The redistributive effects of a mixed pension system in Peru

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Abstract

This paper estimates and analyses the potential fiscal and distributive effects of a proposal to transform the current Peruvian pension system into a multi-pillar pension system. In this new system, part of the contributions would go to a solidarity fund to finance minimum pensions, and the rest to individual retirement accounts. The simulation of actuarial liabilities and future distributions of pensions are performed using random samples from the database of administrative records of individuals insured by the Peruvian public and private pension systems as at December 2013. This study analyses the effects of the reform on actuarial liabilities, inequality of pensions, and overall well-being of pensioners, in order to illustrate the different trade-offs involved in pension reform. At the same time, the explicit inclusion of normative judgments in the evaluation of welfare functions makes it possible to determine that a multi-pillar pension system is better than the current one, even under the stringent condition of no aversion to inequality.

Keywords: Pension reform; pension inequality; social security; Peru; economic policies.

Acronyms

AFP	Pension fund administrators (Administradora de fondos de pensiones)
CRU	Required unit capital (Capital requerido unitario)
ENAHO	National Household Survey (Encuesta Nacional de Hogares)
GDP	Gross domestic product
INEI	National Institute of Statistics and Information (Instituto Nacional de Estadística e Informática)
IRA	Individual retirement account
MEF	Ministry of the Economy and Finances
OECD	Organization for Economic Co-operation and Development
ONP	Pension Normalization Office (Oficina de Normalización Previsional)
MPS	Multi-pillar pension system
PAYG	Pay-as-you-go
PV	Present value
SNP	National Pension System (Sistema Nacional de Pensiones)
SMW	Statutory minimum wage (Remuneración Mínima Vital)
SPP	Private Pension System (Sistema Privado de Pensiones)

1. INTRODUCTION

More than 20 years have passed since the first wave of structural pension reforms in Latin America, which sought to give the private sector a bigger role in the administration of social security and to place greater emphasis on individual savings schemes. Some countries completely replaced their pay-as-you-go (PAYG) public pension systems with ones based on individual retirement accounts managed by private firms, inspired by the Chilean reform of 1981 (e.g., Bolivia, El Salvador, Mexico, and the Dominican Republic). Other countries developed mixed pension systems, in which a public and a private component make up the final pension value (Argentina, Costa Rica, and Uruguay). On the other hand, only Colombia and Peru retained a public PAYG system in competition with new private systems. More details on these reforms can be found in Arenas de Mesa and Mesa-Lago (2006). In recent years, it was again Chile that introduced substantial changes to its pensions system, which were primarily geared toward improving levels of system coverage and pension values as well as combating poverty in old-age. Kritzer *et al.* (2011) describe this reform and those of other countries in the region as second-generation reforms.

These reforms seek to overcome the limitations identified in the pension systems that were reformed in the 1990s. Low pension coverage and, in particular, disparities in coverage and in pensions between income groups have been documented across most Latin American countries (Rofman and Oliveri 2011). The reforms, alongside the recent proliferation in non-contributory pension programs targeted at the poorest sectors (Bosch *et al*. 2013), can be regarded as the necessary implementation of measures intended to reduce both poverty in old age and pension inequality. All this marks an important departure from the approach to pension policy-making taken in the 1990s, which focused primarily on financial sustainability. Recent evidence indicates that economic inequality and old-age poverty can be reduced under mixed pension systems, and especially under the Chilean pension system reformed in 2008 (Forteza 2014; Otero 2013).

Peru embarked upon a pension reform process in 2012 (see Valladares 2012), but the discussions centered on attempts to decrease administrative fees charged by pension fund administrators (administradoras de fondos de pensiones, AFPs) and insurance companies in the Private Pension System (Sistema Privado de Pensiones, SPP). An opportunity was missed to address distributive aspects and fiscal problems caused by competition between the National Pension System (Sistema Nacional de Pensiones, SNP) and the SPP. For example, in 2013, the actuarial deficit of the SNP was approximately 21% of Gross Domestic Product (GDP), which is to say that 21% of GDP in present value is required to be able to pay current and future pensions. Meanwhile, pension inequality has increased considerably in recent years as a result of the growing numbers of pensioners in the SPP. According to the National Household Survey (ENAHO), in 2007 pension inequality in the SPP – measured using the Gini coefficient – was 0.25; while in the SNP it was 0.20; and for pension-holders overall, 0.22.[1] In turn, in 2013, pension inequality in the SPP increased to 0.45, while in the SNP it was only 0.21; and for pension-holders overall, the Gini was 0.27. This trend could continue due to the greater number of SPP affiliates set to retire in the coming years, since there is much greater pension disparity in this system than in the SNP. On this point, the lower inequality in the SNP is explained by the existence of minimum and maximum limits on pensions, while in the SPP the relationship between salaries and pensions is more direct. Of course, pension inequality in the SPP may be exacerbated by profitability, given that lower-income individuals contribute less frequently and therefore accumulate less resources to finance their pensions. Given the above, the structure of the current pension system can be said to be susceptible to the risks of significant actuarial debt and rising inequality.

The main objective of this study is to conduct a well-being analysis of the proposal for a new two-pillar pension system and contrast it with the pension system as it currently stands. This analysis encompasses an assessment of the effects of the reform on three dimensions that are crucial to any pension policy: actuarial liabilities, pension inequality, and the well-being of affiliates. In turn, this last dimension includes an assessment of average pensions and pension inequality under different reform scenarios. The objective is to incorporate a number of opinions regarding fairness in the well-being analysis of

[1] These Gini index values are measured using current pensions - that is, pensions without value are not taken into account. This may apply, for example, to individuals who reach retirement age but do not receive a public pension because they did not contribute for the stipulated minimum number of years, or who have no or very limited funds in their individual retirement account in the private system.

the reform. In the proposed multi-pillar system, all contributors would pay at a rate α of income into their individual retirement account (IRA, the second pillar) and a rate β of income into a solidarity fund (the first pillar), which would finance a general minimum pension scheme.

This study is based on representative and random samples from the database of administrative records of individuals insured by the Peruvian SPP and SNP as at December 2013. This information is utilized to simulate actuarial liabilities and the distributions of future pensions, and to illustrate the different trade-offs at play in pension reform. Results are presented for different combinations of contribution rates and valuations of inequality, all of which makes it possible to determine that a multi-pillar pension system (MPS) would be better than the current system, even under the stringent condition of no aversion to inequality.

This study conducts a partial equilibrium analysis - that is, the possible responses to the reform from other sectors, such as the labor market, are not taken into account. Although such behavioral responses are important, they cannot be estimated using the available data. The remainder of the study is organized as follows. Section 2 describes the Peruvian pension system and the proposed reform to a multi-pillar system (MPS). Section 3 describes the data. Section 4 presents the methodology for computing pensions and actuarial liabilities. Section 5 discusses the results. Finally, Section 6 sets out the conclusions.

2. THE PERUVIAN PENSION SYSTEM AND A HYPOTHETICAL MULTI-PILLAR SYSTEM

2.1 The Peruvian pension system

It is frequently contended that the Peruvian SPP holds advantages over the SNP, its proponents citing superior pension payouts at no expense to the state, and underfunding in the case of the SNP. However, it is difficult to make a true comparison given that both systems have been closely interrelated since their inception - so much so that part of the "success" of the SPP is due to the premeditated erosion of the foundations of the SNP since the creation of the private system in 1993. The SNP, like all PAYG programs, is based on the payment of current pensions using the contributions of active affiliates whereby the more active affiliates there are who actually contribute, the higher the value of the pensions or the lower the amount of money that will need to be contributed; in any case, well-being is improved. The creation of the SPP had two tangible effects on the SNP: a) it precipitated the erosion of its contribution base and, therefore, its funding; and b) it broke its redistribution mechanism. The former was caused by the transfer of many active SNP contributors to the SPP, and the latter by the exodus of the vast majority of high-income workers to the SPP, as a result of which it was no longer possible to redistribute between high- and low-income workers.

Following the introduction of the SPP, some active affiliates remained in the SNP but many others left it in favor of an AFP. The contributions of individuals who opted to stay in the SNP pay for the pensions of current and future retirees, while the contributions of SPP affiliates go directly to their individual retirement accounts. This has prompted a considerable reduction in the ratio of contributing affiliates to pensioners. Obviously, with such a low contribution base, the SNP cannot be expected to be in balance, so the Public Treasury is forced to assume a sizable share of pension payouts.

While it should be acknowledged that a regime such as the SPP does have some advantages, it must also be noted that its implementation has been very costly - something that has received little attention in the empirical research. On the one hand, there is the cost of recognition bonds given and to be given to affiliates who migrate from the SNP to the SPP; and on the other, the transfers that the Treasury has been making since 1995 to pay SNP pensioners, since the affiliates who should have been paying for these pensions have moved across to the SPP. For example, in 2014, income from contributions of SNP affiliates (only under the system implemented through Law Nº 19990) accounted for 69% of these transfers, while the remaining 31% came from direct Treasury transfers (1,422 million soles).[2] The latest calculation of the actuarial reserve in the SNP (as at 2014) is 114 billion soles - that is, 21% of GDP.

The provision of recognition bonds is also problematic. Affiliates in the SNP were considered to be party to an "agreement" in which they contributed to the payment of

[2] The total value of the SNP (under the system implemented under Law Nº 19990) as at 2014 was 4.545 billion soles. When other public pension schemes are taken into account, the total value rises to 5.144 billion soles.

retirement pensions while they remained active workers, which was supposed to entitle them to an old-age pension funded by the contributions of the next generation of active workers. Moreover, retirees expected affiliates to continue paying in so that they would be able to keep on receiving their pensions, plus increases that would maintain the purchasing power of their pensions. With the introduction of the SPP, many workers ceased to participate in this "agreement" when they moved across to the SPP. This meant that the expected contributions of these workers suddenly disappeared and the state was left to plug the gap. The state gave those workers who switched systems a recognition bond for the contributions they made; in other words, pension entitlements that were considered above all to be collective commitments were in a sense individualized. However, these same workers were not charged a bond for the pledged contributions that they ceased to pay. In reality, those who make these contributions at present are taxpayers in general, since Treasury transfers to the SNP are funded by tax revenues. The fact that it is higher-income contributors who account for the bulk of the total value of recognition bonds serves to exacerbate distribution problems. The contributions of these high-income affiliates would have helped to pay for the pensions of SNP retirees, but in actuality, the state transfers resources to these individuals in the form of recognition bonds.

In sum, the SPP allows its affiliates to save via individual accounts without the need to shoulder part of the payment of pensions for older generations. This renders the contributions of SNP affiliates insufficient for the payment of pensioners, with the result that the state has to make up the shortfall. Moreover, the state transfers resources to SPP affiliates in the form of recognition bonds. Because Treasury funds come from taxes paid by all contributors, whether affiliates of either of the two pension systems or not, in practice the outcome is a situation in which the state collects from all but only pays out to some (SPP bonds and SNP pensions) while allowing others to accumulate savings for themselves (individual accounts in the SPP). It is worth noting that within the workforce, those who are not affiliates of any pension system are generally poorer and subject to more precarious working conditions, so the current pension system in Peru can therefore be said to be regressive.

2.2 A new multi-pillar pension system

The proposal for a new MPS consists of bringing SNP and SPP affiliates back together under a single system and recognizing the contributions made by individuals into either of these two systems as a means of assessing entitlement to receive a minimum pension. Such a reform would allow any affiliate to obtain a minimum pension on the condition that they had been contributing for at least 20 years on the basis of an income equivalent to at least the statutory minimum wage (remuneración mínima vital, SMW). This benefit and the corresponding eligibility requirements are already in place for SNP affiliates, but the scheme does not exist in the SPP. Thus, the proposed reform would provide lower-income SPP affiliates the prospect of access to this guarantee. It is important to note that the balances in the individual accounts of each SPP affiliate at the time of the reform would be respected, which lends legitimacy to the proposal. The special case of those SNP affiliates caught in the transition to the private system is also accounted for, such that they would not lose out following the reform. As such, the pension received by an individual who had contributed for 40 years or more would be whichever worked out greater between the new multi-pillar system pension and the previous entitlement under the pre-reform SNP.

Through this reform, each affiliate would contribute at a rate α of income to their individual retirement account, and at a rate β of income to the solidarity fund, which would finance the minimum pensions disbursed under the new system. At the time of retirement, an individual's pension would be calculated on the basis of the funds accumulated in their IRA. If these proved insufficient to fund a minimum pension, the retiree would receive the minimum pension from the solidarity fund.[3] Thus, the solidarity fund would be regarded as the first pillar, and the IRA would be the second. Depending upon the levels set for α and β, the reform could have a significant impact on the reduction of the actuarial reserve, which would free up public funds for reallocation to other social protection programs.

[3] This would mean that the contributions of these affiliates would go into the solidarity fund, from where the minimum pension would be paid out each month to the retiree.

3. THE DATA

The data are taken from representative samples of the administrative records of active SPP and SNP affiliates as at December 2013. The SNP sample was randomly extracted from each stratum (by sex and five-year age groups) into which the contributing population was divided. In the case of the SPP, the sample was also random and stratified by sex, five-year current-age groups, and five-year age groups at time of affiliation. The original sample size was 71,854 and 109,642 for the SNP and the SPP, respectively, which accounts for 2% of the affiliate population in each system. In the case of the SNP, the final sample size was reduced to 68,123 affiliates following the removal of 3,787 individuals below the age of 21, and 44 individuals above the age of 90. The final size of the SPP sample used in the simulations was reduced to 95,481 affiliates after discarding 12,326 individuals with no balance in their IRAs, 41 cases in which no information on IRAs was available, and 1,794 affiliates under the age of 21.[4] The results of the simulation account for the relative weight of each sample in the total population of affiliates. Table 1 shows the size of the final sample and the affiliate population as at December 2013.

Table 1

Population and sample of SNP and SPP affiliates, Peru, December 2013

	SNP		SPP		Total
	Quantity	%	Quantity	%	
Population	3,595,810		5,481,770		9,077,580
≤ 65 years old	3,444,933		5,404,299		8,849,232
> 65 years old	150,877		77,471		228,348
Sample	68,123	1.895	95,481	1.742	163,604
≤ 65 years old	65,179	1.892	94,547	1.749	159,726
> 65 years old	2,944	1.951	934	1.206	3,878

Source: SBS and ONP for the simulation; compiled by author.

[4] Affiliates below the age of 21 are not included because the official mortality tables only calculate the probability of survival starting from that age. Those observations of IRAs without balances likewise do not contain, in general, information on income, which precludes pension calculations and income imputation.

The simulations are performed using a total of 163,604 affiliate records, which represent little over 9 million affiliates across both pension systems. The available variables in these records are salary, age, and sex; and in the case of the SPP, IRA balance, date of affiliation, value of the recognition bond, and the number of months of contributions for calculation of the bond are available. In the case of SPP affiliates for whom no information on income is available, a simple imputation is performed based on a linear regression using the available information regarding other affiliates. The dependent variable in this regression is the logarithm of income, and the explanatory variables are IRA balance, a polynomial of age, a polynomial of the number of years that the individual has been affiliated in the SPP, sex, AFP, number of contributions, and the recognition bond.[5] In the SNP sample, all affiliates had an income in excess of the SMW.

The SNP base does not include information regarding the age at which individuals affiliated with the system, so this variable had to be estimated using information on SPP affiliates. To this end, the average of the age at time of affiliation by sex and the current age of affiliates in the SPP sample was used, with the result that the majority of individuals affiliated between the ages of 20 and 27. Thus, the age of affiliation in the SNP is an increasing function of the current age of the individual, but only up to the age of 40. It is assumed that all individuals over the age of 40 affiliated at 27 years of age. It should be noted that this method contrasts with that employed by the SNP to estimate actuarial reserves, which assumes 25 years of contributions for all affiliates, irrespective of the age at which an individual affiliated.

4. SIMULATION OF PENSIONS AND ACTUARIAL RESERVE

The simulation of pensions for the SPP and SNP takes into account current rules as well as a series of assumptions to make up for the lack of data for some variables. Parameters for estimating pensions and reserves are also used, which could have a significant impact on the results. The values of these parameters are selected on the basis of a review of

[5] Given that contributions must be made on the basis of remuneration of no less than the SMW (750 soles per month), earnings below this amount were adjusted to the SMW value.

the available empirical literature on pension simulations in Latin America and Peru.[6] It should be noted that this study neither estimates nor accounts for the actuarial reserve of current pensions. The reason for this is that the proposed reform analyzed here would not affect current pensions, so the actuarial reserve would remain unchanged.

4.1 Pension simulation

Pensions in the SNP are calculated in accordance with the system's current pension rules (see Section 4.3.4). In the SPP and the multi-pillar system, pensions are calculated in accordance with a simple process of monthly payments to individual accounts, as shown in equations 1 to 4 below.

$$P_{ik}^{spp} = \frac{0.10\sum_{j=k}^{z}\left(w_{ij}d_{ij}^{spp}\sigma^{z-j}\right)+CIC_{ik}\sigma^{z-k}+RB_{ik}}{A_{z,y}} \tag{1}$$

$$A_z = 12\left(\sum_{t=0}^{M-z}\frac{p_{z,z+t}}{\delta^t}\right) \tag{2}$$

$$A_{z,y} = A_z + 12\theta_{spp}\left(\sum_{t=0}^{M-y}\frac{q_{y,y+t}(1-p_{z,z+t})}{\delta^t}\right) \tag{3}$$

$$\delta = 1+\hat{r};\ \ \sigma = 1+r \tag{4}$$

The subindices *i*, *k*, and *z* refer to one individual in particular, their age at the cut-off date (December 2013), and retirement age (which is 65 under the SNP, SPP, and the proposed MPS). P_{ik}^{spp} is the value of the pension calculated at retirement age, w_{ik} is the annual salary, r is the annual rate of return of the pension funds, and d_{ik}^{spp} is the density of contributions, which fluctuates between 0% and 100%. The numerator of Equation (1) represents the accumulated capital with which the pension is calculated, while the denominator $A_{z,y}$ is the price of the annuity. The first component of pension capital is the contributions made between the ages of k and z and their corresponding returns. The second component is the balance accumulated in the IRA (CIC_{ik}) as at December

[6] In particular, this methodology follows much of that employed in Olivera (2010) for the Peruvian pension system.

2013, and the return it generates up to the date of retirement. The third component is the present value of the recognition bond (RB_{ik}), in those cases where an affiliate is entitled to it.

The price of the annuity must be calculated in order to determine the final value of the pension that an affiliate will receive. The price $A_{z,y}$ is expressed in monthly terms and therefore, the final pensions are also expressed in monthly values. This is also known as required unit capital (capital requerido unitario, CRU), which expresses the amount of capital units required at present in order to receive a single monetary unit of a pension for life. Equations (2) and (3) show the CRU formulas for a single affiliate and a married affiliate, respectively. For the calculation of the CRU, the values $p_{z,z+t}$ are needed, which indicate the probability of survival from age 65 up to age 65 + t, according to the official SPP mortality tables, which are also broken down by sex. Similarly, the values $q_{y,y+t}$ indicate the probability of survival from age *y* up to age *y + t* of the pension-holder's surviving spouse. The parameter θ_{spp} is the percentage of the deceased holder's pension that their spouse will receive as a survivor's pension. The default value of this parameter is 42% in the SPP, provided that the surviving spouse is the sole beneficiary. In the SNP, this value is 50%. The parameter *M* is the maximum age included in the mortality tables, which is 110. And finally, $\hat{r}$ is the annuity discount rate.

In the case of the MPS, pensions would be calculated (P_{ik}^{smp}) in a similar way to the SPP, but in this case, affiliates would have the possibility of obtaining a minimum pension (P_{min}^{smp}) in the event that they were unable to secure a pension of at least this amount through their own contributions, on the condition that they had been paying in for at least 20 years. This is the same as the stipulated requirements of the SNP. It should be noted that in the proposed multi-pillar system, the required 20 years of contributions could have been made in either the SPP or the SNP. The dual equation (5) expresses pension calculation in the MPS.

$$P_{ik}^{smp} = \begin{cases} Max\left[\frac{\alpha\sum_{j=k}^{z}\left(w_{ij}d_{ij}^{smp}\sigma^{z-j}\right)+CIC_{ik}\sigma^{z-k}+RB_{ik}}{A_{z,y}}, P_{min}^{smp}\right] & if\ the\ requirements\ are\ met \\ \frac{\alpha\sum_{j=k}^{z}\left(w_{ij}d_{ij}^{smp}\sigma^{z-j}\right)+CIC_{ik}\sigma^{z-k}+RB_{ik}}{A_{z,y}} & if\ the\ requirements\ are\ not\ met \end{cases} \quad (5),$$

In the simulations of the multi-pillar system, it is considered that the contribution rate to the IRA (α) and the solidarity fund (β) are always positive and add up to 10%.

4.2 Actuarial reserve

To ensure that pension payments are fulfilled, the system must be backed by sufficient capital to account for the probabilities of survival of pension-holders and their beneficiaries, as well as a given discount rate that guarantees the payment of future pensions at present value. In the case of PAYG systems, such as the SNP and the PAYG component of the proposed mixed system, the present value of future pensions must be compared with the present value of contributions in order to establish the final balance of the pension system - that is, whether the system has a surplus, a deficit, or is in balance. Equations (6) to (22) are used to calculate the actuarial reserve and the present value of contributions in the existing systems and in the proposed reform scenario.

4.2.1 Actuarial reserve for SNP affiliates

For affiliates ≤ 65

$$RA_{ik}^{snp} = P_{ik}^{snp} A_{65,y} \quad (6)$$

$$RA_{k}^{snp} = p_{k,65} \sum_{i=1}^{N_k} RA_{ik}^{snp} \quad (7)$$

$$RA_{\leq 65}^{snp} = \sum_{k=21}^{65} RA_{k}^{snp}\, \delta^{k-65} \quad (8)$$

For affiliates > 65

$$RA_{ik}^{snp} = P_{ik}^{snp} A_{k,y} \quad (9)$$

$$RA_{k}^{snp} = \sum_{i=1}^{N_k} RA_{ik}^{snp} \quad (10)$$

$$RA_{>65}^{snp} = \sum_{k=66}^{T} RA_{k}^{snp} \quad (11)$$

The actuarial reserve for the total number of active affiliates is:

$$RA_{snp} = RA_{\leq 65}^{snp} + RA_{>65}^{snp} \quad (12)$$

Where:

RA_{ik}^{snp}: actuarial reserve of the individual *i* at age *k*

RA_k^{snp}: actuarial reserve of all individuals at age *k*

N_k: number of individuals at age *k*

$RA_{\leq 65}^{snp}$: total actuarial reserve of affiliates at age *k* ≤ 65

$RA_{>65}^{snp}$: total actuarial reserve of affiliates at age *k* > 65.

According to equations (9) to (11), it is assumed that affiliates above the age of 65 at present will immediately retire. It should be noted that the calculation of all actuarial reserves takes into account the pension of the affiliate and that of their spouse as sole beneficiary. Moreover, actuarial reserves also take into account the reserves accrued by the surviving spouse of a pension-holder who dies before retirement age.

4.2.2 Actuarial reserve for SPP affiliates

Around 4.3% of SPP affiliates have the right to a minimum pension (P_{min}^{spp}). The actuarial reserve for this entitlement is estimated using equations (13) to (18).

For affiliates ≤ 65

$$RA_{ik}^{spp} = S_{min}^{spp}\left(P_{min}^{spp} - P_{ik}^{spp}\right)A_{65,y} \quad (13)$$

$$RA_k^{spp} = p_{k,65}\sum_{i=1}^{N_k} RA_{ik}^{spp} \quad (14)$$

$$RA_{\leq 65}^{spp} = \sum_{k=21}^{65} RA_k^{spp}\,\delta^{k-65} \quad (15)$$

For affiliates > 65

$$RA_{ik}^{spp} = S_{min}^{spp}\left(P_{min}^{spp} - P_{ik}^{spp}\right)A_{k,y} \quad (16)$$

$$RA_k^{spp} = \sum_{i=1}^{N_k} RA_{ik}^{spp} \quad (17)$$

$$RA_{>65}^{spp} = \sum_{k=66}^{T} RA_k^{spp} \quad (18)$$

Where S_{min}^{spp} takes the value of 1 if $P_{min}^{spp} > P_{ik}^{spp}$ and if the affiliate meets the requirements for receiving a minimum pension (20 years of contributions); otherwise, S_{min}^{spp} takes the value of 0.

4.2.3 Present value of affiliates' contributions to the SNP

The present value of individuals' contributions up to retirement date (VP^{snp}) is calculated as shown in equations (19) and (20).

$$VP_k^{snp} = (14 \times 0.13) \sum_{x=1}^{65-k} \sum_{i=1}^{N_k} d_{ik}^{snp} w_{ik} (p_{k,k+x}) \delta^{-x} \quad (19)$$

$$VP^{snp} = \sum_{k=21}^{64} VP_k^{snp} \quad (20)$$

4.2.4 Actuarial reserve of affiliates of the proposed multi-pillar system

This reserve is calculated in a similar way to that for SPP affiliates. It is assumed that the beneficiaries of the pension-holder will receive a pension of at least equal value to the current minimum survivor's pension in the SNP. Moreover, so as not to adversely affect the pension rights of current affiliates over the age of 65, it is assumed that the pension of these individuals is whichever is highest in value between that which would be obtained in the multi-pillar system and in the original system.

4.2.5 Present value of affiliates' contributions to the multi-pillar system

The present value of individuals' contributions up to retirement date in the proposed multi-pillar system (VP^{smp}) is calculated in equations (21) and (22).

$$VP_k^{smp} = (14 \times \beta) \sum_{x=1}^{65-k} \sum_{i=1}^{N_k} d_{ik}^{smp} w_{ik} (p_{k,k+x}) \delta^{-x} \quad (21)$$

$$VP^{smp} = \sum_{k=21}^{64} VP_k^{smp} \quad (22)$$

4.3 Parameters and assumptions

4.3.1 Mortality

For comparative purposes, mortality and the computation of annuities is performed exclusively using the current official tables of the SPP (2010 tables).[7] However, it should be noted that the SNP has estimated its actuarial reserves since 2008 using the SP-2005 tables, which in turn were estimated on the basis of Peruvian data for the period 1999-2005. For its part, the National Institute of Statistics and Information (Instituto Nacional de Estadística e Informática, INEI) also estimates mortality tables for the Peruvian population. The tables provide a breakdown by sex, and account for a maximum survival age of M = 110. As to the number and type of beneficiaries, it is assumed that there will only be a spouse, for it is unlikely that a 65-year-old will have children aged less than 18 years. The assumed age difference between spouses is four years, whereby the husband is the elder partner.[8]

4.3.2 Interest rates

The estimation of pensions and the actuarial reserve implicitly assumes that there is no price rise, so a real rate of return corresponding to the pension fund must be employed. Moreover, long-term profitability must be assumed, given the long period of time over which an individual contributes to the pension system. It is also assumed that the real rate of return of the pension fund is 6%. The same value is assumed in other studies that provide long-term projections for Peru (Morón and Carranza 2003; Bernal *et al.* 2008). On the other hand, the Ministry of the Economy and Finances (MEF 2008) uses a real rate of return of 5%.

The discount interest rate used to calculate the annuity and the actuarial reserves is 4%, the same as that employed by the SNP for the calculation of its reserves. Other studies on pensions in Latin America use a similar value. For example, Zvinieni and Packard (2002) and Bernal *et al.* (2008) use a rate of 4%, while Holzmann *et al.* (2004) utilize values of between 2% and 5%.

[7] The official tables can be seen in the SBS Resolution N° 17728-2010.
[8] In MEF (2008) it is also assumed that the spouse is the sole beneficiary, but with an age difference of five years, while in Bernal *et al.* (2008) the difference is three years.

4.3.3 Density of contributions

The density of contributions is the variable, alongside profitability, that affects the value of future pensions to the greatest extent. According to the official statistics of the SPP and the SNP, the percentage of contributing affiliates out of the total percentage of active affiliates in 2013 was 45% and 42% in the respective systems.[9] Though imperfect, this measurement gives an idea of the average density of contributions in the Peruvian pension system. Other studies on Latin American pension systems find that the density of contributions fluctuates around 50%, on average (for example: Arenas de Mesa *et al.* [2008] for Chile; and Bertranou and Sánchez [2003] for Argentina). However, it has also been shown that the average density of contributions can conceal a significant polarization in that density, with concentrations in the low and high values of the distributions (Bertranou and Sánchez 2003). In general, this polarization occurs between high- and low-income groups. To account for such a characteristic in the distribution of the density of contributions, the density is estimated by decile of income and sex using available data from the SPP and SNP samples. To this end, a probit regression is run using affiliates aged 65 years or below from both systems, where the dependent variable takes the value of 1 if the individual makes any contributions in November or December 2013, and the value of 0 if no contributions are made during this period. For the regression, those affiliates who affiliated very recently (November or December 2013) are not taken into account. The explanatory variables are sex, age, square of age, pension system, decile of income, and the square of the decile. Each individual is assigned the average value of the estimated probability of contribution by sex and decile of income. The results are shown in Table 2.

[9] The density of contributions in the SPP is the average of monthly densities in 2013, which were retrieved from the SPP statistical series at <www.sbs.gob.pe>. In the case of the SNP, the density of contributions is the percentage of contributors out of active affiliates at December 2013, as per ONP (2014).

Table 2

Density of contribution to the pension system by decile of income and sex, Peru, 2013 (in percentages of contributors out of active affiliates)

Decile of income	Men	Women
1	0.328	0.262
2	0.360	0.309
3	0.404	0.330
4	0.442	0.371
5	0.496	0.421
6	0.553	0.482
7	0.623	0.544
8	0.689	0.615
9	0.754	0.690
10	0.817	0.761

Source: SBS and ONP; compiled by author.

In the Peruvian data, it can be seen that the density of contributions increases with the decile of income. Moreover, there is a higher density of women than men. According to Olivera (2010), this may be because women who find employment in the formal sector - and who are thus affiliated in the pension system - enjoy, on average, better working conditions (e.g., more stable contracts) than men.

In the simulation of pensions in the SPP in its current form, it is assumed that the density of contributions of each affiliate (d_{ij}^{spp}) behaves according to the corresponding values in Table 2. The same is assumed in the case of pension simulation in the SNP, but an element of adaptive behavior is also factored into the density of contributions. Given that under the SNP an individual will receive a pension only if they have contributed for a minimum of 20 years, it is assumed that the individual will pay in for at least that period. This means that if the corresponding density in Table 2 does not allow an SNP affiliate to reach 20 years of contributions, the value of the density of that individual is adjusted such that they contribute for exactly 20 years. The argument for this adaptive element is the moral hazard that exists in the receipt of a pension under the SNP, based on the necessity to contribute for 20 years. If an individual contributes for less time, they will not receive a pension. In the SPP there is no such requirement; the pension received upon retirement is a directly proportional function of the funds accrued in the individual retirement account, and therefore there is no need to model this adaptive element. In the case of the simulation of pensions in the hypothetical multi-pillar system, this adaptive element is likewise incorporated in the density of contributions (d_{ij}^{smp}), given that this system will disburse a minimum pension only if an affiliate has contributed for at least 20 years.

4.3.4 Pension rules in the SNP

The pensions in the SNP are calculated by applying the current pension rules in that system, which are as follows:

- Minimum monthly pension: 484 soles
- Maximum monthly pension: 1,000 soles
- Percentage of pension paid to the beneficiary spouse:[10] 50%
- Minimum monthly survivor's pension: 315 soles
- Monthly rate of contribution: 13%
- Replacement rate for calculating pension by age attained in 2013: up to the age of 41, 30% for the first 20 years of contributions and 2% for each additional year; between 42 and 51, 35% for the first 20 years of contributions and 2% for each additional year; between 52 and 61, 40% for the first 20 years of contributions and 2% for each additional year; between 62 and 66, 45% for the first 20 years of contributions and 2% for each additional year; finally, for those over the age of 66, it is 50% for the first 20 years of contributions and 4% for each additional year.

4.3.5 Other assumptions

It should be noted that the simulation of the multi-pillar system respects the funds accumulated in the IRAs of all SPP affiliates, and takes into account the years of contributions to the SPP in the calculation of the minimum contributions necessary to receive a minimum pension in the proposed system. Moreover, the simulation takes into account the special case of the group of SNP affiliates caught in the transition. This refers

[10] Under the SNP, widowers only receive a survivor's pension if they have a disability, or are over the age of 60 in those cases where they were financially dependent on the pension-holder. Therefore, in the estimation of SNP reserves, survivor's pensions are only accounted for in the case of widows.

to affiliates aged 40 or over, whose future pension entitlement is considered to be whichever is higher between that proposed under the multi-pillar system and that which would be paid out under the non-reformed SNP.

In the SPP, the SNP, and the proposed mixed system, 14 payments per year are assumed. Moreover, under the mixed system the survivor's pension entitlement would be the same percentage of the deceased spouse's pension as in the SPP: 42%. It is assumed that the value of the minimum pension in the multi-pillar system (P_{min}^{smp}) is the same as in the SNP - that is, 484 soles per month. This is equivalent to 1.60 times Peru's official national poverty line of 2014, which represents a significant loss of purchasing power since the minimum pension was equivalent to 2.03 times the national poverty line in 2004. It is worth noting that the most recent increase to the minimum pension under the SNP occurred in late 2001.

Throughout these simulations, the prices, salaries, and pensions remain constant and there are no wage increases based on seniority. Besides the fact that the inclusion of such bonuses would complicate the situation, the available administrative records represent only a cross-section for one year and as such there are no reliable data based on which assumptions can be made on bonuses. Moreover, the simulations do not factor new workers into the calculation of pensions and the actuarial reserve. The inclusion of new workers in the pension system would require additional assumptions and simulations regarding fertility, labor supply, decision to affiliate, and labor informality, all of which would require data that is not available in the administrative records and which, in any case, is beyond the scope of this study. In the context of the microsimulation techniques, the exercise performed is similar to statistical simulation. However, the design of the simulation performed in this study is sufficient to underline the trade-offs between pension debt, pension inequality, and the level of well-being of retirees under the proposed reform.

5. RESULTS OF THE SUMULATION

5.1 Actuarial liabilities

The calculation of the actuarial reserve may be significantly sensitive to the assumptions and parameters employed. In particular, the rate of return of the fund and the discount rate have a significant impact. For example, a very high rate of return would result in higher IRA balances, and less solidarity-fund resources would therefore be needed to pay minimum pensions, all of which would have an impact on the requirement of a lower actuarial reserve. Likewise, a higher discount rate could also cause a reduction in the actuarial reserve due to two mechanisms: on the one hand, the pension calculated using IRA funds would increase since the price of the annuity falls with the discount rate (see equations 1 to 3); and, on the other hand, the present value of the actuarial reserve would decrease with a higher discount rate.

The results of the simulation of the actuarial reserves can be observed in Table 3. As it is structured at present, the Peruvian pension system has an actuarial deficit of US $31.489 billion, which amounts to 16% of GDP. This figure represents the difference between the actuarial reserves (US $51.050 billion or 26% of GDP) of current affiliates and the present value of their contributions (US $19.561 billion, or 10% of GDP). The actuarial reserve of current pensioners is not estimated because the reform will not change those pensions that have already been disbursed. In any case, according to information provided by the Pension Normalization Office (Oficina de Normalización Previsional, ONP),[11] the total net actuarial reserve is approximately 21% of GDP. Table 3 shows that the rate of contribution to the solidarity fund increases in inverse proportion to a decrease of the net actuarial reserve. For example, if the rate of contribution to the solidarity fund is $\beta = 1\%$ (and the rate of contribution to the IRA is $\alpha = 9\%$), the net reserve is found to decrease from 16% to 13.7% of GDP - that is, the reform produces a saving of 2.3% of GDP. A more aggressive reform would mean that contribution to the solidarity fund would be higher. For example, if $\beta = \alpha = 5\%$, then the net actuarial reserve decreases from 16% to 4.5% of GDP. The last column in Table 3 shows the

[11] The latest available information on actuarial reserves (calculated as at December 2013) in the SNP can be found in the document “Resumen consolidado del estudio económico de reservas previsionales. Régimen decreto ley 19990” (ONP 2013).

extreme case of a complementary PAYG system, which would have an actuarial surplus of 2.5% of GDP. This extreme case serves primarily to illustrate the ratio of actuarial liabilities to contribution rates. Although the reduction in the actuarial liabilities is positive in its own right, it must be recalled that other important dimensions in the pension system will be affected. Those explored in this study are pension inequality and pensioner well-being.

Table 3

Actuarial liabilities pre- and post-reform, Peru, December 2013 (in millions of dollars)

	Without reform	With reform (scenario based on contribution to the solidarity fund)									
		β = 1%	β = 2%	β = 3%	β = 4%	β = 5%	β = 6%	β = 7%	β = 8%	β = 9%	β = 10%
SNP affiliates											
PV[1] of contributions	19,561	1,505	3,009	4,514	6,019	7,523	9,028	10,533	12,038	13,542	15,047
Reserves	49,702	28,833	30,183	31,681	33,290	35,016	36,858	38,839	40,965	43,217	45,532
Net reserve (reserve - PV of contributions)	30,141	27,329	27,174	27,167	27,272	27,492	27,830	28,306	28,927	29,675	30,485
SPP affiliates											
PV of contributions	0	5,922	11,844	17,766	23,687	29,609	35,531	41,453	47,375	53,297	59,219
Reserves	1,348	5,581	6,611	7,836	9,308	11,003	12,895	15,008	17,425	20,305	23,920
Net reserve (reserve - PV of contributions)	1,348	- 341	- 5,232	- 9,930	- 14,380	- 18,606	- 22,636	- 26,445	- 29,950	- 32,992	- 35,299
Total (system affiliates)											
PV of contributions	19,561	7,427	14,853	22,280	29,706	37,133	44,559	51,986	59,412	66,839	74,266
Reserves	51,050	34,414	36,795	39,517	42,598	46,019	49,753	53,847	58,390	63,522	69,452
Net reserve (reserve - PV of contributions)	31,489	26,988	21,942	17,237	12,892	8,886	5,194	1,861	- 1,023	- 3,317	- 4,814
In % of GDP	16.0	13.7	11.2	8.8	6.6	4.5	2.6	0.9	- 0.5	- 1.7	- 2.5
Reduction of net reserves due to the reform	0.0	4,501	9,547	14,252	18,597	22,602	26,295	29,628	32,511	34,806	36,302
In % of GDP	0.0	2.3	4.9	7.3	9.5	11.5	13.4	15.1	16.6	17.7	18.5

Note

(1) Present Value

5.2 Well-being and inequality

The effect of the proposed reform on pension distribution is measured using the inequality indices from the S-Gini set of indices (Donaldson and Weymark 1980) in Equation (23).

$$I_\rho = 1 - \sum_{i=1}^{n} \left[\left(\frac{n-i+1}{n} \right)^{\rho} - \left(\frac{n-i}{n} \right)^{\rho} \right] \frac{P_i}{\mu} \qquad (23)$$

Pension inequality is measured as the weighted average of the ratios of the individual pension (P_i) and the average pension (μ) for each individual. In Equation (23), *i* indicates the position of the individual in the ranking of pension distribution, which is ordered from lowest to highest pension ($P_i \leq P_{i+1}$), while the expression in brackets indicates the relative weight that each individual receives for the computation of inequality. In a similar manner to the parameter of the Atkinson Index (Atkinson 1970), the parameter ρ can be interpreted as the degree of aversion to inequality of the social planner, and therefore offers the prospect of incorporating normative judgments in the evaluation of well-being. The relative weight of individuals with lower pensions is greater within the distribution provided that $\rho > 1$. The planner is neutral to inequality when $\rho = 1$. In this case, all individuals receive the same relative weight and the index of inequality obtains the value $I_\rho = 0$. The bigger that ρ is, the more averse to inequality the social planner will be. The most used indicator in this set of indices is the Gini coefficient, which is obtained when $\rho = 2$.

In order to allow for different opinions regarding fairness, the effect of the reform on pension distribution is quantified using three different values of the aversion to inequality parameter: $\rho = 1$, $\rho = 2$ and $\rho = 5$. In the first case, inequality is not of interest. The second case is that of the Gini coefficient, in which individuals with lower pensions are given greater weight, and the weights are a linearly decreasing function. Finally, the case of $\rho = 5$ allows the effects on distribution to be ascertained when the planner is highly averse to inequality. In relation to the Gini coefficient, it should be recalled that this has values between 0 and 1. Therefore, a coefficient close to 0 denotes a more equal distribution, while a coefficient close to 1 denotes a more unequal distribution. These characteristics are also applicable to other indices of inequality constructed with other values of ρ. Once the values of the indices of distribution are found, it is possible to measure the effect of the pension reform with functions of social well-being (*W*) which take into account the level of inequality and the value of pensions. According to Lambert (2001), the value of *W* must be increasing in average income, and decreasing in the level of inequality, thereby showing the tension between efficiency and equity. Equation (24) shows the function of social well-being calculated using pension simulations.

$$W_\rho = \mu\left(1 - I_\rho\right) \tag{24}$$

Given that pensions are estimated for different individuals that retire over the period 2014-2054, some form of weight must be used to estimate the average pension and pension inequality of these retirees in any one given year. For example, for 2024 there are pensioners of different ages who have been retired for between one and ten years. The weight to be used to aggregate pensions is the probability of survival from retirement age to the age attained in the year in which the average pension and pension inequality are estimated. To construct these weights, the same mortality tables used in the computation of pensions are employed. With all these inputs, it is possible to ascertain the average pension and inequality for each year over the period 2014-2054.

Table 4 shows the results for the average pension and the indices of inequality taken from the simulations under each of the contribution rate scenarios. If no reform occurs, it can be seen clearly that the SNP pensions (554.20 soles) will be, on average, just 60% of those disbursed under the SPP (927.90 soles). Moreover, the differences in pension inequality in each system are very significant. In the SNP, the Gini coefficient of pensions will be 0.107, while under the SPP it is six times higher: 0.632. In turn, the available administrative data (see the Appendix) show that the Gini coefficient of current retirement pensions in the SPP is 0.514, and 0.236 under the SNP. As a reference, the average Gini coefficient for Organization of Economic Cooperation and Development

(OECD) countries is 0.158 (2013). Part of the explanation for the differences in pension inequality under the SPP and the SNP lies in the income inequality within each system and the structure of each system. The Gini coefficient of SNP affiliate income is 0.227, while under the SPP it is 0.464. Moreover, the SNP's PAYG structure necessitates pensions between minimum and maximum values and inequality therefore has a limit. On the other hand, the SPP, as an individual capitalization system, reflects pension inequality more directly, since the pensions are a directly proportional function of the level of contributions and, therefore, of income level. In addition, pension inequality in the SPP may be exacerbated by differences in the density of contributions by income group. As stated in Section 4, this density is greater in the group of high-income affiliates, and as a result they can accumulate more funds and obtain better pensions than low-income affiliates with a lower density of contribution. One way of showing this effect is through the computation of inequality in the pension funds accumulated by SPP affiliates. By using the same data employed in the simulations, the Gini coefficient of IRA balances turns out to be 0.752; this is a very large figure that denotes considerable inequality in pension wealth.

Table 4

Indices of pension inequality, Peru, December 2013, (pensions in soles)

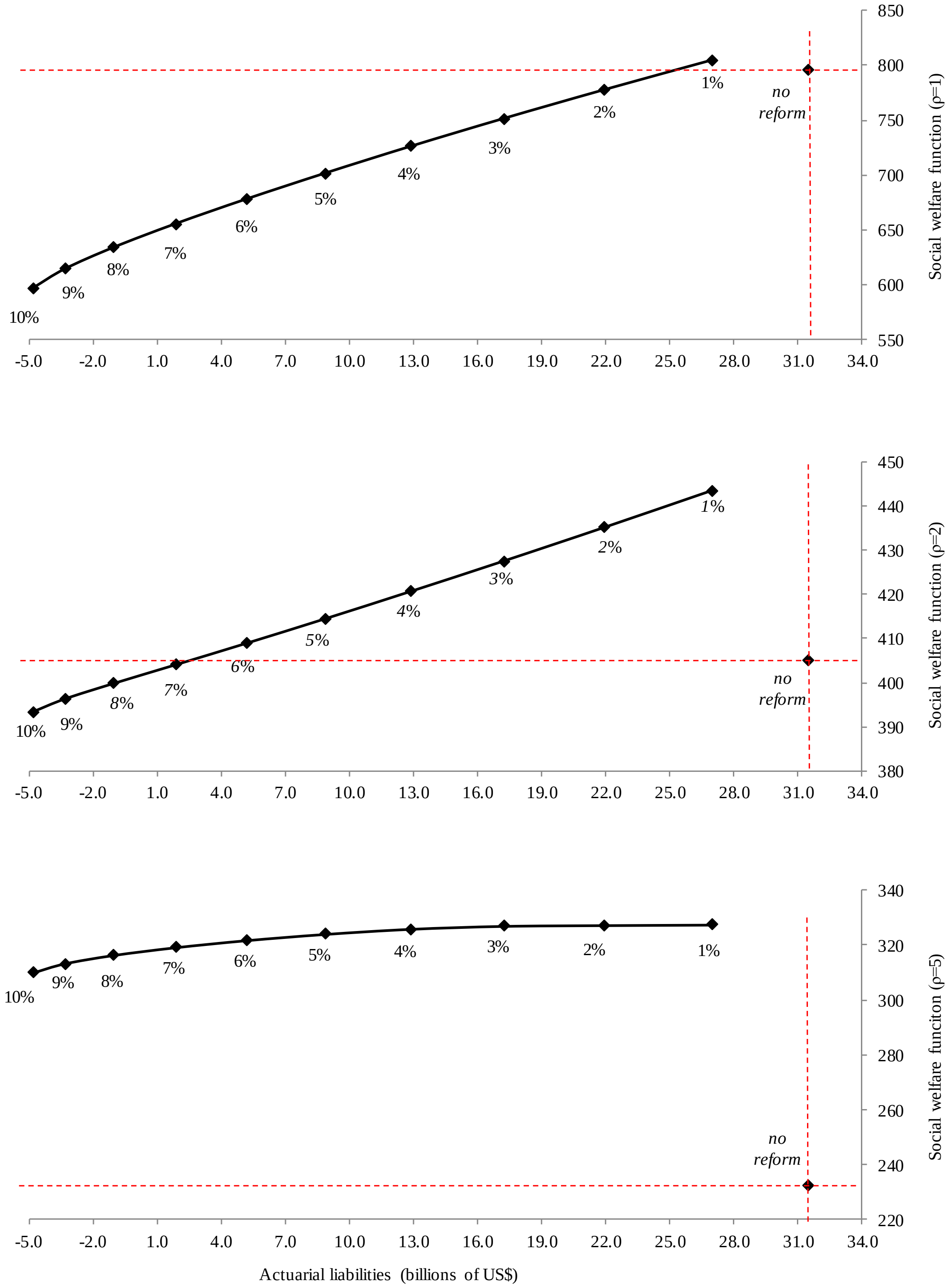
	Without reform	With reform (scenario according to contribution to the solidarity fund)									
		β = 1%	β = 2%	β = 3%	β = 4%	β = 5%	β = 6%	β = 7%	β = 8%	β = 9%	β = 10%
SNP affiliates											
Average pension	554.2	565.1	559.6	554.7	550.5	546.9	544.1	542.1	540.9	540.4	540.3
Inequality (ρ = 1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inequality (ρ = 2) (Gini)	0.107	0.124	0.117	0.110	0.104	0.099	0.094	0.090	0.088	0.088	0.087
Inequality (ρ = 5)	0.071	0.082	0.076	0.071	0.066	0.063	0.060	0.058	0.057	0.057	0.057
SPP affiliates											
Average pension	927.9	935.9	896.1	857.2	819.3	782.4	746.4	711.5	678.1	646.8	618.9
Inequality (ρ = 1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inequality (ρ = 2) (Gini)	0.632	0.583	0.577	0.571	0.564	0.555	0.545	0.534	0.521	0.507	0.492
Inequality (ρ = 5)	0.849	0.760	0.748	0.734	0.720	0.705	0.690	0.675	0.659	0.643	0.628
Total system affiliates											
Average pension	795.4	804.1	777.1	751.0	725.8	701.4	677.9	655.4	634.1	614.4	597.0
Inequality (ρ = 1)	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Inequality (ρ = 2) (Gini)	0.491	0.449	0.440	0.431	0.420	0.409	0.397	0.384	0.369	0.355	0.341
Inequality (ρ = 5)	0.708	0.593	0.579	0.565	0.551	0.538	0.526	0.513	0.501	0.490	0.481

Table 4 clearly shows that the larger the contribution rate to the solidarity fund, the lower the pension inequality in the multi-pillar system. For example, the Gini coefficient can drop 4 points merely by setting the rate of contribution to the solidarity fund at $\beta = 1\%$, and the rate of contribution to the IRA at $\alpha = 9\%$. A more aggressive reform that equaled the contribution rates to the solidarity fund and the IRA ($\beta = \alpha = 5\%$) would cause an 8-point fall in the Gini coefficient, to 0.409. The last row in Table 4 uses a larger inequality aversion parameter ($\rho = 5$) than that used in the Gini. Inequality is greater with this index because the social planner is more concerned about the level of inequality, which comes from the allocation of greater relative weights to lower-income individuals. As with the Gini coefficient, this index decreases in inverse proportion to the increase in contributions to the solidarity fund.

The final step in analyzing the effects of pension system reform entails the construction of the function of social well-being (*W*) for each reform scenario and the current situation, based on average pensions and indicators of pension inequality. The value of *W* is not important in itself; what is relevant is the ranking of these functions. Higher functions of well-being will reflect greater affiliate well-being. Graph 1 simultaneously displays the three dimensions explored in this study: actuarial liabilities, inequality, and well-being for each reform scenario. The two final dimensions are encapsulated in the values of the social well-being function in the vertical axis of the graphs. Each of the parts that comprise Graph 1 includes the level of well-being and the actuarial liabilities generated in the current pension system - that is, these are the values under a scenario of no reform. Each point represents a different reform scenario, while the percentage that appears alongside the point is the value of the contribution rate that goes to the solidarity fund. Any point that appears on the horizontal dotted lines represents a greater level of well-being than the scenario of no reform.

Graph 1

Actuarial debt, inequality, and social well-being function by reform scenario (in billions of dollars)



Nota: The percentages represent the contribution rate to the 'solidarity' fund used in each simulation scenario. The upper panel considers a social welfare function computed with a inequality parameter ρ = 1; the second panel considers ρ = 2 (Gini coefficient); and the third panel uses ρ = 5

It is interesting to note, for example, that if the social planner is neutral on the level of inequality (first part of the graph), a multi-pillar system with a 1% contribution rate to the solidarity fund implies a greater level of well-being than the current situation as well as a reduction in the pension reserve of US $4.501 billion (2.3% of GPD). However, any other rate of contribution to the solidarity fund of more than approximately 1.3% is associated with a higher level of well-being than the current situation, but it also implies lower actuarial liabilities. On the other hand, if pension inequality is important to the social planner, the second part of the graph can be used, which employs the Gini coefficient (ρ = 2) for the construction of pension inequality and the level of well-being. In this case, any reform scenario with a rate of contribution to the solidarity fund of more than 7% implies a loss of well-being - that is, a social planner with aversion to the inequality stemming from the Gini coefficient could propose an aggressive pension reform by selecting an IRA contribution rate of just 3% and of 7% for the solidarity fund, without causing a loss in well-being. Moreover, this scenario brings about a significant reduction in the actuarial reserve of US $29.628 billion (15.1% of GDP) - that is, the actuarial liabilities are only 0.9% of GDP. Finally, for a social planner with high aversion to inequality (ρ = 5, third part of the graph), any reform scenario implies a better situation than at present in terms of well-being and the actuarial reserve.

The three parts of the graph analyzed clearly illustrate the trade-offs to which any pension reform would be subject. It is important to reduce actuarial liabilities, but at the same time the level of well-being of affiliates in relation to inequality and average future pensions is not to be overlooked. The objective of this analysis is not to demonstrate a concrete set of values for the rate of contribution to the solidarity fund and the IRAs, but rather to illustrate the advantages and disadvantages in the selection thereof. However, it is most interesting to find that even a policy with a neutral approach to inequality ($\rho = 1$; $\beta = 1.3\%$; $\alpha = 8.7\%$) would not adversely affect the level of well-being in the current system, and actuarial liabilities would even be reduced.

5.3 Other aspects of the reform

One of the immediate effects of the implementation of a multi-pillar system would be the elimination of the competition for new workers that currently exists between the SPP and the SNP, which could result in an increase in competition between AFPs. Similarly, competition could also increase with respect to current SNP affiliates, who would have to choose one of the AFPs to manage their IRA contributions. It is possible that such an increase in competition could translate into affiliates being charged lower rates of administrative commission, in the case where this competition manifested itself in the sphere of the price of the administrative service. On the other hand, if such competition were to prompt an increase in expenses associated with sales and publicity, an increase in administrative costs and little or no reduction in administration commissions might be expected. One way of promoting a reduction in commissions could be through a public procurement process for all SNP affiliates - approximately 4 million individuals of whom 1.6 million are regular contributors. The winning AFP would be that which offered the lowest administrative fee, to be maintained for a certain period, while requiring a minimum period of affiliation with the firm in question. Another option could be a public procurement process for randomized groups of affiliates, which would reduce the risks associated with concentrating a large proportion of affiliates in the hands of a single company. A sufficiently small administrative fee could be expected to induce other AFPs to reduce their fees following the tender process. Such a public procurement process could be attractive to firms seeking to enter the pension market for the first time, since it would be easier for them meet the industry's high initial costs.

Another possibility is the establishment of a state-owned AFP, which would assume responsibility for current SNP affiliates as well as any other workers who wished to affiliate in the public system, regardless of whether or not they were already affiliated with a private AFP. Such a state-owned AFP ought to be subject to the same regulations as its private counterparts in terms of investments and the processes applicable to pension fund administrators. A public AFP would be expected to set a lower administrative fee since such an entity would not seek to generate windfall profits; this would serve as a benchmark to help push down the administrative fees of its private counterparts.

The proposal for a state-owned AFP was discussed by academics and social planners during the second reform of structural pensions in Chile in 2008 (the so-called Marcel Commission). At present, this proposal has taken on renewed relevance in the context of the third Chilean pension reform process, led by the Bravo Commission, which has developed a series of proposals for change with a view to expanding coverage of the Chilean pension system and increasing pension purchasing power, with special emphasis on low-income sectors. As part of the Bravo Commission's review process, a nationally representative survey was commissioned: the results showed that 79% of respondents were in favor of creating a state AFP, and 69% would be willing to affiliate with such an entity if it were to exist. Although no such survey has been conducted in Peru, it might be reasonable to surmise that the results of such an exercise would be similar to those obtained in Chile, given the similarities between the private pension systems in both countries. Moreover, in the Bravo Commission's final report (Comisión Asesora Presidencial sobre el Sistema de Pensiones 2015), most of its members accepted the proposal to create a public AFP.

With respect to the solidarity fund, a number of possibilities exist for its management. It could be overseen by the state, one of the current AFPs, or another new firm specializing in investment management. As with the stock of SNP affiliates, a public procurement process could be conducted with respect to the management of such a fund. A further option is the creation of a new pension office as part of the NPO and the Superintendence of Banking, Insurance, and AFPs (Superintendencia de Banca, Seguros y AFP, SBS), which could be placed in charge of the affiliation and collection processes; this would make AFPs in their current form redundant. AFPs as they stand at present would cease to be necessary, and would be superseded by small, efficient and pure fund administrators; this would make the entry of new firms more feasible while facilitating competition in the management of investment and administrative fees.

6. CONCLUSIONS

This study shows that the pension system as currently designed is going to experience high levels of pension inequality and actuarial liabilities. The results of the simulation of the proposed MPS indicate that it is possible to reduce actuarial liabilities without affecting overall levels of affiliate well-being. Indeed, if the well-being analysis is neutral to inequality (that it, if there is no aversion to it), the multi-pillar system is found to be better than the one in place at present. The reform proposed and studied here is comprised of two pension pillars: the first is made up of the minimum pension financed by a proportion of contributions (β rate) that go to a solidarity fund, while the second is made up of contributions (α rate) that go the individual retirement accounts. It is worth mentioning that SPP affiliates would keep possession of their contribution balances following implementation of such a reform. It was also found that the greater the aversion to inequality considered in the well-being analysis, the higher the reduction of actuarial liabilities and inequality.

As with all new policies, the proposed reform could also influence the behavior of individuals and affect other sectors of the economy. For example, a very low contribution rate to individual accounts could discourage some workers, especially high-income ones, from remaining in the pension system. Moreover, job opportunities for these individuals could decrease, or employers might seek new forms of labor recruitment to avoid paying contributions. There is also an element of moral hazard, in that some individuals might decide not to contribute more years than is strictly necessary to earn a minimum pension. Given the limitations of these data, such potential responses cannot be estimated in this study, but it is important to point them out so that the proposed reform can be evaluated comprehensively.

Finally, the main lesson drawn from this study is that any pension reform would have to be evaluated on the basis of the effects that it might have on different dimensions of interest. This research has set out the multiple effects of the reform on pension debt, pension inequality, and the level of well-being of affiliates. Making the trade-offs in relation to these aspects visible and quantifying them is perhaps the most significant contribution of this study in helping economic policy-makers arrive at better decisions.

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APPENDIX

Table A1

Distribution of gross monthly pensions under the SPP, Peru, June 2014 (in soles)

Range	Number of retirees	Range	Number of retirees
> 5,000	1,182	900-1,000	2,928
4,500-5,000	354	800-900	4,041
4,000-4,500	438	700-800	4,223
3,500-4,000	637	600-700	4,655
3,000-3,500	961	500-600	4,939
2,750-3,000	689	400-500	12,407
2,500-2,750	784	300-400	5,210
2,250-2,500	893	200-300	6,094
2,000-2,250	1,117	100-200	7,430
1,900-2,000	601	90-100	204
1,800-1,900	663	80-90	180
1,700-1,800	782	70-80	152
1,600-1,700	921	60-70	128
1,500-1,600	1,123	50-60	114
1,400-1,500	1,264	40-50	128
1,300-1,400	1,329	30-40	117
1,200-1,300	1,784	20-30	116
1,100-1,200	2,167	10-20	132
1,000-1,100	2,655	< 10	144
		Total	73,686

Source: SBS.

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