How do we should charge administrative fees in an individual capitalization pension system?

Noelia Bernal, Daniel Castillo, Nicolas Dominguez and Javier Olivera*†

Abstract

The way fees are charged in an individual capitalization pension system has important consequences in present consumption and future pension wealth. This type of pension system is present in many Latin American countries, and hence it is important to assess potential effects of those fees. This paper profits from a policy change in Peru occurred in 2013 regarding the scheme of fees to study its potential impact on the wellbeing of workers and pensioners. The scheme changed from a front-end load fee regime (charges a percentage of the monthly wage) to a balance fee regime (charges an annual percentage of the pension balance). This study uses a micro-simulation model with detailed individual and administrative and survey data to study the future effects of the policy change. The results indicate that pensions and replacement rates will significantly decline with the balance fee scheme, and in particular for younger and richer individuals. Thus, this paper contributes to highlight the effects of alternative fees scheme that can be useful for other countries that are considering a similar policy change.

JEL classification: J32, G23
Key words: Social Security, Defined Contribution System, Balance fee, Front-end load fee, Micro-simulation.

---

*We are grateful to Fabrizio Orrego and Gonzalo Llosa for the suggestions provided. We would also like to thank people from the Superintendence of Banking and Insurance for providing the administrative data.

†Bernal:Netspar, University of Piura; e-mail: noelia.bernal@udep.pe. Castillo: University of Piura; e-mail: daniel.castillo@pregrado.udep.edu.pe. Dominguez: University of Piura; e-mail: nicolas.dominguez@pregrado.udep.edu.pe. Olivera: Luxembourg Institute of Socio-Economic Research (LISER); e-mail: javier.olivera@liser.lu.

1 Introduction

Social protection reforms for old-age have been an important issue in Latin America in the last 30 years. Following the pioneered experience of Chile, many countries of this region have implemented structural reforms, which introduced (totally or partially) defined contribution schemes (DC) in their social security systems. These schemes are, in general, administrated by the private sector, mandatory to formal employees and offer a pension based on individual saving accounts.

Although pension reforms had helped to make pension systems more financially sustainable across Latin America, there are still major challenges of the DC schemes. One of them is that the coverage rate has remained low, with acute differences between rural and urban areas and among income groups (Rofman and Oliveri, 2011). Another issue is the assessment of the potential impacts of market competition and fee (Kritzer, Kay and Sinha, 2011) on old-age pensions.

In this paper, we analyze the impact of a new fees scheme on expected pensions and replacement rates. We use the recent reform implemented in Peru on its DC system. In 2012, the authorities change from a front-end load fee regime (that charges a percentage of the monthly income) to a balance fee regime (that charges an annual percentage of the accumulated saving account)[1].

A first feature of our analysis is that we make use of a micro-simulation model of retirement. These models have enabled economists to project a variety of variables over time and under uncertainty, and to bring detailed results which add value to policy recommendations (Sonsbeek, 2011). Such models operate at individual level and ,therefore, they are able to capture the heterogeneity of the population and outperform the usually applied representative agent models. Given the fact that the impact of the reform in expected pensions will be in full force in the long run, a micro-simulation model seems the most natural starting point for our analysis.

A second feature of our study is that our micro-simulation model is applied to new administrative data from the Superintendence of Banking, Insurance and Private Pension Funds (SBS) which is a cross-sectional sample of 107,692 affiliates to the peruvian Private Pension System (SPP, for its acronym in Spanish) aged 18 to 64 years old in December 2013. The main advantage of this data is that it includes very accurate and detailed information on individual incomes, pension saving accounts, date of last contribution and whether the individual is entitled to a recognition bond. This level of accuracy will be most useful to predict future pensions and replacement rates under uncertainty. As far as we know, an

[1] Law 29903. For more details on this reform see Subsection 2.1.

analysis of the reform based on a micro-simulation model on such administrative data has not been conducted yet.

Some studies in Social Security in Pensions have been made by Alonso et al. (2014), Chavez-Bedoya and Ramirez-Rondan (2014), Aguila et al. (2014), Olivera (2010) and Bernal et al. (2008). Alonso et al. (2014) analyze the recent reform, but they use a representative agent model by groups and do not explore its impact on pensions and replacement rates. Chavez-Bedoya and Ramirez-Rondan (2014) develop a theoretical model to compare both fee schemes considering the present value of disbursements that affiliates will have to make, but they neither explore the effects on pensions nor have administrative data. Aguila et al. (2014) compares the impact on pension wealth for before and after Mexico's 2008 reform on fee scheme charged by pension fund managers (AFORE), but it does not take into account long-term effects of each fee scheme on pension wealth. Studies made by Bernal et al. (2008) and Olivera (2010) use administrative data and explore expected pensions like our study, but none of them focus on the recent reform[2].

In general, our model is able to exploit the heterogeneity and accuracy observed in the data. In the simulation, we observe that as individuals get older their pensions and replacement rates decline considerably when they are charged a balance fee instead to a front-end load one. This effect varies by age and income: younger individuals are more affected by the reform because of the expected growth on incomes and larger capitalization horizon whereas individuals on the highest quintiles of income are negatively affected due to the balance fee shall be levied on a higher saving account. We conduct our analysis using two scenarios: a non-competitive and a competitive scenario. The negative effects remain in the second scenario.

This analysis contrasts with some assumptions or arguments given on behalf of the reform's sake. One of them was that, by implementing a balance fee regime, individuals would have more present income during their life cycle. Indeed, a front-end load fee charges a percentage of the monthly income, which reduces present consumption whereas a balance fee charges an annual percentage of the accumulated saving account so directly reduces future consumption and favors present one. Therefore, the argument is true but it is incomplete to make welfare analysis. Does the reform seem to be welfare improving for individuals? The potential welfare impact of having more income today has to be analyzed considering the impact of having less income tomorrow (smaller pension during retirement) as a trade-off. The proper way to explore this could be to explore the impacts in terms of substitution between present and future consumption modelling preferences (see for instance Chavez-Bedoya and Ramirez-Rondan (2014)). Nevertheless, we may say that this reform under analysis does not

[2] Appendix A provides a more complete review on such studies and describes others.

necesarily matches the principal objectives of a social security system: providing sufficient old age pension.

The need for research on potential impacts before implementing this type of reforms seems crucial. This study focus on evaluating a specific reform and, by doing so, on having some piece of work that increases the understanding on this issue. The possibilities to further investigate this are broad and challenging.

The rest of the paper is organized as follows. Section 2 offers background of the Peruvian Social Security System and its 2012 reform; in addition, it describes the administrative data used for this study. Section 3 presents our micro-simulation model and gives details on how pensions and replacement rates are predicted. It also describe the crucial variables needed to simulate pension saving accounts. The estimation results are presented in Section 4. In Section 5, we conclude and provide some ideas on how to continue working on this topic.

2 Background and Data

2.1 Background

Peru has currently a parallel social security system. This means that 2 systems coexist at the time: one publicly administered by the State, the National Pension System (SNP, for its acronym in Spanish); and another privately administered by Pension Fund Managers (AFP, for its acronym in Spanish), the Private Pension System (SPP). The first scheme operates on the basis of a solidarity pillar in which active workers (rent generators) finance the pensions of those people going to retirement (Bernal et al., 2008). However, this scheme started to have financial and sustainability problems, among other reasons, due to the population ageing tendency, the inconstancy of the contributions of active workers and a poor financial management conducted by the government. Thus, in 1992 the SPP was launched, following the pioneering experience of Chile. This system left aside the solidarity pillar that characterizes the Pay-as-you-go systems and replaced it for one in which every affiliate would finance its own pension with the contributions that he makes during his active working life to his individual saving account. These accounts were privately managed by the AFPs, which could charge a management fee to the affiliates for doing so.

In 2013, the Peruvian Social Security System Reform came in force and established that balance fees would be mandatory for all Pension Fund Managers (before the reform, only front-end load management fees were allowed). However, this change has a transition period of 10 years, in which a two-component mixed fee will be applied: the first component is a front-end load fee, and the second component is a fee calculated on the basis of the new pension fund balance generated by contributions since the effective date in which the reform came in force (February 2013). The front-end load fee component will decrease until it disappears and, from then on, only a balance fee will be applied. For the existent affiliates before the reform, this mixed fee will be applied on the basis of their new contributions, unless they indicate (within time and means established by the Superintendency) their decision to remain under the old fee scheme (front-end load fee only). It is important to mention that the new affiliates after the reform do not have this option.

Between December of 1999 and December of 2014, 6 different AFP have operated in the SPP within different periods of time: Horizonte, Integra, Profuturo and Union Vida were already operating in 1999. The latter was no longer operating by the end of 2006, and, in the case of Horizonte, by the end of 2013. On the other side, Prima and Habitat started operations by the end of 2005 and middle 2013, respectively.

Under the Front-end load scheme, by the end of 1999, the lowest, the mean and the highest management fees were 2.30, 2.39 and 2.50%, respectively; and by the end of 2014, they were 1.55, 1.61 and 1.69%, respectively. Thus, within a 15-years period, there has been a small reduction on management fee levels, as it is shown in Figure 1. Under the mixed-fee scheme, for both components (front-end load and balance fee) there has been a significant reduction on fee levels (Figure 2) as the new pension fund manager Habitat enter the market, and as the date (September 2013) on which affiliates must decide if they wanted to return to the front-end load fee scheme or stay in the new balance fee scheme approached. However, it is worth noting that only a 23-months period is observed and further reductions can be expected over time depending on the competition level of the pension managers market.

2.2 Datasets

The database used to conduct the simulation consists of a random and stratified sample of administrative records drawn from the total population of SPP affiliates in December 2013 (SPP 2013). The sample size is 107,692 individuals that are 18-64 years old in December 2013, which is equivalent to 1.8% of the total population of affiliates. This database have detailed information on income, date of last contribution, pension fund balance, whether the affiliate has or not right to a recognition bond, actual value of the recognition bond, among others. These mentioned variables are required to predict pensions and replacement rates.

Moreover, we use two additional random and stratified administrative datasets that con-

Figure 1: Fee levels under Front-end Load Scheme

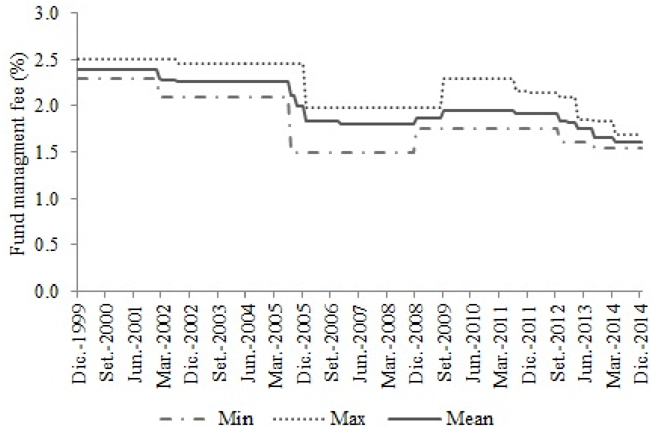
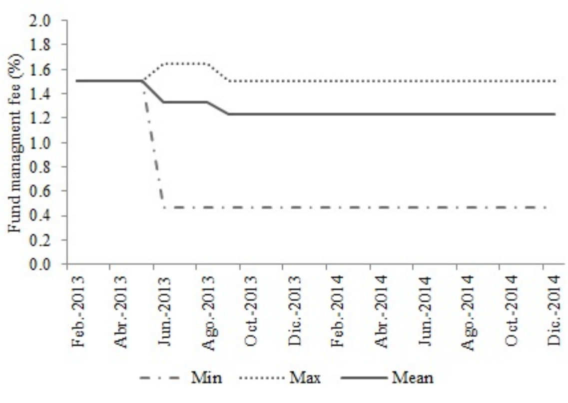
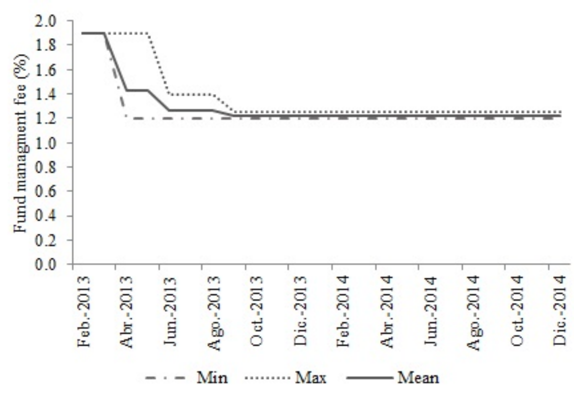


Figure 2: Fee levels under Mixed Scheme: Front-end Load and Balance Fee Components



(a) Front-end Load fee Component



(b) Balance fee Component

tain similar information to that of our principal database: the first one is a sample drawn from the total population of the SPP in December 2006 (SPP 2006), provided by the Superintendency, and we use it to compute annual income growth rates, as described in subsection 3.1; the second one is a sample drawn from the total population of the SNP in December 2013 (SNP 2013), provided by the National Pension System Administrator (ONP, for its acronym in Spanish), and we use it, together with the SPP 2013 database, to estimate a proxy of contribution density, as described in subsection 3.2.

2.3 Descriptive Analysis

The administrative database used to conduct the simulation (SPP 2013) has a total number of 94,808 observations. A larger presence of men over women is observed (64% and 36%, respectively), which is consistent with a still existing lower presence of women in the formal labor market. The average age is 38 with no major difference between men and women.

There is a high incidence of missing values in the income variable. To deal with this, and to be able to exploit as much information as possible from the database when conducting the simulation, we follow Olivera (2015) and estimate the income of these individuals by using an OLS regression [3]. The database also shows incomes that do not belong to the cross-section date, but to past dates. These will be updated by inflation, using the Consumer Price Index (IPC, for its acronym in Spanish).

Observations with monthly wages above 99th percentile and below 1st percentile are removed because they are considered as outliers, leaving us with a final number of 94,808 observations. Table 1 shows descriptive statistics for the administrative database used for simulations.

3 Model

Micro-simulation is a modelling technique that operates at individual unit levels, like persons, households and firms. The results of these models are known for providing richness in details, which adds value to projections and policy recommendations Sonsbeek (2011). Given that micro-simulation models operate at individual level, they capture the heterogeneity of the population and outperform the usually applied representative agent models. The model

[3] Where the logarithm of income is the dependent variable, and is estimated as a function of the following variables: logarithm of the pension balance, age of the individual, age squared, age to the power of 3, time spent in the SPP, time spent squared, time spent to the power of three, a dummy for sex, Pension Fund Manager, months contributed to a recognition bond, and the nominal value of the recognition bond

Table 1: Descriptive statistics of Administrative database

Variable	Total N=94808		Female N=33963		Male N=60845		With RB N=12,280		Without RB N=82,528	
	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.	Mean	Std. Dev.
Male (fraction)	64.18	-	0.00	-	100.00	-	?		?	
Age	37.75	10.47	36.80	10.14	38.28	10.61	52.21	5.86	35.59	9.21
Income in S/.	1723.71	2087.81	1557.09	1800.85	1816.72	2226.60	2242.26	2820.46	1646.55	1943.70
Last contribution year	2012.16	1.70	2012.14	1.72	2012.17	1.69	2012.38	1.59	2012.13	1.70
Enrolment year	2002.79	6.32	2003.21	6.35	2002.55	6.28	1994.56	1.84	2004.01	5.81
Pension Balance (CIC) in S/.	19230.95	49822.97	16773.96	39667.44	20602.41	54629.72	60104.30	101520.50	13149.07	32134.92
Bond entitlement (fraction)	12.95	-	11.41	-	13.81	-	100.00	-	0.00	-
Bond nominal value	3337.369	8768.759	3014.12	7546.853	3486.399	9274.691	3337.36	8768.75	-	-
Bond actual value in S/.	10361.83	26737.73	9312.25	22656.33	10845.73	28410.9	10361.83	26737.73	-	-
Type of fund (fraction)										
1 Conservative	2.92	-	2.15	-	3.36	-	12.99	-	1.43	-
2 Balanced	90.97	-	92.47	-	90.13	-	80.02	-	92.60	-
3 Risk taker	6.11	-	5.38	-	6.51	-	7.00	-	5.97	-

used in this paper projects individual pensions and replacement rates through the modelling of three major factors: monthly wage and its annual growth during the active working life of the affiliate until his retirement, the probability of contributing or not the next month to his pension fund, and the profitability of the fund in which the affiliate contributes. The pension value is computed with the following expression:

$$Pension_i = \frac{CIC_{i,t}^{65} + RB_i}{CRU_i} \tag{1}$$

Where $CIC_{i,t}^{65}$ is the pension balance accrued up to retirement age (65), RB_i is the real value of the Recognition Bond, and CRU_i is the annuity price for individual i. This last factor is computed with a given discount rate and survival probabilities drawn from the SPP's official life tables[4]. It is observed in Equation 2 that the value of the pension depends on the value of the accumulated fund at retirement date; and this, at the same time, depends on income, contribution density and the profitability of the pension fund. The replacement rate is the ratio of pension to wage. There is no agreement of what wage one should take to compute the replacement rate, (some researchers favor the last wage earned before retirement, while others favor an average of past years). In this study, we will use the last wage earned to compute the replacement rate.

$$RR_i = \frac{Pension_i}{W_{i,t}} \tag{2}$$

Equations 3 and 4 describe the monthly growth of the pension balance (CIC) until retirement date under two scenarios: under a front-end load fee scheme and a balance fee scheme, respectively. In the case of the balance fee scheme, two alternatives are considered: competitive and non-competitive scenario. In the non-competitive scenario, we will take a balance fee rate of $\lambda = 1.44\%$[5], which will be constant over time; in the competitive scenario, a decreasing long-term balance fee will take the same value and, gradually, reach $\lambda = 0.55\%$[6] in the long-term. The balance fee will be levied from the pension balance at the end of each year. According to the 2013 reform, the new balance fee will only be levied on funds accrued starting from January 2013.

$$CIC_{i,t+1}^{f} = CIC_{i,t}^{f} \times \left(1 + \frac{R_{t+1}}{21}\right)^{21} + W_{i,t+1} \times 0.10 \times contd_i \tag{3}$$

[4]CRU is 161.68 and 155.55 for females and males. It is assumed that every affiliate is married and that the husband is four years older than his wife

[5]Average balance fee rate in August 2013.

[6]Estimated balance fee as the long-term equilibrium SBS (2013).

$$CIC^s_{i,t+1} = CIC_{i,t_0} + (1-\lambda) \times \left(CIC^s_{i,t} \times \left(1 + \frac{R_{t+1}}{21}\right)^{21} + W_{i,t+1} \times 0.10 \times contd_i - CIC_{i,t_0} \right) \tag{4}$$

Where R_t is the monthly rate of return considered for the pension fund at period t (for more detail see subsection 3.1), W_t is the wage of the affiliate in period t and $contd_i$ is the proxy estimated for contribution density, as described in subsection 3.2. We use 21 in the equations, because we assume that a month only has 21 business days and, on the other hand, 0.10 is the fraction of the affiliate's wage that has to be contributed to the pension fund.

It is important to mention that, due to the fact that we do not count with a variable that shows under which commission scheme is the affiliate, the analysis in the current study is developed assuming two scenarios: one in which all the affiliates stay under the front-end load fee scheme, and other one in which everyone switch to the balance fee scheme. This, however, is not an obstacle for the micro-simulation model to provide inference over future pensions and replacement rates for different groups of age, sex and income level.

3.1 Wages

The micro-simulation model uses trajectories of real wage that follow growth rates g specific by sex, income quintile and age group (see equation 5). This growth rates are estimated using the SPP 2006 and 2013 databases, and then computed to the SPP 2013 database by birth cohort, in order to conduct the microsimulation process. This means, for example, that the median income in the 2006 database for men, in the highest income quintile, belonging to a certain age group, and thus to a determined birth cohort, will be compared with median income for men, in the highest income quintile and belonging to that same birth cohort in the 2013 database. It is important to mention that medians of incomes by sex, income quintile and group age are used to compute the growth rates, due to the fact that the median is not affected by outlier values, while the mean is affected by them. Table 2 shows these wage growth rates.

$$W_{i,t+1} = W_{i,t}(1 + g_{a,s,q}) \tag{5}$$

Where i refers to the individual affiliate, a to age group, s to sex and q to income quintile

Table 2: Annual Growth Rates (%) by age group and income quintile

Men						Women					
Age Group	Q1	Q2	Q3	Q4	Q5	Age Group	Q1	Q2	Q3	Q4	Q5
20-24	1.7	2.1	1.9	3.1	4.9	20-24	0.2%	2.6%	1.9%	2.8%	3.4%
25-29	1.5	1.9	2.1	2.5	4.2	25-29	0.6%	2.2%	1.6%	2.5%	3.8%
30-34	1.7	1.9	1.7	2.8	3.2	30-34	1.2%	1.9%	1.2%	2.2%	2.9%
35-39	1.0	1.9	1.8	2.5	2.4	35-39	1.0%	1.8%	1.0%	2.4%	3.2%
40-44	1.3	1.9	1.6	2.5	2.8	40-44	1.2%	1.7%	1.0%	3.0%	4.4%
45-49	1.1	1.6	1.8	2.2	3.0	45-49	2.3%	1.7%	1.1%	3.0%	3.4%
50-54	1.8	1.7	1.8	2.5	3.2	50-54	0.3%	1.6%	1.3%	2.9%	1.6%
55-59	1.6	2.0	1.6	2.7	3.2	55-59	1.5%	2.6%	1.5%	2.0%	2.4%
60-64	0.0	0.0	0.0	0.0	0.0	60-64	0.0%	0.0%	0.0%	0.0%	0.0%

3.2 Contribution density

Contribution density is defined as the number of contributed months over the total number of months that the individual has been affiliated with the SPP. A low contribution density can be consequence, among other reasons, of long term unemployment and periods of informal employment. This last feature is common in a country like Peru and other Latin American countries that exhibit large informal sectors. Given the unavailability of the exact contribution density, a proxy must be estimated. Following Olivera (2015) , we use the SPP and SNP 2013 databases to conduct a probit model for such estimation, where the dependent variable is a dummy variable that takes a value of 1 if the affiliate has contributed in November or December of 2013, and 0 otherwise.

$$pcontd_i = \beta_0 + \beta_1 male_i + \beta_2 age_i + \beta_3 age_i^2 + \beta_4 system_i + \beta_5 inc10_i + \beta_6 inc10_i^2 + \varepsilon_i \qquad (6)$$

Where $pcontd_i$ is the probability that the affiliate contributes the next month whether he has contributed or not within the two months prior to the data collection; male is a dummy variable for sex, $system_i$ shows the tipe of pension system and $inc10_i$ is the decile of income to which the affiliate belongs to.

This proxy of contribution density will be used to provide more heterogeneity to the micro-simulation model: the estimated mean probability of contribution will be computed by sex and income decile to every single individual. It is important to mention that this is the best possible estimation with the available data. Results are shown in Table 3

Table 3: Mean Probability of Contribution by sex and income decile

Income Decile	Female	Male
1	0.3264	0.2668
3	0.4445	0.3770
4	0.5045	0.4356
5	0.5624	0.4938
6	0.6197	0.5513
7	0.6723	0.6066
8	0.7208	0.6593
9	0.7652	0.7084
10	0.8054	0.7544

3.3 Return rate of pension funds

The rate of return of pension funds is a crucial determinant of the pensions levels that the affiliates will receive and is measured by the variations in the share value, which is a measure used by the Pension Fund Managers to standardize the value of each fund[7] given that they invest in diverse instruments.

The pension an affiliate will receive depends directly on the pension balance at retirement date, while this will be equal to the share value of the day (this varies daily) multiplied by the number of shares the affiliate owns. It is important to mention that the number of shares an affiliate owns depends of the number and amount of the contributions made during his active working life as an affiliate.

Normally, literature about social security assumes scenarios with fixed profitability rates along the projection horizon, which is a really strong assumption, given that historical evidence shows that returns are not fixed through time. This is the case of studies like the ones made by Bernal et al. (2008), Olivera (2010), Alonso et al. (2014). Thus, in this study we follow Chavez-Bedoya and Ramirez-Rondan (2014) and use a Geometric Brownian Motion (GBM)(like the one in Figure 3) to model the path that the share value will follow in the future and achieve an adequate modelling of profitability. The GBM is a stochastic process that has a deterministic component and also a random one; this last one is given by a Wiener process. It is also observed in Figure 3 how good the GBM, using historical parameters, predicts real observed returns from 2001 to 2014. The GBM follows the following stochastic differential equation:

[7] In 2005, the 'multi-fund' system was created to give the affiliates wider investment options according to their risk appetite. Fund 2 is used for the calculus made in this study

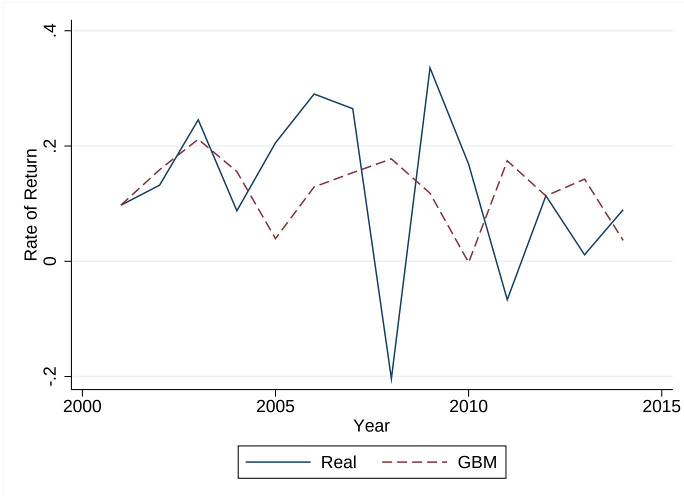


Figure 3: Simulated returns using a GMB (2001-2014)

$$dV(t) = \mu V(t)dt + \sigma V(t)dB(t), V(0) = V_0 \quad (7)$$

Historical share value returns adjusted by inflation from January 2001 to December 2014 from Integra AFP[8] are used to calculate the monthly volatility (which multiplied by the Wiener Process is part of the random component of the GBM); this is done following Chavez-Bedoya and Ramirez-Rondan (2014). It must be mentioned that due to the abnormal returns that took place since 2005 until 2011, these years are not included in the calculus. After this, $\sigma = 1.27\%$ is obtained.

On the other hand, for the deterministic component of the GBM, a real annual rate of return of 5% is assumed. This assumption is made following the recommendations of the Superintendency (SBS, 2013) on its Technical Appendix 1. This is consistent with the fact that, as an economy registers a sustainable growth and its stock market develops, a reduction of the country risk so as a reduction of the rate of return of the Pension Fund investments are expected. In that line, evidence from pension funds from OCDE country members shows that real annualized rate of return from these countries was lower than 5% for the 2002-2011 period. Likewise, the real annualized rate of return of the Chilean Private Pension System (which has been operating more than 30 years) decreased from 14% on the first 10 years of operation to 5% on the first 30 years of operation.

1,000 simulations of the GBM are made in order to obtain different paths that the share value could take and, therefore, different rate of return options. We took the average of all simulations, and thus obtained a reasonable average path, more in line with a standard

[8]This AFP is taken as an adequate Benchmark of the SPP due to the fact that it was the only AFP that remained or did not go through a fusion process since the beginning of the available historical observations

Table 4: Projected annual Returns-Average of the 1000 GBM

Year	R%	Year	R%	Year	R%	Year	R%
2015	5.51%	2027	5.30%	2039	5.28%	2051	5.64%
2016	5.40%	2028	5.54%	2040	5.46%	2052	5.71%
2017	5.56%	2029	5.50%	2041	5.80%	2053	5.58%
2018	5.62%	2030	5.53%	2042	5.66%	2054	5.64%
2019	5.55%	2031	5.35%	2043	5.62%	2055	5.51%
2020	5.41%	2032	5.70%	2044	5.63%	2056	5.51%
2021	5.42%	2033	5.51%	2045	5.73%	2057	5.55%
2022	5.58%	2034	5.40%	2046	5.57%	2058	5.40%
2023	5.61%	2035	5.75%	2047	5.38%	2059	5.82%
2024	5.46%	2036	5.57%	2048	5.27%	2060	5.64%
2025	5.63%	2037	5.60%	2049	5.40%	2061	5.30%
2026	5.59%	2038	5.68%	2050	5.61%		

return provided by the Pension Fund Managers. Returns projected until year 2061 (year in which the youngest affiliate in the sample goes to retirement) are presented in Table 4.

4 Results

Intuitively, changing to balance fee scheme affects affiliates as it replaces future income (lower pensions) with present income (increased monthly disposable income). Therefore, in this section, we present results of comparing pensions and replacement rates under both fee schemes in groups determined by sex and income quintile. Furthermore, heterogeneous results will be described among these groups for each of the nine age groups there are. Finally, a comparison analysis on money disbursement throughout the horizon period of contribution to the SPP under both fee schemes is made.

In order to achieve robustness analysis, first, it is considered a scenario in which the balance fee charged on average by the SPP will maintain the same level that has from a starting point (suggesting that there is no decline in fee rates for competition). This scenario will be considered as the *non-competitive scenario*. Second, another scenario on which these rates do get lower during the contribution horizon (following the same assumptions raised by the SBS (2013) about the evolution of the balance fee) is contemplated. The latter will be considered as the *competitive scenario*.

Results found from using a static micro-simulation model suggests that pensions and replacement rates decrease because of the reform, specifically because of the change in fee charging scheme.

4.1 Flat balance fee

For the analysis made based on a fixed balance fee over time, evidence shows that younger affiliates are the most affected in terms of further reduction in their pension, compared with other older affiliates (see Table 5). This is what was expected, since young people have a greater expected horizon for capitalization of their pension balance, which will allow the fee to levy a growing balance fund for a longer period of time. Thus, it can be said that the negative effect on pensions for changing the fee scheme is decreasing in the age of the affiliate.

On the other hand, it is also concluded that individuals in the upper income quintile will be always more affected in terms of reduction of their pension. This is intuitive, since it is expected that the higher the income is (and thus, the higher the contributions to the pension balance), the greater will be the burden of a fee that levies the pension balance. It can also be argued that people with high income levels may have more chance to keep increasing their wages in the future, as a consequence of higher productivity gains throughout their active working live. This will lead them to, once again, make bigger contributions to the pension balance and, thus, face a greater negative effect on their final retirement pension.

Together with the findings in the affiliates' pension analysis, affiliates to be the most affected in terms of further reducing of their replacement rate as a result of the reform are the youngest, due to the aforementioned higher horizon of expected capitalization to their individual accounts, which will allow the balance fee to levy over a growing fund during a longer period of time.

However, the negative effect of the balance fee on the replacement rate has its top in the third quintile, and then starts to decreases in the fourth and fifth quintile; unlike the pension analysis, in which the negative effect had its top in the fifth quintile. It can be observed in Table 6 that, for all group ages, the negative effect due to the balance fee increases until the third quintile and then, starts to decrease in the following ones.

This can be explained because the replacement rate is a relative indicator (unlike the pension, which is an absolute one) that shows what proportion of the individual's income is covered by the pension received. Taken this into account, and also the fact that the wage used to build the replacement rate in this study is the last one during the affiliate's active working live, and thus, by construction of the model, the highest income that the affiliate will have, a possible explanation for these results would be that, even though the pension is lower under the balance fee scheme for every income quintile category (compared with the front-end load scheme), the higher wage taken to built the replacement rate in the last two quintiles will shorten the difference between the replacement rates under the two different fee scheme scenarios and thus, make the negative effect smaller.

4.2 Decreasing balance fee

Assuming a scenario of declining balance fee over time, as argued by the SBS (2013), the results found are very similar to those found by assuming a flat balance fee over time: pensions and replacement rates will be reduced as a result of the change in fee scheme, however, they do so in a smaller magnitude.

Thus, in Table 7, it can be observed that as a consequence of the reform, younger individuals will be most affected in terms of their pension while richer affiliates will see their pensions reduced in larger magnitudes than for those with no college education.

On the other hand, Table 8 shows the same pattern observed in the replacement rate analysis when a constant balance fee was assumed over time (see Table 6): young affiliates will see their replacement rates reduced to a greater extent than older affiliates; whereas, once again, the greater negative impact on replacement rates has its top in the third quintile and then decreases.

However, it is worth noting that the biggest difference in the magnitudes of the effects between analysis assuming constant and decreasing balance fees, it is observed for younger affiliates. This is because, in case fees are not reduced over time as suggested by the SBS, younger affiliates are those who would have to face non-decreasing charges, levying on their individual pension account for a longer period of time.

4.3 Cost comparison analysis

So far, the analysis provided here consists in quantifying pensions and replacement rates the affiliates will receive as a measure of whether the migration to a balance fee regime is beneficial for these affiliates or not.

However, this measure would be incomplete since this reform proposes a trade-off for the affiliate: the individual will have a lower pension but higher monthly disposable income. Therefore, we propose a similar methodology raised by the application of the SBS (2013) to compare the amounts of money that should be disbursed by the affiliate under both fee schemes. The amounts of money disbursed are annualized and discounted at an annual rate of 4 % in order to obtain present values and, thus, make the comparison.

Table 9 indicates the proportion of affiliates of each heterogeneous group (by sex, income quintile and age) that would *spend less* if they would be charged the front-end load fee (over their monthly income). An increasing trend is observed in the proportion of affiliates which would spend less money if they were under the front-end load fee along the horizon of age, so as along the income quintiles (the higher the income level, the more expensive the balance fee).

The explanation for this is that the balance fee, in the first 10 years of its implementation, is actually a *mixed fee*[9], which includes a charging component over the accumulated pension fund (balance fee) and other over the monthly income (front-end load fee). This last component over remuneration will be reduced to zero in February 2023, according to **Resolucion SBS No. 8514-2012**. Therefore, affiliates who are closest to retire will have to deal with a double collection fee for being in the *mixed fee* scheme, which will make cheaper to stay under the front-end load fee regime.

On the other hand, front-end load fee along the contribution period had been assumed to be constant, as indicated by SBS (2013); because this regime only applies to those individuals who asked to stay in it, who eventually will disappear from the SPP.

Meanwhile, the balance fee (*mixed fee*) is assumed to be decreasing during the contribution horizon. Therefore, larger annual amounts shall be disbursed in the front-end load fee regime. However, the balance fee, for levying on the accumulated fund, will mean higher payments from affiliates as the fund is greater. This will happen as incomes are higher and as the affiliate has more years contributing. This suggests that we should expect young people (who have a higher horizon for capitalization of their fund and for income growth) to disburse larger amounts of money under a balance fee regime as they approach to retirement age. This higher cost that will be incurred by young affiliates in the distant future is not reflected because this cost comparison analysis is done using present value of disbursements. This means that these higher costs are reduced because they are far from the current time period, making believe that being on a balance fee scheme is cheaper than being on a front-end load fee.

It is important to notice that something different happens in the non competitive scenario, shown in Table 10, where a high concentration of people for whom the front-end load fee would be cheaper (in terms of disbursements along the active working live) is observed among the younger and richer affiliates.

This can be explained because, in this scenario, the balance fee would not decrease over time and that implies that younger affiliates with a longer capitalization horizon and also the ones that belong to the higher quintiles of income, who are expected to have greater growth of their pension balances, will face a greater burden because of the balance fee. That is why there is a high concentration of people for whom the front-end load fee would be cheaper

[9] As described in Subsection 2.1.

among the two mentioned groups.

Table 5: Differences in Pensions by age, sex and income quintile: Non Competitive Scenario

Age	Fee	Male										Female									
Group	Scheme	Q1		Q2		Q3		Q4		Q5		Q1		Q2		Q3		Q4		Q5	
<=25	F/E Load	375	**118**	587	**180**	1175	**358**	2192	**640**	5424	**1523**	398	**125**	670	**204**	1159	**360**	2287	**664**	5409	**1508**
		(63)		(200)		(228)		(424)		(2625)		(53)		(206)		(217)		(431)		(2381)	
	Balance	257		407		817		1552		3901		273		466		798		1624		3902	
		(42)		(137)		(154)		(291)		(1902)		(33)		(142)		(146)		(297)		(1723)	
26-30	F/E Load	295	**79**	467	**123**	924	**245**	1754	**453**	4929	**1245**	297	**81**	520	**137**	909	**246**	1805	**465**	5316	**1328**
		(112)		(200)		(212)		(376)		(2946)		(70)		(194)		(195)		(388)		(3027)	
	Balance	216		344		679		1301		3684		216		383		663		1340		3989	
		(84)		(148)		(155)		(275)		(2204)		(52)		(143)		(140)		(285)		(2277)	
31-35	F/E Load	243	**55**	391	**87**	746	**168**	1386	**307**	4152	**908**	240	**55**	422	**94**	736	**169**	1420	**313**	4379	**950**
		(170)		(194)		(225)		(355)		(2940)		(104)		(203)		(224)		(348)		(2547)	
	Balance	188		304		578		1078		3244		184		327		567		1107		3429	
		(136)		(153)		(177)		(276)		(2301)		(83)		(161)		(176)		(271)		(1992)	
36-40	F/E Load	188	**35**	340	**61**	616	**112**	1096	**199**	3581	**643**	191	**36**	368	**66**	617	**114**	1177	**211**	3766	**676**
		(179)		(238)		(262)		(378)		(3000)		(141)		(226)		(240)		(373)		(2636)	
	Balance	154		280		504		898		2938		155		302		504		966		3090	
		(151)		(199)		(219)		(314)		(2465)		(118)		(190)		(201)		(310)		(2157)	
41-45	F/E Load	161	**22**	310	**41**	503	**70**	885	**123**	3024	**416**	160	**23**	345	**46**	560	**76**	969	**133**	3419	**467**
		(237)		(317)		(315)		(392)		(2684)		(293)		(277)		(268)		(340)		(2576)	
	Balance	139		269		434		761		2608		137		299		483		836		2952	
		(210)		(281)		(279)		(344)		(2317)		(258)		(245)		(236)		(297)		(2225)	
46-50	F/E Load	126	**12**	277	**25**	407	**38**	704	**68**	2604	**245**	117	**12**	291	**26**	489	**45**	802	**75**	2615	**246**
		(465)		(279)		(247)		(458)		(2619)		(185)		(219)		(306)		(357)		(1959)	
	Balance	114		253		369		636		2359		105		265		444		727		2369	
		(428)		(259)		(228)		(421)		(2388)		(173)		(202)		(285)		(330)		(1779)	
51-55	F/E Load	85	**5**	219	**11**	322	**18**	547	**30**	2199	**115**	72	**5**	240	**12**	397	**21**	633	**34**	2221	**121**
		(185)		(236)		(278)		(388)		(2144)		(77)		(186)		(253)		(282)		(1796)	
	Balance	80		208		305		517		2084		67		228		376		599		2100	
		(177)		(226)		(267)		(371)		(2041)		(74)		(179)		(243)		(271)		(1702)	
56-60	F/E Load	71	**2**	157	**3**	254	**5**	427	**9**	1831	**37**	48	**1**	196	**4**	313	**7**	548	**12**	1679	**34**
		(334)		(177)		(258)		(428)		(1867)		(100)		(237)		(203)		(1152)		(1172)	
	Balance	69		154		249		418		1794		47		192		307		535		1644	
		(328)		(175)		(255)		(423)		(1835)		(100)		(233)		(199)		(1127)		(1150)	
61-65	F/E Load	52	**0**	134	**0**	200	**1**	368	**1**	1759	**6**	48	**0**	134	**0**	238	**1**	378	**2**	1519	**5**
		(126)		(204)		(226)		(582)		(1813)		(148)		(136)		(291)		(288)		(1062)	
	Balance	51		134		199		367		1753		48		134		237		376		1514	
		(126)		(203)		(226)		(581)		(1807)		(148)		(135)		(290)		(287)		(1059)	

* Standard deviations are shown between parenthesis, whereas bold numbers are the differences in pensions under front-end load and under balance fee.

** Differences are shown in Nuevos Soles (Peruvian currency)

Table 6: Differences on Replacement Rates (%) by age, sex and income quintile: Non Competitive Scenario

Age Group	Fee Scheme	Male										Female									
		Q1		Q2		Q3		Q4		Q5		Q1		Q2		Q3		Q4		Q5	
<=25	F/E Load	29.0	**9.1**	33.4	**10.2**	53.3	**16.2**	49.7	**14.5**	51.2	**14.5**	28.7	**9.0**	36.7	**11.1**	63.5	**19.7**	49.2	**14.3**	53.5	**15.0**
		(4.7)		(9.6)		(6.0)		(4.0)		(6.3)		(3.7)		(9.2)		(6.7)		(3.5)		(6.9)	
	Balance	19.9		23.2		37.1		35.2		36.7		19.7		25.5		43.8		35.0		38.5	
		(3.1)		(6.7)		(4.0)		(2.6)		(4.0)		(2.5)		(6.4)		(4.3)		(2.3)		(4.6)	
26-30	F/E Load	23.4	**6.3**	30.8	**8.1**	45.5	**12.1**	44.7	**11.5**	42.7	**10.8**	27.0	**7.4**	32.8	**8.6**	54.0	**14.6**	45.4	**11.7**	45.0	**11.2**
		(8.8)		(12.2)		(7.7)		(5.3)		(3.8)		(6.5)		(10.9)		(7.7)		(5.3)		(4.0)	
	Balance	17.1		22.7		33.4		33.2		31.9		19.6		24.1		39.4		33.7		33.7	
		(6.7)		(9.1)		(5.7)		(3.9)		(2.8)		(4.9)		(8.2)		(5.6)		(3.9)		(3.0)	
31-35	F/E Load	20.8	**4.7**	28.3	**6.3**	40.3	**9.1**	40.2	**8.9**	39.4	**8.6**	22.3	**5.1**	30.0	**6.7**	47.5	**10.9**	40.5	**8.9**	41.8	**9.0**
		(14.6)		(13.4)		(10.7)		(7.5)		(6.1)		(9.6)		(14.0)		(13.3)		(6.6)		(6.2)	
	Balance	16.1		22.0		31.2		31.3		30.8		17.1		23.3		36.6		31.6		32.8	
		(11.7)		(10.7)		(8.5)		(5.9)		(4.9)		(7.7)		(11.2)		(10.6)		(5.2)		(5.0)	
36-40	F/E Load	17.5	**3.2**	27.2	**4.8**	36.6	**6.7**	36.1	**6.5**	37.1	**6.6**	18.5	**3.5**	29.1	**5.2**	42.9	**7.9**	38.0	**6.8**	39.9	**7.1**
		(16.6)		(18.8)		(14.6)		(10.7)		(9.7)		(13.7)		(17.6)		(15.7)		(9.8)		(9.8)	
	Balance	14.3		22.4		29.9		29.6		30.5		15.0		23.9		35.0		31.2		32.8	
		(14.1)		(15.8)		(12.3)		(9.0)		(8.2)		(11.5)		(14.9)		(13.3)		(8.2)		(8.3)	
41-45	F/E Load	16.0	**2.2**	27.1	**3.6**	32.8	**4.5**	33.0	**4.6**	35.2	**4.8**	16.3	**2.3**	30.0	**4.0**	41.6	**5.7**	34.6	**4.8**	40.5	**5.5**
		(23.4)		(27.5)		(21.7)		(13.7)		(13.4)		(29.5)		(23.9)		(19.7)		(10.4)		(14.4)	
	Balance	13.8		23.5		28.3		28.4		30.4		13.9		26.0		35.9		29.9		35.0	
		(20.7)		(24.4)		(19.3)		(12.1)		(11.9)		(26.0)		(21.1)		(17.5)		(9.1)		(12.8)	
46-50	F/E Load	13.3	**1.3**	26.7	**2.3**	28.9	**2.7**	29.6	**2.8**	32.5	**3.0**	12.7	**1.3**	27.7	**2.5**	37.9	**3.5**	32.6	**3.0**	37.2	**3.4**
		(48.2)		(26.8)		(17.3)		(17.7)		(16.4)		(20.4)		(20.8)		(22.5)		(13.1)		(16.3)	
	Balance	12.0		24.3		26.2		26.7		29.5		11.4		25.2		34.4		29.5		33.8	
		(44.3)		(24.9)		(16.1)		(16.3)		(15.2)		(19.1)		(19.2)		(20.9)		(12.1)		(15.1)	
51-55	F/E Load	9.5	**0.6**	23.0	**1.1**	24.7	**1.4**	26.2	**1.4**	32.1	**1.7**	8.4	**0.5**	24.8	**1.2**	32.3	**1.7**	29.3	**1.6**	34.0	**1.8**
		(20.6)		(24.6)		(21.3)		(18.5)		(16.6)		(8.9)		(18.8)		(21.0)		(12.4)		(15.5)	
	Balance	9.0		21.8		23.4		24.8		30.4		7.9		23.6		30.6		27.7		32.2	
		(19.6)		(23.6)		(20.5)		(17.8)		(16.0)		(8.6)		(18.0)		(20.1)		(12.0)		(14.9)	
56-60	F/E Load	8.5	**0.2**	18.0	**0.3**	21.3	**0.4**	23.1	**0.5**	28.9	**0.6**	6.0	**0.2**	22.0	**0.4**	27.0	**0.6**	30.0	**0.7**	32.2	**0.6**
		(39.6)		(20.3)		(21.5)		(23.8)		(17.7)		(12.3)		(26.5)		(17.8)		(68.4)		(14.7)	
	Balance	8.3		17.7		20.9		22.6		28.4		5.8		21.6		26.5		29.4		31.5	
		(38.9)		(20.1)		(21.3)		(23.6)		(17.4)		(12.3)		(26.1)		(17.4)		(66.9)		(14.5)	
61-65	F/E Load	6.6	**0.0**	16.5	**0.1**	18.4	**0.1**	21.4	**0.1**	28.2	**0.1**	6.3	**0.0**	16.3	**0.1**	22.1	**0.1**	22.8	**0.1**	29.3	**0.1**
		(16.3)		(24.7)		(21.1)		(35.0)		(18.1)		(19.5)		(16.6)		(25.3)		(17.2)		(16.6)	
	Balance	6.6		16.4		18.3		21.3		28.1		6.3		16.3		22.1		22.7		29.2	
		(16.2)		(24.7)		(21.1)		(34.9)		(18.0)		(19.5)		(16.6)		(25.2)		(17.1)		(16.6)	

* Standard deviations are shown between parenthesis, whereas bold numbers are the differences in replacement rates under front-end load and under balance fee.

** Differences are shown percentage points)

Table 7: Differences on Pensions by age, sex and income quintile: Competitive Scenario

Age Group	Fee Scheme	Male										Female									
		Q1		Q2		Q3		Q4		Q5		Q1		Q2		Q3		Q4		Q5	
<=25	F/E Load	375	**58**	587	**89**	1175	**177**	2192	**312**	5424	**732**	398	**62**	670	**100**	1159	**179**	2287	**323**	5409	**725**
		(63)		(200)		(228)		(424)		(2625)		(53)		(206)		(217)		(431)		(2381)	
	Balance	317		498		998		1880		4692		336		569		979		1964		4685	
		(52)		(169)		(192)		(359)		(2277)		(43)		(174)		(182)		(366)		(2064)	
26-30	F/E Load	295	**40**	467	**62**	924	**124**	1754	**226**	4929	**615**	297	**41**	520	**69**	909	**125**	1805	**232**	5316	**653**
		(112)		(200)		(212)		(376)		(2946)		(70)		(194)		(195)		(388)		(3027)	
	Balance	255		405		800		1528		4314		255		451		784		1573		4663	
		(97)		(173)		(183)		(325)		(2579)		(61)		(168)		(167)		(336)		(2657)	
31-35	F/E Load	243	**29**	391	**46**	746	**89**	1386	**160**	4152	**470**	240	**29**	422	**50**	736	**90**	1420	**163**	4379	**489**
		(170)		(194)		(225)		(355)		(2940)		(104)		(203)		(224)		(348)		(2547)	
	Balance	213		345		658		1226		3681		210		372		646		1257		3890	
		(152)		(172)		(199)		(314)		(2608)		(92)		(181)		(198)		(308)		(2262)	
36-40	F/E Load	188	**20**	340	**34**	616	**63**	1096	**111**	3581	**358**	191	**20**	368	**37**	617	**64**	1177	**118**	3766	**373**
		(179)		(238)		(262)		(378)		(3000)		(141)		(226)		(240)		(373)		(2636)	
	Balance	169		306		553		985		3223		171		330		553		1059		3393	
		(163)		(216)		(237)		(342)		(2702)		(128)		(205)		(218)		(338)		(2373)	
41-45	F/E Load	161	**13**	310	**25**	503	**42**	885	**73**	3024	**248**	160	**14**	345	**28**	560	**46**	969	**79**	3419	**276**
		(237)		(317)		(315)		(392)		(2684)		(293)		(277)		(268)		(340)		(2576)	
	Balance	148		285		461		811		2776		146		318		513		890		3143	
		(221)		(295)		(292)		(364)		(2467)		(273)		(258)		(249)		(315)		(2369)	
46-50	F/E Load	126	**10**	277	**19**	407	**30**	704	**53**	2604	**193**	117	**9**	291	**20**	489	**36**	802	**59**	2615	**194**
		(465)		(279)		(247)		(458)		(2619)		(185)		(219)		(306)		(357)		(1959)	
	Balance	117		258		377		651		2412		108		270		453		743		2421	
		(436)		(263)		(232)		(430)		(2437)		(175)		(206)		(289)		(336)		(1818)	
51-55	F/E Load	85	**5**	219	**10**	322	**16**	547	**28**	2199	**106**	72	**4**	240	**11**	397	**19**	633	**31**	2221	**111**
		(185)		(236)		(278)		(388)		(2144)		(77)		(186)		(253)		(282)		(1796)	
	Balance	81		209		306		519		2093		68		229		377		602		2110	
		(178)		(227)		(268)		(373)		(2049)		(74)		(180)		(244)		(272)		(1711)	
56-60	F/E Load	71	**2**	157	**3**	254	**5**	427	**9**	1831	**37**	48	**1**	196	**4**	313	**7**	548	**12**	1679	**34**
		(334)		(177)		(258)		(428)		(1867)		(100)		(237)		(203)		(1152)		(1172)	
	Balance	69		154		249		418		1794		47		192		307		535		1644	
		(328)		(175)		(255)		(423)		(1835)		(100)		(233)		(199)		(1127)		(1150)	
61-65	F/E Load	52	**0**	134	**0**	200	**1**	368	**1**	1759	**6**	48	**0**	134	**0**	238	**1**	378	**2**	1519	**5**
		(126)		(204)		(226)		(582)		(1813)		(148)		(136)		(291)		(288)		(1062)	
	Balance	51		134		199		367		1753		48		134		237		376		1514	
		(126)		(203)		(226)		(581)		(1807)		(148)		(135)		(290)		(287)		(1059)	

* Standard deviations are shown between parenthesis, whereas bold numbers are the differences in pensions under front-end load and under balance fee.

** Differences are shown in Nuevos Soles (Peruvian currency)

Table 8: Differences on Replacement Rates (%) by age, sex and income quintile: Competitive Scenario

Age Group	Fee Scheme	Male										Female									
		Q1		Q2		Q3		Q4		Q5		Q1		Q2		Q3		Q4		Q5	
<=25	F/E Load	29	**4.5**	33.4	**5**	53.3	**8**	49.7	**7.1**	51.2	**6.9**	28.7	**4.5**	36.7	**5.5**	63.5	**9.8**	49.2	**6.9**	53.5	**7.2**
		(4.7)		(9.6)		(6)		(4)		(6.3)		(3.7)		(9.2)		(6.7)		(3.5)		(6.9)	
	Balance	24.5		28.4		45.3		42.6		44.3		24.2		31.2		53.7		42.3		46.3	
		(3.9)		(8.2)		(5)		(3.3)		(5.2)		(3.1)		(7.8)		(5.5)		(2.9)		(5.8)	
26-30	F/E Load	23.4	**3.2**	30.8	**4.1**	45.5	**6.1**	44.7	**5.7**	42.7	**5.3**	27	**3.8**	32.8	**4.4**	54	**7.4**	45.4	**5.8**	45	**5.6**
		(8.8)		(12.2)		(7.7)		(5.3)		(3.8)		(6.5)		(10.9)		(7.7)		(5.3)		(4)	
	Balance	20.2		26.7		39.4		39		37.4		23.2		28.4		46.6		39.6		39.4	
		(7.7)		(10.7)		(6.6)		(4.6)		(3.3)		(5.7)		(9.5)		(6.7)		(4.6)		(3.5)	
31-35	F/E Load	20.8	**2.5**	28.3	**3.3**	40.3	**4.8**	40.2	**4.6**	39.4	**4.5**	22.3	**2.8**	30	**3.5**	47.5	**5.8**	40.5	**4.6**	41.8	**4.7**
		(14.6)		(13.4)		(10.7)		(7.5)		(6.1)		(9.6)		(14)		(13.3)		(6.6)		(6.2)	
	Balance	18.3		25		35.5		35.6		34.9		19.5		26.5		41.7		35.9		37.1	
		(13)		(11.9)		(9.5)		(6.7)		(5.4)		(8.6)		(12.5)		(11.9)		(5.9)		(5.5)	
36-40	F/E Load	17.5	**1.8**	27.2	**2.7**	36.6	**3.8**	36.1	**3.6**	37.1	**3.7**	18.5	**2**	29.1	**2.9**	42.9	**4.5**	38	**3.8**	39.9	**4**
		(16.6)		(18.8)		(14.6)		(10.7)		(9.7)		(13.7)		(17.6)		(15.7)		(9.8)		(9.8)	
	Balance	15.7		24.5		32.8		32.5		33.4		16.5		26.2		38.4		34.2		35.9	
		(15.2)		(17.1)		(13.3)		(9.7)		(8.9)		(12.4)		(16.1)		(14.3)		(8.9)		(8.9)	
41-45	F/E Load	16	**1.3**	27.1	**2.1**	32.8	**2.7**	33	**2.7**	35.2	**2.9**	16.3	**1.4**	30	**2.4**	41.6	**3.4**	34.6	**2.8**	40.5	**3.3**
		(23.4)		(27.5)		(21.7)		(13.7)		(13.4)		(29.5)		(23.9)		(19.7)		(10.4)		(14.4)	
	Balance	14.7		25		30.1		30.3		32.3		14.9		27.6		38.2		31.8		37.2	
		(21.8)		(25.6)		(20.1)		(12.8)		(12.5)		(27.4)		(22.2)		(18.4)		(9.7)		(13.4)	
46-50	F/E Load	13.3	**1.1**	26.7	**1.9**	28.9	**2.1**	29.6	**2.3**	32.5	**2.4**	12.7	**1**	27.7	**2**	37.9	**2.8**	32.6	**2.4**	37.2	**2.7**
		(48.2)		(26.8)		(17.3)		(17.7)		(16.4)		(20.4)		(20.8)		(22.5)		(13.1)		(16.3)	
	Balance	12.2		24.8		26.8		27.3		30.1		11.7		25.7		35.1		30.2		34.5	
		(45.2)		(25.2)		(16.3)		(16.6)		(15.5)		(19.3)		(19.6)		(21.2)		(12.3)		(15.3)	
51-55	F/E Load	9.5	**0.5**	23	**1.1**	24.7	**1.2**	26.2	**1.3**	32.1	**1.5**	8.4	**0.5**	24.8	**1.1**	32.3	**1.6**	29.3	**1.4**	34	**1.7**
		(20.6)		(24.6)		(21.3)		(18.5)		(16.6)		(8.9)		(18.8)		(21)		(12.4)		(15.5)	
	Balance	9		21.9		23.5		24.9		30.6		7.9		23.7		30.7		27.9		32.3	
		(19.7)		(23.7)		(20.6)		(17.8)		(16)		(8.7)		(18.1)		(20.2)		(12)		(15)	
56-60	F/E Load	8.5	**0.2**	18	**0.3**	21.3	**0.4**	23.1	**0.5**	28.9	**0.5**	6	**0.2**	22	**0.4**	27	**0.5**	30	**0.6**	32.2	**0.7**
		(39.6)		(20.3)		(21.5)		(23.8)		(17.7)		(12.3)		(26.5)		(17.8)		(68.4)		(14.7)	
	Balance	8.3		17.7		20.9		22.6		28.4		5.8		21.6		26.5		29.4		31.5	
		(38.9)		(20.1)		(21.3)		(23.6)		(17.4)		(12.3)		(26.1)		(17.4)		(66.9)		(14.5)	
61-65	F/E Load	6.6	**0**	16.5	**0.1**	18.4	**0.1**	21.4	**0.1**	28.2	**0.1**	6.3	**0**	16.3	**0**	22.1	**0**	22.8	**0.1**	29.3	**0.1**
		(16.3)		(24.7)		(21.1)		(35)		(18.1)		(19.5)		(16.6)		(25.3)		(17.2)		(16.6)	
	Balance	6.6		16.4		18.3		21.3		28.1		6.3		16.3		22.1		22.7		29.2	
		(16.2)		(24.7)		(21.1)		(34.9)		(18)		(19.5)		(16.6)		(25.2)		(17.1)		(16.6)	

* Standard deviations are shown between parenthesis, whereas bold numbers are the differences in replacement rates under front-end load and under balance fee.

** Differences are shown in percentage points

Table 9: Proportion (%) of affiliates for whom front-end load fee is less expensive - **Competitive Scenario**

Age	Female					Male				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
<=25	0.0	0.0	0.6	0.0	0.0	0.0	0.1	0.1	0.1	0.0
26-30	0.2	0.9	3.0	1.8	0.7	0.5	1.0	1.1	0.6	0.3
31-35	1.3	3.8	9.3	7.1	5.9	1.8	3.0	6.5	4.4	4.7
36-40	2.5	13.6	23.0	22.8	28.2	3.5	10.0	15.5	13.4	21.0
41-45	4.3	23.4	41.2	33.9	48.4	5.5	16.5	21.1	22.9	34.5
46-50	6.2	36.6	66.2	76.4	77.3	5.8	30.8	36.5	52.2	63.6
51-55	5.3	44.6	74.0	82.5	84.8	6.0	33.3	42.4	67.6	80.2
56-60	3.1	44.6	85.5	89.7	96.7	6.0	33.9	58.1	75.8	87.2
61-65	40.8	69.5	92.6	94.8	98.9	47.3	68.6	90.1	91.1	98.4

Table 10: Proportion (%) of affiliates for whom front-end load fee is less expensive - **Non Competitive Scenario**

Age	Female					Male				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
<=25	10.0	52.5	100.0	100.0	100.0	4.1	48.5	100.0	100.0	100.0
26-30	10.7	56.3	100.0	100.0	100.0	9.5	49.5	100.0	100.0	100.0
31-35	10.3	56.3	100.0	100.0	100.0	12.5	46.3	98.8	100.0	100.0
36-40	9.2	53.9	99.6	100.0	100.0	10.7	39.0	90.6	99.5	100.0
41-45	8.6	50.0	93.4	98.0	99.9	10.5	35.7	76.0	91.3	98.2
46-50	8.7	48.5	84.1	91.5	96.7	8.1	37.0	61.8	77.5	88.0
51-55	5.7	46.1	81.1	85.6	89.8	6.2	34.7	49.2	73.1	85.1
56-60	3.1	44.6	85.5	89.7	96.7	6.0	33.9	58.1	75.8	87.2
61-65	40.8	69.5	92.6	94.8	98.9	47.3	68.6	90.1	91.1	98.4

5 Conclusions and discussion

This paper profits from a policy change in Peru occurred in 2013 regarding the scheme of fees to study its potential impact on the wellbeing of workers and pensioners, the scheme changed from a front-end load fee regime to a balance fee regime. It also uses a micro-simulation model with detailed individual administrative data to study the future effects of the policy change. The results indicate that pensions and replacement rates will significantly decline with the balance fee scheme, and in particular for younger and richer individuals. Thus, this paper contributes to highlight the effects of alternative fees scheme that can be useful for other countries that are considering a similar policy change.

Does the reform seem to be welfare improving for individuals? According to the results, it seems that it is not the case. Moreover, our analysis contrasts with some assumptions or arguments given on behalf of the reform's sake. One argument carried the idea that private pension managers will have incentives to perform better since they can directly charge their managing fees from the fund instead of from wages, leading to higher rates of returns for the new aligned interests. However, some literature (Moloche, 2012) show that individuals' saving accounts and pension funds do not have the same horizon plan: the formers maximize returns in the long run whereas the latter maximize current returns, and therefore aligned interests do not necessarily occur.

From the analysis we have learnt that an -apparently innocuous- change in the fees scheme can severely affect the future consumption of pensioners. Although we have illustrated the effects of such policy in the particular case of Peru, it is not difficult to draw policy recommendations to other Latin American countries with similar pension plans and institutional arrangements. Perhaps, the main message of our research is that policy makers need to pay more attention on the assumptions (arguments) made when these types of reforms are designed. Nevertheless, this paper cannot be taken as conclusive about what type of fee should the pension fund managers charge as it performs as a partial equilibrium model. This because it only takes into account long-term costs for the affiliates and not the pension fund managers'. It also does not have information about preferences for the affiliates' present and future consumption.

References

Aguila, E., Hurd, M. and Rohwedder, S. (2014), "How Do Management Fees Affect Retirement Wealth under Mexico's Personal Retirement Account System?", *Latin American Policy*, vol. 5, No. 2, pp.331-350.

Alonso, J., Sanchez, R. y Tuesta, D. (2014), "A model for the Pension System in Peru: Diagnosis and Proposals", *Revista Estudios Economicos*, vol. 27, pp.81-98.

Arenas de Mesa, A., Behrman, J. y Bravo, D. (2004), "Characteristics of and Determinants of the Density of Contributions in a Private Social Security System", *Retirement Research Center. University of Michigan*, vol. 077. Working Paper.

Bernal, N., Muñoz, A., Perea, H., Tejada, J., Tuesta, D. (2008), "A look at the Peruvian Pension System: Diagnosis and Proposals", *BBVA Research*, pp.1-207.

Bernal, N. (2009), "Expected old-age pensions in The Netherlands: A micro simulation approach", *Master's Thesis*, Tilburg University, pp.1-64.

Chavez-Bedoya, L., Ramirez-Rondan, N. (2014), "Comparison between Front-end load and Balance Fees in Individual Accounts Pension Systems" (No. 2014-9), *Peruvian Economic Association.*

Elton, E., Gruber, M. and Blake, C. (2003), "Incentive Fees and Mutual Funds", *The Journal of Finance*, vol. 58, No. 2, pp.779-804.

Escriva, J.L., Fuentes, E., Garcia-Herrero, A. (2010), "Reform of the Pension Systems in Latin America: Progress and Pending issues", *BBVA Research*, pp.1-379.

Kritzer, B., Kay, S. and Sinha, T. (2011), "Next Generation of individual account pension reforms in Latin America", *Social Security Bulletin*, 71(1): pp.35-76.

Moloche, G. (2012), "Politica optima de inversion de las AFPs: Implicancias del marco regulatorio y los esquemas de comisiones", *Consorcio de Investigacion Economica y Social. Proyecto Mediano*, pp.1-65.

OECD, World Bank and IADB (2015), "Pensions landscape: Latin American and the Caribbean", *Inter American Development Bank*, pp.1-180.

Iglesias, A. (2009). "Capitulo VII. Gestion del Negocio. Estructura de comisiones en un sistema de AFP". In: Federacion Internacional de Administradoras de Fondos de Pensiones, ed., *El futuro de las pensiones: Desarrollo de los programas de capitalizacion individual*, 1st ed. Universidad del Pacifico, pp.275-288.

Olivera, J. (2010), “Recuperando la Solidaridad en el Sistema de Pensiones Peruano: Una propuesta de Reforma”, *Consorcio de Investigacion Economica y Social y Universidad de Piura*, pp.1-151.

Olivera, J. (2015), “Efectos fiscales y distributivos de un sistema de pensiones multi-pilar en Per”, *Asociacin Peruana de Economa*. Documento de trabajo.

Rofman, R., & Oliveri, M. L. (2011). “The coverage of pension systems in Latin America: concepts and indicators”. World Bank.

SBS, Technical Appendix (2013), “Methodology applicable to calculations made for the fee comparison application”, *Technical report, Superintendency of banking, insurance, and AFP. Republic of Peru.*

Van Sonsbeek, J. M. (2011), “Microsimulation as a Decision Making Tool In Social Security Policy”, *het Zijlstra Center for Public Control and Governance*, pp.1-302.

A Social Security literature

Table 11: Selected Studies on Social Security in Pensions

	Country	Methodology	Findings
Bernal et al. (2008)	Peru	Macro-Cells 24 heterogeneous groups	By 2050, pension levels will increase, but replacement rates from SNP and SPP will decrease and increase, respectively. Affiliates with low contribution density and middle income will not be able to reach a basic consume level.
Olivera (2010)	Peru	Static Microsimulation	A migration to a multi-pillar system would reduce the burden on Government expenditure to sustain the current pension system. Income distribution inequality would be reduced.
Bernal (2009)	The Netherlands	Static Microsimulation	Pension levels rise for every group, however replacement rates are reduced, specially for young cohorts and women. Besides, a negative relation between level of education and replacement rates is found.
Sonsbeek (2011)	The Netherlands	Dynamic Microsimulation	Totally and partially handicapped individuals that work will increase their replacement rates in one or two percentage points, while partially handicapped individuals that are unemployed will have a significantly lower replacement rate.
Alonso et al. (2014)	Peru	Macro-Cells 60 heterogeneous groups	Number of contributors will be duplicated by 2050, but labour coverage rates (in terms of regular contributors) will continue to be low. Additional measures will be required in addition to the reforms of 2012.
Aguila et al. (2014)	Mexico	Mathematical calculations	Management fees have drained a significant part of individuals retirement wealth and have increased the number of persons claiming a minimum pension.
Chavez-Bedoya and Ramirez-Rondan (2014)	Peru	Theoretical Model. CRRA Utilit Functions	Balance fee becomes more attractive for affiliates with higher risk aversion; besides, in a neutral risk aversion scenario, higher growth rates of share value make front-end load fee more attractive than balance fee.

B SBS application: calculator for fee cost comparison

This calculator was developed by the Superintendency of Banking, Insurance and Pension Funds Managers (SBS for its initials in spanish) driven by the Private Pension System (SPP for its initials in spanish) reform in which this study focuses. Its function is to provide affiliates information about which will be the cheaper commission scheme for them: whether the front/end load fee scheme or the balance one. The comparison is made for each affiliate on the basis of the present value of the fees paid under the two schemes, from his/her current age until 64 years old. To accomplish this task, assumptions about the future salaries future evolution, contribution density, fees, profitability and employment of the affiliate must be made. It is important to mention that this calculator takes the lowest fees in the market under the two schemes to make the comparison.

To begin with, the real salary evolution between the current age and when the affiliate turns 65 years old will be a function of different growth rates by sex, education level and the range of age to which the affiliate belongs. Thus, four groups are established: women with university education, women without university education, men with university education and men without university education. Those growth rates are the same that are used in this study (detail is showed in table ??).

The assumption about the real salary growth rate is based on historical information about the Private Pension System affiliates salary and on information from the Permanent Employment Survey (EPE for its initials in spanish). The first source of information is used to build the real salary growth rate along the salary curve of the Private Pension System affiliates (life cycle). On the other side, the salary growth rate explained by gains in productivity is obtained from the EPE. Thus, the assumption about the real salary growth rate between the affiliate's current age and when he/she turns 65 years old will be the sum of the real salary growth rate registered along the salary curve and the growth rate for gains in productivity.

Then, three possible scenarios are presented for the contribution density: contribution density of 50%, 75% and 100%, which means that the affiliate will contribute 50%, 75% and 100% of the period between its current age and when he/she turns 65 years old, respectively.

Finally, the assumption for the real annual profitability of the pension fund is that it will be divided in three periods with the following characteristics:

1. First period: first 10 years of the new fee scheme. Three options for the real annual profitability are established for the affiliate to choose: 5%, 6%, 7%
2. Second period: years 11 to 20 of the new fee scheme. Average between the real annual profitability from the first period and the one from the third period.
3. Third period: from the year 21 of the new fee scheme: 5%

C Fee Schemes in Individual Capitalization Pension Systems: Comparative Approach

Fee schemes used around the world can be summarized in 4 types: Fixed fee schemes, fee over fund rate of return, front-end load fee, and balance fee. The first one is a fixed amount charged, that does not take in count the salary or contribution amount of the affiliate; the second one is a percentage charged over the rate of return generated for the fund by the Pension Fund Manager; the third one is a percentage charged over the salary or contribution of the affiliate; and the last one is charged as a percentage of the accumulated pension fund of the affiliate: its pension balance. The last two schemes are the most commonly used in individual capitalization pension systems around the world (Iglesias , 2009). Table 12 shows different countries with Individual Capitalization Pension Systems and the fee scheme they use.

Due to the fact that this study profits from a reform in which only the front-end load and the balance fee are involved, we will cite some relative advantages and disadvantages that can be established between them.

Affiliates may be more sensible to the impact of a fee that levy their taxable income than to one that levy their pension fund (and, as a consequence, their pension), which is an amount administrated by the Pension Fund Manager, and therefore they do not perceive. Thus, a front-end load fee may favor competition in the pension system, given that the affiliates will be directly and immediately affected by the level of the fees charged by the different Pension Fund Managers (Iglesias , 2009).

In addition, a front-end load fee reduce entry-barriers to the pension system industry, especially when the individual capitalization systems are starting to operate, because it allows Pension Fund Managers to perceive revenues even when the funds that they administrate are still relatively small. This would not be possible under a balance fee only scenario (Iglesias , 2009).

On the other side, a balance fee will not affect the income of affiliates during their active working life, favoring present consume. However, it will reduce their final retirement pension.

Additionally, it is argued that a balance fee scheme favors a greater return seeking administration of the pension funds by the Pension Fund Managers, which would derive in greater pension funds and, thus, favor the affiliate. However, Elton et al. (2003) provides evidence on Mutual Funds industry, where balance fees are usually applied, suggesting that Fund Managers that charge a fee over the fund amount may, indeed, obtain greater returns. However, that result may well be explained by a selection bias. This is explained because, in the US Mutual Fund industry, where the study is made, it is not mandatory that all Fund Managers charge a balance fee, and thus, it is expected that the ones that choose to do it will be the most capable ones and therefore will obtain greater returns.

Considering all this, it is an important discussion topic whether a balance fee works in favor of the objectives of a Social Security System.

Table 12: Fee schemes in Individual Capitalization Pension Systems around the world

Country	Report Year	MAXIMUM fees on (%)					AVERAGE fees on (%)					Notes
		Contributions	Salary	Assets	Returns	Other	Contributions	Salary	Assets	Returns	Other	
Albania	2013			3.00					2.40			Market average fee by assets.
Botswana	2010			0.60								
Bulgaria (2nd pillar)	2012	5.00		1.00		BGN 20	4.97		1.00			Other: transfer fee.
Bulgaria (3rd pillar)	2012	7.00			10.00	BGN 20	2.75			9.43		Other: transfer fee, entry fee, early withdrawal fee and additional information fee.
Chile	2012		N/A					1.42			1.26	Other: Insurance as a percentage of salary for independent and voluntary worker. Average weighted by number of contributors.
Colombia	2012		1.31			1.70						Other: Insurance as a percentage of salary.
Costa Rica	2013			1.10 (2017: 0.35)								
Croatia (2nd pillar) (1)	2012	0.80		0.65 (2013: 0.45)		0.80						Other: exit fee (for mandatory funds charged only if changing funds when having less than 3 years of membership).
Croatia (3rd pillar) (2)	2012						8.00		2.00		10.00	
Czech Republic (3)	2013			0.60	15.00				0.60	15.00		
Dominican Republic	2012		0.50		30.00	1.00						Returns: over local bank average rates, Other: Insurance as a percentage of salary.
El Salvador	2012		2.20					1.10			1.11	Other: Insurance as a percentage of salary.
Estonia (4)	2011			1.20 / 2.00					1.49			
Ghana	2011			2.50								
Greece (5)	2011								0.90			
Hong Kong (6)	2013								1.70			
Hungary	2013	0.90		0.20								The Central Bank of Hungary calculates charge ratios (fee components related to assets).
India	2013	0.25		0.25		Rs 225						(In Rupee) Opening charges: 150, Record keeping: 225.
Israel	2012	6.00		0.50			3.80		0.33			
Kazakhstan	2011				15.00							
Kenya	2010								0.36			
Latvia (7)	2012								2.00			
Lithuania (8)	2013	2.00 (2016: 0)		0.65 / 1.00		0.05	1.86		0.65 / 0.99			Other: fee on transfers. Simple average fee.
Macedonia	2013	4.00 (2020: 2.00)		0.54 (2020: 0.36)		EUR 15	4.00		0.54		EUR 15	Other: transfer fee for people switching earlier.
Mexico	2012			1.50					1.38			
Namibia	2011								0.85			
Panama (SUMEVAL)	2012			2.50					2.50			
Panama (SIACAP)	2012			0.30					0.30			
Peru	2013							**1.62**			**1.23**	**Other: Insurance as a percentage of salary.**
Poland (9)	2011	3.50		0.60			3.50		0.46			
Romania (2nd pillar)	2012	2.50		0.60		5.00	2.50		0.60			Other: transfer fee for people switching earlier.
Romania (3rd pillar)	2012	5.00		2.40			4.58		1.79		0.21	Other: transaction fees, audit fees, depositary.
Russia	2010			0.40								
Serbia	2012	2.27		2.00								
Slovak Republic (2nd pillar) (10)	2013	1.25		0.30	10.00		1.25		0.30	10.00		
Slovak Republic (3rd pillar) (11)	2013			0.90 - 1.80	10.00	5.00			0.90 - 1.80	10.00	5.00	Other: fee on transfers.
South Africa	2010								0.39			
South Korea	2011								0.70			
Spain (occupational)	2012			2.00		0.50			0.21			Other: custodian fees.
Spain (personal)	2012			2.00		0.50			1.39			
Turkey (12)	2013	2.00		1.09 - 2.28		10.0	N/A		2.00		N/A	Other: exit fee (charged only for a maximum period of 10 years) and entrance fee; the cap for these types of fees is 10% of the monthly gross minimum wage.
United Kingdom (13)	2011			1.50					N/A			
Uruguay	2012		1.77			1.40						Other: Insurance as a percentage of salary.

Source: International Organization of Pension Supervisors (IOPS).