The effects of management fees on pension wealth *

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Abstract

We study a policy change on pension fund management fees implemented in Peru in 2013 to shed light about the potential effects of this type of policy on pension wealth. The reform established a new balance fee charging a percentage of the pension balance (the default) unless the individual opted for remaining in the load factor fee that charges a percentage of the salary. We use administrative data to simulate pension balances taking into account the individual's actual fee scheme and the corresponding counterfactual if the individual had chosen the other scheme. Our results indicate that the reform has been potentially adverse for 63.8 percent of individuals. This figure is composed of 40.4 percent of affiliates who fall into the default and 23.4 percent who voluntary chose remaining in the load factor fee, which may suggest an alarming lack of soundness in individual financial decisions and ill-designed policy. We also detect large heterogeneity in the intensity of losses and gains due to the reform, being the size of losses larger than the size of gains. In particular, the younger and poorer individuals and those falling into the default option show higher losses. Moreover, the change of fee scheme is also associated with increasing inequality of pension wealth and a reduction on individual's well-being.

Key words: Pension funds, management fees, individual retirement accounts, pension reform, inequality, Peru

JEL-classification: D31, G28, J14, J32.

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1 Introduction

Reforming old public pension systems into Individual Retirement Accounts (IRA) schemes has fueled much debate among both policy makers and academics for long time. Latin America is an interesting case because an important wave of pension reforms towards implementing IRA started with Chile in 1981, and then it diffused to other countries (Peru: 1992, Colombia: 1993, Mexico: 1997, etc.). Although some agreement has been reached regarding the positive spill-overs of these reforms into enhancing national saving, growth, financial and annuities markets (Kritzer et al. (2011), Aguila et al. (2014)), less is known and agreed upon on the effects of pension fund management fees on individual pension wealth. Indeed, the level of these fees and the way they are charged can differ considerably across countries, and therefore they may have different effects on the final value of pensions and individuals' well-being. Additionally, the high level of fees are a constant source of criticism in countries where IRA systems are mandatory; hence it is important to better understand their effects on the value of pensions.[1]

We use a policy change occurred on the Peruvian IRA's fees scheme in 2013 to shed light on the potential long-term effects of these fees on individual's well-being. Before the reform, individuals used to pay a load factor fee, which charges a percentage of the monthly salary. The reform established a new balance fee that charges a percentage of the saving balance unless the individual expressed that will remain in the previous scheme. Individuals had about five months to opt out from the balance fee and remain in the previous load factor fee. After this window of time, there is no way to get out of the default balance fee. Importantly, the balance fee is not applicable to the saving balance accrued before the reform; it applies only to the balance that will be accumulated after the reform and to the balances of new affiliates.

The analysis is based on a sample of administrative registers of 64,588 individuals enrolled at the Peruvian IRA system as of December 2016. This data is provided by the Superintendencia de Banca, Seguros y Administradoras Privadas de Fondos de Pensiones (known as SBS) which is the public institution monitoring and regulating the Private Pension System. We simulate the final value of pension balance for each individual in our sample under certain assumptions and apply a series of sensitivity checks for key parameters. Exploiting this sample allows us to capture the heterogeneity of the population enrolled into the IRA system and exposed to the policy change in management fees, including those individuals who actively opted out of the new balance fee scheme. Importantly, we simulate savings both taking into account the individual's actual fee scheme and the corresponding counterfactual if the individual had chosen the other scheme. Therefore, we are able to assess losses and gains in savings due to the choice of fee scheme.

Among other studies analyzing the effects of fees on pension wealth for compulsory IRA systems we can mention Whitehouse (2001), Alonso et al. (2014), Aguila et al. (2014) and

[1] See Table A.1 in the Appendix for a description on fees schemes in Individual Retirement Accounts Systems for selected countries and Table A.2 for details on the Peruvian IRA's fees levels.

Chávez-Bedoya (2017). In particular, Alonso et al. (2014) analyses –by means of a representative agent model by groups- some features of the Peruvian policy reform passed in 2012 that included various regulatory changes and not only the change in management fees. However, they only compute the mechanical effect of the change in fees for the specific example of a 40-year-old worker. Chávez-Bedoya (2017) discusses the theoretical implications of pension contribution density and risk aversion on the final level of individual pensions for different schemes of management fees and illustrates his predictions with parameters of the Peruvian IRA system. The main difference with our work is that we use observed and representative data of the individuals affected by the reform and exploit the heterogeneity of the population to draw results for different groups of individuals. Importantly, we are also able to account for distributional concerns regarding the relationship between the position of the individual in the income and pension wealth distribution and potential gains/losses from the change of fees. Aguila et al. (2014) study the Mexican IRA system where three types of fees schemes were operating until 2008 (load fee, balance fee and return rate fee), and then only the load fee was permitted. They find that, before 2008, the management fees significantly reduced pension wealth and increased the claims for publicly subsidized minimum pensions. Dobronogov and Murthi (2005) analyses the cases of Croatia, Hungary, Kazakhstan and Poland and find that management fees (varying from 0.6 to 1.2 percent of assets) may reduce the returns on IRA by around 1 percent per year.

The default option of the Peruvian reform (balance fee) can have important consequences on the value of retirement wealth. Using data from a large Australian pension fund, Dobrescu et al. (2016) show that default settings strongly influence wealth accumulation and identify that not carefully designed defaults –particularly the irreversible ones- can severely affect retirement savings. Indeed, broader literature have already examined the role of defaults on sub-optimal retirement outcomes (e.g. Carroll et al. (2009), Goda and Flaherty (2013)).

Bearing in mind that our analysis focuses on the affiliates for whom the reform was salient (those enrolled before 2013 and showing a more active contributory behaviour), our results indicate that the policy fee reform is beneficial only for 36.2 percent of the individuals and is adverse for the other 63.8 percent. This last figure is composed of 40.4 percent of affiliates falling into the default option (i.e. for whom the default option was wrong) and 23.4 percent who voluntary exerted a bad choice for the fee scheme. This result has, therefore, elements of a not well-designed policy and an alarming lack of soundness in individual financial decisions. We also detect large heterogeneity in the intensity of losses and gains due to the reform. The size of losses tend to be larger than the size of gains; the average size of changes in the final saving balance for those who lose is -5.0 percent and it is 3.1 percent for those who gained with the reform. Furthermore, the default option implies higher losses among those who opted for it than the active choice of load fees. Among the individuals taking the default option, the average size of changes in the final pension balance for those who lose is -7.0 percent, and is 0.9 percent for those who gained. Among the affiliates who opted for the load fee, the average size of changes in the final saving balance for those who lose is -1.3 percent and it is 3.6 percent

for those who gained. We also find important differences in losses and gains across age groups, income and retirement wealth distribution. The younger and poorer individuals show higher losses.

The remainder of the paper is organized as follows: Section 2 gives an overview of the institutional background and the pension management fees reform. Section 3 describes the data and variables. Section 4 presents the methodology. Section 5 provides the main results and Section 6 presents some robustness checks and further results. Section 7 concludes.

2 Background

2.1 The Private Pension System

The Peruvian IRA is known as the Private Pension System (SPP due to its name in Spanish) and was introduced in 1992. The system was launched following the pioneering experience of Chile of 1981 although the National Pension System (known as SNP) was not dismantled as in the case of Chile and other pension reforms in Latin America. Thus, a worker is free to enroll either in the SPP or SNP.

Participation in the SPP or SNP is mandatory only for individuals formally registered in a payroll, i.e. working as employees in the formal sector. About 37 and 27 percent of the total labour force were enrolled to the SPP and SNP, respectively, in 2015. However, many individuals do not contribute regularly or not contribute at all because there is high transition between the formal and informal sector. The share of individuals of the labour force contributing regularly to the SPP and SNP was about 17 and 10 percent, respectively, in 2015.

The individual accounts of the SPP are managed by private pension fund managers known as AFP (Administradoras Privadas de Fondos de Pensiones in Spanish). Pension contributions are made solely by the worker at a rate of 10 percent of the total monthly gross wage.[2] Two additional charges are also paid by the worker. The first one is an insurance premium paid to insurance firms to cover disability and mortality risks and the second one is a management fee paid to the AFP for the administration of retirement accounts. Both the insurance and the management fee are deducted from the monthly gross wage, but in the case of the first one there is cap applied to the wage.

Peru has not been absent of a new wave of second generation pension reforms (Kritzer et al. (2011)) again started by Chile and focused on closing coverage gaps and reducing the administrative costs of IRA systems. In this context, an important reform in the SPP was passed in July 2012 (Law N° 29903) while it went into effect the following year. The main goal of the reform was to increase efficiency (through reductions in private costs) and to improve pension

[2]There were periods in which the contribution rate was different than 10 percent. In 1993-1995, it was 11 percent, which included a solidarity charge and, during 1995-2005, it was reduced to 8 percent. After 2005, the contribution rate has been set up in 10 percent.

coverage and contribution behaviour. One important aspect of the reform was the change in the way the administrative fees are charged. It was established that the new fee will be charged on the individual saving balance, which, following a transition period of 10 years, will be the unique management fee from 2023 onward.

The 2012 reform also introduces two auction schemes with the primary objective of reducing administrative fees. One concerns the choice of the AFP that will enroll all the new workers for two years and the other one concerns the choice of the insurance firms that will provide the coverage for the disability and mortality risks. Both schemes are a type of reverse auction (Kurach and Kusmierczyk (2017)) where the firms bid to provide pension fund management or insurance services to the clients. As firms offering lower prices win the bid in this type of auctions, there is an expected reduction in the fees paid by the individuals. Other changes included in this reform aimed at enhancing efficiency were allowing AFP to centralize operations (i.e. contributions collection, provision of benefits, etc.) and to use new financial instruments to increase portfolio diversification. While it was eventually removed or never implemented, it was also established mandatory enrollment for self-employees aged 40 and younger and individuals working in small firms with a contribution subsidized by the Government.

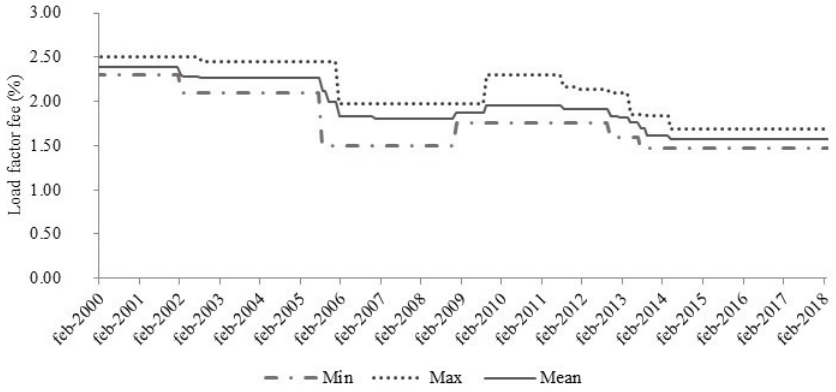
2.2 Management fees reform

The evolution of the load factor fee during the period 2000-2018 is reported in Figure 1. It is observed a reduction over the period, from 2.39 percent in 2000 to 1.58 percent in 2017, though much of this variation took place between 2005 and 2013. It is plausible that the reductions of fees observed in 2005-2013 are related to the entry of a new pension fund manager. Indeed, in August 2005 AFP Prima started operations and charged a fee much lower than the average in the market (1.50 versus 2.11 percent on average) which in turn seems to have triggered a price reduction in January 2006 in AFP Profuturo and AFP Union Vida. However, these reductions did not last long because in December 2008, AFP Prima increased the fee to 1.75 percent whereas AFP Profuturo did the same nine months later. In July 2013 AFP Habitat entered into the market with a fee of 1.47 percent, the lowest of the system, and no variation in these fees are observed since then. Regarding the insurance premium fee, the value has increased from 1.23 percent in December 2013 to 1.36 percent in December 2017.

While a broader SPP reform was passed in July 19th 2012, the detailed rules for changing management fees were published in November 8th 2012 and the affiliates were allowed to choose their preferred fees scheme between January 2nd 2013 and May 31st 2013, so that the new scheme was effective on June 1st 2013. More precisely, the default option of the reform was set up for the balance fee scheme, so that the individuals preferring to remain in the previous load factor fee had to follow certain procedures in a window of five months time. The only option for new individuals enrolling in an AFP after February 1st 2013 is the balance fee.

To remain in the load factor fee the individuals had to communicate their decision to the

Figure 1: Load Factor Fees



Notes: The figure shows monthly values (Feb 2000 to Feb 2018) of load factor fees extracted from SBS's official statistics. The mean corresponds to the simple average of fees.

AFP and sign some authorization forms. There was a period of approval of around four weeks in which individuals were required to record the confirmation of their decision by phone. Furthermore, it was established a cooling-off period of six months after June 1st 2013 in order to allow individuals to reverse their decision of remaining in the load factor fee scheme. By December 2013, 35 percent (1.92 million) of the affiliates remained in the previous load factor fee, while 65 percent were assigned to the new balance fee scheme.

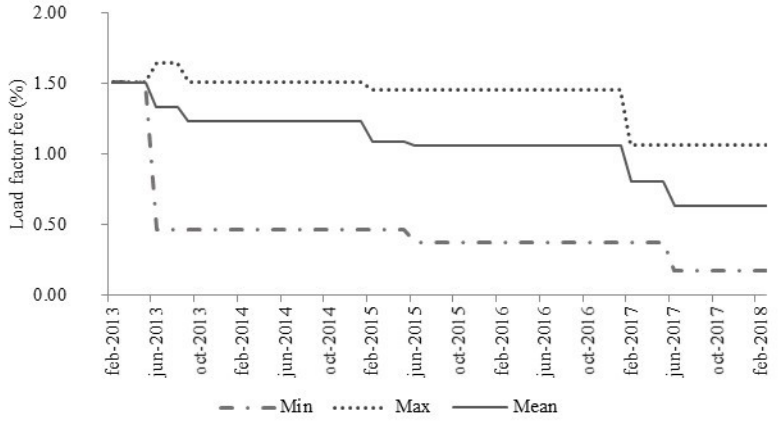
The balance fee is embedded in the so called mixed fee scheme, which by regulation is a transitory scheme valid until 2023. The first component of this scheme is a load factor fee that gradually will decrease up to zero in that year and the second component is a balance fee which will be the only type of fee after 2023.[3]

Figure 2 shows the evolution of the two components of the mixed fee scheme. As of February 2013, the average load factor fee component was 1.51 percent whereas in February 2018 this is 0.63 percent, which implies an important reduction in a five years period. There is some variance among AFP. For example, Prima AFP and Habitat AFP are the ones offering the lowest prices, 0.18 and 0.38 percent, respectively, whereas Profuturo AFP is the most expensive one with 1.07 percent. While the load factor component has been reduced in the last five years, there are not much changes in the balance fee component. This fee has not changed since June 2013 when its average value was 1.23 percent. It is worth mentioning that the reverse auction for the new affiliates does not mandate any type of reduction on the value of this component when choosing the winner of the bid. This is perhaps the reason behind the lack of variation for this component.

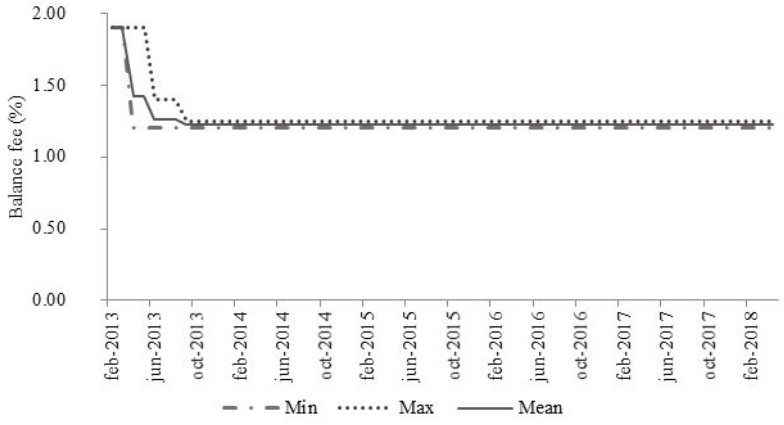
[3] According to specific rules generated with the reform, the load factor fee of the mixed fee scheme must be reduced by 86.5 percent during the period February 2013 to January 2015, 65.8 percent during February 2015 to January 2017, 50.0 percent during February 2017 to January 2019, 31.5 percent during February 2019 to January 2021, 13.5 percent during February 2021 to January 2023, and then the load factor fee reaches zero after February 2023.

Figure 2: Mixed Fees

(a) Load Factor Component



(b) Balance Component



Notes: The figures show monthly values (Feb 2013 to Feb 2018) of the load factor fee and balance fee components of the mixed fee scheme extracted from SBS's official statistics. The mean corresponds to the simple average of fees.

3 Data

We use a sample of 2 percent of the total non-retired population from SBS's individual administrative registers as of December 2016. The sample is random, stratified and representative of the following strata: 5-year age group, sex and enrollment year. It is the only available data set including information about individual's type of management fee, pension balances, income and some socio-economic variables.

The initial sample size is composed of 100,024 observations, which correspond to 21-64 old individuals who enrolled into the SPP before 2013. Individuals enrolled in 2013 or later would not have been able to exercise any choice about a preferred fee scheme and hence are not part of our sample framing. After applying some selections related to the focus of our analysis, we obtain a sample of 64,588 observations. To arrive to this number we drop 9,129 individuals with zero pension balance and 63 with missing pension balance as many of them have not registered

incomes and were enrolled into the SPP long time ago.[4] An individual affiliated to the SPP long time ago and, simultaneously, having an empty balance may indicate that she is an infrequent contributor or no contributor at all. Given our interest on studying the prospective effects of the reform on individuals for whom the reform is relevant, we restrict our sample to those who are current contributors. These individuals are defined as those whose last registered contribution occurred at least in 2013 (14,546 individuals are dropped). This is a somewhat flexible criterion as we are considering that in practice the individual made at least one contribution between 2013 and 2016.[5] Further, we drop 11,656 affiliates who do not register incomes nor information on the last contributed year. Finally, 42 individuals caught in the transition procedure for retirement are also dropped.

Given these selections, we consider that our final sample is representative of the individuals for whom the reform is salient, i.e. those showing a more active contributory behaviour, but it is not of the total population of the SPP.

The data contains information on age, gender, labour income, last contribution date, pension balance, balance affected and unaffected by the reform, type of chosen or allocated fee scheme, enrollment date, AFP, type of pension fund, contribution density, employment condition and information about recognition bonds. This bond is an amount of money –based on past contributions- guaranteed by the government to the individuals that were previously affiliated with the national pension system. There are three main types of pension funds. The fund type 1 includes investments with relatively low return and volatility and it is mandatory to individuals aged 60-65 unless the individual chooses fund type 0 or 2. The fund type 2 includes investments with moderate growth and volatility combining both fixed-income instruments and equities and fund type 3 is composed of investments with higher return and exposed to high volatility, composed mostly by equities. Ideally, this last type of fund is chosen by younger affiliates or by more sophisticated individual investors. Fund type 0 is designed to maintain the capital, offer low return and volatility and is intended for individuals in the process of retirement after age 65.[6]

Two additional and similar samples of SBS's data from years 2006 and 2013 are also used to compute labour income growth rates specific by gender, income quintile and birth cohort.

Table 1 shows the descriptive statistics of the variables in our final sample as of December 2016. The information is shown for all individuals and by type of fee scheme, i.e. balance (mixed) or load factor fee. We construct quintiles of income, pension balance and contribution density. The quintiles are specific by birth cohorts captured by 2016's age groups (21-25, 26-30, ..., 61-64) in order to reduce life-cycle effects. The type of occupation, employee or self-

[4] 81 percent of these cases were enrolled in 2006 or earlier.

[5] 77.2 percent of individuals in the final sample made their last pension contribution in 2016, 9.3 percent in 2015, 7.3 percent in 2014, and 6.2 percent in 2013.

[6] Fund type 1 invests up to 100 percent in short-term fixed-income instruments and 10 percent in equities, fund type 2 invests up to 75 percent in short-term fixed-income instruments and 45 percent in equities and fund type 3 is composed of investments up to 80 percent in equities and 70 percent in short-term fixed-income instruments.

employed, corresponds to the type of occupation recorded in the last contribution. The date of last contribution indicates the last time the individual was registered in an occupation where she contributed to pensions. As pension contribution is compulsory only for formal sector employees, we cannot clearly observe whether the individual was unemployed or not.

In this sample, 53 percent of individuals (34,237) chose to remain in the load factor fee scheme, while 47 percent (30,351) were assigned to the default balance (mixed) scheme. This is interesting for our analysis because choosing the load factor fee implies an active decision, meaning that individuals had to inform it to the AFP and follow an specific procedure. Despite this transaction cost, a significant portion of the population seems to have opted for it..

On average, individuals assigned to the balance (mixed) fee are younger than those in the load factor fee (38 versus 41 years-old), are relatively composed more by men than by women (69 versus 61 percent), have less time enrolled to the SPP (8.2 versus 10.4 years) and are poorer in terms of pension balances (S/.20,244 versus S/.50,316) and incomes (S/.1,879 versus S/.3,194, on average). The frequency or density of contributions also differs significantly. Individuals charged with the balance fee contribute on average 47 percent of the time they are enrolled, while individuals charged with the load factor fee contribute 79 percent.

A sort of revealed preference for risk can be inferred from the distribution of individuals among the different fund types. The large majority of individuals, regardless the fee scheme, invest their funds in the fund type 2, which is a portfolio with moderate risk. However, it is interesting to observe that the proportion of individuals choosing a riskier portfolio (composed up to 80 percent in equities) in the load factor fee doubles the proportion in the balance fee (9.4 versus 4.7 percent), which might imply that they are a more financial sophisticated group.

On summary, individuals deciding to remain in the load factor fee are slightly older, enrolled more time in the SPP, a bit more composed by women, earn higher income, have more pension savings, contribute more often and have slightly higher preferences for risk than the group of individuals assigned to the balance fee. Differences by gender are reported in Table A.4 in the Appendix.

Table 1: Mean Differences among Affiliates by Actual Fee Scheme

Variable	Overall N=64,588	Balance (Mixed) Fee N=30,351	Load Factor Fee N=34,237	Mean diff.
Male	0.651	0.694	0.613	0.081***
Age	39.663	38.401	40.782	-2.381***
Balance not affected by balance fees (S/. '000)	33.907	15.397	50.316	-34.919***
Balance charged with balance fees (S/. '000)	-	4.847	-	4.847***
Total saving balance (S/. '000)	36.185	20.244	50.316	-30.072***
1st quintile (% of individuals)		0.357	0.061	0.296***
2nd quintile		0.240	0.165	0.075***
3th quintile		0.173	0.224	-0.051***
4th quintile		0.134	0.259	-0.125***
5th quintile		0.097	0.291	-0.195***
Monthly labour income (S/.)	2,572.8	1,871.8	3,194.3	-1322***
1st quintile (% of individuals)		0.287	0.135	0.152***
2nd quintile		0.223	0.170	0.053***
3th quintile		0.198	0.200	-0.003
4th quintile		0.169	0.229	-0.059***
5th quintile		0.123	0.266	-0.143***
Contribution density (%)	0.638	0.468	0.788	-0.320***
1st quintile (% of individuals)		0.370	0.050	0.320***
2nd quintile		0.258	0.148	0.110***
3th quintile		0.166	0.230	-0.064***
4th quintile		0.113	0.277	-0.164***
5th quintile		0.093	0.295	-0.202***
Self-employed	0.028	0.031	0.025	0.006***
Years enrolled in SPP	9.389	8.265	10.386	-2.121***
AFP Integra	0.398	0.387	0.408	-0.021***
AFP Profuturo	0.329	0.364	0.298	0.066***
AFP Prima	0.269	0.246	0.289	-0.044***
AFP Habitat	0.004	0.003	0.005	-0.001***
Fund type 1 (secure)	0.036	0.030	0.041	-0.012***
Fund type 2 (moderate)	0.892	0.923	0.865	0.059***
Fund type 3 (risky)	0.072	0.047	0.094	-0.047***
Have recognition bond	0.040	0.021	0.056	-0.035***

Source: Analyzed sample of SBS administrative registers as of December 2016.

4 Assessing the choice of fee scheme

4.1 Charge ratios

We seek to evaluate the potential effect of the choice of fees scheme on the level of pension wealth, i.e. on the final balance accrued for retirement. An illustrative and easily implementable measure for this purpose is the so-called "charge ratio" (Whitehouse (2001), Tapia and Yermo (2008), Murthi et al. (1999), Aguila et al. (2014)). The charge ratio indicates how much the fees represent with respect to the accumulated fund:

$$\lambda^l = \left[1 - \frac{S^{l,fee}}{S^{l,nofee}}\right] \tag{1}$$

$$\lambda^m = \left[1 - \frac{S^{m,fee}}{S^{m,nofee}}\right] \tag{2}$$

λ^l and λ^m are the charge ratios for the load and balance (mixed) fee schemes computed at the age of retirement 65. The value of $S^{l,fee}$ is the balance an individual would obtain with her pension contributions under the load factor fee, while $S^{l,nofee}$ is the balance she would obtain if both contributions and fees were accumulated in the saving account. Similar definitions apply for the default balance (mixed) fee scheme. The most convenient fee scheme for the individual is that one with the lower charge ratio, so that if $\lambda^l < \lambda^m$, then the load factor fee would be the best option for the individual. The following example can illustrate this point. Assume that the final balance under the mixed scheme is 80 ($S^{m,fee}$) and that this balance would have been 100 if the fees would have been capitalized in the balance ($S^{m,nofee}$). Contrary, under the load fee scheme, the final balance is 100 ($S^{l,fee}$) and the balance would have been 120 if the fees would have been capitalized in the balance ($S^{l,nofee}$). So, the load factor fee scheme has a lower charge ratio, $\lambda = 1 - \frac{100}{120} \cong 1 - \frac{83}{100} < 1 - \frac{80}{100} = \lambda^m$. In the case of balance (mixed) fees, for each 100 units invested the individual could obtain 80 units, while in the case of load factor fees, the individual could obtain 83 units for each 100 units invested.

Interestingly, the difference between charge ratios ($\Delta_{ml} = 100 \times (\lambda^m - \lambda^l)$) can indicate the degree of losses or gains -in terms of the percentage change in the final saving balance- due to the choice of certain fee scheme. The gains of an individual choosing the load factor fee are equal to Δ_{ml} if $\lambda^l < \lambda^m$, and her losses are equal to Δ_{ml} if $\lambda^l > \lambda^m$. In the case of and individual choosing the balance fee scheme, her gains are equal to$-\Delta_{ml}$ if $\lambda^l > \lambda^m$, and her losses are equal to $-\Delta_{ml}$ if $\lambda^l < \lambda^m$.

4.2 Pension balance simulation

The computation of charge ratios requires the estimation of individual's future balances for each fee scheme: $S^{l,fee}$, $S^{l,nofee}$, $S^{m,fee}$ and $S^{m,nofee}$. We denote d_{jt} as a percentage deducted from

the individual's income (w_t) that includes the pension contribution c_t to the saving account (S_t) and any load factor management charge a_{jt}, if that is the case. Under the load factor fee scheme the unique charge is a_{1t}, so that $d_{1t} = c_t + a_{1t}$. The mixed fee scheme includes both a load factor fee a_{3t} that will gradually decrease up to zero in 2023, and a balance fee a_{2t}, levied as a proportion of the balance, that will remain beyond that year. Thus, under the mixed fee scheme, the income deduction is $d_{3t} = c_t + a_{3t}$ until 2023 and $d_{3t} = c_t$ after that year. Individuals make pension contributions with probability p_t, and the saving balances earn returns r_t. The affiliates also pay an insurance premium to private firms to be covered against mortality and disability risks, but we do not include it in the simulation. The saving balance accumulation follows a monthly (t) discrete process as indicated below:

$$S_{t+1}^{l,fee} = S_t(1+\frac{r_t}{n})^n + p_{t+1}(d_{1t+1} - a_{1t+1})w_{t+1} \tag{3}$$

$$S_{t+1}^{m,fee} = S_t(1+\frac{r_t}{n})^n + S_t^a(1+\frac{r_t}{n})^n(1-\frac{a_{2t+1}}{n})^n + p_{t+1}(d_{3t+1} - a_{3t+1})w_{t+1} \tag{4}$$

Equations 3 and 4 describe the accumulation processes for individuals who chose the load factor fee scheme and those who were assigned to the default fee scheme, respectively. Note that in equation 4, the balance fee (a_{2t}) applies only to the savings accumulated after the reform (S_t^a) and not to the previously accrued balance (S_t).

We also need the counterfactual pension balance that had been accrued if both pension contributions and fees had been invested into the individual balance in order to compute the charge ratios for each fee scheme. For this purpose, we define the following accumulation processes:

$$S_{t+1}^{l,nofee} = S_t(1+\frac{r_t}{n})^n + p_{t+1}d_{1t+1}w_{t+1} \tag{5}$$

$$S_{t+1}^{m,nofee} = S_t(1+\frac{r_t}{n})^n + p_{t+1}d_{3t+1}w_{t+1} \tag{6}$$

where $S_{t+1}^{l,nofee}$ and $S_{t+1}^{m,nofee}$ denote pension balances for the load factor and the default fees schemes, respectively. Note that all payroll deductions feed the retirement account. By definition, $S_{t+1}^{l,fee}$ and $S_{t+1}^{m,fee}$ imply lower balances than $S_{t+1}^{l,nofee}$ and $S_{t+1}^{m,nofee}$, respectively, when charges a_{1t+1}, a_{2t+1}, and a_{3t+1} are positive.

The simulation of the four types of balances is implemented for each individual from January 2017 until reaching retirement age 65. In this exercise we are unable to consider the fees already paid between the dates of policy implementation (June 2013) and sample drawn (December 2016) in our simulation. This may overestimate the final pension balances, but the effect on the charge ratios should be rather small.

The fees are assumed to be equal to their current levels (February 2018) until the end of the

simulation period, except for the mixed scheme's load fee, which will decrease until it reaches zero in 2023.[7] Labour income evolves at growth rates -specific by gender, income quintile and birth cohort- estimated with SPP's individual registered data from years 2006 and 2013 (see Table A.3 in the Appendix).

The probability of making pension contributions p_t is proxied by the observed individual's density of contribution, which is the number of contributed months over the total number of months enrolled in the SPP. The available individual contribution densities are those computed for the period starting in May 2006 onward as the records before this date are less reliable.

The investment return rate is a crucial determinant of retirement wealth. By regulation, pension fund's managers use the so called "share value", which is the unit of measure of the fund's value. Share values are calculated and published daily by the SBS. The pension balance of an individual in period t is the number of pension fund's shares she holds at t multiplied by the share value of period t. Similar to Chávez-Bedoya (2017), we assume that the share values follow a Geometric Brownian Motion (GBM) stochastic process, which has both a deterministic and random Wiener component:

$$dV(t) = \mu V(t)dt + \sigma V(t)dW(t) \tag{7}$$

with

$$V(0) = V_0$$

$V(t)$ indicates the share value in period t; $W(t)$ is a Wiener process or Brownian motion; μ denotes the average return and σ the volatility. The first component of equation 7 is used to model deterministic trends, while the second one is used to model a set of unpredictable events occurring during this motion. To model this process we use data from AFP Integra's pension fund from January 2001 to December 2017. We decide to work with this pension fund because it has an important share of the market and has been part of the SPP since the beginning of the system without any merge or acquisition. For the deterministic component, an average real annual rate of return of 5 percent is assumed. This assumption follows SBS (2013) and it is based on the fact that, as an economy registers a sustainable growth and its stock market develops, it is expected a reduction on country risk and pension fund's returns. Evidence from OECD countries shows that pension funds real annualized rates were lower than 5 percent during the period 2002-2011. Furthermore, on a long-term view, annualized rate of return of the Chilean private pension system (which has been in place for more than 35 years) decreased from 14 percent on the first 10 years of operations to 5 percent over the 30 years of operations. Volatility is set at σ = 1.27 percent, which is the figure arising from returns excluding the period from 2005 to 2011 due to abnormal returns. We conduct one thousand

[7]The assumed values are:1.58 percent for the load factor fee, on average, and for themixed fee: (i) load factor component: 0.63 percent and (ii) balance component: 1.23 percent, on average. See Table A.2 in the Appendix for more details.

GBM simulations in order to obtain different paths for the share value and, therefore, different rates of return paths. We take the average of all the share value simulations.

5 Results

5.1 Who gain and lose with the policy?

Table 2 summarizes our main results. The columns indicate either the individual fall into the mixed balance fee scheme (default) or she deliberately chose the load fee option (active choice). Based on the comparison of charge ratios arising from our simulations, the rows specify which fee scheme is better for the individual. Recall that the best scheme for the individual is the one showing the lower charge ratio.

We observe that the policy is beneficial only for 36.2 percent of the individuals, while it is adverse for the other 63.8 percent. On the one hand, individuals who win with the default balance fee are 4,252 and those who win with the load factor fee are 19,155. So, only a total of 23,407 out of 64,588 individuals (36.2 percent) made a right choice by choosing the cheaper fee at the time the policy gave them the chance to do it. On the other hand, however, the allocation of the balance fee scheme for the majority of individuals appears to be a bad decision. 86 percent of those assigned to this scheme (=26,099/30,351) are currently losing money in comparison to the balance they would obtain under the load factor fee. Similarly, among the individuals who actively decided to remain in the load factor fee scheme, 44 percent (=15,082/34,237) were wrong about it. They would be better off under the default option. We can interpret this overall negative result as a combination of an ill-designed policy and an lack of soundness in individual financial decisions.[8]

Table 2: Winners and Losers with the Balance and Load Factor Fees Schemes

	Affiliates' actual fee scheme		
	Balance (mixed) fee (default option)	Load factor fee (active choice)	Total
Balance (mixed) fee scheme is better 1/.	4,252	15,082	19,334
Load fee scheme is better 1/.	26,099	19,155	45,254
Total	30,351	34,237	64,588

Note: A fee scheme is better than the other one if this has a lower charge ratio. Baseline simulation assumes a simple (not weighted) average balance fee of 1.23 percent.

Knowing that the reform is potentially adverse for around two thirds of the affiliates, it is important to explore with more detail who are the individuals losing or gaining more and how

[8]It must be mentioned that the original policy reform promoted by the Government was severely amended by the Parliament, which resulted on some loss of consistency. The original idea of the Government was to change the scheme fee towards a balance fee for all the affiliates and in this way expect that competition will push for fees reductions, but the Parliament allowed individuals to remain in the load fee scheme.

much are these gains and losses. For this end, we run probit models about the likelihood to choose the load fee scheme and the likelihood that this scheme –based on the comparison of charge ratios- is a better option than the default balance fee scheme for the individual. Table 3 reports these results. Both regressions include regional (individual's department of residence) fixed effects in order to control for possible unobservables at the department level. The first set of results show the marginal effects on the probability that the individual chose the load fee scheme. In this case, the dependent variable takes value one if the individual chose the load fee and zero otherwise, and the equation utilizes the full sample of analysis.

It is observed in column 1 of Table 3 that females, older and self-employed individuals are more prone to choose the load factor fee scheme. Contribution density is a very important determinant of choosing this type of fees. For example, an increase of 10 percent in contribution density is associated with an increase of 6.2 percentage points in the probability of choosing the load fee scheme. This choice is positively associated with the position of the individual in the income and saving balance distribution of 2016. So, income-rich or pension balance-rich individuals are more likely to choose the load fee. The position within the pension balance distribution has a more sizable effect than that of the income distribution. For example, moving from the first to the fifth quintile of income increases the probability of choosing load fees by 6.0 percentage points, while this effect is 24.3 percentage points for the same quintiles of the pension balance distribution.

Interestingly, there are some differences in the likelihood of choosing the load fee according to the level of risk in the investments taken by the individuals. Having a risky fund (fund type 3) or a low risky fund (fund type 1) is associated with an increase of 2.0 percentage points and a decrease of 4 percentage points, respectively, in the probability of choosing the load fee scheme. So, individuals more willing to take risk are more prone to choose the load fee scheme. It is not implausible that individuals who voluntary opted for risky funds (7.2 percent of the sample) –which require a special administrative procedure- can also be more knowledgeable and sophisticated investors who exerted the option of keeping the load fee if this was best option for them.[9]

[9]This seems to be the case. Among the affiliates with risky funds, 42.4 percent chose the best possible fee scheme (the one producing the lower charge ratio). For the affiliates with moderate (fund type 2) and secure pension funds (fund type 1), this figure is 35.7 and 37.4 percent, respectively.

Table 3: Probability to Choose and To Be Better Off with the Load Factor Fee

	Prob. of choosing load factor fee		Prob. load factor fee is better (among those choosing the load fee scheme)	
	Coef.	S.E.	Coef.	S.E.
Male	-0.111***	(0.005)	0.117***	(0.012)
Age	0.002***	(0.000)	-0.209***	(0.014)
Contribution density	0.617***	(0.011)	0.192***	(0.023)
Pension balance - 2nd quintile	0.151***	(0.008)	-0.178***	(0.040)
Pension balance - 3th quintile	0.190***	(0.009)	-0.382***	(0.053)
Pension balance - 4th quintile	0.210***	(0.010)	-0.527***	(0.056)
Pension balance - 5th quintile	0.243***	(0.011)	-0.736***	(0.049)
Income - 2nd quintile	0.004	(0.007)	-0.003	(0.012)
Income - 3th quintile	0.031***	(0.007)	0.023**	(0.009)
Income - 4th quintile	0.045***	(0.007)	-0.112***	(0.021)
Income - 5th quintile	0.060***	(0.008)	-0.068***	(0.019)
Self-employed	0.056***	(0.014)	0.008	(0.018)
Years enrolled in SPP	0.002***	(0.001)	-0.006***	(0.001)
AFP Profuturo	-0.016***	(0.005)	-0.720***	(0.020)
AFP Prima	0.029***	(0.005)	-0.400***	(0.024)
AFP Habitat	-0.061*	(0.034)	0.050***	(0.006)
Fund type 1 (secure)	-0.040***	(0.014)	0.039***	(0.012)
Fund type 3 (risky)	0.019**	(0.009)	-0.004	(0.010)
pseudo R2	0.206		0.951	
N	64,588		34,237	

Notes: Probit marginal effects for distinctive samples. All regressions include region fixed effects. The reference categories for balance and income quintiles is the first quintile, for self-employed is employee, for fund administrators is AFP Integra, for fund type is fund type 2 (moderate). Robust standard errors in parentheses. *p<0.10, **p<0.05, ***p<0.01.

In the other set of results of Table 3 we analyze the likelihood that the load factor fee is better than the balance fee scheme for the individual. For this model, the dependent variable takes value one if the charge ratio of the load fee scheme is lower than that of the balance fee scheme and zero otherwise. The sample consists of individuals who decided to remain in the load fee scheme. Within this group, being male, young and frequently contributor seems to increase the probability that the load factor fee is a better option. The position in the pension balance distribution is a key determinant too. However, being at the top part of the distribution seems to decrease the probability that the load factor fee results in a good option. In the case of the income distribution, the relationship is less clear. Moving from the first to the third quintile of income increases the likelihood by 2.3 percentage points, but moving to the fourth and fifth quintile decreases it by 11.2 and 6.8 percentage points, respectively.

To further analyze this, in Figure A.1 in the Appendix, we plot the predicted probability that the load fee is a better scheme by age, income and saving ventiles. We plot this probability

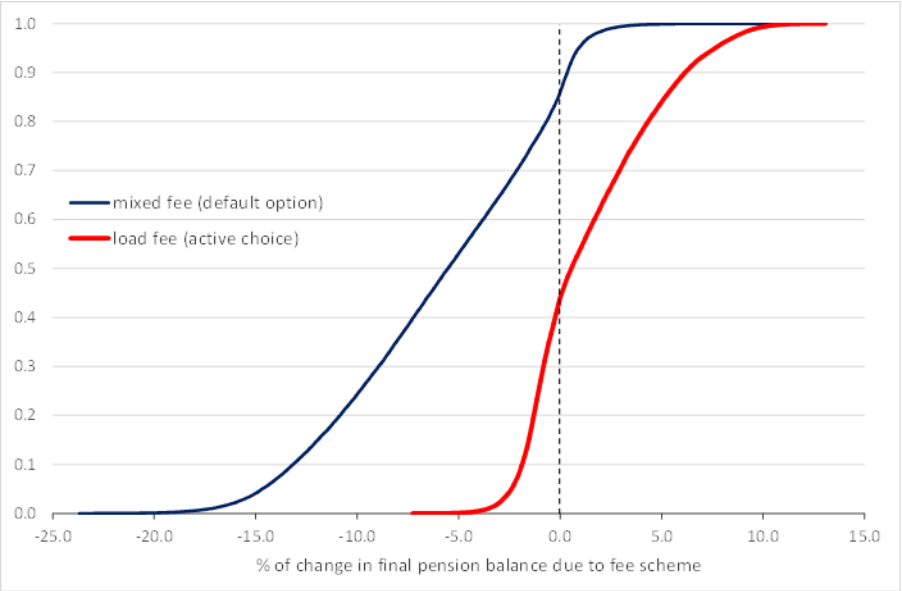
by the actual fee scheme chosen by the individuals. What it is observed is that, independently of the ventile of income or saving, individuals assigned to the default balance fee have a very high probability that the load factor fee would have been a better option (above 80 percent). This means that they would pay less (as a percentage of their lifetime pension balances) if they would have remained in the previous scheme. This is especially observed for individuals at the top part of the distributions. For individuals who are enrolled in the load fee scheme, the probability is lower but still above 50 percent. In the analysis by age, we observe that for the vast majority of individuals below 40 years-old, the load factor fee is (with probability close to one) a better option than the balance fee, but the likelihood of this decreases after that age. For those assigned to the mixed fee scheme, the load factor fee would have been a better option until age 51 with probability above 50 percent. Above that age, this likelihood significantly decreases. For individuals enrolled in the load fee scheme, the probability also decreases and it reaches zero at the age of 44.

5.2 The extent of gains and losses

Although we find that a large share of individuals will lose money in the fee scheme where they are, it is also important to assess the intensity of these losses and whether there are some gains. As explained in Section 4.1, the difference of charge ratios (Δ_{ml}) indicate the degree of gains or losses in terms of the percentage change in the final pension balance. Figure 3 shows the cumulative distribution of this variable by type of fee choice in order to observe the intensity of gains and losses. The thin blue line shows the cumulative distribution for the individuals who were assigned to the default balance (mixed) fee, and the thick red line represents the cumulative distribution for the individuals who chose the load factor fee.

We observe that the intensity of the loss is very high for the persons who obtained the default option. For example, 20.2 percent of these individuals will have a loss between 10 and 15 percent in the value of their final pension balance, and about 4.1 percent will loss more than 15 percent. The size of the gains for those individuals who are better off with the default option is considerably lower. Among the individuals assigned to the default option, the average size of changes in the pension balance for those who lose is negative, -7.0 percent, and is 0.9 percent for those who gained, being -5.9 percent for all the individuals in the default option. In contrast, as shown in Figure 3, the losses among the affiliates who opted for the load factor fee are less severe than in the case of those who opted for the mixed fee. On average, the size of changes in the pension balance for those who lose is -1.3 percent and it is 3.6 percent for those who gained, being 1.4 percent for all the individuals in the load fee scheme.

Figure 3: Cumulative of Gains/Losses due to Fee Scheme



Losses and gains due to the reform vary largely over age. As it is shown in Table 4, young individuals (those below 40 years-old) assigned to the default option seems to be the main losers of the reform. Being assigned to this scheme means that these individuals will pay more resources to the AFP and therefore their pension balances will be reduced. For example, all individuals in the 21-25 age group lose money and their pension balance is reduced in 13.6 percent, while the 51-55 age group is less affected because only 34 percent will lose money and their balances will be reduced by much less (1.4 percent). Table 4 also shows the losses and gains for individuals who opted for the load factor fee. In this case, older cohorts above 45 years-old are those who lose more and the size of changes in their pension balances goes from -1.4 to -0.9 percent.

Tables A5, A6 and A7 in the Appendix provides additional results by quintiles of income, density of contribution and pension balance. The main result is that, independently of the quintile, a significant proportion (around 86 percent) of individuals assigned to the balance fee are the main losers of the reform. Their retirement savings will be reduced by around 7.0 percent.

Table 4: Losses and Gains by Actual Fee Scheme and Age Group

Type of choice	Measure	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-64	Total
Balance (mixed) fee	% individuals losing	100.0	100.0	100.0	100.0	93.5	70.9	34.0	18.1	11.4	86.0
(default option)	% individuals gaining	0.0	0.0	0.0	0.0	6.5	29.1	66.0	81.9	88.6	14.0
	avg % change in balance (for those losing)	-13.6	-11.0	-8.1	-5.4	-3.3	-1.8	-1.4	-0.8	-0.2	-7.0
	avg % change in balance (for those gaining)	0.0	0.0	0.0	0.0	0.4	0.8	1.0	1.2	0.8	0.9
	avg % change in pension balance (for all)	-13.6	-11.0	-8.1	-5.4	-3.0	-1.1	0.2	0.9	0.6	-5.9
Load fee	% individuals losing	0.0	0.0	0.0	1.4	75.2	100.0	100.0	100.0	100.0	44.1
(active choice)	% individuals gaining	100.0	100.0	100.0	98.6	24.8	0.0	0.0	0.0	0.0	55.9
	avg % change in balance (for those losing)	0.0	0.0	0.0	-0.2	-0.6	-1.4	-2.0	-1.9	-0.9	-1.3
	avg % change in balance (for those gaining)	9.1	6.3	3.7	1.5	0.3	0.0	0.0	0.0	0.0	3.6
	avg % change in pension balance (for all)	9.1	6.3	3.7	1.4	-0.3	-1.4	-2.0	-1.9	-0.9	1.4
Total	% individuals losing	66.5	55.6	48.9	45.8	83.2	88.0	74.2	67.5	62.8	63.8
	% individuals gaining	33.5	44.4	51.1	54.2	16.8	12.0	25.8	32.5	37.2	36.2
	avg % change in balance (for those losing)	-13.6	-11.0	-8.1	-5.3	-1.9	-1.6	-1.9	-1.8	-0.9	-5.0
	avg % change in balance (for those gaining)	9.1	6.3	3.7	1.5	0.3	0.8	1.0	1.2	0.8	3.1
	avg % change in pension balance (for all)	-6.0	-3.3	-2.1	-1.7	-1.5	-1.3	-1.1	-0.8	-0.3	-2.0

5.3 Determinants of making a good decision

In this section we analyze the main determinants of making a good decision regarding the fee scheme. Table 5 reports the results. The first column show the marginal effects of a probit model where the dependent variable takes value one if the individual has the fee scheme offering the best value for money (i.e. the fee scheme with the lower change ratio), and zero otherwise. Males are slightly less prone to make a good choice. Being a male reduces the likelihood of making a good call by 2.8 percent. Being one year older reduces the likelihood by 0.4 percent. Although this is a small effect for one extra year, we can observe important differences between young and old individuals. For example, the probability of choosing the right fee scheme is about 12 percent higher for a 25-year-old affiliate than for a 55-year-old affiliate. Contribution density, self-employment and the position in the pension balance distribution are positively associated with the likelihood to make a good fee choice, but the effect of income position is less clear or less precisely estimated. For example, moving from the first to the fifth quintile of the pension balance distribution boosts the probability of making a good choice by 26.5 percent. Furthermore, having a secure or risky pension fund, in contrast of having a moderate risk pension fund, increases this probability by 18.5 and 3.2 percent, respectively.

The second set of results of Table 5 shows the OLS estimates of the percentage change in pension balance (Δ_{ml}). Age and contribution density are two of the most important variables determining the size of gains and losses. For example, moving from the second to the third quintile of the age distribution (from age 39 to 47) is associated –all else equal- with a percentage change of 1.06 in the pension balance. Similarly, moving from the second to the third quintile of the distribution of contribution density is associated with an increase of 0.83 percentage points in the pension balance. Belonging to a higher position in the pension balance distribution and being self-employed is also associated with larger gains. Contrary, the years enrolled in the SPP are related with more losses. For the type of pension fund, we observe that having a low risk portfolio (type 1) is associated with more losses in the pension balance (-0.77 percentage points) due to the fee scheme, while a risky portfolio (type 3) is associated with an increase of 0.22 percentage points. In sum, the policy reform seems to produce higher losses for individuals who are younger, males, poorer in terms of pension balance, employees, have low contribution density, more years enrolled in the SPP and have taken less risky pension funds.

Table 5: Determinants of Making a Good Choice of Fee Scheme and Estimates for Losses/Gains in Pension Balance

	Dep var: the individual chose the better fee scheme (Probit ME)		Dep var: percentage change in pension balance due to fee scheme (OLS)	
	Coef.	S.E.	Coef.	S.E.
Male	-0.028***	(0.004)	-0.642***	(0.044)
Age	-0.004***	(0.000)	0.133***	(0.003)
Contribution density	0.198***	(0.011)	2.887***	(0.095)
Pension balance - 2nd quintile	0.090***	(0.008)	1.138***	(0.076)
Pension balance - 3th quintile	0.178***	(0.009)	2.186***	(0.091)
Pension balance - 4th quintile	0.230***	(0.011)	2.841***	(0.101)
Pension balance - 5th quintile	0.265***	(0.012)	3.303***	(0.116)
Income - 2nd quintile	-0.023***	(0.006)	-0.407***	(0.066)
Income - 3th quintile	-0.002	(0.007)	-0.063	(0.067)
Income - 4th quintile	-0.014**	(0.007)	-0.033	(0.070)
Income - 5th quintile	-0.013*	(0.008)	-0.083	(0.082)
Self-employed	0.042***	(0.013)	0.633***	(0.107)
Years enrolled in SPP	-0.017***	(0.001)	-0.100***	(0.004)
AFP Profuturo	-0.020***	(0.005)	-0.073	(0.046)
AFP Prima	0.019***	(0.005)	0.240***	(0.053)
AFP Habitat	-0.047*	(0.028)	-0.506	(0.404)
Fund type 1 (secure)	0.185***	(0.013)	-0.766***	(0.072)
Fund type 3 (risky)	0.032***	(0.008)	0.222***	(0.056)
Constant			-10.207***	(0.284)
R2	0.093		0.162	
N	64,588		64,588	

Notes: All regression include region fixed effects. The reference categories for balance and income quintiles is the first quintile, for self-employed is employee, for fund administrators is AFP Integra, for fund type is fund type 2 (moderate). Robust standard errors in parentheses. *p<0.10, **p<0.05, ***p<0.01

6 Sensitivity checks

6.1 Impact on welfare

In the previous section we compare charge ratios to explore whether individuals are better or worse off in terms of how much pension balance was lost due to the policy reform. However, assessing the effects of the reform on a measure of welfare including preferences for risk, time discounting and consumption may offer an important robustness check for our results. For this aim we need to rely on certain assumptions for the utility function and its parameters. A straightforward method (used for example in Kotlikoff and Spivak (1981)) consists in computing indirect utilities for each individual for both types of fees and assess how much the individual should be compensated to make her indifferent between the choice of the two fees.

We consider that an individual's consumption choice problem at age x is maximizing her expected utility (equation 8) from current and future consumption subject to a budget constraint (equation 9):

$$EU = \sum_{t=0}^{D-x} p_{x_t} \beta^t U(C_t) \tag{8}$$

$$\sum_{t=0}^{D-x} p_{x_t} C_t R^{-t} = W_0 \tag{9}$$

where D is the maximum survival age, C_t is the consumption in time t , $\beta = 1/(1+\delta)$ is the inter-temporal discount factor using individual subjective rate of time preference δ, p_{x_t} is the probability of survival from age x to age $x+t$, $R = (1+r_t)$ is one plus the interest rate, which, for simplicity, would be similar to pension fund return rate.

We also assume that the utility function is separable in consumption over time. The optimal consumption plan in the left-hand side of equation 9 must be financed with the total wealth the individual has, W_0, which can be interpreted as all resource streams from labor and pension savings prior to her current age. The only source of uncertainty is the date of death and there are no bequests; therefore, the individual wishes to consume all her resources until death.

Using an iso-elastic utility function and considering both types of fee schemes, we rewrite equations 8 and 9 as follows:

$$EU = \sum_{t=0}^{D-x} p_{x_t} \beta^t \frac{C_t^{1-\gamma}}{1-\gamma} \tag{10}$$

$$\sum_{t=0}^{D-x} p_{x_t} C_t R^{-t} = \sum_{t=0}^{65-x-1} \left[w_t (1 - c_t - a_{1t}) R^{-t} \right] +$$

$$\sum_{t=65-x}^{D-x}\left[\frac{S_0(1+r_t)^{65-x-1}+\sum_{t=0}^{65-x-1}p_t c_t w_t(1+r_t)^{65-x-1-t}}{CRU_{65}}\right]R^{-t} \quad (11)$$

$$\sum_{t=0}^{D-x} p_{x_t} C_t R^{-t} = \sum_{t=0}^{65-x-1}\left[w_t(1-c_t-a_{3t})R^{-t}\right]+$$

$$\sum_{t=65-x}^{D-x}\left[\frac{S_0(1+r_t)^{65-x-1}+\sum_{t=0}^{65-x-1}p_t c_t w_t(1+r_t)^{65-x-1-t}(1-a_{2t})^{65-x-1-t}}{CRU_{65}}\right]R^{-t} \quad (12)$$

where γ is the parameter of relative risk aversion and equations 11 and 12 correspond to the budget constraints when the individual choose the load factor fee and the balance (mixed) fee scheme, respectively.

In both cases, the discounted consumption plan must be financed with all resources earned from labor between age x and retirement age assumed in 65 and resources from pensions obtained in old-age until death. It is assumed that the individual receives a life annuity pension which is computed as the total savings divided by the annuity price CRU at age 65. Note how load factor charges (a_{1t}, a_{3t}) affect labor resources' streams whereas the balance charge (a_{2t}) affects pension resources. By considering different values of γ we will be able to analyze how the gains or looses depend on the degree of risk aversion.

In the load factor fee case maximization of equation 10 subject to equation 11 leads to the following consumption plan:

$$C_t^* = \frac{W_0^{l,fee}}{\sum_{t=0}^{D-65} p_{x_t}\beta^{\frac{t}{\gamma}}R^{\frac{t}{\gamma}-t}} \quad (13)$$

where $W_0^{l,fee}$ summarizes all resources from labor and pension savings described in the right-hand side of the budget constraint.

In the case of the balance (mixed) fee, maximizing equation 10 subject to equation 12 leads to:

$$C_t^* = \frac{W_0^{m,fee}}{\sum_{t=0}^{D-65} p_{x_t}\beta^{\frac{t}{\gamma}}R^{\frac{t}{\gamma}-t}} \quad (14)$$

where $W_0^{m,fee}$ equals to the right-hand side of the corresponding budget constraint.

Then we replace both consumption plans on the utility function and obtain indirect utilities as functions of the total resources for each case as follows:

$$V_t(W_0^{l,fee}) = \sum_{t=0}^{D-65} p_{x_t}\beta^t \left[\frac{W_0^{l,fee}}{\frac{p_{x_t}\beta^{\frac{t}{\gamma}}R^{\frac{t}{\gamma}-t}}{1-\gamma}} \right]^{(1-\gamma)} \tag{15}$$

$$V_t(W_0^{m,fee}) = \sum_{t=0}^{D-65} p_{x_t}\beta^t \left[\frac{W_0^{m,fee}}{\frac{p_{x_t}\beta^{\frac{t}{\gamma}}R^{\frac{t}{\gamma}-t}}{1-\gamma}} \right]^{(1-\gamma)} \tag{16}$$

Once the values of these indirect utilities are obtained, for instance $\bar{V}$, we can compute, for an individual who was assigned to the balance fee, the value of M such that $V_t(MW_0^{m,fee}) = \bar{V} = V_t(W_0^{l,fee})$ which would be the percentage increase in wealth we need to give to make her as well off as she would be in the load factor fee scheme. This measure resembles the concept of compensating variation, which refers to the amount of additional money a person would need to reach her initial utility after a change in prices, which in this case would be the change in fees.

We compute total resources, consumption plans and indirect utilities for all individuals in our sample. Simulations of resource streams from labor and pension balances are explained in Section 4.2. To calculate consumption plans and indirect utilities we assume values of $R = 1.05$ $\beta = 0.95$ and survival probabilities for singles using Mortality Tables SPP-S-2017.[10] We also consider three different values of risk aversion, 0.1, 0.5 and 0.9, which is a sufficiently large range to analyze the risk tolerance in our sample.

Table 6 and Figure 4 show the main results. Table 6 shows that the load factor fee is the option that brings the highest utility to individuals up to 35 years-old in comparison to the balance (mixed) fee. The mean differences are significant for all cohorts, independently of the assumed value of risk aversion. For the cohort 36-40 years-old, the load factor fee is the option that makes them better-off when the value of risk aversion is 0.5 or higher, which means preferences for low or very low levels of risk. For older cohorts, however, mean differences are not significant, therefore it is difficult to distinguish which type of fee scheme brings the highest utility.

[10]These probabilities are also used to compute the annuity price, *CRU*. See the following regulation for more details: Resolución SBS N° 886-2018.

Table 6: Mean Difference of Indirect Utility Functions (IUF) by Level of Risk Aversion

Age group	Relative risk aversion	IUF load factor fee	IUF balance (mixed) fee	Mean difference
21-25	0.10	119.48	110.10	9.38***
26-30	0.10	247.57	232.46	15.11***
31-35	0.10	394.31	377.05	17.26***
36-40	0.10	576.65	559.91	16.75
41-45	0.10	779.87	766.97	12.90
46-50	0.10	917.63	911.16	6.47
51-55	0.10	1,008.53	1,007.67	0.86
56-60	0.10	1,056.24	1,058.67	-2.42
61-64	0.10	809.43	811.61	-2.18
21-25	0.50	275.15	262.95	12.20***
26-30	0.50	313.33	302.69	10.64***
31-35	0.50	302.43	295.27	7.16***
36-40	0.50	274.31	270.06	4.24**
41-45	0.50	238.76	236.67	2.09
46-50	0.50	194.92	194.18	0.74
51-55	0.50	153.45	153.40	0.06
56-60	0.50	119.36	119.53	-0.16
61-64	0.50	79.84	79.97	-0.13
21-25	0.90	28.99	28.73	0.27***
26-30	0.90	27.66	27.47	0.19***
31-35	0.90	25.03	24.91	0.12***
36-40	0.90	22.07	22.00	0.07*
41-45	0.90	19.13	19.09	0.03
46-50	0.90	16.07	16.05	0.01
51-55	0.90	13.24	13.24	0.00
56-60	0.90	10.62	10.63	-0.00
61-64	0.90	8.27	8.28	-0.00

Notes: Means of the Indirect Utility Functions corresponding to the levels of risk aversion of 0.1 and 0.9 are expressed in thousands of utils. *p<0.10, **p<0.05, ***p<0.01.

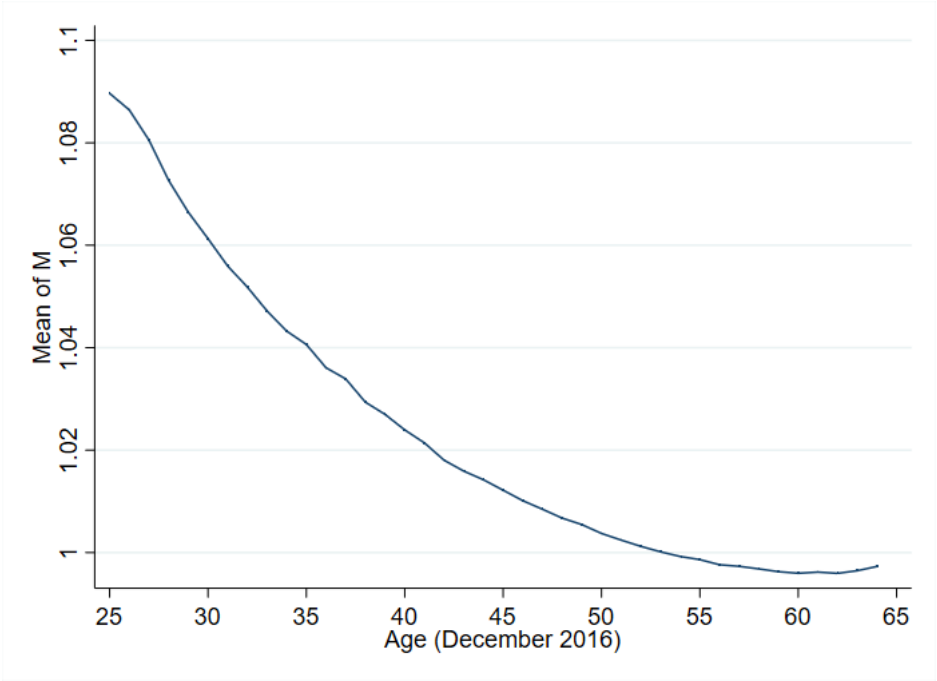
Figure 4 shows the average of additional wealth (M) by age we would need to give individuals in the balance (mixed) fee to make them as well off as they would be in the load fee scheme. We find that $M \geq 1$ for the vast majority of individuals, which would be indicative that they are worse-off due to the reform and they need additional resources to reach their initial utility levels. Consistent with our previous results, young individuals (below 40 years-old) are the ones most affected and will need significant compensations in comparison to the old ones. Among individuals assigned to the balance fee scheme, the proportion who is worse-off ($M \geq 1$) is 81 percent, whereas this proportion is only 16 percent in the load fee scheme. Importantly, results are independent of the value of risk aversion.

Tables A8, A9 and A10 in the Appendix provides additional results by quintiles of income, density of contribution and pension balance separated by actual fee scheme. Similar as before, individuals assigned to the balance fee appear to be the main losers in terms of welfare, especially those who are in the upper quintiles of the contribution density and the pension balance

distribution. To avoid these welfare losses we would need to compensate them in about 4.8 percent of their total resources.

This overall negative result is consistent with our findings in Section 5, where we use variations on charge ratios and pension balances. Now, using variations on utilities and compensating measures, we can argue that the policy was indeed not well-designed and not welfare improving for the majority of individuals.

Figure 4: Mean of Additional Wealth Needed to Compensate Individuals



Notes: For this Figure we restrict the sample to individuals older than 25 years.

6.2 Different values of the balance fee

One may wonder whether our results change with the level of fees used in the simulation (average default balance fee of 1.23 percent). We highlight this with the use of two different values of the default fee, 1.00 and 0.75 percent. The level of the load factor fee remains the same. Assuming a scenario of declining balance fees over time is quite optimistic in a market with just four providers and very low dynamic in prices (see Figure 2b), but it is still important to assess whether the relative proportions of losers and winners change and whether the intensity of the losses and gains is varying. [11]

Table 7 summarizes our results. As expected, the percentage of individuals that are better-off (winners) with the default balance fee increases. In the baseline scenario shown in Table 2, this

[11] An important assumption during the approval of the reform was that balance fees will decline over time (SBS (2013)). It is assumed a declining balance fee over time reaching 0.60 percent around the year 2024. The assumption is based on the evolution of the ratio of Pension Funds fee's revenues and total pension balance over time for the Chilean pension system after 30 years of functioning.

percentage is only 6.6 percent, but in scenarios where the balance fee is lower, for example 1.0 or 0.75 percent, the percentage increases to 10.5 and 19.6, respectively. Accordingly, the fraction of winners under the load factor fee decreases from 29.7 to 21.8 and 7.0 percent, respectively. Table 7 also shows that in the baseline scenario those assigned to the default who made a wrong choice represent 40.4 percent of the sample, but in scenarios 1 and 2, they represent 36.5 and 27.4 percent, respectively. So, even in a very optimistic scenario where the balance fee is relatively low (0.75 percent), still more than one quarter of the sample is worse-off with the default fee, being this percentage higher than the percentage of winners (19.6). For those who opted for the load factor fee, assuming scenarios of decreasing balance fees, naturally implies that they will lose money because they are enrolled in a more expensive scheme; the fraction of losers increases from 23.4 to 31.2 (balance fee 1.0 percent) and 46.0 percent (balance fee 0.75 percent).

Even decreasing balance fees are always good news for the individuals in the default scheme, we observe that this trend may also increase the overall number of losers (from 63.8 to 67.7 and 73.4 percent), the reason being that more individuals in the load factor fee would become losers provided they do not switch to the mixed fee.

Table 7: Type of Choice under Different Values of Balance Fee (% of total individuals)

Type of choice	Baseline Balance fee = 1.23%	Scenario 1 Balance fee = 1.00%	Scenario 2 Balance fee = 0.75%
a. Mixed fee scheme is better & mixed fee is chosen	6.6	10.5	19.6
b. Load fee scheme is better & load fee is chosen	29.7	21.8	7.0
Total of individuals with right choice (a+b)	36.2	32.3	26.6
c. Load fee scheme is better & mixed fee is chosen	40.4	36.5	27.4
d. Mixed fee scheme is better & load fee is chosen	23.4	31.2	46.0
Total of individuals with wrong choice (c+d)	63.8	67.7	73.4
Total	100.0	100.0	100.0

Note: A fee scheme is better than the other one if this has a lower charge ratio. 2/. Balance fees correspond to simple average of fees.

Figures A.2 and A.3 in the Appendix show the cumulative distribution of gains/losses in terms of percentage change in the final pension balance to observe whether the intensity of gains and losses varies in a scenario of decreasing balance fees. As we observe, the intensity of the loss is reduced for the individuals who were assigned to the default option in comparison to the distribution shown in Figure 3, specially in the scenario of a balance fee of 0.75 percent. The size of the gains also changes positively in this scenario, as expected. Consequently, the losses among the affiliates who opted for the load factor fee increase indicating relatively lower final pension balances.

In sum, the analysis presented in this section suggests, first, that the relative proportions of losers and winners change with the levels of balance fees. The fraction of winners (losers)

under the default scheme increases with a lower (higher) balance fee. Second, the intensity of the losses and gains for individuals assigned to the default option varies when there are lower balance fees. The intensity of the loss reduces and the intensity of the gains increases. However, an open question would be whether balance fees can decrease over time to reach 0.75 percent on average, given current levels of 1.23 percent, especially in a mandatory IRA system with just four providers.

6.3 Potential effects on inequality

The study of the distribution of wealth has received a renewed interest thanks to the emergence of new data (Saez and Zucman (2016), Piketty and Zucman (2015)) and developments in its measurement (Cowell and Van Kerm (2015), Davies et al. (2017), Cowell et al. (2017)). As pension balance is also included in household wealth portfolios, we could assess whether the fees reform could have some effects on one of the important components of wealth. For this aim we use Gini-Recentered Influence Function (RIF-Gini) regressions to uncover the predictors of pension balance inequality (Firpo et al. (2009) and Choe and Van Kerm (2018)). This method allows to compute how much would the effect of a small change in one covariate on the Gini index (or any other inequality statistic). The key covariate that we investigate is the fee scheme chosen by the individual. There are two stages in RIF regressions. First, the influence function (IF) (Hampel et al. (1986)) of each individual on the pension balance distribution is computed. This means that we estimate the influence of each individual on the Gini index of pension balances as a function of her own pension balance and of the overall distribution of pension balances. In the second stage, the computed Gini influence function is linearly regressed against some covariates of interest. For example, a positive coefficient for the mixed fee (a dummy variable) may suggest that marginally increasing the share of individuals with this fee –and assuming that the distribution of all the other covariates are constant- would lead to an increase in the Gini index. The size of this coefficient would indicate the size of the increase in the Gini index if all individuals would have chosen the mixed fee. [12]

The IF and Gini index are computed with the pension balance simulated for each individual taking into account her actual fee scheme, i.e. this is the pension balance projected until the individual is 65. In order to reduce the role of life-cycle effects due to pension balance accumulation paths across life-span, we compute Gini indices for different cohort groups. Equation 17 shows the specification model of RIF-Gini regressions for a particular cohort. The dependent variable is the influence function (IF, previously estimated in a first stage) of each individual divided by the Gini index of pension balances of the corresponding cohort. The covariates (X_i) are sex, age, contribution density, income, initial pension balance, labour status, time enrolled in SPP, fund administrator, fund type and region fixed effects; $mixed fee$ takes value one if the

[12] Although we focus on the Gini index, due to its popularity and normative properties, there are other IF types useful for distribution analysis (see Essama-Nssah and Lambert (2012), Davies et al. (2017)).

individual is in the mixed fee scheme and zero otherwise.

$$IF_i = \alpha + \beta_1 X_i + \beta_2 mixedfee_i + \varepsilon_i \tag{17}$$

Table 8 reports only the coefficients estimated for *mixedfee* for each cohort group (the estimates of all covariates can be consulted in the Appendix). The coefficients are interpreted as percentage changes. For example, the coefficient 0.118 for the cohort group 26-30 indicates that an increase of 1percent in the proportion of individuals with the default mixed fee is associated with an increase of 0.12 percent in the Gini index of pension wealth. When statistically significant, the effect on inequality of the default fee scheme is positive and ranges between 0.05 percent and 0.14 percent. Therefore, another potential impact of the pension reform is an increase in the inequality of pension wealth in the future. This result can be explained by the fact that balance fees penalize the accumulation of funds, particularly the funds of individuals who exhibit both low income and low contribution density, and hence enlarging the wealth distance between individuals.

Table 8: Influence of Balance (Mixed) Fee on Pension Wealth Inequality

Age group regression	Gini index	RIF Gini	
		coeff	se
21-25	0.552	-0.023	(0.020)
26-30	0.598	0.118***	(0.015)
31-35	0.591	0.138***	(0.011)
36-40	0.602	0.113***	(0.012)
41-45	0.616	0.091***	(0.010)
46-50	0.619	0.082***	(0.011)
51-55	0.628	0.065***	(0.016)
56-60	0.644	0.022	(0.017)
61-65	0.666	0.056**	(0.023)

Notes: ***p<0.01, **p<0.05, *p<0.10. Robust standard errors are reported in parenthesis. Each row corresponds to a regression by age group. The dependent variable is the Influence Function (IF) of each individual in the Gini of final pension balance in each age group divided by the Gini index of the corresponding age group). All regressions include region fixed effects, sex, age, contribution density, labor status, time enrolled in SPP, fund administrator, fund type, income and initial pension balance.

7 Conclusions

One of the main lessons from our study is that pension policies, and particularly the features of an irreversible default option, should be carefully designed and take into consideration market limitations and lack of adequate financial literacy. In pension systems, mistakes made by individuals have irreversible and long-term consequences. We show that a reform on pension fund

management fees implemented in Peru's IRA system in 2013 has adverse effects on pension wealth. The reform established a new balance fee charging a percentage of the pension balance - labeled the mixed fee scheme (the default) - unless the individual opted for remaining in the load factor fee that charges a percentage of the salary. Our results indicate that pension wealth of 63.8 percent of individuals will be hampered by the type of fees scheme chosen or assigned. This percentage is composed by 40.4 percent of individuals who were assigned to the default option and 23.4 percent who freely chose remaining in the load factor fee.

Our analytical data set composed of individual administrative records does not allow us to establish whether the individuals assigned to the default were simply inactive regarding the choice of a fee scheme or erroneously believed that the mixed fee scheme was the best one for their interests. But it is worrying that almost one quarter of the individuals were "wrong" about remaining in the load fees scheme.

We also perform some robustness checks and detect that, as expected, the individuals assigned to the default option will be better off with reductions of the balance fees. But, even decreasing balance fees are always good news, we observe that this may also increase the overall number of people losing due to the reform, the reason being that more individuals in the load factor fee would lose provided they do not switch to the mixed fee. Therefore, if a hypothetical reduction of balance fees occurs, the Government may consider encourage the shift from the load factor to the mixed fee for certain individuals.

We also observe large heterogeneity in the intensity of losses and gains due to the reform, being the size of losses larger than the size of gains. In particular, the younger and poorer individuals and those falling into the default option show higher losses. Moreover, we utilize Gini-Recentered Influence Function regressions to uncover the predictors of pension balance inequality and detect that the change of fee scheme is associated with increasing inequality of pension wealth.

In general, our findings contrast with some assumptions made to implement the reform. One assumption was that private pension managers will have incentives (aligned interests) to perform better since they can directly charge their management fees from the pension balance instead of salaries, leading to higher rates of returns for both individuals and providers. However, this seems to be a strong assumption in a market with just four providers and very low dynamic in prices observed in the past. Another implicit assumption was that the default option is the best one for individuals given that it is irreversible. Nevertheless, our results show that this is not necessarily the case.

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Appendix

Table A.1: Fees Schemes in Individual Capitalization Pension Systems for Selected Countries

Country	Income level	Mandatory / Voluntary	Year	Average fees on (%)				Maximum fees on (%)			
				Contributions	Salary	Assets	Returns	Contributions	Salary	Assets	Returns
Czech Republic	High	Voluntary	2013			0.60	15.00			0.60	15.00
Hong Kong 1/.	High	Mandatory	2013			1.70					
South Korea	High	Voluntary	2011			0.70					
Spain (occupational)	High	Voluntary	2012			0.21				2.00	
Sweden 2/.	High	Mandatory	2016			0.38					
United Kingdom 3/.	High	Voluntary	2011							1.50	
United States 4/.	High	Voluntary	2011			0.78					
Bulgaria	Middle	Mandatory	2013	5.00		1.00		4.97		1.00	
Colombia 5/.	Middle	Mandatory	2014						3.00		
Costa Rica 6/.	Middle	Mandatory	2017			0.19				0.50	
Chile	Middle	Mandatory	2017		1.23						
Dominican Republic 7/.	Middle	Mandatory	2017	0.50							
Mexico	Middle	Mandatory	2018			1.02					
Peru 8/.	Middle	Mandatory	2016		1.07	1.25					
South Africa	Middle	Voluntary	2010			0.39					
Uruguay	Middle	Mandatory	2017		0.97						
Bolivia 9/.	Low	Mandatory	2007		0.50						
El Salvador 10/.	Low	Mandatory	2017		2.00						
Namibia	Low	Voluntary	2011			0.85					

Source: International Organization of Pension Supervisors (IOPS), CONSAR (Mexico).

Notes: 1/. It refers to the average Fund Expense Ratio of Mandatory Provident Fund (MPF) constituent funds as of December 2013. 2/. There is an average fee of 0.028% on account value (2015) for Notional Defined Contribution administrative fees. 3/. This represents a statutory cap on annual management charges for the stakeholder pension plan. Other than for stakeholder pension plans, there is no statutory limit or cap on charging in the UK. 4/. Deloitte Consulting conducted a survey of 525 pension plans and found that the average administrative fee for 401(k) saving plans is 0.78%. The fees varied from a minimum of 0.28% up to a maximum of 1.38% of assets. This fee includes record-keeping, administration and investment management. 5/. For insured persons, the fee is charged on the combined individual account contributions of the insured person and his or her employer. For self-employed persons the administrative fee is 1.5%. 6/. The OPCs have to charge administrative fees only on assets under management. In 2017 the maximum fee established in the regulation is 0.50% per annum and will drop to 0.35% in 2020. 7/. Of the total insured person and employer contributions. 8/. As a process of transition, a mixed fee (1,07% of monthly salary, plus 1.25% on Assets Under Management) is being implemented. The process will finish in 2023. After that, the only fee will be the fee on assets. 9/. AFPs charge a fee of 0.5% of the contributory salary (taken from contributions) for affiliation, data processing, and benefit administration. AFPs charge between 0 and 0.2285% for asset management services depending on the value of the funds. They may also deduct transaction and custody costs from funds. There is no legal maximum fee. 10/. Charge for disability and survivor insurance and administrative fees.

Table A.2: Fees Schemes in the Peruvian Private Pension System (February 2018)

Pension Fund (AFP)	Load factor fee or fee on salary (%)	Mixed fee 1/.		Percentage of affiliates of the SPP (%)
		Part 1: Load factor fee (%)	Part 2: Balance fee (%)	
Integra	1.55	0.90	1.20	32.02
Prima	1.60	0.18	1.25	23.43
Profuturo	1.69	1.07	1.20	28.89
Habitat	1.47	0.38	1.25	15.66

Source: Superintendency of Banking, Insurance and Pension Funds (SBS).

Notes: The reform (effective on June 1st 2013) set up the mixed fee as the default option, so individuals preferring to remain in the previous load factor fee had to take actions. This mixed scheme has two components, the load factor fee and the balance fee. The load factor fee will gradually decrease up to zero in 2023, so the balance fee will be the only type of fee after 2023. The only option for new workers enrolling in an AFP after 2013 is the balance fee. 3/. See the following regulations for more details: Law N° 29903, D. S. N° 068-2013-EF and Resoluciones SBS N° 8514-2012, N° 9617-2012, N° 2935-2013.

Table A.3: Income Annual Growth Rates by Birth Cohort and Income Quintile

Birth Cohort	Women					Men				
	Q1	Q2	Q3	Q4	Q5	Q1	Q2	Q3	Q4	Q5
21-25	0.2	2.6	1.9	2.8	3.4	1.7	2.1	1.9	3.1	4.9
26-30	0.6	2.2	1.6	2.5	3.8	1.5	1.9	2.1	2.5	4.2
31-35	1.2	1.9	1.2	2.2	2.9	1.7	1.9	1.7	2.8	3.2
36-40	1.0	1.8	1.0	2.4	3.2	1.0	1.9	1.8	2.5	2.4
41-45	1.2	1.7	1.0	3.0	4.4	1.3	1.9	1.6	2.5	2.8
46-50	2.3	1.7	1.1	3.0	3.4	1.1	1.6	1.8	2.2	3.0
51-55	0.3	1.6	1.3	2.9	1.6	1.8	1.7	1.8	2.5	3.2
56-60	1.5	2.6	1.5	2.0	2.4	1.6	2.0	1.6	2.7	3.2
61-64	5.3	2.6	1.9	3.9	0.0	0.0	2.8	1.8	3.1	0.0

Notes: Based on administrative data provided by the Superintendency of Banking, Insurance and Pension Funds (SBS) for the years 2006 and 2013. Median growth rates, in percentages.

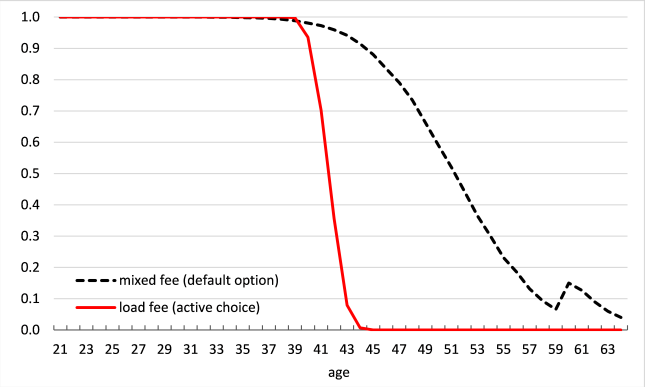
Table A.4: Mean Differences Among Affiliates by Gender and Actual Fee Scheme

Variable	Load Factor Fee		Balance (Mixed) Fee		Mean Difference	
	Women (N=13,263)	Men (N=21,004)	Women (N=9,295)	Men (N=21,068)	Women	Men
Age	40.03	41.27	37.39	38.85	2.64***	2.42***
Balance not affected by balance fees (S/. '000)	42,512.83	55,370.78	12,041.44	16,931.81	30,471.39***	38,438.97***
Balance charged with balance fees (S/. '000)			3,969.34	5,240.81	-3,969.34***	-5,240.81***
Total saving balance (S/. '000)	42,512.83	55,370.78	16,010.78	22,172.62	26,502.05***	33,198.16***
1st quintile (% of individuals)	0.08	0.05	0.4	0.34	-0.32***	-0.29***
2nd quintile	0.18	0.16	0.24	0.24	-0.06***	-0.08***
3th quintile	0.22	0.22	0.16	0.18	0.06***	0.05***
4th quintile	0.25	0.26	0.12	0.14	0.13***	0.12***
5th quintile	0.26	0.31	0.08	0.11	0.19***	0.20***
Monthly labour income (S/.)	2,769.39	3,467.34	1,551.86	2,014.65	1,217.53***	1,452.69***
1st quintile (% of individuals)	0.15	0.12	0.33	0.27	-0.17***	-0.15***
2nd quintile	0.20	0.15	0.26	0.21	-0.06***	-0.06***
3th quintile	0.20	0.20	0.18	0.21	0.02***	-0.01
4th quintile	0.20	0.24	0.12	0.19	0.08***	0.06***
5th quintile	0.24	0.28	0.11	0.13	0.13***	0.15***
Contribution density (%)	0.78	0.79	0.46	0.47	0.32***	0.32***
1st quintile (% of individuals)	0.05	0.05	0.38	0.37	-0.33***	-0.32***
2nd quintile	0.15	0.15	0.26	0.26	-0.11***	-0.11***
3th quintile	0.22	0.23	0.15	0.17	0.07***	0.06***
4th quintile	0.27	0.28	0.11	0.12	0.16***	0.17***
5th quintile	0.30	0.29	0.10	0.09	0.20***	0.20***
Self-employed	0.03	0.02	0.04	0.03	-0.01**	-0.01***
Years enrolled in SPP	13.87	14.71	11.72	12.51	2.15***	2.20***
AFP Integra	0.43	0.4	0.42	0.37	0.01*	0.02***
AFP Profuturo	0.27	0.31	0.33	0.38	-0.05***	-0.07***
AFP Prima	0.30	0.28	0.25	0.24	0.04***	0.04***
AFP Habitat	0.004	0.005	0.004	0.003	-0.0003	0.002***
Fund type 1 (secure)	0.03	0.05	0.02	0.03	0.01***	0.01***
Fund type 2 (moderate)	0.88	0.85	0.94	0.92	-0.06***	-0.06***
Fund type 3 (risky)	0.08	0.1	0.04	0.05	0.04***	0.05***
Have recognition bond	0.05	0.06	0.02	0.02	0.03***	0.04***

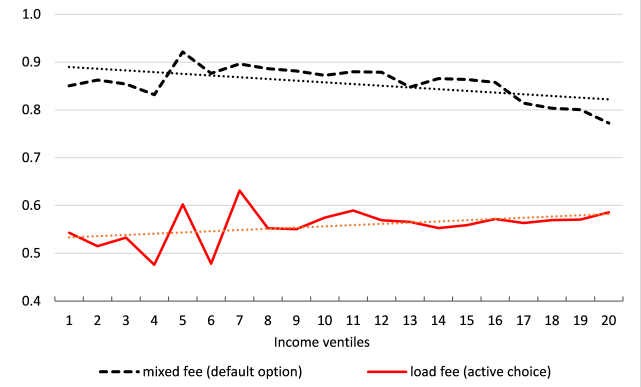
Notes: Based on data provided by the Superintendency of Banking, Insurance and Pension Funds (SBS).

Figure A.1: Conditional Probability that Load Factor Fee Scheme is Better

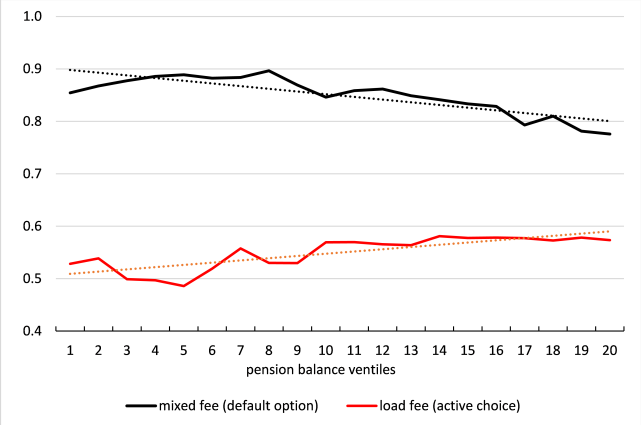
(a) Predicted Probability by Age and Actual Fee Scheme



(b) Predicted Probability by Income Ventiles and Actual Fee Scheme



(c) Predicted Probability by Balance Ventiles and Actual Fee Scheme



Notes: Predicted probabilities are based on column 2 of Table 3. Mixed fee scheme includes the balance fee.

Table A.5: Losses and Gains by Actual Fee Scheme and Income Quintiles

Type of choice	Measure	Q1	Q2	Q3	Q4	Q5	Total
Balance fee	% individuals losing	84.9	89.5	87.8	85.7	79.7	86.0
(default option)	% individuals gaining	15.1	10.5	12.2	14.3	20.3	14.0
	avg % change in balance (for those losing)	-6.8	-7.5	-7.2	-7.0	-6.7	-7.0
	avg % change in balance (for those gaining)	0.9	0.7	0.9	1.0	1.1	0.9
	avg % change in pension balance (for all)	-5.6	-6.6	-6.2	-5.8	-5.1	-5.9
Load fee	% individuals losing	48.7	44.3	42.9	43.7	42.7	44.1
(active choice)	% individuals gaining	51.3	55.7	57.1	56.3	57.3	55.9
	avg % change in balance (for those losing)	-1.2	-1.2	-1.3	-1.4	-1.5	-1.3
	avg % change in balance (for those gaining)	3.4	3.4	3.6	3.8	3.7	3.6
	avg % change in pension balance (for all)	1.2	1.4	1.5	1.5	1.5	1.4
Total	% individuals losing	72.3	68.6	63.8	60.4	53.5	63.8
	% individuals gaining	27.7	31.4	36.2	39.6	46.5	36.2
	avg % change in balance (for those losing)	-5.5	-5.6	-5.1	-4.5	-3.7	-5.0
	avg % change in balance (for those gaining)	2.5	2.9	3.2	3.4	3.4	3.1
	avg % change in pension balance (for all)	-3.3	-2.9	-2.1	-1.4	-0.4	-2.0

Table A.6: Losses and Gains by Actual Fee Scheme and Contribution Density Quintiles

Type of choice	Measure	Q1	Q2	Q3	Q4	Q5	Total
Balance fee	% individuals losing	89.2	91.2	87.7	86.1	55.4	86.0
(default option)	% individuals gaining	10.8	8.8	12.4	13.9	44.6	14.0
	avg % change in balance (for those losing)	-7.3	-7.7	-7.2	-6.7	-2.6	-7.1
	avg % change in balance (for those gaining)	1.2	1.1	0.9	1.0	0.6	0.9
	avg % change in pension balance (for all)	-6.4	-6.9	-6.2	-5.6	-1.1	-5.9
Load fee	% individuals losing	39.2	32.4	32.8	31.4	71.4	44.1
(active choice)	% individuals gaining	60.8	67.6	67.2	68.7	28.6	56.0
	avg % change in balance (for those losing)	-1.1	-1.4	-1.4	-1.5	-1.3	-1.3
	avg % change in balance (for those gaining)	4.3	4.0	3.8	3.9	1.8	3.6
	avg % change in pension balance (for all)	2.2	2.3	2.1	2.2	-0.4	1.4
Total	% individuals losing	82.7	68.1	54.2	45.9	67.9	63.8
	% individuals gaining	17.3	31.9	45.8	54.1	32.1	36.2
	avg % change in balance (for those losing)	-7.0	-6.8	-5.1	-4.1	-1.5	-5.0
	avg % change in balance (for those gaining)	2.6	3.5	3.5	3.7	1.5	3.1
	avg % change in pension balance (for all)	-5.3	-3.3	-1.1	0.2	-0.5	-2.0

Table A.7: Losses and Gains by Actual Fee Scheme and Balance Quintiles

Type of choice	Measure	Q1	Q2	Q3	Q4	Q5	Total
Balance fee	% individuals losing	87.0	88.8	85.7	83.6	78.9	86.0
(default option)	% individuals gaining	13.0	11.2	14.3	16.4	21.1	14.0
	avg % change in balance (for those losing)	-7.2	-7.3	-7.1	-6.6	-6.2	-7.0
	avg % change in balance (for those gaining)	1.4	0.9	0.6	0.6	0.6	0.9
	avg % change in pension balance (for all)	-6.1	-6.4	-6.0	-5.4	-4.8	-5.9
Load fee	% individuals losing	49.2	47.4	44.1	42.5	42.4	44.1
(active choice)	% individuals gaining	50.8	52.6	55.9	57.5	57.6	55.9
	avg % change in balance (for those losing)	-2.2	-1.6	-1.3	-1.2	-1.1	-1.3
	avg % change in balance (for those gaining)	4.1	3.6	3.6	3.6	3.5	3.6
	avg % change in pension balance (for all)	1.0	1.2	1.5	1.6	1.5	1.4
Total	% individuals losing	80.9	70.7	61.0	55.4	50.7	63.8
	% individuals gaining	19.1	29.3	39.0	44.6	49.3	36.2
	avg % change in balance (for those losing)	-6.7	-5.6	-4.6	-3.8	-2.9	-5.0
	avg % change in balance (for those gaining)	2.6	3.0	3.2	3.2	3.2	3.1
	avg % change in pension balance (for all)	-4.9	-3.1	-1.6	-0.6	0.1	-2.0

Table A.8: Welfare Losses and Gains by Actual Fee Scheme and Income Quintiles

Type of choice	Measure	Q1	Q2	Q3	Q4	Q5	Total
Balance fee	% individuals losing	77.9	78.6	78.9	83.4	89.0	80.5
(default option)	% individuals gaining	22.1	21.4	21.1	16.6	11.0	19.5
	avg % M (for those losing)	6.2	4.1	4.2	4.4	4.6	4.8
	avg % M (for those gaining)	-0.7	-0.7	-0.7	-0.6	-0.5	-0.7
	avg % M (for all)	4.7	3.0	3.2	3.6	4.0	3.7
Load fee	% individuals losing	18.6	16.5	16.6	15.6	12.8	15.6
(active choice)	% individuals gaining	81.4	83.5	83.4	84.4	87.2	84.4
	avg % M (for those losing)	-0.4	-0.4	-0.4	-0.4	-0.3	-0.4
	avg % M (for those gaining)	4.3	3.0	3.4	3.6	3.8	3.6
	avg % M (for all)	3.4	2.5	2.8	3.0	3.2	3.0
Total	% individuals losing	57.3	49.9	45.6	42.5	34.9	46.1
	% individuals gaining	42.7	50.1	54.4	57.5	65.1	53.9
	avg % M (for those losing)	5.4	3.4	3.3	3.4	3.3	3.9
	avg % M (for those gaining)	2.6	2.2	2.7	3.1	3.5	2.9
	avg % M (for all)	4.2	2.8	3.0	3.2	3.5	3.3

Table A.9: Welfare Losses and Gains by Actual Fee Scheme and Contribution Quintiles

Type of choice	Measure	Q1	Q2	Q3	Q4	Q5	Total
Balance fee	% individuals losing	58.2	92.6	95.6	96.3	90.0	80.5
(default option)	% individuals gaining	41.8	7.4	4.4	3.7	10.0	19.5
	avg % M (for those losing)	3.5	5.0	6.2	6.6	2.5	4.8
	avg % M (for those gaining)	-0.8	-0.4	-0.2	-0.2	-0.1	-0.7
	avg % M (for all)	1.7	4.6	5.9	6.4	2.3	3.7
Load fee	% individuals losing	50.6	18.0	10.3	6.7	21.1	15.6
(active choice)	% individuals gaining	49.4	82.0	89.7	93.3	78.9	84.4
	avg % M (for those losing)	-0.7	-0.4	-0.3	-0.3	-0.2	-0.4
	avg % M (for those gaining)	2.7	3.4	4.0	4.8	2.2	3.6
	avg % M (for all)	1.0	2.7	3.5	4.4	1.7	3.0
Total	% individuals losing	57.2	63.2	43.6	30.5	36.1	46.1
	% individuals gaining	42.8	36.8	56.4	69.5	63.9	53.9
	avg % M (for those losing)	3.0	4.4	5.3	5.5	1.3	3.9
	avg % M (for those gaining)	-0.2	2.9	3.9	4.7	2.1	2.9
	avg % M (for all)	1.6	3.9	4.5	4.9	1.8	3.3

Table A.10: Welfare Losses and Gains by Actual Fee Scheme and Balance Quintiles

Type of choice	Measure	Q1	Q2	Q3	Q4	Q5	Total
Balance fee	% individuals losing	60.0	88.6	93.5	94.0	94.7	80.5
(default option)	% individuals gaining	40.0	11.4	6.5	6.0	5.3	19.5
	avg % M (for those losing)	3.6	4.6	5.5	5.7	5.6	4.8
	avg % M (for those gaining)	-0.8	-0.5	-0.3	-0.2	-0.1	-0.7
	avg % M (for all)	1.8	4.0	5.2	5.4	5.3	3.7
Load fee	% individuals losing	39.5	21.5	14.3	12.5	11.1	15.6
(active choice)	% individuals gaining	60.5	78.5	85.7	87.5	88.9	84.4
	avg % M (for those losing)	-0.7	-0.4	-0.3	-0.3	-0.2	-0.4
	avg % M (for those gaining)	2.7	3.0	3.5	3.8	3.9	3.6
	avg % M (for all)	1.4	2.3	2.9	3.3	3.5	3.0
Total	% individuals losing	56.7	59.3	46.4	38.1	30.1	46.1
	% individuals gaining	43.3	40.7	53.6	61.9	69.9	53.9
	avg % M (for those losing)	3.1	3.8	4.5	4.4	3.9	3.9
	avg % M (for those gaining)	0.0	2.5	3.3	3.7	3.9	2.9
	avg % M (for all)	1.8	3.3	3.8	3.9	3.9	3.3

Figure A.2: Cumulative of Gains and Losses with a Balance Fee of 1%

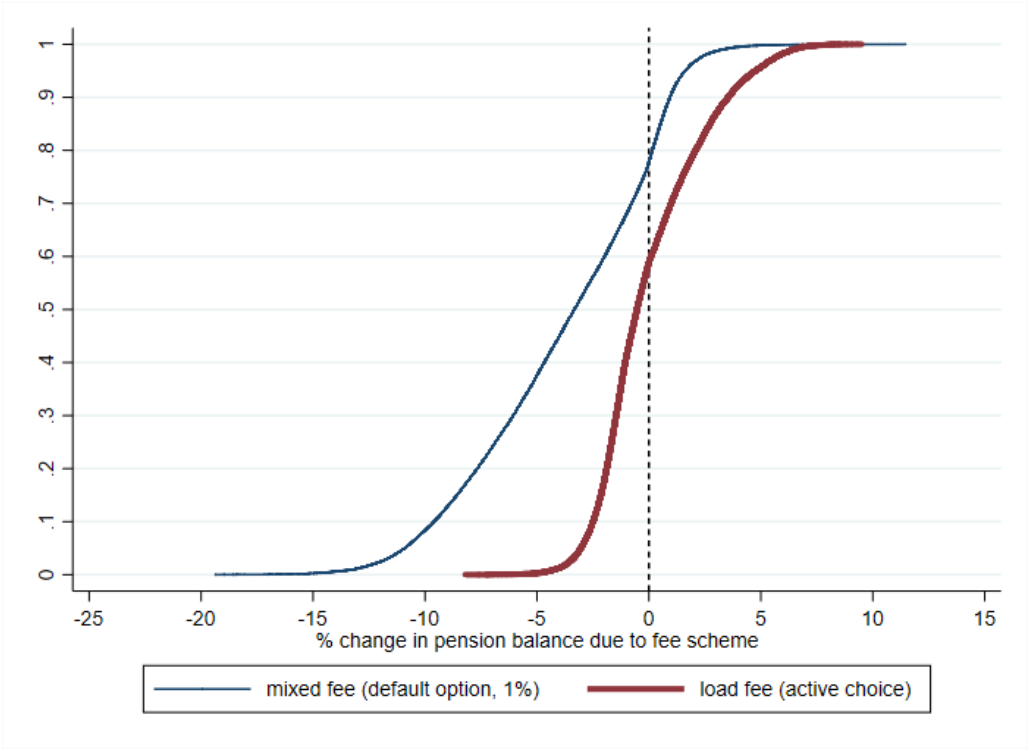


Figure A.3: Cumulative of Gains and Losses a Balance Fee of 0.75%

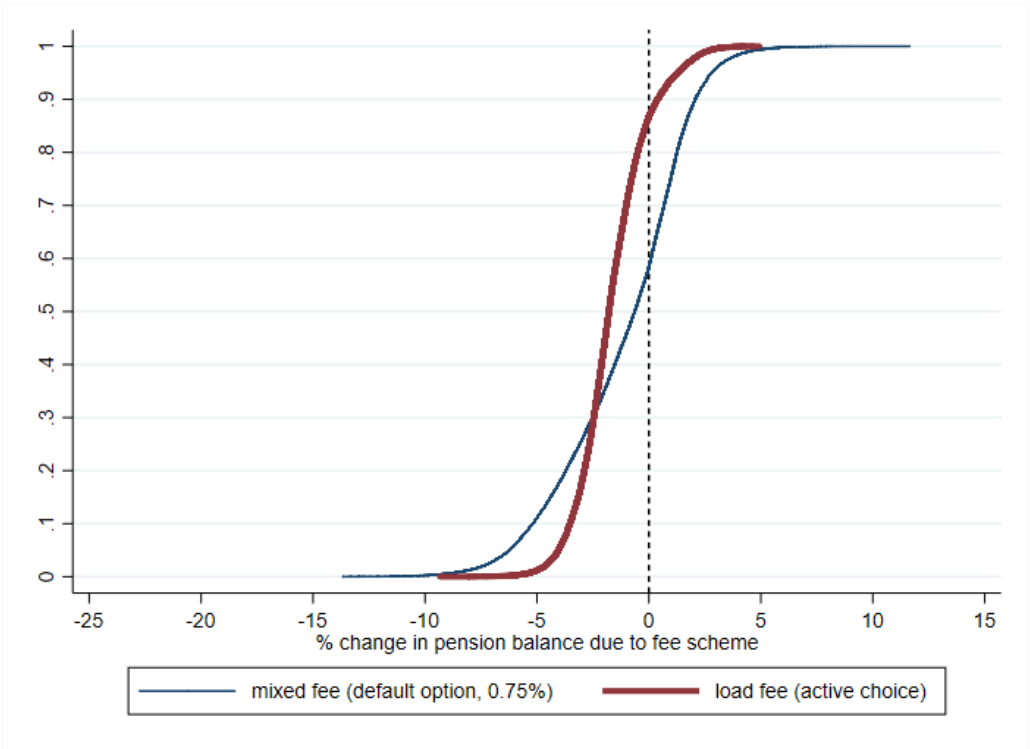
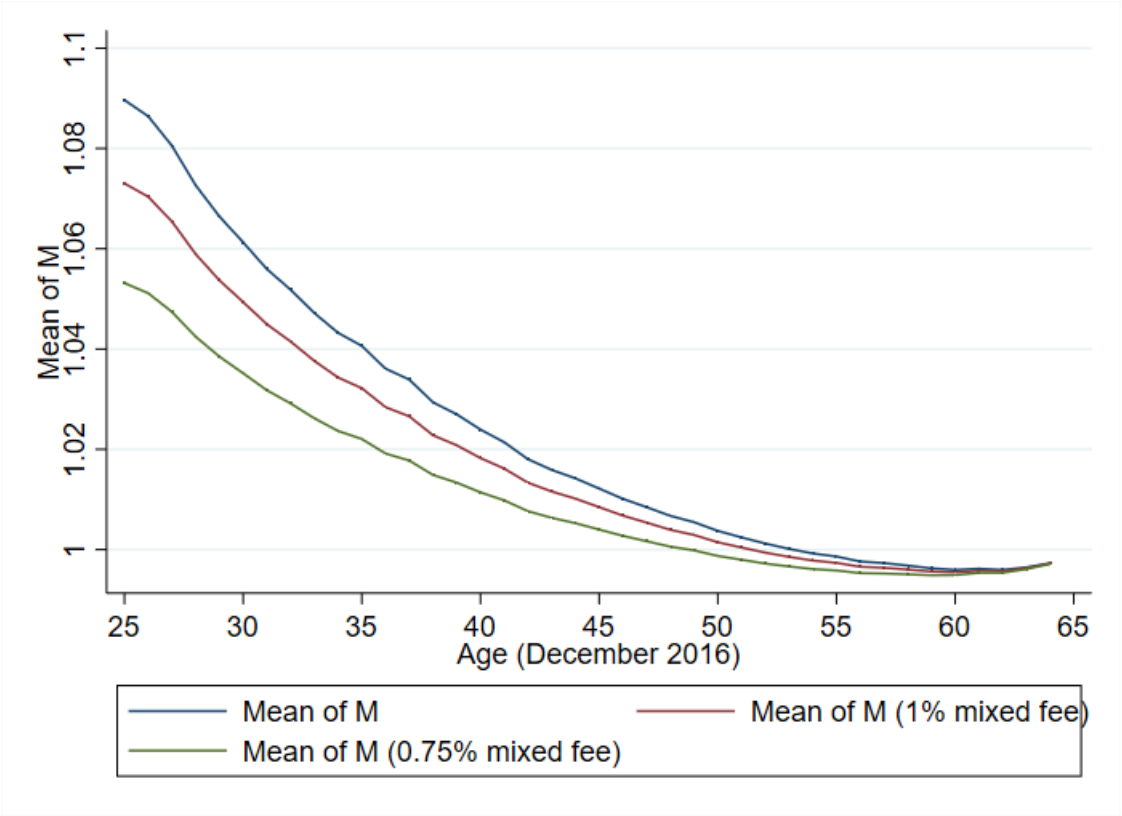


Figure A.4: Mean of Additional Wealth Needed (M) by Different Levels of the Balance Fee



Notes: For this Figure we restrict the sample to individuals older than 25 years. Mixed fee scheme includes the balance fee.

Table A.11: Gini RIF Regressions for Final Pension Balance Inequality by Age Group

Variable	21-25	26-30	31-35	36-40	41-45	46-50	51-55	56-60	61-65
Mixed fee	-0.023	0.118***	0.138***	0.113***	0.091***	0.082***	0.065***	0.022	0.056**
	(0.020)	(0.015)	(0.011)	(0.012)	(0.010)	(0.011)	(0.016)	(0.017)	(0.023)
Male	-0.072***	-0.037***	-0.063***	-0.093***	-0.101***	-0.055***	-0.094***	-0.039**	-0.008
	(0.020)	(0.010)	(0.008)	(0.009)	(0.011)	(0.010)	(0.018)	(0.016)	(0.024)
Age	-0.021*	-0.013***	0.002	0.004	0.003	-0.002	-0.009*	0.004	-0.024**
	(0.011)	(0.004)	(0.003)	(0.003)	(0.003)	(0.003)	(0.005)	(0.007)	(0.011)
Contribution density	-1.846***	-1.272***	-1.181***	-1.070***	-1.037***	-0.928***	-1.028***	-0.899***	-0.849***
	(0.106)	(0.091)	(0.046)	(0.044)	(0.034)	(0.022)	(0.061)	(0.038)	(0.044)
Self-employed	0.093*	0.139***	0.195***	0.211***	0.082**	0.041	0.093***	0.133***	0.094*
	(0.054)	(0.035)	(0.023)	(0.029)	(0.033)	(0.034)	(0.032)	(0.032)	(0.053)
Years enrolled in SPP	-0.085***	-0.037***	-0.016***	-0.014***	-0.019***	-0.029***	-0.031***	-0.025***	-0.027***
	(0.014)	(0.009)	(0.003)	(0.003)	(0.002)	(0.001)	(0.003)	(0.002)	(0.003)
AFP Profuturo	-0.040*	0.018	0.019**	0.014	0.030***	0.061***	0.046***	0.074***	0.071***
	(0.022)	(0.013)	(0.009)	(0.010)	(0.011)	(0.010)	(0.014)	(0.016)	(0.025)
AFP Prima	0.031	-0.011	-0.031***	-0.042***	-0.005	0.002	-0.027	0.009	0.041
	(0.023)	(0.016)	(0.012)	(0.015)	(0.014)	(0.013)	(0.020)	(0.022)	(0.030)
AFP Habitat	-0.259*	0.163	0.042	-0.191**	-0.143	-0.111	-0.166	0.363	-0.086
	(0.142)	(0.133)	(0.125)	(0.078)	(0.133)	(0.127)	(0.281)	(0.382)	(0.245)
Fund type 1 (secure)	-0.480***	0.304	-0.175*	-0.234**	-0.111	-0.276***	-0.109	-0.037	0.141
	(0.027)	(0.480)	(0.091)	(0.101)	(0.085)	(0.063)	(0.150)	(0.028)	(0.097)
Fund type 3 (risky)	-0.001	-0.002	-0.004	-0.081***	-0.152***	-0.137***	-0.253***	-0.073	0.000
	(0.120)	(0.045)	(0.023)	(0.023)	(0.027)	(0.028)	(0.043)	(0.048)	(.)
Income (000s)	0.424***	0.225***	0.173***	0.156***	0.095***	0.043***	0.055***	0.026***	-0.000
	(0.078)	(0.064)	(0.021)	(0.027)	(0.010)	(0.010)	(0.006)	(0.008)	(0.002)
Pension balance (000s)	0.098***	0.018*	0.005*	0.002	0.004***	0.005***	0.005***	0.003***	0.003***
	(0.012)	(0.010)	(0.003)	(0.002)	(0.001)	(0.000)	(0.001)	(0.000)	(0.000)
Constant	1.654***	-0.015	1.985***	0.000	0.260	0.113	0.261***	0.000	-0.289***
	(0.278)	(0.121)	(0.167)	(.)	(0.520)	(0.077)	(0.087)	(.)	(0.109)
R2	0.485	0.601	0.649	0.713	0.834	0.741	0.878	0.697	0.663
N	3484	9543	11861	11587	10120	7822	5315	3325	1531