is estimated as follows: $p_{t,r,f} = \prod_{s=r}^{f-1}(1 - q_{t+(s-r),s})$ with f $\leq M$.

retirement age is set at age 65 and the maximum age M up to which individuals are assumed to survive is 109 years.

Eq. 2 $$CRU_{t,r} = 12 * \left(\sum_{j=0}^{M-r} \frac{p_{t,r,r+1+j}}{(1+i)^j} - \frac{11}{24} \right)$$

A discount rate i is applied in Equation 2 which reflects the assumed nominal rates of return rr as well as the indexation regime of pensions p_index after retirement (see equation 3). In our calculations p_index is equal to the assumed inflation rate of 2 percent.

Eq. 3 $$i = \frac{(1+rr)}{(1+p\_index)} - 1$$

Survival probabilities and mortality rates q are based on the latest gender-specific mortality table published for the SPP population in March 2018 (SPP-S-2017). For the estimation of future mortality rates of a year t at age x an age-specific reduction factor of mortality rates a_x is taken into account (see equation 4).[28] As a result, a man born in 1952 has a remaining life expectancy of 22.5 years at the retirement age 65 in 2017. A woman can expect to live 25.8 years (SBS, 2018). It should be noted that life expectancy of the general population in Peru is about 5 years shorter than in the SPP population. For new SPP retirees in 2047 (at the end of our projection horizon) a further rise in life expectancy by about 2.5 years is assumed.

Eq. 4 $$q_{t,x} = q_{2017,x} * (1 - a_x)^{(t-2017)}$$

For the final calculation of monthly pensions *P* we divide the value of the pension account of an individual i ($AC_{t,r,i}$) by the value of the CRU at a given year t and retirement age r (equation 5).

Eq. 5 $$P_{t,r,i} = \frac{AC_{t,r,i\cdot}}{CRU_{t,r}}$$

Individuals who accrued pension rights in the SNP before the SPP was established have the right to a minimum pension under certain conditions (such as age and contribution length). Final replacement rates are estimated by dividing the monthly starting pension with the final monthly earnings prior to retirement. Replacement rates are only estimated for those affiliates for which earnings information has been provided in the period 2010-17. Consequently, about one third of pension affiliates (born between 1953 and 1982 in our

[28] The value of a_x is an additional information provided in the SPP-S-2017 mortality tables.

sample) are neglected in the calculations which may lead to an overestimation of future replacement rates.[29]

The key assumptions of the projections are displayed in Table 2. We briefly discuss each of the assumptions in turn.

Table 2: Key Assumptions for Replacement Rate Projections

Inflation	2%
Real wage growth	2%
Real gross rate of return	4.2%
Mortality assumptions	SPP-S-2017
Retirement age	65
Contribution density	average of 2012-2016

Source: Authors' assumptions.

Inflation: We assume inflation of 2 percent, in line with the BCRP's inflation target.

Real wage growth: We assume real wage growth of 2 percent, slightly below the 2.6 percent average between 2007 and 2016 and a standard assumption in many studies (see, for example, OECD/IDB/TheWorld Bank (2014)).

Real gross rate of return: In the baseline simulation a future gross real rate of return of 4.2 is assumed but in robustness exercises we also show results for a rate of return of 5.2 percent. Replacement rates in 2047 are about 7 percentage points higher in the latter scenario. The range of 4.2 to 5.2 is based on several considerations explained below.

As a starting point, consider Figure 5 which shows historical rates of return for Peru and Latin American peers. Over the fifteen-year period from 2003 until 2017, Peru was a positive outlier, achieving very high real annual rates of return of 8.9 percent, relative to a regional average of 5.5 percent. Over the more recent period, rates of return have fallen, however, both in Peru and regionally, and stood at 4.2 and 4.4 percent, respectively, over 2013-17. There are several reasons to assume that going forward, rates of return are likely to be closer to those numbers than to the higher average over 2003-17. As a first approximation, real rates of return would be expected to be relatively close to real GDP growth when looking over a longer horizon. Given that the current potential growth rate for Peru is estimated at around 3.75-4 percent by the IMF, this provides a first anchor for our assumptions.

[29] Note that while the simulation assumes that all pensioners in the SPP choose an annuity, other retirement options exists in Peru.

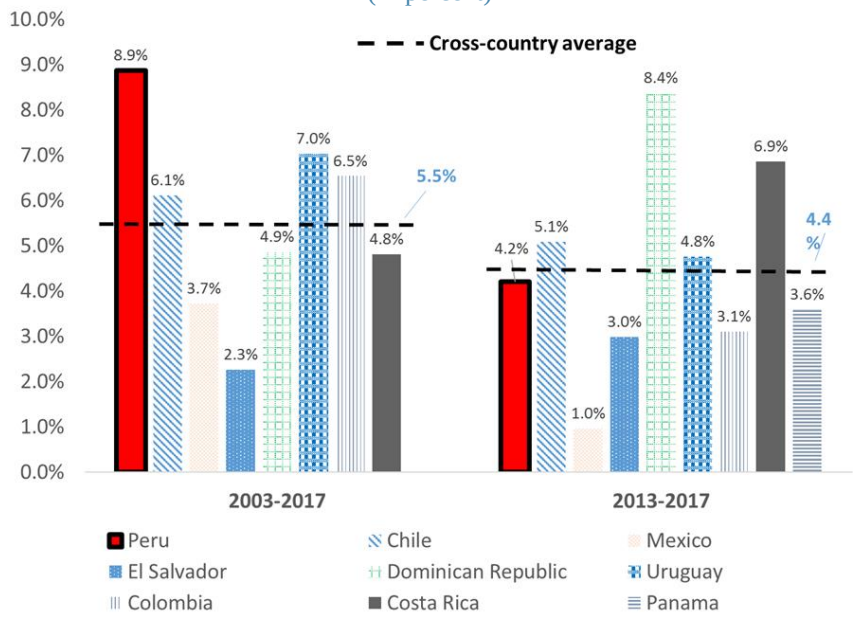
Additionally, over the long-term, real rates of return can be assumed to not outperform but converge towards levels achieved by a "best practice" fund, such as the Norwegian Government Pension Fund Global (which has achieved an average annual gross real return of 3.8 percent since inception). Third, pension funds all over the World have moderated expectations of rates of return as a new normal with lower interest rates than pre-2008 seems to have established itself. Last, previous authors have tended to use rates of returns for Peru around 5 percent (e.g. Alonso et al., 2014) while OECD/IDB/TheWorld Bank (2014) use a net real rate of return of 3.5 percent. Taking all the above into account, we thus use a range of 4.2 -5.2 percent for the real gross rate of return in our simulations.

Mortality assumptions: We use the latest mortality tables (SPP-S-2017) which came into effect in early 2019. Relative to the old mortality tables (RV2004-Modificada-Ajustada) this lowers replacement rates due to increased life expectancy.

Retirement age: In the baseline simulations we assume an unchanged retirement age of 65 but we present reform scenarios with increased retirement ages.

Contribution Density: In the baseline we assume that contribution densities are unchanged relative to the average over 2012-16. This is a somewhat conservative assumption. In an alternative scenario we allow contribution densities to continue to grow linearly the way they did over 2012-16. This has a meaningful impact on cohorts after 2030, raising replacement rates in 2047 by around 3 percentage points.

Figure 5: Real Annual Rate of Return of Pension Funds in Latin America
(In percent)



Source: Federación Internacional de Administradoras de Fondos de Pensiones (FIAP).

IV. RESULTS

A. Replacement Rates: Baseline Projections

Low contribution densities pose a significant challenge to pension adequacy going forward. With short or interrupted contribution careers it is very difficult to achieve high replacement rates. And while contribution densities have increased in recent years, with full contribution careers, affiliates in Peru would contribute over twice as much in total over their working lives as they currently do, with resulting consequences for replacement rates.

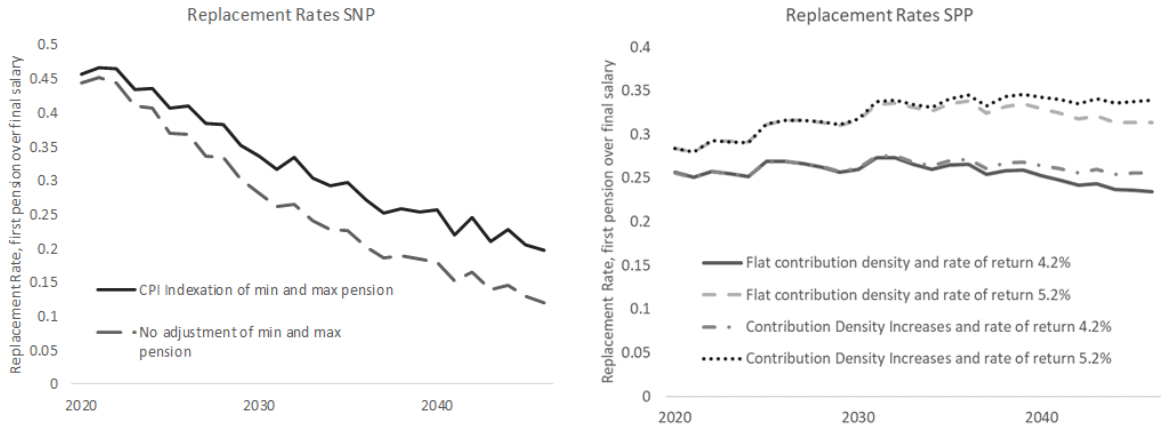
In the baseline simulations, replacement rates are projected to lie between 20 and 30 percent over the coming decades. Absent any policy changes, the mean replacement rate over the full forecast horizon from 2020-47 is projected to be 25-31 percent in the SNP and 25-33 percent in the SPP. The range for the SPP is largely explained by uncertainty about future real rates of return. In the SNP, the replacement rate for those pensioners who are eligible for a pension because they contributed the minimum necessary number of years is relatively high at 60 percent, but about 60 percent of affiliates (and around 50 percent of affiliates who contributed over the past five years) are likely to receive a replacement rate of zero.

In the baseline, replacement rates will fall over time in the SNP while the time-profile in the SPP depends on the assumptions (Figure 6). In the SNP, the decline is expected to be quite large, with replacement rates falling from around 45 percent in 2020, to 12-20 percent by 2045. The fall is mainly due to the impact of reforms which improved fiscal sustainability by reducing replacement rates of younger cohorts. But the steepness of the reduction depends on whether and how the minimum and maximum pension are adjusted going forward. Figure 6 shows two scenarios – full CPI indexation and no adjustment at all. For the distributional analysis in the remainder of this section we use the scenario in which the minimum and maximum pension are indexed with inflation (which likely represents the upper bound) but we return to the topic in section IV.B.

In the SPP, several factors influence replacement rates in opposite directions. First, as previously discussed, contribution densities increased in recent years and this will positively impact replacement rates going forward. Second, rates of return decreased in recent years which will negatively impact replacement rates. Third, fees decreased in recent years, increasing replacement rates. Fourth, younger cohorts will not be eligible for minimum pensions, and this will negatively impact replacement rates in the outer years by increasing the number of people with very low replacement rates. Last, life expectancy is increasing over time, pushing down replacement rates. All these factors underlie the time profile of replacement rates as shown in Figure 6.

In addition, the time profile also depends on two key assumptions: the real rate of return and future changes in contribution densities. For this reason, we show four different scenarios for the SPP in Figure 6. In the most conservative scenario, replacement rates increase slightly until about 2030 before dropping about 3 percentage points. In a high return scenario, on the other hand, replacement rates rise until roughly 2030 before stabilizing at a higher level. And in a scenario where contribution densities continue to grow linearly the way they have over 2012-16, replacement rates are higher than in the flat contribution scenarios over the final years of the projection horizon. Going forward, we will use the most conservative out of the four scenarios as our baseline, but it is important to keep in mind that depending on assumptions, replacement rates could be somewhat higher.

Figure 6: SNP and SPP Mean Replacement Rate Projections



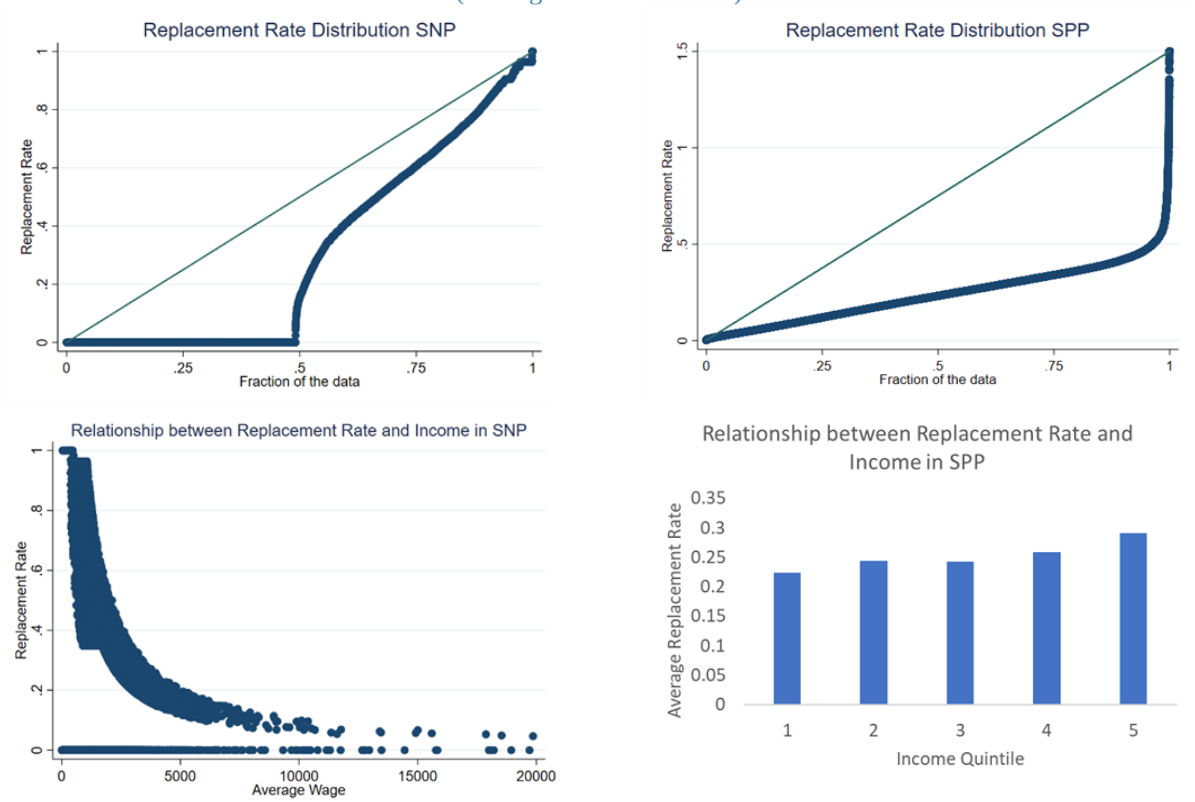
Source: Authors' calculations.

In both SPP and SNP, higher income groups achieve higher projected replacement rates. In the SPP, the top income quintile achieves an estimated replacement rate of 29 percent while the bottom quintile only reaches 22 percent, largely due to lower contribution densities of lower income affiliates. The contribution density effect is amplified in the SNP due to the 20-year vesting period.

Figure 7 presents the details of replacement rate projections for individual affiliates. As shown in the top left chart, close to 50 percent of affiliates are projected to get a replacement rate of 0 in the SNP since they will fail to contribute for the minimum 20-year period. For the remaining 50 percent, there is a wide dispersion of replacement rates, with the majority between 30 and 100 percent. The bottom left chart illustrates that for those who reach the 20-year period, there is a strong negative relationship between replacement rates and income due to the maximum and minimum pensions. In the SPP, the replacement rate distribution is

Figure 7: SNP and SPP Distributional Replacement Rate Projections 1/

(Averages across 2018-47)

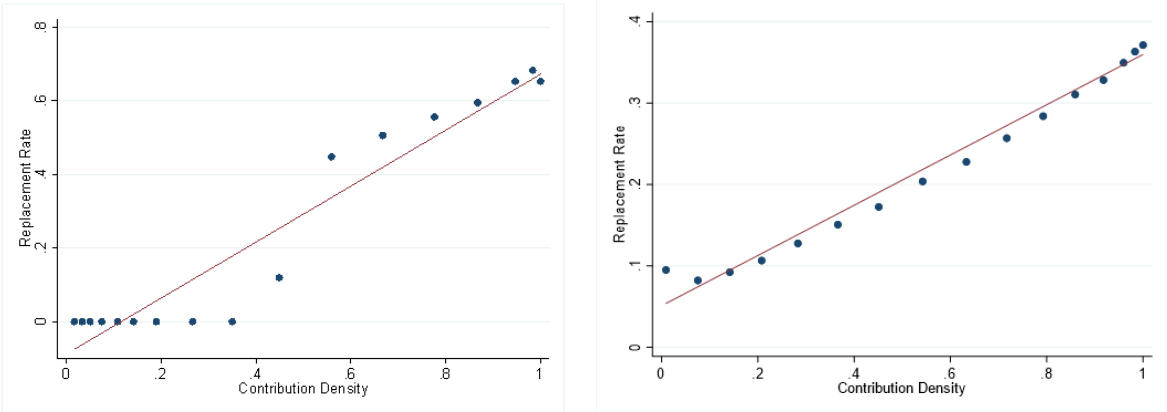


Source: Authors' calculations.

1/ Average monthly earnings above 20,000 Soles in the SNP are omitted from the graph to facilitate presentation.

Figure 8: Relationship Between Contribution Density and Replacement Rate

SNP (left) and SPP (right)



Source: Authors' calculations.

Note. The graphs show bin-scatters for individual level replacement rates and contribution densities. Contribution densities refer to the last five years up to 2017. For the SNP, the replacement rate for somebody in the 0.4-0.5 contribution density bin is 0.15 since a contribution density of 0.4 gives a replacement rate of 0.

smoother, going from close to 0 to around 40 percent for most affiliates. As the bottom right chart shows, there exists a positive relationship between replacement rates and income in the SPP. Underlying these positive relationships between income and replacement rates is the fact that higher income groups have higher contribution densities, and affiliates with higher contribution densities achieve higher replacement rates (see Figure 8).

In the SNP, the minimum contribution period implies strongly regressive redistribution since low-income groups are disproportionally likely to not reach the 20-year floor. Resources which these workers contributed are lost from their perspective and their contributions then partly finance the pensions of those who did reach the threshold.

The combination of maximum and minimum pensions on the other hand adds a progressive, albeit highly intransparent component. Depending on how it is de facto indexed (discussed below), the maximum pension could be binding for a large fraction of affiliates in the top quintile while the minimum pension could be binding for a large fraction of lower-income groups who do reach the 20-year contribution period. The result is redistribution from both high-income affiliates and lower-income affiliates to lower and middle-income affiliates with a long contribution career.

Splitting projected replacement rates by gender shows that women are projected to have a slightly lower replacement rate than men in the SPP (about 1 percentage point over the forecast horizon). This is mainly due to higher life expectancy of women which translate into lower SPP pension annuities. In the SNP, on the other hand, gender-specific mortality differences are not considered in the SNP benefit formula. This aspect as well as somewhat higher female contribution densities explain why we project on average a higher replacement rate for women than men in the SNP.[30]

Relative to other studies of replacement rates in Peru we project somewhat lower rates. Several studies have projected theoretical replacement rates which are not based on empirical contribution behavior. The OECD (2014), Asociación de AFP (2014) as well as the IMF (2018a) have estimated such theoretical replacement rates. The results of these studies range from 71 percent to 28 percent and differ due to assumptions and schemes covered (see Table 3 below). The high estimate of the OECD is explained by an assumed contribution density of 100 percent, and an assumed high indexation of maximum pensions with wages.

[30] It is worth noting that women account for significantly less than half of total affiliates in both the SNP and SPP. Moreover, it should be noted that gender-specific earnings differences, generally, do not affect replacement rates as they are considered both in the nominator and denominator of replacement rates.

Table 3: Comparison of Results with Recent Replacement Rate Studies

Study	Replacement Rate	Contribution Density	Gross Real rate of Return	Real Wage Growth	Year of Starting Pension
		Theoretical Replacement Rates			
OECD (2014)	71% (SNP)	100%	3.50%	2%	2055
Asociacion de AFP (2014)	32% (SPP)	57%	5%	2%	n/a
IMF (2018)	28% (SPP)	75%	3.50%	2%	2065
		Empirical Replacement Rates			
Alonso et al. (2014)	approx. 38%	differs by individual	5%	2%	2050
Own calculations	24% (SPP), 20% (SNP)	differs by individual	4.20%	2%	2045

Source: Authors' calculations, OECD (2014), Asociación de AFP (2014), IMF (2018a), Alonso et al. (2014).
Note: Asociación de AFP (2014) and IMF (2018a) projections are for males. Asociación de AFP provides further rates of return and wage growth scenarios besides the one presented here.

To the best of our knowledge, the only comprehensive previous empirical replacement rate calculations for Peru were made by Alonso and others (2014).[31] Their approach is broadly comparable to ours but the estimates of Alonso and others (2014) and the ones in this paper differ since we use more updated data as well as due to several differences in assumptions. First, our data runs all the way through 2017. Second, we use the latest SPP mortality tables (SPP-S-2017) which assume a significantly higher life expectancy than previous tables. Third, Alonso and others consider only affiliates with more than 20 contribution years in SNP replacement rates. Our estimates, on the contrary, cover also SNP affiliates with a zero-replacement rate. Last, it is worth noting that the real rate of return assumption in Alonso and others is closer to our optimistic scenario of 5.2 percent (they use a gross rate of 5 percent) than our baseline of 4.2 percent. The return spread is increased further in net terms: our calculations consider – in contrast to the base scenario of Alonso and others – asset-based fees for mixed fee members equal to 1.1 percent.

B. Replacement Rates: Reform Scenarios

It is worth noting that rather than improving the outlook, several recent reforms have worsened the outlook for replacement rates. These include (i) exempting the 13th and 14th salary from contributions, (ii) moving towards a system where commissions are charged on the stock of contributions,[32] (iii) allowing lump-sum withdrawals and (iv) reverting the requirement for independent workers to contribute. In this section we discuss the role various

[31] The Peruvian Social Protection Commission (2017) presents empirical replacement rates, too. Unfortunately, the published report lacks details on the projection assumptions. Thus, they are omitted in Table 3.

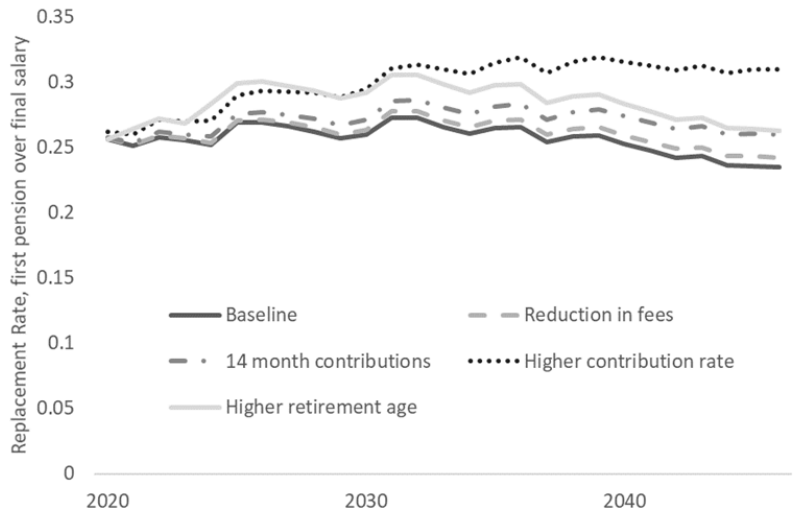
[32] All else equal, moving from commissions based on the flow of contributions (so that total contributions are 10 percent of gross earnings plus 1-2 percent for commissions) to a system where fees are charged on the stock of contributions (so that total contributions are 10 percent and commissions are later deducted from the stock of assets) reduces replacement rates. Having said that, there are many valid reasons for changing from a flow to stock commissions system (see further below).

reforms could have in increasing replacement rates, and among the options discussed are also the roll-back of recent reforms which went the other way.

SPP

Besides low contribution densities, several policy choices and institutional parameters determine the projected replacement rates in the SPP. These include the contribution base, the contribution rate, AFP asset-based fees, the retirement age and the possibility to withdraw lump-sum amounts from private pension accounts. We model possible reform scenario for each of these factors to illustrate their impact on replacement rates (Figure 9).

Figure 9: SPP Replacement Rate Reform Scenarios



Source: Authors' calculations.

Contribution Rates

Contribution rates play a key role in determining replacement rates since the total stock of contributions can be calculated as a function of the contribution rate and the contribution density. The current contribution rate of 10 percent in the SPP is lower than in most other countries in the region (Table 4).

Increasing the contribution rate to 15 percent would raise replacement rates by 7 percentage points over the long-term. The underlying assumption is that the rate increases immediately and permanently to 15 percent, thus having a larger impact on younger cohorts. Such an increase would still be broadly in line with regional averages and would still

leave contribution rates below the OECD average (Table 4).[33] Chile is currently discussing a gradual increase in contribution rates from 10 to 14 percent.

Higher contribution rates might have important adverse consequences, however. In the context of high labor informality, increasing contribution rates can discourage labor formality, negatively impacting both coverage and contribution densities which in an extreme case could even be self-defeating. The planned 2019 review of contribution rates will be a good opportunity to analyze these trade-offs in more detail.[34]

Table 4: Main Parameters of Pension System in Latin America

			Contribution Rates (2017)	
Country	Type of System	Statutory Penionable Age	Total	Employer
Argentina	DB	65	21.2	10.2
Bolivia	DC	60	15.2	3
Brazil	DB	65 (60)	28	20
Chile	DC	65 (60)	12.8	1.4
Colombia	DB/DC	62 (57)	16	12
Costa Rica	Mixed	65	12.7	8.3
Dominican Republic	DC	60	10	7.1
Ecuador	DB	non-age requirements	6.9	1.2
El Salvador	DC	60 (55)	15	7.75
Guatemala	DB	60	5.5	3.7
Honduras	DB	65 (60)	6	3.5
Mexico	DC	65	8.7	6.9
Nicaragua	DB	60	14	10
Panama	Mixed	62 (57)	13.5	4.3
Paraguay	DB	60	23	14
Peru	DB/DC	**65**	**13**	**0**
Uruguay	Mixed	60	22.5	7.5
Venezuela	DB	60 (55)	13	9
OECD Average		**64.7 (63.5)**	**19.6**	**11.2**

Note: Includes disability and survivors' contributions and contribution (flow) fees where applicable.
Sources: SSA (2018) and IMF (2018a).

[33] One consideration could be to make the added contributions employer-contributions. Peru is an outlier in having the full contributions on the employee side at the moment. Higher employer contributions could still be borne by employees over the long-term, however (see Melguizo and Gonzalez-Paramo. 2013 and Saez et al., 2012 for a discussion). For certain groups which are more likely to react to contribution rate changes by lower/higher formal labour supply, such as the young, a subsidy covering (part) of the employer contribution could be considered. As mentioned in the body of the text, there might exist a trade-off between higher labor informality and higher replacement rates for those who are in the formal sector.

[34] According to Inter-American Development Bank data, over half of all workers in Peru receive less than or equal to the minimum wage, highlighting the difficulty of saving sufficiently for retirement.

Contribution Base

An alternative or complement to higher contribution rates could be a broader contribution base. While payment of a July and December bonus is common in Peru (13th and 14th salary), since 2009 they are not subject to pension contributions. Making contributions on these payments obligatory would expand the income base on which contributions are made and thus contribute to higher replacement rates.

Including the 13th and 14th salaries in pensionable income would increase replacement rates by over 2 percentage points. The trade-off between higher replacement rates and adverse effects on coverage is likely to also exist for base broadening, thus requiring careful discussion and analysis going beyond the replacement rate calculations presented here.

Retirement Age

In Peru, the retirement age is set at 65 for both men and women and across both SNP and SPP, among the highest in the region and putting Peru on par with advanced country levels. Workers can also choose to work for an additional five years until they turn 70, at which point retirement is mandatory.[35]

The retirement age is set at adequate levels currently and will probably not have to be changed in the short- to medium-term. In the longer-term, however, further adjustment might be warranted. A higher retirement age increases replacement rates due to longer accrual of benefits and lower remaining life expectancy. As an illustration we consider a scenario where the retirement age increases from 65 to 66 in five years and to 67 by 2026. This would increase replacement rates by about 3 percentage point at the end of the projection period.

AFP Fees and Commissions

As previously discussed, the net real rate of return is a key determinant of replacement rates. And the net real rate of return increases when the gross real rate of return increases or when asset-based pension fund fees fall. Figure 6 highlighted the crucial role of the gross real rate of return for replacement rates in the SPP – a gross real rate of return of 5.2 instead of 4.2 increases replacement rates by roughly 7 percentage points. And as Figure 5 showed,

[35] Early retirement before 65 is also possible under certain conditions. In the SNP, at age 55 with at least 30 years of contributions (men) or age 50 with at least 25 years of contributions (women); age 55 (men) or age 50 (women) with at least 20 years of contributions in the event of a collective lay-off from employment. In the SPP, retirement is possible at any age if the individual account has accumulated assets that will replace at least 40 percent of average indexed earnings in the last 120 months. The cut-off used to be 50 percent but was changed in 2012.

Peru has performed well with regard to gross rates of return in the past. In this section we look at the role of fees.

It is instructive to first consider the structure of pension fund fees in Peru. Prior to a 2013 reform, pension funds in Peru charged their fees on the flow of gross earnings rather than charging asset-based fees. In other words, out of roughly 13 percent of gross earnings (total contributions of affiliates) 10 percentage points went to their individual savings accounts, 1.4 to old-age and disability insurance and around 1.5 to pension fund fees. No more fees were collected on accumulated savings.

Since 2013 all new entrants are being charged asset-based fees.[36] The idea of the reform was to bring Peru in line with international standards and establish a closer link between the services of the AFPs and their revenues to align incentives. While there are certainly important advantages, ceteris paribus, the reform increases affiliates disposable income in exchange for possibly lower future replacement rates. This is because total contributions are now only around 11.5 percent of gross earnings. As before, 10 percent go to the individual savings accounts, but fees are now charged on the stock of savings, reducing the net real rate of return. [37]

As of 2016, 33 percent of affiliates and 52 percent of contributors were still operating under the flow-based commission system. According to the SBS, flow commissions in 2017 were between 1.47 and 1.69 percent of gross earnings depending on the AFP. In the mixed system the average fee structure was 0.18-1.07 percent on the flow of gross earnings and 1.2-1.25 percent on the stock.

The 2013 reform also introduced a tender system modelled on the Chilean system which aimed to increase competition between AFPs and thus ultimately reduce commissions. First signs suggest that this has been successful as fees have been falling in Peru over time. The December 2018 tender saw a winning bid such that for mixed-fee members the flow component will be charged at 0 percent while the stock component will have a fee of 0.82 percent. This is a significant reduction relative to the numbers at end-2017 discussed below.

[36] To avoid double-charging people who had already been paying fees on the flow, a complicated structure was introduced. First, all contributors who had been members prior to 2013 could choose whether to migrate to the new fee set-up or stay with the old one. If they chose to migrate to the new one, a 10-year transition window was created where "mixed commissions" are charged – a weighted average between flow and asset-based fees (asset-based fees only on the amount accumulated since 2013), with the weight on the stock slowly increasing over time.

[37] See Bernal and Olivera (2019) for a detailed discussion of the impact of the change in the fee structure on affiliates.

To gauge how the level of fees in Peru compared to peer countries using the latest available cross-country data, Table 5 shows two possible metrics.[38] First, Table 5a uses data from AIOS for different countries in Latin America. The raw data makes it somewhat hard to compare across countries due to the difference between flow and asset-based fees. As an alternative measure, Table 5b shows the ratio of income from commissions to net contributions collected. This measure shows a clear downward trend for Peru, more pronounced than the downward trend in some peer countries. In terms of the level, Peru is toward the upper end, however.

It is worth pointing out that in many Latin American countries the private pension system is concentrated among few players, and each player provides a full bundle of packaged services. Peru is no exception. A small market size is likely to be a key factor for the market concentration and level of fees.[39]

Table 5a: Pension Fund Commissions in Latin America

Country	Flow-based	Stock-based
Chile	1.17	
Colombia	1.29	
El Salvador	2	
Mexico		1.02
Panama		0.305
Peru (mixed fee affiliates)	0.65	1.22
Peru (flow fee affiliates)	1.61	
Dominican Republic	0.5	
Uruguay	1.23	0.13

Source: Asociación International de Organismos de Supervisión de Fondos de Pensiones (AIOS).

[38] The 2017 report by the Peruvian Social Protection Commission contains a detailed discussion of pension fund fees and commissions in Peru, including some regional comparisons. They conclude that at the time of writing they were relatively high in Peru.

[39] Reducing commissions is a difficult task with many factors potentially influencing this equilibrium price. Market size appears to be a key factor and it is largely outside the scope of policy makers (see Carranza and others, 2017).

Table 5b: Income from Commissions/Net Contributions Collected
(In percent)

Country	2012	2013	2014	2015	2016	2017
Chile	10.4	10.2	9.9	9.6	9.6	9.1
Colombia	12.3	12.7	12.2	10.7	11.2	11.7
Costa Rica	11.1	13.1	10.3	11.4	11.3	9.5
El Salvador	11.2	9.8	10.1	10.5	11.1	11.0
Mexico	16.9	16.6	15.3	14.9	14.2	14.7
Panamá SIACAP				7.07	4.5	4.3
Peru	19.3	17.6	15.0	13.5	13.2	12.15
Dominican Republic	26.6	31.4	22.5	19.3	24.5	23.5
Uruguay	9.9	9.7	9.4	8.9	10.4	8.4

Source: Asociación International de Organismos de Supervision de Fondos de Pensiones (AIOS).

Turning back to our simulations, we find that reducing *asset-based fees* by 0.5 percentage points would increase replacement rates at the end of the forecast horizon by around 1 percentage point on average. As discussed above, a significant fraction of affiliates is currently still paying contribution-based fees and their replacement rate is thus not affected by a change in asset-based fees. Once all affiliates are under an asset-based fee regime, reducing fees by 0.5 percentage point will increase replacement rates by 1.5 percentage points. The difference between this 1.5 and the 3 percentage points gained by increasing the net real rate of return by 0.5 percentage points arises because in the simulations it is assumed that no asset-based fees are paid during the deaccumulation phase (retirement).

Further work could usefully study best practices on private pension funds from a cross-country perspective in more detail to draw out specific recommendations for Peru.

Lump-sum withdrawals

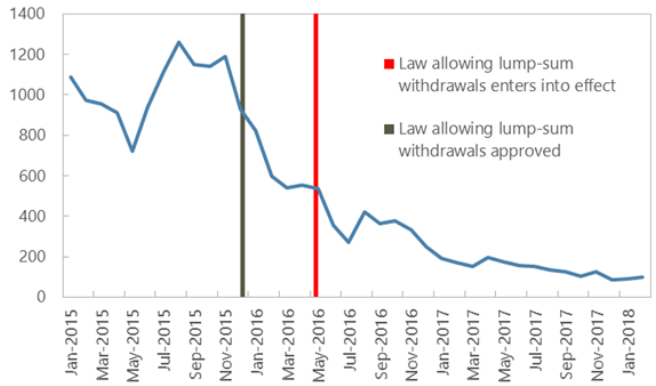
Since 2016 it has been possible for affiliates to make lump-sum withdrawals from their pension savings accounts. Three types of withdrawals are possible. First, a withdrawal of up to 95.5 percent at the time of retirement.[40] Second, an early withdrawal of up to 25 percent to pay for a mortgage down-payment, or third, an early withdrawal of up to 25 percent to pay down previously incurred mortgage debt.

[40] With the remaining 4.5 percent going to health insurance.

The withdrawal options have proven popular with affiliates. As of end-January 2018, close to 60,000 affiliates had withdrawn a total of 2bn soles, or 1.2 percent of total SPP assets, for mortgage related withdrawals. 89 percent of the total value of these withdrawals was used for mortgage amortization with the remainder going to down-payments.[41] As for lump-sum withdrawals at the point of retirement, the introduction of this option has led to a sharp reduction in retirement pensions paid by the SPP, suggesting that a majority of affiliates now chooses the withdrawal option over a SPP pension (Figure 10). This development has put the already small annuity market of Peru under pressure.[42]

The lump-sum withdrawals pose a substantial risk to pension adequacy. A 95.5 percent withdrawal at the point of retirement leaves the full financial risk of longevity and investment in the hands of the affiliate. As a back-of-the-envelope illustration, consider a retiree with 20-year life expectancy. If that person withdraws the full amount, leaves it in a savings account with a 1 percent real return and pays himself the same monthly amount he would have received from the SPP, savings would be depleted after 14 years, leaving the person without financial resources in the final six years of their life.

Figure 10: Number of New Retirement Pension per Month (SPP)



Source: SBS.

The impact of a 25 percent housing withdrawal is less severe but also large. In particular, the older the affiliate who withdraws a 25 percent lump-sum, the larger the impact on replacement rates. For a 55-year-old, simulations show that the replacement rate would fall by around 18 percent, for a 45-year-old by around 14 percent and for a 35-year-

[41] It is concerning that most withdrawals are to pay down existing mortgage debt rather than for down payments. Down payments involve the acquisition of new assets so it could more easily be defended as a valid alternative way of old-age savings even though the absence of reverse mortgage markets limits the cash flow which can be generated by the asset.

[42] As of 2016 there were 6 insurance companies which offered annuities in Peru.

old around 8 percent. For older cohorts who still benefit from the minimum pension, the impact is cushioned somewhat.

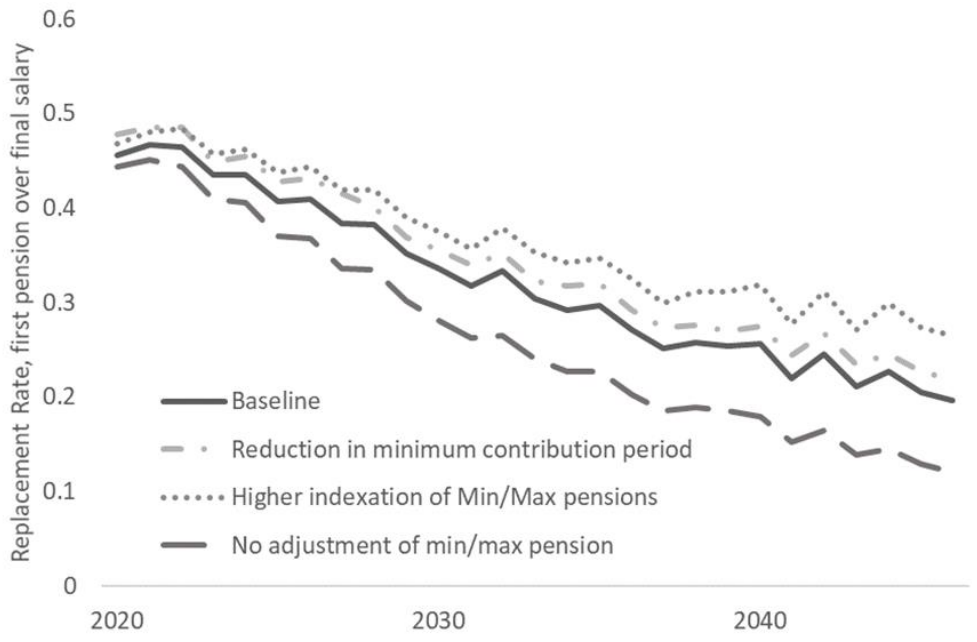
SNP

As discussed before, minimum and maximum pension adjustment plays an important role for replacement rates in the SNP. While the downward trend over time is determined by the reforms which made the SNP fiscally sustainable, the choice of how to adjust or not adjust minimum and maximum pensions will determine the slope of the decrease to some degree. There exist no explicit indexation rules for either the maximum or minimum pension and indeed they have been frozen in nominal terms since 2001. If they remain frozen, replacement rates would be noticeable lower than in the case with CPI indexation (by about 8 percentage points in 2045 – see Figure 11).

Already in 2018 the minimum wage had outpaced the SNP maximum pension level, explaining the very low replacement rates in a scenario with no adjustment in minimum and maximum pensions. Given the long history of keeping the minimum and maximum pension frozen in nominal terms, it seems that a scenario with CPI indexation going forward could be an upper bound for future replacement rates. The scenario with no adjustment, on the other hand, would then provide the lower bound. This gives a range of average replacement rates in the SNP between 12-20 percent by the end of the forecast horizon.[43]

[43] If we consider a scenario where the minimum and maximum pension increase with wage growth, replacement rates would be around 26 percent in 2045.

Figure 11: SNP Replacement Rate Reform Scenarios



Source: Authors' calculations.

A lower minimum contribution period would increase mean replacement rates. With a lower minimum contribution length of 15 years, roughly 5 percent more SNP affiliates become eligible for a pension (it is assumed that they get 15/20 of the current minimum pension). This leads to an increase in replacement rates for overall affiliates by about 2 percentage points. Clearly, only those previously at the margin of the 20-year period are affected by such a reform. While they unambiguously raise replacement rates, a shorter minimum contribution period and larger increases in the minimum and maximum pension would raise fiscal costs and trade-offs would need to be studied. Specifically, on the reduction in the vesting period from 20 to 15 years, we estimate that the measure would entail a gross fiscal cost of close to 0.05 percent of GDP per year in the medium-term.[44]

A steeper reduction in the minimum contribution period could be considered, while de-linking the minimum contribution period from the vesting period required to qualify for a minimum pension. It is hard to justify affiliates losing all their accumulated

[44] The calculations assume that the microdata we have are representative for each cohort individually and not only for the system as a whole (not necessarily true but perhaps a reasonable approximation). The *net* cost might be somewhat lower if it implies that less people would receive Pension65. On the other hand, the calculations do not consider the likely negative impact on SNP revenues (e.g. affiliates choosing to stop contributing earlier than they would have otherwise) which would imply a higher net fiscal cost.

contributions when failing to reach the minimum contribution period. While this would entail additional fiscal costs, the threshold could be cut significantly, potentially to 5 or 10 years. However, at the same time, the link to minimum pension eligibility could be broken, keeping the latter at 20 years. Individuals who only contribute for 5 or 10 years, would then, at the very least, be allowed to collect a lump-sum at retirement (as is the case in several other countries).

The overall package of minimum contribution period and minimum and maximum pension is complex and highly unpredictable for affiliates. As previously discussed, the SNP currently redistributes from those who do not reach the 20-year period and those with high incomes to those on low income who contribute long enough. From both a social perspective and the perspective of individual contributors the mechanism is in-transparent, unpredictable and sets often sub-optimal incentives (high-income workers are incentivized to leave the SNP due to the maximum pension, low income groups are incentivized to stop contributing if it becomes clear that they cannot reach the 20-year minimum contribution period).

V. Policy Implications and Broader Considerations

The analysis in this paper highlighted the outlook for pension adequacy in Peru. Partly due to low contribution densities, replacement rates are projected to be relatively low on average, at 25-33 percent in the baseline projection for the private defined contribution system (SPP) and 25-31 percent in the public defined benefit one (SNP) when averaging across all affiliates and across the next 30 years. In the SNP, replacement rates are projected to decline from roughly 45 percent in 2020 to 12-20 percent in 2047, largely due to past reforms which made the system more sustainable. In the SPP, average replacement rates over the same period change from around 25-28 in 2020 to 23-33 percent in 2047, with the exact value within the range depending on how real gross rates of return and contribution densities will develop in the future.

The simulations also highlight how results would change under several reform scenarios. Broadening the contribution base to make pension contributions obligatory for the 13th and 14th monthly salaries again would increase replacement rates by close to 3 percentage points in the SPP. An increase in contribution rates by 5 percentage points has the largest impact on replacement rates but possible adverse effects on labor formalization should be carefully assessed. Reducing asset-based pension fund fees by 0.5 percentage points would increase replacement rates by 1 percentage point during the forecast horizon and by 1.5 percentage point in the longer-run.

Perhaps the most important short-term reform suggestion for the SPP is to not allow or strongly limit large lump-sum withdrawals since they place the full financial market and financial longevity risk in the hands of the affiliate.

In the SNP, the minimum contribution period creates highly regressive redistribution. Lowering the minimum contribution period from 20 to 15 years would reduce these regressive effects but comes at a fiscal cost of close to 0.05 percent of GDP.

In any case, as in many other emerging markets, it will be very hard to increase replacement rates to advanced country levels in a fiscally sustainable way over the next decades, necessitating careful communication. To avoid setting false expectations which ultimately result in implicit claims on government finances, expected replacement rates under several scenarios should be communicated and publicly discussed in a transparent way. And given that a large share of the population is not covered at all by the contributory pension system, the non-contributory pillar will remain important for the foreseeable future and should be further strengthened. Appendix III discusses some considerations in that regard.

In terms of the overall pension design, competition between the private and public pillar is a major weakness of the system. First, competition between the two systems introduces a hard-to-predict fiscal risk given that fiscal sustainability of the SNP depends in part on whether future affiliates will choose to join the SNP or SPP. Given the maximum pension and depending on how it will be increased, in particular high-income affiliates are likely to choose the SPP, reducing the revenue base of the SNP. Second, the two competing systems increase uncertainty about future pension levels and therefore hamper individual retirement planning. In the case of the SNP, the above described fiscal risk could translate into further reductions in pension benefits. For the SPP, retirement benefits become harder to predict. As the composition of SPP members is gradually changing, longevity and with it pension adequacy is altered. The impact of this composition effect on pension adequacy is difficult to predict. Third, the fragmented system complicates supervision and makes the system less transparent for affiliates. Fourth, economic shocks which affect one of the two schemes more than the other (e.g. capital market shocks) may raise intra-generational inequality and social concerns. Last, the opportunity cost of having two competing systems is large given that an integrated system would allow to hedge different risks (pay-as-you-go systems are subject to demographic/labor market risks while funded systems are subject to capital market risks).

A larger reform to restructure the system and avoid competition between the private and public pension plans should thus be a priority. Several possibilities for a reorganization of the pension system exist, and public discussion can build on the suggestions of the 2017 Peruvian Social Protection Commission report.

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APPENDIX I: A BRIEF INTERNATIONAL COMPARISON

Empirical Replacement Rates in Regional Comparison

For Mexico, replacement rates in the defined contribution system, once it has matured (2050), are expected to be somewhat below 40 percent on average according to Alonso et al. (2015). Recent IMF projections for Mexico find that conditional on receiving a pension, average replacement rates will be between 40 and 47 percent. But about 64 percent of workers in the private sector and 27 percent of workers in the public sector will not contribute long enough to receive a pension, implying a lower average replacement rate for overall affiliates (IMF, 2018b).

For Chile, prior to the recent discussion about increasing contribution rates, Mesa-Lago and Beltranou (2016) projected median replacement rates of 37 percent over 2025-2035 when including the public solidarity contribution (APS). Benavides and Valdéz (2018) report observed replacement rates for recent pensioners in Chile and find a replacement rate of 40 percent when including the solidarity pillar and a significantly lower replacement rate when excluding it (around 20 percent). They also find higher replacement rates for men than for women and a strong relationship between income quintile and replacement rate, qualitatively similar to the results we obtain for Peru.

Theoretical Replacement Rates in International Comparison

Using theoretical rather than empirical contribution densities, the outlook for pension adequacy in Peru is in line with the regional average. IMF (2018a) simulates replacement rates for a representative agent in several Latin American countries based on country specific parameters and theoretical contribution densities (50, 75 and 100 percent). Distributional elements, e.g. minimum/maximum pensions, as well as non-linear accrual schedules are reflected in the calculations and partly explain non-linear increases in replacement rates between the different contribution density scenarios (see e.g. El Salvador or Uruguay in Figure I.1).[1] In Costa Rica and Uruguay, the pension systems are mixed, and the higher replacement rates are partly explaining by the defined benefits component (similar to

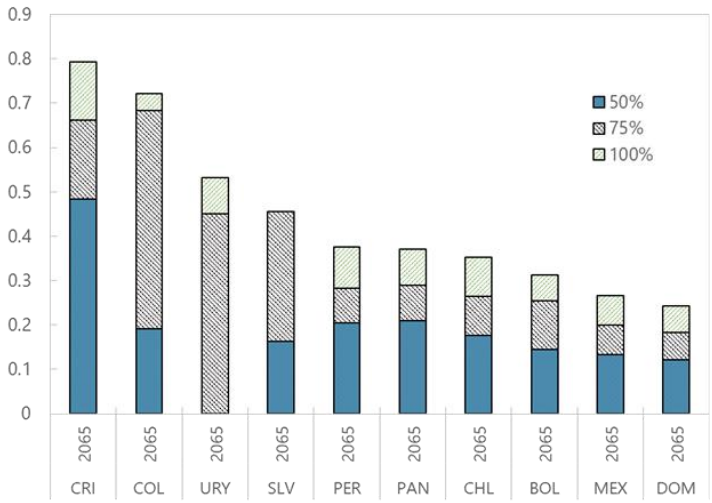
[1] Additionally, long vesting periods to receive a pension annuity play a role. For instance, in Uruguay, no pension is paid out if fewer than 30 years of contributions have been accrued.

Colombia).[2] In Peru, the representative agent is generally[3] in the SPP. Using a theoretical contribution density of 50 percent, the representative agent in Peru is projected to have a replacement rate very close to that of Panama and higher than that of Chile in 2065. But as shown in this note, empirical contribution densities in Peru are below 50 percent and are lower than those in many peer countries.

[2] In Colombia, high adequacy is due to defined benefit (DB) entitlements. It is assumed that future new contributors, who have the choice between DB and DC, opt for the more generous DB scheme. Individuals with a low contribution density of 50 percent, however, do not fulfill the vesting period (1150 weeks) for DB annuities and therefore end up with significantly lower (DC) replacement rates in Colombia.

[3] It is assumed that the agent chooses at the start of his career the system which provides the highest replacement rates for a given contribution density. As a result, the lower contribution density scenario (50 percent) in the figure above reflects an SNP affiliate, while the 75 percent and 100 scenarios represent an SPP affiliate.

Figure I.1: Theoretical Replacement Rates in Latin America by Contribution Density



Source: IMF (2018a).

APPENDIX II: CONCEPTS AND MEASUREMENT OF CONTRIBUTION DENSITIES

There is no unique and consistent definition of contribution densities in the literature. Most authors agree that it measures the intensity of contributions in a given time period. Differences occur, however, regarding the definition of "intensity" and "time period".

Most studies measure the intensity in time units. In other words, it is asked how much time a participant paid contributions relative to some total time. Some authors measure the frequency of contributions in months (e.g. De Mesa et al, 2004), others in quarters (e.g. Braham and Marouni, 2016) or even in contribution years (e.g. Melguizo et al., 2017). Usually, these differences are explained by data limitations of the respective studies. Contribution time is generally related to the "total potential periods of contributions" (Mc Gillivrary, 2003, p. 321), or put differently to the "total months or years potentially active" (Rofman et al. 2015, p. 7).

Other authors propose to measure contribution densities in monetary units, such as Valdes-Prieto (2008) who defines contribution density "as the share of (the present value of) earnings in the active phase of life on which the individual contributes to some contributory pension system". Also, Mc Gillivrary (2003, p. 321) proposes to use such a monetary indicator in addition to a time-based contribution density metric. Additionally, the period over which contribution densities are measured differs across studies. In the case of theoretical models, a very long-time span is often considered, e.g. the entire working career of 40 and more years (OECD, 2014 or IMF, 2018a). Empirical estimates of contribution densities, on the contrary, cover often much shorter periods due to data limitations.

In this paper we apply the relatively common time-based contribution density metric. It measures the total contribution months accrued relative to the maximum possible months to be accrued. We refer to this indicator as "contributions at the intensive margin" (CIM) – following comparable terms in labor economics.

APPENDIX III: CONSIDERATIONS FOR A NON-CONTRIBUTORY PILLAR AND OPTIONS FOR INCREASING CONTRIBUTORY COVERAGE[1]

A. The case for a strengthened non-contributory pillar

Given the tight link between the level of development and contributory pension coverage, it has to be acknowledged that reaching near-complete coverage must be a long-term goal. In the meantime, a non-contributory pillar will remain essential to tackle old-age poverty.

The current de factor non-contributory pension (Pension 65) has been successful in reducing old-age poverty. A recent impact evaluation (Bando and others, 2017) shows that despite the nominal value of the payments being less than the poverty line, the program has been successful in improving health and consumption of recipients.[2] A simple counter-factual exercise using 2016 household survey data corroborates the importance of Pension 65 – subtracting Pension 65 payments from household income increases the old-age extreme poverty rate from 4 to 10 percent (12 to 29 percent in rural areas).

The challenge of non-contributory pension design is to tackle old-age poverty without further reducing contributory pension coverage. (More generous) non-contributory pensions can disincentivize participation in the contributory pillar, potentially lowering contributory coverage and contribution densities. This makes non-contributory pension design a challenging task. The policy maker has to decide on whether to target the pension, at what value to set it and what claw-back rate to apply.[3]

While Pension 65 has worked well, it could be further strengthened to broaden coverage. One potential reform option which follows the suggestion made by the report of the Peruvian Social Protection Commission (2017) would be to broaden the non-contributory pillar further while at the same time introducing an intermediate claw-back rate between 0 and 1 to set incentives for contributory pension savings. Keeping the current level of

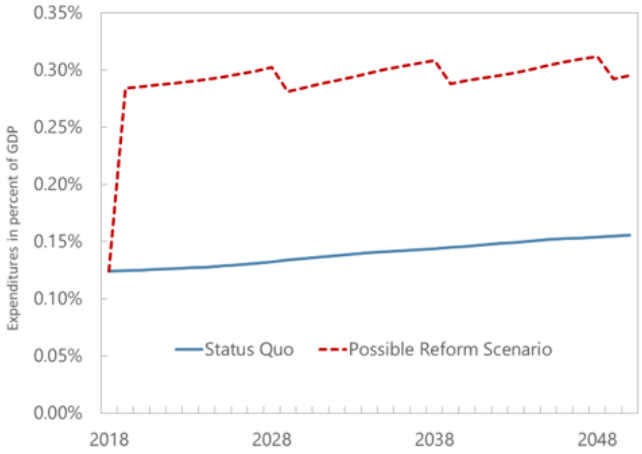
[1] Options to increase coverage of the contributory pillar and the design of the non-contributory pillar are complex topics. This appendix merely lays out some thoughts, without the presumption of completeness. Future work should look more carefully at detailed policy design issues for Peru.

[2] The beneficial effects of Pension 65 are very similar to the impact of the non-contributory pension (Adultos Mayores) found in Mexico (Galiani and others, 2014). Lopez Garcia and Otero (2017), on the other hand, only find limited effects of the Chilean non-contributory pension.

[3] The claw-back rate (not smaller than 0 and not larger than 1) is the rate at which the non-contributory pension decreases with contributory pension savings. See Valdes-Prieto (2008) for an insightful theoretical discussion of the challenges of non-contributory pension design. Galiani and other (2014) find no negative anticipation effects of the non-contributory pension in Mexico but other studies have found an adverse impact on labor formality. See also World Bank (2008) for an extensive discussion.

125 soles per month would guarantee that virtually everybody with a contributive pension will receive substantially more in the contributive pillar than they would in the non-contributive one. Additionally, the eligibility age could be automatically adjusted in line with rising life expectancy.[4] Raising effective pension coverage to close to 100 percent (everybody who does not get a contributory pension is covered by the non-contributory one) would involve an additional fiscal cost of roughly 0.2 percent of GDP per year in that scenario (Figure III.1).

Figure III.1: Fiscal Costs of Non-Contributory Pillar Reform Scenario



Source: Fund staff estimates.
Note: The baseline scenario assumes CPI indexation of the non-contributory pension. Kinks in the annual cost of the reform scenario are due to discrete increases in eligibility age tied to increased life expectancy.

B. Options for increasing contributory pension coverage and contribution densities: Matching and Consumption-based contributions

Ex ante subsidies such as matching contributions can be an important tool to expand coverage. While non-contributory pensions provide ex post benefits, matching contributions increase the incentive to participate in a pension plan by providing ex ante support for every dollar or sol which the affiliate contributes. In Latin America, Colombia, Chile and Mexico have elements of matching embedded in their pensions systems.[5] From a theoretical perspective, ex ante subsidies are attractive tools and could improve pension outcomes at a lower fiscal cost and with less distortions than ex post subsidies. But the behavioral impact in

[4] Indexing eligibility to life expectancy implies that by 2050, Peruvians over 69 would be eligible. Keeping the eligibility age constant at 65 would add another 0.1 percent of GDP in annual costs by 2050. Low income is particularly acute for those aged above 70.

[5] In Peru, legislation which calls for matching contribution for workers in firms with less than 10 employees exists, but it has so far not been implemented.

the context of high informality is not yet well understood, posing a challenge in terms of how large the matching contribution needs to be and potentially to whom it should be targeted.[6]

Consumption-based contributions are another potentially interesting way to foster pension savings. The 2017 report of the Social Protection Commission suggests complementing the traditional income-based pension contributions with consumption-based contributions. In practice, this would operate like a sales tax which goes towards a private pension savings account. Empirical evidence is even more scarce on the impact of consumption-based savings but with the continued roll-out of electronic payments they might eventually become an important support tool.

While promising, it is likely that the impact of these ex ante tools would initially be felt mostly at the margin.[7] Household survey data show that rural saving rates are close to 0 on average in Peru and are particularly low for those workers who do not have pension coverage. Even allowing for substantial measurement error, these workers thus do not seem to substitute formal pension savings with savings outside of the pension system. Rather it seems that they save little in general. Attempting to obtain pension contributions which lead to reasonable replacement rates from such 'hand-to-mouth' workers is likely to be a difficult task. If attempted via consumption-based contributions it would likely require prohibitively high rates, for example.

[6] Bernal and others are currently running a field experiment in Peru which will evaluate the impact of a 50 percent and a 100 percent matching contribution.

[7] No explicit reform scenario for matching contributions is estimated in the main body of the paper given that there currently still exists high uncertainty regarding the behavioral response of contributors with respect to matching contributions in a country with high informality.